PHASE II
ALTERNATIVE DESCRIPTIONS

CALFED
BAY-DELTA
PROGRAM

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PHASE II
ALTERNATIVE DESCRIPTIONS

The CALFED Bay-Delta Program has developed the following descriptions of the three comprehensive solution alternatives evaluated as part of Phase II of the Program. The alternatives represent a broad range of potential solutions to problems in the Bay-Delta system.

Each alternative is built on a foundation of the four common programs with distinguishing variations in conveyance and storage components. Appendices A - F (bound separately) provide detailed descriptions of the common programs as well as the basis of operational assumptions which have been incorporated in the overall analysis. An executive summary of the three Alternatives follows this section.

The reader should keep several considerations in mind while reviewing the alternatives:

- Each alternative is structured around a set of four common programs that remain relatively constant. Each common program was designed with potential linkages so they each contribute in multiple ways toward achieving Program goals and a comprehensive solution to Bay-Delta problems including ecosystem quality, water quality, levee system vulnerability, and water supply reliability. The intent has been to make the total greater than the sum of its parts.

- Physical differences between the alternatives lie mainly in the method of transporting water through or around the Delta, and the amount of additional water storage included in each alternative. Each of the three alternatives includes a variety of potential combinations, or variations, of conveyance and storage consistent with the fundamental differences between the three concept constructs (i.e. 1A-1C, 2A-2E, and 3A-3I).

- While the basic composition of the common programs remains relatively constant in each alternative, they may perform somewhat differently depending on the storage and conveyance components included within a specific alternative formulation. For example, the water quality common program focuses each alternative on source control and reducing the level of water quality parameters of concern before they enter the Bay-Delta system. Storage proposals in various alternatives may provide additional opportunity to manage flow and diversion timing to the benefit of water quality to a greater or lesser degree than in other alternatives.

- These alternative descriptions define the range of actions that could be implemented. Beneficial and detrimental consequences will be evaluated during Phase II impact analysis.

- The final preferred alternative resulting from the Phase II process will include a set of institutional assurances to complete the package.

- The alternatives will also include a range of reasonable operational policies and strategies (an initial description to provide context for analysis is included with each alternative).

- Some of the actions in these alternatives display ranges of values for targets or capacities; these numbers have been presented to provide a context for analysis during Phase II of the program. It is anticipated that a more refined range will be developed during the preferred alternative discussions.

- The three Alternatives have a total of 17 variations. Each variation is being evaluated. Through the Programs' alternative evaluation process, the number of these variations will decline and the selected preferred alternative may not be one of the unique variations described in this document; rather it may be a composite of several variations.

EXECUTIVE SUMMARY OF ALTERNATIVES

ALTERNATIVE 1
EXISTING SYSTEM CONVEYANCE

This alternative essentially relies on the common programs to meet Program Goals, using only existing Delta channels for water conveyance, preserving the current Delta common pool as it provides a common source of water for all users dependent on delta water supplies. Three configurations (1a through 1c) with various south Delta modifications differentiate the variations in this alternative. One variation includes new surface and groundwater storage.

Common Programs[a]				Delta Configuration	Water Storage[b]
Ecosystem Restoration	Water Quality	Water Use Efficiency	Levee System Integrity	Varies from existing Delta channels with no conveyance modifications to select south Delta modifications	Varies from no new storage to: 3.0 MAF Upstream (Sac) 2.0 MAF Off-Aqueduct 200 TAF In-Delta 500 TAF Sac. Valley GW 500 TAF San Joaquin GW

[a]The common programs for each alternative include significant habitat improvements, improvements in water quality parameters of concern before they enter the waterways of the Bay-Delta system, policies for implementing cost effective measures to improve water use efficiency, and levee improvements throughout the Delta.
[b]The numbers are not fixed, they are conceptual and representative of the range to be studied.

ALTERNATIVE 2
MODIFIED THROUGH-DELTA CONVEYANCE

This alternative combines the common programs with significant modifications of through-Delta channels to improve water conveyance across the Delta. This alternative preserves the Delta common pool in that it provides a common source of water for all users dependent on Delta water supplies. Combinations of four potential conveyance configurations and three new storage configurations differentiate the five variations (2a through 2e) of this alternative.

Common Programs[a]				Delta Configuration	Water Storage[b]
Ecosystem Restoration	Water Quality	Water Use Efficiency	Levee System Integrity	Varies from channel modifications primarily for water conveyance to extensive modifications for water conveyance and habitat restoration	Varies from no new storage to: 3.0 MAF Upstream (Sac) 500 TAF Upstream (SJ) 2.0 MAF Off-Aqueduct 200 TAF In-Delta 500 TAF Sac. Valley GW 500 TAF San Joaquin GW

[a]The common programs for each alternative include significant habitat improvements, improvements in water quality parameters of concern before they enter the waterways of the Bay-Delta system, policies for implementation of cost effective measures to improve water use efficiency, and levee improvements throughout the Delta.
[b]The numbers are not fixed, they are conceptual and representative of the range to be studied.

ALTERNATIVE 3
DUAL DELTA CONVEYANCE

This alternative adds an isolated facility to the through-Delta modifications of Alternative 2 which together combine with the common programs to move water through and around the Delta. Combinations of seven potential conveyance configurations and two new storage configurations differentiate the nine variations (3a through 3i) of this alternative.

Common Programs[a]				Delta Configuration	Water Storage[b]
Ecosystem Restoration	Water Quality	Water Use Efficiency	Levee System Integrity	Through-Delta channel modifications vary from those primarily for water conveyance to those for water conveyance with extensive habitat restoration. Isolated facility varies from small (5000 cfs) to large (15,000 cfs).	Varies from no new storage to: 3.0 MAF Upstream (Sac) 500 TAF Upstream (SJ) 2.0 MAF Off-Aqueduct 200 TAF In-Delta 500 TAF Sac. Valley GW 500 TAF San Joaquin GW

[a]The common programs for each alternative include significant habitat improvements, improvements in water quality parameters of concern before they enter the waterways of the Bay-Delta system, policies for implementation of cost effective measures to improve water use efficiency, and levee improvements throughout the Delta.
[b]The numbers are not fixed, they are conceptual and representative of the range to be studied.

COMMON PROGRAMS

SUMMARY OF COMMON PROGRAMS

OVERVIEW

The mission of the CALFED Bay-Delta Program is to develop a long-term comprehensive plan to restore ecosystem health and improve water management for beneficial uses of the Bay-Delta system. The Program addresses problems in four resource areas: ecosystem quality, water quality, water supply reliability, and levee system integrity. Programs to address problems in these four resource areas are designed and integrated to fulfill the CALFED mission.

The CALFED Bay-Delta Program has developed three alternative descriptions for evaluation in Phase II of the Program. The alternatives represent a broad range of potential solutions to problems in the Bay-Delta system. The foundation of each alternative is a set of four common programs that remain relatively constant between alternatives. Each of the three alternatives also includes a variety of potential modification combinations for water conveyance and for storage.

This report focuses on the four common programs. It also includes the basic facility operation assumptions that remain relatively constant between alternatives. The four **common programs** for each alternative include:

- **Ecosystem Restoration** - Provides for habitat improvements and reduction of stressors throughout the Bay-Delta system
- **Water Quality** - Provides for improved water quality for all uses primarily by reducing pollutant loads entering the Bay-Delta system and managing input timing of remaining pollutants
- **Water Use Efficiency** - Provides policies for implementation of cost effective measures to improve water use efficiency and water transfers
- **Levee System Integrity** - Provides levee improvements throughout the Delta

The common programs each contribute in multiple ways toward achieving the CALFED Program mission and goals. These contributions to the four Program goals are summarized in the following paragraphs:

Ecosystem Quality - *The goal for ecosystem quality 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 ecosystem restoration program provides for significant habitat improvements for species dependent on the Delta and reduces the effects of stressors (such as unscreened diversions) that inhibit ecological processes, habitats, and species.

Improvements from other common programs will also improve and increase habitats. The water quality program would reduce those water quality stressors that affect aquatic species by reducing water quality parameters of concern before they enter the waterways of the Bay-Delta system. The water use efficiency program combined with changes in facility operations may allow some shifting of water diversion timing to reduce impacts on fisheries. Levee improvements would provide some opportunities for new habitat.

Water Quality - *The goal for water quality in the Bay-Delta system is to provide good water quality for all beneficial uses.* The water quality program would improve water quality by reducing water quality parameters of concern before they enter the Bay-Delta system waterway. New aquatic habitat restoration may provide some natural bio-treatment to improve water quality. New storage and new flexibility in diversion timing would provide additional opportunities for water management and timing to improve water quality for all beneficial uses.

Water Supply Reliability - *The goal for water supply reliability is to reduce the mismatch between Bay-Delta water supplies and current and projected beneficial uses dependent on the Bay-Delta system.* Water supply reliability would be improved through policies for implementing cost effective measures to improve water use efficiency, water transfers, and groundwater management. Improvements in levee system integrity should reduce the probability that water diversions would be interrupted by levee failure. Improvements in ecosystem quality should lead to healthier species populations, reduced constraints on water diversions and associated improvements in water supply reliability.

System Vulnerability - *The goal for addressing Bay-Delta system vulnerability is to reduce the risk to land use and associated economic activities, water supply, infrastructure, and the ecosystem from catastrophic breaching of Delta levees.* Levee improvements would initially protect western Delta islands that are critical for water quality, population centers, and valuable habitats. Levee Improvements would continue until an acceptable higher level of protection is provided throughout the Delta. Where possible levee rehabilitation would incorporate habitat improvements that simultaneously reduce system vulnerability, increase ecosystem quality, and improve water quality.

DESCRIPTION OF COMMON PROGRAMS

The four common programs for ecosystem restoration, water quality, water use efficiency, and levee system integrity form the foundation for each alternative. Some modifications of these programs may be required depending on the specific requirements of the various storage and conveyance configurations of each alternative.

Ecosystem Restoration Restoration Plan

The blueprint of the CALFED Ecosystem Restoration Program is the Ecosystem Restoration Program Plan (ERPP). The ERPP focuses on the restoration of ecological processes associated with streamflow, stream channels, watersheds, and floodplains. These processes create and maintain habitats essential to the survival of species dependent on the Delta. In addition, the Program aims to reduce the effects of stressors, such as unscreened diversions, that inhibit ecological processes, habitats, and species.

The ecological hub of the Central Valley is the Sacramento-San Joaquin Delta and Bay. The ERPP represents a fundamental shift in the way ecological resources of the Central Valley are to be managed. For many decades, government entities, non-profit organizations, and the private sector have engaged in managing, protecting, regulating, and in some cases breeding fish and wildlife species of the Bay and Delta - yet many populations have not recovered sufficiently and remain in decline. In spite of constant human intervention to repopulate fish and wildlife that have commercial, recreational, and biological importance to society (e.g., hatchery programs and expensive re-engineered water diversions), populations have not been sustained at stable, healthy levels that support historic economic utilization of those resources.

These efforts at individual species regulation and management will be replaced by an integrated systems approach that aims to reverse the fundamental causes of decline in fish and wildlife populations. A systems approach recognizes the natural forces that created historic habitats and uses these forces to help regenerate habitats. The Bay-Delta ecosystem is not simply a list of species. Rather, it is a complex living system sustained by innumerable interactions that are physical, climatic, chemical, and biological in nature, both within and outside of the geographic boundaries of the Delta. The central theme of the ERPP is the recognition that truly durable and resilient fish and wildlife populations inhabiting the Bay and Delta require, above all else, the rehabilitation of ecological processes throughout the Central Valley river and estuary systems and watersheds.

The ERPP is fundamentally different from many past efforts in another way as well. It is not designed as mitigation for projects that would improve water supply reliability or to bolster the integrity of Delta levees. Improving ecosystem functions and increasing the amount and quality of habitat are equally important as other program goals related to water supply reliability, water quality, and system integrity.

The ERPP, like all components of the proposed Bay-Delta solution alternatives, is being developed and evaluated at a programmatic level. The complex and comprehensive nature of a Bay-Delta requires that it would be composed of many different programs, projects, and actions that would be implemented over time. During Phase II of the Program, solution alternatives will be evaluated as a set of programs and projects so that broad benefits and impacts can be identified. In the next phase of the Program, more focused analysis and environmental documentation of specific programs and actions would occur.

The CALFED goal for ecosystem quality will be achieved by developing implementation objectives, targets, and programmatic actions that can be implemented to naturally restore ecological processes. Restoring these processes is intended to restore and maintain habitats, and to provide for the needs of the species dependent on a healthy Bay-Delta system. For example, restoring stream channels contributes to natural sediment deposition, nutrients, and a variety of habitats. The strategy recognizes that not all processes can or should be completely restored and that intervention, manipulation, and management would be required. For example, streambed gravel may have to be introduced, habitats may have to be constructed, and vegetation planted. Still, an important part of the approach is to recommend measures that in the long-term would limit the need for human intervention.

Implementation of the ERPP is further guided by the recognition that all landscape units and physical and biological components of the ecosystem are interdependent and dynamic. Interdependence means that actions and stressors in one part of the system can and do affect populations and conditions that may be separated by hundreds of miles (e.g., in watersheds and spawning tributaries), or affect the foodweb in ways that may not be noticed for several years.

Dynamic refers to the exposure of natural systems to constant cycles of change in response to both human and natural forces. Most habitats undergo expansions and contractions, or shifts in space and time. The dynamic nature of healthy habitats is the cause of much biological diversity, and complex habitats tend to make species populations more resilient to change. If the mosaic of habitats distributed across a broad landscape is complex, and if large areas of habitat are connected by smaller patches and corridors such as those associated with riparian systems, then healthy areas of the ecosystem can be relied on to sustain species during temporary setbacks in other areas.

Geographic Scope

The overall geographic scope of the ERPP is defined by the interdependence and linkage of watersheds, streams, rivers, and the Bay-Delta and the complex survival requirements of the dependent fish, wildlife and plant communities. The restoration of ecological processes requires implementation of actions throughout much of the Central Valley, its upper watersheds, the Bay-Delta, and near-shore ocean. The primary geographic focus is the Bay-Delta, the Sacramento River, the San Joaquin River, and their tributary watersheds directly connected to the Bay-Delta system below major dams and reservoirs. Secondarily, the ERPP addresses, at a program level, the near-shore ocean and the upper watersheds above the major dams.

The primary geographic focus area for the ERPP has been divided into 14 zones, each characterized by a predominant physical habitat type and species assemblage. These 14 ecological zones constitute the geographic areas in which the majority of restoration actions would occur. The upper watersheds surrounding the primary focus area are important and addressed through general programmatic actions that focus on watershed processes.

Implementation Strategy

A large and diverse ecosystem like the Bay-Delta is extremely complex. There are many processes and relationships at work in the ecosystem that are not fully understood. Thus, there are many difficulties and uncertainties associated with a program to improve ecosystem health. In some cases, problems are well understood and the steps to improvement are clear. In other cases, there is some understanding of the reasons for decline but this understanding is not sufficient to warrant full-scale implementation of remedial measures. In still other cases, additional research is needed before solutions can be identified with certainty.

The difficulties and uncertainties of ecosystem restoration call for a flexible implementation strategy that can accommodate and respond to new information. The foundation of the ERPP implementation strategy is **adaptive management**. Adaptive management is a process of testing alternative ways of meeting objectives, and adapting future management actions according to what is learned. Adaptive management relies on identifying indicators of ecosystem health, comprehensive monitoring of indicators, focused research, and phasing of actions:

Indicators are ecosystem features or attributes that are expected to change over time in response to implementation of the ERPP. Indicators are selected to provide measurable evaluations of important ecological processes, habitats, and species. Indicator status, measured individually and cumulatively, provide an assessment of ecological health. Indicators of ecosystem health are the gauges we would use to measure progress toward the goal. Some indicators are very broad while others are very specific. For example, a very broad or landscape-level indicator of ecosystem health might be the total area of riparian forest or the average distance between patches of such forest. A more specific indicator might be the concentration of toxic substances in the flesh of adult striped bass.

Comprehensive monitoring is the process of measuring the abundance, distribution, change, or status of indicators. For example, contaminant concentrations in fish tissues can be measured at various locations and times in the system to determine if contaminant levels are changing. This would allow progress to be measured, allow actions to be modified if necessary, and provide assurances that the restoration objectives are being achieved.

Focused research would help answer questions about the system and its components and increase the certainty surrounding the relationships of ecological processes, habitats, and species. For example, the relationships among streamflow, storm events, flow-related

shaping of river channels to modify habitat, and the physical and chemical signals that flow provides for aquatic species all need to be better understood.

Phasing is the logical sequence of implementing restoration actions to achieve CALFED goals as effectively as possible. Phasing would consider all targets and programmatic actions and would be used to prioritize actions. For example, actions directed at recovering endangered species have a high priority. Early segments of the program would include restoring ecological processes and habitats that are most important for endangered species recovery, reduction of stressors that affect threatened and endangered species, and other actions that may reduce conflicts between beneficial uses in the system. As restoration progresses and threats to endangered species are reduced or eliminated, restoration efforts can expand and focus on the broader issue of restoring ecological health.

Summary of ERPP Programmatic Actions

Appendix A provides a detailed list of the ERPP targets and programmatic actions. Restoring upstream habitats and establishing extensive meander belts in the Sacramento River system would improve spawning and survival success of fish. Restoring channel features in the lower San Joaquin River would help lower water temperatures, provide habitat, and improve survival success of fish. In the Delta, restoring shallow riverine and riparian habitat would provide spawning areas for native fish and increase forage areas and escape cover for juvenile salmon, delta smelt, splittail, and other species. New habitat would be constructed along Delta channels and levees. Areas of shallow tidal habitat would be developed in the Suisun Bay for wet-year spawning and rearing of Delta smelt and rearing of salmon. Fish screens would be installed on all priority diversions to reduce entrainment and keep migrating fish in the main river channel.

New water supplies would be developed in the San Joaquin basin or purchased from willing sellers and released to transport fish through the Delta and improve water quality in the San Joaquin River and south Delta. This water could be used to improve fish transport conditions in the Delta and to shift the timing of diversions to avoid entrainment effects.

In summary, the program includes the following broad restoration ranges of programmatic actions:

- 75,000 to 120,000 acres of freshwater and brackish tidal marsh and shallow water habitat.
- 100 to 200 miles of riparian woodland and shaded riverine areas.
- 300,000 to 500,000 acre-feet annually of increased critical-period flows to restore physical processes and ecological functions. The proposed flows in each ecological zone would be developed through a variety of means including reoperation of existing reservoirs, new storage (if included in the alternative), conjunctive management, and water transfers. A portion may be recaptured for other uses.

- 40,000 to 100,000 tons of gravel replacement annually to enhance spawning.
- New or improved fish screens at selected diversions (approximately half of existing Bay-Delta system diversions).
- Develop floodways on the San Joaquin and Cosumnes Rivers.
- Improve fish passage through new fish ladders or removal of barriers that limit access to habitat.
- Manage undesirable introduced species that interfere with native or economically important species.
- Manage water quality that degrades ecosystem health.

Water Quality Program

The CALFED Water Quality Program goal is to provide good water quality for environmental, agricultural, drinking water, industrial, and recreational beneficial uses. The water quality program includes programmatic actions to reduce water quality degradation from agricultural drainage, urban and industrial runoff, acid mine drainage, wastewater and industrial discharges, and natural sources. This Program focuses on reducing the release of pollutants into the Bay-Delta system and its tributaries. Reducing the total pollutant load entering the Delta will provide benefits for all water users. These benefits include improved drinking water quality, reduced salt load for agricultural diversions, and improved water quality for the ecosystem, including reduced toxicity. The Water Quality Program recognizes that additional benefits can be obtained by managing the timing release of remaining pollutant discharges and other dilution actions.

Geographic Scope of the Water Quality Program

The geographic scope of the CALFED water quality problem area is the legally defined Delta. CALFED staff is developing the strategy to resolve water quality problems in this area that affect beneficial uses of the estuary. Included in this strategy is the intent to resolve water quality problems for certain species (e.g., anadromous fish) that inhabit the Delta but may be impacted at different life stages by conditions outside of the Delta. In resolving the water quality problems of the Delta, CALFED staff may undertake actions throughout its geographic solution area, as necessary.

Water Quality Parameters of Concern

Parameters of concern are constituents that cause water quality problems by affecting beneficial uses of water, or are indicators of water quality problems. The parameters of concern for the CALFED water quality program were identified with the assistance of technical experts from public agencies, private industry, and public representatives. Collectively, agricultural, urban, environmental, industrial and recreational interests are represented by this group. The parameters of concern to CALFED staff include:

- metals and trace elements (cadmium, copper, mercury, and zinc),
- pesticides and other synthetic organic chemicals (carbofuran, chlordane, chlorpyrifos, diazinon, toxaphene, DDT, PCBs),
- minerals and nutrients (total dissolved solids, chloride, bromide, nitrates),
- physical characteristics (pH, temperature), toxicity and pathogens (viruses, bacteria, protozoa).

Sources of Water Quality Problems

Sources of water quality problems in the Delta and its tributaries include:

- acidic drainage from inactive and abandoned mines that introduces metals such as zinc, cadmium, copper, and/or mercury;
- stormwater inflows and urban runoff that may contribute selenium, turbidity, pathogens, organic carbon, nutrients, pesticides, and/or other chemical residues;
- municipal and industrial discharges that may contribute salts, trace elements, nutrients, metals, pathogens, chemical residues, oil and grease, and/or turbidity;
- agricultural tail water, or return flows, that may contribute salts, nutrients, pesticide residues, pathogens, and/or turbidity; and,
- subsurface agricultural drainage that may contribute salts, nutrients, pesticides (some fungicides), selenium, and/or other trace elements.

Action Strategies to Address Water Quality Problems

Action strategies have been developed by the Water Quality Program participants to address water quality problems in the Delta and its tributaries. The strategies are recommended actions to reduce pollutants from sources of water quality problems (e.g., mine drainage, agricultural

drainage, urban and industrial runoff, and municipal and industrial wastewater treatment facilities), to improve source water quality; to upgrade water treatment plants, or to change water management practices.

Action strategies to address water quality problems include a combination of research, pilot studies and full-scale actions. For some parameters, such as mercury, there is little understood about its sources, the bioavailability of the various sources, and the load reductions needed to reduce fish tissue levels. For this parameter further study is recommended before full-scale actions are taken. For other parameters, such as selenium, sources are better documented, and source control or treatment actions can be taken with a reasonable expectation of positive environmental results. The following actions highlight some of the major strategies that make up the Water Quality Common Program. A complete listing of actions can be found in the CALFED Water Quality Common Report or Appendix B.

Delta

Actions strategies to address water quality problems in the Delta address mining draininge, urban and industrial runoff, municipal and industrial wastewater, agricultural drainage, and source control and treatment. Following is a description of the main action strategies for each of these sources.

Mine drainage actions will reduce mercury loadings to the Delta from abandoned and inactive mines. These actions include source control and treatment measures. Actions for mercury occur throughout the basin and are primarily being addressed through a system-wide research-program that will attempt to identify bioavailable forms of mercury, sources of the bioavailable forms and an action plan to reduce the loadings of these forms. Pilot scale actions are recommended for mines that drain mercury to Cache Creek and the Yolo Bypass.

Urban and industrial runoff actions will help to reduce toxicity from the pesticides chlorpyrifos and diazinon, copper, and oxygen depletion in the Delta, and to reduce pathogens. Actions include both source control and treatment measures.

Municipal and industrial wastewater actions will help to reduce pathogens and oxygen depletion. These actions include source control and treatment measures including improved management of boat discharges and additional source control or treatment at wastewater treatment plants.

Agricultural drainage actions will reduce toxicity from the pesticide carbofuran, chlorpyrifos, and diazinon in the Delta. Actions are primarily source control measures such asBMPs.

Drinking water source actions include relocation of water supply intakes to avoid areas of high salinity, total organic carbon, and turbidity.

Drinking water quality actions include upgrades to treatment processes to improve disinfection while reducing production of unwanted disinfection byproducts.

Unknown toxicity actions focus on developing a comprehensive monitoring, assessment, and research program to identify toxicities, the sources of these toxicities, and action plans to address unknown toxicity in the Delta and its tributaries.

Sacramento Basin

Action strategies in the Sacramento Basin predominantly include mine drainage actions with some agricultural drainage and urban and industrial runoff actions. Following is a description of the main action strategies for each of these sources.

Mine drainage actions will reduce mercury, cadmium, copper, and zinc loadings to the Sacramento River and its tributaries from abandoned and inactive mines. These actions include point source and non-point source measures. Actions for cadmium, copper, and zinc are focussed at mine sites that drain into the upper Sacramento River. Actions for mercury occur throughout the basin and are primarily being addressed through a system-wide research-program to identify bioavailable forms of mercury, sources of the bioavailable forms and an action plan to reduce the loadings of these forms.

Urban and industrial runoff actions will reduce toxicity of the pesticide chlorpyrifos and diazinon in the Sacramento River and its tributaries from urban areas. These actions will include implementing BMPs for pesticide usage in urban areas.

Agricultural drainage actions will reduce toxicity from the pesticides carbofuran, chlorpyrifos, and diazinon in the Sacramento River and its tributaries from agricultural areas. Actions are primarily source control measures such as BMPs, especially from farm areas that drain to the Feather River, Colusa Basin Drain, and mainstem Sacramento River.

Unknown toxicity actions focus on developing a comprehensive monitoring, assessment and research program to identify toxicities, the sources of these toxicities, and action plans to address unknown toxicity in the Sacramento River and its tributaries.

San Joaquin Basin

Action strategies in the San Joaquin Basin predominantly include agricultural drainage actions with limited mine drainage actions. Following is a description of the main action strategies for each of these sources.

Agricultural drainage actions include drainage reduction and reuse, timed drainage release, drainage treatment to reduce trace elements and other contaminants, salt separation and utilization and land use changes to reduce drainage quantities. Subsurface agricultural drainage discharged to the San Joaquin River from the Grasslands area are perhaps the most significant

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cause of water quality problems, specifically selenium and salinity (TDS, chloride, bromide), in the River. Agricultural drainage actions will reduce toxicity from the pesticides chlorpyrifos and diazinon in the San Joaquin River and its tributaries from agricultural areas. Actions are primarily source control measures such as best management practices (BMPs) particularly in farm areas that drain to Mud and Salt sloughs, and the San Joaquin River.

Mine drainage actions associated with loadings of cadmium and zinc to the San Joaquin Basin (specifically the Mokelumne River) have been undertaken as part of the Penn Mine Remediation Plan. However, mercury loadings continue to be a problem in the basin. Actions for mercury occur throughout the basin and are primarily being addressed through a system-wide research-program that will attempt to identify bioavailable forms of mercury, sources of the bioavailable forms and an action plan to reduce the loadings of these forms.

Unknown toxicity actions focus on developing a comprehensive monitoring, assessment and research program to identify toxicities, the sources of these toxicities, and action plans to address unknown toxicity in the San Joaquin River and its tributaries.

Water Quality Targets

Numerical or narrative water quality targets have been developed for each parameter of concern. These targets relate to acceptable in-stream concentrations of parameters. They will be used to gauge action and alternative effectiveness at protecting beneficial uses. Targets are based on: 1) Water Quality Control Plans (Basin Plans) of the Bay Area and Central Valley Regional Water Quality Control Boards or U.S. Environmental Protection Agency National Toxics Rule objectives; 2) standard agricultural water quality objectives; and 3) acceptable source drinking water quality ranges as defined by technical experts.

Performance Targets

Performance targets have been established to measure the effectiveness of actions in improving water quality. Performance targets are generally stated as load reduction levels. For example, the target for copper in the Sacramento River may be to reduce copper loadings in the Upper Sacramento River (during an average water year) from approximately 65,000 pounds to 10,000 pounds per year. For actions that recommend further parameter study or research the target will be a focussed outcome. For example, if research is required to identify sources of mercury the outcome would be a list of the ten most significant sources along with an action program to address these sources.

Comprehensive Monitoring, Assessment and Research Program

The Water Quality Program, and indeed all CALFED activities, must be based on the application of rigorous science. While there is some information on the existence of water quality problems in the CALFED solution area, much is yet to be learned. CALFED is developing a

Comprehensive Monitoring, Assessment, and Research Plan (CMARP) to address the need for adequate scientific support. CMARP will address the water quality area, system integrity, ecosystem restoration, and water supply reliability resource areas. The CMARP is central to the CALFED philosophy of adaptive management. The water quality component of the CMARP will provide for:

- Establishing a quality assurance/quality control program to assure the scientific validity of CALFED data collection;
- Establishing the actual existence and severity of water quality problems, including evaluating the ecosystem effects of water quality parameters;
- Establishing baseline water quality conditions against which CALFED actions will be measured; and,
- Evaluating the effectiveness of CALFED water quality improvement actions and identifying the need for adaptive management actions.

Coordinated Watershed Approach

CALFED staff may work with local agencies to assist in forming alliances and cooperative projects to improve water quality for beneficial uses on a larger scale than might be possible with local agencies working alone or in more narrowly scoped programs. CALFED's systemwide watershed focus on water quality will help to better integrate and coordinate State and federal resource management programs with local watershed activities, while ensuring long-term benefits for the Bay-Delta estuary. The approach will be incorporated into the CALFED Watershed Management Program Element described on Page 18.

CALFED activities are being coordinated with existing or new watershed management programs affecting the Bay-Delta system including, but not limited to, the State Water Resources Control Board's (SWRCB) Sacramento River Watershed Program, the Sacramento River Toxic Parameter Control Program, the San Joaquin Valley Drainage Implementation Program, the San Francisco Estuary Project Comprehensive Conservation and Management Plan and the federal, State, and Regional Water Quality Control Board's Watershed Management Initiative Programs.

Appendix B provides detailed descriptions of the water quality programmatic actions together with targets for their implementation and potential indicators of success. Individual programmatic actions may vary in cost, technical feasibility, and other respects that would affect the final choices for implementing actions. These will, therefore, be subject to pre-feasibility analysis to determine which programmatic actions are most appropriate to be carried forward toward implementation. This work will begin during Phase II of the CALFED program, and will continue into Phase III. Full feasibility analysis in conjunction with project-specific environmental documentation will be performed during Phase III.

Water Use Efficiency Program

The Water Use Efficiency Program reflects California's well accepted public policy, that places a strong emphasis on efficient use of developed water supplies. At CALFED scoping sessions, participants expressed a strong sentiment that water use efficiency should figure prominently in all CALFED alternatives. Existing supplies must be used efficiently before undertaking costly efforts to develop additional supplies or improve the ability to convey water across the Delta.

Many local water agencies in California have strong water use efficiency programs. The greatest current challenge in water use efficiency is finding ways to encourage more water users and water suppliers to implement proven, cost-effective efficiency measures.

The term efficiency may be defined in different ways. Increases in physical efficiency and increases in the achievement of CALFED objectives through improved water management would be direct results of the water use efficiency program. Increasing economic efficiency -- which might result in a reallocation of water -- is not a specific objective of the Program but would likely be an indirect result.

The CALFED water use efficiency program differs from other components of proposed Bay-Delta solution alternatives in two fundamental ways: it is concerned with policy, not technical issues, and **most actions would be implemented by local agencies rather than CALFED agencies.**

Implementation objectives were established to guide the development of approaches for water use efficiency. These objectives are intended to reflect and protect the various stakeholder interests regarding local water use management and efficiency. The objectives were used during program development to test whether a draft approach was satisfactory. There are general objectives as well as specific objectives for urban water conservation and agricultural water use efficiency. General objectives include:

- Ensure a strong water use efficiency component in the Bay-Delta solution.
- Emphasize incentive-based actions over regulatory actions.
- Preserve local flexibility.
- Remove disincentives and barriers to efficient water use.
- Offer greater help in the planning and financing of local water use management and efficiency improvements.

Objectives that relate to urban water use efficiency improvements include:

- Incorporate the strengths and benefits of the *California Urban Water Conservation Council (CUWCC) and the Memorandum of Understanding Regarding Urban Water Conservation in California (MOU).*

- Provide assurance that a high "floor" level of conservation implementation would occur.

Objectives that relate solely to agricultural local water use management and efficiency improvements include:

- Build on the progress and achievements of the *Memorandum of Understanding Regarding Efficient Water Management Practices by Agricultural Water Suppliers in California* (AB 3616).

- Provide adequate assurance that agricultural water supplies would be used at highly efficient levels.

- Improve local water use management to achieve multiple benefits.

The CALFED solution alternatives must provide assurance that appropriate water management planning is carried out by local agencies and that cost-effective efficiency measures are implemented. Demonstration of appropriate planning and implementation would be necessary prerequisites for an agency to be eligible to:

- receive any "new" water made available by a Bay-Delta solution,

- participate in a water transfer that requires approval by any CALFED agency or use of facilities operated by any CALFED agency, and

- receive water through the California Department of Water Resources' (DWR) Drought Water Bank (this is already a policy of DWR).

The Water Use Efficiency Program includes policies covering five main areas. **Appendix C** provides detailed descriptions of the policies for these five areas.

- **Agricultural Water Use Efficiency** - The agricultural approach recognizes a clear standard for voluntary agricultural water management planning and a balanced process for recognition of adequate programs of planning and implementation. The approach is supported by planning and technical assistance, financing assistance, and proposed assurances.

- **Urban Water Conservation** - The urban approach recognizes a clear standard for implementing cost-effective conservation measures and responsibility to carry out local

water management planning. The approach establishes a process for recognizing adequate planning efforts and recommends a balanced process for achieving adequate conservation. The approach is supported by planning and technical assistance, financing assistance, and proposed assurances.

- **Efficient Use of Environmental Diversions** - Policies related to efficient use of environmental diversions are being examined in the context of the water use efficiency program. Three CALFED agencies are working with other organizations to develop an Interagency Coordinated Program for optimum water use planning for Central Valley wetlands. This program would identify Best Management Practices for refuge water management and would develop a water-use management planning process for refuge and wetland areas of the Valley. The Interagency Coordinated Program staff would work closely and coordinate with CALFED staff to assure policy consistency, meet the general implementation objectives for water use efficiency, and assurances for the efficient use of water on refuges, wildlife areas, and managed wetlands.

- **Water Recycling** - The recycling approach establishes a process for water recycling planning. The approach could include water recycling planning and implementation, technical and planning assistance, funding assistance, and identification of regional water recycling opportunities. This approach will be developed in coordination with appropriate CALFED agencies and consultation with stakeholders and the public, including the Water Use Efficiency Work Group.

- **Water Transfers** - This approach (which is in progress) will be developed in coordination with appropriate CALFED agencies and in consultation with stakeholders and the public, including the Water Use Efficiency Work Group.

One of the main objectives of the Water Use Efficiency Program is to maintain local flexibility in implementing cost-effective efficiency actions. For this reason, each of the approaches include only policy-level actions and do not attempt to identify technical actions. The program should provide the nexus for local water suppliers and water users to implement the appropriate technical actions.

Local water suppliers and water users have a large array of technical actions to evaluate and implement. These actions are included in the approach by reference to the following:

- The *Memorandum of Understanding Regarding Water Conservation in California* which lists 16 Best Management Practices (BMPs) to be analyzed and, if cost-effective, implemented by local agencies.

- The *Urban Water Management Planning Act* (California Water Code 10610 et. seq.).

- The *Memorandum of Understanding Regarding Efficient Water Management Practices by Agricultural Water Suppliers in California* which includes several Efficient Water

Management Practices (EWMPs) to be analyzed and, if cost-effective, implemented by local agencies.

In addition, technical and planning assistance programs would provide access to numerous other technical actions, especially for consideration at the on-farm level. CALFED Program support would also foster collaboration between water suppliers to analyze technical actions from a basin-wide perspective.

Though unknown as to the actual outcome of local water use management and efficiency improvements, it is assumed that the component would result in significant changes from existing conditions. The extent to which such changes occur independent of the CALFED Program, is not known either, for efficiency improvements would continue to occur regardless of the Program. However, the Program would facilitate greater levels of implementation than would otherwise be expected to occur. The following is anticipated as a result of both current trends and the added influence of the CALFED Program:

- Implementation of urban BMPs could result in a 10-20% reduction in total municipal and industrial demand. Water saved would most likely be used to improve the reliability of existing water supplies and to offset future demands.

- Implementation of agricultural efficient water management practices (EWMPs) could result in real water savings from the reduction of losses. This could be 1-3% of the total demand. This water would be available for reallocation to other beneficial uses. Reallocation of saved water would most likely occur through water transfer markets.

- Implementation of agricultural EWMPs could also result in 8-12% reductions in current applied water demands. These reductions do not, however, necessarily constitute a source of water that can be reallocated to other beneficial uses. Rather, applied water reductions can provide water quality benefits, allow changes in the timing of reservoir releases, and reduce entrainment impacts associated with diversions.

- Increased implementation of urban recycling projects, both local and regional, could provide 1-2 million acre-feet of reusable supply. For local projects, recycled water would most likely be used to improve supply reliability or offset future demands. Regional projects may allow the reallocation of reusable water to other beneficial uses. These reallocations may or may not make use of water transfer markets.

- Changes in water use management at wetlands areas and refuges would not generate water to be reallocated to other uses. Rather, management changes could provide opportunities to modify the timing of wetland dewatering to correspond to water quality needs, or changes could result in reductions in applied water, with benefits similar to that of agriculture.

Levee System Integrity Program

Improvements to Delta levees and channels are included in the Levee System Integrity Program to reduce the risk of failure caused by floods, earthquake, and general deterioration of the facilities. The Program will provide for uniform funding and guidance to increase the level of protection throughout the Delta.

Levee improvements would initially protect critical western Delta islands. Levee improvements would continue until an acceptably higher level of protection is provided throughout the Delta. However, ongoing activities such as emergency repairs, the feasibility of beneficial reuse of dredge materials and the Delta configuration may change what is ultimately achievable.

Appendix D provides detailed descriptions of the levee system integrity programmatic actions. The Program focuses on nine approaches to improve the integrity of the levee system:

- **Delta Levee Base-Level of Funding Program** - provides equitably distributed funding to participating local agencies
- **Special Habitat Improvements and Levee Stabilization Program** - sets priorities and funding for special project improvements
- **Subsidence Control** - reverse effects of subsidence through shallow flooding and managed wetlands in key areas
- **Levee Associated Habitat** - incorporates habitat (identified in the ERPP) into levee improvements where feasible
- **Beneficial Reuse of Dredge Material** - uses dredged material to increase feasibility of levee improvements and habitat restoration
- **Delta Levee Emergency Response** - creates a plan to address developing levee problems to prevent failure
- **Delta Levee Seismic Susceptibility** - performs research and implements improvements to reduce seismic risk to levees
- **Delta In-Channel Islands** - restores in-channel islands for levee erosion control and provides opportunities for in-channel island habitat (identified in the ERPP)
- **Levee Associated Recreation** - enhances opportunities for in-Delta recreation

ELEMENTS INCLUDED IN SEVERAL COMMON AND VARIABLE PROGRAMS

Watershed Management

The CALFED Bay-Delta Program is developing and implementing a comprehensive plan to address a declining ecosystem, uncertain water supplies, and imperiled water quality. This plan will include an integrated approach to solving these problems and watershed management is one of the components of that approach. Watershed management will be included in each of the three alternative Bay-Delta solutions as a means of improving water quality, overall ecosystem, and water yield.

As defined in this policy, watershed management is a comprehensive, integrated, basin-wide approach. It takes into account many water quality problems including but not limited to point and non-point pollution sources, habitat loss, surface-water and groundwater degradation.

The Program fosters local stewardship and supports community-based watershed interests. Program staff might, for example, work with local agencies to assist in the formation of alliances or cooperative projects to improve water quality for beneficial uses on a larger scale than might be possible with local agencies working alone or in more narrowly-scoped programs.

The Program supports sound scientific investigations and pilot programs to develop and demonstrate methods for protecting and enhancing beneficial uses of the Bay-Delta system. An important component of the Programs' support is to assure development of adequate technical documentation for decision-making in a long-term adaptive management process. For example, Program personnel might assume a leadership role by providing educational opportunities and coordinating assessment activities throughout the watersheds tributary to the Bay-Delta to assure uniform data collection protocols, uniform application of quality control, standardized analyses, and compatible database structures.

The Program's staff involvement in watershed management will focus on activities that are consistent with the Program's solution principles to reduce conflict, and to be equitable, affordable, durable, implementable and not to have significant redirected impacts. Other criteria such as technical, economical, financial and institutional feasibility will also be considered for any watershed management project.

The problems to be addressed by the Program are those in the legally defined Delta (generally extending north to the City of Sacramento, east to Interstate 5, south to Tracy and west to Chipps Island), Suisun Bay (extending to the Carquinez Strait), and Suisun Marsh. To address problems in the Delta estuary, Program activities may extend throughout the Central Valley watershed, the Southern California water system service area and the portion of the Pacific Ocean out to the Farallon Islands.

In all such activities, it will be the Program staff's role to assist with implementing projects on a larger watershed scale to help unify and provide a cost-effective approach to individual watershed management activities. Ways that the Program might accomplish this include:

- Taking an active role to help plan and coordinate outreach and education programs. The Program will serve as a clearinghouse for information related to watershed-wide activities affecting the Bay-Delta system. The Program will develop a Model Work Plan and funding information for use by local watershed groups.

- Supporting and fostering local watershed management activities through technical, financial and policy activities.

- Soliciting assistance in developing selection criteria for Programs funded watershed implementation projects.

- Soliciting technical information and involving the agencies and other stakeholders to develop a standardized approach to assure uniform data collection protocols, application of quality control, standardized analyses, and compatible database structures.

- Conducting a survey to assess the number of stakeholder groups who have a vested interest in the benefits of a watershed program. Watershed stakeholders will be actively solicited for their cooperation and the Program will serve as a central network for information among these stakeholders to help ensure coordination.

- Developing a Watershed Strategic Plan containing a stakeholder agreed-upon vision for the future of the watersheds affecting the Bay-Delta system. This plan will establish water quality, ecosystem restoration, and resource goals.

- Helping to provide quality control checks to existing and new watershed monitoring programs to enable accurate measurements and decision-making.

- Integrating existing watershed management programs and agency mandates with additional actions supporting the Programs Solution Principles.

The Programs watershed management activities will be fully coordinated with existing or new watershed management programs affecting the Bay-Delta system including, but not limited to, the State Water Resources Control Board's Sacramento River Watershed Program, the Sacramento River Toxic Pollutant Control Program, and the federal, State and Regional Water Quality Control Board's Watershed Management Initiative Program.

Water Transfers

Water transfers are an important part of the CALFED Program's effort to improve water supply reliability. The Program will include a water transfer element as part of the Water Use Efficiency component. Like other elements of this component, the water transfer element does not propose a water transfer market that is actively managed by the Program. Rather, the Program recognizes that transfers are part of the overall water management landscape in California. The element proposes that the CALFED agencies work cooperatively to facilitate a statewide water transfer market consistent with the Governor's water policy on transfers and the CALFED solution principles.

Transfers can provide an effective means of moving water between users on a voluntary and compensated basis. Compensation provided for transferred water can also create incentives for implementing local water-use management and efficiency improvements.

The CALFED water transfer element will encourage the development of an effective, standardized water transfer market. The Program will seek to encourage the development of a uniform set of rules and criteria to be consistently applied to transfers by affected State and federal agencies. The Program also recognizes that transfers can have adverse impacts on local environmental and groundwater resources, and local economic conditions. Therefore, a critical piece of any transfer element will be the development of rules and criteria for the identification, analysis, and mitigation of third-party impacts.

Some of the possible objectives of the water transfer element are the development of recommendations and/or criteria on:

- Permit coordination issues, particularly timing and permit processing.
- Standardized rules on the definition of saved, conserved, and transferrable water.
- Identification, analysis, and mitigation of third-party impacts resulting from inter-basin transfers.
- Relative priorities in conveyance facilities.
- Carriage water requirements for cross-Delta transfers.
- Groundwater substitution or "pump and replace" transfers.
- Reservoir refill and carryover criteria.

To the extent possible, the Program's water transfer element will be developed within the framework of existing law. If issues arise that cannot be resolved without new legislation, such issues will be referred to a legislative negotiation process. The Program's inclusion of this element in the alternatives is intended to facilitate and, where necessary, supplement other on-going efforts to create an effective water transfer market.

Subsidence Reversal and Delta Habitat Restoration

During Phase II, the Program will study a full range of habitat restoration options in the Delta. The range will include options that could be implemented if less sustainable Delta levees are not maintained indefinitely.

The Program includes in its alternatives, a set of targets to meet ecosystem goals and an adaptive management approach to restoring Delta habitat and levee system integrity. To aid in this effort the Program will also convene an expert panel to provide scientific review on long-term sustainability of Delta habitat and infrastructure. The panel will be asked to consider subsidence reversal and Delta habitat restoration in the target-setting and adaptive management approach. This approach may yield a mix of actions that allow for the gradual, phased, large-scale restoration of leveed islands to a mosaic of uses emphasizing high quality habitat.

The expert panel will focus on a planning area including all the islands which are potentially tidally influenced. To define the recommended areal extent of this habitat restoration component, the Program will examine such factors as:

1. The environmental and economic costs and benefits resulting from major conservation of land to environmental purposes

2. The long-term sustainability of Delta islands, given the economics of farming, the risks of permanent flooding from seismic and other causes, and the costs of levee maintenance and repair and subsidence control

3. The long-term feasibility of restoring productive aquatic habitat on islands where substantial subsidence has occurred

FACILITY OPERATIONS

The four common programs form the foundation for each CALFED alternative. When supplemented by various storage and conveyance configurations and their corresponding facility operation assumptions, these common programs perform in different ways to achieve Program goals and objectives.

Each alternative has a set of assumptions for use in modeling facility operations that varies depending on the storage and conveyance configurations. These operating assumptions are based on the operating assumptions for the No-Action Alternative. The descriptions of each CALFED alternative illustrates how the operational assumptions differ from those for the No-Action Alternative.

Operation Assumptions for No-Action Alternative

The DWR Planning Simulation Model (DWRSIM) study 472 presents the operation assumptions for the No-Action Alternative. Study 472 meets SWRCB'S May 1995 Water Quality Control Plan (Plan) and includes selected upstream ESA requirements and CVPIA flow prescriptions. Detailed assumptions are shown in **Appendix E.**

Operation Assumptions for Existing Conditions

Each CALFED alternative will be compared, during impact analysis with the existing conditions and the No-Action Alternative. The DWRSIM study 469 presents the operation assumptions for existing conditions. Study 469 meets SWRCB's Decision D-1485, selected upstream requirements and CVPIA flow criteria, SWRCB'S May 1995 Water Quality Control Plan, and additional water is provided from the San Joaquin River upstream of its confluence with the Stanislaus, if necessary, to meet salinity and pulse flow objectives at Vernalis. Detailed assumptions are shown in **Appendix F.**

ALTERNATIVE 1

C-001453

ALTERNATIVE 1
EXISTING SYSTEM CONVEYANCE

This alternative essentially relies on the common programs to meet Program Goals, using only existing Delta channels for water conveyance, preserving the Delta common pool as currently in place in that it provides a common source of water for all users. Three configurations with various south Delta modifications differentiate the variations in this alternative. One variation includes new surface and groundwater storage.

Common Programs[a]				Delta Configuration	Water Storage[b]
Ecosystem Restoration	Water Quality	Water Use Efficiency	Levee System Integrity	Varies from existing Delta channels with no conveyance modifications to select south Delta modifications	Varies from no new storage to: 3.0 MAF Upstream (Sac) 2.0 MAF Off-Aqueduct 200 TAF In-Delta 500 TAF Sac. Valley GW 500 TAF San Joaquin GW

[a]The common programs for each alternative include significant habitat improvements, improvements in water quality parameters of concern before they enter the waterways of the Bay-Delta system, policies for implementation of cost effective measures to improve water use efficiency, and levee improvements throughout the Delta.
[b]The numbers are not fixed, they are conceptual and representative of the range to be studied.

OVERVIEW

This alternative relies on the **four common programs** of ecosystem restoration, water quality, water use efficiency, and levee system integrity together with existing Delta channel conveyance to improve each of the target resource areas and to achieve Program goals and objectives. This alternative preserves the Delta common pool in that it provides a common source of fresh water for all users. Three configurations within this alternative include some modifications within the south Delta and a range of potential surface and groundwater storage.

The common programs each contribute in ways towards achieving the CALFED mission and Program goals. These goals are summarized below:

Ecosystem Quality - *The goal for ecosystem quality 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.*

Water Quality - *The goal for water quality in the Bay-Delta system is to provide good water quality for all beneficial uses.*

Water Supply Reliability - *The goal for water supply reliability is to reduce the mismatch between Bay-Delta water supplies and current and projected beneficial uses dependent on the Bay-Delta system.*

System Vulnerability - *The goal for addressing Bay-Delta system vulnerability is to reduce the risk to land use and associated economic activities, water supply, infrastructure, and the ecosystem from catastrophic breaching of Delta levees.*

Program elements included in several Common and Variable Programs help achieve several of the above goals:

- Waterhsed Management
- Water Transfers
- Subsidence Reversal and Delta Habitat Restoration

The summary descriptions are discussed in the **Summary of Common Programs** section of this package. Detailed descriptions are given in **Appendices A thru F.**

ALTERNATIVE 1 VARIATION DESCRIPTIONS

As with all alternatives, the four common programs form the foundation for Alternative 1. Three storage and conveyance configurations are being analyzed as possible Alternative 1 options.

Alternative 1A

Alternative 1A combines and integrates the four common programs without adding new storage and conveyance facilities to supplement the status quo. Figure 1A shows the Alternative 1A configuration. The main elements of the common programs are summarized below. The reader is referred to the **Summary of Common Programs and Appendices A through D** for more complete descriptions.

Ecosystem Restoration Program

The Ecosystem Restoration Program Plan (ERPP) describes proposed ecosystem improvements throughout the Bay-Delta System, including:

- Habitat restoration of approximately 150,000 acres
- Changes in environmental water flows through operational adjustments
- Development of floodways and meander zones
- Fish passage improvements
- Fish screens installations
- Management of undesirable species
- Water quality improvements through implementation of the Water Quality Program

The ERPP is described in more detail in the Summary of Common Programs and the associated Appendix A. Alternative 1A would implement the entire ERPP with the following modifications:

- Operational changes in environmental water flows would be achieved through purchase of water from willing sellers rather than reliance on regulatory mandates.

- 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 away from the South Delta pumping facilities.

Water Quality Program

The Water Quality Program focuses on source control and reducing the release of pollutants into the Bay-Delta system and its tributaries. The Water Quality Program recognizes that additional benefits can be obtained by treatment, timing release of remaining pollutant discharges and water management strategies associated with other CALFED actions. The programmatic water quality actions can be summarized in four general categories.

- **Source control actions** to reduce the total pollutant load entering the Delta.

- **Treatment actions** to reduce the total pollutant load by removing pollutants in waste discharges to the Bay-Delta system or by reducing pollutants in water diverted from the Delta.

- **Management actions** to reduce the concentration of remaining pollutants.

- **Other actions** such as relocation of water supply intakes to avoid salts and organic carbon that reduce the ability to recycle water and that complicate disinfection and are sources of disinfection byproducts.

The Water Quality Program is described in more detail in the Summary of Common Programs and the associated Appendix B. The entire Water Quality Program would be implemented for Alternative 1A with the following addition:

- Evaluate relocating water supply intakes (such as North Bay Aqueduct, Tracy, and Contra Costa Water District intakes) to avoid salts and organic carbon. Salts and organic carbons reduce water recyclability, complicate disinfection, and are sources of disinfection byproducts.

Water Use Efficiency Program

The Water Use Efficiency Program reflects California's well-accepted public policy that places a strong emphasis on efficient use of developed water supplies. The CALFED water use efficiency program differs from other components of a Bay-Delta solution in two fundamental ways: it is more concerned with policy, not technical issues, and **most actions would be implemented by local agencies rather than CALFED agencies.**

The Water Use Efficiency Program is described in more detail in the Summary of Common Programs and the associated Appendix C. No changes in the Water Use Efficiency Program are needed to implement Alternative 1A.

Levee System Integrity Program

The Levee System Integrity Program focuses on nine approaches to improve the long-term structural integrity of the levee system in the Delta and in specific locations upstream:

- **Delta Levee Base Level of Funding Program** - provides equitably distributed funding to participating local agencies
- **Special Habitat Improvements and Levee Stabilization Program** - sets priorities and funding for special project improvements
- **Subsidence Control** - reverse effects of subsidence through shallow flooding and managed wetlands in key areas
- **Levee Associated Habitat** - incorporates habitat (identified in the ERPP) into levee improvements where feasible
- **Beneficial Reuse of Dredge Material** - uses dredged material to increase feasibility of levee improvements and habitat restoration
- **Delta Levee Emergency Response** - creates a plan to address developing levee problems to prevent failure
- **Delta Levee Seismic Susceptibility** - performs research and improvements to reduce seismic risk to levees
- **Delta In-Channel Islands** - restores in-channel islands for levee erosion control and provides opportunities for in-channel island habitat (identified in the ERPP)
- **Levee Associated Recreation** - enhances opportunities for in-Delta recreation

The Levee System Integrity Program is described in more detail in the Summary of Common Programs and the associated Appendix D. No changes in the Levee System Integrity Program are needed for Alternative 1A.

Conveyance

No conveyance improvements are included in Alternative 1A.

Storage

No new water storage is included in Alternative 1A.

Operations

The basic operating assumptions for the initial study of this alternative are described in Appendix E-CALFED Benchmark Study. No changes in these assumptions are proposed for implementing Alternative 1A. However, some reoperation of system facilities will occur to

accommodate changes in flow timing resulting from potential purchases of supplemental environmental flows from willing sellers.

Alternative 1B

Alternative 1B combines and integrates the four common programs with select south Delta improvements. Alternative 1B builds upon Alternative 1A by adding fish screens either at the Banks and Tracy pumping plants or at the head-end of the Clifton Court Forebay and an intertie between the Tracy pumping plant and Clifton Court Forebay. All common programs fit together as they did in Alternative 1A. Figure 1B shows the Alternative 1B configuration.

Ecosystem Restoration Program

Same as Alternative 1A

Water Quality Program

Same as Alternative 1A.

Water Use Efficiency Program

Same as Alternative 1A.

Levee System Integrity Program

Same as Alternative 1A.

Conveyance

Proposed **South Delta Modifications** are intended to result in removal of current regulatory constraints and thus allow the export pumps to operate to their physical capacity. These improvements include:

- Installing an operable barrier or equivalent at the head of Old River to maintain a positive flow down the San Joaquin River.
- Installing flow and stage control measures on Middle River, Grant Line Canal, and Old River or other methods to control flow, stage, and south Delta salinity

CVP-SWP improvements to provide additional operational flexibility. These improvements include:

- New fish screens at the Skinner Fish facility (or at the head-end of the Clifton Court Forebay)

- New fish screens at the Tracy Pumping Plant intake (or at the head-end of the Clifton Court Forebay)

- Intertie between Tracy Pumping Plant and Clifton Court Forebay to provide operational flexibility to minimize fisheries impacts

Storage

As in Alternative 1A, no new water storage is proposed in Alternative 1B.

Operation Assumptions

Same as Alternative 1A except for the operational flexibility to shift diversions between Tracy and Banks Pumping Plant to promote fisheries and water quality.

Alternative 1C

Alternative 1C builds on Alternative 1B by adding new conveyance to provide for increasing in the diversion capicity of existing export to their full physical capacity. Alternative 1C is the same as Alternative 1B except that it enlarges Delta Channels and includes new surface and groundwater storage facilities throughout the watershed. Figure 1C shows the Alternative 1C configuration.

Ecosystem Restoration Program Plan

Alternative 1C would implement the entire ERPP with the following change from Alternative 1A:

- Some environmental water flows would be met through use of new storage specifically allocated to environmental water supplies.

Water Quality Program

Same as Alternatives 1A.

Water Use Efficiency Program

Same as Alternatives 1A.

Levee System Integrity Program

Same as Alternatives 1A.

Conveyance

Proposed **South Delta Modifications** are intended to result in removal of current regulatory constraints and thus allow the export pumps to operate to their physical capacity. These improvements include:

- A new Clifton Court Forebay intake structure
- Channel enlargement along a 4.9 mile reach in Old River
- Installation of an operable barrier or equivalent at the head of Old River to maintain a positive flow down the San Joaquin River.
- Flow and stage control measures on Middle River, Grant Line Canal, and Old River or other methods to control flow, stage, and south Delta salinity

CVP-SWP improvements to provide additional operational flexibility. These improvements include:

- New fish screens at the Skinner Fish facility (or at the head-end of the Clifton Court Forebay)
- New fish screens at the Tracy Pumping Plant intake (or at the head-end of the Clifton Court Forebay)
- Intertie between Tracy Pumping Plant and Clifton Court Forebay to provide operational flexibility to minimize fisheries impacts

Storage

New storage would provide opportunities for enhanced timing and flow management to more effectively and efficiently satisfy urban, agricultural, and environmental beneficial users. Additional study will be required to determine optimal storage sizes.

The first priority for developing surface storage will be to raise existing dams. The second priority will be to develop off-stream storage. The last priority will consider developing new on-stream storage. Groundwater storage development will be implemented with demonstration projects in partnership with local agencies with attention to groundwater levels, water quality, local economic impacts, and any other third party issues.

A range of facility sizes will be evaluated up to:

- 3.0 MAF surface storage upstream of the Delta (enlarging existing storage or new off-stream storage) on Sacramento River tributaries
- 1.0 MAF surface storage off-aqueduct (South of Delta)
- 500 TAF groundwater storage in the Sacramento Valley
- 500 TAF groundwater storage in the San Joaquin Valley

Operating Parameters

The basic operating assumptions for the initial study of this alternative are described in **Appendix E**-CALFED Benchmark Study. More detail is included in the Summary of Common Programs and the associated Appendix E). These are supplemented by the following specific operational assumptions for Alternative 1C:

Operating Parameters and assumptions established for preliminary evaluation of the three CALFED alternatives with various configurations are as described in "DWR Planning Simulation Model (DWRSIM) Assumptions for CALFED Benchmark Study 1995C6F-CALFED-472", except as superseded or supplemented by the following:

Surface and Groundwater Storage Components

- All new surface storage facilities will be operated primarily to maximize average annual deliveries to meet all beneficial uses.
- All new groundwater and conjunctive use facilities will be primarily operated to maximize average dry year deliveries to meet all beneficial uses.
- Filling of and discharging from new storage will be made with the following priorities (*The following will be modified as necessary for consistency with local water management practices and water rights*):
  - Tributary groundwater storage facilities have first priority for filling and last priority for discharging from storage (withdrawals from groundwater basins will only be made in dry and critical years).
  - Aqueduct groundwater storage facilities have second priority for filling and fourth priority for discharging from storage.
  - Aqueduct surface storage facilities have third priority for filling and third priority for discharging from storage.
  - Tributary surface storage facilities have fourth priority for filling and second priority for discharging from storage.

- Delta storage facilities have fifth priority for filling and first priority for discharging from storage.

- The total volume of all new storage is assumed to be split evenly among the "three beneficial use sectors", such that we have 1/3 for environmental purposes, 1/3 for urban purposes, and 1/3 for agricultural purposes.

- For 500 TAF of groundwater storage, diversion capacity is 500 cfs. Discharge capacity is 500 cfs. Flow event targets as specified for surface storage are not applicable for diversions to groundwater storage.

Tributary Storage (Sacramento River System) diversions to storage

- All in stream flow requirements must be met before diversions to new storage are allowed.

- Assumed diversion and discharge capacity for off-stream storage is 5,000 cfs.

- For new diversion points between Keswick and Chico Landing, no new diversions are allowed in any given water year until a 60,000 cfs mean daily flow event that preserves the river's natural fluvial geomorphology process has occurred at Chico Landing. (Future study will be conducted to determine the actual flow needed). For the monthly time step used in modeling, a corresponding monthly volume of 1.5 million acre feet has been used as a surrogate.

- For new diversion points at and downstream of Chico Landing, no flow event target is proposed.

Aqueduct Storage

- New storage is assumed to be connected to the California Aqueduct with 3,500 cfs diversion and discharge capacity.

Instream Flow Targets

- ERPP in-stream flow targets are to be met through purchase of existing water and use of new storage allocated to environmental water supplies.

Note: These operating parameters have been developed to provide a preliminary basis for conducting system and Delta model studies of CALFED alternatives. They do not reflect the culmination of the consensus process. A wide range of operating parameters will eventually be explored as part of the alternative evaluation process.

Facilities included in Alternative 1 configurations will be operated to provide multiple benefits for the environment, water supply reliability, and water quality improvement. Additional study will be required before CALFED can settle on the best operational mode considering the hydrology and hydraulic constraints, the size range of potential facilities, the economic allocation of costs, and the assurances needed for successful multi benefit operations.

ALTERNATIVE 2

C-001465

ALTERNATIVE 2
MODIFIED THROUGH DELTA CONVEYANCE

This alternative combines the common programs with significant modifications of through Delta channels to improve water conveyance across the Delta. This alternative preserves the Delta common pool as it provides a common source of water for all users dependent on Delta water supplies. Combinations of four potential conveyance configurations and three new storage configurations differentiate the five variations of this alternative.

Common Programs[a]				Delta Configuration	Water Storage[b]
Ecosystem Restoration	Water Quality	Water Use Efficiency	Levee System Integrity	Varies from channel modifications primarily for water conveyance to extensive modifications for water conveyance and habitat restoration	Varies from no new storage to: 3.0 MAF Upstream (Sac) 500 TAF Upstream (SJ) 2.0 MAF Off-Aqueduct 200 TAF In-Delta 500 TAF Sac. Valley GW 500 TAF San Joaquin GW

[a]The common programs for each alternative include significant habitat improvements, improvements in water quality parameters of concern before they enter the waterways of the Bay-Delta system, policies for implementation of cost effective measures to improve water use efficiency, and levee improvements throughout the Delta.
[b]The numbers are not fixed, they are conceptual and representative of the range to be studied.

OVERVIEW

This alternative relies on the **four common programs** of ecosystem restoration, water quality, water use efficiency, and levee system integrity combined with a variety of configurations of storage and through-Delta conveyance modifications to improve each of the resource areas and to achieve Program goals and objectives. This alternative preserves the Delta common pool in that it provides a common source of fresh water for all users.

The common programs each contribute in multiple complementary aspects toward achieving the CALFED mission and Program goals. These goals are summarized below:

Ecosystem Quality - *The goal for ecosystem quality 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.*

Water Quality - *The goal for water quality in the Bay-Delta system is to provide good water quality for all beneficial uses.*

Water Supply Reliability - *The goal for water supply reliability is to reduce the mismatch between Bay-Delta water supplies and current and projected beneficial uses dependent on the Bay-Delta system.*

System Vulnerability - *The goal for addressing Bay-Delta system vulnerability is to reduce the risk to land use and associated economic activities, water supply, infrastructure, and the ecosystem from catastrophic breaching of Delta levees.*

Program elements included in several Common and Variable Programs help achieve several of the above goals:

- Waterhsed Management
- Water Transfers
- Subsidence Reversal and Delta Habitat Restoration

The summary descriptions are discussed in the **Summary of Common Programs** section of this package. Detailed descriptions are given in **Appendices A thru F.**

ALTERNATIVE 2 VARIATION DESCRIPTIONS

As with all Alternatives, the four common programs form the foundation for Alternative 2. Combinations of four potential conveyance configurations and three new storage configurations differentiate the five variations of this alternative. All Alternative 2 variations would result in permitted Delta pumping limits to be removed to allow pumping at the full physical pumping capacity.

Alternative 2A

Alternative 2A combines and integrates the four common programs 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 (or at the head-end of the Clifton Court Forebay), an intertie between the pumping plants, and operable barriers or equivalent in the south Delta. The alternative does not provide additional water storage. Figure 2A shows the Alternative 2A configuration.

Ecosystem Restoration Program

The Ecosystem Restoration Program Plan (ERPP) describes proposed ecosystem improvements throughout the Bay-Delta System, including:

- Habitat restoration of approximately 150,000 acres
- Changes in environmental water flows through operational adjustments
- Development of floodways and meander zones
- Fish passage improvements
- Fish screens installations
- Management of undesirable species
- Water quality improvements by implementing the Water Quality Program

The ERPP is described in more detail in the Summary of Common Programs and the associated Appendix A. Alternative 2A would implement the entire ERPP with the following modifications:

- Operational changes in environmental water flows would be achieved through purchase of water from willing sellers rather than reliance on regulatory mandates.

- Habitat restoration identified for the south Delta area would be located west of the flow and stage control structures on Middle River, Grant Line Canal, and Old River.

- Habitat improvements along the North Fork Mokelumne River would be limited to establishing a riparian habitat corridor associated with setback levees constructed to modify 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 Program

The Water Quality Program focuses on source control and reducing the release of pollutants into the Bay-Delta system and its tributaries. The Water Quality Program recognizes that additional benefits can be obtained by treatment, timing release of remaining pollutant discharges and water management strategies associated with other CALFED actions. The programmatic water quality actions can be summarized placed in four general categories.

- **Source control actions** reduce the total pollutant load entering the Delta.

- **Treatment actions** reduce the total pollutant load by removing pollutants in waste discharges to the Bay-Delta system or by reducing pollutants in water diverted from the Delta.

- **Management actions** to reduce the concentration of remaining pollutants.

- **Other actions** such as relocating water supply intakes to avoid salts and organic carbon that reduce the ability to recycle water and that complicate disinfection and are sources of disinfection byproducts.

The Water Quality Program is described in more detail in the Summary of Common Programs and the associated Appendix B. The entire Water Quality Program would be implemented for Alternative 1A with the following additions:

- 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.

- Relocate Delta island drainage discharges away to channels other than those identified for conveyance modifications.

Water Use Efficiency Program

The Water Use Efficiency Program reflects California's well accepted public policy that places a strong emphasis on efficient use of developed water supplies. The CALFED water use efficiency program differs from other components of a Bay-Delta solution in two fundamental ways: it is more concerned with policy, not technical issues, and **most actions would be implemented by local agencies rather than CALFED agencies.**

The Water Use Efficiency Program is described in more detail in the Summary of Common Programs and the associated Appendix C. No changes in the Water Use Efficiency Program are needed to implement Alternative 2A.

Levee System Integrity Program

The Levee System Integrity Program focuses on nine approaches to improve the long-term structural integrity of the levee system in the Delta and in specific locations upstream:

- **Delta Levee Base Level of Funding Program** - provides equitably distributed funding to participating local agencies

- **Special Habitat Improvements and Levee Stabilization Program** - sets priorities and funding for special project improvements

- **Subsidence Control** - reverse effects of subsidence through shallow flooding and managed wetlands in key areas

- **Levee Associated Habitat** - incorporates habitat (identified in the ERPP) into levee improvements where feasible

- **Beneficial Reuse of Dredge Material** - uses dredged material to increase feasibility of levee improvements and habitat restoration

- **Delta Levee Emergency Response** - creates a plan to address developing levee problems to prevent failure

- **Delta Levee Seismic Susceptibility** - performs research and improvements to reduce seismic risk to levees

- **Delta In-Channel Islands** - restores in-channel islands for levee erosion control and provides opportunities for in-channel island habitat (identified in the ERPP)

- **Levee Associated Recreation** - enhances opportunities for in-Delta recreation

The Levee System Integrity Program is described in more detail in the Summary of Common Programs and the associated Appendix D. The entire Levee System Integrity Program would be implemented for Alternative 2A with the following modification:

- The program would be adjusted to accommodate new setback levees for improved water conveyance and flooding of McCormack Williamson Tract

Conveyance

A new **10,000 cfs Screened Intake at Hood** would divert water into the improved through-Delta channels from the Sacramento River. This component would include:

- Installing gated intake with pumping plant to open channel

- Installing fish screen and bypass system

- Opening channel to Snodgrass Slough with setback levee along east side of channel to McCormack Williamson Tract

- Relocating or replacing existing improvements displaced by the new channel

- Breaching McCormack Williamson Tract levee to flood island for shallow water habitat and water conveyance

North Delta Channel modifications would provide for widening the Mokelumne River channel to improve water conveyance and flood control in the northern Delta. These modifications include:

- Purchasing a 600-foot-wide alignment along Mokelumne River from I-5 to the San Joaquin River

- Replacing existing levees on one side of the existing channel with new setback levees approximately 500 feet back from the existing channel

- Removing existing levees where they obstruct the new channel and convert remaining portions into channel islands

- Relocating or replacing existing improvements displaced by the widened channel

South Delta Modifications would provide for increasing the diversion capacity of existing export pumps up to their full physical capacity. These improvements include:

- A new Clifton Court Forebay intake structure
- Channel enlargement along a 4.9-mile reach in Old River
- Operable barrier or equivalent at the head of Old River to maintain a positive flow down the San Joaquin River.
- Flow and stage control measures on Middle River, Grant Line Canal, and Old River or other methods to control flow, stage, and South Delta salinity

Central Valley Project-State Water Project(CVP-SWP) improvements would provide additional operational flexibility. These improvements include:

- New fish screens at the Skinner Fish facility (or at the head-end of the Clifton Court Forebay)
- New fish screens at the Tracy Pumping Plant intake (or at the head-end of the Clifton Court Forebay)
- Intertie between Tracy Pumping Plant and Clifton Court Forebay to provide operational flexibility to minimize fisheries impacts

Storage

New water storage is not included in Alternative 2A.

Operating Parameters

The basic operating assumptions for the initial study of this alternative are described in **Appendix E**-CALFED Benchmark Study. No changes in these assumptions are proposed for implementing Alternative 2A. However, some reoperation of system facilities will occur to accommodate changes in flow timing resulting from potential purchases of supplemental environmental flows from willing sellers.

Alternative 2B

Alternative 2B combines and integrates the four common programs 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. Figure 2B shows the Alternative 2B configuration.

Ecosystem Restoration Program

Alternative 2B would implement the entire ERPP with these modifications:

- 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 all be located west of the flow and stage control structures on Middle River, Grant Line Canal, and Old River.
- Habitat improvements along the North Fork Mokelumne River would be limited to establishing a riparian habitat corridor associated with setback levees constructed to modify 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 Program

Same as Alternative 2A.

Water Use Efficiency Program

Same as Alternative 2A.

Levee System Integrity Program

Same as Alternative 2A.

Conveyance

Same as Alternative 2A.

Storage

New storage would provide opportunities for enhanced timing and flow management to more effectively and efficiently satisfy urban, agricultural, and environmental beneficial users. Additional study will be required to determine optimal storage sizes.

The first priority for development of surface storage will be to raise existing dams. The second priority will be to develop off-stream storage. The last priority will consider development of new on-stream storage. Groundwater storage development will be implemented with demonstration

projects in partnership with local agencies with attention to groundwater levels, water quality, local economic impacts, and any other third party impacts.

A range of facility sizes will be evaluated up to:

- 3.0 MAF surface storage upstream of the Delta (enlargement of existing storage or new off-stream storage) on Sacramento River tributaries
- 500 TAF surface storage upstream of the Delta (enlargement of existing storage or new off-stream storage) on San Joaquin River tributaries
- 2.0 MAF surface storage off-aqueduct (South of Delta)
- 500 TAF groundwater storage in the Sacramento Valley
- 500 TAF groundwater storage in the San Joaquin Valley

Operating Parameters

The basic operating assumptions for the initial study of this alternative are described in **Appendix E**-CALFED Benchmark Study. More detail describing the basic operating assumptions is included in the Summary of Common Programs and the associated Appendix E. These are supplemented by the following specific operational assumptions for Alternative 2B:

Surface and Groundwater Storage Components

- All new surface storage facilities will be operated primarily to maximize average annual deliveries to meet all beneficial uses.
- All new groundwater and conjunctive use facilities will be primarily operated to maximize average dry year deliveries to meet all beneficial uses.
- Filling of and discharging from new storage will be made with the following priorities (*The following will be modified as necessary for consistency with local water management practices and water rights*):
  - Tributary groundwater storage facilities have first priority for filling and last priority for discharging from storage (withdrawals from groundwater basins will only be made in dry and critical years).
  - Aqueduct groundwater storage facilities have second priority for filling and fourth priority for discharging from storage.
  - Aqueduct surface storage facilities have third priority for filling and third priority for discharging from storage.
  - Tributary surface storage facilities have fourth priority for filling and second priority for discharging from storage.

- Delta storage facilities have fifth priority for filling and first priority for discharging from storage.

- The total volume of all new storage is assumed to be split evenly among the "three beneficial use sectors", such that we have 1/3 for environmental purposes, 1/3 for urban purposes, and 1/3 for agricultural purposes.

- For 500 TAF of groundwater storage, diversion capacity is 500 cfs. Discharge capacity is 500 cfs. Flow event targets as specified for surface storage are not applicable for diversions to groundwater storage.

Tributary Storage (Sacramento River System) diversions to storage

- All in stream flow requirements must be met before diversions to new storage are allowed.

- Assumed diversion and discharge capacity for off-stream storage is 5,000 cfs.

- For new diversion points between Keswick and Chico Landing, no new diversions are allowed in any given water year until a 60,000 cfs mean daily flow event that preserves the river's natural fluvial geomorphology process has occurred at Chico Landing. (Future study will be conducted to determine the actual flow needed). For the monthly time step used in modeling, a corresponding monthly volume of 1.5 million acre feet has been used as a surrogate.

- For new diversion points at and downstream of Chico Landing, no flow event target is proposed.

Tributary Storage (San Joaquin River System) diversions to storage

- All in-stream flow requirements must be met before diversions to new storage are allowed

- Assumed diversion and discharge capacity for off-stream storage is 5,000 cfs.

- New storage is assumed to be diverted from existing canal diversion locations or assumed to be an increase of existing on-stream storage. No flow event targets set.

Aqueduct Storage

- New storage is assumed to be connected to the California Aqueduct with 3,500 cfs diversion and discharge capacity.

In stream Flow Targets

- ERPP in-stream flow targets are to be met through purchase of existing water and use of new storage allocated to environmental water supplies.

Note: These operating parameters have been developed to provide a preliminary basis for conducting system and Delta model studies of CALFED alternatives. They do not reflect the culmination of the consensus process. A wide range of operating parameters will eventually be explored as part of the alternative evaluation process.

Facilities included in Alternative 2 configurations will be operated to provide multiple benefits for the environment, water supply reliability, and water quality improvement. Additional study will be required before CALFED can settle on the best operational mode considering the hydrology and hydraulic constraints, the size range of potential facilities, the economic allocation of costs, and the assurances needed for successful multi-benefit operations.

Alternative 2C

Alternative 2C combines and integrates the four common programs with three new diversion locations for Tracy and Banks pumping plants. The new diversions could be used 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 or at the head-end of the Clifton Court Facility, and an intertie between the pumping plants. Figure 2C shows the Alternative 2C configuration.

Ecosystem Restoration Program

The ERPP is described in detail in the Summary of Common Programs and the associated Appendix A. Alternative 2C would implement the entire ERPP with these modifications:

- Environmental water flows changes would be met through purchase of existing water from willing sellers.

- 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.

- Habitat restoration identified for the South Delta area near the new diversion locations would be relocated to the northern and western Delta.

Water Quality Program

Same as Alternative 2A.

Water Use Efficiency Program

Same as Alternative 2A.

Levee System Integrity Program

The Levee System Integrity Program is described in detail in the Summary of Common Programs and the associated Appendix D. Alternative 2C would implement the entire Levee System Integrity Program with these modifications:

- The program would be modified to accommodate the isolated channels, and associated levees, leading from the new diversion locations to Clifton Court Forebay.
- Levees selected for breaching, and the associated flooded land, along the eastern side of the South Fork Mokelumne River would not be improved to reduce flood risk.

Conveyance

Three isolated conveyance channels would convey water to Clifton Court Forebay and the Tracy Pumps from two locations on the San Joaquin River and one on Old River near Franks track. The **New Diversion Locations** would provide the flexibility to divert water from different parts of the Delta depending on need and operating criteria at the time.

Western 15,000 cfs isolated South Delta Intake would include:

- Intake on Holland Track near the south side of Franks Tract.
- Setback levee, approximately 500-feet from channel, along western side of Old River.
- Isolated conveyance parallel to Old River and connected to Clifton Court Forebay. The conveyance could serve water users along the alignment.
- Isolated conveyance connected to new in-Delta storage on Holland Track. The intake would be constructed to allow diversion out of the storage (may require pumps) or directly out of the Delta channel.
- Relocation or replacement of existing improvements displaced by the new facility.

Northern 15,000 cfs Isolated South Delta Intake would include:

- Intake from San Joaquin River at northern end of Lower Roberts Island.
- Isolated conveyance to Clifton Court Forebay. The conveyance could serve water users along the alignment.

- Relocation or replacement of existing improvements displaced by the new facility.

Eastern 5,000 cfs Isolated South Delta Intake would include:

- Intake from San Joaquin River at southern end of Upper Roberts Island.
- Isolated conveyance to Clifton Court Forebay. The conveyance could serve water users along the alignment.
- Relocation or replacement of existing improvements displaced by the new facility.

South Delta Modifications would provide for increasing the diversion capability of existing export pumps up to their physical capacity. These modifications include:

- A new Clifton Court Forebay intake structure.

CVP-SWP improvements provide for further improvements in operational flexibility. These improvements include:

- New fish screens at the Skinner Fish facility (or at the head-end of the Clifton Court Forebay)
- New fish screens at the Tracy Pumping Plant intake (or at the head-end of the Clifton Court Forebay)
- Interconnection between Tracy Pumping Plant and Clifton Court Forebay

Storage

New in-Delta storage (50,000 to 100,000 acre-feet) on Holland Tract would be connected to the Western 15,000 cfs isolated South Delta Intake.

Operating Parameters

The basic operating assumptions for the initial study of this alternative are described in **Appendix E**-CALFED Benchmark Study. More detail is included in the Summary of Common Programs and the associated Appendix E). No changes in these assumptions are need for Alternative 2C. The storage would be operated to minimize fish loss from diversions. Some reoperation of system facilities will occur to accommodate the change in flow timing from the purchase of environmental flows from willing sellers.

Alternative 2D

Alternative 2D combines and integrates the four common programs 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 (or at the head-end of the Clifton Court Forebay), an intertie between the pumping plants, and an operable barrier or equivalent at the Head of Old River. Figure 2D shows the Alternative 2D configuration.

Ecosystem Restoration Program

The ERPP is described in detail in the Summary of Common Programs and the associated Appendix A. Alternative 2D would implement the entire ERPP with these modifications:

- Environmental water flow changes 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 habitat with the setback levees along Old River.

Water Quality Program

Same as Alternative 2A.

Water Use Efficiency Program

Same as Alternative 2A.

Levee System Integrity Program

The Levee System Integrity Program is described in detail in the Summary of Common Programs and the associated Appendix D. Alternative 2D would implement the entire Levee System Integrity Program with this modification:

- The program would be adjusted to accommodate new setback levees and the flooding of McCormack Williamson Tract, Bouldin Island, and tracts along the eastern side of the South Fork Mokelumne River.

Conveyance

A new **10,000 cfs Screened Intake at Hood** would divert water into the through-Delta channels from the Sacramento River. These modifications (which are identical to Alternative 2A) include:

- Gated intake with pumping plant to open channel
- Fish screen and bypass system
- Open channel to Snodgrass Slough with setback levee along east side of channel to McCormack Williamson Tract
- Relocation or replacement of existing improvements displaced by the new channel
- Breach McCormack Williamson Tract levee to flood island for shallow water habitat, emergent marsh, riparian forest, and water conveyance

Mokelumne River Floodway and **East Delta Wetlands Habitat** (channel modifications along the South Fork Mokelumne River) provide for improved conveyance and associated habitat. Modifications include:

- Setback levees on New Hope Tract about 2,000 feet east of existing alignment from Mokelumne River to Beaver Slough.
- Remove segments of the eastern levee along South Fork Mokelumne River to provide new flooded habitat (such as Canal Ranch and Brack Tracts), and protecting interior levee slopes.
- Setback levees on Terminous Tract about 2,000 feet east of existing alignment.
- Setback levees on Staten Island, south of Sycamore Slough, about 4,000 feet west of existing alignment.
- Remove portions of Bouldin Island levee to flood the island for conveyance and habitat. Interior levee slopes will be protected from erosion.
- Relocate or replace key infrastructure such as Highway 12.

South Delta Habitat Modifications would provide new habitat and allow increasing diversion capacity of existing export pumps up to their physical capacity. Improvements include:

- Setback levees along Old River from Rock Slough to Clifton Court Forebay to create approximately 3,000 foot-wide channel for conveyance and habitat.

- Construct a new Clifton Court Forebay intake structure

- Construct an operable barrier or equivalent at the head of Old River to maintain a positive flow down the San Joaquin River. (Downstream flow or stage control structures would not be constructed).

CVP-SWP improvements would provide for further improvements in operational flexibility. These improvements include:

- New fish screens at the Skinner Fish facility (or at the head-end of the Clifton Court Forebay)

- New fish screens at the Tracy Pumping Plant intake (or at the head-end of the Clifton Court Forebay)

- Interconnection between Tracy Pumping Plant and Clifton Court Forebay

Storage

New storage would provide opportunities for additional flow management and timing for urban, agricultural and environmental uses. Additional study will be required to determine the best storage size considering physical factors, hydrology and hydraulic constraints, the economic allocation of costs, and the assurances needed for successful multi-benefit operations. A range of facility sizes will be evaluated up to:

- 2.0 MAF surface storage off-aqueduct (south of Delta)

Operating Parameters

The basic operating assumptions for the initial study of this alternative are described in **Appendix E**-CALFED Benchmark Study. More detail is included in the Summary of Common Programs and the associated Appendix E). These are supplemented by the following for Alternative 2D:

- All new surface storage facilities will be operated primarily to maximize average annual deliveries to meet all beneficial uses.

- All new storage is assumed to be split evenly among the "three beneficial use sectors", such that we have 1/3 for environmental purposes, 1/3 for urban purposes, and 1/3 for agricultural purposes.

- The new storage is assumed to be connected to the California Aqueduct with 3,500 cfs diversion and discharge capacity.

- Aqueduct surface storage facilities have third priority for filling and third priority for discharging from storage

- ERPP targets are to be met through purchase of existing water and use of the new storage allocated to environmental water supplies.

Note: These operating parameters have been developed to provide a preliminary basis for conducting system and Delta model studies of CALFED alternatives. They do not reflect the culmination of the consensus process. A wide range of operating parameters will eventually be explored as part of the alternative evaluation process.

Facilities included in Alternative 2 configurations will be operated to provide multiple benefits for the environment, water supply reliability, and water quality improvement. Additional study will be required before CALFED can settle on the best operational mode considering the hydrology and hydraulic constraints, the size range of potential facilities, the economic allocation of costs, and the assurances needed for successful multi-benefit operations.

Alternative 2E

Alternative 2E combines and integrates the four common programs 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 of this alternative are the similar to Alternative 2D with the exception of the addition conveyance and habitat on Tyler Island and the eliminating the 10,000 cfs intake at Hood. Figure 2E shows the Alternative 2E configuration.

Ecosystem Restoration Program

The ERPP is described in detail in the Summary of Common Programs and the associated Appendix A. Alternative 2E would implement the entire ERPP with these modifications:

- Environmental water flow changes would be met through purchase of existing water from willing sellers and use of the new storage allocated to environmental water supplies.

- Modifying the Mokelumne River Floodway with setback levees, converting Bouldin Island and Tyler Island to aquatic habitat, and constructing the East Delta Wetlands Habitat will re-establish about 10,000 to 20,000 acres more habitat than identified in the ERPP.

- Incorporate a portion of identified South Delta habitat with the setback levees along Old River.

Water Quality Program

Same as Alternative 2A.

Water Use Efficiency Program

Same as Alternative 2A.

Levee System Integrity Program

The Levee System Integrity Program is described in detail in the Summary of Common Programs and the associated Appendix D. Alternative 2E would implement the entire Levee System Integrity Program with these modifications:

- The program would be adjusted to accommodate the new setback levees and the flooding of McCormack Williamson Tract, Bouldin Island, Tyler Island, and tracts along the eastern side of the South Fork Mokelumne River.

Conveyance

Tyler Island Aquatic Habitat provides habitat and flow control into the central Delta. Modifications include:

- Setback levee, 500 feet west of Georgiana Slough, from the Sacramento River to weir intake into the central Delta.
- Construct 600-foot wide inflatable rubber dam to control weir elevation to control water flow.
- Construct channel section control in Georgiana Slough to prevent accelerated erosion of channel bottom; armoring with rip-rap or gabion baskets.
- Breach a 2,000-foot section of Tyler Island levee on northeast side of island.
- Rip-rap all remaining interior levee slopes

Mokelumne River Floodway and **East Delta Wetlands Habitat** (channel modifications along the South Fork Mokelumne River) provide for conveyance and significant expansion of habitat. These modifications include:

- Breach McCormack Williamson Tract levee to flood island for shallow water habitat and water conveyance.

- Setback levees on New Hope Tract about 2,000 feet east of existing alignment from Mokelumne River to Beaver Slough.

- Removal of segments of the eastern levee along South Fork Mokelumne River to provide new flooded habitat (such as Canal Ranch and Brack Tracts)(Protect interior levee slopes).

- Setback levees on Terminous Tract about 2,000 feet east of existing alignment.

- Setback levees on Staten Island, south of Sycamore Slough, about 4,000 feet west of existing alignment.

- Remove portions of Bouldin Island levee to flood the island for conveyance and habitat. Protect interior levee slopes.

South Delta Habitat Modifications would provide new habitat and allow increasing diversion capacity of existing export pumps up to their physical capacity. These improvements include:

- Setback levees along Old River from Rock Slough to Clifton Court Forebay to create approximately 3,000 foot-wide channel for conveyance and habitat.

- A new Clifton Court Forebay intake structure

- Operable barrier or equivalent at the head of Old River to maintain a positive flow down the San Joaquin River. Downstream flow or stage control structures would not be constructed.

CVP-SWP improvements provide for further improvements in operational flexibility. These improvements include:

- New fish screens at the Skinner Fish facility (or at the head-end of the Clifton Court Forebay)

- New fish screens at the Tracy Pumping Plant intake (or at the head-end of the Clifton Court Forebay)

- Interconnection between Tracy Pumping Plant and Clifton Court Forebay

Storage

New storage would provide opportunities for enhanced timing and flow management to more effectively and efficiently satisfy urban, agricultural and environmental beneficial users. Additional study will be required to determine optimal storage sizes considering physical factors, hydrology and hydraulic constraints, economic allocation of costs, and assurances needed for successful long-term multi-benefit operations.

The first priority for development of surface storage will be to raise existing dams. Second priority will be to develop off-stream storage. The last priority will consider development of new on-stream storage. Groundwater storage development will be implemented with demonstration projects in partnership with local agencies with attention to groundwater levels, water quality, local economic impacts, and any other third party impacts.

A range of facility sizes will be evaluated up to:

- 3.0 MAF surface storage upstream of the Delta (enlargement of existing storage or new off-stream storage) on Sacramento River tributaries
- 500 TAF surface storage upstream of the Delta (enlargement of existing storage or new off-stream storage) on San Joaquin River tributaries
- 2.0 MAF surface storage off-aqueduct (south of Delta)
- 500 TAF groundwater storage in the Sacramento Valley
- 500 TAF groundwater storage in the San Joaquin Valley

Operating Parameters

Same as Alternative 2B.

ALTERNATIVE 3

C-001486

ALTERNATIVE 3
DUAL DELTA CONVEYANCE

This alternative adds an isolated facility to the through-Delta modifications of Alternative 2 which together combine with the common programs to move water through and around the Delta. Combinations of seven potential conveyance configurations and two new storage configurations differentiate the nine variations of this alternative

Common Programs[a]				Delta Configuration	Water Storage[b]
Ecosystem Restoration	Water Quality	Water Use Efficiency	Levee System Integrity	Through-Delta channel modifications vary from those primarily for water conveyance to those for water conveyance with extensive habitat restoration. Isolated facility varies from small (5000 cfs) to large (15,000 cfs).	Varies from no new storage to: 3.0 MAF Upstream (Sac) 500 TAF Upstream (SJ) 2.0 MAF Off-Aqueduct 200 TAF In-Delta 500 TAF Sac. Valley GW 500 TAF San Joaquin GW

[a]The common programs for each alternative include significant habitat improvements, improvements in water quality parameters of concern before they enter the waterways of the Bay-Delta system, policies for implementation of cost effective measures to improve water use efficiency, and levee improvements throughout the Delta.
[b]The numbers are not fixed, they are conceptual and representative of the range to be studied.

OVERVIEW

This alternative supplements **four common programs** of ecosystem restoration, water quality, water use efficiency, and levee system integrity with a series of **through-Delta channel improvements, CVP-SWP improvements, an isolated facility, and new water storage** to achieve Program goals and objectives. New surface storage upstream, in, and off-aqueduct, and south Delta and CVP-SWP improvements will provide greater flexibility in timing inflows to the Delta and withdrawals from the Delta. Upstream storage will be used for water supply, to help manage the timing of inflow to the Delta for environmental benefit, and for Delta outflow. Off-aqueduct storage, in conjunction with groundwater/conjunctive use, will be used to better manage the timing of Delta exports. Improved conveyance through the Delta and isolated conveyance around the Delta further enhance the system flexibility.

The common programs contribute in multiple complementary aspects toward achieving the CALFED mission and Program goals. As partially illustrated in the following descriptions of common programs in the introduction to this package:

Ecosystem Quality - *The goal for ecosystem quality 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.*

Water Quality - *The goal for water quality in the Bay-Delta system is to provide good water quality for all beneficial uses.*

Water Supply Reliability - *The goal for water supply reliability is to reduce the mismatch between Bay-Delta water supplies and current and projected beneficial uses dependent on the Bay-Delta system.*

System Vulnerability - *The goal for addressing Bay-Delta system vulnerability is to reduce the risk to land use and associated economic activities, water supply, infrastructure, and the ecosystem from catastrophic breaching of Delta levees.*

Program elements included in several Common and Variable Programs help achieve several of the above goals:

- Waterhsed Management
- Water Transfers
- Subsidence Reversal and Delta Habitat Restoration

The summary descriptions are discussed in the **Summary of Common Programs** section of this package. Detailed descriptions are given in **Appendices A thru F.**

ALTERNATIVE 3 VARIATION DESCRIPTIONS

This alternative supplements **four common programs** of ecosystem restoration, water quality, water use efficiency, and levee system integrity with a series of **through-Delta channel improvements, CVP-SWP improvements, an isolated facility, and new water storage** to achieve Program goals and objectives. Nine variations are considered for analysis. The modified conveyance would provide increased diversion capacity of existing export pumps up to their physical capacity for each variation of Alternative 3.

Alternative 3A

Alternative 3A combines and integrates the four common programs 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 (or at the head-end of Clifton Court Forebay), an intertie between the pumping plants, and operable barriers or equivalent in the south Delta. The alternative provides no new water storage. Figure 3A shows the Alternative 3A configuration.

Ecosystem Restoration Program

The Ecosystem Restoration Program Plan (ERPP) describes proposed ecosystem improvements throughout the Bay-Delta System, including:

- Habitat restoration of approximately 150,000 acres
- Changes in environmental water flows through operational adjustments
- Development of floodways and meander zones
- Fish passage improvements
- Fish screens installations
- Management of undesirable species
- Water quality improvements through implementation of the Water Quality Program

The ERPP is described in more detail in the Summary of Common Programs and the associated Appendix A. Alternative 3A would implement the entire ERPP with the following modifications:

- Changes in environmental water flows would be met through purchase of existing water from willing sellers.

- 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 the east levee along the South Fork Mokelumne River and protecting interior levee slopes.

Water Quality Program

The Water Quality Program focuses on source control and reducing the release of pollutants into the Bay-Delta system and its tributaries. The Water Quality Program recognizes that additional benefits can be obtained by treatment, timing release of remaining pollutant discharges and dilution strategies associated with other CALFED actions. The programmatic water quality actions can be summarized placed in four general categories.

- **Source control actions** reduce the total pollutant load entering the Delta.

- **Treatment actions** reduce the total pollutant load by removing pollutants in waste discharges to the Bay-Delta system or by reducing pollutants in water diverted from the Delta.

- **Management actions** to reduce the concentration of remaining pollutants.

- **Other actions** such as relocation of water supply intakes to avoid salts and organic carbon that reduce the ability to recycle water and that complicate disinfection and are sources of disinfection byproducts.

The Water Quality Program is described in more detail in the Summary of Common Programs and the associated Appendix B. The entire Water Quality Program would be implemented for Alternative 3A with the following addition:

- 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.

- Relocate Delta island drainage discharges away from the channels identified for conveyance modifications.

Water Use Efficiency Program

The Water Use Efficiency Program reflects California's well accepted public policy that places a strong emphasis on efficient use of developed water supplies. The CALFED water use efficiency program differs from other components of a Bay-Delta solution in two fundamental ways: it is more concerned with policy, not technical issues, and **most actions would be implemented by local agencies rather than CALFED agencies.**

The Water Use Efficiency Program is described in more detail in the Summary of Common Programs and the associated Appendix C. No changes in the Water Use Efficiency Program are needed to implement Alternative 3A.

Levee System Integrity Program

The Levee System Integrity Program focuses on nine approaches to improve the long-term structural integrity of the levee system in the Delta and in specific locations upstream:

- **Delta Levee Base Level of Funding Program** - provides equitably distributed funding to participating local agencies
- **Special Habitat Improvements and Levee Stabilization Program** - sets priorities and funding for special project improvements
- **Subsidence Control** - reverse effects of subsidence through shallow flooding and managed wetlands in key areas
- **Levee Associated Habitat** - incorporates habitat (identified in the ERPP) into levee improvements where feasible
- **Beneficial Reuse of Dredge Material** - uses dredged material to increase feasibility of levee improvements and habitat restoration
- **Delta Levee Emergency Response** - creates a plan to address developing levee problems to prevent failure
- **Delta Levee Seismic Susceptibility** - performs research and improvements to reduce seismic risk to levees
- **Delta In-Channel Islands** - restores in-channel islands for levee erosion control and provides opportunities for in-channel island habitat (identified in the ERPP)
- **Levee Associated Recreation** - enhances opportunities for in-Delta recreation

The Levee System Integrity Program is described in more detail in the Summary of Common Programs and the associated Appendix D. Alternative 3A would implement the entire Levee System Integrity Program with this modification:

- The program would be adjusted to accommodate the new setback levees for water conveyance along the North Fork Mokelumne River.

Conveyance

North Delta Channel Modifications would provide for widening the Mokelumne River channel to improve water conveyance and flood control in the northern Delta. These modifications include:

- Purchase of 600-foot wide alignment along Mokelumne River from I-5 to the San Joaquin River
- Replacement of existing levees on one side of the existing channel with new setback levees approximately 500 feet back from the existing channel
- Removal of existing levees where they obstruct the new channel and convert remaining portions into channel islands
- Relocation/replacement of existing improvements displaced by the widened channel

South Delta Modifications would provide for increasing diversion capacity of existing export pumps up to their physical capacity. These improvements include:

- A new Clifton Court Forebay intake structure
- Channel enlargement along a 4.9 mile reach in Old River
- Operable barrier or equivalent at the head of Old River to maintain a positive flow down the San Joaquin River.
- Flow and stage control structures on Middle River, Grant Line Canal, and Old River or other methods to control flow, stage, and south Delta salinity

CVP-SWP improvements provide for further improvements in operational flexibility. These improvements include:

- New fish screens at the Skinner Fish facility (or at the head of Clifton Court Forebay)
- New fish screens at the Tracy Pumping Plant intake (or at the head of Clifton Court Forebay)

- Interconnection between Tracy Pumping Plant and Clifton Court Forebay

The 5000 cfs **isolated facility** would provide for improved operational flexibility for use in conjunction with through-Delta improvements. The isolated facility includes:

- New screened intake at Hood (or alternatively at Freeport)
- Pumping plant to open channel
- 2000-foot wide alignment (which includes the channel and mitigation lands) from Hood to Clifton Court Forebay along the eastern side of the Delta
- 5000 cfs open channel from Hood (or alternatively Freeport) to Clifton Court Forebay with siphons under all major stream crossings
- Relocation/replacement of existing improvements displaced by the new facility

Storage

New water storage is not included in this alternative.

Operations

The basic operating assumptions for the initial study of this alternative are described in **Appendix E**-CALFED Benchmark Study. More detail is included in the Summary of Common Programs and the associated Appendix E. No changes in these assumptions are needed for Alternative 3A except as shown below. Some reoperation of system facilities will occur to accommodate the change in flow timing from the purchase of environmental flows from willing sellers.

Delta Standards with Isolated Conveyance

- Delta Cross Channel closed September through June, open July through August.
- Isolated facilities should be operated to maximize isolated conveyance year round, consistent with the need to meet south Delta water quality objectives. The minimum levels of monthly export flows taken through the south Delta export facilities are suggested as follows:

October-March	1,000 cfs
April-June	0 cfs
July-September	1,000 cfs

- Isolated Facilities will be studied using two separate levels of ecosystem protection:

-Existing Export/Inflow (E/I) ratio
-Isolated flow is assumed to be not included in both export and inflow in E/I ratio

Note: These operating parameters have been developed to provide a preliminary basis for conducting system and Delta model studies of CALFED alternatives. They do not reflect the culmination of the consensus process. A wide range of operating parameters will eventually be explored as part of the alternative evaluation process.

Facilities included in the Alternative configurations will be operated to provide multiple benefits for the environment, water supply reliability, and water quality improvement. Additional study will be required before CALFED can settle on the best operational mode considering the hydrology and hydraulic constraints, the size range of potential facilities, the economic allocation of costs, and the assurances needed for successful multi benefit operations.

Alternative 3B

Alternative 3B combines and integrates the four common programs 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. Figure 3B shows the Alternative 3B configuration.

Ecosystem Restoration Program Plan

The ERPP is described in detail in the Summary of Common Programs and the associated Appendix A. Alternative 3B would implement the entire ERPP with these modifications:

- 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 the east levee along the South Fork Mokelumne River and protecting interior levee slopes.

Water Quality Program

Same as Alternative 3A.

Water Use Efficiency Program

Same as Alternative 3A.

Levee System Integrity Program

Same as Alternative 3A.

Conveyance

Conveyance modifications are the same as those included with Alternative 3A except that spur conveyance links to the Bay Area and areas east of the Delta will be studied.

Storage

New storage would provide opportunities for enhanced timing and flow management to more effectively and efficiently satisfy urban, agricultural and environmental beneficial users. Additional study will be required to determine optimal storage sizes considering physical factors, hydrology and hydraulic constraints, economic allocation of costs, and assurances needed for successful long-term multi benefit operations.

The first priority for development of surface storage will be to raise existing dams. The second priority will be to develop off-stream storage. The last priority will consider development of new on-stream storage. Groundwater storage development will be implemented with demonstration projects in partnership with local agencies with attention to groundwater levels, water quality, local economic impacts, and any other third party impacts.

A range of facility sizes will be evaluated up to:

- 3.0 MAF surface storage upstream of the Delta (enlargement of existing storage or new off-stream storage) on Sacramento River tributaries
- 500 TAF surface storage upstream of the Delta (enlargement of existing storage or new off-stream storage) on San Joaquin River tributaries
- 2.0 MAF surface storage off-aqueduct (South of Delta)
- 200 TAF in-Delta storage
- 500 TAF groundwater storage in the Sacramento Valley
- 500 TAF groundwater storage in the San Joaquin Valley

Operations

The basic operating assumptions for the initial study of this alternative are described in **Appendix E**-CALFED Benchmark Study. More detail is included in the Summary of Common Programs and the associated Appendix E. These are supplemented by the following for Alternative 3B:

Surface and Groundwater Storage Components

- All new surface storage facilities will be operated primarily to maximize average annual deliveries to meet all beneficial uses.

- All new groundwater and conjunctive use facilities will be primarily operated to maximize average dry year deliveries to meet all beneficial uses.

- Filling of and discharging from new storage will be made with the following priorities (*The following will be modified as necessary for consistency with local water management practices and water rights*):
  - Tributary groundwater storage facilities have first priority for filling and last priority for discharging from storage (withdrawals from groundwater basins will only be made in dry and critical years).
  - Aqueduct groundwater storage facilities have second priority for filling and fourth priority for discharging from storage.
  - Aqueduct surface storage facilities have third priority for filling and third priority for discharging from storage.
  - Tributary surface storage facilities have fourth priority for filling and second priority for discharging from storage.
  - Delta storage facilities have fifth priority for filling and first priority for discharging from storage.

- The total volume of all new storage is assumed to be split evenly among the "three beneficial use sectors", such that we have 1/3 for environmental purposes, 1/3 for urban purposes, and 1/3 for agricultural purposes.

- For 500 TAF of groundwater storage, diversion capacity is 500 cfs. Discharge capacity is 500 cfs. Flow event targets as specified for surface storage are not applicable for diversions to groundwater storage.

Tributary Storage (Sacramento River System) diversions to storage

- All instream flow requirements must be met before diversions to new storage are allowed.

- Assumed diversion and discharge capacity for off-stream storage is 5,000 cfs.

- For new diversion points between Keswick and Chico Landing, no new diversions are allowed in any given water year until a 60,000 cfs mean daily flow event that preserves the river's natural fluvial geomorphology process has occurred at Chico Landing. (Future study will be conducted to determine the actual flow needed). For the monthly time step used in modeling, a corresponding monthly volume of 1.5 million acre feet has been used as a surrogate.

- For new diversion points at and downstream of Chico Landing, no flow event target is proposed.

Tributary Storage (San Joaquin River System) diversions to storage

- All in-stream flow requirements must be met before diversions to new storage are allowed

- Assumed diversion and discharge capacity for off-stream storage is 5,000 cfs.

- New storage is assumed to be diverted from existing canal diversion locations or assumed to be an increase of existing on-stream storage. No flow event targets set.

Aqueduct Storage

- New storage is assumed to be connected to the California Aqueduct with 3,500 cfs diversion and discharge capacity.

In-Delta Storage

- Assumed diversion and discharge capacity for in-Delta storage is 5,000 cfs

Instream Flow Targets

- ERPP in-stream flow targets are to be met through purchase of existing water and use of new storage allocated to environmental water supplies.

Delta Standards with Isolated Conveyance

- Delta Cross Channel closed September through June, open July through August.

- Isolated facilities should be operated to maximize isolated conveyance year round, consistent with the need to meet south Delta water quality objectives. The minimum levels of monthly export flows taken through the south Delta export facilities are suggested as follows:

October-March	1,000 cfs
April-June	0 cfs
July-September	1,000 cfs

- Isolated Facilities will be studied using two separate levels of ecosystem protection:
  -Existing Export/Inflow (E/I) ratio
  -Isolated flow is assumed to be not included in both export and inflow in E/I ratio

Note: These operating parameters have been developed to provide a preliminary basis for conducting system and Delta model studies of CALFED alternatives. They do not reflect the culmination of the consensus process. A wide range of operating parameters will eventually be explored as part of the alternative evaluation process.

Facilities included in the Alternative configurations will be operated to provide multiple benefits for the environment, water supply reliability, and water quality improvement. Additional study will be required before CALFED can settle on the best operational mode considering the hydrology and hydraulic constraints, the size range of potential facilities, the economic allocation of costs, and the assurances needed for successful multi benefit operations.

Alternative 3C

Alternative 3C combines and integrates the four common programs 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 (or at the head-end of Clifton Court Forebay), 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.** Figure 3C shows the Alternative 3C configuration.

Ecosystem Restoration Program Plan

Same as Alternative 3A.

Water Quality Program

Same as Alternative 3A.

Water Use Efficiency Program

Same as Alternative 3A.

Levee System Integrity Program

Same as Alternative 3A.

Conveyance

Conveyance modifications are the same as Alternative 3A except:

The 5000 cfs **isolated facility** would provide for improved operational flexibility for use in conjunction with the through-Delta improvements. The isolated facility includes:

- New screened intake at Hood (or alternatively at Freeport)
- Pumping plant to open channel
- 45 miles of three 18-foot diameter cast-in-place pipe (5000 cfs) from Hood (or alternatively at Freeport) to Clifton Court Forebay along the eastern side of the Delta with siphons under Stone Lake, Mokelumne River, Beaver Slough, Hog Slough, Sycamore Slough, Disappointment Slough, San Joaquin River, and Middle River.
- Relocation/replacement of existing improvements displaced by the new facility
- Spur conveyance links to Bay Area and areas east of the Delta

Storage

No new water storage is included with this alternative.

Operations

Same as Alternative 3A.

Alternative 3D

Alternative 3D combines and integrates the four common programs with North and South Delta channel modifications designed for water conveyance, a small (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.** Figure 3D shows the Alternative 3D configuration.

Ecosystem Restoration Program Plan

Same as Alternative 3B.

Water Quality Program

Same as Alternative 3B.

Water Use Efficiency Program

Same as Alternative 3B.

Levee System Integrity Program

Same as Alternative 3B.

Conveyance

Conveyance modifications are the same as those included with Alternative 3C.

Storage

Same as Alternative 3B.

Operations

Same as Alternative 3B.

Alternative 3E

Alternative 3E combines and integrates the four common programs 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 the head of Old River. Figure 3E shows the Alternative 3E configuration.

Ecosystem Restoration Program Plan

Same as Alternative 3B.

Water Quality Program

The Water Quality Program is described in detail in the Summary of Common Programs and the associated Appendix B. The entire Water Quality Program would be implemented for Alternative 3E with the following additions:

- 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 deal with Delta island drainage (TOC control) would not be needed with this alternative.

Water Use Efficiency Program

Same as Alternative 3A.

Levee System Integrity Program

Same as Alternative 3A.

Conveyance

North Delta Channel Modifications would provide for widening the Mokelumne River channel to improve water conveyance and flood control in the northern Delta. These modifications include:

- Purchase of 600-foot wide alignment along Mokelumne River from I-5 to the San Joaquin River

- Replacement of existing levees on one side of the existing channel with new setback levees approximately 500 feet back from the existing channel

- Removal of existing levees where they obstruct the new channel and convert remaining portions into channel islands

- Relocation/replacement of existing improvements displaced by the widened channel

South Delta Modifications would provide for increasing the permitted capacity of existing export pumps up to their physical capacity. These improvements include:

- A new Clifton Court Forebay intake structure

- Operable barrier or equivalent at the head of Old River to maintain a positive flow down the San Joaquin River. Downstream flow/stage control structures would not be constructed.

CVP-SWP improvements provide for further improvements in operational flexibility. These improvements include:

- New fish screens at the Skinner Fish facility (or at the head of Clifton Court Forebay)
- New fish screens at the Tracy Pumping Plant intake (or at the head of Clifton Court Forebay)
- Interconnection between Tracy Pumping Plant and Clifton Court Forebay

15,000 cfs isolated facility would provide for improved operational flexibility for use in conjunction with the through-Delta improvements. The isolated facility includes:

- New screened intake at Hood
- Pumping plant to open channel
- 2000-foot wide alignment from Hood to Clifton Court Forebay along the eastern side of the Delta
- 15,000 cfs open channel from Hood to Clifton Court Forebay with siphons under all major stream crossings
- Relocation/replacement of existing improvements displaced by the new facility

Storage

Same as Alternative 3B.

Operations

Same as Alternative 3B.

Alternative 3F

Alternative 3F combines and integrates the four common programs 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 eight lakes, created by flooding Delta islands, would

convey water via siphons and pumps beneath Delta channels. Figure 3F shows the Alternative 3F configuration.

Ecosystem Restoration Program Plan

Same as Alternative 3B.

Water Quality Program

The Water Quality Program is described in detail in the Summary of Common Programs and the associated Appendix B. The entire Water Quality Program would be implemented for Alternative 3E with the following additions:

- 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 deal with Delta island drainage (TOC control) would not be needed with this alternative.

Water Use Efficiency Program

Same as Alternative 3A.

Levee System Integrity Program

The Levee System Integrity Program is described in more detail in the Summary of Common Programs and the associated Appendix D. Alternative 3F would implement the entire Levee System Integrity Program with these modifications:

- The program would be adjusted to accommodate the new setback levees for water conveyance along the North Fork Mokelumne River.

- The program would be adjusted to accommodate the levees surrounding the lakes (flooded islands) which would now have varying water levels on both sides of the levees.

Conveyance

10,000 cfs intake at the Delta Cross channel combined with **5,000 cfs** from distributed pumps along the isolated storage and conveyance facility would provide for improved operational flexibility. A connected chain of up to 8 lakes, created by flooding Delta islands, would convey water via siphons and pumps beneath Delta channels to Clifton Court Forebay.

Intake facilities include:

- Enlarged Delta Cross Channel
- New gates north of existing gates and supplemental intake and transition channel
- Delta Cross Channel Fish Screen
- New low lift pump station downstream of fish screens
- Distributed pump stations with cylindrical fish screens to facilitate filling islands from adjacent channel and returning flow form storage along storage and conveyance route

Isolated island conveyance facilities include:

- Convert all or a major portion of Tyler, Bouldin, Venice, Mandeville, Bacon, Woodward, and Victoria Islands to storage and conveyance facilities.
- Rip-rap interior slopes of levees to protect against wave wash and strengthen levees as required
- New bridges across isolated channels
- Low lift pump stations and siphons under river and slough crossings
- Seepage interception wells (if needed) along channels adjacent to islands and tracts devoted to isolated conveyance
- Elevated embankment roadways and bridges for Highway 4 across Victoria Island and Highway 12 across Bouldin Island

North Delta Channel Modifications would provide for widening the Mokelumne River channel to improve water conveyance and flood control in the northern Delta. These modifications include:

- Purchase of 600-foot wide alignment along Mokelumne River from I-5 to the San Joaquin River
- Replacement of existing levees on one side of the existing channel with new setback levees approximately 500 feet back from the existing channel
- Removal of existing levees where they obstruct the new channel and convert remaining portions into channel islands
- Relocation/replacement of existing improvements displaced by the widened channel

South Delta Modifications would provide for increasing diversion capacity of existing export pumps up to their physical capacity. These improvements include:

- Operable barrier or equivalent at the head of Old River to maintain a positive flow down the San Joaquin River. Downstream flow/stage control structures would not be constructed.

CVP-SWP improvements provide for further improvements in operational flexibility. These improvements include:

- New fish screens at the Skinner Fish facility (or at the head of Clifton Court Forebay)
- New fish screens at the Tracy Pumping Plant intake (or at the head of Clifton Court Forebay)
- Interconnection between Tracy Pumping Plant and Clifton Court Forebay

Storage

The storage in the chain-of-lakes will would provide for improved operational flexibility.

Other **New storage** would provide opportunities for enhanced timing and flow management to more effectively and efficiently satisfy urban, agricultural and environmental beneficial users. Additional study will be required to determine optimal storage sizes considering physical factors, hydrology and hydraulic constraints, economic allocation of costs, and assurances needed for successful long-term multi benefit operations.

The first priority for development of surface storage will be to raise existing dams. Second priority will be to develop off-stream storage. The last priority will consider development of new on-stream storage. Groundwater storage development will be implemented with demonstration projects in partnership with local agencies with attention to groundwater levels, water quality, local economic impacts, and any other third party impacts.

A range of facility sizes will be evaluated up to:

- 3.0 MAF surface storage upstream of the Delta (enlargement of existing storage or new off-stream storage) on Sacramento River tributaries
- 500 TAF surface storage upstream of the Delta (enlargement of existing storage or new off-stream storage) on San Joaquin River tributaries
- 2.0 MAF surface storage off-aqueduct (South of Delta)
- 500 TAF groundwater storage in the Sacramento Valley
- 500 TAF groundwater storage in the San Joaquin Valley

Operations

Same as Alternative 3B.

Alternative 3G

Alternative 3G combines and integrates the four common programs with North and South Delta channel modifications designed for water conveyance with a 5,000 cfs Deep Water Ship Channel, a western Delta conveyance tunnel and channel, and surface and groundwater storage. Figure 3G shows the Alternative 3G configuration.

Ecosystem Restoration Program Plan

Same as Alternative 3B.

Water Quality Program

Same as Alternative 3A.

Water Use Efficiency Program

Same as Alternative 3A.

Levee System Integrity Program

Same as Alternative 3A.

Conveyance

North Delta Channel Modifications would provide for widening the Mokelumne River channel to improve water conveyance and flood control in the northern Delta. These modifications include:

- Purchase of 600-foot wide alignment along Mokelumne River from I-5 to the San Joaquin River
- Replacement of existing levees on one side of the existing channel with new setback levees approximately 500 feet back from the existing channel
- Removal of existing levees where they obstruct the new channel and convert remaining portions into channel islands
- Relocation/replacement of existing improvements displaced by the widened channel

South Delta Modifications would provide for increasing diversion capacity of existing export pumps up to their physical capacity. These improvements include:

- A new Clifton Court Forebay intake structure
- Channel enlargement along a 4.9 mile reach in Old River
- Operable barrier or equivalent at the head of Old River to maintain a positive flow down the San Joaquin River.
- Flow and stage control structures on Middle River, Grant Line Canal, and Old River or other methods to control flow, stage, and south Delta salinity

CVP-SWP improvements provide for further improvements in operational flexibility. These improvements include:

- New fish screens at the Skinner Fish facility (or at the head of Clifton Court Forebay)
- New fish screens at the Tracy Pumping Plant intake (or at the head of Clifton Court Forebay)
- Interconnection between Tracy Pumping Plant and Clifton Court Forebay

The 5000 cfs **isolated facility** would provide for improved operational flexibility for use in conjunction with through-Delta improvements. The isolated facility includes:

- New screened intake in Deep Water Ship Channel at Sacramento River near Sacramento
- Ship Channel Closure and Pumps
  -Sub-Component 1: Close Port of Sacramento, build rock dam at mouth of ship channel, near mile 18.7
  -Sub-Component 2: Large boat traffic continues, build Lock at mile 19
- Unscreened pumping plant at mile 18.7
- Siphon under Cache Slough
- Pipeline to Sacramento River downstream of Rio Vista, siphon under Sacramento and San Joaquin River with terminus structure at Brentwood
- Open channel from Brentwood to Clifton Court Forebay

Storage

New storage would provide opportunities for enhanced timing and flow management to more effectively and efficiently satisfy urban, agricultural and environmental beneficial users. Additional study will be required to determine optimal storage sizes considering physical factors, hydrology and hydraulic constraints, economic allocation of costs, and assurances needed for successful long-term multi benefit operations.

The first priority for development of surface storage will be to raise existing dams. Second priority will be to develop off-stream storage. The last priority will consider development of new on-stream storage. Groundwater storage development will be implemented with demonstration projects in partnership with local agencies with attention to groundwater levels, water quality, local economic impacts, and any other third party impacts.

A range of facility sizes will be evaluated up to:

- 3.0 MAF surface storage upstream of the Delta (enlargement of existing storage or new off-stream storage) on Sacramento River tributaries
- 500 TAF surface storage upstream of the Delta (enlargement of existing storage or new off-stream storage) on San Joaquin River tributaries
- 2.0 MAF surface storage off-aqueduct (South of Delta)
- 200 TAF in-Delta storage
- 500 TAF groundwater storage in the Sacramento Valley
- 500 TAF groundwater storage in the San Joaquin Valley

Operations

Same as Alternative 3B.

Alternative 3H

Alternative 3H combines and integrates the four common programs with modified conveyance in the north and south Delta designed for water conveyance and significant habitat restoration with a small (5,000 cfs) isolated facility constructed as an open channel, and surface and groundwater storage. Figure 3H shows the Alternative 3H configuration.

Ecosystem Restoration Program

The ERPP is described in detail in the Summary of Common Programs and the associated Appendix A. Alternative 3H would implement the entire ERPP with these modifications:

- 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 and Tyler Island to aquatic habitat, and construction of the East Delta Wetlands Habitat with about 10,000 to 20,000 acres more habitat than identified in the ERPP.
- Incorporate a portion of identified south Delta habitat with the setback levees along Old River.

Water Quality Program

Same as Alternative 3A.

Water Use Efficiency Program

Same as Alternative 3A.

Levee System Integrity Program

The Levee System Integrity Program is described in detail in the Summary of Common Programs and the associated Appendix D. Alternative 3H would implement the entire Levee System Integrity Program with these modifications:

- The program would be adjusted to accommodate the new setback levees and the flooding of McCormack Williamson Tract, Bouldin Island, Tyler Island, and tracts along the eastern side of the South Fork Mokelumne River.

Conveyance

Tyler Island Aquatic Habitat provides habitat and flow control into the central Delta. Modifications include:

- Setback levee, 500 feet west of Georgiana Slough, from the Sacramento River to weir intake into the central Delta.
- Construct 600-foot wide inflatable rubber dam to control weir elevation to control water flow.

- Construct channel section control in Georgiana Slough to prevent accelerated erosion of channel bottom; armoring with rip-rap or gabion baskets.

- Breach 2000-foot section of Tyler Island levee on northeast side of island.

- Rip-rap all remaining interior levee slopes

Mokelumne River Floodway and **East Delta Wetlands Habitat** (channel modifications along the South Fork Mokelumne River) provide for conveyance and significant expansion of habitat. These modifications include:

- Breach McCormack Williamson Tract levee to flood island for shallow water habitat and water conveyance.

- Setback levees on New Hope Tract about 2000 feet east of existing alignment from Mokelumne River to Beaver Slough.

- Removal of segments of the eastern levee along South Fork Mokelumne River to provide new flooded habitat (such as Canal Ranch and Brack Tracts)(Protect interior levee slopes).

- Setback levees on Terminous Tract about 2000 feet east of existing alignment.

- Setback levees on Staten Island, south of Sycamore Slough, about 4000 feet west of existing alignment.

- Remove portions of Bouldin Island levee to flood the island for conveyance and habitat. Protect interior levee slopes.

South Delta Habitat Modifications would provide new habitat and allow increasing diversion capacity of existing export pumps up to their physical capacity. These improvements include:

- Setback levees along Old River from Rock Slough to Clifton Court Forebay to create approximately 3000 foot-wide channel for conveyance and habitat.

- A new Clifton Court Forebay intake structure

- Operable barrier or equivalent at the head of Old River to maintain a positive flow down the San Joaquin River. Downstream flow/stage control structures would not be constructed.

CVP-SWP improvements provide for further improvements in operational flexibility. These improvements include:

- New fish screens at the Skinner Fish facility (or at the head of Clifton Court Forebay)
- New fish screens at the Tracy Pumping Plant intake (or at the head of Clifton Court Forebay)
- Interconnection between Tracy Pumping Plant and Clifton Court Forebay

The 5000 cfs **isolated facility** would provide for improved operational flexibility for use in conjunction with through-Delta improvements. The isolated facility includes:

- New screened intake at Hood (or alternatively at Freeport)
- Pumping plant to open channel
- 2000-foot wide alignment (which includes the channel and mitigation lands) from Hood to Clifton Court Forebay along the eastern side of the Delta
- 5000 cfs open channel from Hood (or alternatively Freeport) to Clifton Court Forebay with siphons under all major stream crossings
- Relocation/replacement of existing improvements displaced by the new facility

Storage

New storage would provide opportunities for enhanced timing and flow management to more effectively and efficiently satisfy urban, agricultural and environmental beneficial users. Additional study will be required to determine optimal storage sizes considering physical factors, hydrology and hydraulic constraints, economic allocation of costs, and assurances needed for successful long-term multi benefit operations.

The first priority for development of surface storage will be to raise existing dams. Second priority will be to develop off-stream storage. The last priority will consider development of new on-stream storage. Groundwater storage development will be implemented with demonstration projects in partnership with local agencies with attention to groundwater levels, water quality, local economic impacts, and any other third party impacts.

A range of facility sizes will be evaluated up to:

- 3.0 MAF surface storage upstream of the Delta (enlargement of existing storage or new off-stream storage) on Sacramento River tributaries
- 500 TAF surface storage upstream of the Delta (enlargement of existing storage or new off-stream storage) on San Joaquin River tributaries

- 2.0 MAF surface storage off-aqueduct (South of Delta)
- 500 TAF groundwater storage in the Sacramento Valley
- 500 TAF groundwater storage in the San Joaquin Valley

Operations

Same as Alternative 3B.

Alternative 3I

Alternative 3I combines and integrates the four common programs 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. A 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 (or at the head-end of Clifton Court Forebay), and an intertie between the pumping plants. This Alternative is similar to Alternative 2C with one diversion extended to the Sacramento River Hood. Figure 3I shows the Alternative 3I configuration.

Ecosystem Restoration Program

The ERPP is described in detail in the Summary of Common Programs and the associated Appendix A. Alternative 3I would implement the entire ERPP with these modifications:

- Changes in environmental water flows would be met through purchase of existing water from willing sellers.
- 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.
- Habitat restoration identified for the south Delta area near the new diversion locations would be relocated to the northern and western Delta.

Water Quality Program

Same as Alternative 3A.

Water Use Efficiency Program

Same as Alternative 3A.

Levee System Integrity Program

The Levee System Integrity Program is described in detail in the Summary of Common Programs and the associated Appendix D. Alternative 3I would implement the entire Levee System Integrity Program with these modifications:

- The program would be modified to accommodate the isolated channels, and associated levees, leading from the new diversion locations to Clifton Court Forebay.
- Levees selected for breaching, and the associated flooded land, along the eastern side of the South Fork Mokelumne River would not be improved to reduce flood risk.

Conveyance

Three isolated conveyance channels would convey water to Clifton Court Forebay and the Tracy Pumps from two locations on the San Joaquin River and one on Old River near Franks track. The **New Diversion Locations** would provide the flexibility to divert water from different parts of the Delta depending on need and operating criteria at the time.

Western 15,000 cfs isolated south Delta Intake would include:

- Intake on Holland Track near the south side of Franks Tract.
- Setback levee, approximately 500-feet from channel, along western side of Old River.
- Isolated conveyance parallel to Old River and connected to Clifton Court Forebay. The conveyance could serve water users along the alignment.
- Isolated conveyance connected to new in-Delta storage on Holland Track. The intake would be constructed to allow diversion out of the storage (may require pumps) or directly out of the Delta channel.
- Relocation/replacement of existing improvements displaced by the new facility.

Northern 15,000 cfs Isolated South Delta Intake would include:

- Intake from San Joaquin River at northern end of Lower Roberts Island.
- Isolated conveyance to Clifton Court Forebay. The conveyance could serve water users along the alignment.
- Relocation/replacement of existing improvements displaced by the new facility.

Northern 15,000 cfs Isolated Sacramento River Intake would include:

- Screened Intake from Sacramento River at Hood
- Isolated conveyance with siphons under all major stream crossings to the Diversion on the San Joaquin River.
- Siphon under the San Joaquin River
- Relocation/replacement of existing improvements displaced by the new facility.

Eastern 5,000 cfs Isolated South Delta Intake would include:

- Intake from San Joaquin River at southern end of Upper Roberts Island.
- Isolated conveyance to Clifton Court Forebay. The conveyance could serve water users along the alignment.
- Relocation/replacement of existing improvements displaced by the new facility.

South Delta Modifications would provide for increasing the diversion capacity of existing export pumps up to their physical capacity. These modifications include:

- A new Clifton Court Forebay intake structure.

CVP-SWP improvements provide for further improvements in operational flexibility. These improvements include:

- New fish screens at the Skinner Fish facility (or at the head of Clifton Court Forebay)
- New fish screens at the Tracy Pumping Plant intake (or at the head of Clifton Court Forebay)
- Interconnection between Tracy Pumping Plant and Clifton Court Forebay

Storage

New **in-Delta storage** (50,000 to 100,000 acre-feet) on Holland Tract would be connected to the Western 15,000 cfs isolated south Delta Intake.

Other **New storage** would provide opportunities for enhanced timing and flow management to more effectively and efficiently satisfy urban, agricultural and environmental beneficial users. Additional study will be required to determine optimal storage sizes considering physical factors,

hydrology and hydraulic constraints, economic allocation of costs, and assurances needed for successful long-term multi benefit operations.

The first priority for development of surface storage will be to raise existing dams. Second priority will be to develop off-stream storage. The last priority will consider development of new on-stream storage. Groundwater storage development will be implemented with demonstration projects in partnership with local agencies with attention to groundwater levels, water quality, local economic impacts, and any other third party impacts.

A range of facility sizes will be evaluated up to:

- 3.0 MAF surface storage upstream of the Delta (enlargement of existing storage or new off-stream storage) on Sacramento River tributaries
- 500 TAF surface storage upstream of the Delta (enlargement of existing storage or new off-stream storage) on San Joaquin River tributaries
- 2.0 MAF surface storage off-aqueduct (South of Delta)
- 500 TAF groundwater storage in the Sacramento Valley
- 500 TAF groundwater storage in the San Joaquin Valley

Operations

Same as Alternative 3B.