# CALFED PHASE II INTERIM REPORT

## Agency Review Draft

### February 16, 1998

CALFED
BAY-DELTA
PROGRAM

E-035190

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CALFED Bay-Delta Program
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Either we have hope within us or we don't. It is a dimension of the soul and is not essentially dependent on some particular observation of the world. It is an orientation of the spirit, an orientation of the heart. It transcends the world that is immediately experienced and is anchored somewhere beyond its horizons. Hope in this deep and powerful sense is not the same as joy that things are going well or a willingness to invest in enterprises that are obviously headed for early success, but rather an ability to work for something because it is good, not just because it stands a chance to succeed. Hope is definitely not the same thing as optimism. It is not the conviction that something will turn out well, but the certainty that something makes sense regardless of how it turns out. It is hope, above all, which gives the strength to live and continually try new things.

-- Vaclav Havel

# EXECUTIVE OVERVIEW

At the confluence of California's two largest rivers, the Sacramento and San Joaquin, the San Francisco Bay and adjoining Sacramento-San Joaquin Delta together represent the largest estuary in the western United States. The Bay-Delta is a haven for plants and wildlife, supporting over 750 plant and animal species. The Bay-Delta supplies drinking water for two-thirds of California's citizens and irrigation water for 200 crops which make California the world's largest agricultural economy.

There is a rich history of conflict over resource management in the Bay-Delta system. For decades the region has been the focus of competing interests--economic and ecological, urban and agricultural. These conflicting demands have resulted in a number of resource threats to the Bay-Delta: declining wildlife habitat; several native plant and animal species becoming threatened with extinction; the degradation of the Delta as a reliable source of high-quality water; and a Delta levee system faced with an unacceptably high risk of failure.

Even though environmental, urban and agricultural interests have recognized the Delta as critical, for decades they were unable to agree on appropriate management of the Delta resources. Consequently, the numerous "traditional" efforts made to address the Bay-Delta problems, including government decrees, private remediation efforts and seemingly endless rounds of litigation have failed to reverse the steady decline of the Delta as fish and wildlife habitat or as a reliable source of high-quality water.

The CALFED Bay-Delta Program (Program) is an open, collaborative, state-federal-stakeholder effort seeking to develop a comprehensive long-term plan to restore ecosystem health and improve water management for beneficial uses of the Bay-Delta system. The Program is fundamentally different from previous efforts because it seeks to address ecosystem restoration, water quality, water supply reliability and levee and channel integrity as co-equal program purposes. The Program is focusing on alternatives that:

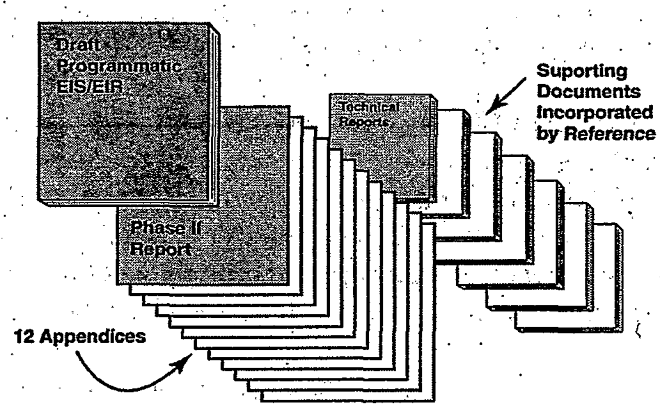
- improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta to support sustainable populations of diverse and valuable plant and animal species;
- provide good water quality for all beneficial uses;
- reduce the mismatch between Bay-Delta water supplies and current and projected beneficial uses dependent on the Bay-Delta system; and
- reduce the risk to land use and associated economic activities, water supply infrastructure, and the ecosystem from catastrophic breaching of Delta levees.

The CALFED Program has used public workshops, an advisory council, technical work groups, and an interagency team to identify and evaluate potential long-term solutions. This work was divided into three discrete phases. In Phase I, completed in September 1996, the Program identified the problems confronting the Bay-Delta system, developed a mission statement and guiding principles, and devised three basic alternative approaches to solving the problems.

In Phase II the Program has refined the preliminary alternatives, is conducting a comprehensive programmatic environmental review of which this report is a portion and is developing implementation strategies. A final environmental document is scheduled to be completed by December 1998.

In Phase III, beginning in December 1998, the Program, including any additional site-specific environmental review and permitting, will be implemented.

This Phase II Report is one of many supporting documents published in conjunction with the draft Programmatic Environmental Impact Statement / Environmental Impact Report (EIS/EIR). The main body of the EIS/EIR provides a technically-oriented analysis of the broad environmental effects that might accompany program implementation. This Phase II Report describes the CALFED process, solution alternatives and the fundamental program concepts that have guided their development, and analyses that have revealed the comparative technical advantages of each alternative. Finally, this report describes how the CALFED agencies will use analysis results in a public process to proceed to selection of a preferred alternative by December 1998. This Phase II Report and the Executive Summary of the EIS/EIR are being widely disseminated. The full EIS/EIR, other technical appendices, and supporting technical reports -- comprising thousands of pages -- are available from CALFED.




Some basic concepts related to the Bay-Delta system and its problems have guided the development of potential CALFED solutions. First, water in the system is most valuable for all uses at times when it is scarce. We can take advantage of this time value of water to divert water to offstream and groundwater storage in times of high flow in order to release it for agricultural, environmental, and urban purposes in times of shortage when the greatest conflicts exist among the competing uses.



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Second, many of the system's problems are interrelated, so the solution must be comprehensive: no single action or project can possibly resolve all the conflicts. Many specific program elements will need to be a part of any solution, including program elements for ecosystem restoration, water quality, water use efficiency, and levee and channel integrity. The Program alternatives evaluated in this EIS/EIR fall into three basic approaches to solving the problems:

**Alternative 1** - includes programs for ecosystem restoration, water quality, levee and channel integrity and water use efficiency. In addition, Alternative 1 proposes existing Delta channels for water conveyance with various storage options.

**Alternative 2** - includes programs for ecosystem restoration, water quality, levee and channel integrity and water use efficiency. In addition, Alternative 2 proposes significant modifications of Delta channels to increase water conveyance across the Delta combined with a variety of storage options.

**Alternative 3** - includes programs for ecosystem restoration, water quality, levee and channel integrity and water use efficiency. In addition, Alternative 3 includes Delta channel modifications coupled with a conveyance channel that takes water around the Delta and a variety of storage options.

Each alternative must satisfy six solution principles adopted by the CALFED Bay-Delta Program. Any acceptable solution will:

- reduce major conflicts among beneficial uses of water;
- focus on solving problems in all problem areas. Improvements for some problems will not be made without corresponding improvements for other problems;
- be implementable and maintainable within the foreseeable resources of the Program and stakeholders;
- have political and economic staying power and will sustain the resources they were designed to protect and enhance;
- have broad public acceptance and legal feasibility, and will be timely and relatively simple to implement compared with other alternatives; and
- will not solve problems in the Bay-Delta system by redirecting significant negative impacts, when viewed in their entirety, within the Bay-Delta or to other regions of California.

In Phase II, the Program has performed technical analyses to determine how the three alternatives perform when measured against 18 distinguishing characteristics. All the alternatives share a high level of performance by virtue of the program elements that are common to all three: ecosystem restoration, water quality, levee and channel integrity and water use efficiency. The distinguishing characteristics are intended to help the CALFED agencies and members of the public determine the relative performance levels of each alternative. The distinguishing characteristics include how each alternative is predicted to affect:

| | |
|---|---|
| • In-Delta Water Quality | • Storage and Release of Water |
| • Export Water Quality | • Water Transfer Opportunities |
| • Diversion Effects on Fisheries | • South Delta Access to Water |
| • Delta Flow Circulation | • Total Cost |
| • Water Supply Opportunities | • Habitat Impacts |
| • Assurances Difficulty | • Land Use Changes |
| • Operational Flexibility | • Socio-Economic Impacts |
| • Risk to Export Water Supplies | • Ability to Phase Facilities |
| • Consistency with the Solution Principles | • Brackish Water Habitat |

Among these characteristics, some were found through the evaluation process not to vary greatly among the three alternatives, while other characteristics truly allowed us to distinguish differences in performance. These more critical characteristics are the ones in the left column above.

**The analysis showed that, with respect to these critical distinguishing characteristics, Alternative 3 provided greater performance, followed by Alternative 2. For two distinguishing characteristics, Export Water Quality (specifically salt, organic carbon, and bromide) and Diversion Effects on Fisheries, Alternative 3 appears to offer resource management advantages. However, Alternative 3 also offers the greatest challenges in terms of providing adequate assurances and implementability.**

CALFED has not identified a preferred alternative. Although technical performance has been assessed, there are additional factors that may affect the selection of a preferred alternative. A great deal of dialog will need to take place among elected officials, CALFED agencies, local agencies, interest groups, and the public before a decision can be made. Together, all interests will need to answer questions such as:

- How well does each alternative meet the CALFED solution principles? Is any one alternative clearly superior to others?

- Is the construction of water facilities (such as an isolated conveyance facility) acceptable to the public, irrespective of technical merit?

- Are beneficiaries willing to pay for a comprehensive Bay-Delta solution?

- Can we devise an adequate set of actions and mechanisms to assure that the program will be implemented and operated as agreed?

Deliberations that enable us to answer these questions and select the preferred alternative will be the focus for the rest of Phase II of the Program. This report will help you prepare to participate in these deliberations. It includes a summary of the work conducted thus far in Phase II of the CALFED Bay-Delta Program. It is structured to introduce the Program (Chapter 1) and describe some significant fundamental Program concepts (Chapter 2). It also describes the Program alternatives (Chapter 3), explains the technical evaluation (Chapter 4), and explains the process that the CALFED agencies will use to identify a preferred alternative (Chapter 5).

The format of this report includes "sidebars" that identify the issues of concern or areas where greater detail is provided on a particular topic. Because this is a summary report of the Phase II process, it includes references to sections in the Programmatic Environmental Impact Statement and Report where additional information and/or detail may be found.

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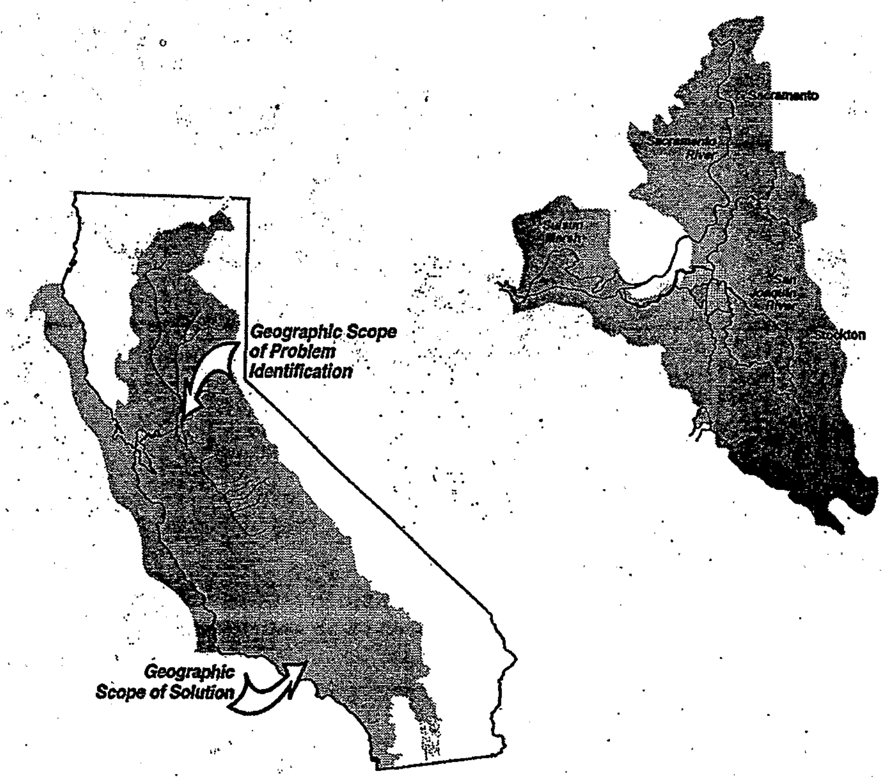
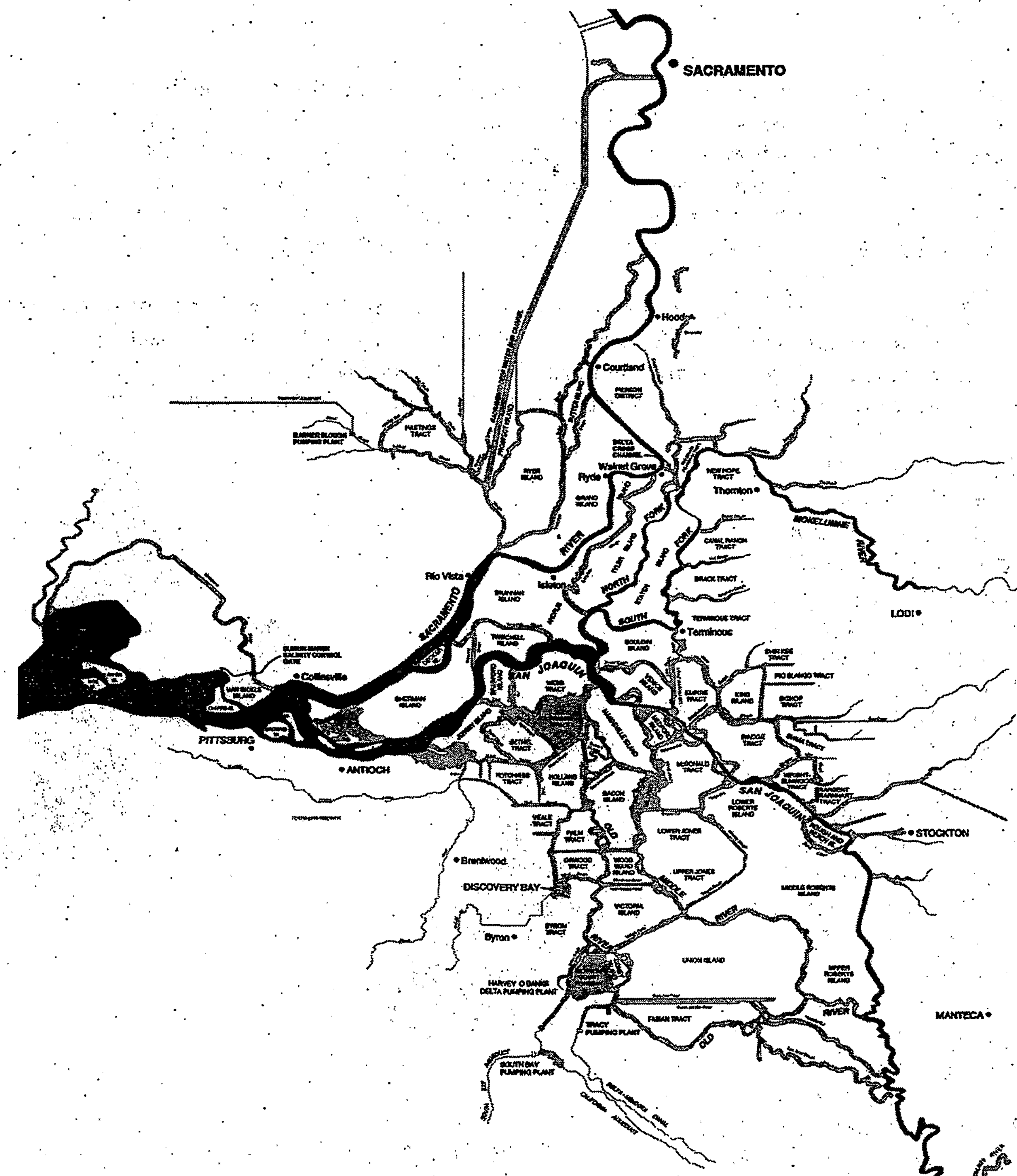
# 1. INTRODUCTION

A maze of tributaries, sloughs and islands, the Bay-Delta is the largest estuary on the West Coast. It is a haven for plants and wildlife, supporting over 750 plant and animal species. The Bay-Delta is critical to California's economy, supplying drinking water for two-thirds of Californians and irrigation water for 200 crops which make California the world's largest agricultural economy. Although all agree on its importance for both habitat and as a reliable source of water, few have agreed on how to manage and protect this valuable resource.

The CALFED Bay-Delta Program was established to reduce conflicts in the system by solving problems in the resource areas of ecosystem quality, water quality, water supply reliability, and levee and channel integrity. The Program seeks to do this by developing a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta system. The Program has crafted alternatives that recognize the importance of water quality improvements that will protect Delta drinking water supplies and improve the quality of aquatic habitat. Maintaining and improving the integrity of Delta levees and channels will protect agricultural, urban and environmental uses within the Delta and protect the quality of water used elsewhere in the state. Water conservation and recycling programs will assure the efficient use of existing water supplies as well as the efficient use of any new supplies developed through the Program.




**Geographic Scope of Problems and Solutions**




**Sacramento/San Joaquin Delta**

****insert map of CALIFORNIA showing Delta watershed boundary and major tributaries****

**California**

# A Vision from Year 2030
# Return to a Healthy Bay-Delta System

For a third straight year, biologists have observed record returns of winter run chinook salmon to its Central Valley spawning streams. Over the past three decades, habitat rehabilitation and improvements in river flow management have provided the impetus for rebounding populations of all the major migratory and resident fish in the Bay-Delta. There are no longer any fish species in this system listed under the Endangered Species Act. The combination of a rigorous management program with restored natural stream flows have minimized the adverse effects of undesirable exotic species in the aquatic environment. For the first time since the early part of the twentieth century, both the commercial fishing industry and the sports fishery are thriving along coastal California and in the Delta.

Other wildlife resources in the Bay and Delta have experienced a similar revival. The substantial restoration of riparian habitat upstream and in the Delta has reversed the decline of both aquatic and terrestrial species that were threatened with extinction at the end of the last century. The innovative use of "set-back" levees and flood bypass easements on the upstream tributaries, and waterside berms in the Delta, provided critical dual benefits during last year's heavy rains. In addition, a portion of the flood waters were moved into storage for later use by water users and to provide environmental flows in drier times. Not only did the Valley avoid catastrophic levee failure and loss of agricultural resources, but the floodways provided a major stopover for the migratory waterfowl on the Pacific Flyway. With its patchwork of restored habitat and working farms, the Delta has become a favorite destination for hunters, anglers, and "eco-tourists" alike.

Unlike last year, with its heavy rains, this year promises to be extremely dry. Nevertheless, even though California's population now exceeds 50 million people, urban and agricultural water users will avoid the economic dislocation and inconvenience of unexpected water shortages. Innovative programs of water conservation and water recycling have allowed all water users to reduce their demand on California's water resources. With an efficient water market in place, many water providers are relying on short-term voluntary water transfers and local groundwater management programs to see them through the dry period. Although transfers were initially controversial, local governments and water agencies have worked out arrangements for water transfers that protect local economies and water resources. Sustained improvements in the fish and wildlife populations have led to reduced environmental restrictions on the operations of the State's water conveyance facilities, so water can be transferred from groundwater banks and other storage facilities to the areas of greatest need.

All of the State's water users have benefitted from better water quality in the Delta. Better management practices have substantially reduced the negative effects of agricultural run-off in the Delta and its tributaries, and most of the toxic discharges into the Bay and Delta have been curtailed by a combined program of regulatory enforcement and economic incentives. Even the long-term problem of toxic drainage from abandoned mines is close to resolution, as the substantial investments in treatment and containment over the past 30 years have drastically reduced the volume of heavy metals entering the Bay Delta ecosystem. These water quality improvements have resulted in a cleaner, safer supply of drinking water for a large percentage of California's 50 million residents.

The return to a healthy Bay-Delta system that meets California's needs was made possible by a spirit of cooperation and grassroots involvement. Many groups are responsible for this success story including state/federal/local partnerships, conservancies, and local land owners.

The most intense conflict over the available water supply occurs during times of drought. It is during these times that fish and wildlife are most stressed and demands for water from the Delta are greatest. During periods of shortage, water holds its highest value for all uses. An important part of the CALFED approach to this conflict is to take water from the system in times of plenty and then release these flows in times of need. By supplementing the existing flows during drought periods, the CALFED Program may be able to help prevent disastrous consequences to fish populations that travel through, live-in or are in some way dependent upon the Delta for habitat during critical life stages. Through creation of additional aquatic habitat along the rivers tributary to the delta, removing obstructions to upstream fish migration, recreating spawning beds, restoring riparian vegetation, increasing the acreage of wetland, and restoring more natural flow patterns within the Delta, the Program hopes to help restore fish and wildlife whose viability has been threatened by land and water development.

# The Program

The CALFED Bay-Delta Program began in June of 1995 to address the tangle of complex issues that surrounds the Delta. The CALFED Program is a cooperative, interagency effort of state and federal agencies with management or regulatory responsibilities for the Delta.

The CALFED agencies appointed an executive director to oversee the process of developing a long-term comprehensive plan for the Delta. The Executive Director selected staff from the CALFED agencies to carry out the task. In addition, the CALFED agencies and stakeholders worked with the interagency CALFED Program team through multi-level technical and policy teams.

**CALFED**

**State Agencies**

Resources Agency of California
- Department of Water Resources
- Department of Fish and Game

California Environmental Protection Agency
- State Water Resources Control Board

California Department of Food and Agriculture

**Federal Agencies**

U.S. Department of Interior
- Bureau of Reclamation
- Fish and Wildlife Service
- Bureau of Land Management
- U. S. Geological Survey

U.S Army Corps of Engineers

U.S. Environmental Protection Agency

U.S. Department of Commerce
- National Marine Fisheries Service

U.S. Department of Agriculture
- Natural Resources Conservation Service
- U.S. Forest Service

Western Area Power Administration

The CALFED Program is an open, collaborative effort including representatives of agricultural, urban, environmental, fishery, business and rural counties who have contributed to the process. The Bay-Delta Advisory Council, a 34-member federally chartered citizens' advisory committee, provides formal comment and advice to the agencies during regularly scheduled public meetings. In addition, the CALFED process has included members of the public in development of every program component from ecosystem restoration to financing.

****insert CALFED organization chart***

## Phase I

The Program was divided into three discrete phases. In Phase I, completed in September 1996, the Program identified the problems confronting the Bay-Delta, developed a mission statement and guiding principles, and devised three preliminary categories of solutions. The goals established during Phase I are to provide good water quality for all beneficial uses; 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; to reduce the mismatch between Bay-Delta water supplies and current and projected beneficial uses dependent on the Bay-Delta system; and to reduce the risk to land use and associated economic activities, water supply, infrastructure and the ecosystem from catastrophic breaching of Delta levees.

### CALFED BAY-DELTA PROGRAM MISSION STATEMENT AND SOLUTION PRINCIPLES

***The mission of the CALFED Bay-Delta Program is to develop a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta system.***

In addition, any CALFED solution must satisfy the following solution principles:

- ***Reduce Conflicts in the System*** Solutions will reduce major conflicts among beneficial uses of water.
- ***Be Equitable*** Solutions will focus on solving problems in all problem areas. Improvements for some problems will not be made without corresponding improvements for other problems.
- ***Be Affordable*** Solutions will be implementable and maintainable within the foreseeable resources of the Program and stakeholders.
- ***Be Durable*** Solutions will have political and economic staying power and will sustain the resources they were designed to protect and enhance.
- ***Be Implementable*** Solutions will have broad public acceptance and legal feasibility, and will be timely and relatively simple to implement compared with other alternatives.
- ***Have No Significant Redirected Impacts*** Solutions will not solve problems in the Bay-Delta system by redirecting significant negative impacts, when viewed in their entirety, within the Bay-Delta or to other regions of California.

Following scoping, public comment, and agency review, the Program identified three preliminary alternatives to be further analyzed in Phase II. The three preliminary alternatives each included Program elements for levee system integrity, water quality improvements, ecosystem restoration, and water use efficiency and three differing approaches to conveying water through the Delta. The first conveyance configuration relies primarily on the existing conveyance system with some minor changes in the South Delta and a combination of ground and surface water storage options. The second configuration relies on enlarging channels within the Delta in combination with ground and surface water storage options. The third configuration includes in-Delta channel modifications and a conveyance channel that would move some water around the Delta in combination with ground and surface water storage options.

**MAJOR CONCLUSIONS FROM PHASE I**

- The complexity of the problems will require a long-term sustained effort lasting perhaps 20-30 years to achieve a healthy Bay-Delta system.
- Based on public comment, significant Program elements are needed for levee system integrity, water quality, ecosystem restoration and water use efficiency in all alternatives. These Program elements remain relatively unchanged between the alternatives.
- The alternatives must encourage local participation and partnerships to further Program objectives rather than a regulatory approach.

## Phase II

In Phase II, the Program has refined the preliminary alternatives, is conducting comprehensive programmatic environmental review, and is developing implementation strategies. The final environmental document is scheduled for release in December 1998. In Phase II, the Program has added greater detail to each of the Program elements (levee system integrity, water quality, ecosystem restoration, and water use efficiency) and crafted frameworks for a water transfers policy and watershed management coordination. Pre-feasibility studies and modeling aided evaluation of many variations of the three broad alternatives. Phase II will conclude with the selection of a preferred alternative, development of an implementation plan including financing and assurances, and completion of a final programmatic environmental impact statement and report (Programmatic EIS/EIR). A programmatic EIS/EIR, also referred to as a first-tier document, is typically prepared for a series of actions that can be characterized as one large project and is required for actions proposed by or approved by California public agencies.

This Phase II Report is one of many supporting documents published in conjunction with the draft Programmatic Environmental Impact Statement / Environmental Impact Report (EIS/EIR). The main body of the EIS/EIR provides a technically-oriented analysis of the broad environmental effects that might accompany program implementation. This Phase II Report describes the CALFED process, solution alternatives and the fundamental program concepts that have guided their development, and analyses that have revealed the comparative technical advantages of each alternative. Finally, this report describes how the CALFED agencies will use analysis results in a public process to proceed to selection of a preferred alternative by December 1998. This Phase II Report and the Executive Summary of the EIS/EIR are being widely disseminated. The full EIS/EIR, other technical appendices, and supporting technical reports -- comprising thousands of pages -- are available from CALFED.

### Phase III

In Phase III, following completion of the final Programmatic EIS/EIR, implementation begins. This period will include additional site-specific environmental review and permitting necessary. Because of the size and complexity of any of the alternatives, implementation is likely to take place over a period of decades. Part of the challenge for Phase II is designing an implementation strategy that acknowledges this long implementation period and keeps all participants committed to the successful completion of all phases of implementation.

## Public Involvement

During Phase I, the Program held scoping meetings, technical workshops, public information meetings, public Bay-Delta Advisory Council (BDAC) meetings, and public BDAC workgroup meetings. This commitment to active public involvement has continued through Phase II with additional public meetings, presentations before focused groups, media outreach to the general and ethnic media, special mailings of newsletters, regular updated information placed on the Program's website and a new toll-free public information telephone line.

**WHERE TO FIND PUBLIC OUTREACH INFORMATION**

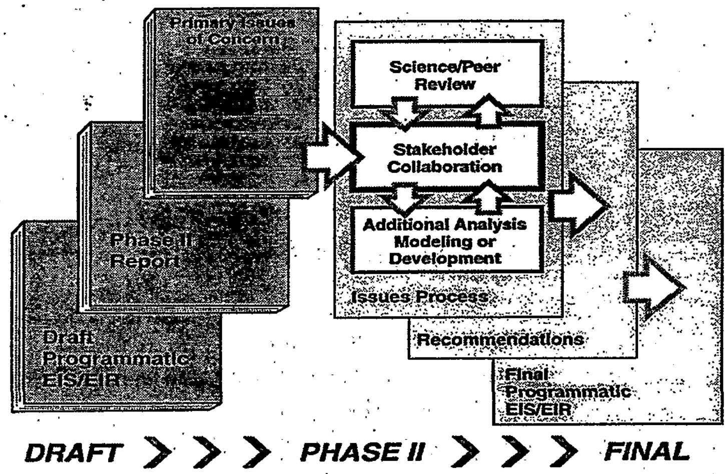
- Program's website (http:\\calfed.ca.gov)
- Toll-free public information telephone line (1-800-700-5752)
- *CALFED News*, *EcoUpdate* and Factsheets (available from CALFED Bay-Delta Program, 1416 Ninth Street, Suite 1155, Sacramento, CA 95814; phone 916-657-2666)
- BDAC and other Public Meetings

## Next Steps in Phase II

Between the Public Draft EIS/EIR and the Final EIS/EIR work will continue on defining and selecting the preferred alternative. This will include technical evaluations to refine storage options, select the method of Delta conveyance, determine the appropriate operating criteria, and develop the package of assurances. The CALFED agencies will work with elected officials, local agencies, interest groups, and the public over the coming months to develop a preferred alternative that reduces major conflicts in the system, is equitable, affordable, durable, implementable, and will not solve problems in the system by redirecting significant impacts.

The entire Program can benefit from further focused technical review and implementation planning. Program staff will develop implementation strategies for all Program elements in order to clarify the goals and objectives, underlying assumptions, tools and strategies, conceptual models, adaptive management, and measures of success. Chapter 5 more fully describes these efforts.

Work will continue between the Draft and Final Programmatic EIS/EIR on resolving the primary issues of concern that remain in this Phase II Report. A series of scientific/peer reviews and additional analyses will be linked through stakeholder collaboration to arrive at recommendations for the preferred alternative and its associated implementation including financing and assurances.




## Some Bay-Delta Statistics

**Area of the Watershed:** The system drains more than 61,000 square miles, or 37% of the state.
**Area of the Delta:** The legal Delta includes 738,000 acres.
**Delta Inflow:** Inflow ranges from 6 to 69 million acre feet per year; average is 24 MAF.
**Diversions:** Over 7,000 diverters draw water from the system, including 1,800 in the Delta itself.
**Delta Exports:** The SWP and CVP draw an average of 6 MAF from the Delta each year.
**Flora:** Over 400 plant species can be found in the Delta, not including agricultural crops.
**Fauna:** The Delta harbors about 225 birds, 52 mammals, and 22 reptile and amphibian species.
**Fish:** There are 54 fish species in the Delta, and a total of 130 in the Delta and Bay.
**Marshes:** There are 8,000 acres of tidal marsh in the Delta; originally there were 345,000 acres.
**Levees and Channels:** Over 700 miles of waterways are protected by 1100 miles of levees.
**Subsidence:** Some Delta lands are more than 20 feet below sea level.
**Delta Farmland:** Over 520,000 acres are farmed in the Delta.
**Principal Crops:** The most commonly grown Delta crops are wheat, alfalfa, corn, and tomatoes.
**Agricultural Value:** Average annual gross value of Delta production is $500 million.
**Recreation:** Recreational use of the Delta is about 12 million user days per year.

# 2. FUNDAMENTAL PROGRAM CONCEPTS

Three fundamental concepts related to the Bay-Delta system and its problems have guided the development of proposed CALFED solutions. These concepts are not new, but the Program has looked at them in new ways in order to develop options for solving problems successfully. These concepts are so important that this chapter is devoted to a detailed description of them.

First, problems in the four resources areas of ecosystem quality, water quality, water supply reliability, and levee system integrity are **interrelated**. We cannot even describe problems in one resource area without discussing the other resource areas. It follows that solutions will be interrelated as well: many past attempts to improve a single resource area have achieved limited success because solutions were too narrowly focused.

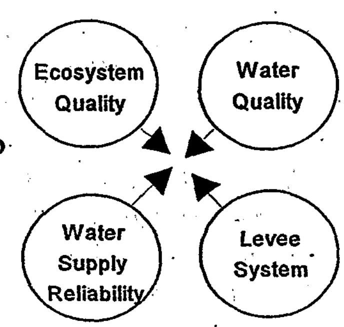
Second, there is great **variation** in the flow of water through the system and in the demand for that water, at any time scale we might examine: from year to year, between seasons, even on a daily basis within a single season. The value of water for all uses tends to vary according to its scarcity and timing. We can take advantage of this variability to reduce conflict and solve problems in several resource areas.

Finally, the solutions we implement must be guided by **adaptive management**. The Bay-Delta ecosystem is exceedingly complex, and it is subject to constant change as a result of factors as diverse as global warming and the introduction of exotic species. We will need to adapt our management of the system as we learn from our actions and as conditions change.

This chapter describes each of these concepts in greater detail. An additional fundamental concept is that of assurances. The preferred alternative will need to include a set of actions and mechanisms to assure that the Program will be implemented and operated as agreed. Assurances are discussed in Chapter 5.

## Interrelationships

In the past, most efforts to improve water supply reliability or water quality, improve ecosystem health, or maintain and improve Delta levees were single-purpose projects. A single purpose can keep the scope of a project manageable, but may ultimately make the project more difficult to implement. The difficulty occurs because a project with narrow scope may help to solve a single problem but have impacts on other resources, causing other problems. This in turn leads to opposition. Ultimately no problem is solved, or one problem is solved while others are created.



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The CALFED Program takes a different approach, recognizing that many of the problems in the Bay-Delta system are interrelated. Problems in any one resource area cannot be solved effectively without addressing problems in all four areas at once. This greatly increases the scope of our efforts, but will ultimately enable us to make progress and move forward to a lasting solution.

What are the problems that face the Bay-Delta system and why have they occurred? At the simplest level, problems occur when there is conflict over the use of resources from the Bay-Delta system. As California's population increases, we ask more of the system and there is more conflict. Single-purpose efforts to solve problems often fail to address the conflict. To the extent that these efforts acquire or protect resources for one interest, they may cause impacts on other resources and increase the level of conflict. Major conflicts are summarized below.

- *Fisheries and Diversions* The conflict between fisheries and diversions results primarily from fish mortality attributable to water diversions. This includes direct loss at pumps, reduced survival when young fish are drawn out of river channels into the Delta, and reduced spawning success of adults when migratory cues are altered. The effects of diversions on species of special concern have resulted in regulations that restrict quantities and timing of diversions.

- *Habitat and Changes in Land Use* Habitat to support various life stages of aquatic and terrestrial biota in the Bay-Delta has been lost because of land development and construction of flood control facilities to protect developed land. The need for habitat affects land development planning as well as levee maintenance and planning. Efforts to restore the balance often require that land used for other purposes be dedicated to habitat.

- *Water Supply Availability and Beneficial Uses* As water use and competition for water have increased during the past several decades, conflict has also increased among users. A major part of this conflict is between the volume of instream water needs and out-of-stream water needs, and the timing of those needs within the hydrologic cycle.

- *Water Quality and Land Use* Water quality can be degraded by land use and resulting runoff, and ecosystem water quality needs are not always compatible with urban and agricultural water uses.

From these central conflicts, the Program identified a series of problems in each resource area. From each problem, a Program objective was developed. The main problems and objectives are shown on the following page. A complete set of identified problems and program objectives is contained in a technical appendix to the draft programmatic EIS/EIR.

# BAY-DELTA PROBLEM AREAS & PROGRAM OBJECTIVES

## ECOSYSTEM QUALITY

| Problems | Objectives |
|---|---|
| • Important aquatic habitats are inadequate to support production and survival of native and other desirable estuarine and anadromous fish in the Bay-Delta system. Examples of fishes that have experienced declines related to changes in Delta habitat include delta smelt, longfin smelt, Sacramento splittail, chinook salmon, striped bass, and American shad | • Improve and increase aquatic habitats so they can support the sustainable production and survival of native and other desirable estuarine and anadromous fish in the estuary |
| • Important wetland habitats are inadequate to support production and survival of wildlife species in the Bay-Delta system | • Improve and increase important wetland habitats so they can support the sustainable production and survival of wildlife species |
| • Populations of some species of plants and animals dependent on the Delta have declined | • Increase population health and population size of Delta species to levels that assure sustained survival. |

## WATER QUALITY

| Problems | Objectives |
|---|---|
| • Water quality is often inadequate or is perceived as inadequate for drinking water needs | • Provide good water quality in Delta water exported for drinking water needs |
| • Delta water quality is often inadequate for agricultural needs | • Provide good Delta water quality for agricultural use |
| • Delta water quality is often inadequate for industrial needs | • Provide good Delta water quality for industrial use |
| • Delta water quality is often inadequate for recreational needs | • Provide good Delta water quality for recreational use within the Delta. |
| • Water quality is often inadequate for environmental needs for the Bay-Delta system | • Provide improved Delta water quality for environmental needs |

## WATER SUPPLY RELIABILITY

| Problems | Objectives |
|---|---|
| • Water supplies of the Bay-Delta system do not meet needs because of conflict among beneficial uses and because of system inadequacies | • Reduce the conflict between beneficial uses and improve the ability to transport water through the Bay-Delta system. |
| • Bay-Delta system water supplies are uncertain with respect to short- and long-term needs. | • Reduce the uncertainty of Bay-Delta system water supplies to help meet short- and long-term needs. |

## BAY-DELTA SYSTEM VULNERABILITY

| Problems | Objectives |
|---|---|
| • Existing agricultural land use, economic activities, and infrastructure in the Delta are at risk from gradual deterioration of delta conveyance and flood control facilities as well as sudden catastrophic inundation of Delta islands. | • Manage the risk to existing land use, associated economic activities, and infrastructure from gradual deterioration of Delta conveyance and flood control facilities and catastrophic inundation of Delta islands. |
| • Water supply facilities and operations in the Delta are at risk from increased salinity intrusion which can result from sudden catastrophic inundation of Delta islands | • Manage the risk to water supply facilities and operations in the Delta from catastrophic inundation of Delta islands. |
| • Water quality in the Delta is at risk from increased salinity intrusion which can result from sudden catastrophic inundation of Delta islands. | • Manage the risk to water quality in the Delta from catastrophic inundation of Delta islands. |
| • The existing Delta ecosystem is at risk from gradual deterioration of Delta conveyance and flood control facilities as well as catastrophic inundation of Delta islands. | • Manage the risk to the existing Delta ecosystem from gradual deterioration of Delta conveyance and flood control facilities and catastrophic inundation of Delta islands. |

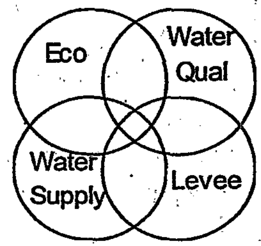
Together, the objectives reflect strategies for solving problems in the four resource areas:

**Ecosystem Quality** - The primary ecosystem quality objective of the Program 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." The strategy to achieve this objective is to reverse the decline in ecosystem health by reducing or eliminating factors which degrade habitat, impair ecological functions, or reduce the population size or health of species. These factors may cause direct mortality of plants and animals in the system, but more often they result in indirect mortality by degrading habitat conditions or functions. For this reason, the Program objectives emphasize the improvement of habitats and ecological functions.

**Water Supply Reliability** - The primary water supply reliability objective of the Program is to "Reduce the mismatch between Bay-Delta water supplies and current and projected beneficial uses dependent on the Bay-Delta system." The Program has a three-part strategy to reduce conflict and meet water supply reliability objectives. This strategy seeks to: reduce the mismatch between supply and beneficial uses through a variety of actions; reduce the impacts that water diversions have on the Bay-Delta system; and increase the flexibility to store and transport water.

**Water Quality** - The primary water quality objective of the Program is to "Provide good water quality for all beneficial uses." Good water quality means different things to different users, and there are different ways to achieve the objective. For example, organic carbon that is naturally present in Delta water can form carcinogenic treatment byproducts in drinking water, but this carbon does not generally pose problems for ecosystem quality. The Program's strategy to achieve the water quality objective is to improve source water quality by reducing or eliminating parameters which degrade water quality. The Program's water quality sub-objectives concentrate on this direct source control approach.

**Levee System Integrity** - The primary system vulnerability objective of the Program is to "Reduce the risk to land use and associated economic activities, water supply, infrastructure, and the ecosystem from catastrophic breaching of Delta levees." Failure of Delta levees can result either from catastrophic events such as earthquakes and floods, or from gradual deterioration. Subsidence of the Delta island peat soils and settling of levee foundations places additional pressure on levees and increases the risk of failure. The Program's strategy for achieving the system integrity objectives is to implement a comprehensive plan to address long-term levee maintenance, stabilization, and emergency levee management.




Significantly, there are many linkages among the objectives in the four resource areas and among the actions that might be taken to achieve these objectives. Solving problems in four resource areas at once does not require a four-fold increase in the cost or the number of actions. Most actions that are taken to meet Program objectives, if carefully developed and implemented, will make simultaneous improvements in two, three, or even four resource areas. This makes the scope of the effort less daunting, and the cost far more affordable.

What kinds of actions can be taken to solve problems in the Bay-Delta system? The actions can be grouped into categories of water use efficiency, water transfers, water storage, Delta conveyance modifications, levee system improvements, ecosystem restoration, water quality improvements, watershed coordination, and financing. Specific actions range from physical restoration of habitat in the Delta to water conservation measures implemented in the furthest reaches of the state. The actions in our problem-solving "toolbox" are described below, along with examples of the problems that can be solved and the multiple benefits that can be gained from each type of action. A more detailed description of various Program elements is presented in Chapter III of this document. Complete descriptions of program elements are contained in various technical appendices to the draft programmatic EIS/EIR.

**Water Use Efficiency**

Water use efficiency measures include conservation of water used in urban areas, in agricultural areas, and on wildlife refuges, as well as water recycling. Efficiency measures reduce water demand, thereby reducing the mismatch between supply and demand. Efficiency measures provide other benefits as well. Reduced demand can mean reduced diversion of water from the Bay-Delta system and reduced diversion impacts associated with the entrainment of fish. Efficient use can also yield water quality benefits. Careful application of water to gardens, lawns and farm fields can result in less runoff of herbicides, pesticides, fertilizers, and salts back into water bodies that provide drinking water sources and aquatic habitats.

**Water Transfers**

If water conservation increases the physical efficiency of water use by accomplishing a task with less water, then water transfers increase economic efficiency by making water available for the tasks that provide the greatest economic return. A water transfer is a voluntary transaction in which a person or entity that possesses the right to use water can sell the use of the water for a period of time to another person or entity that places a higher value on the water. Transfers reduce the mismatch between supply and demand by satisfying the strongest demands for water and compensating others for reducing their water use. A water transfer that moves water from upstream of the Delta to Delta export (water diversion from the Delta used for purposes outside the Delta) regions can provide ecosystem benefits by increasing flow into the Delta or modifying the timing of flows in ways that may benefit the ecosystem. Transfers of water between two users in Delta export areas may reduce the need to pump water from the Delta and reduce the environmental impacts of that Delta pumping. Transfers can reduce the need for new or expanded reservoirs. In some cases, conserved water can be transferred so the ability to transfer water offers an economic incentive to conserve. Finally, water can be transferred from diverters to instream uses, restoring beneficial timing of flows and increasing Delta outflow during critical periods.

Transfers are not without potential impacts, and these impacts must be clearly recognized and either avoided or adequately mitigated. Two of the most critical potential impacts of transfers are effects on groundwater resources and effects on local economies. Water transfers can cause depletion of groundwater if water users transfer their surface water supplies and replace them by pumping groundwater. Local economies can be affected if farmers fallow land and transfer the water. Both the buyer and seller may benefit, but third parties such as farm workers may be seriously affected. An active water transfers market must recognize these potential impacts and offer mechanisms for avoidance or acceptable mitigation.

**Water Storage**

Water can be captured and stored in a number of different ways, including surface storage (dams and reservoirs) as well as storage in underground aquifers where groundwater can be banked or used in conjunction with surface supplies. Increasing the capacity to store water by building new dams or increasing the size of existing ones is controversial because the construction and operation of dams can have serious environmental impacts. However, careful reservoir operation can yield a net environmental benefit while also providing water for other uses. This fundamental program concept is discussed in detail later in this chapter.

Storage has the potential to offer different benefits according to its location in the Bay-Delta system. Storage upstream of the Delta has the potential to increase the amount of water flowing into the Delta during dry periods, and to increase the reliability of a predictable amount of water flowing into the Delta. This is possible because new storage lets more water be held upstream of the Delta in times of high flows. During dry periods, this water can be released to increase the flow for many purposes. Ideally, these releases can be planned to produce instream benefits for the ecosystem and water quality, as well as diversion benefits, from the same release of water. Off-aqueduct storage has the potential to reduce demand on the Delta during periods when diversions would have the greatest impact, including times when vulnerable fish species could be at risk of entrainment from Delta pumping. Water can be put into this storage out of the Delta during less critical periods, so that when water from the Delta is not available or when impacts of Delta pumping would be high, users can turn to this stored water as an alternative.

Storage can also make water conservation and water recycling more feasible. Reservoirs or aquifers can hold water that is not needed because conservation measures have reduced demand.

This water can be carried over into subsequent years when water shortage might otherwise require more vigorous drought conservation measures. Local storage can make recycling projects more feasible by giving water managers flexibility to hold water and better balance a constant supply of recycled water against a demand that may be variable.

**Delta Conveyance Modifications**

The Program has examined three broad choices for conveyance through the Delta: minor physical modifications coupled with operational changes, increases in the capacity of certain Delta channels to facilitate conveyance through the Delta, and a dual system that increases the capacity of certain channels and includes a new isolated channel to convey water from the Sacramento River around the Delta to water export pumps in the south Delta. All three decrease the detrimental effects on the ecosystem and Delta water users of using the Delta for water conveyance, while improving the effectiveness of the Delta as a conveyance hub.

Conveyance modifications can enable drinking water to be moved through the Delta with less risk of contamination by seawater or naturally occurring organic material found in the Delta. The conveyance modifications can also reduce the detrimental effects on fish of moving water through the Delta by reducing unnatural flow patterns, screening diversions, and providing alternative diversion points. Changes in Delta conveyance can also enable more water to be moved through the Delta during times when it does the least environmental harm, so that less water is moved through the Delta at times when it would be more harmful.

**Levee System Improvements**

Levee system improvements reduce the risk that levees will fail during flood periods or as a result of gradual deterioration. This can protect not only lives and property of those who would otherwise have been flooded, but can also protect wildlife habitat from inundation. Strong levees also protect water quality for all who use Delta water. The land surface of Delta islands is often below the level of the water in surrounding channels because the organic peat soils have subsided over time. When a levee fails, water rushes onto the island and draws salty water up into the Delta from downstream. This salty water in the Delta channels may be unsuitable for irrigation of crops on lands that are not flooded, and may be unsuitable as a drinking water source for urban areas that get their water from the Delta.

Improvements to Delta levees can be made in ways that accommodate habitat restoration, so that levees can simultaneously protect land uses, protect water quality, and support a variety of wetland, aquatic, and riparian habitats.

**Ecosystem Restoration**

Actions to restore ecosystem health are very diverse, reflecting all the different kinds of stress that have been placed on the Bay-Delta system. Many actions focus on the restoration of physical habitat including shaded riverine aquatic habitat along the banks of Delta channels, shallow water habitat, wetlands, and riparian forests. All of these habitat types can be compatible with levee restoration in various Delta areas. Other actions are designed to reduce fish mortality by screening diversions, both small diversions along rivers and channels as well as large Delta export diversions. Water flows are also important for fish and aquatic habitats. Flow patterns will be restored to more natural patterns by acquiring water for the ecosystem through transfers and by using storage facilities to capture water at high flow periods and release it later according to the needs of aquatic species.

Over time, these actions can result in the Delta ecosystem being more resilient and less subject to damage from the effects of water diversions for human uses. From the perspective of the Delta, this means that there may reduced need to curtail pumping at certain times to protect fish, thus improving water supply reliability.

**Water Quality Improvements**

Program actions to improve water quality focus on source control: improving the quality of source water that flows through the Bay-Delta system. In some cases this may involve cleanup of abandoned mines that leach toxic heavy metals from mine tailings. In other cases, water quality may be improved by conserving water on a farm or an urban landscape, reducing the amount of runoff that finds its way back into streams. Modifications to Delta conveyance can improve water quality in the Delta by reducing salinity. This in turn can improve water supply reliability: high quality Delta water can be blended with lower quality water from other sources to stretch water supplies. Water quality improvements can also facilitate water recycling. When water is used it becomes saltier. Recycling this water may produce water with unacceptable salinity levels if source water is to salty to begin with.

**Watershed Coordination**

The watershed coordination element of the Program consists of ecosystem restoration and water quality actions in the lower watershed and partnership projects with local entities in the upper watershed to improve water quality and habitat, decrease erosion, and increase base flows in the tributaries to the Delta. This coordinated approach improving the condition of watersheds can increase the reliability of predictable amounts of water flowing into the Delta during dry seasons by slowing down the rate at which water leaves the upper watershed.

## Economic and Financial Aspects

The Program will propose extensive investments in the resources of the Bay-Delta system, to be implemented and paid for over the next several decades. Implementation will provide opportunities to economize in many ways, as single actions yield benefits in multiple resource areas. Other actions, such as water quality source control, may prove far more economical than alternatives such as treatment of degraded water before use. Other aspects of the Program will be unavoidably costly. For example, if new reservoirs are included in the Bay-Delta solution, they will likely provide water at higher costs than existing projects. This is because the most economical sites are already taken, and new reservoir operation would likely be more conservative and protective of the ecosystem. Thus, despite the opportunities for economy, implementation will be costly and water costs will almost certainly go up. The additional cost will be justified and the program affordable if it results in a healthy Bay-Delta system that more successfully meets the demands that we place on it.

The Program has viewed financing from the standpoint that beneficiaries will pay their proportion of the cost of actions that yield benefits for them. Adherence to such a policy, with water users being asked to pay the full cost of any expensive new supplies, would change perspectives on the cost-effectiveness of other measures such as conservation, recycling, and water transfers. The price of obtaining water determines whether storage is economically justified, whether water users decide to transfer their water, which water efficiency measures are cost effective, as well as the level of demand for water from the Delta system.

The combination of these actions and their economic effects serves to reduce the mismatch between supply and demand for water from the Bay-Delta system. There is incentive to reduce demand due to higher costs of obtaining water. The demand reduction comes in the form of increased conservation and recycling, greater incentive to use alternative supplies including those from outside the Delta system, as well as forgoing some water use. Water transfers within the Bay-Delta system, perhaps augmented with supplies from new or expanded storage, help to complete the water supply reliability picture.

## Putting it All Together

John Muir said that "When we try to pick anything out by itself, we find that it is hitched to everything else in the universe." This certainly applies to solving problems and reducing conflict in the Bay-Delta system. A few examples demonstrate the interrelationships:

- A farmer in the Sacramento Valley conserves water by capturing tailwater that runs off his field and reusing it. In the process, he takes less irrigation water out of the river and releases less runoff back into it. Fewer fish are entrained by his pumps, and downstream water quality improves.

- Modifications in Delta conveyance provide greater channel capacity in some areas, reducing the danger of winter flooding and creating shallow water habitat where Delta smelt can spawn and young salmon can forage on their way to the ocean. The modified conveyance improves the flexibility to divert more at times when fish species are less likely to be drawn to Delta pumps, and curtail pumping at times when fish are at greater risk. At these times, water users in export areas can use groundwater in conjunction with surface supplies to assure a reliable supply. Demands in the export areas are lower than previously expected due to implementation of conservation and recycling measures, further reducing the mismatch between supply and demand.

- A local conservancy along a tributary to the Sacramento River helps ranchers to modify grazing practices and fence a riparian corridor along the creek. Over time, soil erosion is reduced which improves the quality of spawning grounds in the tributaries, and the land holds water for longer periods. Grazing conditions improve. Peak winter flows are reduced slightly, and the creek has greater base flow through the summer. Water temperatures go down, and conditions are improved for salmon.

- Delta landowners incorporate habitat improvements into a levee rehabilitation project. Farms and wildlife habitat on the Delta island are better protected from floods. There is less risk to water quality in the Delta from levee failure, so the Delta provides a more reliable water supply. Along the water side of the improved levee, habitat conditions are better for Delta fish, bird, and plant species.

The CALFED Program proposes hundreds of actions that will be implemented throughout the watershed and export areas. We can divide the actions into those that improve water supply reliability, improve water quality, restore ecosystem health, or improve Delta levees, but this classification of actions obscures the interrelationships. Take away any action, and it is harder to meet program objectives in two, three, or even four resource areas. It is harder to reduce conflict. This is why a comprehensive Bay-Delta solution, although challenging in scope, holds the greatest promise to improve the system for all beneficial uses.

# System Variability and the Time Value of Water

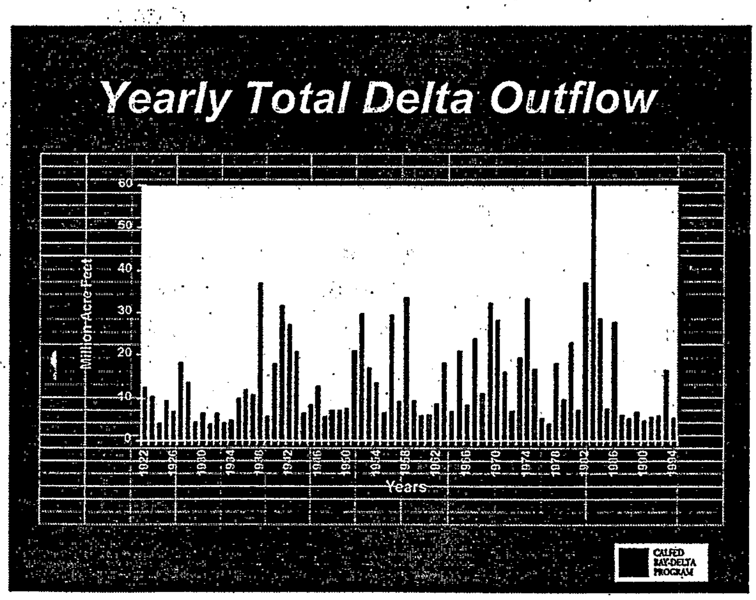
The watershed of the Bay-Delta system is subject to a highly variable rain and snowfall pattern. The total amount of precipitation and runoff in the watershed varies widely from month to month and from year to year. Year types are classified from wet to critically dry. Within any given year, whether wet or dry, most of the rain falls in the winter months, while snow pack typically melts in the late spring and early summer. In other months, water flow is typically much lower, leading to dramatically different flow levels for different months. Even within each month, flow can vary widely.

**SOME EXAMPLES OF FLOW VARIATION**

- High Delta inflow: **69** million acre-feet per year
- Low Delta inflow: **6** million acre-feet per year
- Average Delta inflow: **24** million acre-feet per year

Planners often discuss water in terms of averages that describe overall system performance-- average Delta outflow, average water project deliveries -- but there is more conflict over water management in drier years than in average years. Furthermore, average values are often misleading because they mask the incredible variability in flows in the Bay-Delta system. An increase in average outflow may have a minor beneficial effect on the environmental health of the system, but if outflow can be increased during a dry year or during a critical period within a year, the benefits may be far greater. Similarly, an increase in water supplies for urban and agricultural users may be desirable during an average year, but critically important to local economies during a drought.

The adjacent figure shows a simulated yearly total Delta outflow for the period from 1922 to 1994. The simulated Delta outflow is based on historical hydrology, but with existing storage and conveyance facilities in place and operating to meet demand. The graph reflects the average annual variability that occurs from year to year. Memorable extremes, such as the drought of 1976-77, are quite apparent. It is during drought periods such as this when competition between water diverters and in-stream water needs are most keenly felt.



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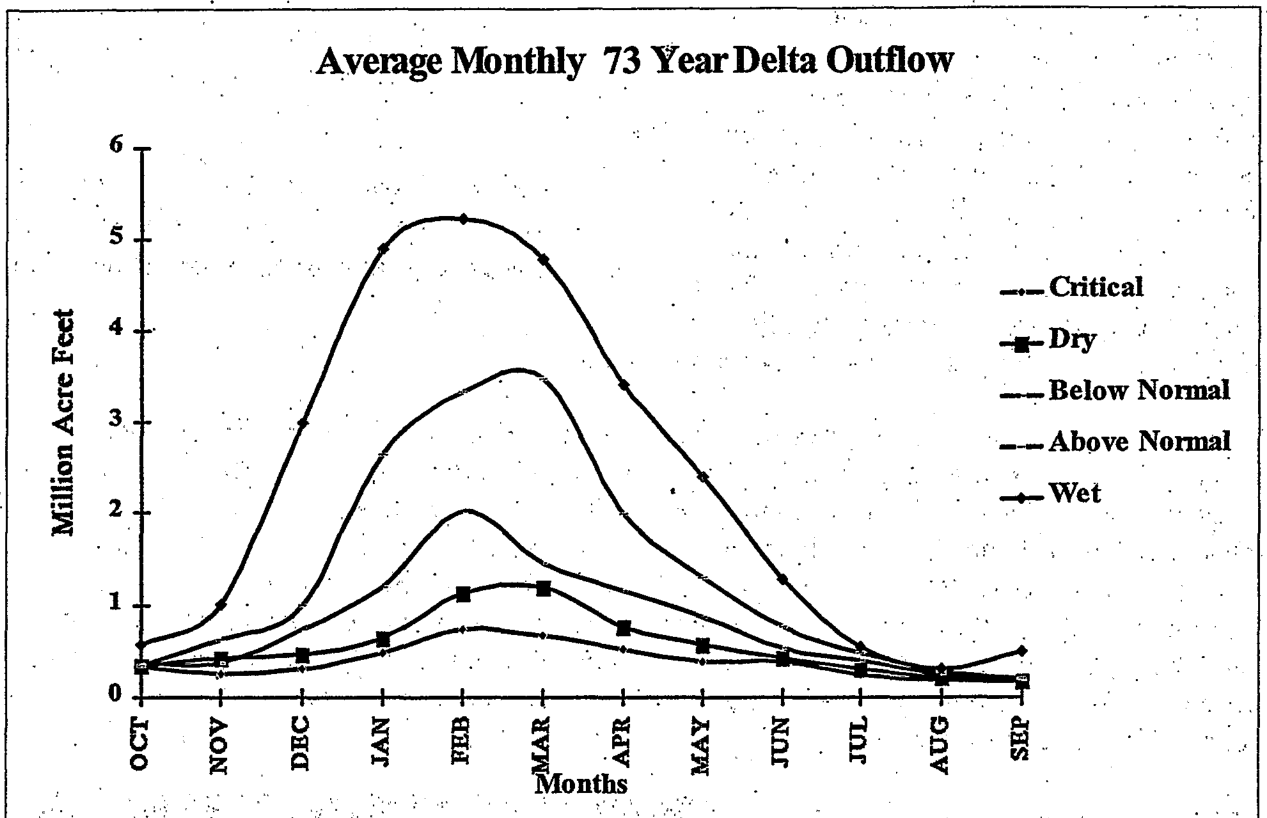
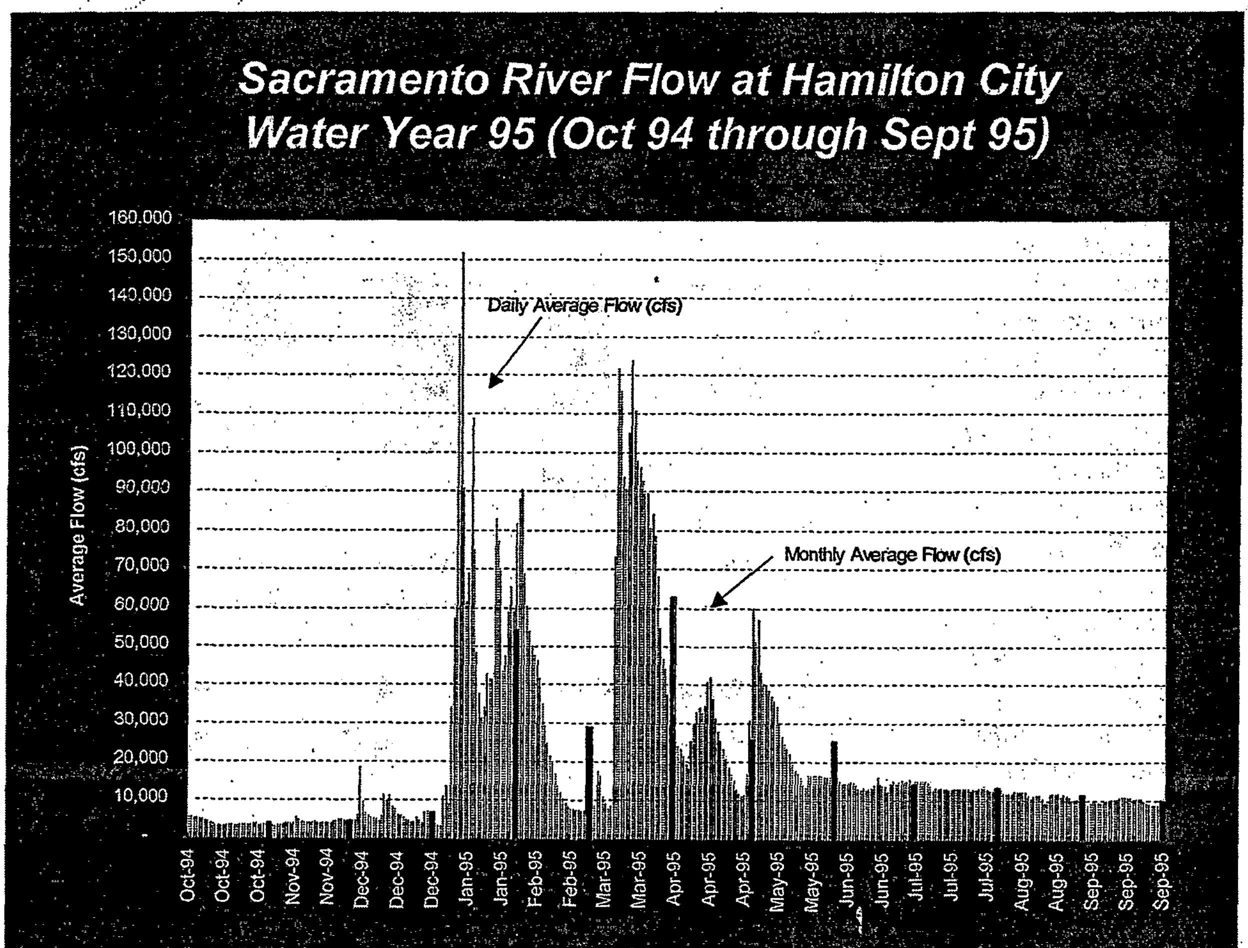
The next figure, a plot of average monthly Delta outflow for each of five water year types, illustrates both the variability among years and the variation in flows throughout the year. Late summer flows are low in all year types, but there is great variation in the magnitude of outflow during the wet winter and spring months.




Demand for water also varies over time. Demands tend to be higher than average in dry years -- there is less natural soil moisture so plants need more irrigation. Water demand also varies seasonally. The demand is highest in summer when natural flows are lowest.

As these figures illustrate, while average flow data are useful for long-term water management planning, averages obscure the reasons that conflict exists concerning Delta flow and Bay-Delta water management. Conflict arises when water is scarce, and the averages do not illustrate the scarcity that occurs at the low flow levels within a given month or year. The conflicts that arise during times when water is in short supply create the need for a more effective water management strategy.

The water flow variability is most notable when daily flows are examined. The figure below presents a graph of daily flows throughout a water year. For comparison, average monthly flows are also shown, using thicker black bars. The average monthly flows mask the much greater variation exhibited in daily flows that rise and fall with the passing of each major storm system. It is quite typical for winter and spring storms to produce periodic peaks in flow such as those shown in January, March, and May. These peak flows appear to be very important to ecosystem health: they cleanse and move gravel in riverbeds where salmon spawn, they give rivers the energy to meander and thereby sustain a host of ecological processes related to river banks and riparian vegetation, and these peak flows send behavioral cues to fish, inducing them to spawn or migrate.



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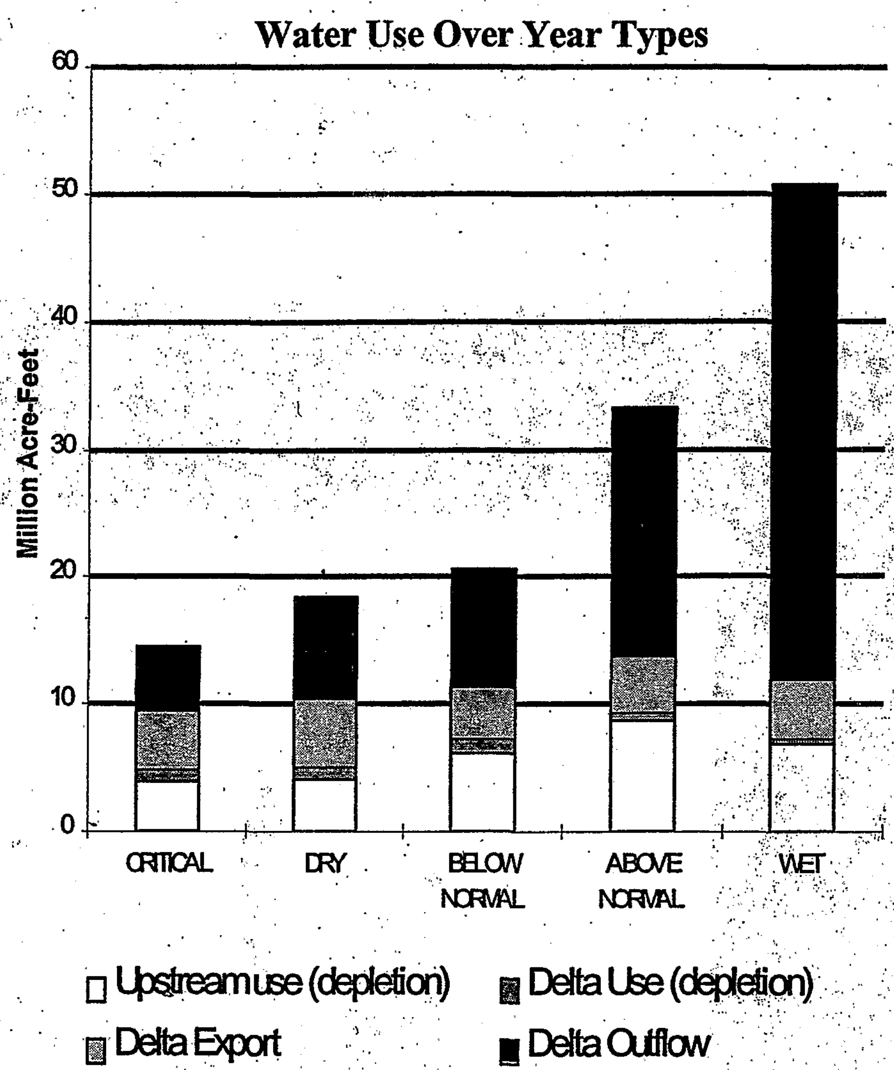
In water years that are very dry, the natural peaks in flow may not be as high as in wetter years, or some of the typical peaks may not occur at all. Water is more valuable to all users in these dry years, so the peak flows may be further reduced through the operation of reservoirs in which scarce water is captured for use later in the year. Thus, the impact of water management activities on important peak flow events is greatest during years when natural flows may be most sensitive to disturbance. The adjacent figure, based on data contained in Department of Water Resources Bulletin 160-93, illustrates this point. During wet years, approximately 20% of the water is diverted from the system for other uses. In a critical year, approximately 70% of the water is diverted, and there is considerable conflict between fisheries and diversions. During years of low outflow, and especially during periods when peak flows might typically occur, water has its highest value for all beneficial uses.




One of the greatest challenges for the program is to reduce this conflict while simultaneously improving ecosystem quality and water supply reliability. This can be done by recognizing that the value of water varies according to its quantity and timing in the system. This recognition can be used to the advantage of both water diverters and the ecosystem. The importance of a unit of water in the system is not fixed, but varies according to the flow rate, the time of year, and the water year type. Thus, it is possible to increase diversion and storage of water during some high



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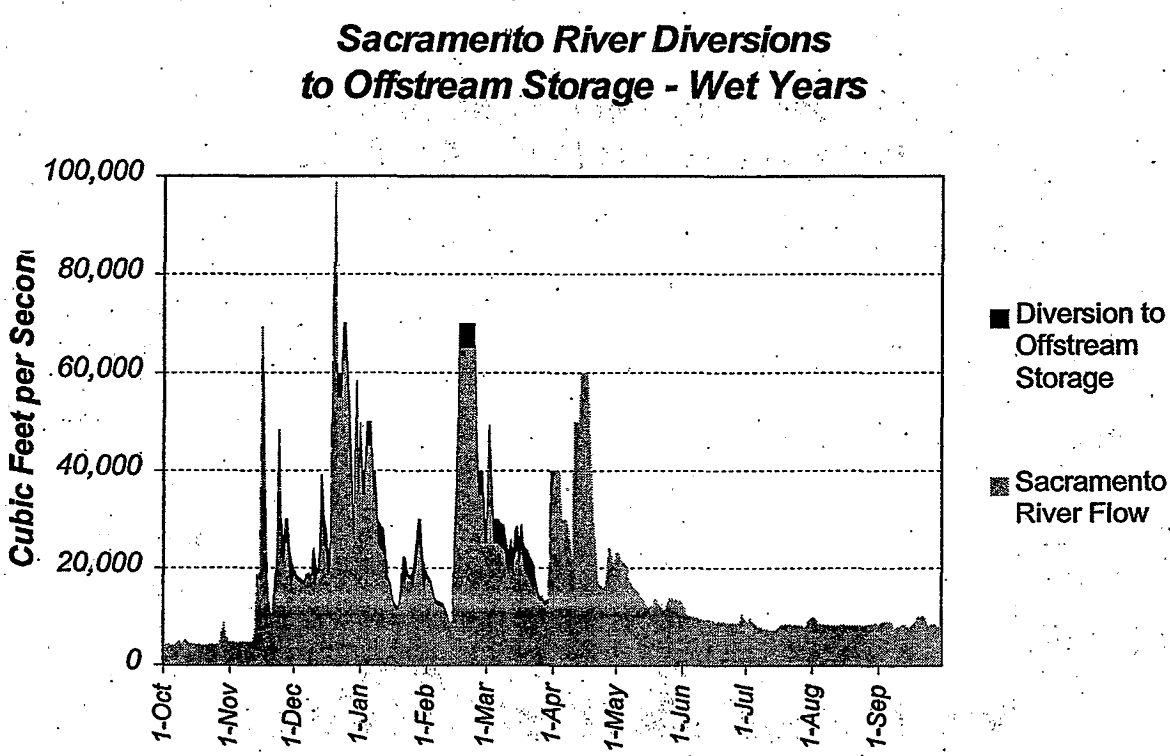
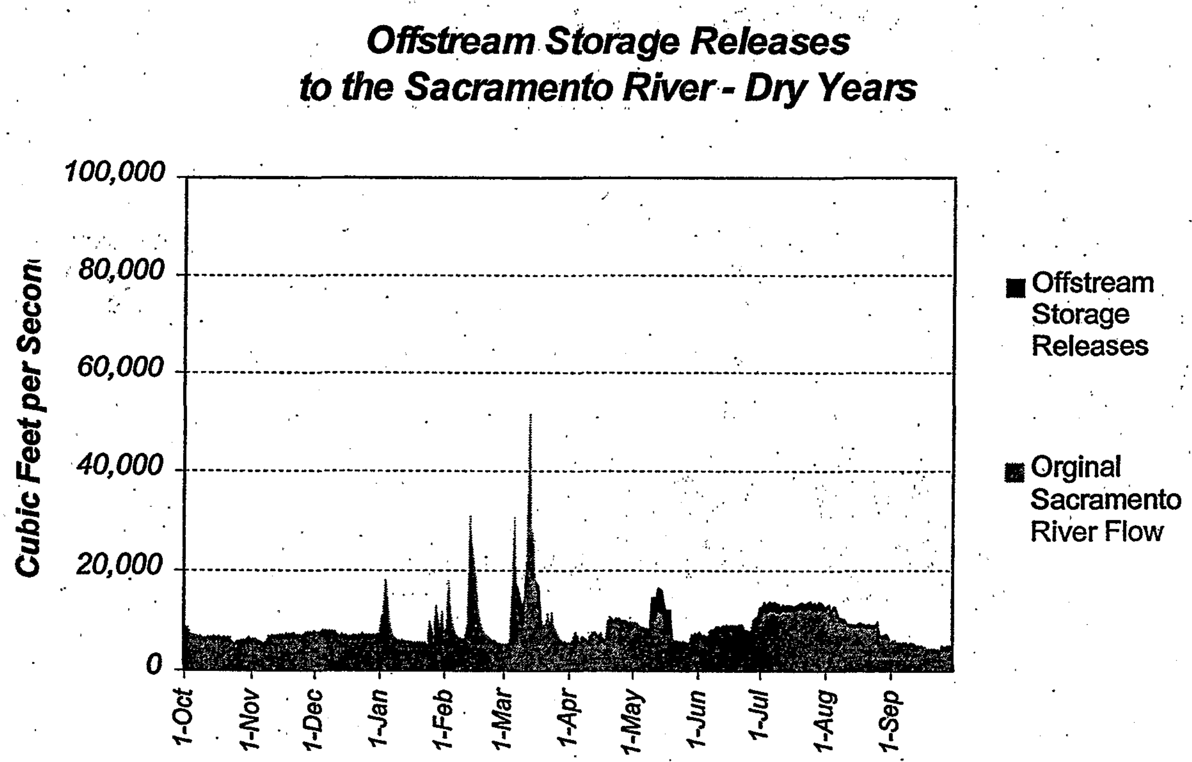
flow periods (while preserving peak flows that serve important functions in the system) in order to provide water supply later for diverters and the ecosystem. Some of this stored water can be used to augment outflow peaks during dry years when there is keen competition for water. At these times water operations have their greatest impact on the ecosystem, and additional water is most needed by Bay-Delta species. In short, water can be diverted during high flow periods with relatively little impact on the system, and can be released at other times to produce great benefit to the system. Of course, this type of diversion must be operated in a way that preserves most of the variability in the flow, ensuring that peak flows so important to ecosystem health still occur in the river.

The figures below show an example to illustrate the concept. The upper diagram shows a wet year, with the black area representing water that is diverted into storage. Runoff from upstream tributaries to the Delta usually occurs in large volumes over short periods of time in the winter and spring. New storage upstream of the Delta could store a portion of these flows with relatively little impact on the ecosystem.




Diversions would need to be made according to criteria ensuring that the environmental impacts of diversion during wet periods were less than the subsequent environmental benefits of releasing some of this water during critical periods. This is a more vital consideration associated with enlarged on-stream storage compared to off-stream storage; large amounts of water can quickly be detained in on-stream storage, while due to conveyance capacity constraints, only a minor percentage of large peak river flows can be diverted to off-stream storage. The operation of any new or enlarged facility will require much additional study during the remainder of Phase II and during Phase III of the Program to ensure that strong environmental safeguards can be incorporated into economically feasible operational criteria.

The figure below shows a dry year, and the black areas represent releases of previously stored water to augment flows for fisheries and water supply. Water could be released to meet direct needs or to provide additional benefits through exchanges. For example, water could be released from off-stream storage in the Sacramento River basin directly to local water users, reducing existing diversions from the Sacramento River during periods critical to fisheries. Water released for environmental purposes could include pulse flows that act as behavioral cues or help transport fish through the Delta. Water could also be released to provide sustained flows for riverine and shallow water habitats and improve water quality in the Delta during drier years.



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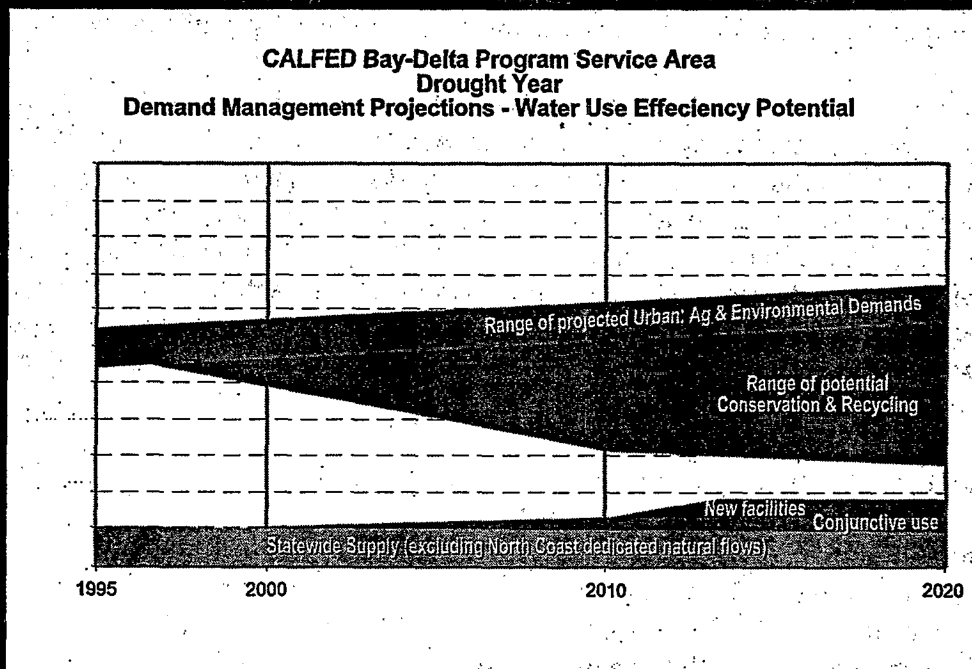
## WILL CALFED SOLVE CALIFORNIA'S WATER PROBLEMS?

For many years water managers have projected an increasing gap between California's water supply and the demand for that water. The CALFED Program is striving to balance the Bay-Delta system to increase water supply reliability, but the Program will not completely close the gap between supply and projected demand.

The following figure illustrates the relative effect of various water management measures contemplated within the CALFED Program. The figure shows statewide water supply and the projected increase in water demand over time. Also shown are potential supply increases and demand reductions that might be achieved through new surface storage, conjunctive management, and a host of efficiency measures including urban water conservation, agricultural water conservation, water recycling, and water transfers. Even with all the CALFED actions in place, there may be economic hardship during drought years when supplies cannot satisfy California's demand for water.




1. Supply and demand values are from draft Bulletin 160-98 and have been adjusted to reflect the Central Valley Watershed (North Coast Rivers are excluded).
2. Demand range includes adjustments from baseline for existing water conservation measures and reduced agricultural acreage plus potential AFRP and ERPP needs.

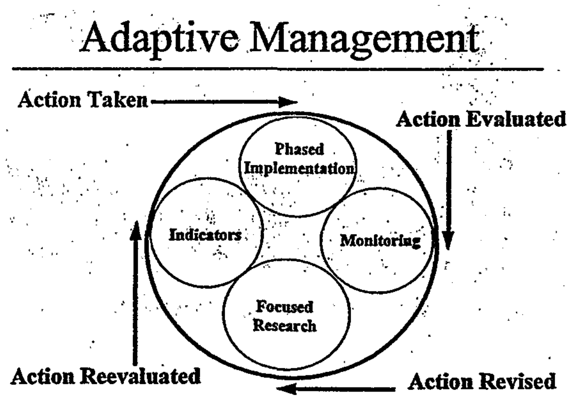
# Adaptive Management

No long term plan for management of a system as complex as the Bay-Delta can predict exactly how the system will respond to Program efforts, or foresee events such as earthquakes, climate change, or the introduction of new species to the system. Adaptive management acknowledges that we will need to adapt the actions that we take to restore ecological health and improve water management. These adaptations will be necessary as conditions change and as we learn more about the system and how it responds to our efforts. The Program's objectives will remain fixed over time, but our actions may be adjusted to assure that the solution is durable.

The concept of adaptive management can be illustrated as applied to the Program. A critical step of the ecosystem restoration component is to construct a comprehensive adaptive management framework that includes policy and management decision-making based on existing and newly developed scientific and technical information. To be effective, this process also needs to consider the ecological, economic, and social goals of communities, agencies, and interested parties and incorporate these distinct values into the design of the adaptive management process.

Adaptive management of ecosystem restoration has a dual nature. First, adaptive management is a philosophical approach toward restoration that acknowledges we need to better understand the Bay-Delta watershed if we are to succeed in restoring ecosystem health. It acknowledges that we will proceed with restoration efforts using existing information while we gather the knowledge that we lack. Although we know much about the Bay-Delta system (its ecological processes, habitats, and species), we do not know everything we need to successfully restore ecosystem health. The adaptive management philosophy accommodates the status of knowledge and provides an avenue to obtain the necessary knowledge (and experience) through the duration of the implementation period.

Second, adaptive management is a structured decision-making process that includes important components to identify indicators of ecosystem health (indicators); a program for monitoring indicators of ecosystem health (monitoring); a program for implementing research to gather new or additional information (focused research); a process to optimize the implementation projects through time (phased implementation); a feedback process to integrate knowledge gained from monitoring and research; and the flexibility to change the program in response to new information.



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The concept of adaptive management is an essential part of other program elements as well. In every part of the program, new or more intensive actions are proposed. Along with these proposed actions comes uncertainty. What actions work best to achieve program objectives? How can these actions be modified to work better, cost less, or be simpler to implement? How should the emphasis among actions change over time? Are there new or different actions that should complement or replace those that are being implemented? An adaptive management approach helps to answer these questions.

Even within the area of adaptive management there are linkages among Program elements and opportunities for more effective action. This is especially true for the Ecosystem Restoration Program and the Water Quality Program. There is a lack of conclusive information about cause and effect relationships and how much restoration is needed for a "healthy" ecosystem and good water quality. An effective adaptive management program requires the continuous examination of monitoring data to measure progress and redirect activities where necessary. The Program is currently identifying the monitoring, assessment and research needs for CALFED-related projects, actions, and activities. A Comprehensive Monitoring, Assessment, and Research Program (CMARP) is a critical component of the CALFED adaptive management strategy.

The concept of adaptive management will be developed more fully for all program components as implementation plans are developed later in Phase II of the Program.

# Other Concepts

There are a number of other concepts that will figure prominently in any successful Bay-Delta solution, and issues that must be adequately resolved in order to move forward. This section provides an introduction to some of these important issues and concepts.

**Common Delta Pool** - The Delta is often referred to as a water supply hub. Many of the individuals and agencies that use water from the Bay-Delta system divert their water supplies directly from the Delta itself, including in-Delta agricultural users, some Bay area communities, and the state and federal water projects. This reliance by many users on a single source is sometimes called the common pool concept. Accompanying the use of a common pool is common interest: a shared interest in restoring, maintaining and protecting Delta resources, including water supplies, water quality, and natural habitat. Water users who have no alternative to Delta supplies believe that the maintenance of the common pool is their best guarantee of continued broad interest in maintaining and improving Delta conditions.

Under each alternative for the CALFED Program, all diverters would continue to take some or all of their water from Delta channels, maintaining the common Delta pool concept. Under any variation of alternative 1 or 2, all Delta diverters would continue to be fully reliant on the Delta channels for water supplies they take from the system. Under alternative 3, a dual conveyance system would allow some water users to take some of their Delta supplies from the Sacramento River upstream of the Delta. Facilities to do this would be sized so that even these diverters would continue to depend on the common pool for part of their water supplies. A successful Bay-Delta solution must provide adequate assurance that the legitimate interests of all parties will be protected.

**Conjunctive Management Regional Concerns -** Conjunctive management is the operation of a groundwater basin in combination with a surface water storage and conveyance system. Water is stored in the groundwater basin for later use in place of, or to supplement, surface supplies. Water is stored by natural recharge or by intentionally recharging the basin during years of above-average water supply. Residents of areas where conjunctive management may occur have concerns over development and operation of facilities by entities outside the region due to potential impacts on existing groundwater resources. CALFED is seeking to facilitate the safe development of additional conjunctive management and groundwater banking opportunities as one way to help maximize the overall water supply and protect groundwater resources.

Currently, CALFED is pursuing an outreach program to local communities to determine in which areas interest exists in participating in a locally-controlled conjunctive use program. The Program has developed guiding principles that are designed to protect resources, help address local concerns, and avoid potential impacts prior to implementing a conjunctive management operation. The draft principles developed to date include the following:

- Funding support will be provided for local assessment of groundwater resources
- Conjunctive management programs will be voluntary
- Groundwater will first be used to meet local water needs
- Transfers outside the basin will involve appropriate compensation for the resource
- Pilot programs, in addition to computer models, will be used to evaluate local conjunctive management potential and mitigation requirements
- conjunctive management projects will be overseen by local agencies in partnership with other entities to assure that concerns are addressed through interest-based negotiation

Conjunctive management is, by definition, the operation of a groundwater basin in combination with a surface water storage and conveyance system for more effective management of the water supply. The CALFED alternatives assume that development of any groundwater system for conjunctive management cannot be effective without access to surface storage that enables water to be retained and released as needed.

**Area-of Origin/Water Rights -** Area of origin statutes stipulate that the priority use of water is within a local basin. This is an important concept for communities in the watershed that will grow over time and will need more water than they are currently using. CALFED supports this concept and will develop its Program consistent with the laws and regulations protecting areas of origin. While the Phase II analysis examined potential programmatic impacts of the proposed alternatives on areas of origin, modifying California water law in order to strengthen, expand, or modify area of origin protections is beyond the scope of the CALFED program.

**Coordinated Permitting** - To ensure timely and successful implementation of the CALFED Bay-Delta Program, a coordinated permit process will be established. The process needs to anticipate the numerous permit requirements for all actions approved as part of the Program. Coordinated permitting cannot result in relaxation of permitting requirements, but must include good information sharing among permit agencies to make the permitting process more efficient. In 1998, the conceptual framework for the process will be developed.

It is expected that the coordinated permit process and framework will include the following components: a permit assistance team to assist the project proponents in understanding and obtaining the required permits, and a regulatory permit review team dedicated to the CALFED projects. The regulatory team would provide timely review of environmental documentation and permitting, close interagency coordination, development of mitigation measures and monitoring requirements, and completion of biological opinions. The permit coordination framework would also be designed to address broad issues to improve the efficiency of permitting such as, general and regional permits and mitigation banks.

Initially, the coordinated permit framework will be applied to the near-term ecosystem restoration projects currently being funded. As other elements of the Program are approved, those projects and actions would also benefit from the framework.

**Coordinated Flood Control Activities** - The Federal Government and the Sate of California have recognized the need for a comprehensive approach to flood plain management as described in reports such as the 1997 Governor's Flood Emergency Action Team (FEAT) Report, Federal Public Law 87-874, and the 1998 Energy and Water Development Appropriations Bill.

The U.S. Army Corps of Engineers' Sacramento and San Joaquin River Basins Comprehensive study is addressing the general objectives of flood damage reduction and ecosystem restoration. The study will ultimately have implementation plans for long-range management of the entire river systems. The study will include consideration of the full range of structural and non structural flood damage reduction measures, as well as the diverse, but interrelated, water and land management objectives. In addition, the Long-Term Management Strategy (LTMS) for handling and disposal of dredged materials from San Francisco Bay could lead to availability of dredge material for levee construction and habitat restoration. These studies will be fully coordinated and compatible with other related programs and will contribute directly towards meeting the goals of the CALFED Delta Long-Term Levee System Protection Plan.

**North and South Delta Flood Improvements** - The Delta Long-Term Levee Protection Plan is focused on improving levee protection within the Delta. The plan includes 1) base-level funding to provide equitably distributed funding to participating local agencies in the Delta, 2) special improvement project funding with priorities funding for special habitat improvement and levee stabilization projects to augment the base-level funding, 3) Delta island subsidence control plan, 4) emergency management plan, and 5) seismic risk assessment. The Delta Long-Term Levee Protection Plan addresses potential island flooding for all areas of the Delta, not just the north and south Delta.

**San Joaquin Drainage** - San Joaquin drainage problems have been evaluated in several studies over the past two decades. Complete resolution of the San Joaquin drainage problems is beyond the scope of the CALFED Bay-Delta Program. However, some CALFED actions can improve the San Joaquin drainage problems. For example, improved water quality (reduced salinity) to the Delta Mendota Canal would result in improved San Joaquin drainage and improved quality water in the San Joaquin River. In addition, the Water Quality program element includes actions which control agricultural surface and subsurface drainage to improve water quality in the San Joaquin River region.

**Recreation** - CALFED seeks to plan for recreation enhancement and, if necessary, to mitigate impacts to Delta recreation resulting from CALFED activities designed to restore other Delta resources. Construction of new facilities will appropriately provide for on-site recreation development. The responsibilities and procedures for recreation development at new storage and other facilities is clearly addressed in current law. Federal and State laws, and local laws and plans, govern recreation developments associated with water development projects in and near the Delta. The draft EIS/EIR and accompanying technical reports address general impacts that the CALFED Program implementation could have on recreational resources and on how the recreational resources could impact the other parts of the Program.

Within the existing CALFED framework exists the need and opportunity for a Recreation Coordination Program. Such a program would identify and prioritize recreation enhancement and mitigation projects for implementation once a preferred alternative is selected. Specific recreation mitigation and enhancement actions and projects could then be selected appropriate to need. The time line of such a process should be consistent with the Phase III documentation and implementation schedule, ensuring that recreation resources are appropriately considered as part of the Bay-Delta solution.

**Climate Change/Sea Level Rise** - The Program is proposing significant investments to improve water quality, ecosystem quality, water supply reliability, and levee system integrity. The long-term durability of the Program could be adversely affected by future climate changes.

The geologic record shows evidence of past substantial changes in global and regional climates with the resultant marks from flooding and droughts. Sea level changes are directly related to extremes in climate change. For example, sea levels were 2 to 6 meters higher than present levels during the last interglacial period of 125,000 years ago and approximately 120 meters below present levels during the last Ice Age, 20,000 years ago. Considering this wide range of sea level fluctuation, the Delta has likely existed with current sea levels for only small portions of the geologic history.

Future sea level changes are difficult to estimate because not enough is known about how the ice sheets in Greenland and Antarctica will react to global warming, and how much global warming may occur. Warming may cause not only melting of ice sheets and land-based glaciers, but some thermal expansion of the sea water itself. If global warming causes increased precipitation at very high latitudes and resultant storage of water in the ice sheets, sea level could actually decrease.

Estimates of current sea level rise in the neighborhood of 1.5 millimeters per year is typical in the literature. One study estimates that global warming may cause further rise of about 18 centimeters (0.7 foot) by the year 2030. Also, if current trends in greenhouse gas emissions continue, the study estimates the rise could amount to 1 meter (3.3 feet) above current levels by 2100. A similar evaluation by the U.S. Environmental Protection Agency estimates that sea levels may rise globally approximately 20 inches (range of 6 to 38 inches) by year 2100 and average global temperatures could increase by 2 degrees Celsius (range of 1 to 3.5 degrees C).

Rising sea levels could have significant adverse impacts on the Delta system (including habitat, water supply, and Delta agriculture) if levees are overtopped or if substantial future investments are required to prevent overtopping. Higher sea levels would increase salinity levels throughout the Delta and for many miles inland. This would alter the effectiveness of Program habitat restoration projects and likely alter the entire ecosystem of the Delta. Water diversions dependent on taking water from the Delta channels would likely need to be abandoned and moved inland to areas of lowered salinity. While these changes are potentially significant over the long term (hundreds or thousands of years), they are unlikely to significantly alter Program facilities or operations within the foreseeable future (20 to 50 years).

The long-term change in temperatures could result in more variability in precipitation and runoff from year to year and season to season. Higher flooding could become more common at times and drought periods could become more frequent, increasing competition for remaining scarce water supplies. Some estimates indicate that California will experience an increase in winter runoff, a decrease in spring and summer runoff with a resultant decrease in water supply and reliability in the Central Valley Basin.

**Agricultural Land Conversion in Delta** - Agricultural land conversion in the Delta resulting from the CALFED Program is limited to that needed for implementation of levee system improvements, ecosystem restoration, and other facilities. Possible land area in the Delta affected by Program implementation could range from approximately 140,000 to 230,000 acres depending on the alternative. Some of this land is already owned by the government and other possibilities such as the reclamation of Franks Tract will be considered prior to converting prime agricultural land. The CALFED Program seeks to preserve as much prime and unique agricultural land as possible during Program implementation in Phase III. The Program is investigating the concept of preserving the overall State-wide level of agricultural production to offset Delta regional agricultural production losses due to the land conversion.

**Agricultural Land Conversion in Service Areas** - Agricultural land conversion in the service areas (areas served water by the State Water Project and the Central Valley Project) is included in the CALFED alternatives as a potential measure to improve water quality by reducing discharges from drainage lands with selenium problems. The CALFED Program policy is not to convert land to reduce water demands. However, depending on water supply and water transfer opportunities available in the various alternatives, farmers may choose to change cropping patterns, temporarily fallow land, or permanently take land out of agricultural production. Program implementation will require some land conversion to accommodate new facilities or restoration activities. Possible land area in the service areas affected by Program implementation could range from approximately 35,000 to 100,000 acres depending on the alternative. Third party impacts of such actions will be carefully evaluated and taken into consideration.

**Needs of San Francisco Bay** - There have been some concerns that the CALFED Bay-Delta Program is not doing enough to the promote health of the Bay, especially in the central and south Bay. The focus of the Program, and the geographic scope of the problem area established by the Program, is the legally defined Delta, Suisun Bay extending to the Carquinez Strait, and Suisun Marsh and near-shore ocean. The program will address interactions between the Delta and San Francisco Bay such as flow or sediment by examining the "inputs" and "outputs" from the defined problem area. Under this approach, outputs such as flow or sediments that are needed to protect the rest of the Bay are within the scope of the Program. Problems which originate and are manifest outside the Program's problem area, such as toxic discharges into the South Bay, are not within the scope of the Program to address.

The ecosystem restoration component includes the majority of Program actions dealing with the Bay. Ecosystem restoration actions would provide additional springtime Delta outflow, habitat improvements in the North Bay, local watershed actions surrounding the Bay, and exotic species control.

**Effects on Hydropower Generation** - The CALFED Program has no specific objectives for hydropower generation. However, the Program does seek to minimize impacts on other resources, such as hydropower generation, during implementation. The Program is coordinating with the Western Area Power Administration to assure that issues are identified and properly framed.

# 3. PROGRAM ALTERNATIVES

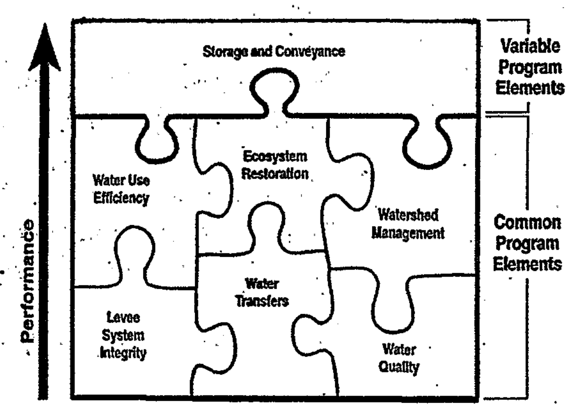
Phase II focused on evaluating variations to alternatives developed in Phase I and preparing a Programmatic EIS/EIR for twelve of these variations. These alternatives are programmatic in nature, intended to help agencies and the public make decisions on the broad methods to meet Program objectives. The alternatives are not intended to define the site specific actions that will ultimately need to be designed. For example, the alternatives are not intended to define the precise size and location for surface water storage. They are intended to provide the decision makers enough information on whether or not storage in a size range is warranted, for example, in the Sacramento River watershed.

> Alternatives are intended to provide information on broad programmatic issues, not site specific issues.

The alternatives are comprised of building blocks referred to as Program elements. The basic structure from Phase I contained **common** and **variable** Program elements which were used to build the Phase II alternatives and variations. Common Program elements included levee system integrity, water quality, ecosystem restoration, and water use efficiency and variable elements included storage and conveyance) During Phase II, it was recognized that two additional common Program elements (water transfers and watershed management) were needed because of their multi-objective impact.

The common or foundational Program elements resulted from a realization during Phase I that some categories of actions were so basic in addressing Bay-Delta system problems that they should not be optional nor be made to arbitrarily vary in level of implementation. These common Program elements are also distinguished from the variable storage and conveyance elements in that each consists of hundreds of individual actions which can be implemented over a twenty to thirty year period. They will be guided by specific policy direction and an ongoing adaptive management framework and require local partnerships, coordination and cooperation. The storage and conveyance Program elements are different in that they generally require a more classic "yes" or "no" decision with respect to the need for new or modified facilities (e.g. off-stream storage or Delta conveyance facilities).

The six common Program elements provide the foundation for overall improvement in the Bay-Delta system. These Program elements represent a significant investment in and improvement (reduction) of the resource conflicts in the system. Each of the individual elements is a major program of its own. For example, the ecosystem Program element represents the largest, most complex restoration ever undertaken.



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The levee element in isolation will result in significantly improved system integrity by strengthening levees throughout the Delta. The water quality element will dramatically lower toxicants in the system. Water use efficiency is expected to avoid over 3 MAF of water demand annually by year 2020. A more effective and protective water transfer market will provide critical ecosystem flows without regulatory action and will result in a reduction of drought-induced economic damage. Watershed management coordination is a large long-term program to encourage habitat enhancement, reduce pollutant load, and help stabilize runoff.

However, the performance of each common element is enhanced when developed together as part of the total Program. Additionally, the total performance is enhanced (or the risks reduced) by the range of modifications under consideration in the storage and conveyance Program elements.

A significant part of the overall performance of the CALFED Bay-Delta Program is attributable to the common Program elements. The variable Program elements further enhance performance, and provide greater operational certainty and Program balance.

This chapter provides an overview of the common and variable program elements, describes the 12 alternative variations built from these elements, and concludes with a description of the evaluation and refinement of the alternatives.

## Common Program Elements

The alternatives for the CALFED solution are assembled from hundreds of programmatic actions. To help organize the discussion of alternatives, the actions are summarized below under each of the major Program elements introduced above. The common program elements remain relatively unchanged from one alternative to another:

- **Delta Long-Term Levee System Protection Plan** - provides significant improvements in the reliability of the Delta levees to benefit all users of Delta water and land

- **Water Quality Program** - makes significant reductions in point and non-point pollution for the benefit of all water uses

- **Ecosystem Restoration Program** - provides significant improvements in habitat for the environment, restoration of some critical flows, and reduced conflict with other Delta system resources

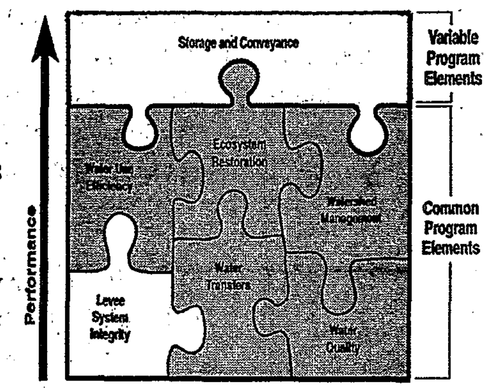
- **Water Use Efficiency Program** - provides policies for efficient use of water in agricultural and urban settings which is essential to using existing water supplies wisely and assuring efficient use of any new supplies developed through the Program.

- **Water Transfer Policy** - Provides a policy framework to facilitate and encourage a properly regulated water market to move water between users, including environmental purposes, on a voluntary and compensated basis

- **Watershed Management Coordination** - encourages watershed activities that benefit all Delta system resources

These Program elements remain relatively the same for all alternatives. They are supplemented with various Delta conveyance configurations and options for storage in assembling into alternatives.

## Delta Long-Term Levee System Protection Plan




The Sacramento-San Joaquin Delta is an area of great regional and national importance, which provides a broad array of benefits including agriculture, water supply, transportation, navigation, recreation and fish and wildlife habitat. Delta levees are the most visible man made features of this system. Historically, the levee system has been viewed as a means of protecting other resources. However, levees are an integral part of the Delta landscape and are key to preserving the Delta's physical characteristics and processes including definition of the Delta waterways and islands.

Given the numerous public benefits protected by Delta levees, the focus of the Delta Long-Term Levee Protection Plan is to supplement and improve Delta levee maintenance and emergency management practices. There are five main parts to levee protection plan:

**Delta Long-Term Levee Protection Plan Issues and Concerns**

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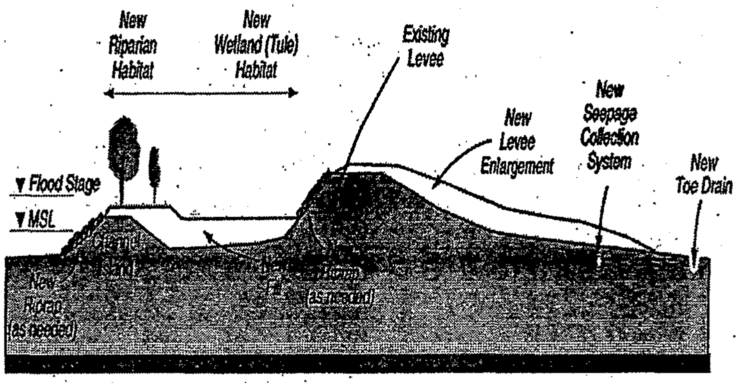
**1. Base-Level Protection Plan** - Base-level funding provides equitably distributed funding to participating local agencies in the Delta. One of the primary goals of the CALFED Program is to reconstruct all Delta levees to a particular standard. The Program has tentatively selected the U.S. Army

Corps of Engineers PL 84-99 standard. This standard provides for reconstructing levees to 1.5 feet above the 100-year flood level. However, the selection of any levee standard must be compatible with available funding. If the selected levee standard is too low then many of the benefits which the levees provide will be lost. If the levee standard is too high then reconstruction becomes too expensive for most local agencies and implementation is not uniform.

**2. Special Improvement Projects** - The special improvement project funding sets priorities and establishes a funding mechanism for special habitat improvement and levee stabilization projects to augment the base-level funding. Under the special improvement projects, levee improvement projects would be identified and prioritized based on the public benefit accruing from island protection such as protection of water quality, conservation or enhancement of fish and wildlife habitat, and protection of public and private infrastructure. Special improvement project funding is based on the <u>benefit</u> to the public , not solely on the <u>need</u> for improvement.




*Levee Enlargement, Waterside Berm with New Riparian Habitat*

**3. Delta Island Subsidence Control Plan** - Subsidence of Delta soils substantially contributes high maintenance costs to repair and rebuild the levees as they sink with the adjoining land. Continued subsidence can directly jeopardize the long-term viability of the Delta levee system. The plan focuses on subsidence control for approximately 67,000 Delta acres having the highest subsidence potential.

**4. Emergency Management Plan** - The most recognizable threat to Delta islands and resources in the Delta is inundation due to winter flood events. In addition, other potential disasters can be caused by fire, burrowing animals whose actions can cause levees to fail, toxic spills, and failure of Delta levees during low flow periods. Approximately 20 islands have flooded since the 1960s, including repeated flooding of some islands. The emergency management plan will build upon existing State, Federal, and local agency emergency management responsibilities to improve protection of Delta resources in the event of a disaster.

**5. Seismic Risk Assessment** - Earthquakes can cause levees to fail by slumping or liquefaction of underlying soils. To date, there have been no known Delta levee failures or island inundations as a result of seismic events. However, there are several active faults located sufficiently close to the Delta to present a threat to Delta levees. The seismic risk assessment will evaluate the potential performance of existing levee system during seismic events and recovery actions and accessibility following a seismic event. Currently, little is know on how peat soils will respond to earthquake induced ground accelerations; peat soils may diminish or amplify ground motions.

The levee plan will remain relatively unchanged among the alternatives. Delta channel modifications for conveyance may require a levee setback along the alignment or a different levee cross section depending on channel flow velocities. The levee cross sections in places may vary depending on locations selected for levee associated habitat.

Overall potential benefits of the Delta Long-Term Levee Protection Plan include:

- Subsidence reduction helps long-term Delta system integrity
- Ensures suitable funding, equipment and materials availability, and coordination to rapidly respond to levee failures
- Provides funding for continued maintenance of levees to protect Delta functions
- Increased reliability for water supply needs from the Delta and in-Delta water quality
- Increased reliability for in-Delta land use
- Increased reliability for in-Delta aquatic and wildlife habitat

**Delta Long-Term Levee Protection Plan**
**Facts and Figures**

- Helps protect land uses, water quality, and water supply reliability.
- Provides new opportunities for habitat.
- Remains relatively unchanged between alternatives.
- **Meets Program objectives for reducing vulnerability to the Delta system.** However, seismic risk is uncertain.
- Requires additional research on seismic vulnerability.
- Could exceed $2 billion over 20-30 years if all levees raised to PL84-99 standards; however, an affordable annual investment rate a critical issue that will require prioritization given the extent of eligible areas (e.g. if only $1 billion is funded some standards for some areas may need to be relaxed). Annual investment rates exceeding $25 to $30 million may not be practical.



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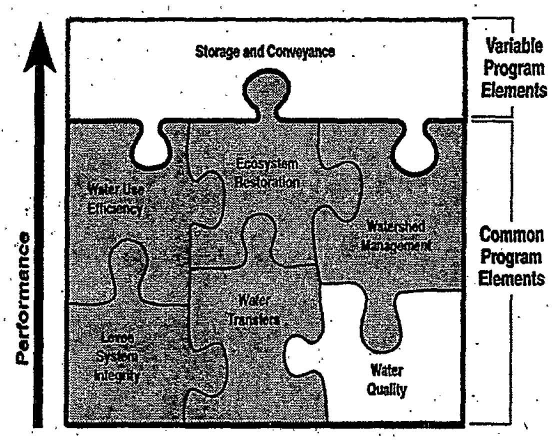
## Water Quality Program




The Water Quality Program includes 25 programmatic actions to further the Program's goal of providing good water quality for environmental, agricultural, drinking water, industrial, and recreational beneficial uses of water. The majority of these actions rely on comprehensive monitoring and research to improve understanding of effective water quality management and on the ultimate **control of water quality problems at their sources.**

Determining impairment to a water quality beneficial use is always a difficult and complicated matter. For some beneficial uses, such as drinking water use and agricultural water use, water quality impacts on use are generally well known. For other beneficial uses such as ecosystem use, water quality impacts on species are less well understood. As a result, the program has relied on the technical expertise of a variety of stakeholders representing beneficial uses. The 25 water quality actions include a combination of research, pilot studies, and targeted activities. This approach allows actions to be taken on known water quality problems and sources of those problems, while allowing further research of potential problems and solutions. Actions will be adapted over time to ensure the most effective use of resources.

**Water Quality Program Issues and Concerns**

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In summary, the Water Quality Program element includes the following broad ranges of programmatic actions:

- **Mine drainage** - Reduce heavy metals
- **Urban and Industrial Runoff** - Reduce heavy metals, pesticides, nutrients, and sediment and subsequent turbidity. Evaluate loadings of total organic carbon (TOC), salinity, and pathogens in urban runoff and assess the need for source control measures to reduce these parameters of concern to drinking water beneficial uses.

**Further research is needed for some water quality problems.**

For example, for some parameters of concern, such as mercury, not enough is understood about its sources, the bioavailability of mercury to various species, factors contributing to its bioavailability, and the load reductions needed to reduce fish tissue concentrations necessary for human consumption.



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- **Wastewater and Industrial Discharge -** Reduce pathogens (from boat discharges), oxygen depleting substances, selenium, and ammonia. Evaluate the loadings of TOC, salinity, and pathogens from wastewater and industrial treatment plant discharges and assess the need for source control measures to reduce these parameters of concern to drinking water beneficial uses.

- **Agricultural Drainage and Runoff -** Reduce selenium (agricultural subsurface drainage), salinity, pesticides, sediment, TOC (discharges from Delta islands), nutrients and ammonia, and pathogens (controlling inputs from rangelands, dairies, and confined animal facilities).

- **Water Treatment -** Reduce formation of disinfection by-products by controlling TOC, pathogens, turbidity, and bromides.

- **Water Management -** Use water management techniques and improved outflow patterns and water circulation in the Delta region to control salinity levels.

- **Human Health -** Reduce impairment of recreational beneficial uses within the Delta due to human health concerns associated with consumption of fish and shellfish containing elevated levels of DDT, chlordane, toxophene, mercury, and PCBs and their derivatives by research/monitoring and source control.

- **Toxicity of Unknown Origin -** Through research/monitoring identify parameters of concern in the water and sediment within the Delta, Bay, Sacramento River and San Joaquin River regions and implement actions to reduce their toxicity to aquatic organisms.

The water quality program will remain relatively unchanged among the alternatives but its performance can vary significantly depending on the other Program elements. Storage can help timing for release of pollutants remaining after source control efforts. Improved conveyance to south Delta export pumps will improve water quality for those diversions but may decrease quality for in-Delta diversions. Water use efficiency measures can improve water quality entering the Delta by reducing some agricultural drain water containing pollutants.

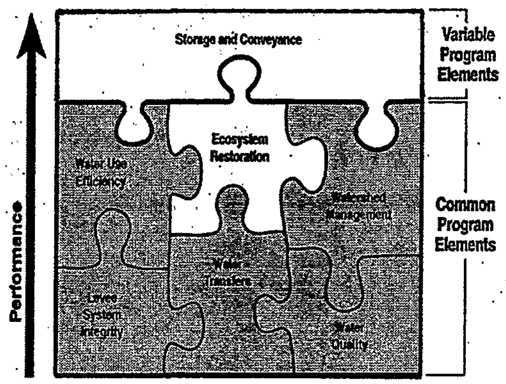
**Water Quality Program Facts and Figures**

- Remains relatively unchanged between alternatives.
- Provides critically needed reduction of toxics for fisheries and an important reduction in organic carbon to improve drinking water.
- **Does not address health concerns associated with bromide without other Program elements.**
- Could exceed $0.75 billion over 20-30 years. May require annual investment exceeding $25 million.

Potential benefits of the water quality program include:

- Improves Delta water quality by reducing the volume of urban and agricultural runoff/drainage and concentration of pollutants entering the Delta
- Improves water quality for the ecosystem by reducing toxicants as a limiting factor
- Improves drinking water quality and public health benefits
- Reduces concentration of compounds contributing to trihalomethane formation potential and degradation of drinking water supplies

## Ecosystem Restoration Program




The Ecosystem Restoration Program (ERP) includes over 700 programmatic actions which, in combination with the program elements for storage and conveyance and the other common program elements, are expected to result in greatly improved ecological health for the Bay-Delta system. Adaptive management, scientific oversight, and program review will guide implementation of the ERP over the 20 to 30 years it will take to restore ecological health.

The ERP is designed 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. A foundation of this program element is restoration of ecological processes that are associated with streamflow, stream channels, watersheds, and floodplains. These restored processes can create and maintain habitats essential to the life history of species dependent on the Delta, and can help the system function in a more sustainable way.

**Ecosystem Restoration Program Issues and Concerns**

The ERP also focuses on Delta species. Major elements of the ERP are directed at recovering endangered species, implementing ecosystem improvements to eliminate the need for additional species listings, and providing increased abundance of valuable sport and commercial fishes. In addition, the ERP will improve population abundance and distribution of many other aquatic and terrestrial plants and animals.

Some of the actions that are important for ecosystem health are already being implemented at the local level. The Program will support and work with local conservancies engaged in restoration projects and will foster collaborative programs with local watershed groups to protect and manage watersheds in the Bay-Delta system.

In summary, the ERP will implement the following types of programmatic actions:

- Restore, protect, and manage important habitat types, including tidally influenced fresh and brackish water marsh habitat; seasonal, fresh emergent, and nontidal perennial aquatic habitat; perennial grasslands; agricultural lands managed using "wildlife friendly" techniques; stream meander corridor and riparian land along the Sacramento River; and riparian woodland and shaded riverine aquatic habitat.

- Restore critical instream flows and Delta outflow in key springtime periods (an average of about 100,000 to 300,000 acre-feet of increased flow depending on year type, ranging from near 0 to approximately 500,000 acre feet depending on actual year).

- Develop floodways along the lower Cosumnes and San Joaquin rivers.

- Construct setback levees to increase floodplain interactions and provide seasonal aquatic and riparian habitats.

- Develop control programs for invasive species.

- Protect sediment sources that feed streams and rivers in the Bay-Delta system.

- Support local watershed planning and management programs.

- Install state-of-the-art fish screens.

- Implement or expand fish marking programs at hatcheries and fish production facilities in the Bay-Delta system.

- Modify barriers that temporarily impair fish passage.

- Evaluate and reduce adverse effects of contaminants.

- Implement a strong ecosystem monitoring program to evaluate short- and long-term trends in ecosystem health.

- Implement a well-funded research program to provide information needed for future solutions and decisions.

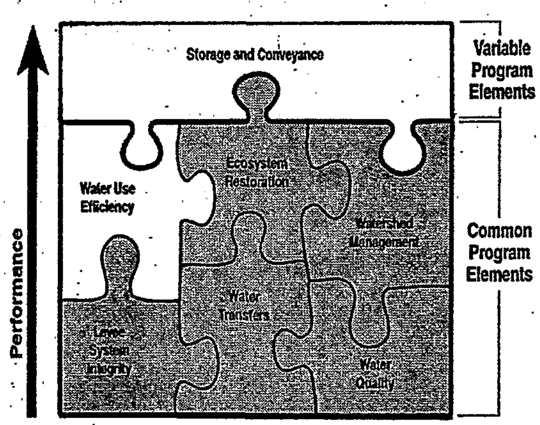
The ecosystem plan will remain relatively unchanged among the alternatives. However, its performance can vary with the other Program elements. Storage can improve the timing of instream flows and Delta outflows, and can allow modification of timing of diversions. Improved conveyance to the south Delta export pumps can improve timing of diversions to reduce impacts on fish. Modified conveyance can reduce adverse Delta flow circulation issues and can also reduce the entrainment effects on fisheries. Water quality improvements through source controls and timing of remaining pollutant releases improves water quality and reduces toxicity for the ecosystem. Improvements of levees and channels for improved system integrity can also incorporate new habitat features. Reduced diversions associated with water use efficiency measures helps reduce diversion effects on fisheries.

**Ecosystem Restoration Program Plan Facts and Figures**

- Remains relatively unchanged between alternatives.
- Provides critically needed habitat and reduction of other stressors to the environment.
- **Depending on the alternative, may not do enough to reduce entrainment impacts of exports from the south Delta.**
- Could exceed $1.5 billion over 20-30 years. Annual investments exceeding $50 million may be required.

Potential benefits of the habitat restoration program include:

- Reverses the decline in ecosystem health by reducing or eliminating factors which degrade habitat, impair ecological functions, or reduce the population size or health of species
- Produces a healthy Bay-Delta ecosystem that provides for the needs of plants, animals, and people using the system
- Supports sustainable production and survival of plant and wildlife species, including resident species as well as migrants such as the waterfowl that use the Pacific Flyway each winter
- Reduces the conflict between fisheries and diversions; healthier fishery populations could lead to reduced diversion limitations




## Water Use Efficiency Program

The CALFED Water Use Efficiency element approaches water use efficiency from a policy perspective. In contrast to all other Program elements,



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few technical issues are addressed. This approach is necessary and appropriate because implementation of efficiency measures occurs mostly at the local and regional level by local agencies, not by State and federal CALFED agencies. The Program's policy toward water use efficiency is a reflection of the California's legal requirements for reasonable and beneficial use of water: existing water supplies must be used efficiently, and any new water supplies that are developed by the program must be used efficiently as well.

**Water Use Efficiency Program Issues and Concerns**

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The role of CALFED agencies will be twofold. First, they will offer support and incentives through expanded programs to provide planning, technical, and financing assistance. Second, the CALFED agencies will play an important role in providing assurances that cost-effective efficiency measures will be implemented.

Based on a more detailed analysis provided in the *Water Use Efficiency Technical Appendix* to the Programmatic EIS/EIR, estimates of potential conservation and water recycling are summarized in the following table. Values represent water savings expected to occur for future conditions regardless of the outcome of a CALFED solution (termed no-action) as well as the incremental savings expected from a CALFED solution.

| | Net Water Savings [1] (1,000 acre-feet annually) | | |
|---|---|---|---|
| | Urban Conservation | Agriculture Conservation | Urban Recycling |
| CALFED No Action (occur as future trends in absence of a Bay-Delta solution) | 1,480 | 230 | 1,170 |
| CALFED Program (result of CALFED Program actions) | 740 | 160 | 550 |
| Total | 2,220 | 390 | 1,720 |
| | | Grand Total | 4,330 |

1. "Net water savings" is water available for reallocation to other water supply uses. Reductions in applied water would be greater.

With respect to urban and agricultural conservation, the program proposes to rely largely on locally-directed processes to provide endorsement or certification of urban and agricultural water suppliers that are properly analyzing conservation measures and are implementing all measures that are cost-effective and feasible. Organizations composed of water suppliers and public interest or environmental groups already exist that may be able to serve this function. Endorsement or certification of water suppliers will enable CALFED agencies to target assistance programs and other measures to assure reasonable and beneficial use.

The water use efficiency program element includes the following programmatic actions.

Conservation related actions include:

- Work with the California Urban Water Conservation Council and the Agricultural Water Management Council to identify appropriate urban and agricultural water conservation measures, set appropriate levels of effort, and certify or endorse water suppliers that are implementing cost-effective feasible measures.
- Expand State and federal programs in order to provide sharply increased levels of planning, technical, and financing assistance, and develop new ways of providing assistance in the most effective manner.
- Help urban water suppliers comply with the Urban Water Management Planning Act.
- Help water suppliers and water users identify and implement water management measures that can yield multiple benefits including improved water quality and reduced ecosystem impacts.

Water recycling actions include:

- Help local and regional agencies comply with the water recycling provisions in the Urban Water Management Planning Act.
- Expand State and federal recycling programs in order to provide sharply increased levels of planning, technical, and financing assistance, and develop new ways of providing assistance in the most effective manner.
- Provide regional planning assistance which can increase opportunities for use of recycled water.

Assurances will play a critical role in the Water Use Efficiency program element. The assurance mechanisms are structured to ensure that urban and agricultural water users implement the appropriate efficiency measures. As a prerequisite to obtaining CALFED program benefits (receiving "new" water, participating as a buyer or seller in a water transfer, receiving water from a drought water bank) water suppliers will have to show that they are in compliance with the applicable urban or agricultural council agreements and applicable State law. This requirement will result in serious analysis and implementation of conservation measures identified in those agreements. In addition, the Program is considering a requirement that recipients of "new" or transferred water meet water measurement and volumetric pricing requirements developed under the Central Valley Project Improvement Act.

A high level of water use efficiency may also be assured through the concept of linked implementation. Widespread demonstration of efficient use by local water suppliers and irrigation districts could be a prerequisite to CALFED implementation of other Program actions for water supply reliability.

Economic analyses are underway which will compare water use efficiency options (including conservation, recycling, and transfers) and new facilities and identify least-cost ways of meeting CALFED objectives. These analyses are expected to better define the mix of demand management options and water supplies from new facilities. CALFED will work with stakeholders on technical and implementation issues as these analyses proceed.

**Water Use Efficiency Program Facts and Figures**

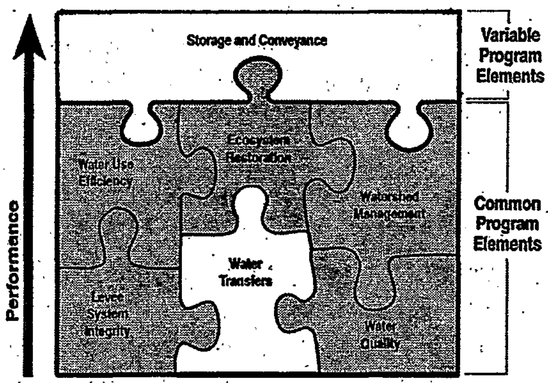
- Remains relatively unchanged between alternatives.
- Is an essential part of overall water management.
- Emphasis is on providing technical, planning, financing assistance.
- Could exceed $0.75 billion over 20-30 years. May require annual investment exceeding $25 million.

The water use efficiency program remains relatively unchanged among the alternatives. However, depending on the alternative, more or less implementation of water use efficiency measures may occur at the local level as water suppliers integrate efficiency measures into their integrated resources planning. The effectiveness of water use efficiency methods can be enhanced by storage of the saved water for later use. For example, the groundwater banking and conjunctive use programs in Delta export areas such as the San Joaquin Valley and the Tulare Lake Basin and in the Sacramento Valley could enable water users to bank conserved water for use in times of shortage. The extent of feasible water recycling is affected by efforts to maintain and improve water quality. Source water that is high in salinity may not be suitable for subsequent recycling.

Potential benefits of the water use efficiency program include:

- Reduces demand for Delta exports and reduces related entrainment effects on fisheries
- Can help in timing of diversions for reduced entrainment effects on fisheries
- Could make water available for transfers
- May improve overall Delta and tributary water quality
- Could reduce the total salt load to the San Joaquin Valley

## Water Transfer Framework Policy




Water transfers are currently an important part of water management in California, and offer the potential to play an even more significant role in the future. An open and active water transfers market will improve the economic efficiency of water use, will provide an incentive for water users to implement cost-effective conservation measures that yield transferable water, and will help ensure realistic evaluation of the cost-effectiveness of any new supply development. The Program is addressing water transfers from both a technical and policy perspective. Technical considerations related to conveyance and storage are discussed later in this report. A water transfer policy framework is being established to resolve many of the issues that currently constrain transfers or raise concerns when transfers do occur.

**Water Transfer Framework Policy Issues and Concerns**

The policy framework is expected to provide an effective means of moving water between users on a voluntary and compensated basis, as well as a means of providing incentives for water users to implement management practices which will improve water use efficiency. Transfers can also provide water for environmental purposes in addition to the minimum instream flow requirements.

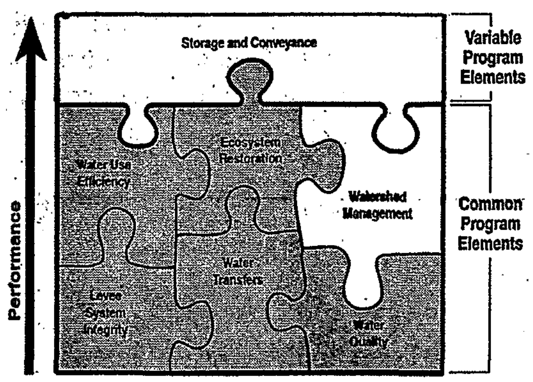
Water transfer policy must also provide a means of ensuring that water transfers do not merely improve short-term water supply reliability at the expense of local communities or groundwater resources. Reductions in groundwater can occur when users of surface water transfer this water to others and switch to groundwater instead. Local communities can be affected when agricultural land is taken out of production in order to transfer the water that would have been used for irrigation. All of those dependent on an agricultural economy -- from farm workers to farm equipment mechanics -- can be adversely affected. Strong mechanisms to avoid or mitigate water transfer impacts to third parties and groundwater resources will be essential elements of a CALFED water transfer policy.

The CALFED water transfer element proposes a policy framework for water transfer rules, baseline data collection, public disclosure, and analysis and monitoring of water transfers, both short and long-term. The element, in its final form, may also identify areas where additional regulation or statutory changes are desirable. Such modifications to existing policy are expected to facilitate the water transfer market, although the annual volume of transfers will still be dependent on locally developed agreements and assurances.

Development and refinement of the Program's water transfers policy will be guided by several criteria that form the basis of California transfers policy:

- Water transfers must be voluntary.
- These transactions must result in transfers that are real, not just paper.
- Water rights of sellers must not be impaired.
- Water transfers must not harm fish and wildlife resources and their habitats.
- Transfers must not cause overdraft or degradation of groundwater basins.
- Entities receiving transferred water should be required to show that they are making efficient use of existing water supplies.
- Water districts and agencies that hold water rights or contracts to transferred water must have a strong role in determining what is done.
- The impact on the fiscal integrity of the districts and on the economy of small agricultural communities cannot be ignored.

## Watershed Management Coordination Plan




Watershed management is a broad term used to describe diverse actions that maintain or improve environmental conditions throughout a watershed. There are many potential watershed management actions in the Bay-Delta system that are consistent with the CALFED mission and can contribute to meeting CALFED objectives for ecosystem quality, water quality, water supply reliability, and levee and channel system integrity.

The Program's approach and level of involvement in watershed management actions will vary according to the location where these actions take place. The Bay-Delta watershed can be divided into two distinct areas that reflect differing physical characteristics of the watershed:

- The upper tributary watershed above reservoirs and major fish passage obstructions.
- The lower watershed, generally

**Watershed Management Issues and Concerns**

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below those major fish passage obstructions.

In the lower watershed, the Program proposes hundreds of programmatic actions that are included in the various Program elements. CALFED and the CALFED agencies will be actively involved in these actions. In the upper watershed, the Program proposes relatively few actions. The Program will support the efforts of others in the upper watershed primarily by helping to coordinate these activities. Coordination is important because there are so many entities working on watershed management: individuals, local conservancies and other non-governmental organizations, and government agencies at the local, regional, State, and federal levels.

The following are examples of watershed management projects that can make improvements in each CALFED resource area:

- Ecosystem Quality - Watershed projects which improve riparian habitat along streams, increase or improve fisheries habitat and passage, restore wetlands, or restore the natural stream morphology affecting downstream flows or species may benefit ecosystem quality.

- Water Quality - Watershed management activities may benefit water quality in the Delta by helping to identify and control nonpoint sources of pollution and identify and implement methods to control or treat contaminants. Watershed projects which reduce the pollutant loads in streams, lakes, or reservoirs could measurably improve downstream water quality.

- Water Supply Reliability - Meadows and riparian corridors in the upper watershed tend to slow the rate of runoff and allow more percolation of water into aquifers. When meadows erode and riparian corridors are degraded, runoff during storms can occur at higher rates. This makes flood management more difficult and reduces the opportunities to capture runoff in downstream reservoirs. Watershed management projects to restore meadows and riparian corridors can attenuate the peak flows that occur during storms and allow more of this water to be absorbed into aquifers of the upper watershed. This water can contribute to increased stream base flow later in the season which improves water supply reliability and provides environmental benefits for fish and wildlife.

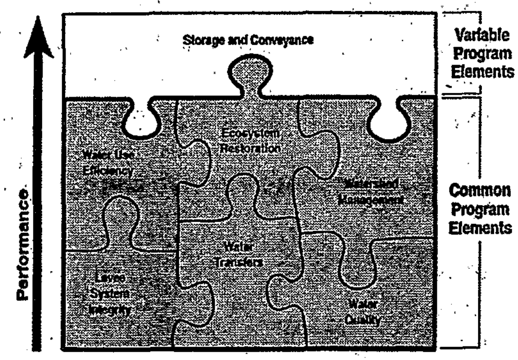
- Levee and Channel Integrity - Attenuation of flood flows coming from the upper watershed can provide benefits far downstream in the system. Delta levees are most vulnerable during high winter flows, so watershed management that reduces these flows can help maintain the integrity of Delta levees.

# Variable Program Elements

In addition to the common program elements described above, some of the alternatives include provisions for new or expanded water storage. Each alternative includes modification of Delta conveyance. The variable program elements for storage and conveyance are described below.

## Storage

Storage of water in surface reservoirs or groundwater basins can provide opportunities to improve the timing and availability of water for all uses. The benefits and impacts of surface and groundwater storage vary depending on the location, size, operational policies, and linkage to other Program elements. By cautiously diverting water into storage during times of high flow and low environmental impact, more water is available for release for environmental and consumptive purposes during dry periods when conflicts over water supplies are critical. Properly managed, storage turns low value water into high value water for all uses.




Surface storage also provides other important benefits including flood control, power generation and regulation, and recreational opportunities. However, construction of surface storage reservoirs can result in significant terrestrial and aquatic impacts and is generally very costly. Groundwater storage, in general, has fewer terrestrial and aquatic impacts and is less costly than surface storage, but is limited in flexibility due to slower rates of storage and withdrawal compared to surface storage. Other issues such as adverse effects on third parties and fish and wildlife, land subsidence, and degradation of water quality in aquifers must be addressed before implementing any groundwater storage program.

**Storage**
**Issues and Concerns**

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A significant amount of storage exists in the Sacramento – San Joaquin system today. Beginning in the 1920s, large reservoirs were built in Northern California for hydroelectric power, flood control, and to provide a more reliable source of water supply. There are now over 30 major reservoirs within the Sacramento – San Joaquin system with a combined gross capacity of over 25 million acre-feet (MAF). Average annual unimpaired runoff (the amount of runoff that would occur in the absence of dams and diversions) in the two river basins is about 27 MAF.

During Phase II of the Program, various types of new storage were evaluated for their potential to contribute to an overall approach to meeting Program objectives. Based on practical expectation of acceptable levels of impacts, total costs, and potential benefits, the a range of new storage considered in this evaluation was from zero up to about 6 MAF. This amount of new storage was considered a reasonable range for study purposes; much more detailed study and significant interaction with stakeholders will be required before specific locations and sizes of new storage are proposed. For the purposes of the Phase II evaluation, an inventory of potential new storage projects was compiled. Those projects that appeared most feasible were evaluated to provide representative information on costs and benefits. A more complete screening process, taking into account potential environmental impacts, engineering feasibility, costs, and benefits, will proceed over the coming months.

**SOME DELTA FLOW STATISTICS**

Flow patterns through the Delta channels are influenced by tidal actions and export operations. For the period of 1980 to 1991, average annual inflow to the Delta was 27,900 TAF, with the Sacramento River contributing about 62 percent and the San Joaquin River contributing about 16 percent. Of this total inflow, about 18 percent was exported at the SWP and CVP export facilities in the southern Delta, while about 76 percent went to outflow to the San Francisco Bay. Delta inflow, export, and net outflow rates are dwarfed by tidal flows in the Delta. During the 1980 to 1991 period, winter outflow in the Delta averaged about 32,000 cfs and summer outflow averaged about 6,000 cfs, compared to average tidal flow (ebb or flood) through the Golden Gate of 2,300,000 cfs and at Chipps Island in the western Delta of 170,000 cfs.

Various types of storage would provide different kinds of benefits that could contribute towards the multiple Program objectives. Storage upstream of the Delta would function differently than storage adjacent to export canals downstream of the Delta. Off-stream surface storage provides different benefits and generally fewer environmental impacts than on-stream surface storage. Groundwater banking and conjunctive use programs could enhance benefits provided by surface storage. Descriptions and examples of the various types of storage evaluated during Phase II of the Program are provided below.

## Upstream Surface Storage

Runoff from upstream tributaries to the Delta usually occurs in large volumes over short periods of time in the winter and spring. New storage upstream of the Delta could store a portion of these flows in excess of instream flow requirements and water supply needs. While detaining water in storage, care must be taken to maintain periodic peak flow events in rivers that provide for natural fluvial geomorphological processes, including the moving and cleansing of gravels, which are important to aquatic ecosystems. This is a more vital consideration associated with enlarged on-stream storage compared to off-stream storage; large amounts of water can quickly be detained in on-stream storage, while due to conveyance capacity constraints, only a minor percentage of large peak river flows can be diverted to off-stream storage.

Water could be released from upstream surface storage when needed to supplement instream flows and water supply. Water could be released to meet direct needs or to provide additional benefits through exchanges. For example, water could be released from off-stream storage in the Sacramento River basin directly to local water users, reducing existing diversions from the Sacramento River during periods critical to fisheries. Water released for environmental purposes could include pulse flows to help transport fish through the Delta. Water could also be released to provide sustained flows for riverine and shallow water habitats and improve water quality in the Delta during drier years. Examples of potential upstream surface storage include:

> **Enlargement of Shasta Reservoir.** This additional on-stream storage on the Sacramento River could provide water for instream and consumptive use purposes, flood control, instream water temperature control, and hydropower.
>
> **Sites-Colusa Reservoir.** Storage in this new off-stream storage reservoir in the Sacramento Valley would be limited by conveyance capacity from the Sacramento River to the reservoir. The reservoir could be filled during periods when diversions from the river would have low impacts on fisheries. Water stored in the reservoir could be used to supply Sacramento Valley agriculture, thereby reducing agricultural diversions from the river during times more critical to fisheries. Water from the reservoir could also be released back into the river, directly or through exchange, to increase flows at critical periods.
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> **Enlargement of Millerton Reservoir.** While this project appears prohibitively expensive, this additional storage on the San Joaquin River could be used to store supplies during high flow periods. Stored water could be released for increased environmental flows during drier periods, directly to water users, or to enhance groundwater conjunctive use operations in the San Joaquin Valley.
>
> **Montgomery Reservoir.** This off-stream storage project on the Merced River in the San Joaquin basin also appears prohibitively expensive. Water stored in this facility could be used to increase environmental flows during drier periods, directly to water users, or to enhance groundwater conjunctive use operations in the San Joaquin Valley.

### In-Delta Surface Storage

In-Delta surface storage could be developed by converting one or more Delta islands into reservoirs. Existing levees would be reconstructed and screened facilities for diverting water into the islands would be provided. In-Delta storage would be filled during high flow periods when potential harm to fisheries would be lowest. Water could be released directly into the Delta during drier periods for environmental, in-Delta water supply, or water quality need. A direct connection to State Water Project (SWP) and Central Valley Project (CVP) export facilities might also be provided to allow stored water to be exported during periods when curtailing south Delta diversions could benefit fisheries.

Several concerns regarding in-Delta storage must be resolved. If the stored water is to be used for drinking water purposes, there may be a need to evaluate sealing or removing the naturally occurring peat soils from the islands to avoid the release of organic carbons. This could add significant expense to any in-Delta storage project. Foundation and slope stability concerns associated with Delta levees could limit the rate of water removal from in-Delta storage, thereby reducing operational flexibility and potential benefits.

Examples of potential in-Delta surface storage include:

> **Bacon, Woodward, and Victoria Islands.** These Delta islands might be converted to in-Delta storage by reconstructing the surrounding levees, providing a screened inlet facility, and connecting the islands to one another and to Clifton Court Forebay with inverted siphons. Together, these three islands might provide about 200 thousand acre feet (TAF) of storage. Real-time monitoring might guide operations to determine when species of concern are not present and water may be diverted into storage and when to release water from storage and curtail south Delta CVP and SWP diversions.
>
> An alternative to inundation of prime Delta agricultural acreage would be to develop storage facilities near the Delta (such as an expanded Los Vaqueros) that would, like in-Delta storage, provide the ability to store water while enabling maximum flows during wet periods.

**South of Delta Off-Aqueduct Storage**

A version of off-stream storage, south of Delta off-aqueduct storage could be filled by diversions through the Delta Mendota Canal or the California Aqueduct. Examples of existing off-aqueduct storage include San Luis Reservoir and Castaic Lake. New off-aqueduct storage would be filled by increasing Delta exports during periods of high flows and least potential harm to Delta fisheries. Water stored in new off-aqueduct storage could be released to meet export needs while curtailing export pumping from the Delta during times of heightened environmental sensitivity in the Delta. Filling of off-aqueduct storage is limited by the capacity of export facilities. However, water stored in off-aqueduct storage is of great value to export water users, since it can be delivered directly for use without Delta operational constraints.

Examples of south of Delta off-aqueduct storage include:

> **Enlarged Los Vaqueros Reservoir.** This off-stream storage reservoir, currently under

construction with a planned capacity of 100 TAF, could be expanded to store about 1 MAF of water supply. Because of its proximity to the Delta, Los Vaqueros could provide greater flexibility and water supply benefits than other south of Delta off-aqueduct reservoirs. While filling of other off-aqueduct reservoirs is limited by capacity in the California Aqueduct and Delta-Mendota Canal, a direct intake could be constructed from the Delta to Los Vaqueros. This would allow greater diversion capacity during high flow periods in the Delta.

**Los Banos Grandes Reservoir.** This reservoir would be filled with water exported through the California Aqueduct during periods of high flow, allowing water to be released for use while exports are curtailed from the Delta during times most sensitive to fisheries. Los Banos Grandes has received extensive study over the past two decades, including detailed surveys of biological resources. While the project appears to be among the most economical of prospective surface storage reservoirs, the feasibility of mitigating several significant environmental impacts associated with the project has been questioned.

## Groundwater Storage

Groundwater storage can take the form of direct groundwater banking operations or groundwater conjunctive use operations. Under a groundwater banking program, water is stored in depleted groundwater aquifers through spreading grounds or direct injection and withdrawn from storage by pumping, similar in operation to a surface storage reservoir. Operations are limited by percolation or injection rates and pumping withdrawal rates, which are generally much slower than intake and outlet rates from surface storage reservoirs. For these reasons, groundwater banking programs can be enhanced if surface storage is available to store high flows more quickly and release them for groundwater storage at lower rates.

Under a groundwater conjunctive use operation, surface water is diverted for agricultural or urban use during wet years, allowing underlying groundwater aquifers to recharge naturally and from percolation of excess applied water. During dry years, water is pumped from groundwater storage to meet the identified agricultural or urban needs, allowing reduced diversion of surface water from rivers.

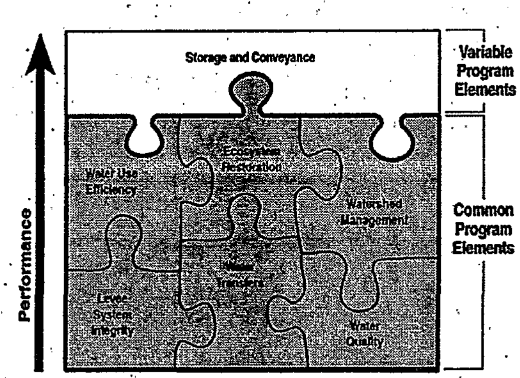
Groundwater banking and conjunctive use operations range in scope and formality. For decades growers in parts of the Central Valley have practiced informal conjunctive use operations by using surface water supplies when available and then turning to groundwater during dry periods. Recently, more formal programs such as the Semitropic Water Storage District's water banking agreement with Metropolitan Water District of Southern California have become more common place. While groundwater storage operations are an important water management tool, significant issues such as adverse effects on third parties and fish and wildlife, land subsidence, and degradation of water quality in aquifers must be addressed on a case by case basis before implementing any groundwater storage program. Guiding principles to address these issues were discussed in Chapter 2.

Examples of potential groundwater storage operations include:

> **American Basin Conjunctive Use Project**. This project, located in western Placer County and southwestern Sutter County, is currently under investigation by the California Department of Water Resources (DWR) in cooperation with a group of local agencies. State Water Project water would be delivered for agricultural use in this area in wet and above normal years, reducing groundwater pumping and providing "in-lieu" recharge during those years. In dry and critical years, these agricultural users would pump groundwater to meet local demands, foregoing diversion of surface water supplies that would be made available to the State Water project.
>
> **Kern Water Bank.** The Kern Water Bank was studied extensively and partially implemented by DWR during the 1990s. As originally envisioned, the Kern Water Bank would consist of a Kern Fan Element operated by DWR for the State Water Project and several conjunctive use elements operated in cooperation with local agencies. The Kern Fan Element, consisting of conveyance facilities, spreading grounds, and extraction wells, is currently operated by a local authority. Surplus flows from the Kern River are recharged when available, as well as SWP supplies delivered through the California Aqueduct in wet years. Additional recharge and extraction facilities could allow expansion of storage in the Kern Water Bank.

## Conveyance

The Delta conveyance element of the Program describes the various configurations of Delta channels for moving water through the Delta and to the major export facilities in the southern Delta. While there are countless combinations of potential modifications to Delta channels, three primary categories of Delta configuration options, as described below, were studied in Phase II of the Program. These Delta conveyance options were the primary distinguishing feature among the three broad categories of alternatives studied in Phase II.




Under the Program's No Action assumptions, additional exports are expected from the Delta in the future as statewide demands for water increase. Currently, the combined physical capacity of SWP and CVP export facilities in the southern Delta is approximately 15,000 cubic feet per second (cfs). However, a U.S. Corps of Engineers permit limits exports through the SWP export facility to 6,680 cfs, except during some winter months when marginal increases are allowed. The Department of Water Resources is currently proposing an Interim South Delta Improvements Program, including a new intake structure into Clifton Court Forebay, channel modifications, an operable fish control barrier at the head of Old River, and flow control barriers. Under the DWR proposal, these improvements would allow the permitted export limit at the SWP export facility to be increased to full physical capacity of 10,300 cfs. Of course, use of this capacity would be limited by various Bay-Delta standards.

**Conveyance Issues and Concerns**

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Because of the potential impact on flow patterns and Delta water quality, the Delta conveyance configuration of an alternative can greatly affect the performance of other Bay-Delta Program elements. The three primary Delta conveyance configurations evaluated in Phase II of the program are:

**Existing System Conveyance.** The Delta channels would be maintained essentially in their current configuration. One significant variation would include some selected channel improvements in the southern Delta together with flow and stage barriers at selected locations to allow for increasing the permitted pumping rate at the SWP export facility to full existing physical capacity of 10,300 cfs (similar to DWR's Interim South Delta Program). Other variations include constructing an intertie between the CVP export facility and Clifton Court Forebay, and improvements to SWP and CVP fish screening facilities.

**Modified Through Delta Conveyance.** Significant improvements to northern Delta channels would accompany the southern Delta improvements contemplated under the existing system conveyance alternative. Variations include a wide variety of channel configurations, designed to improve flow patterns to benefit fisheries throughout the Delta, provide flood control, and improve water quality in many parts of the Delta.

**Dual Delta Conveyance.** The dual Delta conveyance alternative is formed around a combination of modified through Delta channels and a new canal or pipeline connecting the Sacramento River in the northern Delta to the SWP and CVP export facilities in the southern Delta. Capacities for this new isolated conveyance facility in the range of 5,000 cfs to 15,000 cfs were evaluated in Phase II of the Program. The new facility would siphon under all major waterways to minimize aquatic impacts.

# 12 Alternative Variations

At the beginning of Phase II, 17 alternative variations (later reduced to 12) were developed around the three broad alternatives resulting from the Phase I work. These are described in detail in the *Phase II Alternative Descriptions*, May 1997 and are summarized below. They represented a reasonable range of different configurations of Delta conveyance and storage assembled with the program elements for levee system integrity, water quality, ecosystem quality, water use efficiency, water transfers, and watershed management coordination.

**Alternative 1A -** combines and integrates the program elements for levee system integrity, water quality, ecosystem restoration, water use efficiency, water transfers, and watershed management coordination without adding new storage and conveyance facilities to supplement the status quo.

**Alternative 1B -** combines and integrates the program elements for levee system integrity, water quality, ecosystem restoration, water use efficiency, water transfers, and watershed management coordination with select south Delta improvements. Alternative 1B builds upon Alternative 1A by adding fish screens at the Banks and Tracy pumping plants and an intertie between the Tracy pumping plant and Clifton Court Forebay. All common programs fit together as they did in Alternative 1A.

**Alternative 1C -** builds on Alternative 1B by adding new conveyance to provide for increasing in the permitted south Delta pumping capacity to the full physical capacity. Alternative 1C is the same as Alternative 1B except that it includes new surface and groundwater storage facilities throughout the watershed.

**Alternative 2A -** combines and integrates the program elements for levee system integrity, water quality, ecosystem restoration, water use efficiency, water transfers, and watershed management coordination with north and south Delta channel modifications designed to improve water conveyance. Alternative 2A is the "minimal" alternative to achieve improved through Delta conveyance. It provides for more efficient water conveyance from the Sacramento River through Snodgrass Slough, North Fork Mokelumne River, and Old River near Clifton Court Forebay. It also includes new fish screens at the Tracy and Banks pumping plants, an intertie between the pumping plants, and operable barriers or equivalent in the south Delta. The alternative does not provide additional water storage.

**Alternative 2B -** combines and integrates the program elements for levee system integrity, water quality, ecosystem restoration, water use efficiency, water transfers, and watershed management coordination with north and south Delta channel modifications designed for water conveyance and new surface and groundwater storage. The alternative is the same as Alternative 2A except it adds new water storage facilities.

**Alternative 2C** - combines and integrates the program elements for levee system integrity, water quality, ecosystem restoration, water use efficiency, water transfers, and watershed management coordination with three new diversion locations for Tracy and Banks pumping plants. The new diversions could be use separately or in combination to provide increased operational flexibility. New in-Delta water storage would receive water from one of these new diversions. The alternative also includes new fish screens at the Tracy and Banks pumping plants, and an intertie between the pumping plants.

**Alternative 2D** - combines and integrates the program elements for levee system integrity, water quality, ecosystem restoration, water use efficiency, water transfers, and watershed management coordination with system modifications in the north and south Delta designed to improve water conveyance, to provide habitat restoration integrated with the conveyance improvements and new aqueduct storage south and downstream of the Delta. The alternative provides for more efficient water conveyance from the Sacramento River through Snodgrass Slough, South Fork Mokelumne River, and Old River near Clifton Court Forebay. It also includes new fish screens at the Tracy and Banks pumping plants, an intertie between the pumping plants, and an operable barrier or equivalent at the Head of Old River.

**Alternative 2E** - combines and integrates the program elements for levee system integrity, water quality, ecosystem restoration, water use efficiency, water transfers, and watershed management coordination with modifications in the north and south Delta designed to improve for water conveyance, to provide significant habitat restoration and additional surface and groundwater storage. The conveyance and habitat portions are the similar to those in Alternative 2D with the exception of the addition of conveyance and habitat on Tyler Island and the elimination of the 10,000 cfs intake at Hood.

**Alternative 3A** - combines and integrates the program elements for levee system integrity, water quality, ecosystem restoration, water use efficiency, water transfers, and watershed management coordination with north and south Delta channel modifications designed to improve water conveyance and a small (5,000 cfs) open channel isolated facility. This alternative is considered the "minimal" option for the dual Delta conveyance Alternative. It also includes new fish screens at the Tracy and Banks pumping plants, an intertie between the pumping plants, and operable barriers or equivalent in the south Delta. The alternative provides no new water storage.

**Alternative 3B** - combines and integrates the program elements for levee system integrity, water quality, ecosystem restoration, water use efficiency, water transfers, and watershed management coordination with north and south Delta channel modifications designed for water conveyance, a small (5,000 cfs) isolated facility constructed as an open channel, and surface and groundwater storage. The alternative is the same as Alternative 3A except for the new water storage.

**Alternative 3C** - combines and integrates the program elements for levee system integrity, water quality, ecosystem restoration, water use efficiency, water transfers, and watershed management coordination with north and south Delta channel modifications designed for water conveyance and a small (5,000 cfs) isolated facility constructed as a pipeline. It also includes new fish screens at the Tracy and Banks pumping plants, an intertie between the pumping plants, and operable barriers or equivalent in the south Delta. The alternative provides no new water storage. **This alternative is identical to Alternative 3A except for the facilities associated with the pipeline configuration.**

**Alternative 3D** - combines and integrates the program elements for levee system integrity, water quality, ecosystem restoration, water use efficiency, water transfers, and watershed management coordination elements with north and south Delta channel modifications designed for water conveyance, a small (5,000 cfs) isolated facility constructed as a pipeline, and surface and groundwater storage. **This alternative is identical to Alternative 3B except for the facilities associated with the pipeline configuration.**

**Alternative 3E** - combines and integrates the program elements for levee system integrity, water quality, ecosystem restoration, water use efficiency, water transfers, and watershed management coordination with north Delta channel modifications designed to improve water conveyance, a large (15,000 cfs) isolated facility constructed as an open channel, and surface and groundwater storage. The alternative is similar to Alternative 3B except for the size of the isolated facility, and the elimination of Old River enlargement and barrier at Head of Old River.

**Alternative 3F** - combines and integrates the program elements for levee system integrity, water quality, ecosystem restoration, water use efficiency, water transfers, and watershed management coordination with a combined isolated storage and conveyance facility to transfer Sacramento River flow across the Delta to Clifton Court Forebay. A connected chain of up to 8 lakes, created by flooding Delta islands, would convey water via siphons and pumps beneath Delta channels.

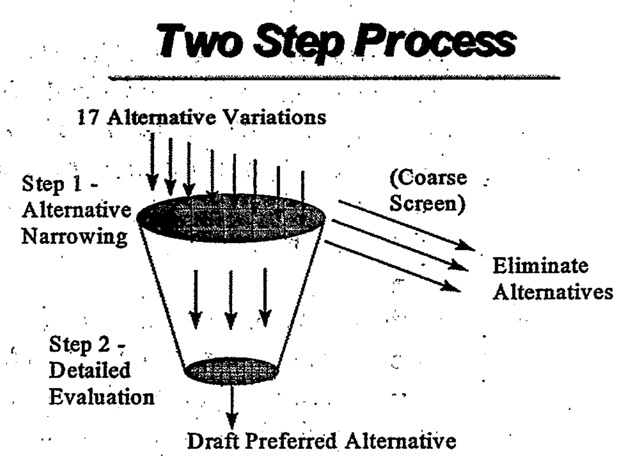
**Alternative 3G** - combines and integrates the program elements for levee system integrity, water quality, ecosystem restoration, water use efficiency, water transfers, and watershed management coordination with north and south Delta channel modifications designed for water conveyance, a 5,000 cfs Deep Water Ship Cannel, a western Delta conveyance tunnel and channel, and surface and groundwater storage.

**Alternative 3H** - combines and integrates the program elements for levee system integrity, water quality, ecosystem restoration, water use efficiency, water transfers, and watershed management coordination with modified conveyance in the north and south Delta designed for water conveyance and significant habitat restoration, a small (5,000 cfs) isolated facility constructed as an open channel, and surface and groundwater storage.

**Alternative 3I** - combines and integrates the program elements for levee system integrity, water quality, ecosystem restoration, water use efficiency, water transfers, and watershed management coordination with three new diversion locations for Tracy and Banks pumping plants and surface and groundwater storage. The new diversions could be use separately or in combination to provide increased operational flexibility. One new in-Delta water storage would receive water from one of these new diversions. The alternative also includes new fish screens at the Tracy and Banks pumping plants, and an intertie between the pumping plants. This Alternative is similar to Alternative 2C with one diversion extended to Hood and new surface and groundwater storage.

The first activities undertaken by the Program to refine these alternatives were to modify or eliminate the ones that had technical problems, and to reduce the number of alternatives that achieved the same Delta conveyance function. The following activities were followed during this narrowing of the number of alternatives (depicted as "Step 1" in the adjacent figure):

**Identify and eliminate technical problems** (technical problems not evident when the alternatives were formulated and which severely limit an alternative's success):




- Identify alternatives with engineering/technical problems which must be resolved for the alternative to proceed.
- Modify each alternative, if possible, to remove the technical problems.
- If modifications to the alternative cannot solve the problem, the alternative is not practicable and will be eliminated.

**Reduce the number of alternatives** (that achieve the same Delta conveyance function):

- Identify alternatives that meet program objectives approximately the same and achieve the same Delta conveyance function.

- Use engineering/technical and cost evaluations to compare Delta conveyance. Consider adverse impacts of each alternative. If one alternative has significantly higher costs for conveyance and/or greater adverse impacts, it is not practicable and will be eliminated from further consideration.

Five alternative variations were eliminated during this alternative narrowing process. These were:

- **Alternative 2C** - The intent of the alternative is to provide operational flexibility by permitting multiple points of intake to enable pumping to be discontinued at locations where sensitive species are present in significant numbers, in order to avoid entrainment. Analysis of the alternative indicated similar operational flexibility could be achieved through other alternatives at lesser cost. The multiple intake concept was still represented in Alternative 3I.

- **Alternative 3C** -Alternative 3A and 3C differ only in that the isolated facility would be an open channel with alternative 3A and a pipeline in 3C. The pipeline has potential advantages in the degree of protection against toxic spills and other advantages, but is much more expensive. The CALFED agencies decided to analyze a pipeline as a potential minor variation of 3A, as opposed to a stand-alone alternative.

- **Alternative 3D** -Alternative 3B and 3D differ only in that the isolated facility would be an open channel with alternative 3B and a pipeline in 3D. The pipeline has potential advantages in the degree of protection against toxic spills and other advantages, but is much more expensive. The CALFED agencies decided to analyze a pipeline as a potential minor variation of 3B, as opposed to a stand-alone alternative.

- **Alternative 3F** -Under this alternative, six major Delta islands would be converted to reservoirs connected with siphons and pumps to act as a conduit of water supply though the Delta. This alternative would result in large scale loss of prime agricultural lands, would have significant potential for degrading the quality of export water supplies, and would be very expensive as compared to other alternatives for transporting water through the Delta with fewer water quality risks and with reduced impact on prime agricultural acreage.

- **Alternative 3G** -This isolated facility alternative would take water from the Sacramento River in West Sacramento, use the existing ship channel to its southern terminus, then connect with a pipeline conveying water to Clifton Court. This alternative would require facilities to enable ship passage through the water supply conduit, and would require a tunnel under the Sacramento River. The alternative was rejected because the biological and functional characteristics of this alternative are similar to other alternatives, the cost of this facility would be much higher than for other alternatives, and its engineering feasibility with respect to tunneling under the Sacramento River is untested.

The twelve remaining alternative variations are shown in summary form on the following page. The twelve cover the broad range of potential solutions surrounding the three alternatives. The Programmatic EIS/EIR focuses on the potential consequences of the three alternatives (with the twelve variations). See the main document of the Programmatic EIS/EIR for discussion of these consequences.

| | | Programs | | | | | | Storage | | | | | | Conveyance | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | South Delta | | | | | North Delta | | | | | Isolated Facilities | | |
| | | Water Quality | Water Use Efficiency | Ecosystem Restoration | Levee System Integrity | Water Transfers | Watershed Coordination | surface storage on Sac R. tributaries (in MAF) | surface storage on San Joaquin R. (in TAF) | groundwater storage in Sac Valley (in TAF) | groundwater storage in San Joaquin Valley (in TAF) | surface storage off-aqueduct (in MAF) | In-Delta storage (in TAF) | Tracy/CCF intertie and new fish facility | new CCF intake structure | operable Old R. barrier (or equivalent) | flow & stage control measures installed (or equivalent) | channel enlargement along Old R. | screened intake at Hood | North Delta Channel Modifications | Mokelumne River Floodway (East) | Mokelumne R. Floodway (West) and Tyler Island Aquatic Habitat | East Delta Habitat | 3 isolated conveyance channels | 5,000 cfs open channel/pipeline from Hood to CCF | 15,000 cfs open channel from Hood to CCF |
| Existing Through Delta Channels | Alt 1 A | X | X | X | X | X | X | | | | | | | | | | | | | | | | | | | |
| | B | X | X | X | X | X | X | | | | | | | X | | X | X | | | | | | | | | |
| | C | X | X | X | X | X | X | 3 | | 250 | 500 | 1 | | X | X | X | X | X | | | | | | | | |
| Modified Through Delta | Alt 2 A | X | X | X | X | X | X | | | | | | | X | X | X | X | X | X | X | | | | | | |
| | B | X | X | X | X | X | X | 3 | 500 | 250 | 500 | 2 | | X | X | X | X | X | X | X | | | | | | |
| | D | X | X | X | X | X | X | | | | | 2 | | X | X | X | | X | X | | X | | X | | | |
| | E | X | X | X | X | X | X | 3 | 500 | 250 | 500 | 2 | | X | X | X | | X | | | | X | X | | | |
| Dual System | Alt 3 A | X | X | X | X | X | X | | | | | | | X | X | X | X | X | X | X | | | | | X | |
| | B | X | X | X | X | X | X | 3 | 500 | 250 | 500 | 2 | 200 | X | X | X | X | X | X | X | | | | | X | |
| | E | X | X | X | X | X | X | 3 | 500 | 250 | 500 | 2 | 200 | X | X | X | | | X | X | | | | | | X |
| | H | X | X | X | X | X | X | 3 | 500 | 250 | 500 | 2 | | X | X | X | | X | X | | | X | X | | X | |
| | I | X | X | X | X | X | X | 3 | 500 | 250 | 500 | 2 | 100 | X | X | | | | X | X | | | | X | | X |

# The 18 Distinguishing Characteristics

Looking simultaneously at all the information on how well the alternatives meet the objectives and how well they satisfy the solution principles would be nearly impossible due to the large amount of information. Furthermore, many aspects of the alternatives do not vary from one alternative to another. They all include common program elements that make significant progress toward meeting program objectives and reducing conflict in the system.

On the other hand, there are aspects that do differ among the alternatives and it is these aspects, or distinguishing characteristics, that guided the evaluation. These characteristics are important when assessing the performance, impacts and overall merits of each alternative. Following are the 18 identified distinguishing characteristics:

- **In-Delta water quality** - provides a measure of **salinity** and **flow circulation** for four areas of the Delta. The measure focuses on water quality for in-Delta agricultural uses.

- **Export water quality** - provides a measure of **salinity, bromide, and total organic carbon** for four export diversion location from the Delta. The measure focuses on municipal/industrial uses for the North Bay Aqueduct and Contra Costa Intake and for agricultural and municipal/industrial uses for the SWP and CVP export pumps.

- **Diversion Effects on Fisheries** - intended to include only the **direct effects on fisheries due to the export diversion intake and associated fish facilities**. These will vary depending on diversion location, size, type, method of handling bypassed fish, and annual volume of water diverted. The effects on flow patterns in the Delta as a result of the diversion are addressed in the distinguishing characteristic for "Delta Flow Circulation". The loss of fish due to diversion to another route is covered in this effect.

- **Delta Flow Circulation** - is intended to include the **direct and indirect effects of water flow circulation on fisheries due to the export diversions and changes in cross-Delta water conveyance facilities**. These will vary depending on diversion location, size, type, and operation of conveyance facilities, and annual volume of water diverted.

- **Storage and Release of Water** - provides a measure of the environmental benefit or adverse effects of storing water in a new Program storage facilities and releasing that water at a later time of need. Storing the water will generally result in some degradation of environmental conditions and releasing that water, for whatever use, will generally result in some environmental benefits.

- **Water Supply Opportunities** - is a measure of the change provided by the alternatives for water supply for the environment and for agricultural and urban uses.

- **Water Transfer Opportunities** - is an estimate of how well each alternative can carry water that may be generated through market sales or trades at different locations in the system.

- **Operational Flexibility** - provides an indication of how well each alternative can shift operations as needed from time to time to provide the greatest benefits to the ecosystem, water quality, and water supply reliability.

- **South Delta Access to Water** - is a measure of how the alternatives affect local access to water due to changes in water levels in the channels.

- **Risk to Export Water Supplies** - is intended to provide a measure of which alternatives best reduce the risk to export water supplies from a catastrophic earthquake.

- **Total Cost** - will include the initial capital costs for the Program as well as annual costs. Initial costs will include study, design, permitting, construction, mitigation, acquisition, and other first costs of the Program. Annual costs will include operation and maintenance, monitoring, reoccurring annual purchases, and other annual costs.

- **Assurances Difficulty** - is an estimate on how hard an assurance package will be to formulate and get consensus among agencies and stakeholders. It is not an assessment on the perceived effectiveness of the assurance package.

- **Habitat Impacts** - is an assessment of the adverse habitat impacts due to implementation of the storage and conveyance facilities.

- **Land Use Changes** - is a measure primarily of the amount of agricultural land that would change to other uses by implementation of the Program.

- **Socio-economic Impacts** - include adverse and beneficial impacts such as commercial and recreational fishing, farm workers, power production, and other third party impacts.

- **Consistency with Solution Principles** - provides a qualitative measure of how well the alternatives meet the Program solution principles. Alternatives which violate the solution principles are not likely to be practicable or implementable. However, since the solution principles have been used throughout the Program development, it is unlikely at this point that alternatives will violate the solution principles. The solution principles provide insight in considering tradeoffs among the other distinguishing characteristics in a balanced manner.

- **Ability to Phase Facilities -** provides an indication on how easy it will be to phase implementation of storage and conveyance facilities over time.

- **Brackish Water Habitat -** In the Bay-Delta system there is a salinity gradient between fresh and salt water. In the western Delta is an area of important aquatic habitat with salinity levels of approximately 2 parts per thousand. The location of this salt concentration, known as X2, is an indicator of changes in brackish water habitat among the alternatives.

# Moving Toward a Preferred Alternative

The twelve alternative variations addressed in the Programmatic EIS/EIR cover the broad range of potential consequences of implementing a CALFED solution. The CALFED staff and agencies will continue evaluation of the alternatives and, with the help of the public, will select a preferred alternative prior to the Final Programmatic EIS/EIR in late 1998.

As a tool in moving towards a preferred alternative, CALFED agencies sought to develop the best alternative for each of the three main categories:

- **Alternative 1** (existing system conveyance)
- **Alternative 2** (modified through Delta conveyance)
- **Alternative 3** (dual Delta conveyance)

The process began by looking how each of the twelve alternative variations performed for the preliminary evaluations of the distinguishing characteristics. This assessment provided information on where alternatives performed particularly well and where there were significant deficiencies. The Program looked for modifications, including operational changes, that would resolve the major deficiencies and enhance the overall performance of Alternatives in each of the three categories.

### Considerations for the Fisheries and Diversion Conflict

One of the primary problems presently encountered in the Delta is the conflict between the need to maintain water deliveries and the sensitive fish species in the Delta which are drawn into the pumps of the State Water Project, Central Valley Project and, to a lesser extent, the Contra Costa Water District intakes in the southern and western-central Delta. Currently, there are requirements for pumping activities to be curtailed during periods when sensitive species are present in the Delta. Future evaluations may indicate the need for further restrictions. This is the most important factor causing conflict presently and, left uncorrected, is likely to produce greater conflict in the future. This conflict can be reduced in three basic ways:

- by utilizing best available technology to construct improved fish screening facilities to physically avoid fish entrainment in an operating export facility;

- by providing storage in or near the Delta or off-aqueduct storage south of the Delta to enable export deliveries to be continued while pumping is curtailed; or,

- by relocating intakes and/or developing multiple intakes to enable pumping to occur from alternate locations in the Delta. This approach would provide flexibility for enabling pumping to continue from one location while a pumping restriction exists on another location because of the presence of sensitive species;

- land conversion to reduce demand; This approach would reduce the demand for water but, as stated in Chapter 2, the CALFED Program policy is not to convert land to reduce water demands. However, depending on water supply and water transfer opportunities, farmers may choose to change cropping patterns, temporarily fallow land, or permanently take land out of agricultural production.

Combinations of these approaches can be applied to achieve more benefit than would be achieved by any measure by itself. CALFED made the following considerations to help move towards the "best" Alternatives 1, 2 and 3.

**Considerations on Screening -** CALFED formed an Interagency Fish Facilities Technical Team composed of experts on the subject. This group has concluded that construction of advanced screen facilities were feasible up to 15,000 cfs, although no facilities of comparable size exist. Like the current screens, the new screen designs will still be unable to successfully screen eggs and larvae of all species.

In considering the option of upgrading State Water Project and Central Valley Project intake screen facilities in the south Delta separately or as a single project, technical team and engineering experts agree there are advantages to developing a combined screen facility at the head of Clifton Court to support both projects, including potential cost savings. Another advantage of a combined screen facility is that it utilizes an intertie between the SWP and CVP conveyance channels. This intertie is generally recognized as a desirable feature to increase operational flexibility, and is included in all three alternatives.

As envisioned, screen facilities in the south Delta would include low lift pumps on the downstream side of the screens. This feature allows the use of fish screens over the complete tidal cycle and reduces velocities and scour rates in the supply channels. However, such pumping during low tidal heights may exacerbate problems with water elevations in the channels supplying Delta agricultural users. Thus, the use of such screens will require tidal gates, or other measures to protect Delta agricultural water supplies.

**Considerations on Relocating Intakes and Multiple Intakes** - Having a choice of Delta export locations offers the potential to avoid peaks in fish abundance near one intake while continuing operation of the water projects at another intake. In general, the more widely the points of intake are separated, the more likely sensitive species can be avoided while exports are continued. However, relocating intake points and developing multiple points of intake are generally expensive, and in the case of alternatives that would require significant disruption of Delta lands, will have significant environmental impacts.

An intake on the Sacramento River would differ from an intake in the south Delta in three significant ways:

- Fewer species reside year-round in the area of the upstream diversion and therefore resident species are much less exposed to entrainment there.

- Bypass flows across a diversion at Hood would transport the screened fish without the need for salvage and trucking that poses a significant threat of additional mortality for fish screened from the south Delta.

- Migratory species of the Sacramento Valley will all be exposed to screens at Hood, whereas the south Delta diversion has much less direct effect on these species. For some species, particularly striped bass, the new screens cannot screen the vulnerable life stage and will therefore represent a relocation of screening mortality from the south Delta to the Sacramento River.

The San Joaquin River (near Stockton) has been proposed as potential point of intake. This possibility was evaluated with the result that water yield and water quality associated with this point of intake would be inadequate in relation to the cost ($450 million) of constructing an intake on the San Joaquin River. Upstream flow requirements on the Sacramento River and the Vernalis flow requirement on the San Joaquin River place significant constraints on the availability of export flows.

**Avoidance of Disrupted Delta Flow Patterns** - In the absence of export pumping, the Sacramento and San Joaquin Rivers would normally flow downstream through the Delta towards the ocean. Some observers believe that a major problem currently affecting fishery resources in the Bay-Delta estuary is net reversal of normal flows in the Delta caused by export operations in the southern Delta. Such flow disruptions cause damage to fishery resources by complicating or confusing fish movement which ultimately results in reduced reproductive success in sensitive species. The alternatives being evaluated vary significantly in their effectiveness in addressing this problem.

**Use of Storage to Enable Export Curtailments** - Storage in the Delta, near the Delta, or off-aqueduct south of the Delta (including groundwater storage) offer the potential to maintain water deliveries while diversions from the Delta are curtailed.

In-Delta storage (created by reinforcing levees on one or more islands and converting them into reservoirs) and near-Delta storage (created in a location near the Delta, such as the Los Vaqueros reservoir site) would be functionally equivalent with respect to the capability to respond very quickly to changing flow requirements needed to reduce fishery impacts at critical times. The two are different in the respect that in-Delta storage would take prime agricultural lands out of production producing shallow reservoir facilities with a lengthy perimeter that would have to be maintained. Also, in-Delta storage could present significant water quality problems because of the peat soils present at central and southern Delta locations. Near-Delta storage could be made deeper and with a higher volume for the same acreage, as compared to storage within the Delta, but cost will be an important factor. Both forms of storage would have higher yield than off-aqueduct storage south of the Delta, because this storage could be filled directly from the Delta without using aqueduct capacity needed to fill other reservoirs during wet periods. Water quality, environmental impact, and redirected impact considerations, along with cost information will determine the choice between these approaches.

Off-aqueduct storage south of the Delta could be used to temporarily curtail south Delta pumping without interrupting deliveries. A range of facility sizes would be possible, but the yield of such facilities would be lower. Off-aqueduct storage would have to be filled from the existing aqueduct capacity.

Based on these considerations and the need to reduce the fishery/diversion conflict, CALFED identified the following features of the twelve alternative variations that should be modified to improve performance:

**Existing Screens at existing Banks and Tracy Pumping Plants** -The inadequacy of the current facilities to prevent fish entrainment in the water project intakes, along with predation that occurs in Clifton Court, are major sources of fish losses in the system.

**New screens at existing Clifton Court Location** - Currently, predation in Clifton Court is believed responsible for major fish losses. While an improved screen at the existing location would significantly reduce entrainment, it would not affect predation in Clifton Court. The effectiveness and cost of constructing screens at the current location would not provide nearly the ecological benefit as other alternatives. One proposed solution to this problem is to construct a new intake facility at the head of Clifton Court and to construct screens at that location, largely eliminating fish from Clifton Court, and thereby eliminating predation there.

**Shallow channel integrated with Snodgrass Slough** - The ecology of Snodgrass Slough could be significantly affected by channel modifications. Construction of a separate intake channel would avoid these impacts and is, therefore, the preferred approach.

**Tyler Island Aquatic habitat and Andrus Island Levee Setback** - This feature would involve removing a major Delta island from agricultural production, and would create a major change in the Delta hydraulic system. However, the physical and biological consequences of this action are uncertain and would be known only after years of operating and evaluating the system. Thus, the value of this investment would be subject to considerable risk. Similar water conveyance and flood control benefits can be obtained through other, more well understood alternatives, with reduced impacts on Delta agriculture.

**Mokelumne River Floodway - Conversion of Bouldin Island to Habitat** - This feature would involve removing a major Delta island from agricultural production, and would create a major change in the Delta hydraulic system, having unknown physical and biological consequences. Similar water conveyance and flood control benefits can be obtained through other, more well understood conveyance configurations, with reduced impacts on Delta agriculture.

**Unscreened intakes on San Joaquin River, East Delta, and West Delta** - The benefits to fisheries associated with the flexibility of intake location that would be provided by multiple unscreened intakes are thought by CALFED fishery experts to be minimal as compared to the in-Delta construction impacts and costs that would be associated with this option. Other alternatives exist to accomplish similar operational objectives.

Alternatives 1A, 1B, 2D, 2E, 3H and 3I contain one or more of the less desirable features described above. Alternatives 2A, 2B, and 2D contained the feature of an intake channel from the Sacramento River integrated with Snodgrass Slough. Modification of the plan to isolate the intake channel from Snodgrass Slough in Alternative 2 would eliminate the environmental impact that would be caused to Snodgrass Slough and would make the alternatives viable from that perspective.

The following alternatives were then subjected to additional analysis:

**Alternative 1** - Version C - With and without additional storage

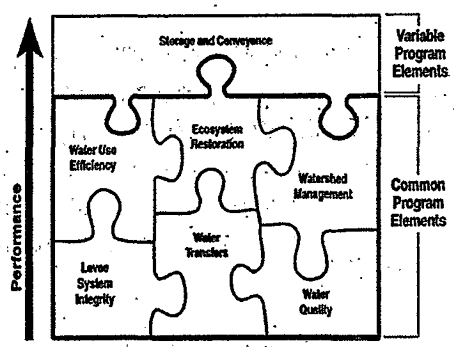
**Alternative 2** - Version A without additional storage, and Version B with additional storage.

**Alternative 3** - Version A - 5000 cfs isolated facility, without additional storage
Version B - 5000 cfs isolated facility, with additional storage
Version E - 15,000 cfs isolated facility, with and without additional storage

Following these evaluations, CALFED included storage in each alternative for planning purposes. Storage from zero up to 6 MAF was considered a reasonable range for planning purposes for each of the three alternatives. This figure of 6 MAF additional storage represented a maximum volume for planning purposes, not a storage target. CALFED also evaluated these alternatives with zero additional storage.

CALFED also considered potential phasing of the alternatives. It may be possible to sequence the development of storage to assure an appropriate amount.

# Description of the Three Alternatives




Based on the analyses described above, CALFED developed the following three alternatives to help move towards a preferred alternative. They represent the "best" alternatives for each of the three main categories. Each alternative includes the six common Program elements plus storage and conveyance. The three alternatives fall within the range of the twelve alternative variations evaluated in the Programmatic EIS/EIR.

The operation of storage and conveyance facilities in the Bay-Delta system has a significant effect on all CALFED Bay-Delta Program resource categories, including water supply reliability, ecosystem health, water quality, and system vulnerability. These existing facilities include numerous reservoirs upstream of the Delta, diversion facilities for local and export water use on the Sacramento and San Joaquin River systems, the Delta Cross-Channel, and the Delta export facilities of the State Water Project and Central Valley Project.

The following brief overview of operating criteria considerations applies to each of the three alternatives. Each alternative description later in this chapter includes information on operating criteria used in the analyses.

## Operating Criteria

A variety of protective measures, implemented under authorities such as the State Water Resources Control Board Bay-Delta Water Quality Control Plan and the federal Endangered Species Act Biological Opinions for Winter-Run Salmon and Delta Smelt, govern operation of storage and conveyance facilities that affect the Bay-Delta system. Together, these protective measures are known as the Bay-Delta standards.

Bay-Delta standards are not static -- as the health of the Bay-Delta has declined over the past several decades and the demand for water supplies from the Bay-Delta system has grown, progressively more protective standards have been implemented. Existing Bay-Delta standards were developed to provide environmental and water quality protection with today's levels of demand for Bay-Delta water supplies in mind. The expected increases in demand for water over the next twenty to thirty years will undoubtedly trigger changes in standards to maintain adequate protections. If new storage and conveyance facilities were constructed as part of the CALFED Bay-Delta Program, new protective measures would be implemented to address their operation. Ultimately, the health of the Bay-Delta will drive changes in Bay-Delta standards. A significant recovery of the Bay-Delta ecosystem as a result of CALFED actions could lead to some relaxation in protective measures over a twenty to thirty year period. Conversely, if Bay-Delta health continues a long-term decline, additional protective measures can be expected.

To evaluate the expected long-term performance of Bay-Delta Program alternatives, it is necessary to make assumptions regarding future operating criteria. Existing Bay-Delta standards and operational practices were used as a starting place in formulating these assumptions. However, existing standards do not address the operation of new storage and conveyance facilities contemplated in the Program alternatives. To complete the evaluation of alternatives, the CALFED agencies made assumptions regarding how existing standards might apply to the Program alternatives.

Many factors could affect future conditions in the Delta, including population growth and land use changes, technological developments affecting water use and water treatment, advancements in scientific understanding of biological processes, introduction and incursion of exotic species in the Bay-Delta system, and ocean conditions for anadromous fish. All of these factors could affect the ultimate performance or the time required to achieve a high level of success of the integrated Bay-Delta Program elements under any alternative. Higher levels of success of Program elements such as the ecosystem restoration program and water quality program could directly affect future operating criteria of Bay-Delta system storage and conveyance facilities. For example, with a high level of fisheries productivity, in time, relatively less protective operating criteria could be acceptable. With a lower level of fisheries productivity, more protective operating criteria could be necessary.

In recognition of the uncertainty regarding future conditions, CALFED agencies performed a sensitivity analysis to evaluate the effects of potential changes in operating criteria under the three Program alternatives. While specific assumptions were necessary to conduct model simulations to aid in this evaluation, no specific standards are proposed or endorsed by CALFED through these assumptions. Changes in two of the most critical Bay-Delta standards were evaluated for illustrative purposes in this sensitivity analysis: the export-inflow ratio requirement and Delta outflow requirement.

The export-inflow ratio requirement, known as the E-I ratio, limits Delta exports by the SWP and CVP to a percentage of Delta inflow. During February through June, months most critical to fisheries, the allowable E-I ratio is reduced to help diminish reverse flows and the resulting entrainment of fish caused by export operations. In this sensitivity analysis, existing E-I ratio requirements were compared to a more protective set of E-I ratios.

While several Bay-Delta standards set minimum Delta outflow requirements, one of the most important is known as X2. The X2 requirement sets the required position of the salinity gradient in the Estuary so that a salt concentration of two parts per thousand is positioned where it may be more beneficial to aquatic life. Freshwater releases from SWP and CVP reservoirs are required to maintain the salinity gradient at set locations for designated periods of time during the months of February through June. In this sensitivity analysis, the existing X2 requirement was compared to a less restrictive X3 requirement, where a salt concentration limit of three parts per thousand was allowed at the locations and time periods set in the existing standard.

For this sensitivity analysis, the CALFED agencies postulated that under less favorable conditions and a lower level of success for all Bay-Delta Program elements, more protective E-I ratios might be required under Alternatives 1 and 2. This additional protection could be necessary to reduce entrainment of fish caused by operation of the SWP and CVP south Delta export facilities under these alternatives. The CALFED agencies also postulated that under more favorable conditions and a high level of success for all Program elements, a relaxation in Delta outflow requirements might be feasible under Alternatives 2 and 3. This adjustment might ultimately be possible due to improvements in Delta flow patterns under these alternatives.

Additional details on operating assumptions are specified in the following descriptions of the Program Alternatives and in *Appendix __ to the Programmatic EIS/EIR.*

## Existing System Conveyance Alternative (Alt. 1)

**Ecosystem Restoration -** The Ecosystem Restoration Program Plan, as discussed earlier, would be implemented with the following refinements:

- Changes in environmental water flows would be met through purchase of existing water from willing sellers and use of the new storage allocated to environmental water supplies.
- Habitat restoration identified for the south Delta area would be relocated to the northern and western Delta. This change would provide for intensive habitat restoration to be located prudently distant from the south Delta pumping facilities.
- Incorporate a portion of identified south Delta wildlife habitat with the setback levees along Old River.

**Water Quality -** The Water Quality Program, discussed earlier, would be implemented with the following refinements:

- Increased emphasis on control of Delta Island drainage will be necessary to achieve improvements in organic carbon concentrations in export water treated for drinking. Potential approaches include treatment and rerouting drainage.

**Levee System Integrity -** The Delta Long-Term Levee System Protection Plan would be implemented as described earlier.

**Water Use Efficiency -** The Water Use Efficiency Program would be implemented as described earlier.

**Water Transfers Policy Framework -** The Water Transfer Policy Framework would be implemented as described earlier.

**Watershed Management Coordination -** The Watershed Management Coordination would be implemented as described earlier.

**Storage Facilities -** The ranges of storage included in Alternative 1 are as follows:

Sacramento Valley
- 0 to 3.0 MAF Surface Storage
- 0 to 250 TAF Groundwater Storage

San Joaquin Valley

- 0 to 500 TAF Surface Storage
- 0 to 500 TAF Groundwater Storage

In-Delta, Near-Delta, or off-aqueduct south of Delta
- 0 to 2.0 MAF Surface Storage

An option for extension of the TC Canal could provide multiple benefits to the Program by providing conveyance to potential off-stream reservoir sites and serving water to areas currently supplied by the North Bay Aqueduct. This would allow elimination of the North Bay Aqueduct diversions in an area of sensitive habitat and providing the service area superior water quality compared to that from the current diversion. As with the extension of the TC Canal, relocation of the North Bay Aqueduct diversion to another point on the Sacramento River provide ecosystem and water quality benefits. Relocation would allow elimination of the current North Bay Aqueduct diversions in an area of sensitive habitat and providing the service area superior water quality compared to that from the current diversion. These will be evaluated in Phase III of the Program.

**Delta Conveyance -** Delta channels would remain in their existing configuration except that Old River would be enlarged in the reach north of Clifton Court to reduce channel velocities and associated scouring, and to enable the fish screen facility to operate more effectively.

**South Delta Intake Facilities -** A new 15,000 screened intake with low lift pumps would be constructed at the head of Clifton Court and the SWP and CVP would be connected (intertied) to consolidate these intakes through a single screen facility.

**Fish Protection and Flow Control Barriers -** To overcome problems with misdirection of San Joaquin River fish, an operable fish control barrier would be constructed at the head of Old River, and operable flow control barriers or their equivalent would be constructed in south Delta channels to alleviate the problem with reduced water levels that would be caused by the fish control barrier and export operations. An alternative to barriers might be to develop overland supply to south Delta islands that were affected by water levels or water quality problems.

**Operating Criteria -** Existing Bay-Delta standards were used as a starting point to evaluate the performance of Alternative 1. Some additional assumptions were necessary to account for new facilities, as described below:

- Improvements in south Delta channels and the SWP and CVP export facilities would result in allowable use of full capacity of the SWP Delta export facility, Banks Pumping Plant, when all Bay-Delta standards are met.

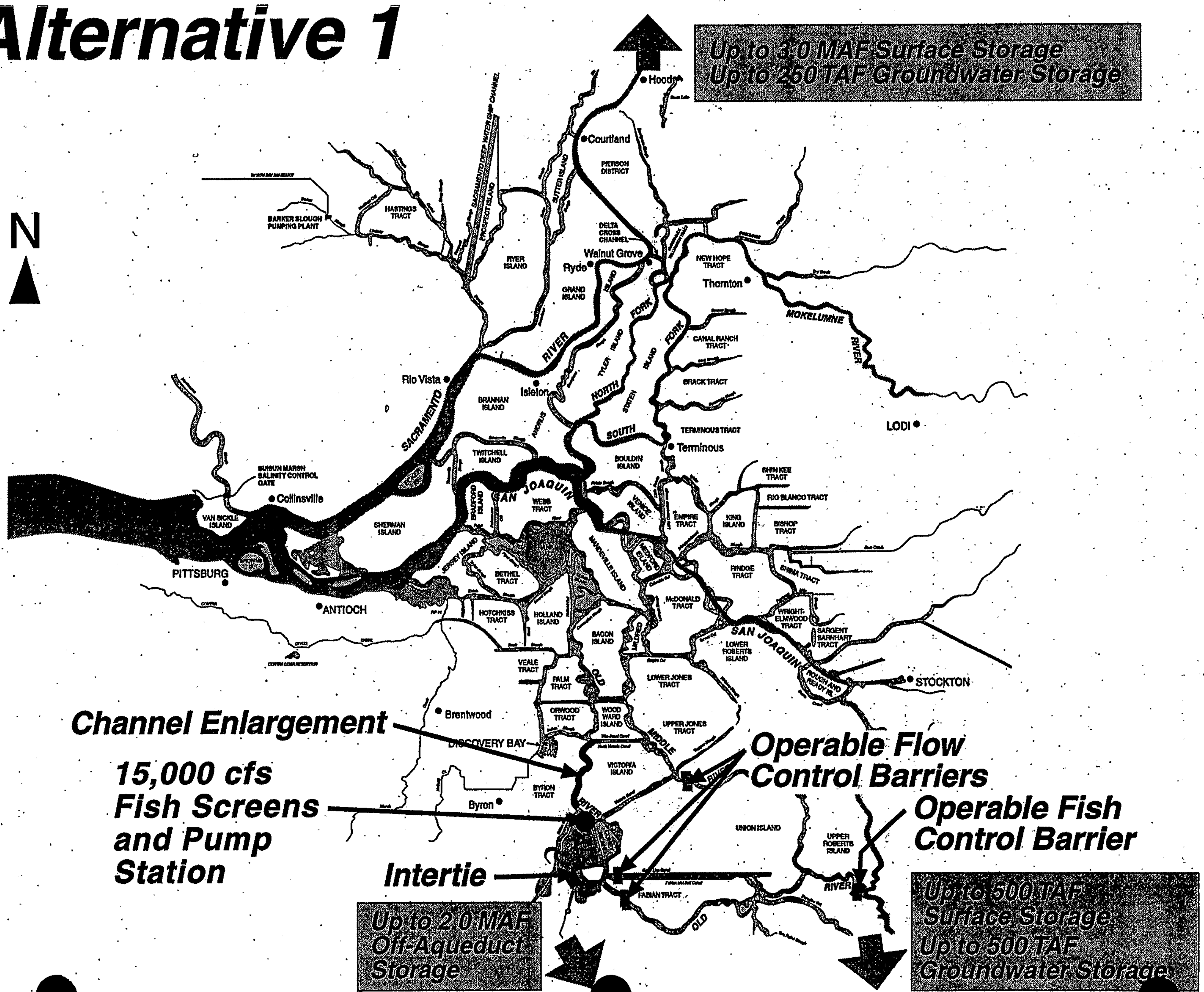
- SWP export facilities may be used to deliver water to CVP users.
- Delta Cross-Channel gates are closed except for the months of July through October.

A sensitivity analysis was performed to evaluate the effects of more restrictive E-I ratio requirements under Alternative 1. Under this alternative, SWP and CVP exports would continue from south Delta pumping facilities, resulting in continued reverse flows in many Delta channels. CALFED agencies postulated that under less favorable conditions and a lower level of success for all Program elements, more protective E-I ratios might be necessary to reduce entrainment of fish caused be operation of the SWP and CVP south Delta export facilities. These more protective E-I ratios would reduce SWP and CVP exports during the months of November through June. The following figure details the E-I ratios examined in this sensitivity analysis:

**Alternative 1: Sensitivity Analysis of Export -Inflow Ratios**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Existing E-I Ratios*** | | | | | | | | | | | | |
| *E/I Ratio* | 65% | 35%-45% | 35% of Delta Inflow | | | | 65% of Delta Inflow | | | | | |
| ***More Protective E-I Ratios*** | | | | | | | | | | | | |
| *E/I Ratio* | 50% | 25% | 25% of Delta Inflow | | | | 65% of Delta Inflow | | | | 50% | |

# Alternative 1




E-035276

## Modified Though Delta Conveyance Alternative (Alt. 2)

**Ecosystem Restoration** -The Ecosystem Restoration Program Plan would be implemented with the following refinements:

- Changes in environmental water flows would be met through purchase of existing water from willing sellers and use of the new storage allocated to environmental water supplies.
- The modification of the Mokelumne River Floodway with setback levees, conversion of Bouldin Island to aquatic habitat, and construction of the East Delta Wetlands Habitat will create about 5,000 to 10,000 acres more habitat than identified in the ERPP.
- Incorporate a portion of identified south Delta wildlife habitat with the setback levees along Old River.

**Water Quality** - The Water Quality Program, discussed earlier, would be implemented with the following refinements:

- Evaluate relocating the water supply intake for North Bay Aqueduct to avoid salts and organic carbon that reduce the ability to recycle water, complicate disinfection, and are sources of disinfection byproducts. Alternative 2 would not, overall, result in improvement of North Bay Aqueduct export water quality, and a change of intake location would be necessary for North Bay Aqueduct water users to benefit from the Delta solution.
- Relocate Delta island drainage discharges away to channels other than those identified for conveyance modifications.

**Levee System Integrity** - The Delta Long-Term Levee System Protection Plan would be implemented as described earlier.

**Water Use Efficiency** -The Water Use Efficiency Program would be implemented as described earlier.

**Water Transfers** - The Water Use Efficiency Program would be implemented as described earlier.

**Watershed Management Coordination** - The Watershed Management Coordination would be implemented as described earlier.

**Storage Facilities** - Construction of storage facilities would be authorized on the Sacramento and San Joaquin River systems, in or near the Delta and off-aqueduct storage south of the Delta would be provided through this alternative. Storage would include both surface water impoundments and groundwater conjunctive use.

The ranges of storage included in Alternative 2 are as follows:

Sacramento Valley
- 0 to 3.0 MAF Surface Storage
- 0 to 250 TAF Groundwater Storage

San Joaquin Valley
- 0 to 500 TAF Surface Storage
- 0 to 500 TAF Groundwater Storage

In-Delta, Near-Delta, or off-aqueduct south of the Delta
- 0 to 2.0 MAF Surface Storage

As described for Alternative 1, an option for extension of the TC Canal and/or relocation of the North Bay Aqueduct diversion to another point on the Sacramento River will be evaluated in Phase III of the Program.

**Delta Conveyance Facilities** - Draft Alternative 2 is based on Alternative 2B. Its major structural features include a screened intake on the Sacramento River near Hood. The capacity of this new diversion facility would be on the order of 10,000 cfs.

A new isolated channel would be constructed from Hood to McCormack Williamson Tract to preserve the existing warm water fishery habitat in Snodgrass Slough. A fish ladder or equivalent would be constructed to convey fish upstream past the pumps and screens to the Sacramento River. Consideration would be given to including turnouts to provide flow for Stone Lake Refuge and a Sacramento County groundwater conjunctive use operation. The McCormack Williamson Tract levee would be breached and the island flooded to provide shallow water habitat and improve water conveyance.

The Mokelumne River channel would be widened to improve water conveyance and flood control in the northern Delta. A 600-foot-wide alignment would be purchased along the Mokelumne River from I-5 to the San Joaquin River. Existing levees on one side of the existing channel would be replaced with new setback levees approximately 500 feet back from the existing channel. Existing levees would be removed where they obstruct the new channel with the remaining portions converted to channel islands. Existing improvements would be relocated or replaced where displaced by the widened channel. The new setback levees would be constructed in stages over several years. When the foundations of the new levees consolidate (over a 5+ year period), existing levees would be breached.

A new 15,000 cfs capacity screened intake with pumps would be constructed at the head of Clifton Court, and an interconnection of the CVP and SWP at Clifton Court would consolidate the project intakes through a single screen facility.

Old River would be enlarged in the reach north of Clifton Court to reduce channel velocities and associated scouring, and to enable the fish screen facility to operate more effectively.

An operable barrier would be provided at the head of Old River to maintain a positive flow down the San Joaquin River and keep San Joaquin River fish in the river channel. If needed, flow and stage control measures would be included on Middle River, Grant Line Canal, and Old River.

**Discussion of Phase II Conveyance Options -**

The primary decision in refining a through-Delta alternative centers on the choice of which Mokelumne River channel to widen and use as the primary water conduit. As currently conceived, the North Fork would be the main conduit; however, it has also been suggested that the South Fork be used. Proponents of the South Fork option suggest that this choice would improve water quality and the ability to repel salinity intrusion from the Bay and ocean. The current concept of using the North Fork is based on the belief that the South Fork has important habitat value that would be lost if the channel was enlarged. This region of the Delta supports Swainson's Hawk, wintering waterfowl, western sandhill cranes, and migrating shorebirds, which all rely on the region's large open expanses of rich agricultural lands for resting and foraging. Also, the South Fork would provide important opportunities for habitat enhancement as an element of the Ecosystem Restoration Program element. A final decision on this option will be made after further study during Phase III of the program, assuming Alternative 2 should become the Preferred Alternative.

**Operating Criteria** - Existing Bay-Delta standards were used as a starting point to evaluate the performance of Alternative 2. Some additional assumptions were necessary to account for new facilities, as described below:

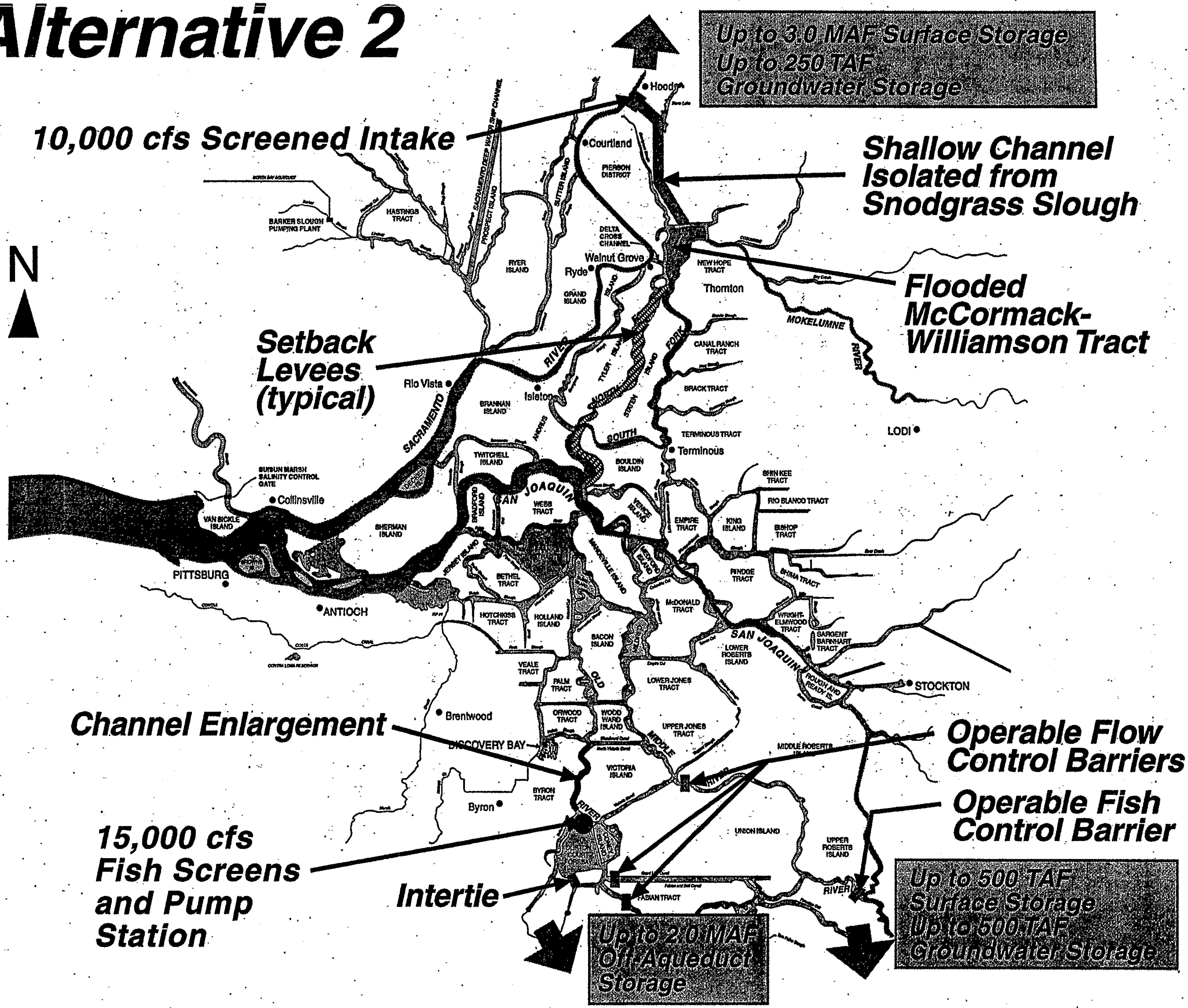
- Improvements in south Delta channels and the SWP and CVP export facilities would result in allowable use of full capacity of the SWP Delta export facility, Banks Pumping Plant, when all Bay-Delta standards are met.
- SWP export facilities may be used to deliver water to CVP users.
- Delta Cross-Channel gates are closed except for the months of July through October.

A sensitivity analysis was performed to evaluate the effects of more protective E-I ratio requirements and relaxed Delta outflow requirements under Alternative 2. Under this alternative, SWP and CVP exports would continue from south Delta pumping facilities, resulting in continued reverse flows in many Delta channels. CALFED agencies postulated that under less favorable conditions and a lower level of success for all Program elements, more protective E-I ratios might be necessary to reduce entrainment of fish caused be operation of the SWP and CVP south Delta export facilities. These more protective E-I ratios would reduce SWP and CVP exports during the months of November through June. CALFED agencies also postulated that under more favorable conditions and a high level of success for all Program elements, a relaxation in Delta outflow requirements might ultimately be feasible under Alternatives 2. This adjustment might eventually be possible due to improvements in Delta flow patterns in the central and western Delta under this alternative. The following figure details the E-I ratios and Delta outflow requirements examined in this sensitivity analysis:

**Alternative 2: Sensitivity Analysis of Export-Inflow Ratios and Delta Outflow Requirements**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Existing E-I Ratios and Delta Outflow Requirements*** | | | | | | | | | | | | |
| *E/I Ratio* | 65% | 35%-45% | 35% of Delta Inflow | | | | 65% of Delta Inflow | | | | | |
| *Delta Outflow* | | X2 Requirement | | | | | | | | | | |
| ***More Protective E-I Ratios and Relaxed Delta Outflow Requirements*** | | | | | | | | | | | | |
| *E/I Ratio* | 50% | 25% | 25% of Delta Inflow | | | | 65% of Delta Inflow | | | | 50% | |
| *Delta Outflow* | | X3 Requirement | | | | | | | | | | |

# Alternative 2





E-035281

## Dual Delta Conveyance Alternative (Alt. 3)

**Ecosystem Restoration** -The Ecosystem Restoration Program Plan would be implemented with the following refinements:

- Changes in environmental water flows would be met through purchase of existing water from willing sellers and use of the new storage allocated to environmental water supplies.
- Habitat improvements along the North Fork Mokelumne River would be limited to establishing a riparian tree corridor associated with the setback levees for modified channel conveyance.
- Shallow water habitat identified for the Delta would be located in the eastern Delta by breaching select portions of the east levee along the South Fork Mokelumne River and protecting interior levee slopes.

**Water Quality** -The Water Quality Program, discussed earlier, would be implemented with the following refinements:

- Evaluate relocating water supply intakes (such as North Bay Aqueduct, Tracy, and Contra Costa Water District intakes) to avoid salts and organic carbon that reduce the ability to recycle water and that complicate disinfection and are sources of disinfection byproducts.
- Actions to reduce contributions of organic carbon from Delta islands through treatment or drainage rerouting may be unnecessary.

**Levee System Integrity** - The Delta Long-Term Levee System Protection Plan would be implemented as described earlier.

**Water Use Efficiency** -The Water Use Efficiency Program would be implemented as described earlier.

**Water Transfers** - The Water Use Efficiency Program would be implemented as described earlier.

**Watershed Management Coordination** -The Watershed Management Coordination would be implemented as described earlier.

**Storage Facilities** - The ranges of storage included in Alternative 3 are as follows:

Sacramento Valley

- 0 to 3.0 MAF Surface Storage
- 0 to 250 TAF Groundwater Storage

San Joaquin Valley
- 0 to 500 TAF Surface Storage
- 0 to 500 TAF Groundwater Storage

In-Delta, Near-Delta, or off-Aqueduct south of Delta
- 0 to 2.0 MAF Surface Storage

**Delta Conveyance Facilities** - An isolated facility of 10,000 ± 2,000 cfs capacity would be constructed. An open channel is recommended over a pipeline because the two appear to have similar degrees of environmental impacts and a pipeline will not significantly improve insurance against future increases in diversion capacity. Though a pipeline would effectively prevent accidental contamination over the reach of the pipeline, its cost would be much higher. (Note: A pipeline was originally considered for a 5,000 cfs conveyance; a pipeline for a 10,000 ± 2,000 cfs capacity is considered impractical from a construction and cost viewpoint.)

The intake to the isolated facility would be in the Freeport-Hood vicinity, and may include dual points of intake. The intake(s) would be screened. The isolated facility would be placed along the eastern side of the Delta and connected to Clifton Court.

Operation of an isolated facility can be expected to cause salinity of the central and south Delta waters to increase. Accordingly potential connection of south Delta islands could eliminate the need for the south Delta flow and stage barriers and would significantly improve water quality. Potential connection of Contra Costa and Tracy would significantly improve water quality. Potential connection of portions of San Joaquin County to the new canal would provide a new source of high quality water and significantly improve water supply reliability to this area of current groundwater overdraft. The feasibility of including these options will be evaluated during Phase III of Program.

A new 5,000 ± 2,000 cfs screened intake with pumps would be constructed at the head of Clifton Court, its size determined by the size of the isolated facility and the manner in which the dual facilities would be operated. Enlargement of Old River north of Clifton Court or enlargement of other channels may or may not be needed, depending on the amount of flow to be exported through the south Delta. The same is true of the fish and flow control barriers.

## COMPARISON OF OPEN CHANNEL AND PIPELINE OPTIONS FOR ISOLATED FACILITY

**Conveyance Types and Environmental Impacts** - The 44-mile canal would generally consist of a trapezoidal section with gentle side slopes and a top width of around 600 feet and a depth 27 feet. The pipeline facility would consist of side-by-side buried concrete pipelines. The total distance of the pipeline route disturbed acreage is approximately the same as the canal alignment. The construction activities to bury the pipeline would disturb similar acreage as the canal. However, the buried pipelines would allow easier terrestrial access from one side of the alignment to the other.

**Pumping Plants** - Pumping plants would lift up to 10,000 ± 2,000 cfs into the conveyance facility. An open channel would utilize a single low operating head (10 feet) pumping plant and the pipeline would require a pumping plant with operating head of 150 feet. The increased operating lift would substantially increase operating and energy cost from around $2 million per year for the canal option to around $24 million per year (based on a power rate of 40 mills) for the pipeline option. Given that the site acreage for the two pumping plants are about the same there would little differences in environmental impacts between the two plants.

**Water Crossings** - In order to convey water across rivers and sloughs, the open canal would require 11 inverted siphons. The siphons would cross under four major rivers and seven sloughs. The pressurize buried pipeline would cross under the same waterways. The environmental impacts of these crossings would be similar for both alternatives.

**Bridge and Utility Relocations** - For the open canal, bridges would be constructed over the canal for all county roads, state highways, and railroad crossings. The pipeline will cross under the same facilities. The construction impacts of the two methods would be similar; however, the elevated bridges across the canal would have more visual impact than the buried pipeline.

**Water Quality Protection** - The buried pipeline is less vulnerable than an open canal to introduction of pollutants, such as those introduced by spills, storm water and agricultural runoff, and sabotage. Given that there is many miles of open water above the intake and miles of open water from the pipelines exit into Clifton Court Forebay to the point of use, the added benefit of this protection appears minor.

**Safety** - Both facilities would be designed to current safety standards and the safety components included in the project cost. There would be substantially less safety measures needed along the route of the buried pipeline than the open canal.

**Seepage Protection** - There would be insignificant, if any, seepage from the pipeline. Monitoring wells along the route of the canal would be installed to identify areas that may have excess and facilities such as seepage interception wells would be installed to protect adjacent lands from seepage problems.

**Seismic** - Both the canal and the pipeline would be designed to the California design code for seismicity. The cost for design and construction for seismicity are included in the cost estimate.

**Right-of-Way** - The right-of-way width for both conveyance methods is similar.

**Costs Comparison** - Preliminary capital cost for the canal conveyance is around $1.4 Billion. The pipeline conveyance would be double this amount, or $2.4 Billion. In addition, the pipeline energy requirement is $22 Million more per year that the canal. While the pipeline remains for further consideration in Phase III of the Program, its additional cost does not appear to be warranted.

## Comparing the 1982 Peripheral Canal and CALFED Alternative 3

CALFED Alternative 3 includes dual Delta conveyance, using modified Delta channels and an isolated facility to convey water from the Sacramento River to the SWP and CVP pumping plants in the south Delta. How does this alternative compare to the 1982 proposal for a peripheral canal? Both include a new facility to move water around the eastern edge of the Delta, but that's where the similarity ends. The main differences include scope of the programs, conveyance capacity and method, strategy to maintain in-Delta water quality, and impacts on local resources.

A big difference between the old peripheral canal and any of the CALFED alternatives is scope. Each of the CALFED alternatives offers a comprehensive program to solve problems in the Bay-Delta system related to water supply reliability, water quality, ecosystem quality, and levee system integrity, with flood control improvements integrated with ecosystem restoration in both the north and south Delta. The peripheral canal was primarily intended to increase water project exports and reduce fish entrainment caused by these exports.

The old peripheral canal had a proposed capacity of 23,000 cfs. Among the variations of Alternative 3, only 3e approaches this magnitude of isolated conveyance with a 15,000 cfs diversion on the Sacramento River. The other variations would carry between 22% and 44% of the peripheral canal capacity. All variations of Alternative 3 include through-Delta conveyance that would continue to carry 33% to 66% of the total Delta export pumping. The main benefits of the isolated facility in Alternative 3 are improvement in export water quality and a reduction in fish entrainment caused by Delta exports, rather than an increase in export water supply.

The CALFED alternatives would improve water quality with a broad range of actions that emphasize point and non-point source control. The through-Delta conveyance included in Alternative 3 would help maintain in-Delta water quality, although salinity levels would increase in some areas. The peripheral canal included a feature to discharge Sacramento River water from the canal into Delta channels to improve in-Delta water quality. This feature is not included in Alternative 3 because these releases could cause anadromous fish to stray from the Sacramento River into the Delta, a very serious environmental impact.

A final difference between CALFED's Alternative 3 and the old peripheral canal is the impact on local resources related to the way any new canal would cross existing Delta streams and channels. Construction of the peripheral canal would have blocked several existing waterways in the eastern Delta. This could have caused local drainage problems during high flows, and would have separated valuable habitat in the eastern Delta from the rest of the Delta ecosystem. Alternative 3 would prevent local drainage problems and maintain the connection of the aquatic ecosystem by using siphons to carry water in the isolated facility underneath existing Delta channels.

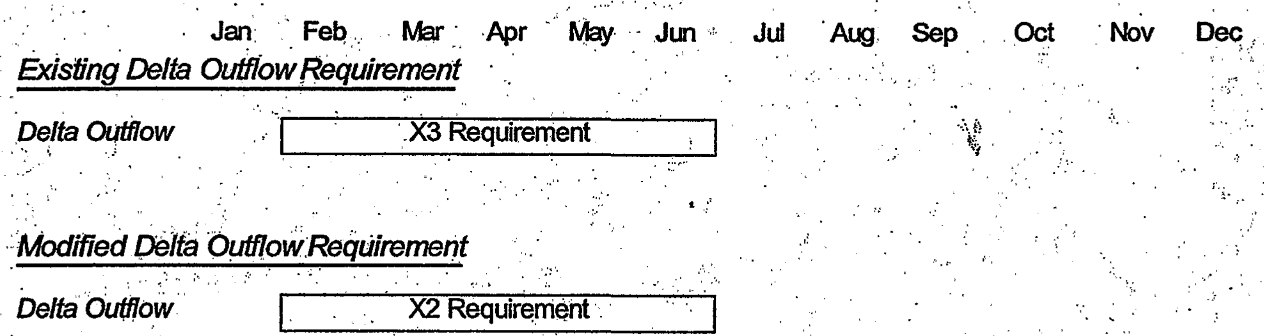
**Fish Protection and Flow Control Barriers** - Operable barriers would be installed if necessary at the head of Old River and elsewhere in the southern Delta to improve fish migration pathways and to reduce the salinity of south Delta water and raise water levels. Whether these barriers will prove necessary depends on how much export pumping is continued in the south Delta. The more flow is sent through the isolated facility the less need would exist for the barriers. During Phase III of the process, studies would be conducted to determine the need to supply good quality water to south Delta islands to mitigate any adverse water quality effects resulting from implementing this alternative. Studies must also be conducted to determine the necessity of relocating the points of diversion to Contra Costa County to mitigate any negative water quality effects of implementing this alternative on that agency.

**Operating Criteria** - Existing Bay-Delta standards were used as a starting point to evaluate the performance of Alternative 3. Some additional assumptions were necessary to account for new facilities, as described below:

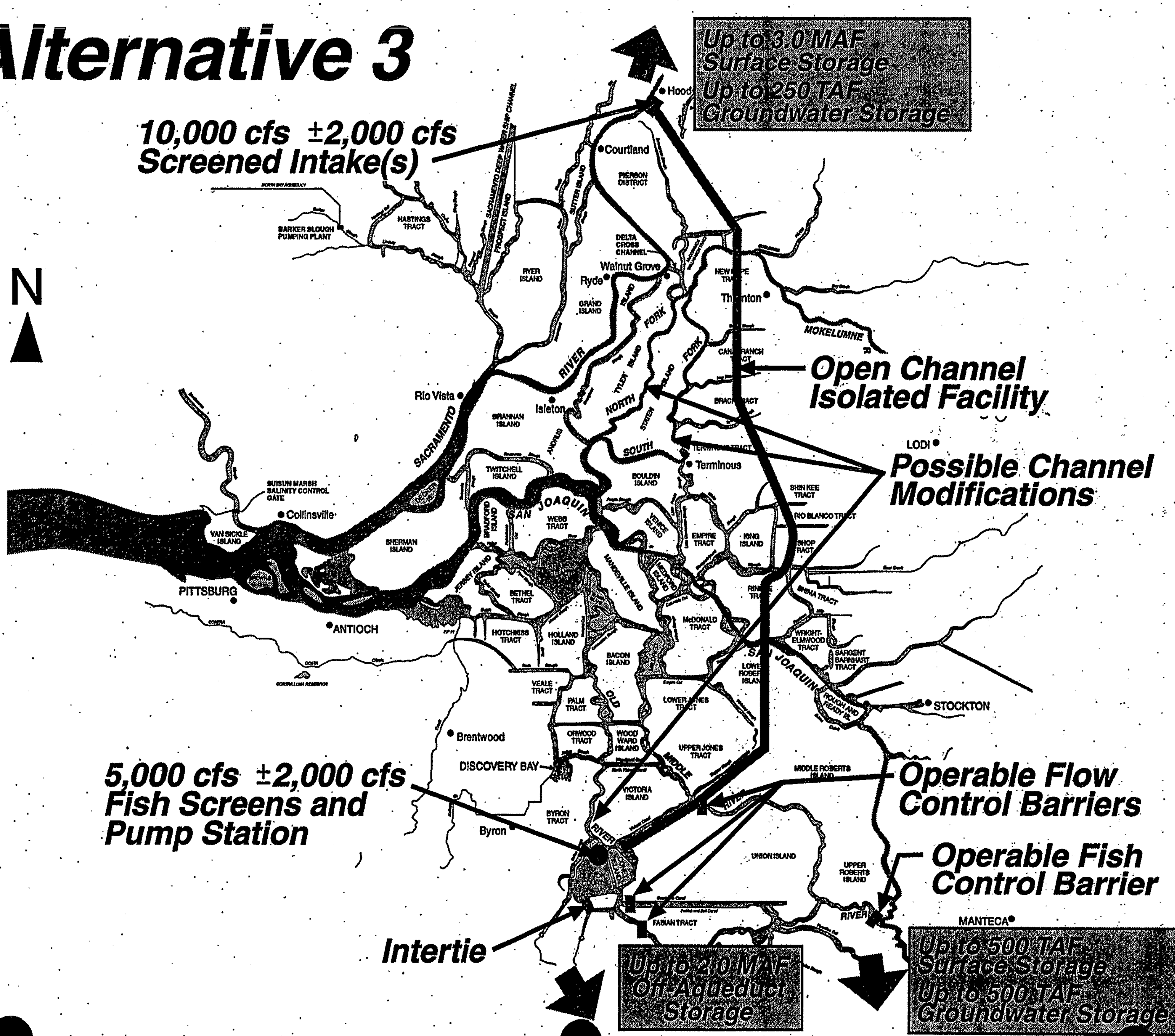
- Improvements in south Delta channels and the SWP and CVP export facilities would result in allowable use of full capacity of the SWP Delta export facility, Banks Pumping Plant, when all Bay-Delta standards are met.
- SWP export facilities may be used to deliver water to CVP users.
- Delta Cross-Channel gates are closed except for the months of July and August October.
- SWP and CVP diversions through the isolated conveyance facility are not be subject to E-I ratio restrictions, but total project exports, including isolated conveyance facility diversions, are limited to 5,000 cfs in May.
- A minimum export of 1,000 cfs is required from south Delta SWP and CVP facilities during July through March to provide for in-Delta water quality, while no diversions from south Delta facilities are allowed April through June to protect fisheries.
- During July through March, after minimum south Delta diversions are met, diversions through the isolated conveyance facility must be maximized before any additional exports are made from south Delta facilities.
- The minimum flow requirement for the Sacramento River at Rio Vista for July and August is 3,000 cfs.

A sensitivity analysis was performed to evaluate the effects of a relaxation in Delta outflow requirements under Alternative 3. Under this alternative, addition of an isolated conveyance facility would significantly reduce SWP and CVP exports from the south Delta, largely eliminating reverse flows in Delta channels. CALFED agencies postulated that under favorable conditions and a high level of success for all Program elements, a relaxation in Delta outflow requirements might ultimately be possible under Alternatives 3. CALFED agencies also postulated that due to these improvements in flow patterns, more protective E-I ratios would not be likely under Alternative 3; therefore, the sensitivity analysis of this alternative did not include adjustments in E-I ratios. The following figure details the Delta outflow requirements examined in this sensitivity analysis:

**Alternative 3: Sensitivity Analysis of Delta Outflow Requirements**



# Alternative 3



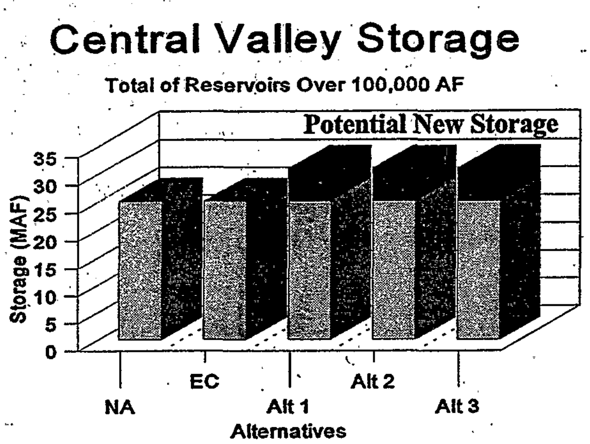
# 4. ALTERNATIVES EVALUATION

## Significance of Distinguishing Characteristics

Applying the distinguishing characteristics to the alternatives required a significant amount of analytical work. Details of that work are provided in the report, "Technical Support for Alternative Evaluation", attached as Appendix __ to the Programmatic EIS/EIR.

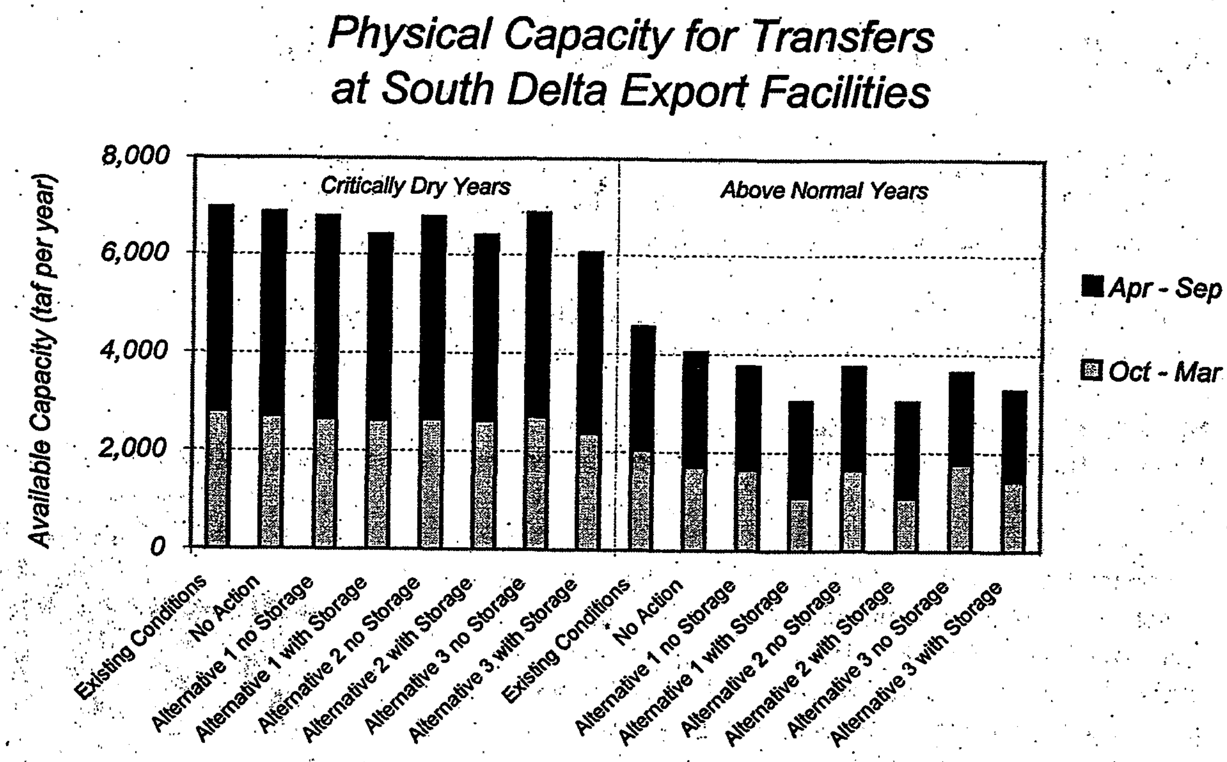
Of the 18 characteristics originally identified as distinguishing among the alternatives, some were found not to vary greatly between the alternatives. These included:

**Storage and Release of Water** - Storage of water in Program facilities will take place during the winter periods of high river flows when potential adverse effects on the environment are at a minimum. Release of the water for environmental uses will take place during lower flows when they provide the most benefit. Release of water for other uses will generally take place during lower flow periods when the additional flows can provide some indirect benefits to instream flows. The amount of water stored and released through Program storage facilities is relatively small compared with other ongoing flows so the overall effects of the storage and release is very similar between the alternatives.




**Water Transfer Opportunities**

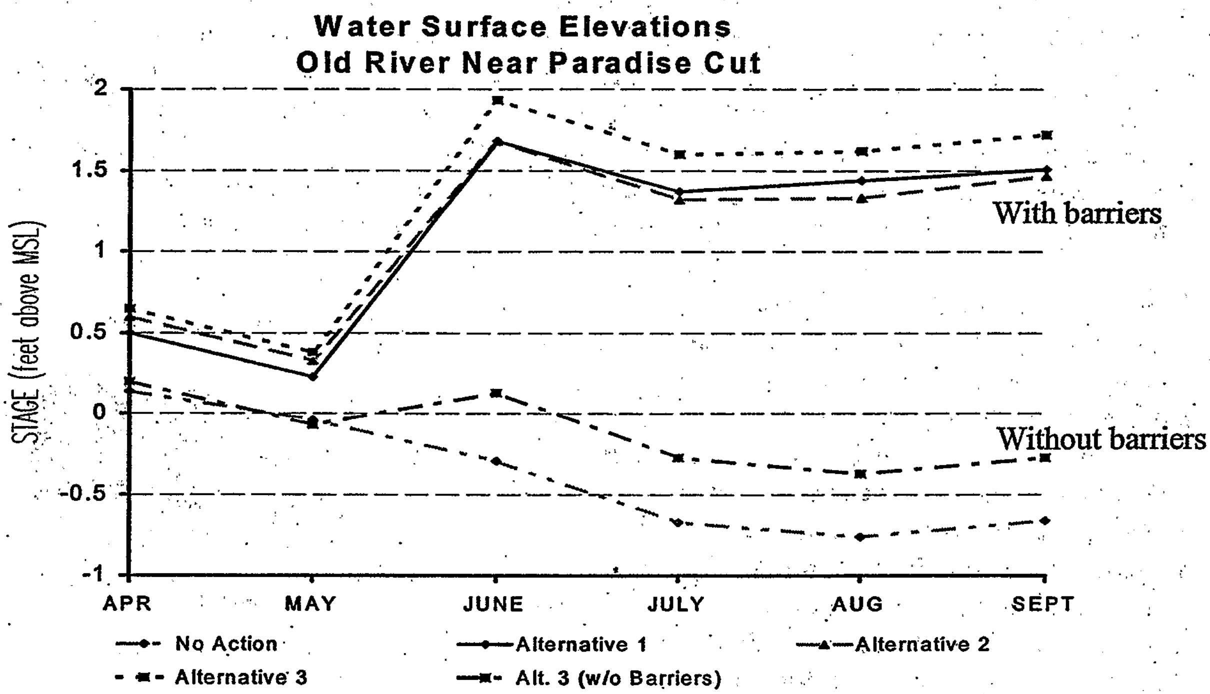
Preliminary evaluations indicate that under each alternative, physical capacity exists in SWP and CVP export facilities to accommodate well over 2 MAF of water transfers in all year types. As the following figure illustrates, much more available capacity exists in these facilities in drier years than in wetter years, since less project water is generally moved through these facilities in drier years. The figure also shows that more capacity for transfers exists in alternatives without new storage compared to alternatives with new storage. This results from an assumption that new storage would provide additional water to SWP and CVP water users, and that this water would receive higher priority of use of available conveyance capacity. Institutional arrangements could be implemented to change the priority of use of export facilities to increase conveyance capacity available for transfer water.



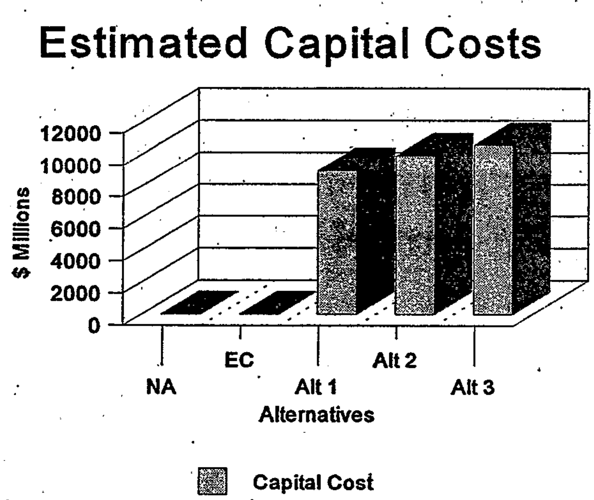

Physical capacity of the export facilities can only be used when exports are allowable under Bay-Delta standards. Preliminary evaluations indicate that under operating criteria based on existing standards (described previously), the ability to export transfer water does not vary significantly between the alternatives. Under these operating criteria, at least 600 TAF per year of transfer water could be exported from the Delta during critically dry years under each alternative. However, a sensitivity analysis on export-inflow ratio requirements (also described previously) indicates that if more protective E-I ratios are necessary under Alternatives 1 and 2 to provide adequate protection to fisheries, the flexibility to export transfer water from the Delta would be significantly diminished.

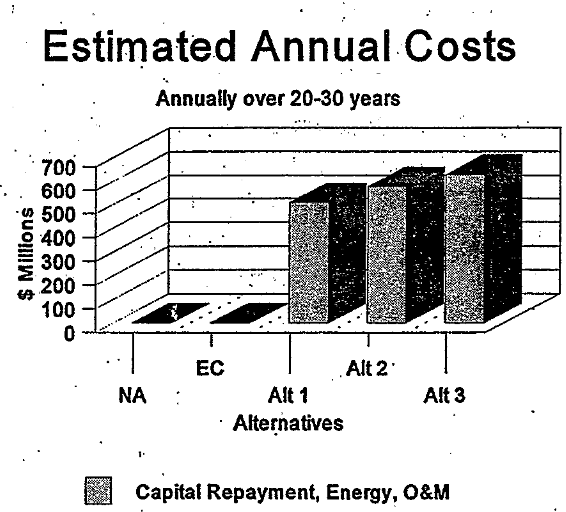
It must be kept in mind that there are many other policy and technical considerations that will affect water transfer opportunities. In particular, water transfer policy must include strong mechanisms to avoid or mitigate impacts to third parties and groundwater resources. These essential aspects of a CALFED water transfer policy will place similar limitations on water transfer opportunities for all the alternatives.

**South Delta Access to Water** - Delta Simulation Modeling indicated that in-Delta flow barriers or functional equivalent would be effective in raising south Delta water levels, essentially independent of the selection of an alternative.



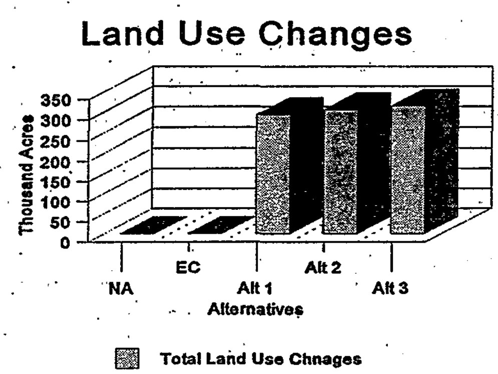

**Total Cost** - There are relatively minor differences in cost among the alternatives. The total cost differential among the alternatives is on the order of $1 billion, whereas total program cost will be on the order of $10 billion. Annual investment is a critical issue for each alternative.



**Habitat Impacts** - Alternative 1 would have lower construction impacts than would Alternatives 2 and 3 because, except for storage, only minimal construction would occur. However, the construction impacts of Alternatives 2 and 3 would be heavily offset by habitat improvement that would be constructed as part of the alternatives. For example, channel modifications and setback levees could be constructed to provide significant additional channel island habitat composed of old levees, and shallow water habitat. Also, all alternatives will include major construction of new habitat associated with the ecosystem restoration element of the program. Taken these factors together, positive and negative impacts on habitat will probably be similar overall for the three alternatives. Also, considering that the magnitude of land use changes are basically the same for each alternative, habitat impacts would also be similar between the alternatives.

**Land Use Changes** - There are relatively minor differences in the acres of land use changes required among the alternatives. Ecosystem restoration will require up to 200,000 acres of change in each alternative. Some of this is already in government ownership. Levee changes could require up to 35,000 acres in each alternative. Storage could affect approximately 60,000 acres in each alternative. Conveyance could impact approximately 5,000 acres more land in Alternative 3 than Alternatives 1 and 2. Land use change is not, therefore, a major distinguishing characteristic between the alternatives.




**Socio-Economic Impacts** - The choice among alternatives will not significantly change socio-economic impacts. Most such impacts will be a result of economic displacement from land and water use changes from water transfers, water conservation, water reclamation, land retirement for water quality improvement, and land use change for habitat enhancements. These features are included in all three alternatives.

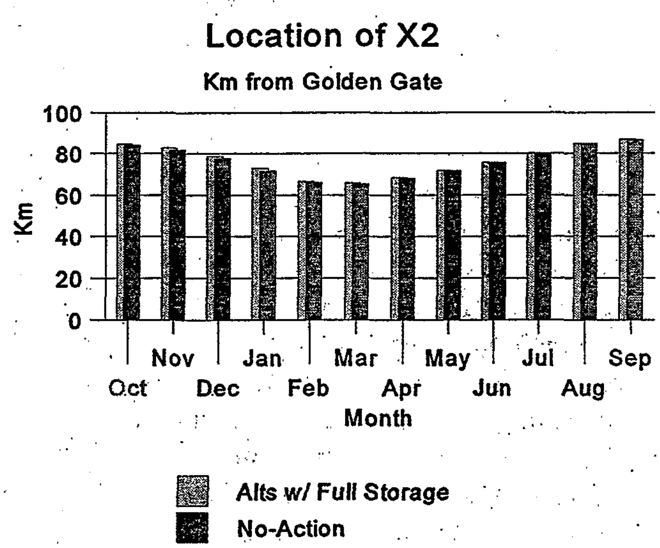
**Ability to Phase Facilities** - Each alternative includes hundreds of programmatic actions that could be implemented over 20 to 30 years. Alternative 3 has more physical features than Alternative 2 which, in turn, has more features than Alternative 1. Therefore, Alternatives 2 and 3 could have more complex phasing plans than for Alternative 1. However, each alternative provides ample opportunity for phasing over the implementation period.

**Brackish Water Habitat** - This characteristic refers to the capability of the alternatives to control salinity intrusion into the Delta from the Bay-ocean and, thereby, to maintain important brackish water habitat in the Western Delta and Suisun Bay. An indicator of the location of this brackish water habitat is the location of 2,000 parts per million total dissolved solids or X2 (measured in kilometers upstream from the Golden Gate Bridge). Hence, X2 is currently used as the primary indicator in managing Delta outflows.

The X2 indicator is used to reflect a variety of biological consequences related to the magnitude of fresh water flowing downstream through the estuary and the upstream flow of salt water in the lower portion of the estuary. It involves both the downstream transport of organisms such as delta smelt and striped bass, and the upstream transport of others such as bay shrimp and Dungeness crabs. The abundance of some species is positively related to the magnitude of downstream flow during the late winter and spring. These include bay shrimp, longfin smelt and starry flounder. The evidence of such relationships led to the existing standards concerning X2. Many people believe that this evidence indicates that reduced freshwater flows in the estuary resulting from consumption of water in the basin and exports from the basin have degraded habitat quality for aquatic resources.

Brackish water habitat was identified as a distinguishing characteristic because of concern that the CALFED alternatives would result in further decreases in freshwater flows, with the greatest concern being for flows in the winter and spring. The principal concern is that the degree to which conditions better than that required by the existing X2 standards would be diminished.

Comparison of the No-Action Alternative to the CALFED alternatives with the full new water supply storage being considered by the program indicates very little difference in the average monthly location of X2 between the No-Action and project conditions.



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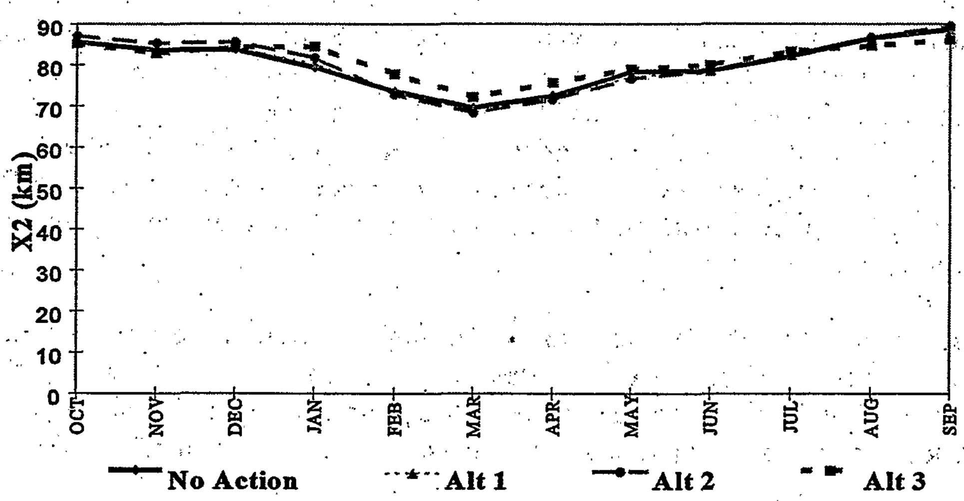
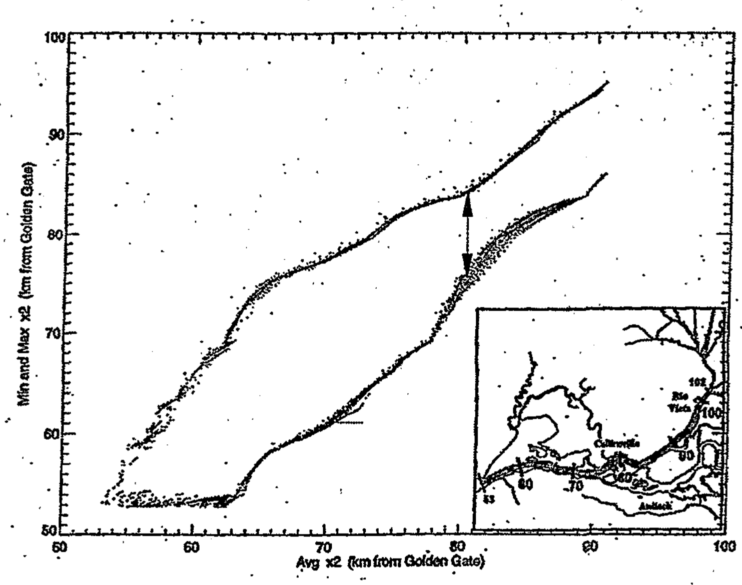
Operations studies for the 1922 through 1992 period indicate the average difference in location of X2 for November through June is about 0.3 km. For dry and critical years, the average difference in location is about 0.2 km. These differences indicate a small incremental decrease in freshwater flow due to the program, but one which is so small that the biological response would not be measurable. This difference is illustrated in figure below where monthly X2 locations are compared by alternative for the dry and critical years from 1975 thru 1991.

X2 Position Comparison under Various Delta Alternatives - 1975-91 WY (Critical & Dry Years Only)




Though Alternatives 2 and 3 could cause a slight upstream shift in the salinity gradient as a result of diverting water from the Sacramento River, the shift would be so small that any biological consequences are expected to be unmeasurable. This is especially true when one considers the daily maximum and minimum range of X2 that occurs around any tidal day average condition. For example, when the average X2 is approximately 80 km from the Golden Gate, the minimum and maximum X2 are approximately 75 and 84 km respectively.



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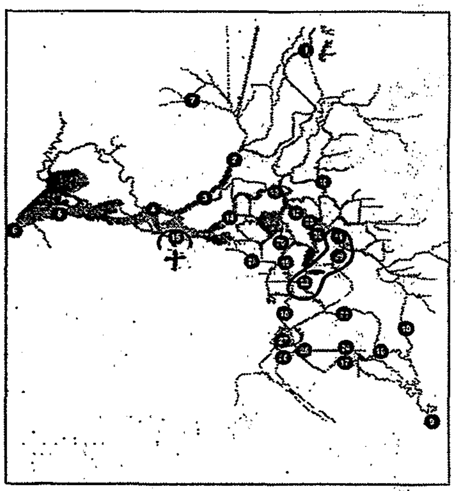
# Most Significant Distinguishing Characteristics

The remaining characteristics were found to distinguish the alternatives:

**In-Delta Water Quality**

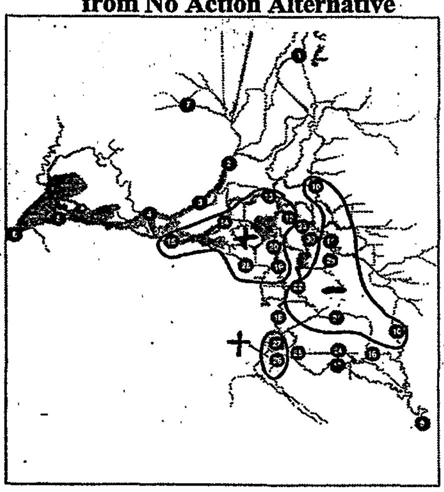
The Delta Simulation Model provides estimates of salinity at many locations throughout the Delta (see following page for locations). Changes in salinity for the alternatives are shown on the following charts as changes in electrical conductivity (EC). Areas with improved water quality (reduced salinity) are shown with a "+" symbol and areas with reduced water quality (increased salinity) are shown with "-" symbol.

**Alternative 1- Changes in Salinity from No Action Alternative**



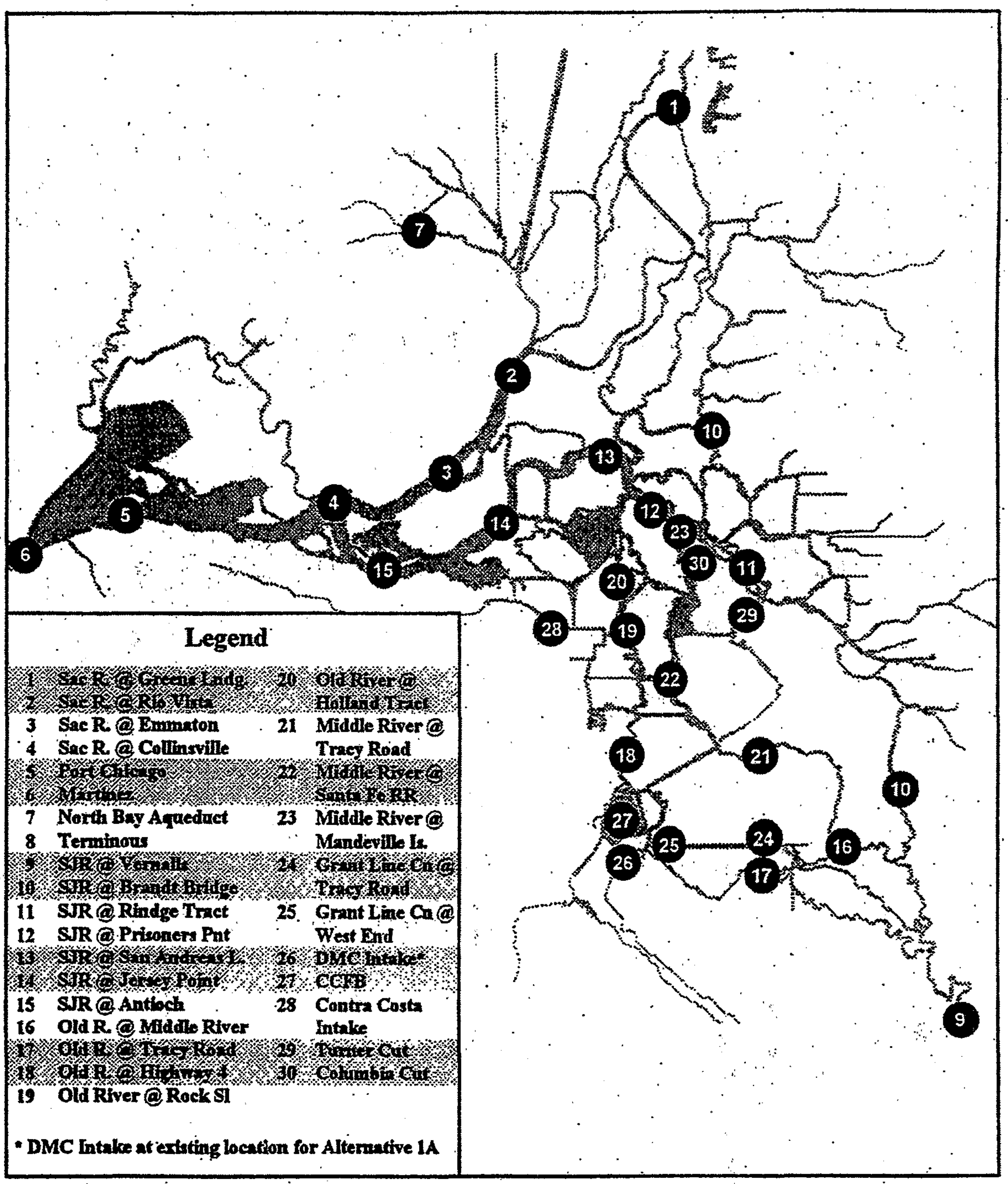
**Alternative 2- Changes in Salinity from No Action Alternative**

**Alternative 3 - Changes in Salintiy from No Action Alternative**



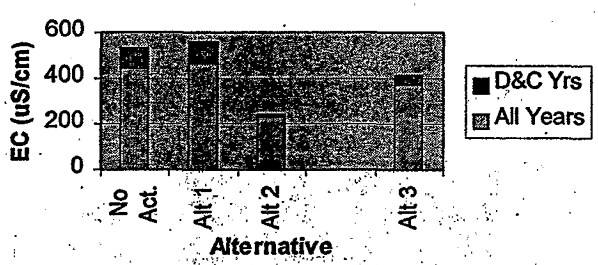
**Note: In these figures "+" means better water quality and reduced salinity measured by electrical conductivity (EC); "-" means worse water quality.**

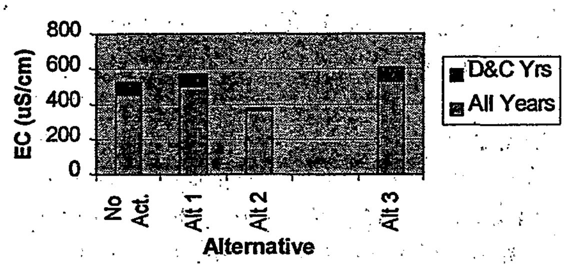
## Model Output Locations for Monthly Average Electrical Conductivity



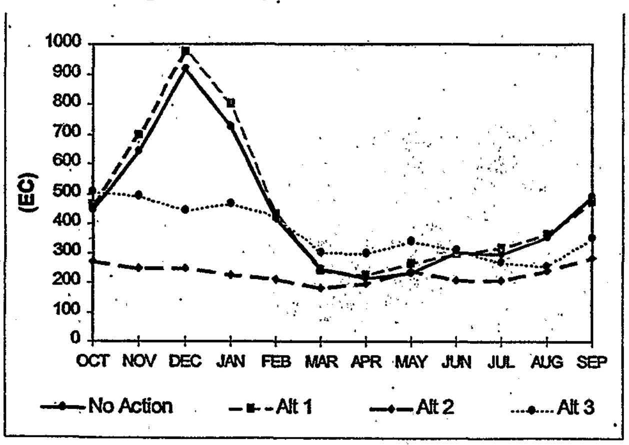
The above figures depict the in-Delta salinity consequences of implementing the alternatives, based on model studies. The modeling results indicate implementation of Alternative 1 would have minimal effects on in-Delta salinity. Alternative 2 would improve (reduce) salinity by up about 45% at some locations in the north and central Delta, while Alternative 3 would result in better conditions in the central Delta, but would reduce quality (increase salinity) by up to 80 percent in the eastern Delta.

The following bar graphs show average EC at two Delta locations. Monthly variations of EC are shown in the graphs located below the average bar graphs. Alternative 2 generally provides better in-Delta water quality.

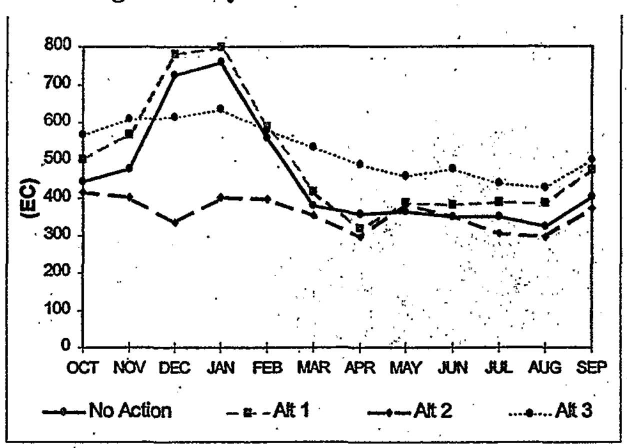



SJR at Prisoners Pt
**At Selected from Water Year 1975 thru 1991**
**Average Monthly Values**



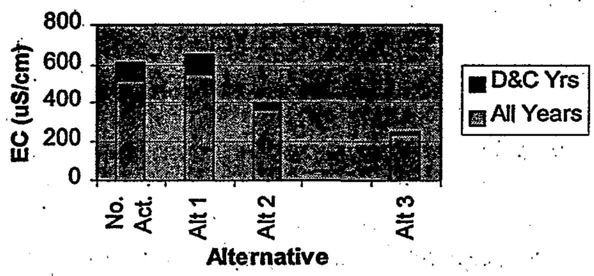

**Middle River at Tracy Road**
**At Selected from Water Year 1975 thru 1991**
**Average Monthly Values**



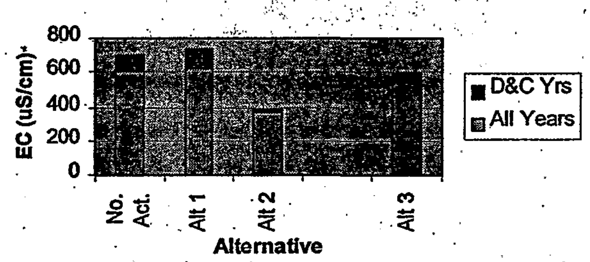
## Export Water Quality

Salinity of waters diverted from the Delta would not significantly change if Alternative 1 were implemented. Alternative 2 would reduce salinity (electrical conductivity) by about 40 percent for Contra Costa Water District, while reducing salinity of State Water Project and Central Valley Project exports by about 30 and 35 percent, respectively. Two important characteristics of drinking water supplies taken from the Delta are organic carbon and bromide. Organic carbon in the system comes primarily from decomposition of plant materials, a major source of which is discharges from organically rich peat soils on Delta islands. Bromide in Delta waters comes primarily from the ocean due to salinity intrusion. Together, organic carbon and bromide form unwanted and potentially harmful chemicals when Delta water is disinfected during drinking water treatment. The implications of organic carbon and bromide for drinking water supplies taken from the Delta are addressed in more detail in Chapter 5.

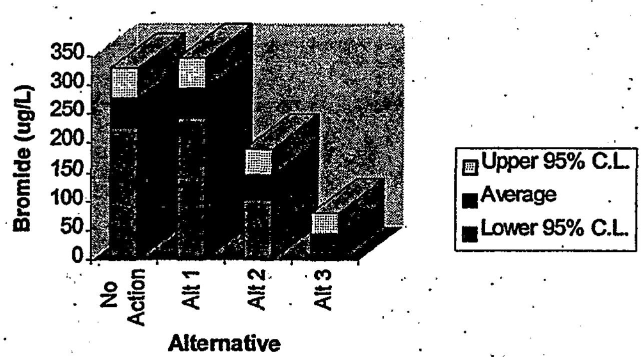
Average EC at Clifton Court



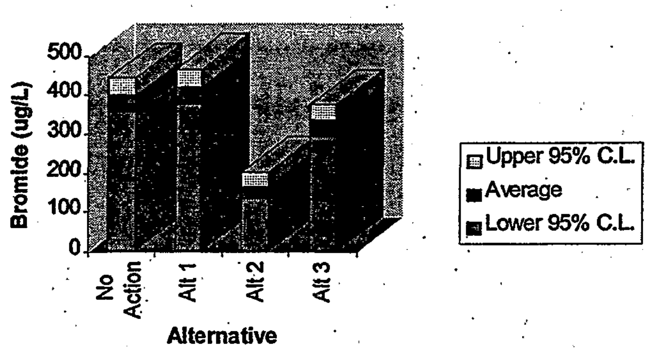

Average EC at Contra Costa Intake




Predicted Bromide at Clifton Court




Predicted Bromide at Rock Slough



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**Diversion Effects on Fisheries**

Currently, diversions in the south Delta capture and destroy many fish. Also, adverse flow patterns induced by the diversions have the capacity to disrupt fish movement and affect reproductive success of Delta fishes. Fish mortality from the current system is high due in large measure to the need to capture, sort, and transport fish from the fish screens at project pumps to elsewhere in the Delta.

**Alternative 1** would continue diversions in the south Delta similar to existing conditions. However, it would tend to increase existing adverse entrainment effects of the SWP and CVP, due to an increase in exports over no action and conditions.

**Alternative 2** would improve Delta flow patterns, and new fish screens at Hood on the Sacramento River will reduce the numbers of fish moved into the central Delta. They have two fundamental advantages in relation to fish screens in the south Delta. Those are:

- Bypass flows will exist in the river, so the screened fish will not have to be handled and trucked to another location for release.
- Fish using the Delta as a spawning and nursery area will not be exposed to the diversion.

However, Alternative 2 still requires diversions to be continued from the south Delta at the same level as Alternative 1, with associated capture and trucking. In addition net flows west of the Mokelumne River limit the exposure of the young of fishes such as Delta smelt and striped bass to the south Delta diversions and from opening the Delta Cross Channel less frequently. Once chinook salmon smolts migrating out of the San Joaquin system reache the Mokelumne, they would receive some benefit from improved net flows. An overriding consideration for them would be that water flowing out of the San Joaquin would continue going to the SWP/CVP export pumps under most circumstances, unless continued or greater export curtailments were implemented to provide some degree of protection. The benefits of Alternative 2 would be offset by the risks associated with the upstream passage of adult fish through the channel from Hood to the Mokelumne River . While CALFED's Fish Facilities Technical Team believes measures can be found to provide adequate passage, difficulties have occurred elsewhere in providing adequate upstream passage for multiple species.

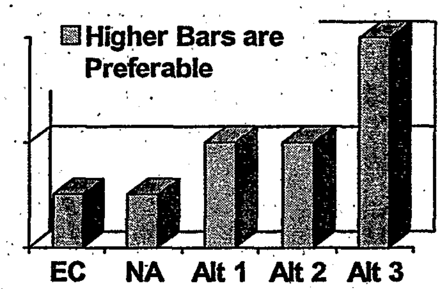
**Alternative 3** would improve Delta flow patterns, and new fish screens at Hood on the Sacramento River will reduce the numbers of fish moved into the central Delta. Like Alternative 2, bypass flows will exist in the river, so the screened fish will not have to be handled and trucked to another location for release. Fish using the Delta as a spawning and nursery area will not be exposed to the diversion. Like the other alternatives, Alternative 3 would include some negative consequences associated with the increase in exports in relation to No Action conditions and Existing Conditions, but would include a large benefit associated with the 80% reduction in exports from the south Delta. While the remaining 20% of exports from the south Delta would continue some adverse impacts, major reductions in conflicts between water exports and the protection of fishes would be expected. Major beneficiaries are those fisheries using the San Joaquin Delta as a spawning and nursery area and chinook salmon smolts migrating from the San Joaquin River. The species residing in the San Joaquin Delta and receiving major benefit include delta smelt, splittail, striped bass and white catfish.

The three CALFED alternatives would affect diversion losses for Sacramento River salmon only minimally. Presently, salmon smolts diverted from the Sacramento River into the San Joaquin Delta through either the Delta Cross Channel or Georgiana Slough survive at a rate only 1/3 to 1/2 of those remaining in the Sacramento River. A substantial amount of this negative impact is presently avoided by keeping the Delta Cross Channel closed during salmon migrations, except when negative water quality consequences in the San Joaquin are too great and require opening the Cross Channel. However, the greater exports under Alternative 1 would increase conflicts with San Joaquin water quality and likely result in the Cross Channel being open more frequently.

The overall qualitative assessment from the CALFED fishery experts is that Alternative 3 performs better (has fewer diversion effects on fisheries) than Alternatives 1 and 2. The judgement of the experts is that Alternative 2 performs only slightly better than Alternative 1.

**Diversion Effects on Fisheries**

(Qualitative Assessment)



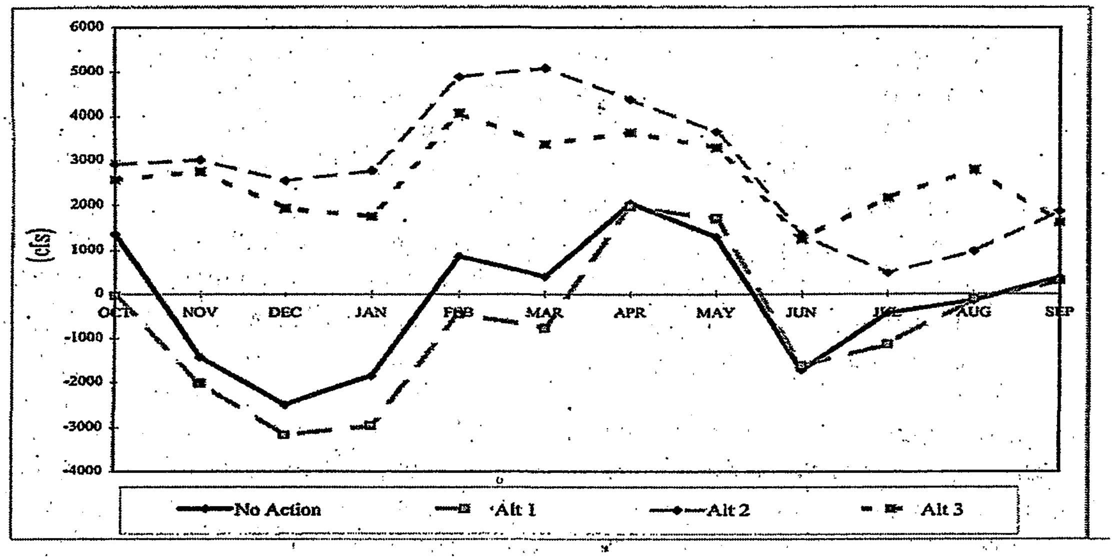

The implication of diversion effects is addressed in more detail in Chapter 5.

**Delta Flow Circulation**

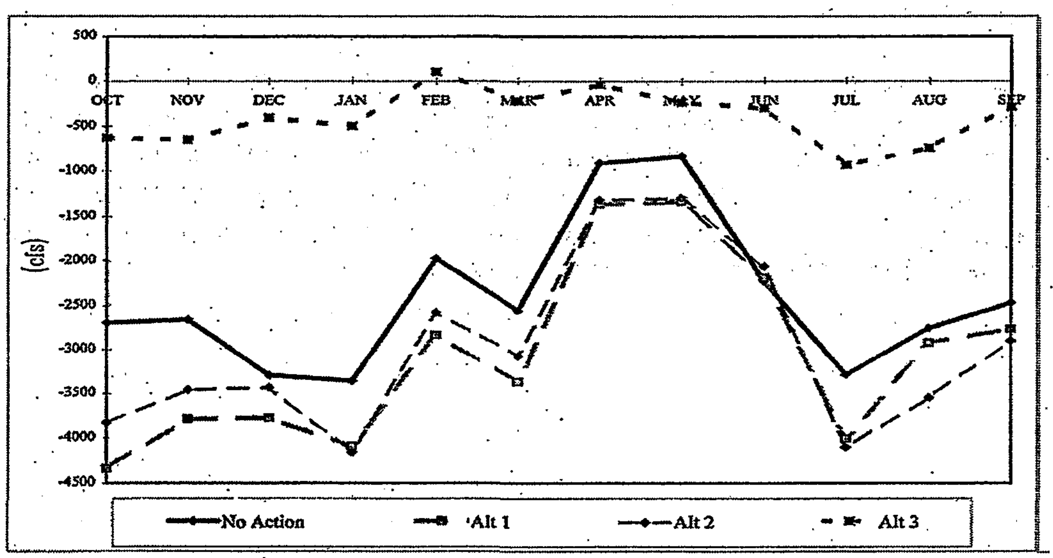
In the Delta, the normal ecological flow condition has been changed primarily by the SWP/CVP pumps being located in the south Delta and the majority of water exported by them coming from the Sacramento River. The result is that the magnitude of flood tides often exceed the magnitude of ebb tides causing a net upstream flow throughout much of the Delta. The result is that many fish and aquatic invertebrates do not have the flow conditions they have evolved to rely on and suffer various adverse consequences.

The following figures compare the flows for each alternative at two Delta locations.

## Antioch




## OLD River




In both locations, the average monthly flows for Alternative 1 are more negative than for the No Action for most of the months. Both Alternative 2 and 3 have positive flow conditions for October through May. Alternative 2 displays some negative months at the fall of the year. Alternative 3 is the only alternative that has flow that are near positive.

Under **Alternative 1,** the existing pattern of upstream net flows will continue, accentuated a little by the increase in exports. Some of the species specific consequences will be:

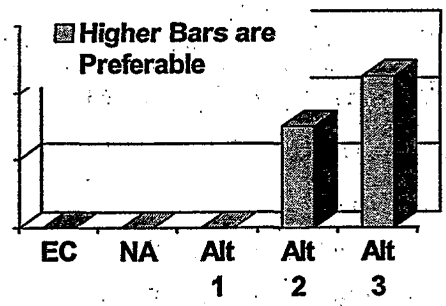
- young delta smelt and striped bass spawned in the San Joaquin Delta or transported into it through the Delta Cross Channel or Georgiana Slough will have difficulty getting to their primary nursery area in Suisun Bay.
- young salmon migrating out of the San Joaquin system will have difficulty finding their way through the San Joaquin Delta.
- adult salmon migrating to the San Joaquin system in the fall will find little or no home stream water to guide them until they reach the reach the eastern Delta.
- adult salmon migrating to the Sacramento system will more frequently migrate via the San Joaquin Delta.

Under **Alternative 2,** considerably better conditions will exist, as normal net downstream conditions will be restored downstream of the Mokelumne River in the San Joaquin Delta, although of a magnitude typically less than that which occurred historically. The principal beneficiaries will be delta smelt and striped bass. This benefit will be achieved at some environmental cost, due to reduced flows in the Sacramento River below Hood. Such reduced flows will likely reduce the survival of young chinook salmon and striped bass traveling down the river. Maintenance of minimum flows at Rio Vista should avoid significant adverse consequences.

Under **Alternative 3,** net downstream flows will be restored throughout most of the Delta. The concern over reduced flows in the Sacramento River below Hood will be identical to Alternative 2, as the magnitude of the diversion at Hood will be similar. Continuing exports from the south Delta may cause some reverse flows, but effects should be small in relation to the present situation. Each of the species specific effects enumerated for Alternative 1 should be alleviated.

The overall qualitative assessment from the CALFED fishery experts is that Alternative 3 performs better (has more natural flow circulation patterns) than Alternative 2. The judgement of the experts is that Alternative 2 performs better than Alternative 1.

**Flow Circulation (for Fisheries)**
(Qualitative Assessment)




**Water Supply Opportunities**

Water supply opportunities were estimated using the system operation model, DWRSIM. Using this model, the operation of existing and proposed storage and conveyance facilities is simulated using a hydrologic record from the years 1922 through 1994. DWRSIM may be used to project the effects of adding new facilities or changing operating criteria on Central Valley stream flows and water supplies. For this evaluation of water supply opportunities, the model was used to project water deliveries to south of Delta SWP and CVP water users. Because specific beneficiaries of any potential increased water supply resulting from implementing a CALFED solution will not be identified until later stages of the Bay-Delta Program, these SWP and CVP water users were used as a surrogate for all potential water supply beneficiaries.

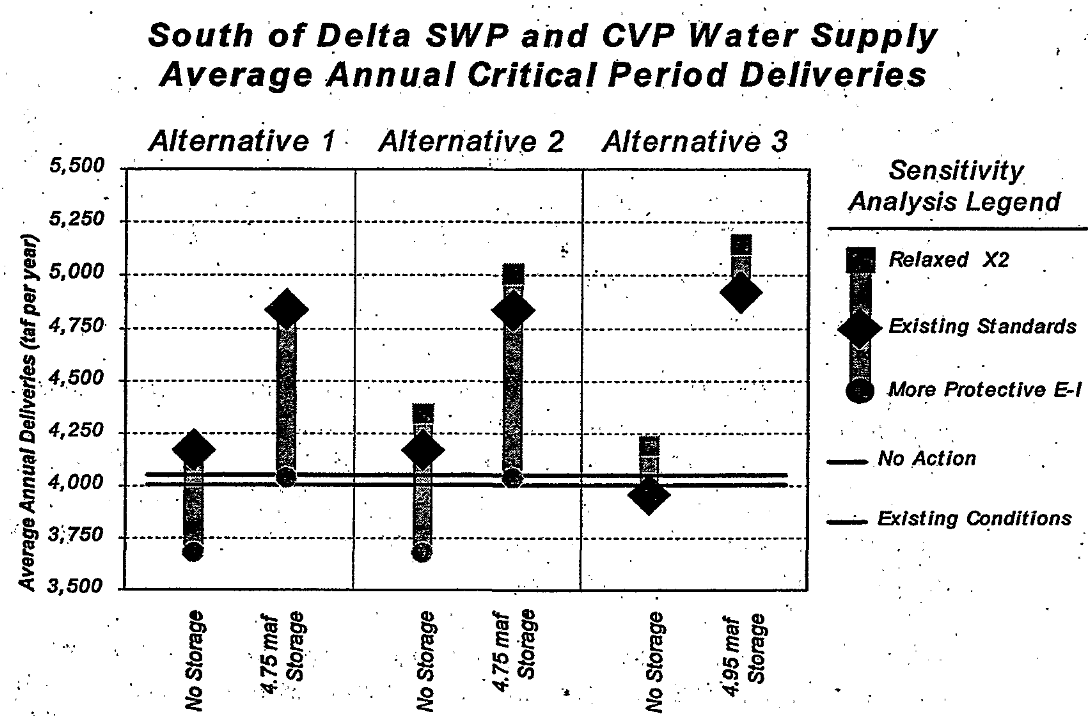
South of Delta SWP and CVP water deliveries were estimated for existing conditions, no action, and the three Program alternatives. Each Program alternative was evaluated with and without new surface and groundwater storage components. The general locations and volumes of new storage considered for SWP and CVP operations are shown in the table below. Additional storage, beyond the amounts shown below, was considered to provide water supply for the CALFED ecosystem restoration program. That storage, with a maximum capacity totaling about 1.25 maf, is not included in this table because it did not contribute to the projected SWP and CVP water supply benefits used to evaluate this distinguishing characteristic. The total amount of storage included in the Program alternatives, from zero up to approximately 6 MAF, is considered a reasonable range for study purposes. Future decisions about the proper amount of storage for any Program alternative will be determined by issues such as cost and site-specific concerns, rather than by a programmatic-level optimization process. More detailed study and significant interaction with stakeholders will be required before specific locations and sizes of new storage are proposed.

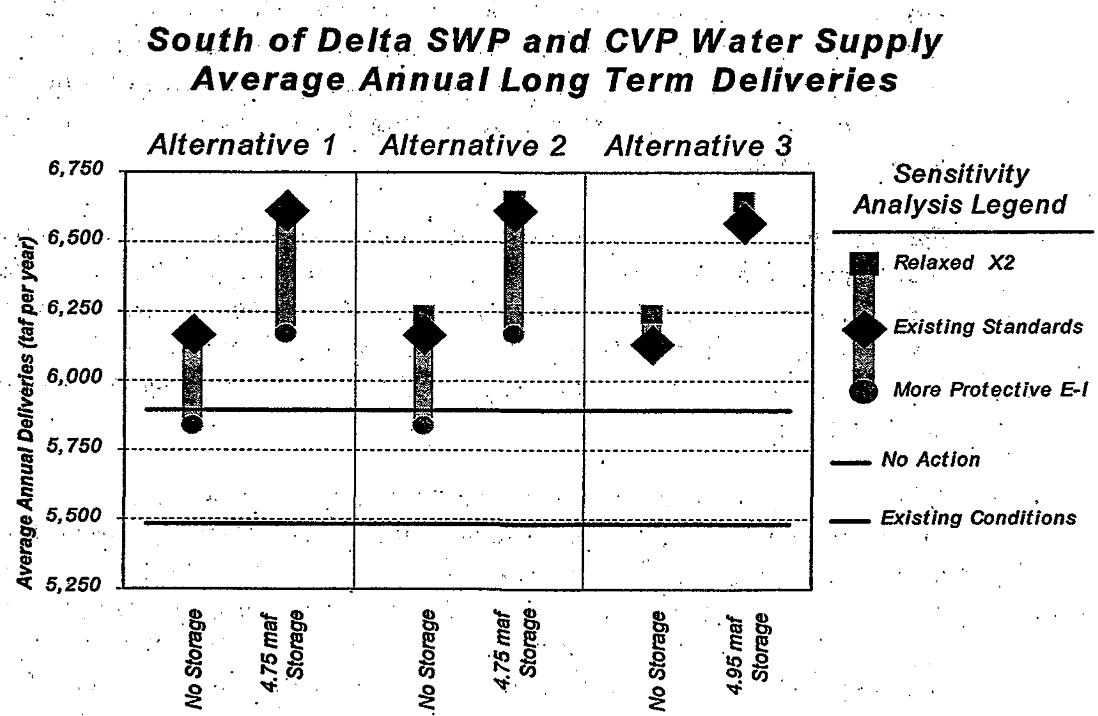
**Storage Components Considered in the Evaluation of Water Supply Opportinities**

| Storage Component | Range of Storage Capacities | | |
|---|---|---|---|
| | Alternative 1 | Alternative 2 | Alternative 3 |
| Sacramento River Tributary Surface Storage | 0 to 2 maf | 0 to 2 maf | 0 to 2 maf |
| Sacramento Valley Groundwater Storage | 0 to 250 taf | 0 to 250 taf | 0 to 250 taf |
| In-Delta Storage | - | - | 0 to 200 taf |
| South of Delta Off-Aqueduct Surface Storage | 0 to 2 maf | 0 to 2 maf | 0 to 2 maf |
| San Joaquin Valley Groundwater Storage | 0 to 500 taf | 0 to 500 taf | 0 to 500 taf |
| **Total** | **0 to 4.75 maf** | **0 to 4.75 maf** | **0 to 4.95 maf** |

To evaluate water supply opportunities, CALFED agencies developed a set of operating criteria for each Program alternative based on existing Bay-Delta standards, as described previously. In addition, a sensitivity analysis was performed to estimate the effects on water supply of potential future changes in Bay-Delta standards. This sensitivity analysis focused on two important operating rules: export-inflow ratios and Delta outflow requirements. As described previously, this sensitivity analysis is intended to provide information regarding possible long-term effects of implementing the three Program alternatives – no specific changes in Bay-Delta standards are proposed or endorsed by CALFED agencies through this evaluation.

Average annual south of Delta SWP and CVP water deliveries, as simulated using hydrologic records for the May 1928 through October 1934 critically dry period and for the long term period of 1922 through 1994, are displayed in the following figures. Each alternative is represented with and without the quantity of storage shown in the previous table. Projected water deliveries under operating criteria based on existing Bay-Delta standards are represented by black diamonds in these figures. The results of the sensitivity analysis of changes in operating criteria are also displayed. Reduced water deliveries due to more protective export-inflow ratios (E-I ratios) are represented by gray circles for Alternatives 1 and 2. Increased water deliveries due to relaxation of Delta outflow requirements (X2) are represented by gray squares for Alternatives 2 and 3. Bars connecting these symbols represent the ranges of potential deliveries based on the bounding operating criteria considered for each alternative in this sensitivity analysis. For comparative purposes, the figures also include black and gray lines representing estimated average annual south of Delta SWP and CVP water deliveries under existing conditions and no action, respectively.


South of Delta SWP and CVP Water Supply
Average Annual Critical Period Deliveries
Alternative 1
Alternative 2
Alternative 3
Average Annual Deliveries (taf per year)
5,500
5,250
5,000
4,750
4,500
4,250
4,000
3,750
3,500
No Storage
4.75 maf Storage
No Storage
4.75 maf Storage
No Storage
4.95 maf Storage
Sensitivity Analysis Legend
Relaxed X2
Existing Standards
More Protective E-I
No Action
Existing Conditions


South of Delta SWP and CVP Water Supply
Average Annual Long Term Deliveries
Alternative 1
Alternative 2
Alternative 3
Average Annual Deliveries (taf per year)
6,750
6,500
6,250
6,000
5,750
5,500
5,250
No Storage
4.75 maf Storage
No Storage
4.75 maf Storage
No Storage
4.95 maf Storage
Sensitivity Analysis Legend
Relaxed X2
Existing Standards
More Protective E-I
No Action
Existing Conditions

Several findings are suggested by this evaluation:

- Significant increases in water supply opportunities are only provided if new storage is included under each Program alternatives. Compared to no action, from 750 to 900 TAF of average annual critical period supply could be developed with the previously described new storage included in the Program alternatives, under the existing Bay-Delta standards-based operating criteria. Without new storage, average annual critical period supply ranges from an increase of about 100 TAF to a decrease of about 100 TAF, compared to no action.

- Under the existing Bay-Delta standards-based operating criteria, storage can provide roughly similar water supply benefits under any Program alternative. While further detailed evaluation is necessary, analyses conducted to date suggest that the relationship of storage to water supply benefits is essentially proportional up to the maximum storage quantities evaluated; the more storage added the more additional water supply is generated.

- While all Program alternatives provide roughly equivalent water supply opportunities under the existing Bay-Delta standards-based operating criteria, the sensitivity analysis conducted as part of this evaluation indicates that the more protective export-inflow ratios evaluated for Alternatives 1 and 2 could have significant effects on water supplies. Without new storage, average annual critical period supply decreases by about 400 TAF compared to no action, with the more protective export-inflow ratios in place. Addition of the new storage considered in Alternatives 1 and 2 with the more protective export-inflow ratios in place results in critical period supplies that are roughly equivalent to those under no action conditions.

- The more protective export-inflow ratios evaluated for Alternatives 1 and 2 in this sensitivity analysis reduce the effectiveness of new storage in providing water supply benefits. The net average annual critical period supply benefit of the new storage with the more protective export-inflow ratios in place is only about 350 TAF, compared to a net benefit of about 650 TAF with existing export-inflow ratios in place.

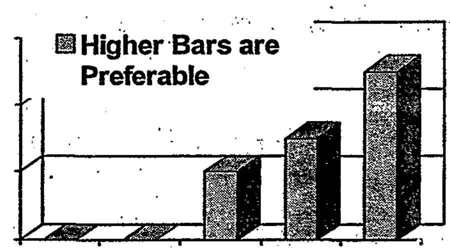
- Relaxation of Delta outflow requirements, as considered in the sensitivity analysis of Alternatives 2 and 3, results in relatively small additional increases in water supply. Under the relaxed Delta outflow requirements, average annual critical period supply increases 150 to 250 TAF compared to projected supplies under existing Delta outflow requirements. It should be noted that this evaluation of relaxing Delta outflow requirements was fairly rudimentary. Different types of adjustments, such as changes in the numbers of days the salinity gradient is required at specific locations in the Estuary, might be evaluated in a more detailed sensitivity analysis.

- Based on the bounding operating criteria considered for each alternative in this sensitivity analysis, the uncertainty regarding water supply opportunities under Alternative 3 is much less than the uncertainty under Alternatives 1 and 2. Critical period water supply benefits under Alternatives 1 and 2 with storage, based on these bounding operating criteria, range from a low of zero to a high of 750 to 950 TAF per year compared to no action. Under Alternative 3 with storage, potential critical period water supply benefits, based on the bounding operating criteria, encompass a smaller range of about 850 to 1,100 TAF per year compared to no action. These ranges of uncertainty might translate to potential future conflict in the management of all Bay-Delta resources. For example, a high level of success of CALFED's ecosystem restoration program could result in equivalent water supply benefits under any alternative – as represented by the tops of the bars in the previous figures. However, if the ecosystem restoration program achieves a lower level of success resulting in the need for more protective operating criteria, water supply benefits could be reduced to the levels represented by the bottoms of the bars in these figures. To the extent that the ranges of operating criteria evaluated in this sensitivity analysis represent the ranges of potential future Bay-Delta standards necessary under each Program alternative, a greater potential for combined benefits to both fisheries and water users exists under Alternative 3 compared to Alternatives 1 and 2.

## Operational Flexibility

Water storage is the one greatest feature that contributes to the operational flexibility of an alternative. Storage allows shifting diversion timing to respond to real time needs of the ecosystem, water quality, and water supply. The potential for adding storage was retained for each alternative. In addition, improvements in conveyance also improve operational flexibility. The Alternative 3 conveyance includes two distinct diversion points which provides added flexibility. Therefore, Alternative 2 generally has more flexibility than Alternative 1, and Alternative 3 generally has more flexibility than Alternative 2.

**Operational Flexibility**
(Qualitative Assessment)



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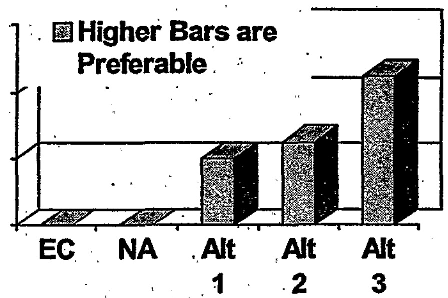
**Risk To Export Water Supplies**

Alternative 1 would improve the physical integrity of the Delta by strengthening Delta levees. Widening of Delta channels associated with Alternative 2 would provide a degree of additional protection from flooding. Both alternatives would, however, leave the export water supplies relatively vulnerable to seismic failure and sea water intrusion which could accompany catastrophic levee failures. Alternative 3 would provide the best physical security for export water supplies since it provides a new canal around the eastern edge of the Delta where it would not be impacted by major levee failures.

**Risk to Export Water Supplies**
(Qualitative Assessment)




**Assurances** - Assurances are mechanisms intended to increase participants confidence that an alternative will be implemented and operated as agreed. Although some people believe it impossible to assure appropriate operation of any isolated conveyance channel, others believe that a moderately sized facility can be operated as agreed. Consequently, additional detailed analyses and discussion of assurances must occur before they can be used to distinguish one alternative from the other.

**Consistency with Solution Principles**

The alternatives are probably not identical in their abilities to meet the solution principles. However, a more thorough analysis and discussion must occur before the solution principles can be used to distinguish one alternative from another.

# Comparison of Alternatives

The previous section shows the major differences between the alternatives. The following table provides a general comparison of the alternatives according to theses eight most distinguishing characteristics. Qualitative rankings of high (H), medium (M), and low (L) were used to summarize the three alternatives. For example, in-Delta water quality is best for Alternative 2 and the lowest for Alternative 3. **From this summary and supporting information it was concluded that, with respect to the key Distinguishing Characteristics, Alternative 3 ranked highest technically with respect to these characteristics.** Alternative 2 was next.



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The results of this analysis do not indicate the selection of a preferred alternative. Indeed, although Alternative 3 ranked higher than the others, there are significant additional issues that affect selection of a preferred alternative.

**Summary Evaluation of Most Significant Technical Distinguishing Characteristics**

| | In-Delta Water Quality | Export Water Quality (South Delta) | Export Water Quality (Contra Costa) | Minimize Diversion Effects on Fisheries | Delta Flow Circulation | Water Supply Opportunities | Operational Flexibility | Minimize Risk to Export Water Supplies | Water Transfer Opportunities |
|---|---|---|---|---|---|---|---|---|---|
| Alternative 1 | M | L | L | L | L | M | L | L | L |
| Alternative 2 | M+ | M | M+ | L | M | M+ | M | M | L |
| Alternative 3 | L | H | L | M+ | M+ | H | H | H | M |

The evaluation depicted graphically here treats each of the key distinguishing characteristics as if they were of equal importance. According to this simplistic evaluation, Alternative 3 best meets CALFED program objectives from a technical perspective as reflected in these distinguishing characteristics. It is important to understand, however, that it is unlikely that all of the key distinguishing characteristics are of equal importance, and different weighting of these factors could affect the outcome of the analysis. In addition, the above table does not attempt to "standardize the scales for each characteristic. That is, the relative difference between an "L" and an "M" on one characteristic may be totally different than the difference between an "L" and an "M" on another characteristic. Interested parties, the public, and CALFED agencies must collectively determine the importance of each distinguishing characteristic in the overall evaluation of alternatives leading to selection of the preferred alternative.

Two key distinguishing characteristics seem to be particularly important in making a decision on how well the alternatives perform. Export Water Quality and Diversion Effects on Fisheries, are highly dependent on the alternative selected. Therefore, irrespective of whether these two characteristics are the most important to selection of the preferred alternative, they are the characteristics most dependent on that decision. The implications of these characteristics are discussed in some detail below to enable the reader to understand their potential importance to a decision. Plans for further evaluation of these characteristics are described as well.

The following chapter identifies some of the additional issues and concern, and describes how the CALFED process will reach selection of a preferred alternative.

# 5. ISSUES TO BE RESOLVED PRIOR TO SELECTION OF A PREFERRED ALTERNATIVE

During the process of developing the Program elements and evaluating the alternatives, many issues and concerns were identified. Some of these issues must be addressed in order to facilitate selection of a preferred alternative. These issues, as shown in the adjacent sidebar, vary in their potential significance in selecting an alternative and in the implementation approach to be taken. As shown in the figure below, some issues may require independent science review, focused stakeholder collaboration or simply additional analysis and development.

Selecting a preferred alternative is not simply a matter of technical analysis. Selection must include consideration of institutional, stakeholder, policy and other issues of concern. Some believe construction of any size isolated facility in Alternative 3 may be unacceptable to the public, irrespective of technical merit. Also, the cost of such a facility could be sufficiently high that water users may feel unwilling to pay for the benefits the facility would bring to them.

The different types of issues to be addressed are:

- Major technical issues
- Implementation strategy and planning issues
- Issues relating to ongoing Program refinement

**ISSUES TO BE ADDRESSED**

**Export Water Quality**
- Drinking Water Issues

**Diversion Effects on Fisheries**

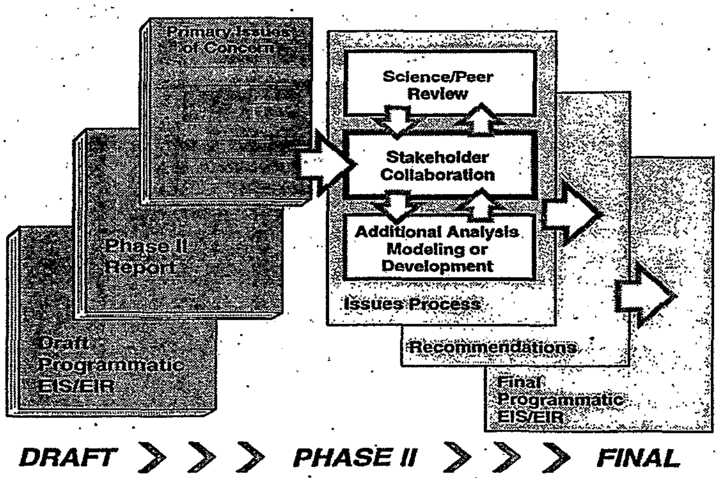
**Program Element Refinement and Implementation Plan Development**
- Water Quality
- Ecosystem
- Levees
- Water Use Efficiency
- Watershed management
- Water Transfers

**Operating Criteria**
- Interim/Long-term
- Time Value of Water
- Health of Bay

**Agricultural Land Impacts**

**Clean Water Act (404) Process**

**Assurances and Financial Plan**



# Major Technical Issues

The key contributing to the strong technical performance of Alternative 3 are improved drinking water quality and reduced fishery entrainment at the south Delta export pumps. Bromide levels in drinking water, and their contribution to potentially carcinogenic and acutely toxic disinfection byproducts, and the water export impacts on fisheries may be the most significant technical issues which are dependent on Alternative 3. Alternative 3 also carries the most stakeholder concern regarding assuring proper operation of an isolated facility and maintenance of the common pool. These assurance concerns were highlighted when California voters defeated a proposal for a larger isolated facility (the Peripheral Canal) in the early 1980s. While CALFED's Alternative 3 is very different than the proposal rejected by voters, some distrust remains.

The public health concerns of bromides have not been clearly established. Also, many fish experts have identified pumping from the south Delta as the single largest problem affecting the Bay-Delta ecosystem. However, others believe that fishery species recovery can occur without changing how water is exported from the Delta. Following is further discussion of these major technical issues that appear to be key in the selection of a preferred alternative and an assurance package. Evaluations will continue to refine how significant these performance issues are and the ability of the Program to address issues of concern.

## Developing a Consensus Assurances Package

The technical evaluations described in the previous chapter did not make any attempt to consider the question of "assurances". In theory, an assurances package could be constructed that would assure implementation of any of the alternatives. As the debate over the Peripheral Canal in 1982 showed, however, the assurance issues associated with an isolated facility are substantial.

Included below is a summary of the substantial work done by CALFED and the Bay-Delta Advisory Council Workgroup on Assurances to define the assurances issues and develop a range of tools and approaches for resolving these issues.

Before CALFED can move forward with any preferred alternative, the CALFED agencies and the many stakeholder communities must develop a consensus on an assurances package. As noted below, CALFED recognizes that the assurances process may affect both the timing (phasing) and the substance of the implementation of a preferred alternative. CALFED will continue developing a consensus package by relying on the BDAC Assurances Workgroup effort, although we anticipate additional processes will be necessary to successfully resolve this issue before the Programmatic EIS/EIR is finalized in late 1998.

## Implications of the Delta Decision on Export Water Quality

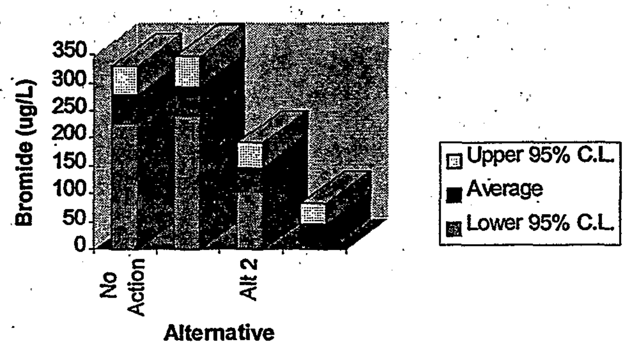
Most Californians ( about two-thirds of the population) get their drinking water supplies from the Sacramento-San Joaquin Delta. The choice of a Delta alternative has important implications for the drinking water supply to these citizens. Water taken from the Delta is treated to destroy disease causing organisms, the agents in drinking water presenting the most significant health threat to people. While drinking water produced from the Delta supply is generally safe to drink, it is also true that treatment is not an absolute guarantee that all organisms having the potential to cause disease are destroyed. For this reason, it is important to establish an additional barrier to disease by protecting drinking water sources from contamination. In its current configuration, the Delta is a relatively unprotected drinking water source.

The desire to increase the safety of drinking water has resulted in federal and state legislation requiring higher treatment efficiency, including more reliable disinfection. An unfortunate side effect of disinfection is formation of unwanted chemical byproducts, some of which are suspected to cause cancer over a lifetime of water consumption, and may have more immediate adverse health effects on some consumers, as is suggested by recent investigations. More effective disinfection has the tendency to increase formation of these unwanted byproducts. A challenge, therefore, is to produce a highly disinfected drinking water while minimizing unwanted byproducts.

Two features of Delta water quality complicate attainment of the optimum balance of effective disinfection and byproduct suppression. Bromide, a salt of sea water origin, is present in Delta water supplies as a result of intrusion into the Delta of sea water. The soils of Delta islands are important sources of organic carbon resulting from natural decomposition of plant materials. Together, bromide and organic carbon react with disinfectant chemicals to produce a broader range and higher concentrations of unwanted chemical disinfection byproducts than is true for drinking water sources lower in these two constituents. As a result, municipalities using Delta waters are at a relative disadvantage with respect to the cost and complexity of producing safe drinking water.

Treatment methodologies exist for economically removing organic carbon to some degree. Therefore, in general, organic carbon is considered to be a lesser problem for drinking water than bromide. Unlike organic carbon, bromide cannot be removed from drinking water supplies except by use of the most advanced and most expensive technologies which are not now practical.

**Predicted Bromide at Clifton Court**





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Because bromide reacts with disinfection chemicals to form a number of unwanted and potentially harmful chemical byproducts, it is of some importance to avoid bromide to the extent practicable in drinking water sources. A national survey indicated the average bromide level in municipal water supplies is about 40 micrograms per liter (parts per billion). By contrast, drinking water supplies diverted from the south Delta now average about 250 micrograms per liter, and are predicted to average near 350 micrograms per liter in the future if no CALFED actions are taken.

It is desirable to provide better protection of Delta drinking water supplies from various sources of contamination, and it is desirable to limit bromide and organic carbon concentrations in Delta drinking water supplies to protect the health of consumers of the water. Because there is no practical way to increase Delta source water protection or reduce bromide concentrations other than through selection of a Delta alternative, careful consideration should be given to the importance of this factor in the process of arriving at a CALFED Preferred Alternative. In making this assessment, CALFED will rely on collaboration with agencies having responsibility for safe drinking water and pollution protection. These include:

- California Department of Health Services staff having state Safe Drinking Water Act responsibility, including responsibility for enforcement of drinking water regulations in California;

- State Water Resources Control Board and Central Valley Regional Water Quality Control Board staff having responsibility for pollution prevention and control in the Delta;

- U.S. Environmental Protection Agency staff having federal Safe Drinking Water Act responsibility; and,

- Urban water supply agencies providing drinking water taken from the Delta.

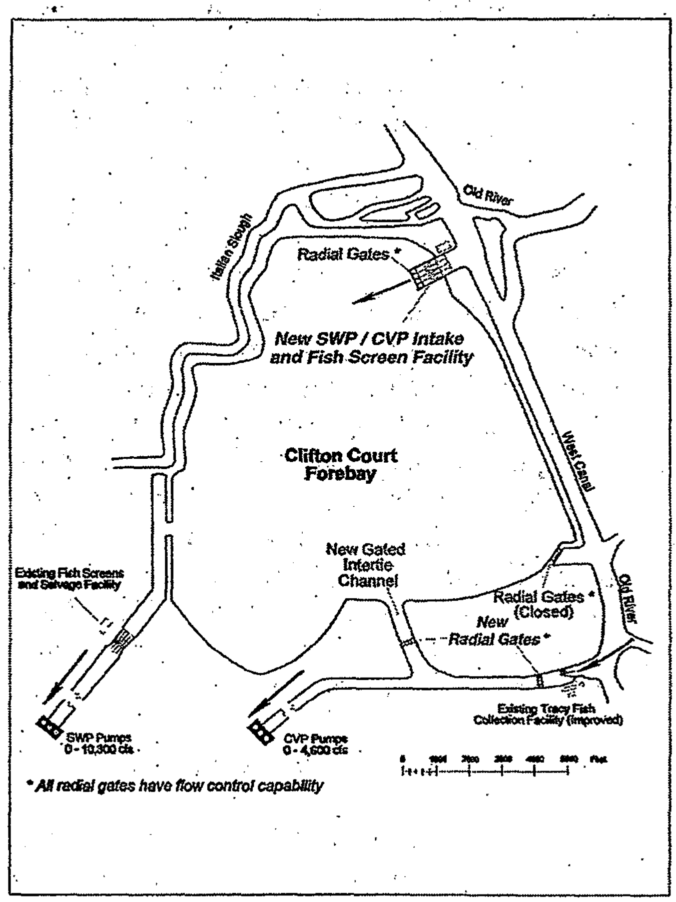
In addition, between release of the Draft Programmatic Environmental Impact Statement/Report and its finalization in Fall 1998, a science review panel will be organized to help evaluate this issue. The panel will be composed of recognized experts who will review and evaluate the analyses performed under the CALFED program and will provide independent perspective of the importance of bromide, organic carbon, and source water protection in the CALFED decision process.

## Implications of the Delta Decision on Diversion Effects on Fisheries

Currently, fish losses associated with south Delta diversions are thought to be an important, perhaps critical, factor in the decline and endangerment of some fish species. Individual aspects of the current problem include predation in Clifton Court, entrainment of fish at the SWP/CVP project pumps (partly due to inadequate fish screen facilities), mortality associated with the need to capture, sort, and transport fish to Delta channels away from the screens, and effects of adverse flow patterns induced by diversions on migration and spawning of fish species.

A fair degree of consensus exists as to the degree of benefit which would be likely for specific biological characteristics, but much less agreement exists as to which characteristics are most important in controlling population responses. For example, reasonable agreement exists as to the relative magnitude of fish losses in diversions for the various alternatives, but there is much less agreement as to the relative roles of losses in diversions in controlling population abundance. Hence the following analysis makes only limited attempts at such integration.

The focus for diversion effects on fisheries is on estuarine and migratory fish. A half century of observations indicates they are quite vulnerable to having their behavior disrupted by the transport of water from the Sacramento River to the export pumps in the south Delta. Fish in this group include chinook salmon, delta smelt, splittail, striped bass, steelhead and white catfish. Other Delta resident fish such as tule perch, and several members of the sunfish appear relatively invulnerable to being drawn to the export pumps. Fish such as starry flounder, longfin smelt, and bay shrimp, which live primarily downstream of the Delta, have little vulnerability to diversion to the export pumps but are potentially affected by the changes in the amount of water flowing from the Delta through San Francisco Bay to the ocean.



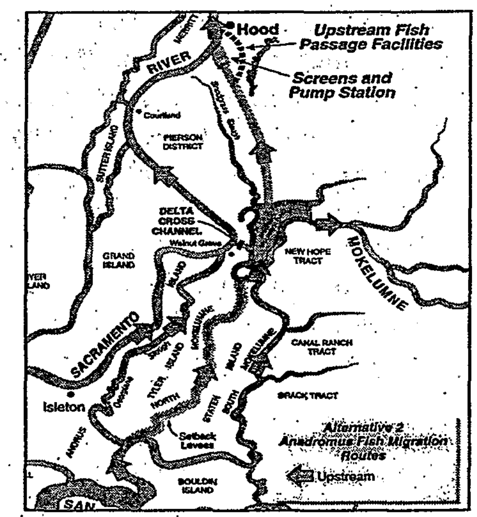

Diversion effects on fisheries are defined to include only the direct effects on fisheries due to water diversion intakes and associated fish facilities. Such effects associated with diversions from the Delta by the State Water Project (SWP) and the Central Valley Project

(CVP) are an integral part of the alternatives being considered by the CALFED Program. In each of the CALFED alternatives, SWP and CVP fish screens in the south Delta will be consolidated in one facility at the intake to Clifton Court Forebay using best feasible technology.

The situation will still be far from perfect, primarily due to the absence of bypass flows in the vicinity of the screens. That will mean that the present handling and trucking operation for salvaged fish will continue. Mortalities during the salvage operations vary greatly by species, size of fish, and seasonal conditions, primarily water temperature. For example, for steelhead, which migrate at a large size during cool seasons, mortalities during handling are virtually nil. For chinook salmon smolts, mortalities are less than 10%. For delta smelt, experiments for aqua culture programs suggest that mortalities exceed 90% even for adults. Another consideration is the greater screening efficiencies expected due to the positive barrier screens will be primarily for the smaller fish. Since smaller fish suffer the highest mortality during salvage operations, the overall benefit will be less than the improvement in efficiency.

In addition to the improvements in SWP and CVP screens in the south Delta, Alternatives 2 and 3 will also have fish screens at Hood on the Sacramento River. The majority of Sacramento River water being exported will pass through these screens. These screens will have two fundamental advantages in relation to fish screens in the south Delta. Those are:

- Bypass flows will exist in the river, so the screened fish will not have to be handled and trucked to another location for release.
- Fish using the Delta as a spawning and nursery area will not be exposed to the diversion.



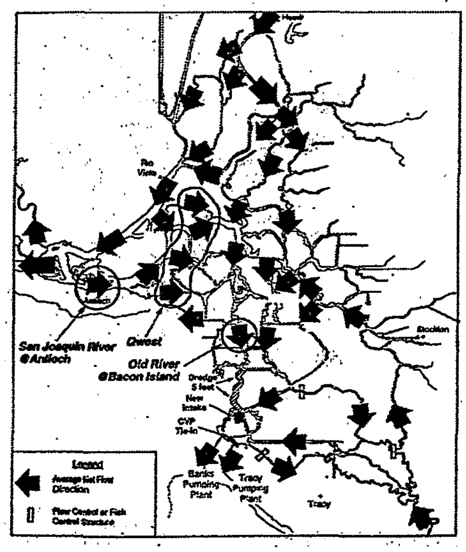

The screens also would be a new risk primarily for salmon from the Sacramento system, in that a larger portion of the population will be exposed to the screens. Also a major portion of the striped bass population and a small fraction of the delta smelt population spawn above the intake. Their young will be too small to be screened, so some brief curtailment of diversions will be required, at least for Alternative 3 in which the diversion would be into an isolated canal. A CALFED Fish Facilities Technical Team of agency and consultant experts evaluated the feasibility of installing effective fish screens at this location and concluded that it is feasible.

Two additional aspects of Alternative 2 are:

- That portion of the water screened at Hood which goes to export pumps in the south Delta has to be screened again to remove fish entrained as the water passes through the Delta, so the south Delta screens will have to have a capacity of about 15,000 cfs as in Alternative 1.

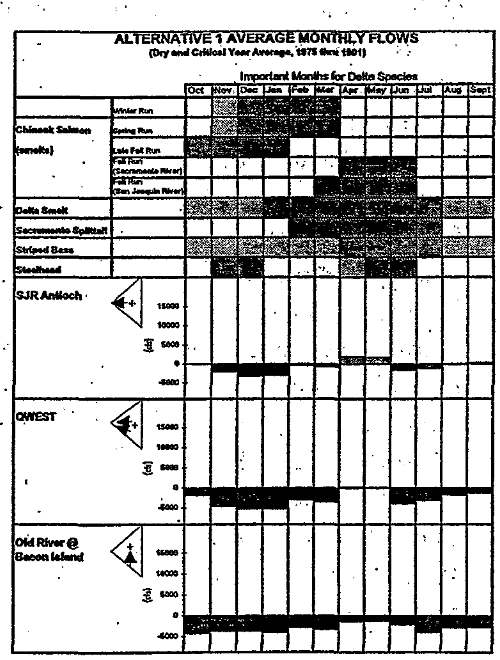
- Many thousands of adult fish of a variety of species will migrate to the Sacramento system through the new channel into which the water diverted at Hood is discharged. The passage of those fish will be blocked at the pumping plant downstream of the Hood fish screen as shown in the adjacent figure. Substantial fish passage facilities will be needed to bypass the pumping plant and fish screens and get the upstream migrants into the Sacramento River.

In addition, each CALFED alternative is characterized by a distinctive flow distribution (hydrodynamic) pattern. For Alternative 1, the direction of net flows during critical controlled flow periods is towards the pumping plants from the junction of the Sacramento and San Joaquin rivers near Antioch upstream through the Delta as shown in the adjacent figure.




This flow pattern exposes fish to being drafted towards the export pumps from a larger area than either Alternatives 2 or 3. The figures illustrates the conditions when diversion effects are most pronounced, one of high exports and low Delta inflow. This condition usually occurs in the summer and fall. During other times of the year, when inflows are higher, diversion effects are not as great. Highlighted are three Delta locations that represent mean flow directions that effect fisheries in those areas:

- San Joaquin River at Antioch
- QWEST ( the sum of Sevenmile Slough, San Joaquin River at Bradford Island, False River and Dutch Slough)
- Old River at Bacon Island.




The bar graph at the right shows Alternative 1 average monthly flows at these locations (for the dry and critical years of the period 1975 to 1991) and the months that are important to Delta species. Note that negative flows occur in most months.



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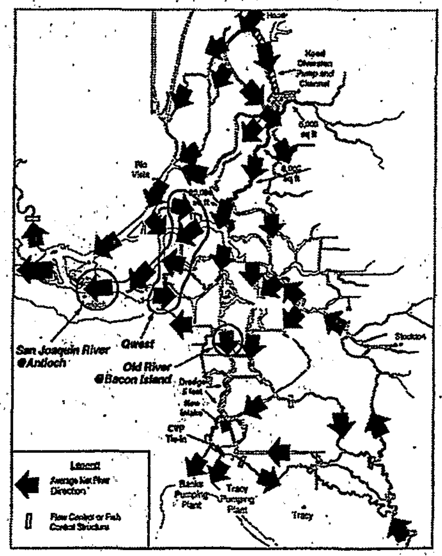
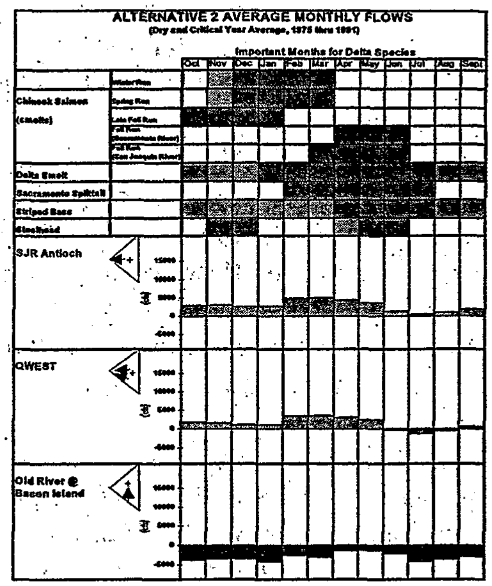
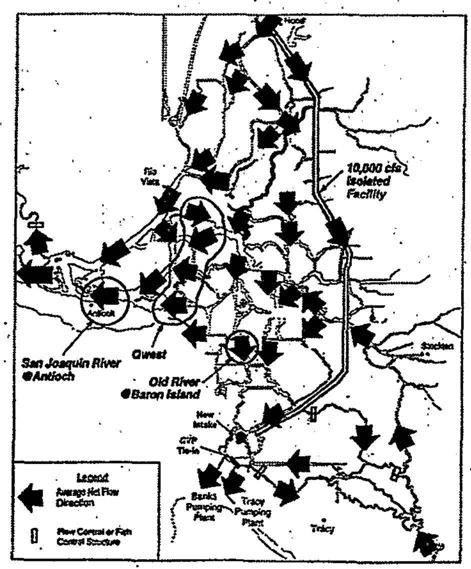
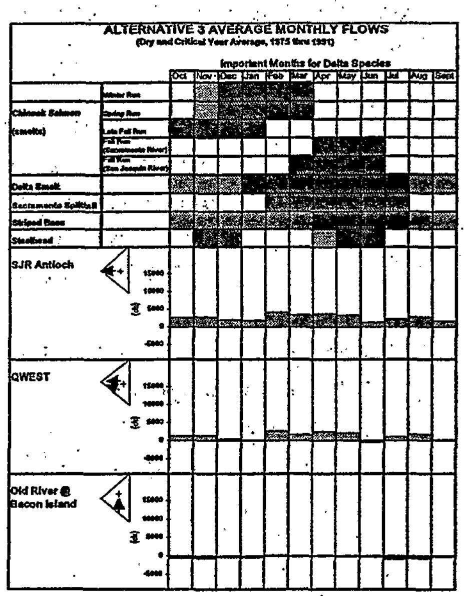
With Alternative 2, sufficient water is diverted at Hood to maintain net downstream flows in the San Joaquin Delta west of the Mokelumne River. The following bar graph also illustrates that the flows at Antioch and QWEST are more positive. Hence fish west of the Mokelumne would no longer be subject to being drafted towards the pumps. Important populations east of that point would still be subject to being drafted towards the pumps.




Finally, with Alternative 3 under operating scenarios, about 80% of the water exported from the Delta would pass through the Isolated Facility and 20% would be diverted directly from the south Delta. While net upstream flows would still occur in some areas under worst case circumstances (adjacent figure), approximately an 80% reduction in fish entrainment in the south Delta could be expected in relation to Alternative 1 and a somewhat lesser percentage in relation to Alternative 2. The bar graph also shows



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that the flows in all three locations are improved.

Chinook salmon in the Sacramento System would benefit substantially from habitat improvement features of the common programs both in the river and in the estuary. They would, however, receive little additional benefit from any of the three conveyances of the alternatives. Existing conflicts with water project operations would continue with Alternative 1, particularly when the Delta Cross Channel Gates are open. These conflicts would be replaced by risks associated with more direct exposure to fish screens and lower Sacramento River flows below Hood under Alternatives 2 and 3.

Chinook salmon in the San Joaquin System would also benefit from habitat improvement features of the common programs, but they would be affected very differently by the three conveyances of the alternatives. Under Alternatives 1 and 2 existing diversion affects would be perpetuated, offset somewhat by improved fish screens, and for Alternative 2, by improved flow distribution in the western Delta. Under Alternative 3 diversion effects would be reduced by about 80%.

Other fishes, such as delta smelt, splittail, striped bass and white catfish, would benefit to varying degrees from habitat improvement features of the common programs. They would also be affected very differently by the three conveyances of the alternatives. Under Alternative 1, existing diversion and flow distribution effects would be perpetuated.
These would be offset some by the improved fish screens, but to a lesser degree than for salmon, since they generally suffer more losses from handling and transport than salmon. They would receive some benefit from Alternative 2, due largely to improved flow distribution in the wester Delta, but substantially greater benefit under Alternative 3. The latter would result from approximately an 80 % reduction in diversion losses in the South Delta and improved flow distribution throughout the Delta. Some risk would continue from exposure to diversions at Hood and reduced flows below Hood.

The central question is whether, even with screen relocation and improvement, will the continued diversions from the south Delta be a sufficiently large cause of fish mortality that outweighs the benefits afforded by the other elements of the CALFED program? If this were true the implication would be that, even with extensive ecosystem restoration and water quality actions to enhance the estuarine environment, recovery of threatened and endangered species would be unlikely. Such a finding would, in turn, have major implications for a Delta decision. This question has been sufficiently discussed by the experts to reveal that there is not a clear-cut answer. It is, however, possible for the decision makers, interested parties, and the public to develop a more complete understanding of the considerations involved.

In coming to an understanding of the implications of diversion effects on fisheries to the CALFED decision process, agencies having responsibility for fishery resources will be consulted. These include, but are not necessarily limited to:

- California Department of Fish and Game
- U.S. Fish and Wildlife Service
- National Marine Fisheries Service
- U.S. Environmental Protection Agency
- State Water Resources Control Board

In addition, to provide an independent perspective of the issues, a science review panel will be convened in the period between release of the Draft Programmatic EIS/EIR and its finalization in November 1998. The panel will be composed of recognized experts having a range of expertise applicable to the problem. Specific remaining issues include:

- Required Sacramento River flow below a Hood diversion to protect egg and larval striped bass and Delta smelt?
- Are models which predict mean channel velocities adequate to predict impacts of egg and larval transport?
- Percent survival of egg and larval striped bass and Delta smelt passing through a Sacramento River screen and pumps in Alternative 2?
- Will Sacramento and San Joaquin salmon benefit more from upstream work than Delta actions?
- How to resolve needed operating criteria when existing information are based on models which meet SWRCB and AFRP criteria? Have alternatives been tested through a large enough range of operational policies to fully evaluate potential beneficial and adverse impacts?

# Implementation Strategy

This section identifies progress on the assurance and funding packages needed for implementing the preferred alternative. Although the preferred alternative has not been selected, the packages may apply to any of the three alternatives under consideration.

## Assurances

Once the CALFED Bay-Delta Program has developed a long-term comprehensive plan to restore the ecological health of the Bay-Delta and improve water management for beneficial uses, the CALFED agencies will need a strategy to guide implementation. One element of this implementation strategy is the assurances package. An assurances package is a set of actions and mechanisms to assure that the program will be implemented and operated as agreed. The assurances package will include mechanisms to be adopted immediately as well as a contingency process to address situations where a key element of the plan cannot be implemented or operated as agreed.

The Program staff, Bay-Delta Advisory Council's Assurances Workgroup, agencies and stakeholders have been working to identify the building blocks that will make up an assurances package. Thus far, Program staff has identified assurances needs and issues for each of the program elements; identified the assurance concerns of stakeholders; a compiled a list of assurance tools; and developed guidelines for evaluating a package of assurances. Each of these elements is described in greater detail in Appendix __ to the Programmatic EIS/EIR, "The Implementation Strategy."

In addition, regardless of which program alternative is selected, the Program must design an implementation strategy that will operate for the life of the Program actions. Because any alternative will likely require a number of funding, legislative, regulatory, contractual and institutional changes, implementation will be a complex, long-term process. Additionally, the nature and complexity of each program element make it impossible to implement the entire program simultaneously. The Program, therefore, will be implemented in phases.

The challenge in implementing a program in phases is to allow actions that are ready to be taken immediately to go forward, while assuring that each interest group has a stake in the successful implementation of the entire program over the implementation period. The Program staff has identified the following three characteristics for a successful phasing strategy:

- each phase should be completed before the next phase can begin;
- each interest group should have strong inducements to support the completion of each and every phase; and
- program elements which are outside the control of the CALFED agencies should be implemented as early as possible to reduce the risk that outside actors may affect implementation.

There is a significant amount of work to occur between the present and certification of the final EIS/EIR if the long-term solution is to be successfully implemented. To that end, the Program is developing individual implementation plans for each program element. Those plans will include:

- a description of the program element;
- a summary of the goals, objectives and targets the element is seeking to achieve;
- a detailed description of the actions to be taken and the tools and strategies to be used. This section will include a description of the order in which actions should be taken and their relative priorities;

- a discussion of how and when success is to be measured;
- and any other information necessary to assure timely and effective implementation.

These individual implementation plans will be wrapped into the program-wide implementation strategy and will also include financing and assurances. As part of this process, Program elements will be refined to improve overall performance.

In addition to the general information described above, the Program staff have identified a number of significant assurance concerns relevant to the alternatives being analyzed in this EIS/EIR. A brief summary of some of these concerns follows.

**Implementing Entity for Ecosystem Restoration Program** - Many stakeholders are concerned that the existing diffused approach to ecosystem management and restoration with responsibilities resting in state, federal, local and private entities is inadequate to assure implementation of the ERPP as envisioned. Program staff, therefore, is examining a variety of implementing entities including joint powers authorities or new entities.

Any implementing entity would have the powers and resources necessary to implement the ERPP. In addition, the decision of how and by whom new actions in the remainder of the program will be implemented is also pending. Program-wide coordination throughout the implementation phase is essential to successfully implementing the entire program. A decision on an ecosystem entity cannot be made without considering the remainder of the program.

**Ongoing Stakeholder Involvement** - Many stakeholders are also concerned with the nature and scope of their involvement in the implementation phase of the Program. The almost unanimous opinion expressed at BDAC Assurance Workgroup meetings is that stakeholders would like to weigh in on decisions and advise agencies in a meaningful and timely manner throughout implementation. For some stakeholders this concept is expressed in stakeholder representation on the governing board of whatever entity implements the ERPP.

**Endangered Species Assurances** - Many stakeholders are concerned with the nature and extent of assurances given to the recovery of endangered species and the assurances given to water users for protection from future regulatory interference with their activities. The overall concept of "no surprises" is an important assurance for both the ecosystem and the water users. Program staff and stakeholders are examining California and federal endangered species laws to craft mutually acceptable assurances for the Bay-Delta ecosystem, as well as the water users.

**Assuring an Isolated Conveyance Facility** - Many stakeholders are concerned that construction and operation of an isolated conveyance facility will unacceptably alter the "common pool" conditions which currently provide export water users with an incentive to protect the delta levees and channels and maintain specified water quality standards throughout the delta. The stakeholders fear that if water could be exported without first passing through the delta that the delta itself could be harmed and that the incentives to continue to protect the delta will be smaller for those now receiving water from a conveyance facility isolated from the delta.

Although some stakeholders believe a small isolated conveyance facility presents overwhelming problems, many more believe that a large isolated conveyance facility presents greater problems as it provides greater capacity to move more water around instead of through the Delta. Stakeholders worry that no assurance mechanisms can adequately prevent the future misuse of a large isolated facility.

Each of these descriptions is but a snapshot of a much larger and complex discussion that is continuing in the BDAC Assurances Workgroup and elsewhere. Although it would be easier developing assurances after a preferred alternative has been selected, the above discussion should provide some insight into the importance of discussing assurance concerns while alternatives are being evaluated.

The assurances effort will continue in public BDAC Workgroup meetings, briefings to BDAC and other discussions with agencies and stakeholders. An implementation plan will be presented in the final EIS/EIR to be released at the end of 1998.

## Financial Package

During Phase II of the Program, a work group appointed by the Bay Delta Advisory Council ("BDAC") identified and discussed a number of issues relating to development of the Financial Implementation Strategy. The work group identified what it considered to be the most important issues relating funding the Solution. A summary of major Funding Sources is provided below followed by a brief discussion of Financial Principles and remaining issues to be addressed.

### Funding Sources

The implementation strategy for finance is to fund the preferred alternative through a combination Federal, State and user funds. The majority of the funding to-date has been for ecosystem actions. Congress authorized Federal funding in the amount of $143 million per year for three years in 1996 for ecosystem-related actions. Proposition 204 provides for in excess of $500 million of State General Obligation (G.O.) bond funding for CALFED actions, the majority of which is for ecosystem-related activities. User funding is currently being provided through a number of ongoing programs for a variety of activities that are consistent with CALFED objectives, in addition to the over $30 million of user funds for the Category III program.

**Federal Funding** - Additional Federal funding for ecosystem actions as well as other Program elements will be required in future years. As was the case in 1997, Federal funding is expected to be appropriated in the form of a consolidated line item for the CALFED Solution, in order to maximize efficiency and effectiveness of the implementation of the Solution.

**State Funding** - Additional State funding will also be required for ecosystem and other Program actions. Governor Wilson has proposed $1.3 billion in additional State G.O. bonds for a mix of CALFED actions, which would need to be approved by the Legislature and State voters during 1998.

**User Funding** - Additional user funding is also required. Actions that benefit users directly are expected to be paid for with user funding. In addition, some portion of the common Program elements that create widespread user benefits may be funded with user money. To accomplish this, some type of new broad-based user charge will likely be necessary in order to reach the necessary spectrum of users benefiting from a CALFED solution. The amount and potential application of such a charge has not been determined.

**Financial Principles**

**Benefits-Based Approach** - Sharing the costs of the Solution based on the benefits being created is the cornerstone principle of the CALFED Financial Strategy. The fundamental philosophy is that costs will be paid by those who enjoy the benefits of the actions, as opposed to seeking payment from those who, over time, were responsible for causing the problems being experienced in the Bay Delta system.

Among State and Federal agencies and within the stakeholder community, there is general agreement with this benefits-based approach as a guide for future cost sharing. A number of questions remain to be answered concerning the application of this principle.

Many of the benefits are difficult to quantify. Benefits associated with restoring ecosystem health, for example, are not measurable in the same way as the benefits of water supply improvements. This implies that while the benefits-based approach is useful as a guide, benefits cannot be used in a strictly quantitative way to arrive at an answer regarding sharing of costs.

Also, even though they agree in principle with the benefits-based approach for future costs, some stakeholders feel that direct beneficiaries of water development, including water users, should pay something for past damage to the ecosystem prior to using the benefits approach for future costs. The essence of this concept is that a benefits-based approach for the future is only fair if all parties start out from an equal position. Some feel that reaching this "level playing field" would take an initial adjustment in favor of the ecosystem. Assessing water users for this type of adjustment is difficult because there is not general agreement over what role any particular water diversion, or water diversions in general, may have played in degrading the ecosystem to date. In addition, water users argue that they have already paid sufficient amounts over time to offset any past actions.

The remaining questions that must be resolved relating to the benefits-based approach revolve around what to do when benefits that cannot be quantified, and whether or not any adjustment for past impacts is appropriate prior to using the benefits approach going forward.

**Public/User Split** - Both public money and user money will be used to fund the CALFED solution. The public and user concepts have also been extended to describe the benefits. In principle, public money will be used to do things that create public benefits, and user money will be used to do things that create user benefits. *User money* refers to money, which is collected in exchange for provision of a good or service. Fees paid for water service are a clear example of user money. Although many of the water providers are public agencies, funds collected by these agencies in exchange for their services are not defined as public money for purposes of funding the CALFED solution.

Benefits can be generally classified as either "public" or "user" based on the practicality of excluding individuals from access. If individuals can be effectively excluded from receiving a benefit, then they can probably be charged for access to it.

> *Public benefits* are generally those that are shared by a wide cross-section of the community and from which individuals cannot be realistically excluded. Inability to exclude individuals means that imposing charges for access to the benefit is difficult. If "free riders" can access the benefits without paying, there is no economic incentive for users to spend their money for these benefits. This means that if these benefits are to be created, public funding must be used.

> *User benefits* are generally those that accrue to an identifiable subset of the community, and from which individuals can be excluded. The ability to restrict benefits to those that pay enables these benefits to be funded with user money. In some cases, such as metered water use, individuals can be charged based on volume of use. In other cases, such as access to recreational facilities, charges are based on simple access to the benefit.

There are additional questions in defining public versus user benefits that arise in conjunction with benefits that are not clearly one or the other. Some user benefits are so widespread that the group sharing them is substantially the same as the general public. The keys to resolving this issue may lie in whether or not access to the benefit can reasonably be excluded to those who do not pay for that access, and in whether future behavior can be beneficially affected depending on the choice of funding mechanism.

**Ability to Pay** - This issue relates to whether or not specific users will be obligated to pay the full cost allocation for their benefits, or whether some obligations should be reduced based on the limited ability of certain users to pay the full cost of their benefits. Such reduced obligations would have to be subsidized either by other users or with public funds. A third option that must be considered is the possibility for reducing or eliminating benefits for those who are unable to pay for them. A third option that must be considered is the possibility for reducing or eliminating benefits for those who are unable to pay for them.

In principle, users should pay their full share, with any exceptions to be considered on a case by case basis after a full cost allocation has been made assuming no ability to pay constraints. The concept is that any reductions in cost obligations based on inability to pay the full cost share should be explicitly identified and justified.

**Crediting** - This policy relates to reducing Solution-related cost obligations to reflect payments made by obliges toward other parallel efforts to address Bay-Delta issues. An interim policy granting credit for cash contributed to the Category III Program has been approved by CALFED, but no additional provisions for long-term crediting have been approved.

In principle, all expenditures directed at the Bay-Delta system are part of the overall effort to improve that system. Consolidating all of the parallel efforts to address Bay-Delta ecosystem issues has been advocated as an important step in ensuring effective and efficient use of the available funding for such efforts. Consolidating these efforts is seen as a way to coordinate the timing and implementation of many diverse and complex projects, as well as to enable flexible use of available funding.

As part of the long-term crediting policy many additional details must be agreed upon, including the start date for crediting, types of payments to be credited, consideration of the timing of payments, and others.

**Cost Allocation Methodology** - This relates to selection of particular cost allocation techniques for making detailed cost allocations within the sphere of a benefits-based cost allocation approach. No policy decision has been articulated here, although individual CALFED agencies have historical policies relating to cost allocation techniques. Within the stakeholder community, there is general consensus that while traditional methodologies may be applicable for conventional facilities, they may not be appropriate for use with the Common Programs due to the difficulty in including non-market benefits created by the Common Programs in the allocation process.

There are many possible cost allocation methods, each with its own strengths and weaknesses. The BDAC work group developed a set of conceptual criteria to guide the selection of methods for dividing the costs of the CALFED solution. Selection of a specific method for each Program element may be in order, and this selection will probably involve tradeoffs among these criteria. There is no single best method that addresses all of the criteria in an optimal way.

While the fundamental policy direction for each of the Financial Principles discussed above has been identified, much work remains to be completed. Most of the remaining work is in the detailed application of these policies to a preferred alternative. Resolution of these issues will require the involvement of policy level representatives of Federal and State agencies and stakeholder interests. The process for moving these issues through the public and stakeholder process that has defined the Program to-date will must be implemented during 1998 to enable resolution of these issues prior to finalization of the Implementation Strategy for the Preferred Alternative.

# Other Continuing/Future Work Efforts

## RESTORATION COORDINATION

In December 15, 1994, the Bay-Delta Accord included a commitment to develop and fund non-flow related ecosystem restoration actions to improve the health of the Bay-Delta ecosystem. This commitment is commonly referred to as *Category III*. Some of the specific non-flow factors identified to be addressed as part of the Category III commitment include unscreened water diversions, waste discharges and water pollution prevention, fishery impacts due to harvest and poaching, land derived salts, exotic species, fish barriers, channel alternations, loss of riparian wetlands, and other causes of estuarine habitat degradation.

While the details of the preferred alternative are not finalized, Category III actions can be beneficial to the long term program regardless of which alternative is selected. The Category III actions must be consistent with each of the three alternatives and provide early implementation benefits. This implementation will also provide valuable information for use in adaptively managing the system in later years of the program. Category III projects must have appropriate environmental documentation, have no significant adverse cumulative impacts, and must not limit the choice of a reasonable range of alternatives.

Funding sources for near-term restoration activities include $60 million from state Proposition 204 funds (Bay-Delta Agreement Program) and 1997 stakeholder contribution of $10 million to fund the Category III ecosystem restoration commitments in the Bay-Delta Accord, bringing the stakeholder total to more than $30 million. In addition, Congress authorized $430 million for fiscal years 1998, 1999, and 2000 to fund the Federal share of Category III and initial implementation of the ERP. In Federal fiscal year 1998, $85 million was appropriated for Bay-Delta ecosystem restoration. Proposition 204 also include $390 million for implementation of the ERP, however, this funding will not be available until after the EIS/EIR is final.

CALFED established a two step process to evaluate and select the 1997 Category III proposals. In addition, public input was obtained via the Bay Delta Advisory Council. Thirteen technical review panels, organized by subject, scored and evaluated each of the 332 proposals. The evaluation sheets were passed on the Integration Panel, comprised of state, federal, and non-agency representatives, whose task was to select the highest priority proposals based on the benefits to the priority species and habitats. Targeted species include anadromous fish, Delta native fish and migratory birds.

On December 17, 1997, the CALFED Bay-Delta Program announced more than $100 million in funding for 50 ecosystem restoration projects selected from proposals. This included approximately $60 million of CALFED awards using Proposition 204, federal and stakeholder funds, with more than $40 million in cost sharing from project proponents. About three-fourths of the money was devoted to projects that restore rivers and riparian forests along them, and for wetlands and marshes restoration. The remainder went to projects such as installing fish screens to keep endangered fish from being pumped out of rivers; preventing introduction of exotic species that are accidentally released into the wild; water quality monitoring and research, educating farmers on how to improve farming practices to lessen reliance on pesticides, as well as research on endangered species such as delta smelt.

Projects to be funded in 1998 will be developed in three ways. They can be drawn from the remaining proposals submitted in 1997, developed as designated actions to develop and fund a proposal from a specific entity, or they can be implemented as focused grants. Currently, $21.6 million in additional proposals are being approved through the process. Approximately $48.5 million in remaining funds will be used to fund designated actions and to support focused grants. The advertising for the focused grants should begin in March 1998.

For 1999 funding, CALFED will be working to revise and update the priorities to ensure that they are consistent with the ERPP and to build on restoration actions funded to date. These revised priorities will guide development of restoration actions.

## FEASIBILITY STUDIES

The Program will also continue work on feasibility studies for the storage and conveyance, water quality, and ecosystem restoration elements; studies for storage and conveyance are underway. These studies will provide more detailed information than that obtained from the impact analyses for the programmatic EIR/EIS and will move program elements closer to implementation. The following paragraphs show some advantages of continuing with feasibility studies:

**Provide Support for Implementation Plans** - The prefeasibility studies provide support for implementation plans by developing specific information on costs, water supply, flows, water quality, site impacts, and other factors for representative combinations of Program elements. For example, the feasibility of implementing offstream storage to enhance water supply opportunities depends on the specific locations available for development such as topography, geology, environmental concern, proximity to a water supply source, and existing conveyance facilities.

**Refine Layouts, Sizes, and Other Details** - While the impact analyses evaluated a broad range of facility sizes, the feasibility studies provide information for additional sizes within that range. The feasibility analyses will provide additional detail that will lead to narrowing the range of sizes for the preferred alternative and ultimately lead to the selected sizes for implementation.

**Provide Detailed Costs** - The programmatic EIR/EIS will primarily display benefits and adverse impacts of the alternatives and will include only program level costs for the ends of the range being studied. The feasibility studies will provide more detailed cost information to assist the stakeholders and decision makers in their deliberations on the "preferred alternative".

**Shorten Time to Implementation** - The feasibility studies provide early direction for the process of planning, site specific environmental documentation, design, and construction required for project implementation in Phase III. While the studies will not progress so far, before the selection of the preferred alternative, so as to produce unnecessary analysis, continuing the feasibility studies will allow the Program to move more efficiently into project implementation.

## STATE AND FEDERAL ENDANGERED SPECIES ACT COMPLIANCE

CALFED will comply with the Federal Endangered Species Act of 1973, as amended (ESA), through initiation of the formal consultation process pursuant to section 7 of the ESA and development of a Habitat Conservation Plan (HCP) pursuant to section 10(a)(1)(B) of the ESA. CALFED will comply with the California Endangered Species Act (CESA) through development of a Natural Community Conservation Plan (NCCP) pursuant to the Natural Community Conservation Planning Act, section 2800 et.seq. of the California Fish and Game Code. In addition, sections 2081 and 2090 of the California Fish and Game Code may be used to comply with the CESA on an individual project basis.

CALFED has begun developing a State and Federal ESA compliance process and will continue to develop that process during Phase II of the Program. As a first step in implementing the State and Federal ESA compliance process, CALFED will develop a conservation strategy. The conservation strategy will address all sensitive species and their habitats potentially affected by the CALFED Program, the effects of CALFED Program actions (both beneficial and adverse) on those species and habitats, and the minimization and mitigation measures needed to offset the anticipated adverse impacts and allow for species/habitat recovery. In addition, the conservation strategy will include a monitoring program, specify a process for adaptive management, and address funding for unforeseen circumstances. The conservation strategy will aim to provide a comprehensive, long-term plan that will allow for the recovery of listed species and conserve currently unlisted species.

Take authorization will not be granted until Phase III when specific actions are defined or at such time as adequate information is available to assess project effects on listed or other sensitive species.

The conservation strategy will outline the criteria for determining the appropriate mechanism for implementing the strategy and authorizing incidental take associated with specific Program actions. A determination whether to use formal consultation (section 7 process) or an HCP/NCCP to authorize incidental take associated with an action will be deferred until Program actions become more defined. The conservation strategy for the species and/or habitats will be the same regardless of the process used to authorize take.

The U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) will conduct a formal section 7 consultation on the CALFED Bay-Delta Program, including: storage, conveyance, and system operations; the ecosystem restoration plan program; the water quality program; the levee integrity program; the water use efficiency program; the overall implementation and assurances strategy for the CALFED Program; and the HCP/NCCP.

An HCP, which is a required component of a section 10(a)(1)(B) incidental take permit application, must describe the activities sought to be authorized by the permit, the levels of incidental take such activities will result in, the effects of the take on the species covered, and the minimization and mitigation measures that will provide for the conservation of those species. The CALFED HCP will be subject to approval by the USFWS and NMFS.

An NCCP provides for the regional or area wide conservation of wildlife resources while allowing for compatible and appropriate development and growth. Section 2835 of the Fish and Game Code authorizes the California Department of Fish and Game (CDFG) to permit the taking of any identified species whose conservation and management is provided for in an approved NCCP. An NCCP, which must include all necessary elements identified in the Natural Community Conservation Planning Act, is subject to approval by CDFG.

The NCCP and HCP developed for the CALFED Program will be prepared jointly, resulting in a common plan, an HCP/NCCP.

CALFED, in consultation with the USFWS and NMFS, has not yet determined which actions will be covered for incidental take by the section 7 consultation and which actions will be covered for incidental take by the HCP/NCCP. The general criterion for making this determination is that Federal actions that may affect special-status species will be addressed through section 7; non-Federal actions that may result in incidental take of special-status species will be addressed through the HCP/NCCP.

Likewise, the determination of whether incidental take of any particular species will be authorized through the HCP/NCCP or through section 7 has not yet been made. The criteria for determining whether incidental take of a species will be covered under the HCP/NCCP are: 1) the species is listed under the State and/or Federal ESA or is reasonably likely to become listed during the term of the permit; 2) there is a reasonable likelihood of incidental take resulting from Program actions; 3) the amount of take of the species resulting from Program actions can be reasonably assessed; 4) there is sufficient biological information available to determine the impacts of the take on the species and provide appropriate mitigation; and 5) the species conservation and management are provided for in the HCP/NCCP. Species which do not meet these criteria would not be covered for incidental take through the HCP/NCCP.

The CALFED State agencies will likely be the initial applicants for a section 10(a)(1)(B) permit and take authorization through section 2835. The initial term of the HCP/NCCP and its associated take authorization is planned to be the same as the CALFED Bay-Delta Program (i.e., 25 to 30 years). The geographic scope of the HCP/NCCP will be no greater than the CALFED Program area; it will likely be more narrow, depending on actions to be covered.

The HCP/NCCP will include monitoring of the impacts of the take and the mitigation, a scientific review process, and an adaptive management program. The HCP/NCCP will identify adequate funding, which will include some form of dedicated funds, to ensure that the plan will be implemented. In addition, the HCP/NCCP will specify the remedies and procedures for dealing with non-compliance with the terms of the plan.

## COMPLIANCE WITH SECTION 404(b)(1) GUIDELINES

Section 404 of the Clean Water Act requires that a project proponent obtain a permit from the Corps for activities that involve the discharge of dredged or fill material into waters of the United States (33 USC 1344). Section 404 requires that the issuance of a permit by the Corps comply with EPA's Section 404(b)(1) Guidelines (Guidelines). These guidelines provide direction and guidance for implementation of Section 404.

EPA's Guidelines (40 CFR 230 et seq.), the Corps' regulatory guidelines (33 CFR 320 et seq.), and the National Environmental Policy Act (NEPA) and NEPA Guidelines (40 FR 1500 et seq) provide part of the substantive environmental criteria and procedural framework used to evaluate applications for Corps permits for the discharge of dredged or fill material into waters of the United States, including wetlands and other designated special aquatic sites. Under the Corps evaluation, an analysis of practicable alternatives is a screening mechanism used to determine the appropriateness of permitting a discharge. The Corps evaluation also includes analysis of compliance with other requirements of the 404(b)(1) Guidelines, a public interest review and evaluation of potential impacts on the environment in compliance with NEPA.

According to EPA Guidelines, an alternative is considered practicable if it is available and can be implemented given considerations of cost, existing technology, and logistics in light of overall project purposes. Practicable alternatives may include siting a project in areas not owned by an applicant, but that could be reasonably obtained by the project applicant, to achieve the basic project purpose (40 CFR 230.10[a][2]).

Many features of CALFED have the potential to require the discharge of dredged or fill material into waters of the United States, including designated special aquatic sites. The ERP contains many such actions, including the restoration of wetlands, restoration of channel islands, construction of fish barriers, construction of fish screens, and restoration of riparian habitat. The Levee System Integrity Program contains actions, such as the creation of setback levees, improvements to levee maintenance, and the flooding of islands, that could require a Corps permit. The water supply reliability components contain actions, such as the creation of additional water storage capacity and the construction of conveyance facilities in the Delta, and the Water Quality Program contains actions, such as the construction of water quality barriers, that would require a Corps permit. Section 404 Permits will be required during Phase III.

A 404 Permit is not required for Phase II of the CALFED process because selection of the Preferred Alternative will not authorize implementation of the projects composing the Preferred Alternative and therefore will not involve the discharge of materials into the waters of the United States. Nevertheless, the alternatives under consideration in the CALFED process are being analyzed in the light of the requirements of the 404(b)(1) Guidelines so that when the Corps is required to determine whether particular Phase III projects comply with the 404(b)(1) Guidelines, it will have the benefit of an analysis as to the consistency of the CALFED Preferred Alternative with the 404(b)(1) Guidelines at a programmatic level.

During Phase I of this process, the problems of the Bay-Delta were identified, objectives defined, a comprehensive list of actions for achieving the objectives were compiled, and preliminary alternatives assembled. The remainder of Phase I consisted of an iterative process of analyzing and screening alternatives, leading to the selection of a Preferred Alternative. The initial screening of alternatives, beginning with 100 and selecting 10, was principally an effort to combine alternatives so that each, in keeping with the CALFED solution principles, provided balanced benefits to each to the problem areas. In screening from 10 to three alternatives, some were removed from further consideration; others were not eliminated, but became variations of the three main conveyance concepts: existing system conveyance, modified through-Delta conveyance, and dual-Delta conveyance (a combination of through-Delta and isolated conveyance). These three alternatives, and 12 variations associated with them, were carried forward for further refinement in Phase II. In Phase II, the three alternatives are being subjected to further analysis, resulting in further refinements, and will result in the eventual selection of the Preferred Alternative.

This process is consistent with the Section 404(b)(1) Guidelines in that the screening of alternatives is intended to lead to the selection of the least environmentally damaging practicable alternative. Implementation of Phase III actions involving the discharge of dredged or fill material into waters of the United States may require site-specific documentation that specific proposals comply with EPA's Section 404(b)(1) Guidelines.

## PHASE III SITE-SPECIFIC ENVIRONMENTAL DOCUMENTATION

During Phase III of the CALFED Program, second-tier site-specific environmental documents will be prepared for the individual actions or site-specific projects chosen for implementation during the current Phase II process. Second-tier documents, will be prepared after certification of the Programmatic EIS/EIR to concentrate on issues specific to the individual parts of the program elements being implemented or the site chosen for the action. The second-tier document will summarize and incorporate by reference the issues discussed in the broader program-oriented EIS/EIR and focus on the issues specific to the part of the overall program being implemented. Information presented in the second-tier EIS/EIR will be specific to a smaller area within the CALFED Bay-Delta study area and will focus on impacts within the smaller area and individual action-level mitigation performance criteria.

# 6. GLOSSARY OF TERMS

***AF*** Abbreviation for acre feet; the volume of water that would cover one acre to a depth of one foot, or 325,851 gallons of water. On average, could supply 1-2 households with water for a year.

***Alternative*** A collection of actions or action categories assembled to provide a comprehensive solution to problems in the Bay-Delta system.

***Action*** A structure, operating criteria, program, regulation, policy, or restoration activity that is intended to address a problem or resolve a conflict in the Bay-Delta system.

***Action Category*** A set of similar actions. For example, all new or expanded off-stream storage might be placed into a single action category.

***Anadromous Fish*** Fish that spend a part of their life cycle in the sea and return to freshwater streams to spawn.

***Best Management Practices (BMP)*** An urban water conservation measure that the California Urban Water Conservation Council agrees to implement among member agencies. The term is also used in reference to water quality standards.

***Carriage Water*** Additional flows released during export periods to ensure maintenance of water quality standards and assist with maintaining natural outflow patterns in Delta channels. For instance, a portion of transfer water released from upstream of the Delta intended for export from south Delta would be used for Delta outflow.

***Central Valley Project (CVP)*** Federally operated water management and conveyance system that provides water to agricultural, urban, and industrial users in California.

***Central Valley Project Improvement Act*** **(CVPIA)** This federal legislation, signed into law on October 30, 1992, mandates major changes in the management of the federal Central Valley Project. The CVPIA puts fish and wildlife on an equal footing with agricultural, municipal, industrial, and hydropower users.

***CFS*** An abbreviation for cubic feet per second.

***Channel Islands*** Natural, unleveed land masses within Delta channels. Typically good sources of habitat.

***Common Delta Pool*** This concept suggests the Delta provides a common resource, including fresh water supply for all Delta water users, and all those whose actions have an impact on the Delta environment share in the obligation to restore, maintain and protect Delta resources, including water supplies, water quality, and natural habitat.

***Common Program*** Four programs for Water Use Efficiency, Water Quality, Levee System Integrity, and Ecosystem Restoration that are essentially the same for each of the three Phase II alternatives.

***Component*** A group of related action categories; the largest building blocks of an alternative. The components for the Phase II Alternatives include a component for Delta conveyance, a component for storage, and the four common programs.

***Conjunctive Use*** The operation of a groundwater basin in combination with a surface water storage and conveyance system. Water is stored in the ground water basin for later use in place of or to supplement surface supplies. Water is stored by intentionally recharging the basin during years of above-average water supply.

***Conveyance*** A pipeline, canal, natural channel or other similar facility that transports water from one location to another.

***Core Actions*** Actions that would be included in all CALFED Bay-Delta Program alternatives. Core actions are no longer viewed as a single set of actions. Rather, these actions are now distributed between the four common programs included in each of the three Phase II Alternatives. These actions basically serve the same role as when originally formulated but are now viewed as the first phase of implementation within each of the four common programs.

***Delta Islands*** Islands in the Sacramento-San Joaquin Delta protected by levees. Delta Islands provide space for numerous functions including agriculture, communities, and important infrastructure such as power plants, transmission lines, pipelines, and roadways.

***Demand Management*** Programs that seek to reduce demand for water through conservation, rate incentives, drought rationing, and other activities.

***Diversions*** The action of taking water out of a river system or changing the flow of water in a system for use in another location.

***Drought Conditions*** A time when rainfall and runoff are much less than average. One method to categorize annual rainfall is as follows, with the last two categories being drought conditions: wet, above normal, below normal, dry critical.

***Dual Conveyance System*** A means of improving conveyance across the Bay-Delta by improving through Delta conveyance and isolating a portion of conveyance from Delta channels.

***Ecosystem*** A recognizable, relatively homogeneous unit that includes organisms, their environment, and all the interactions among them.

***Entrainment*** The process of drawing fish into diversions along with water, resulting in the loss of such fish.

***ESA (Endangered Species Act)*** Federal and State legislation that provides protection for species that are in danger of extinction.

***Export*** Water diversion from the Delta used for purposes outside the Delta.

***Fish Migration Barriers*** Physical structures or behavioral barriers that keep fish within their migration route and prevent them from entering waters that are not desirable for them or their migration pattern.

***Fish Screens*** Physical structures placed at water diversion facilities to keep fish from getting pulled into the facility and dying there.

***Groundwater Banking*** Storing water in the ground for use to meet demand during dry years. In-lieu Groundwater Banking Replaces groundwater used by irrigators with surface water to build up and save underground water supply for use during drought conditions.

***HMP (Hazard Mitigation Plan)*** One of two standards referred to in the alternatives for levee flood protection. Following the flood disasters of the 1980s, HMP standards were established at 1 foot of freeboard above the 100-year flood event level.

***Hydrograph*** A chart or graph showing the change in flow over time for a particular stream or river.

***In-Delta Storage*** Water storage within the Delta by converting an existing island to a reservoir.

***In-lieu Groundwater Banking*** Replaces groundwater used by irrigators with surface water to build up and save underground water supply for use during drought conditions.

***Inverted Siphon*** A pipeline that allows water to pass beneath an obstacle in the flow path. For example, an inverted siphon could be used to allow water in a canal to pass under a Delta channel.

***Isolated Conveyance Facility*** A canal or pipeline that transports water between two different locations while keeping it separate from Delta water.

***Land Fallowing/Retirement*** Allowing previously irrigated agricultural land to temporarily lie idle or purchasing such land and allowing it to remain out of production for a variety of purposes.

***MAF*** An abbreviation for million acre feet.

***Mining Drainage Remediation*** Controlling or treating polluted drainage from abandoned mines.

***Meander Belt*** Protecting and preserving land in the vicinity of a river channel in order to allow the river to meander. Meander belts are a way to allow the development of natural habitat around a river.

***Non-native Species*** Also called introduced species or exotic species; refers to plants and animals that originate elsewhere and are brought into a new area, where they may dominate the local species or in some way negatively impact the environment for native species.

***Real-Time Monitoring*** Continuous observation in multiple locations of biological conditions on site in order to adjust water management operations to protect fish species and allow optimal operation of the water supply system.

***Riparian*** The strip of land adjacent to a natural water course such as a river or stream. Often supports vegetation that provides the best fish habitat values when growing large enough to overhang the bank.

***Riverine*** Habitat within or alongside a river or channel.

***Setback Levee*** A constructed embankment to prevent flooding that is positioned some distance from the edge of the river or channel. Setback levees allow wildlife habitat to develop between the levee and the river or stream.

***Shallow Water*** Water with little enough depth to allow for sunlight penetration, plant growth, and the development of small organisms that function as fish food. Serves as spawning areas for Delta smelt.

***Smolt*** A young salmon that has assumed the silvery color of the adult and is ready to migrate to the sea.

***Solution Principle*** Fundamental principles that guide the development and evaluation of Program alternatives. They provide an overall measure of acceptability of the alternatives.

***South of Delta Storage*** Water storage supplied with water exported south from the Delta.

***State Water Project (SWP)*** A California state water conveyance system that pumps water from the Delta for agricultural, urban domestic, and industrial purposes.

***TAF*** An abbreviation for thousand acre feet, as in 125 TAF or 125,000 AF.

***Take Limit*** The numbers of fish allowed to be lost or entrained at a water management facility before it must limit or cease operations. The numbers are set for different species by regulations.

***Terrestrial*** Types of species of animal and plant wildlife that live on or grow from the land.

***Through Delta Conveyance*** A means of improving conveyance across the Bay-Delta by a variety of modifications to Delta channels.

***Upstream Storage*** Any water storage upstream of the Delta supplied by the Sacramento or San Joaquin Rivers or their tributaries.

***Water Conservation*** Those practices that encourage consumers to reduce the use of water. The extent to which these practices actually create a savings in water depends on the total or basin-wide use of water.

***Water Reclamation*** Practices that capture, treat and reuse water. The waste water is treated to meet health and safety standards depending on its intended use.

***Water Transfers*** Voluntary water transactions conducted under state law and in keeping with federal regulations. The agency most involved is the State Water Resources Control Board (SWRCB).

***Watershed*** An area that drains ultimately to a particular channel or river, usually bounded peripherally by a natural divide of some kind such as a hill, ridge, or mountain.

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