Appendix A

South Delta Improvements Program Alternatives Development and Screening

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Acronyms and Abbreviations

Bay-Delta	San Francisco Bay/Sacramento–San Joaquin River Delta
CALFED	CALFED Bay-Delta Program
CCF	Clifton Court Forebay
CCTAT	Clifton Court Technical Advisory Team
cfs	cubic feet per second
Corps	U.S. Army Corps of Engineers
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CWA	federal Clean Water Act
D-1641	State Water Board Decision 1641
Delta	Sacramento–San Joaquin River Delta
DFG	California Department of Fish and Game
DWR	California Department of Water Resources
E/I	export/inflow
ESA	federal Endangered Species Act
EWA	Environmental Water Account
JPOD	joint point of diversion
msl	mean sea level
NOAA Fisheries	National Marine Fisheries Service
Reclamation	U.S. Department of Interior, Bureau of Reclamation
ROD	Record of Decision
RWQCB	Regional Water Quality Control Board
SDIP	South Delta Improvements Program
SDWA	South Delta Water Agency
SR	State Route
State Water Board	State Water Resources Control Board
SWP	State Water Project
SWP Banks facility	State Water Project Harvey O. Banks facility
taf	thousand acre-feet
TBP	Temporary Barriers Project
TDS	total dissolved solids
USFWS	U.S. Fish and Wildlife Service
VAMP	Vernalis Adaptive Management Plan

Appendix A

South Delta Improvements Program Alternatives Development and Screening

Introduction

The California Department of Water Resources (DWR) and the U.S. Department of Interior, Bureau of Reclamation (Reclamation) have agreed to jointly pursue the development of the South Delta Improvements Program (SDIP). The SDIP is being pursued to address the needs of the aquatic environment, as well as regional and local water supply needs. DWR and Reclamation are proposing the SDIP to meet this basic purpose and need set forth below. This report summarizes the alternatives development and screening process for the SDIP.

Need for Action

DWR and Reclamation have identified three needs for the proposed action:

- *Reduce movement of fish into south Delta.* The operations of the State Water Project (SWP) and Central Valley Project (CVP) export facilities in the south Sacramento–San Joaquin River Delta (Delta) can change flow patterns in local channels. This can cause migrating juvenile San Joaquin River watershed fall-/late fall–run Chinook salmon, a candidate for listing under the federal Endangered Species Act (ESA), to move into the south Delta from the San Joaquin River, primarily through Old River. This can lead to fish mortality increases due to predators and higher levels of exposure to export facilities and agricultural diversions. Survival of juvenile fall- and late fall–run Chinook salmon may be increased by keeping them in the main channels of the San Joaquin River until they reach the central Delta and eventually the Pacific Ocean.
- *Maintain adequate water quality and quantity for south Delta water users.* Local south Delta water users downstream of the head of Old River are affected by water quality and water levels at each intake location. These conditions are influenced by many factors, one of which is diversions in the south Delta by the SWP and CVP.

- *Increase exports to south-of-Delta contractors.* There are unmet water supply needs, with respect to quantity and reliability, south of the Delta for agriculture, municipal and industrial, and environmental uses.

Objectives Used For Screening

Based on the project needs described above, DWR and Reclamation used broad objectives to ensure that all possible single-component/single-objective alternatives were considered in the screening process. The objectives used for screening are:

- minimize the loss of San Joaquin River salmon as a result of operation of the SWP and CVP export facilities;
- improve the reliability of the South Delta Water Agency (SDWA) to divert water needed to meet consumptive use needs within its boundaries by maintaining adequate water quality and quantity; and
- increase water supply to SWP and CVP water contractors through increased diversions into Clifton Court Forebay (CCF) and maximize the frequency of 8,500 cubic feet per second (cfs) pumping at the SWP Harvey O. Banks facility (SWP Banks facility).

The objectives used for screening vary slightly from the actual project objectives described in the environmental impact statement/environmental impact report (EIS/EIR) because as the project was developed, the objectives became more specific to the project need. The EIS/EIR project objectives are:

- reduce the movement of San Joaquin River watershed Central Valley fall-/late fall–run juvenile Chinook salmon into the south Delta via Old River;
- maintain adequate water levels and, through improved circulation, water quality available for agricultural diversions in the south Delta, downstream of the head of Old River; and
- increase water deliveries and delivery reliability to SWP and CVP water contractors south of the Delta and provide opportunities to convey water for fish and wildlife purposes by increasing the maximum permitted level of diversion through the existing intake gates at CCF to 8,500 cfs.

Summary of SDIP Proposed Project Alternatives

The SDIP alternatives consist of one or more of the following elements:

- increasing the maximum allowable diversion at CCF to 8,500 cfs;
- dredging portions of West Canal, Middle River, and Old River to improve conveyance capability during periods of high SWP and CVP Delta exports;

- constructing permanent operable barriers to improve water supply reliability and water quality in the south Delta;
- dredging local channels to reduce the frequency of barrier operations and to accommodate improvements to existing agricultural diversions (extending intakes); and
- constructing a permanent operable fish control structure at the head of Old River to reduce fish losses at the CVP and SWP export facilities.

For purposes of the development of alternatives and the impact analysis, the elements of the SDIP that will be combined into alternatives can be divided into two categories: physical/structural component and operational component. The physical/structural component is the gates (including temporary construction staging areas and operation of the gates), dredging of channels (including the placement of dredged material), and extension of agricultural diversions. The operational component is associated with the timing and volume of diversions occurring at the SWP and CVP facilities.

Screening Methodology and Criteria

The SDIP alternatives analysis was conducted in four phases: project objective screening; technology, logistics and compatibility screening; cost screening; and environmental impact screening. Figure A-1 summarizes the screening results. Four categories of alternatives are described below: No Action, Export-Related, Local-Related, and Fish-Related.

First-Phase Evaluation

In the first phase, which occurred at the beginning of project planning, the DWR assembled single-component alternatives based on their potential to meet one (or more) project objective (i.e., export, local, or fish). These alternatives were developed from a series of interagency meetings that DWR and Reclamation held during 2001 with the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NOAA Fisheries), California Department of Fish and Game (DFG), and the U.S. Army Corps of Engineers (Corps). At these meetings, the agencies discussed and commented on the SDIP.

The first phase separated the alternatives into three single-component and single-objective groups—export-, local-, and fish-related alternatives. These groups of single-component/single-objective alternatives were then evaluated for their ability to meet the relevant project objective, i.e., export alternatives/export objective. The ability of each alternative to satisfy the relevant project purpose was considered only on a general or reconnaissance level. The first-phase screening eliminated those alternatives that could not meet a remedial level of screening based on the project objectives.

Second-Phase Evaluation

The second phase involved screening the single-component/single-objective alternatives for feasibility based on existing technology, logistics, and compatibility with the other project objectives. In the second phase, the alternatives carried forward from the first phase evaluation were analyzed in greater detail. Each screening criterion was rigorously applied to each alternative to identify practicable alternatives to achieve the project purpose. The second phase defined those potentially practicable alternatives that required detailed study for comparison of environmental and cost considerations. Based on the more detailed information, those alternatives that were determined to be infeasible due to existing technology, logistical considerations, and/or incompatibility with the other project objectives were eliminated.

Third-Phase Evaluation

In the third phase, all feasible single-component/single-objective alternatives that were retained after second-phase screening were examined in detail and screened for feasibility based on cost. The alternatives that were not precluded from further analysis (based on the other screening criteria) were compared by their estimated costs in the third phase screening. This economic criterion focused on identifying the alternative that would best satisfy most of the basic project objectives at the most reasonable cost.

Fourth-Phase Evaluation

The fourth phase consisted of detailed analysis that is part of the environmental impact evaluations necessary for the EIS/EIR. Detailed environmental impact assessments focusing on environmental issues, including aquatic ecosystem impacts, were conducted for the comprehensive project alternatives. In addition, this screening phase identified the least environmentally damaging alternative, subject to 40 Code of Federal Regulations (CFR), Part 230, Sections 230.10(b), (c), and (d).

Practicability Analysis of South Delta Improvements Program Alternatives

The following sections of this report discuss the screening of alternatives for the SDIP for inclusion in the EIS/EIR.

First-Phase Screening of Alternatives

The purpose of the first-phase screening is to evaluate all the single-component/single-objective alternatives that have been identified as possibly meeting at least one of the project objectives. They have been developed/identified as single-component and single-objective alternatives with the understanding that multiple single-objective/component alternatives will be linked together to form comprehensive project alternatives (meeting most or all of the project objectives) in the fourth-phase screening process. The first-phase screening evaluates whether the identified single-component/single-objective alternatives are feasible based on whether they meet the applicable project objective. Each applicable project objective used for screening purposes is identified at the beginning of each of the single-objective sections below.

Fish Objective Alternatives

The fish objective used to screen these alternatives is:

- Minimize the loss of San Joaquin River salmon as a result of operation of the SWP and CVP export facilities.

Six alternatives with the potential to meet the project's fish objective have been reviewed. These alternatives include:

- screening CCF intake,
- fish control structure at the head of Old River,
- screening agricultural diversions,
- other conceptual south Delta fish facilities,
- acoustic fish barrier, and
- reduction of CVP and SWP exports.

Those alternatives meeting the criteria of the fish objective are retained for further consideration; those not meeting the criteria have been removed from further consideration.

Fish Objective Alternatives Retained for Further Consideration

The following fish objective alternatives would meet or contribute substantially to meeting the fish objective and are therefore retained for further consideration.

Screening Clifton Court Forebay Intake

This alternative would place operable fish screens in front of the existing intake to CCF. These screens would meet current requirements for approach velocity

(perpendicular to the screen) and sweeping velocity (parallel to the screen). Fish would be bypassed from the screens into a fish handling facility where they would be separated and prepared for transportation back into other areas of the Delta for release. Removing fish at this location would potentially reduce losses from predation in CCF and direct losses from the SWP pumps. The alternative could meet the fish objective and is retained for further evaluation.

Fish Control Structure at the Head of Old River

This permanent, gated structure would be constructed at the head of Old River at its confluence with the San Joaquin River. During the spring, it would be closed to protect outmigrating salmon smolts from being drawn toward the CVP and SWP diversions. When not closed, the gates would allow flow from the San Joaquin River into the south Delta. The exact configuration of this barrier is still being developed. DWR is evaluating several designs. More information on this design alternative and its feasibility is provided in the second-phase screening discussion. The alternative meets the fish objective and is retained for further consideration.

Screening Agricultural Diversions

This alternative would screen all agricultural diversions that are extended (24) or consolidated/extended (40) (both local objective alternatives). These screens would be designed to minimize fish impingement and keep fish from being pulled through agricultural pumps and siphons. When the diversion is extended or consolidated/extended to improve water supply conditions, a properly sized screen would be installed on the end of the siphon/pump.

This approach could contribute to reducing the loss of San Joaquin River salmon directly caused by local water diversions. The operation of the SWP and CVP export facilities may indirectly contribute to losses at local water diversions by drawing more fish into the south Delta where they are exposed to additional risks at local diversions. Therefore, this alternative could minimize the loss of San Joaquin River salmon in the south Delta and is retained for further consideration.

Other Conceptual South Delta Fish Facilities

As described above, the CALFED Record of Decision (ROD) identified the design and construction of new fish screens at CCF and CVP Tracy facilities as an integral element in allowing the export facilities to pump at full capacity more regularly. However, initial investigations have revealed potential problems with the construction and operation of new fish screens at CCF. In response, the Clifton Court Technical Advisory Team (CCTAT) has developed 17 conceptual south Delta fish facilities as alternatives to a screened CCF intake.

These alternatives attempt to address the cost, timing, and technical concerns associated with the current approach to CCF screening, known as the CALFED Module Series approach. This approach would use a series of fish screening modules, each designed to handle 2,500 cfs, at CCF. The module approach was to be tested at the CVP Tracy facility but has yet to be tested and was placed on hold because of cost concerns. The Module Series problems include:

- high capital costs,

- uncertain technologies used before tested,
- long buildout schedule (several decades),
- delay of CALFED ROD schedule,
- minor fish benefits prior to full buildout of facility, and
- minor water supply reliability benefits prior to full buildout.

The alternatives developed in response to the Module Series problems all anticipate the eventual objective of accommodating SWP pumping of 10,300 cfs. These alternatives fall into the following three general categories: CCF internal bypass, Italian Slough bypass of CCF, and new fish facility at existing point of diversion. These options could contribute to minimizing the loss of San Joaquin River salmon at the export facility; they are retained for further review.

Clifton Court Forebay Internal Bypass. These alternatives all entail the creation of a corridor through CCF to the existing fish screens. The alternatives differ in that some propose to use the existing CCF intake and others a new intake via Italian Slough. All the alternatives in this category would use CCF for the storage of water that has first passed through the fish screens. This "screened" water would be used to supply water for operation of the pumps. The creation of the internal bypass would allow all water diverted into CCF to be screened and, therefore, limit impacts of predation.

Italian Slough Bypass of Clifton Court Forebay. Alternatives in this category all use Italian Slough either as the only diversion point or in conjunction with the existing diversion point. Whether relying solely on Italian Slough or using it in conjunction with the existing diversion point, the total diversion capability would be large enough to support a pumping capacity of 10,300 cfs.

New Fish Facility at Existing Point of Diversion. The alternatives in this category all use the existing diversion point into CCF with the installation of new fish screens and salvage facilities in conjunction with dredging of West Canal to help facilitate increased flows. A number of these alternatives would abandon the existing fish screening facility while others would use it only during high-volume pumping.

Acoustic Fish Barrier

This alternative would involve the construction and operation of an acoustic fish barrier at the head of Old River at its confluence with the San Joaquin River. Through the use of acoustic signals, the barrier would assist the migration and guidance of salmon along the San Joaquin River and help protect them from being drawn toward the SWP and CVP diversions. This alternative could meet the fish objective and is retained for further evaluation.

Reduction of Central Valley Project and State Water Project Exports

The operations of the SWP and CVP export facilities in the south Delta can change flow patterns in the local channels. This can cause San Joaquin salmon to move into the south Delta, primarily through Old River where fish mortality

increases due to predators and higher levels of exposure to export facilities and agricultural diversions. Therefore, a reduction in total exports (i.e., diversion limits less than the current permitted amount) may reduce the number of fish entering the south Delta, thus reducing the loss of San Joaquin River salmon. This alternative could meet the fish objective and is retained for further evaluation.

Purchase/Fallow South Delta Water Agency Agricultural Users' Land
Purchasing land for the purposes of having it taken out of production would result in decreasing the SDWA water use demands in proportion to the amount of acreage taken out of production. This reduction in consumptive use needs could result in fewer diverters, which would reduce the effects on fish from these diversions. This alternative is therefore retained for further evaluation.

Fish Objective Alternatives Not Retained for Further Consideration

Each of the single-component/single-objective alternatives identified would meet the fish objective. Therefore, all alternatives have been retained for further evaluation in subsequent screening phases.

Local Objective Alternatives

The local objective used in the first-phase screening is:

- Improve the reliability of the SDWA to divert water needed to meet consumptive use needs within its boundaries by maintaining adequate water quality and quantity.

DWR and Reclamation identified 13 single-component/single-objective alternatives with the potential to at least partially meet the project's local objective. These local objective alternatives include modifications to the existing intake facility, flow barriers, channel dredging, changes to agricultural diversions, and other methods to meet the objective. They include:

- new northwest CCF intake,
- existing intake/enlarge West Canal,
- existing intake/levee setbacks on West Canal,
- temporary barriers,
- permanent south Delta flow control structures,
- localized dredging,
- extending agricultural diversions,
- consolidating/extending agricultural diversions,

- treatment of local agricultural drainage water,
- pumping from CCF to SDWA agricultural users,
- purchases/fallowing of SDWA agricultural users' land,
- compensation for agricultural pump damage, and
- reduction of CVP and SWP exports.

Those alternatives that could at least partially meet the criteria of the local objective are retained for further consideration; those that do not contribute to meeting the criteria have been removed from further consideration.

Local Objective Alternatives Retained for Further Consideration

The following local objective alternatives would meet or contribute substantially to meeting the local objective and therefore are retained for further consideration.

Construct New Clifton Court Forebay Intake

This alternative would require DWR to construct and operate a new intake structure along the northern edge of CCF. Because Delta channels north of the existing intake gates have larger cross-sectional areas than the southern channels, a new northern intake would allow more water to be diverted with fewer impacts on south Delta water levels.

Two sites are being considered for this intake, which would include a new fish screen and have a capacity of 8,500 cfs. The first site would be in the northeast corner of CCF at the confluence of West Canal and Old River. The second site would be in the northwestern corner of CCF. This intake would take water from Old River through screens and across a portion of Byron Tract and then into CCF. Both possible new intake locations are retained for further evaluation because they could partially meet the local objective of improving the reliability of SDWA diverters, as water would be diverted primarily from north of the CCF, rather than from within SDWA boundaries.

Existing Intake/Enlarge West Canal

This alternative would involve enhancing the ability of West Canal to convey water from the north to the current CCF intake by dredging to increase the available areas of flow. The West Canal would be enlarged by 3-foot channel bottom dredging between the existing CCF intake north to the Victoria Canal. Approximately 10,000 cubic yards of material would be removed. This enlargement would produce less drawdown from intake operations. The increased capacity from the north provided by the dredging would obviate some of the water level problems currently experienced in the south Delta by allowing the project to pull more water from the north rather than from the south and east. This alternative could partially meet the local objective and is retained for further evaluation.

Existing Intake/Levee Setbacks on West Canal

This alternative would involve enhancing the ability of Old River to convey water from the north to the current CCF intake by setting back levees on either side of Old River (Coney Island and CCF) to increase the available area of flow. This setback potentially could produce less drawdown from the existing intake operation. Increased capacity from the north could obviate some of the water level problems currently experienced in the south Delta by allowing the project to pull more water from the north rather than from the south and east. This alternative could partially meet the local objective and is retained for further consideration.

Temporary Barriers

In this alternative, the current Temporary Barriers Project (TBP) 2001–2007 would continue. The program involves the seasonal installation of four barriers: one in Middle River, two in Old River, and one in Grant Line Canal. Three of the barriers are operated to improve water levels and circulation for agricultural diversions during the growing season. The fourth barrier, in Old River at its confluence with the San Joaquin River, is designed to assist outmigrating salmon during the spring and emigrating salmon during the fall.[1] The barriers are a combination of rock placed into the main channel bed at each location and overflow weirs and several gated culverts. Although the flow and fish barriers function as intended to maintain adequate water levels and prevent movement of salmon, respectively, they have limited ability to respond to continually changing hydraulic and environmental conditions in Delta channels. However, this alternative meets the local objective and is retained for further evaluation.

Permanent South Delta Flow Control Structures

A system of permanent operable flow control structures installed at strategic locations in south Delta channels could improve water levels and circulation by opening and closing operable gates during phases of the tide. Presently, two permanent flow control structure sites are under consideration in the same locations (Middle River and Old River) where temporary barriers are constructed now; and two locations for a permanent structure on Grant Line Canal are being considered. DWR has examined different types of flow control facilities: rock weirs, gated concrete structures, and inflatable rubber dams. More information on these optional designs and their technological and logistical feasibility is provided in the second-phase screening discussion.

Several variations of this alternative are possible: (1) construct permanent structures at Middle River and Old River near Tracy only; (2) construct permanent structures at Middle River, Old River near Tracy, and in Grant Line Canal near the Tracy Oasis Marina; and (3) construct permanent structures at Middle River, Old River near Tracy, and in Grant Line Canal just east of its confluence with Old River. The variations would differ in that not all structures operate at the same time, and each alternative would have different operational

[1] In fact, DWR has installed a temporary barrier in Middle River annually since 1987, as well as a fish control structure in Old River (at its confluence with the San Joaquin River) beginning in 1963. The Department first installed a temporary barrier in Old River (near the Delta-Mendota Canal) in 1991 and in Grant Line Canal in 1996.

constraints and criteria. The variation among these three flow control structures would also result in different flow distribution and water levels in the south Delta.

The alternative meets the local objective and is retained for further evaluation.

Dredging

Portions of Middle River and Old River would be dredged to improve conveyance and the operation of some individual agricultural diversions in the south Delta. Middle River would be dredged from the head of Middle River to River Mile 5.3 to an elevation of –4 feet mean sea level (msl) to accommodate agricultural siphons and pumps. Approximately 250,000 cubic yards of dredged material would be removed. This dredging component would require deepening of the entire channel in order to prevent pump damage caused by pumping solids into the pipes and to maintain a hydraulic connection to the main channel of the river or canal. Water velocities in the channel and the area near the intake would be minimized to prevent pump damage.

Similar to Middle River, several agricultural siphons and pumps on the Old River provide water for agriculture within the south Delta. Sedimentation has collected around these siphons and pumps and is affecting their ability to provide water. Spot dredging would be conducted in areas where sedimentation is affecting the operation of siphons and pumps, resulting in the removal of approximately 10,000 cubic yards of dredged material. Dredging would occur around pump intake sites and would be limited to the minimum amount needed to prevent pump damage caused by pumping solids into the pipes and to maintain a hydraulic connection to the main channel of the river or canal. Water velocities in the channel and the area near the intake would be minimized to prevent pump damage.

Dredging would be combined with operable barriers or the extension of agricultural diversions to meet the local objective. Agricultural diverters located downstream of operable barriers would not benefit from the barriers and would be subject to the same periodic low water levels that currently occur. Therefore, dredging of Middle River and Old River is proposed to maintain functionality of diversion pumps west of the barriers during low water periods, and to accommodate the extension of agricultural diversions. Because dredging could contribute to meeting the local objective, it is retained for further evaluation.

Extending Agricultural Diversions

Agricultural diversions vary significantly in the depth from which they draw water in the south Delta. Most diversions are deep enough to ensure an adequate amount of water under existing levels; however, a smaller number of diversions are at shallow depths that limit their ability to pump adequate quantities of water without damaging their pumps or incurring other maintenance-related problems. Of the approximately 160 agricultural water pumps and siphons that deliver water to agricultural lands bordering Old and Middle Rivers, Grant Line Canal, and other channels in the south Delta, approximately 24 diversion intakes are currently at these shallow depths. These shallow diversions can be extended to

adequate depths, addressing SDWA's concerns about availability of adequate quantities of water. This alternative partially meets the local objective and is retained for further evaluation.

Consolidating and Extending Agricultural Diversions

Agricultural diversions would be consolidated in reaches of all the south Delta channels. Estimating a ratio of four to one, the approximately 160 agricultural water pumps and siphons that deliver water to agricultural lands bordering Old and Middle Rivers, Grant Line Canal, and other channels in the south Delta would be consolidated to 40 diversions. Consolidation would require channel dredging in some of these channels, and pump platforms potentially would need to be removed and rebuilt with longer intake pipes. By consolidating the number of intakes and extending these to depths sufficient to ensure an adequate supply of irrigation water, this alternative could meet the local objective and therefore will be retained for further consideration.

Treatment of Local Agricultural Drainage Water

This alternative involves construction and operation of agricultural drainage water collection and treatment systems for about 120,000 acres of irrigated agriculture in the SDWA area. The treatment systems would be required to remove total dissolved solids (TDS), natural organic matter, pesticides, and other contaminants including salt from the agricultural drainage water. The treated water could then be reused for crop irrigation or discharged into the Delta channels. As a result of treatment, water quality would improve in the south Delta. However, water levels would not be affected. This alternative has the potential to partially meet the local objective and is retained for further evaluation.

Pumping Water from Clifton Court Forebay to South Delta Water Agency Agricultural Users

In this scenario, DWR would pump water from CCF to SDWA agriculture users on south Delta islands. Irrigation water would be distributed via a pipeline that would extend from CCF to the east as far as Upper Roberts Island.

The pipeline would be constructed of pipes ranging in diameter from 18 inches to 114 inches. The pipeline would be 39 miles long and require five siphons across rivers. Two regulating reservoirs would need to be constructed; both would be steel tanks 230 feet in diameter and 30 feet high. This would provide an alternative source of irrigation water for SDWA water users. This alternative has the potential to meet the local objective and is retained for further evaluation.

Purchase/Fallow South Delta Water Agency Agricultural Users' Land

Purchasing land for the purposes of having it taken out of production would result in decreasing the SDWA water use demands in proportion to the amount of acreage taken out of production. This reduction in consumptive use needs could result in increased water quality and quantity for the remaining diverters. This alternative is therefore retained for further evaluation.

Local Objective Alternatives Not Retained for Further Consideration

The following local objective alternatives do not meet the local objective and therefore will not be retained for further consideration.

Compensation for Agricultural Pump Damage

In this non-physical alternative, DWR and Reclamation would compensate south Delta farmers annually for damage to pumps caused by low water levels attributable to SWP and CVP operations. There are about 160 agricultural diversion pumps in SDWA lands. While farmers would be compensated for pump repairs or replacement under this plan, they would not be compensated for any crop loss and the risk that pumps would continue to fail during the irrigation season. Alternatively, DWR and Reclamation could pay a one-time settlement for all damages in the south Delta attributable to the operation of the SWP and CVP. In this variation of the alternative, the compensation would encompass not only pump damage, but also crop damage. This alternative does not meet the local objective, or the other objectives, and therefore is eliminated from further evaluation.

Reduction of Central Valley Project and State Water Project Exports

Reducing CVP/SWP pumping was originally considered as an alternative that could increase south Delta water levels and lessen reverse flows in the Delta, thus improving water quality by preventing seawater intrusion and reducing adverse effects on fish. At the same time, however, pumping reductions also may cause an adverse impact on water quality in some south Delta channels because tidal action and the pumps draw better quality water into the south Delta channels from the north and central portions of the Delta. Further, even if exports were reduced, there would still be occasions during low tides when irrigators would be unable to pump if no physical changes are made. Because reduction of CVP and SWP exports can worsen water quality in the south Delta and does not improve the ability of south Delta farmers to divert, this alternative does not meet the local objective and is not retained for further evaluation for meeting this objective.

Export Objective Alternatives

The following export objective was used to develop export alternatives:

- Increase water supply to SWP and CVP water contractors through increased diversions into CCF and maximize the frequency of 8,500 cfs pumping at SWP Banks facility.

Currently, maximum diversions into CCF are permitted by the Corps under the Rivers and Harbors Act. Existing conditions for diversion are contained in Public Notice 5820-A Amended and allow for diversion of 13,870 acre-feet daily (and 13,250 acre-feet over a 3-day average). This diversion limit translates into a pumping limit of 6,680 cfs over a 3-day average. From mid-December to mid-

March, diversions are increased by one-third of the San Joaquin River flow at Vernalis if that flow exceeds 1,000 cfs.

To develop operational export objective alternatives, DWR worked with a broad coalition of stakeholders, including Reclamation, to discuss, debate, and develop alternative operational scenarios. This process, referred to as the 8,500 Stakeholders Process, included representatives of resource agencies, including Reclamation, water agencies and districts, and environmental groups. This group held a series of meetings in fall 2002. The result of those meetings was four proposals for 8,500-cfs operational alternatives, which are described below as Operational Scenarios B through E. Reclamation subsequently proposed Operational Alternative F in June 2003. In July 2003, Reclamation and DWR developed Operational Scenario A. Reduction in CVP and SWP exports, while considered for the fish and local objectives, was not considered here because it does not meet the export objective.

Export Objective Alternatives Retained for Further Consideration

Operational Scenario A

Operational Scenario A integrates each of the strengths of the CVP and SWP (storage and conveyance, respectively) to maximize water supplies for the benefit of both CVP and SWP contractors that rely on water delivered from the Bay-Delta in a manner that (1) would not impair in-Delta uses, and (2) would be consistent with fishery, water quality, and other flow and operational requirements imposed under the federal Clean Water Act (CWA) and ESA, Central Valley Project Improvement Act (CVPIA), State Water Resource Control Board (State Water Board) Decision 1641 (D-1641), and consistent with goals and programs under the CALFED ROD. Similar to current operations, the Environmental Water Account (EWA) would be used to alleviate water supply impacts while curtailing pumping for the protection of sensitive fish species.

Operational Scenario A increases the average monthly allowable rates of diversion to 8,500 cfs year-round. Under Operational Scenario A, the 3-day average diversion into CCF would not exceed 9,000 cfs, and the 7-day average diversion would not exceed 8,500 cfs between March 16 and December 14. From December 15 through March 15, diversions into CCF would not exceed the greater of 8,500 cfs over a 7-day average or 6,680 cfs plus one-third of the 7-day running average flow of the San Joaquin River at Vernalis when Vernalis flow exceeds 1,000 cfs. The year-round monthly average diversion rate would not exceed 8,500 cfs. Details regarding rates of diversion and priority of use during specific months are described below.

Details regarding rates of diversion and priority of use during specific months are described below and are presented in Table A-1.

Table A-1. Operational Scenario A

Month	Operation
October	October 1 to December 14
November	Monthly average max of 8,500 cfs 1st priority: SWP 2nd priority: EWA/CVP (50-50)
December	December 15 to March 15
January	Monthly average max of 8,500 cfs by diverting the greater of: ▪ 8,500 cfs (7-day average); or ▪ 6,680 cfs plus ⅓ of the San Joaquin River flow at Vernalis when flow exceeds 1,000 cfs over a 7-day average. 1st priority: SWP 2nd priority: EWA/CVP (50-50)
February	
March	March 15 to July 1
April	Monthly Average max of 8,500 cfs 1st priority: SWP 2nd priority: EWA/CVP (50-50)
May	
June	
July	July 1 to September 30 Monthly average max of 8,500 cfs Up to 90 taf dedicated to EWA Note: If EWA does not use the entire 90 taf, the remaining export capacity could be used by the SWP or CVP, or for transfers. Remaining capacity: 1st priority: SWP 2nd priority: EWA/CVP (50-50)
August	
September	

Note: Under this scenario, DWR would annually convey up to 100,000 acre-feet of CVP Level 2 Refuge water through CCF and SWP Banks in July and August, and Reclamation would provide SWP up to 75,000 acre-feet from CVP storage facilities north of the Delta to meet a portion of the SWP's obligation to comply with Bay-Delta water quality and flow requirements. Because DWR is committed to diverting and pumping Level 2 water, this water would be pumped as part of SWP first priority to pumping capacity.

October 1 through December 14

The average allowable rate of diversion into CCF would not exceed 9,000 cfs over a 3-day average, and 8,500 cfs over a 7-day average. The first priority use of capacity goes to SWP. Capacity not used by SWP would be split equally between EWA and CVP.

December 15 through March 15

The average allowable rate of diversion into CCF would not exceed the greater of 8,500 cfs over a 7-day average or 6,680 cfs plus one-third of the 7-day running average flow of the San Joaquin River at Vernalis when Vernalis flow exceeds 1,000 cfs. The first priority use of capacity goes to SWP. Capacity not used by SWP would be split equally between EWA and CVP.

March 16 through June 30

The average allowable rate of diversion into CCF would not exceed 9,000 cfs over a 3-day average, and 8,500 cfs over a 7-day average. The first priority use of capacity goes to SWP. Capacity not used by SWP would be split equally between EWA and CVP. During the Vernalis Adaptive Management Plan (VAMP) period (April 15–May 15), pumping would be curtailed substantially at both SWP and CVP export facilities below the maximum capacities to meet the D-1641 limit of pumping less than the San Joaquin River inflow and to conduct the VAMP experiment.

July 1 through September 30

The average allowable rate of diversion into CCF would not exceed 9,000 cfs over a 3-day average, and 8,500 cfs over a 7-day average. Of that amount, up to 90 thousand acre-feet (taf) of export capacity is dedicated to the EWA in July, August, and September to export water acquired upstream and reduce any EWA water debt. The remaining export capacity, including unused capacity dedicated for EWA transfers, would first be used by the SWP, and if there is unused capacity, it may be used by EWA and CVP, each with equal priority.

Annual Commitments

Under this scenario, DWR would annually convey up to 100,000 acre-feet of CVP Level 2 Refuge water through CCF and SWP Banks by September 1, and Reclamation would provide SWP up to 75,000 acre-feet from CVP storage facilities north of the Delta to meet a portion of the SWP obligation to comply with Bay-Delta water quality and flow requirements. The Level 2 Refuge water would be pumped as part of SWP first priority to pumping capacity.

Operational Scenario B

Under Operational Scenario B, the rate of diversion would vary in different months of the year to allow DWR to use greater diversion capacity during less-sensitive time periods for fish, while ensuring all regulatory requirements, environmental interests, and local beneficial uses of water are met. Similar to Operational Scenario A, operations would be conducted in a manner that (1) will not impair in-Delta uses, and (2) will be consistent with fishery, water quality, and other flow and operational requirements imposed under CWA and ESA, CVPIA, D-1641, and consistent with goals and programs under the CALFED ROD. Similar to current conditions, EWA would be used to alleviate water supply impacts while curtailing pumping for the protection of sensitive fish species. In addition, this scenario would dedicate up to 1,820 cfs per day to EWA in July, August, and September to provide water that can be used later to offset the effects of fish protection actions.

Operational Scenario B increases the maximum allowable rate of diversion to 8,500 cfs for approximately 5 months out of the year. During these months, 3-day average diversion into CCF would not exceed 9,000 cfs, and 7-day average diversion would not exceed 8,500 cfs.

Under this operational scenario, the maximum rate of diversion would be reduced to 6,680 cfs, unless conditions allow an increased rate of diversion, in

approximately 7 months per year to provide protection for sensitive fish species. The specific months, diversion, pumping, and priority of use are outlined in Table A-2 and described further below.

All diversions under Scenario B would continue to be subject to compliance with other existing constraints governing the operation of the SWP, such as State Water Board water rights decisions and applicable federal and state laws, including the ESA and the CWA, as described under no action (existing conditions).

Table A-2. Operational Scenario B

Month	Operation
October November	October 1 to November 30 Monthly average max of 8,500 cfs 1st priority: SWP 2nd priority: EWA/CVP (50-50)
December January February March April May June	December 1 to June 30 Monthly average max of 6,680 cfs except when fish densities allow higher diversions. Monthly average max of 8,500 cfs 1st priority: SWP 2nd priority: EWA/CVP (50-50)
July August September	July 1 to September 30 Monthly average max of 8,500 cfs 1,820 cfs dedicated to EWA Note: If EWA does not use the entire 1,820 cfs, the remaining export capacity could be used by the SWP, CVP, or for transfers. Remaining capacity: 1st priority: SWP 2nd priority: CVP/EWA (50-50)

October 1 through November 30

The maximum allowable rate of diversion into CCF would not exceed a 3-day average of 9,000 cfs, and 7-day average diversion would not exceed 8,500 cfs. First priority use of the water goes to SWP. Second priority would go equally to EWA and CVP.

December 1 through June 30

This is a period of fish protection for juvenile Chinook salmon and delta smelt. The maximum diversion would be held at 6,680 cfs except during periods when fish are not present at densities that warrant entrainment protection, at which time

diversion could increase to 8,500 cfs. The maximum allowable rate of diversion into CCF would not exceed a 3-day average of 9,000 cfs, and the 7-day average diversion would not exceed 8,500 cfs. For analysis purposes, a monthly maximum diversion of 7,180 cfs was used from December through June. During the VAMP period (April 15–May 15), pumping would be curtailed substantially at both SWP and CVP export facilities below the maximum capacities to conduct the VAMP experiment.

July 1 through September 30

The maximum allowable rate of diversion into CCF would not exceed a 3-day average of 9,000 cfs (17,852 acre-feet), and 7-day average diversion would not exceed 8,500 cfs (16,860 acre-feet). Of that amount, up to 1,820 cfs per day of export capacity would be dedicated to EWA to export water acquired upstream and reduce any EWA water debt. For the remainder of the 8,500 cfs, including unused capacity dedicated for EWA transfers, SWP would receive first priority use, and second priority use would be split equally between EWA and CVP, as necessary.

Annual Commitments

Under this scenario, DWR would not commit to conveying any CVP Level 2 Refuge water and Reclamation would not commit to releasing water from CVP reservoirs north of the Delta to help meet SWP Delta water quality obligations.

Operational Scenario C

Similar to the diversions under Operational Scenario B, operations under Operational Scenario C would vary during different months of the year to allow DWR to use greater diversion capacity during less-sensitive time periods for fish (i.e., October–March and July–September). Similar to Operational Scenarios A and B, operations would be conducted in a manner that (1) will not impair in-Delta uses, and (2) will be consistent with fishery, water quality, and other flow and operational requirements imposed under CWA and ESA, the CVPIA, the State Water Board D-1641, and consistent with goals and programs under the CALFED ROD. This operational scenario restricts diversions to 6,680 cfs (3-day average basis) from March 16 through June 30 in order to provide additional protection for species such as salmon, steelhead, and delta smelt. Similar to current conditions, EWA would be used to alleviate water supply impacts while curtailing pumping for the protection of sensitive fish species. In addition, this scenario would dedicate up to 90 taf of pumping capacity to the EWA from July through September to reduce any EWA debt.

The specific months, diversion, pumping, and priority of use are outlined in Table A-3 and described further below. Under Operational Scenario C, the maximum allowable rate of diversion would increase from 6,680 cfs to 8,500 cfs for approximately 8.5 months of the year. During these months, the 3-day average diversion into CCF would not exceed 9,000 cfs and the 7-day average diversion would not exceed 8,500 cfs. Under this operational scenario, pumping would be limited to its current maximum of 6,680 cfs (3-day average) for 3.5 months out of the year. The specific months, diversion, and priority of use are further described below.

Table A-3. Operational Scenario C

Month	Operation
October	October 1 to March 15
November	Monthly average max of 8,500 cfs 1st priority: SWP 2nd priority: EWA/CVP (50-50)
December	
January	
February	
March	March 16 to June 30
April	Monthly Average max of 6,680 cfs 1st priority: SWP 2nd priority: EWA/CVP (50-50)
May	
June	
July	July 1 to September 30
August	Monthly average max of 8,500 cfs Up to 90 taf dedicated to EWA Note: If EWA does not use the entire 90 taf, the remaining export capacity could be used by the SWP, CVP, or for transfers.
September	Remaining capacity: 1st priority: SWP 2nd priority: CVP (up to 500 cfs) 3rd priority: EWA/CVP (50-50)

October 1 through March 15

The maximum allowable rate of diversion into CCF would not exceed a 3-day average of 9,000 cfs, and 7-day average diversion would not exceed 8,500 cfs. First priority use of the water goes to the SWP. Second priority goes equally to EWA and CVP.

March 16 through June 30

The maximum allowable rate of diversion would be 6,680 cfs on a 3-day average basis; no increases to 8,500 cfs would be allowed. During the VAMP period (April 15–May 15), diversion and pumping would be substantially curtailed at both SWP and CVP export facilities below these maximum capacities to conduct the VAMP experiment. First priority use of the water goes to the SWP. Second priority use goes equally to the EWA and the CVP.

July 1 through September 30

The maximum allowable rate of diversion into CCF would not exceed a 3-day average of 9,000 cfs, and 7-day average diversion would not exceed 8,500 cfs. Of that amount, up to 90 taf of export capacity is dedicated to the EWA to export water acquired upstream and reduce any EWA water debt. The remainder of the 8,500 cfs, including unused capacity dedicated for EWA transfers, would go first

to SWP; CVP would receive second priority up to 500 cfs, and third priority would be split equally between CVP and EWA, as necessary.

Annual Commitments

Under this scenario, DWR would not commit to conveying any CVP Level 2 Refuge water and Reclamation would not commit to releasing water from CVP reservoirs north of the Delta to help meet SWP Delta water quality obligations.

Export Objective Alternatives Not Retained for Further Consideration

Operational Scenario D

Scenario D increases pumping and diversion to 8,500 cfs year-round. Under Scenario D, the maximum allowable diversion and pumping would increase from 6,680 cfs to 8,500 cfs on a monthly average basis (505,792 acre-feet in a 30-day month) during the entire year. This scenario assumes that CVP would be able to declare higher annual allocations early in the year that would include an assumed amount of summer joint point of diversion (JPOD) capacity. Details on specific months, diversion, pumping, and priority of use are outlined in Table A-4 and described further below.

All diversions would continue to be subject to compliance with other existing constraints governing the operation of the SWP, such as State Water Board water rights decisions and applicable federal and state laws, including the ESA and the CWA, as described under no action (existing conditions).

Table A-4. Operational Scenario D

Month	Operation
October	October 1 to June 30 Maximum of 8,500 cfs 1st Priority: SWP 2nd priority EWA/CVP (50-50)
November	
December	
January	
February	
March	
April	
May	
June	
July	July 1 to September 30 Maximum of 8,500 cfs 500 cfs dedicated to EWA Remaining 8,000 cfs: 1st priority: SWP 2nd priority: EWA/CVP (50-50)
August	
September	

October 1 to June 30. The maximum allowable diversion and pumping are 8,500 cfs on a monthly average basis. The first priority use of water goes to SWP. The second priority use would be split equally between the EWA and the CVP.

July 1 to September 30. The maximum allowable diversion and pumping are 8,500 cfs on a monthly average basis. The EWA is dedicated 500 cfs in July, August, and September to export water from upstream releases to refill San Luis Reservoir and reduce any EWA water debt. For the remaining 8,000 cfs, the SWP would receive first priority, and EWA and CVP would receive second priority equally.

During all time periods, the use of the additional diversion and pumping capacity would vary depending upon the water year. During dry and critically dry years, the full diversion and pumping capacity generally would be limited to rare storm events. During wet, above-normal, and below-normal years, there would be opportunities to use the maximum diversion and pumping capacity. In above-normal and below-normal years, the additional water that would be diverted, pumped, and exported could be a significant percentage of freshwater inflows.

Operational Scenario E

Under Scenario E, the maximum allowable diversion and pumping would increase from 6,680 cfs to 8,500 cfs on a monthly average basis (505,792 acre-feet in a 30-day month) during the entire year. Scenario E differs from Scenarios B and C in that diversion and pumping would increase to 8,500 cfs year-round. Scenario E is very similar to Scenario D, except that Scenario E does not include that assumption that the CVP would be able to declare higher annual allocations early in the year that would include an assumed amount of summer JPOD capacity. Details on specific months, diversion, pumping, and priority of use are outlined in Table A-5 and described further below.

All diversions would continue to be subject to compliance with other existing constraints governing the operation of the SWP, such as State Water Board water rights decisions and applicable federal and state laws, including the ESA and the CWA, as described under no action (existing conditions).

Table A-5. Operational Scenario E

Month	Operation
October	October 1 to June 30 Maximum of 8,500 cfs 1st Priority: SWP 2nd priority EWA/CVP (50-50)
November	
December	
January	
February	
March	
April	
May	
June	
July	July 1 to September 30 Maximum of 8,500 cfs 500 cfs dedicated to EWA Remaining 8,000 cfs: 1st priority: SWP 2nd priority: EWA/CVP (50-50)
August	
September	

October 1 to June 30. The maximum allowable diversion and pumping are 8,500 cfs on a monthly average basis. The first priority use of water goes to SWP. The second priority use would be split equally between the EWA and the CVP.

July 1 to September 30. The maximum allowable diversion and pumping are 8,500 cfs on a monthly average basis. The EWA is dedicated 500 cfs in July, August, and September to export water from upstream releases to refill San Luis Reservoir and reduce any EWA water debt. For the remaining 8,000 cfs, the SWP would receive first priority and EWA and CVP would receive second priority equally.

During all time periods, the use of the additional diversion and pumping capacity would vary depending upon the water year. During dry and critically dry years, the full diversion and pumping capacity generally would be limited to rare storm events. During wet, above-normal, and below-normal years, there would be opportunities to use the maximum diversion and pumping capacity. In above-normal and below-normal years, the additional water that would be diverted, pumped, and exported could be a significant percentage of freshwater inflows.

Operational Scenario F

Scenario F assigns the increased export capability to the CVP. Similar to Scenarios D and E, Scenario F increases pumping and diversion to 8,500 cfs year-round. Under Scenario F, the maximum allowable diversion and pumping would increase from 6,680 cfs to 8,500 cfs on a monthly average basis

(505,792 acre-feet in a 30-day month) during the entire year. Details on specific months, diversion, pumping, and priority of use are outlined in Table A-6 and described further below.

All diversions would continue to be subject to compliance with other existing constraints governing the operation of the SWP, such as State Water Board water rights decisions and applicable federal and state laws, including the ESA and the CWA, as described under no action (existing conditions).

Table A-6. Operational Scenario F

Month	Operation[2,3]
October	Maximum of 8,500 cfs 1st priority: SWP[4] up to 6,680 cfs 2nd priority: CVP up to remaining capacity 3rd priority: SWP[5] 4th priority: EWA/Level 4
November	
December	
	December 15 to March 15
January	Maximum of 8,500 cfs[1] 1st priority: SWP[4] up to current Corps limit (6,680 + 1/3 San Joaquin River) 2nd priority: CVP up to remaining capacity 3rd priority: SWP[5] 4th priority: EWA/Level 4
February	
March	
	March 16 to December 14
April	Maximum of 8,500 cfs 1st priority: SWP[4] up to 6,680 cfs 2nd priority CVP up to remaining capacity 3rd priority: SWP[5] 4th priority: EWA/Level 4
May	
June	
July	Maximum of 8,500 cfs 500 cfs dedicated to EWA 1st priority: SWP[4] up to 6,680 cfs 2nd priority: CVP up to remaining capacity 3rd Priority: SWP[5] 4th Priority: EWA/Level 4
August	
September	

[1] Maximum of 8,500 cfs or 6,680 cfs + 1/3 of San Joaquin River flow at Vernalis.

[2] CALSIM assumes a maximum of 8,500 cfs given that it is a monthly average model.

[3] EWA cuts for all the alternatives are maintained at the same level of protection as in the baseline study.

[4] CVP maintains first right to federal share of Delta supplies that can be exported through Tracy and CVP capacity at Banks.

[5] SWP conveyance of project supplies (excludes SWP contractor transfers treated under Article 55).

December 15 to March 15. The maximum allowable diversion and pumping are 8,500 cfs on a monthly average basis. The first priority of use goes to SWP up to

the current Corps permit limit of 6,680 cfs plus 1/3 of San Joaquin River flow at Vernalis. Under the second priority, up to the remaining amount would go to the CVP. The third priority use of water would go to SWP (including SWP Article 21). The fourth priority is split evenly between EWA and the Level 4 refuge water supply program.

March 16 to December 14. The maximum allowable diversion and pumping are 8,500 cfs on a monthly average basis. The first priority use of water, up to 6,680 cfs, goes to SWP (excluding SWP contractor transfers treated under Article 55). The second priority, up to the remaining capacity, would go to the CVP. The third priority use of water would go to SWP (including SWP Article 21). The fourth priority would be split evenly between EWA and the Level 4 refuge water supply program.

During all time periods, the use of the additional diversion and pumping capacity would vary depending on the water year. During dry and critically dry years, the full diversion and pumping capacity generally would be limited to rare storm events. During wet, above-normal, and below-normal years, there would be opportunities to use the maximum diversion and pumping capacity. In above-normal and below-normal years, the additional water that would be diverted, pumped, and exported could be a significant percentage of freshwater inflows.

Export Objective Conclusions

Operational Scenarios A, B, and C would meet or contribute substantially to meeting the export objective and therefore are retained for further consideration. Operational Scenarios D and F were incorporated into Scenario A in July 2003 to optimize the capabilities of the SWP and CVP. Operational Scenario E was dropped from further analysis because it did not provide the CVP assurances for making early annual allocations. This translates into a significant risk to the CVP of failing to meet contractor demands. Therefore, this single-component alternative does not meet the export objective and is not carried forward.

Second-Phase Screening of Alternatives

In the second phase, all alternatives remain single-component and single-objective. The remaining single-component/single-objective alternatives are looked at more closely to screen for technological and logistical feasibility, as well as compatibility with the other objectives. Those that meet the single objective for feasibility and are compatible with the other objectives will be further evaluated in the third-phase screening of alternatives.

Technology

The technology employed in the alternatives must be adequate to ensure that the basic project purpose and objectives can be reasonably met. Reliance on questionable or untested technology would expose the project to substantial risk related to achieving the basic project purposes. Because meeting the project objectives is critical to its success and any practicable alternative will involve substantial costs, implementation of untested or questionable technology is considered risky, and an alternative that is based on unreasonable geotechnical assumptions is considered impracticable. Therefore, the selected alternative would avoid engineering, geotechnical problems, and questionable or untested technologies.

Logistics (Maintenance/Operations)

Logistical considerations must be taken into account to ensure that the basic project purpose and objectives can be reasonably achieved. Alternatives that involve unreasonable logistical constraints could expose the project to substantial risk related to its ability to achieving the basic project purposes. Logistical constraints could include maintenance costs, access, reliability, unreasonable property acquisition, and/or operational constraints. Alternatives that involve such logistical constraints are considered risky in that they involve problems related to maintenance and operation and are considered impracticable. Therefore, the selected alternative would avoid problems related to maintenance, access, reliability, unreasonable property acquisition, and/or operational constraints.

Compatibility

An alternative's compatibility with all or most of the project objectives is evaluated to determine if implementation of any single-component/single-objective alternative would prohibit any of the project objectives from being met. Alternatives that are carried forward to the third screening phase are those that can contribute to meeting all or most of the project objectives, or that do not preclude all or most of the project objectives from being met.

Fish Objective Alternatives

All of the identified alternatives retained from the first-phase screening have been reviewed to determine whether they have technological, logistical, or compatibility problems that make them impracticable and justify their removal from the screening process. Descriptions of the alternatives are provided in the first-phase screening discussion. The alternatives that do not involve either technological, logistical, or compatibility problems are retained for review in third-phase screening.

Fish Objective Alternatives Retained for Further Consideration

Of the five fish alternatives reviewed in the first-phase screening and retained for review and further consideration in the second phase, the fish control structure at the head of Old River has been retained for review in the third-phase screening.

Fish Control Structure at the Head of Old River

As described in the first-phase screening, DWR has considered different types of permanent fish control structures at the head of Old River. This structure would mimic the existing temporary barrier placed at this location along the river, but the permanent structure would have operational flexibility. Because of the technological and logistical problems associated with operating inflatable rubber dams in the south Delta (see Inflatable Rubber Dams discussion below), a gated concrete structure would be constructed. Construction of a gated concrete structure would use existing technology. A similar design approach was successfully used for the Woodbridge Irrigation District Lower Mokelumne River Restoration project. Additionally, a fish control structure constructed at the head of Old River would not preclude the export objective or the local objective from being met. Because this design option does not involve any impracticable logistical or technological problems, and is compatible with the other objectives, it is retained for further consideration.

Fish Objective Alternatives Not Retained for Further Consideration

Screened Clifton Court Forebay Intake

Although the CALFED ROD identified the design and construction of new fish screens at CCF and CVP Tracy facilities as an integral element in allowing the export facilities to pump at full capacity more regularly, initial investigations have revealed potential problems with the construction and operation of new fish screens at CCF.

There are cost, timing, and technical concerns associated with the current approach to CCF screening, known as the CALFED Module Series approach. The module approach would use a series of fish screening modules, each designed to handle 2,500 cfs, at CCF. Although fish screens are being developed for testing in conjunction with the CVP Tracy facility, the module approach has yet to be tested and was placed on hold because of cost concerns. The Module Series problems include:

- high capital costs,
- uncertain technologies used before tested,
- long buildout schedule (several decades),
- delay of CALFED ROD schedule,
- minor fish benefits prior to full buildout of facility, and

- minor water supply reliability benefits prior to full buildout.

There is overall uncertainty about the ability of a fish screen to operate sufficiently to protect the fish and about maintenance and operational constraints. Accordingly, any alternative that requires the construction of new large-scale fish screens is found to be impracticable at this time based on the current status of the CVP Tracy Fish Test Facility (i.e., Module Series approach). Although this alternative would likely be compatible with the export and local objective, this alternative is eliminated from further evaluation because it does not meet the technological and logistical criteria.

Other Conceptual South Delta Fish Facilities

As described in the first-phase screening, members of the CCTAT developed 17 conceptual south Delta fish facilities as alternatives to a screened CCF intake. These alternatives fall into three categories: CCF internal bypass, Italian Slough bypass of CCF, and new fish facility at existing point of diversion.

However, the CCTAT members have identified potential flaws with each approach. The following potential flaws have been identified for the CCF internal bypass approach: limited fish protection, permitting difficulties, experimental technology, and logistical concerns regarding maintenance. The following potential flaws have been identified in association with the Italian Slough bypass of CCF alternatives: permitting difficulties, limited fish protection, limits on export capacity, insufficient water benefits, seasonal operational constraints, and high site-development costs. The following potential flaws have been identified in association with the new fish facility at existing point of diversion alternatives: high infrastructure costs, abandonment of existing facilities, complex operations, limited fish protection, high access costs, multiple facilities, and necessity of additional modules later. Additionally, this alternative is in the conceptual stages and would require an estimated 10–11 years to finalize, implement, and monitor for effectiveness. Although this alternative would likely be compatible with the export and local objectives, this alternative is found to be impracticable at this time and is eliminated from further evaluation.

Acoustic Fish Barriers

In 1993 and 1994, tests were conducted with an acoustic fish barrier in the Georgiana Slough (located adjacent to the town of Walnut Grove, approximately 0.1 mile downstream of the State Route (SR) 160 bridge across from the Sacramento River and about 0.5 mile from the Delta Cross Channel). The tests were conducted to show the efficiency of the acoustic barrier on the guidance of the fish through the Sacramento River and the Georgiana Slough. Testing included exposure testing and underwater sound pressure measurements, and three types of monitoring tests were conducted: the Chinook salmon mark/recapture method, the hydroacoustic monitoring, and the kodiak trawl capture efficiency evaluation.

Prior to testing, the testing groups believed that with the acoustic barrier on, the migration of the Chinook salmon down the Sacramento River would increase and

fewer fish would enter the Georgiana Slough. Results of the three types of tests were inconsistent and therefore inconclusive. Further testing of acoustic barriers in the Delta has not occurred since the initial tests, and the technology has not been proved successful.

There is overall uncertainty about the ability of an acoustic fish barrier to protect the fish. Accordingly, this alternative is found to be impracticable at this time and is eliminated from further evaluation.

Screening Agricultural Diversions

Extending 24 agricultural diversions or consolidating/extending agricultural diversions (both local objective alternatives) could contribute to meeting the fish objective. However screening the extended diversions (24) or screening the consolidated agricultural diversions (40) in the south Delta is not being carried forward because of logistical problems and incompatibility with the local objective. As described for the local objective below, the consolidation of the diversions is not logistically feasible. Screening the extended agricultural diversions would result in logistical constraints due to difficulties in maintaining the screens to allow uninterrupted diversions and effective screening of fish. Additionally, screening of the estimated 24 extended agricultural diversions would not significantly contribute to meeting the fish objective because these 24 diversions account for approximately 15% of all diversions in the south Delta area. This alternative is not retained for further evaluation because it does not significantly contribute to meeting the fish objective and it is incompatible with the local objective.

Reduction of CVP and SWP Exports

Reduction of CVP and SWP exports is technologically and logistically feasible because it would not require new technology, equipment, or maintenance activities. The operation of the export facilities would continue as they are currently with the exception that less water would be diverted to the export facilities. Although this alternative would partially meet the fish objective by reducing entrainment and adverse effects on fish, it would not meet local objective or export objective (see the First-Phase Screening). Therefore, this alternative is not retained for further consideration.

Purchase/Fallow South Delta Water Agency Agricultural Users' Land

Purchasing land for the purposes of having it taken out of production would result in decreasing the SDWA water use demands in proportion to the amount of acreage taken out of production. This would result in a reduction in the number of diversions in the south Delta, which could benefit fish. However, there are uncertainties as to whether an adequate number of acres could be purchased from willing sellers as required by CALFED, and this alternative does not improve SDWA's reliability to divert water needed to meet consumptive use needs within its boundaries. Therefore, it is logistically infeasible. For this same reason, it does not meet the local objective, as described below. Because it does not meet most of the project objectives, it is eliminated from further consideration.

Local Objective Alternatives

All of the identified alternatives retained from the first-phase screening have been reviewed to determine whether they have technological, logistical, or compatibility problems that make them impracticable and justify their removal from the screening process. Descriptions of the alternatives are provided in the first-phase screening discussion. The alternatives that do not involve either technological, logistical, or compatibility problems are retained for review in phase three screening.

Local Objective Alternatives Retained for Further Consideration

Of the 10 local objective alternatives reviewed in the first-phase screening and retained for review and further consideration in the second phase, the following four alternatives have been determined to involve neither unproven technology nor logistical problems:

- existing intake/enlarge West Canal,
- permanent south Delta flow control structures,
- dredging, and
- extending agricultural diversions.

These alternatives have been retained for review in the third-phase screening.

Existing Intake/Enlarge West Canal

Existing dredging methods and machinery would be used to enlarge West Canal. Because of the large canal area that requires enlargement, the hydraulic (suction) dredging method would likely be used. This method has been used in other areas of the south Delta, including Grant Line Canal and Old River. Sufficient area is available in this vicinity to locate the necessary settling ponds, which are required for this dredging method. The settling ponds would allow for water to be pumped back to West Canal. The solids would be dried and reshaped for reinforcement of the levee or for other beneficial agricultural uses in the vicinity. This alternative involves no impracticable logistical or technological problems, and is compatible with the export and fish objectives. Therefore, it is retained for further evaluation.

Permanent South Delta Flow Control Structures

As described in the first-phase screening, DWR has examined different types of flow control facilities for this alternative: rock weirs, gated concrete structures, and inflatable rubber dams. The rock weirs and inflatable rubber dams alternatives are not retained for further analysis and are therefore described below under Alternatives Not Retained for Further Analysis. The technological benefits or drawbacks of the gated concrete structures alternative is discussed below.

Rock weirs. Rock weirs would be similar to the temporary barriers in use now. This design option does not provide the operational flexibility needed for a permanent design structure. Although rock weirs would be compatible with the export and fish objective, they are an infeasible option for permanent barriers due to logistical constraints and are rejected from further consideration.

Gated concrete structure. This type of structure would include some combination of the following components depending on channel geometry and hydrology:

- Bottom-hinged gates—This part of the structure would be the operable portion. The bottom-hinged gates would be opened and closed on the tidal cycle to hold higher water levels behind the gates. These gates can be opened and closed multiple times during a tidal cycle, and the gates can be operated independently of each other. The gates would be lifted by inflating an air bladder beneath the gates. In the open position, the gates would lie on the channel bottom, allowing natural flows to pass unimpeded.
- Boat lock—This structure would not be used on Middle River but would be included at all other flow control gate locations. Based on public input and DWR surveys, there is a need to allow boats to transit the gate locations when the gates are operational; an operable boat lock would allow boaters that opportunity. These locks would be operational during periods when the gate is closed. All boat traffic could pass the gate when it is open, as it would lie on the channel bottom.

Construction and operation of a gated concrete structure use existing technology. A similar design approach was successfully used for the Woodbridge Irrigation District Lower Mokelumne River Restoration Project. Additionally, it is compatible with the export and fish objectives. Because this design option does not involve any impracticable logistical or technological problems and is not incompatible with the fish and export objectives, it is retained for further consideration.

Localized Dredging

Existing dredging methods and machinery would be used to dredge Middle River and Old River. The hydraulic (suction) dredging method would likely be used for Middle River because of the large canal area that requires deepening. Depending on the areas in need of dredging along Old River, dredging methods may be hydraulic or clamshell (mechanical) dredging. For the hydraulic dredging method, sufficient area is available in the area to locate settling ponds required for this method. The settling ponds would allow water to be pumped back to the Middle River or Old River. The solids would be dried and reshaped for reinforcement of the levee or for other beneficial agricultural uses in the vicinity. For the clamshell dredging method, settling ponds are not necessary and dredged material would be placed along the levee to dry and be used as reinforcement. Both of these methods have been used in other areas of the south Delta, including Grant Line Canal, Old River, and Fabian-Bell Canal. This alternative does not involve unproven technology or logistical problems and is

compatible with the export and fish objectives, so it is retained for further evaluation.

Extending Agricultural Diversions

To enable continuous function, agricultural siphons and pumps that are –2 feet msl or shallower would need to be extended. Extension of these shallow diversion intake pipes would involve a relatively simple procedure of securing a few feet of pipe to the existing diversion intake pipe. The diameter of the extended diversion would remain the same as the existing diversion intake pipes. This alternative does not involve any impracticable logistical or technological problems and is compatible with the export and fish objectives. Therefore it is retained for further evaluation.

Local Objective Alternatives Not Retained for Further Consideration

Permanent South Delta Flow Control Structures

Rock weirs. Rock weirs would be similar to the temporary barriers in use now. This design option does not provide the operational flexibility needed for a permanent design structure. Although rock weirs would be compatible with the export and fish objective, their operational flexibility results in logistical constraints in achieving the local objective. Therefore, this alternative is rejected for further evaluation.

Inflatable rubber dams. For this design option, the operable gates would be similar to the gated concrete structures described above, but the bottom-hinged gates and/or portions of sheetpile walls would be replaced with inflatable dams. The inflatable rubber dam consists of a sealed, rubberized fabric tube that is filled with air or water to raise upstream water levels. When it is inflated to full design height, it impounds water and acts like any other fixed dam in this respect. Inflatable rubber dams are also capable of being completely deflated to allow maximum runoff during flood events to increase the area of flow at the barriers. These dams are used throughout the world in applications where the downstream side of the dam has little or no water in it because the dam can completely deflate and lie flat in the open position. However, in the tidal environment of the south Delta, the water on the downstream face of such a dam would cause buoyancy problems that would prevent the dam from lying flat against its foundation. This inability to fully deflate the rubber dam would have a detrimental effect on the ability to move water in either direction through the barrier during times when the operation is not desired (e.g., winter flood events). Also, the most feasible method of installing and constructing a rubber dam is to completely block the channel or a portion of the channel. However, blocking the channel for an extended period of time would not be feasible for floodflow and irrigation requirements. Additionally, repairs to a rubber dam could be very difficult depending on the extent of the damage. If the material were torn or burned, the entire dam would have to be removed from the channel in order to be patched. Although inflatable rubber dams would not be inconsistent with the export and fish objectives, DWR Division of Engineering has rejected this concept because

of the technological and logistical problems associated with operating the dams in the south Delta.

Construct New Clifton Court Forebay Intake

A new intake triggers a requirement for the construction and operation of a fish screen at the intake. The requirement that a new fish screen be constructed makes this alternative impracticable based on both technological and logistical concerns. Uncertainty exists about the ability of a fish screen to operate sufficiently to protect the fish and about maintenance and operational constraints. Fish screens are being developed for testing in conjunction with the CVP Tracy facility. To date, information regarding the fish screen testing has shown extremely high costs coupled with untested technology. Accordingly, any alternative that requires the construction of new large-scale fish screens is found to be impracticable at this time based on the current status of the CVP Tracy Fish Test Facility (i.e., Modules Series approach [see Screened Clifton Court Forebay Intake discussion below]). Although this alternative would be compatible with the export and fish objectives, it is eliminated from further evaluation due to technological and logistical constraints.

Existing Intake/Levee Setbacks on West Canal

Standard levee construction methods would be used to construct setback levees on both sides of West Canal along CCF and Coney Island. Construction of setback levees would involve strict engineering criteria because the levee on the CCF side requires enough strength to withstand pressure from water levels on either side as well as intense wave action from water within CCF. Because the south Delta contains soils such as peat that can subside when fill is placed on them, the existing CCF levee was constructed over a period of several years to allow settling out and to ensure subsidence and consolidation would not occur after construction was completed. As a result, the existing levee is built beyond typical engineering standards for levees. The reliability of a newly constructed levee along CCF would be questionable. To enable construction of a levee setback along the Coney Island side of Old River, DWR would have to acquire privately owned prime agricultural property from willing sellers. Prime agricultural lands have been defined by the state and federal governments as valuable resources with the combination of physical and chemical features that allow them to sustain long-term agricultural production. In light of this information, this alternative would be considered impracticable for reasons relating to technology and logistics. The construction of a new levee along CCF would involve unreasonable geotechnical assumptions, and its reliability is considered risky. In addition, this alternative would require the willingness of local farmers to sell private lands, agreement from local farmers for easements, and extensive maintenance access. If farmers are not willing to sell, this alternative could potentially not be implemented because it is the policy of CALFED that no program/project will exercise the right of eminent domain for property acquisition. Although this would not be inconsistent with the export or fish objective, this alternative is considered an impracticable option for meeting the local objective and is eliminated from further evaluation.

Temporary Barriers

The temporary nature of the barriers results in uncertainty as to the continued permitting and access to the sites for removal and installation. This alternative involves logistical constraints that make it impracticable as a permanent solution even though it is consistent with the export or fish objectives.

Consolidating and Extending Agricultural Diversions

The primary issue to resolve with implementing this alternative is that consolidation and extension of agricultural diversions would require agreement from local south Delta farmers. Local farmers have concerns regarding the necessary easements for maintenance agreements and access, the reliability of consolidated diversions, and flexibility of irrigation. Additionally, if a consolidated diversion failed, several diversions would be affected. Thus, the reliability of providing water is reduced by this alternative. Although this alternative is not incompatible with the export or fish objective, this alternative is eliminated from further evaluation based on impracticable logistical constraints.

Treatment of Local Agricultural Drainage Water

The construction and operation of agricultural drainage water collection and treatment systems would require the cooperation and agreement of more than 160 farmers in the south Delta. The collection and treatment system would occupy at least 0.5 acre of land, permanently removing it from agricultural use. Return water would be collected from agricultural drainages and treated to remove salts and TDS, natural organic matter, pesticides, and other contaminants. Filtrated water would then be reused on crops, and the reject water stream would have to be stored on site or discharged back into south Delta channels. On average, the reject stream would contain 50% or more salt, almost twice the salt level of ambient conditions within south Delta channels. If discharged into south Delta channels, this water could either blend with existing water within the channels or, depending on timing, could be rediverted back onto farmland where its salt levels would be above levels acceptable for crop application. This alternative is impracticable for technological and logistical reasons.

Technologically, it relies on treatment methods that have been untested and unproven in the dynamic tidal environmental of the south Delta. Logistically, this alternative would require cooperation from operators of more than 160 diversions for the construction, operation, and maintenance access to the collection and treatment systems. It would leave farmers responsible for storage or disposal of water with high salt concentrations or potentially liable to implement waste discharge requirements of the Regional Water Quality Control Board (RWQCB) for a reject water stream discharged into south Delta channels. Currently, most farmers in the south Delta have received waivers from the RWQCB for their agricultural drainages. Although it is compatible with the export and fish objectives, this alternative is considered impracticable and is eliminated from further evaluation for the above combined reasons.

Pumping Water from Clifton Court Forebay to South Delta Water Agency Agricultural Users

The primary issue to resolve with implementing this alternative is from a logistical perspective. Construction of the 39 miles of pipeline and the two regulating reservoirs would require the purchase of privately owned prime farmland, a valuable resource recognized by the state and federal governments. In addition, this alternative would require the willingness of local farmers to sell specific private lands, agreement from local farmers for easements, and extensive maintenance access. If farmers are not willing to sell, this alternative potentially could not be implemented because it is the policy of CALFED that no program/project will exercise the right of eminent domain for property acquisition. Additionally, this alternative would require agreement from farmers to consolidate diversions. Local farmers have concerns regarding the reliability of consolidated diversions. If a consolidated diversion failed, several diversions would be affected. Although this alternative is compatible with the export and fish objectives, pumping water from CCF to SDWA agricultural users involves logistical constraints that make it impracticable and the alternative is eliminated from further evaluation.

Purchase/Fallow South Delta Water Agency Agricultural Users' Land

Purchasing land for the purposes of having it taken out of production would result in decreasing the SDWA water use demands in proportion to the amount of acreage taken out of production. There are uncertainties as to whether an adequate number of acres could be purchased from willing sellers as required by CALFED, and this alternative does not improve SDWA's reliability to divert water needed to meet consumptive use needs within its boundaries. Therefore, it is logistically infeasible. Additionally, it does not meet the fish objective or the export objective. Therefore, this alternative is eliminated from further consideration.

Export Objective Alternatives

All three of the export objective alternatives (Operational Scenarios A–C) use existing technology and do not involve logistical problems. Therefore, they have been retained.

Third-Phase Screening of Alternatives

In the third phase, all alternatives remain single-component and single-objective. The remaining single-component/single-objective alternatives are looked at more closely to screen for feasibility based on cost. The cost-analysis phase takes into consideration the fact that multiple local objective alternatives and fish objective alternatives would be required to ensure that the overall project objectives are achieved. Those that would not create a financial barrier to project implementation are carried forward for analysis in the EIS/EIR.

Costs

Cost is an important factor in determining which alternatives, either individually or in combination, are practicable or feasible in relation to the other project alternatives. However, costs often cannot be accurately applied as a criterion early in the project selection process because project components lack specific details needed to estimate costs. Comparatively high costs are not acceptable in that they can outweigh the benefits of a project or create barriers to the implementation and continuing operation of the project. Accordingly, projects that entail significantly higher costs or have uncertainties as to ongoing costs compared to the other alternatives being evaluated have been screened out as being impracticable or infeasible. A summary of cost comparisons of the remaining project components is provided in Table A-7.

Table A-7. Third-Phase Screening Component/Single-Objective Alternative Costs

Component/Single-Objective Alternative	Estimated Capital Cost ($)
Fish Objective	
Fish Control Structure at Head of Old River	9.9 million
Local Objective	
Permanent South Delta Flow Control Structures	
Middle River	6.5 million
Grant Line Canal	15.1 million
Old River	9.3 million
Dredging	
Middle River	
Clamshell	1.75 million
Hydraulic	4.2 million
Old River	
Clamshell	0.07 million
Hydraulic	0.21 million
Extending Agricultural Diversions	2.5 million
Existing Intake/Enlarge West Canal (depending on method)	0.84 million or 0.28 million
Export Objective	
Operational Scenario A	No Capital Costs
Operational Scenario B	No Capital Costs
Operational Scenario C	No Capital Costs

Fish Objective Alternatives

The head of Old River barrier would fully meet the project fish objective. The Proposition 13 funding earmarked to address the issues in the south Delta (approximately $56 million) makes this alternative feasible from a budgetary perspective. In addition, the CVPIA directs and authorizes Reclamation to construct a fish control barrier at the head of Old River. The Fish Control Structure at the head of Old River alternative has been retained to meet the fish objective.

Local Objective Alternatives

As previously mentioned, implementation of more than one local objective alternative would be required to ensure that the overall project objective is achieved. For example, as noted under the first-phase screening of the Dredging Alternative, the Permanent South Delta Flow Control Structures Alternative would require the implementation of the Dredging Alternative to meet the local objective. Also, because of the large project area and tidal environment of the south Delta, local objective alternatives would require implementation at various locations to meet the local objective. Although the costs of the different local objective alternatives vary greatly, combining multiple alternatives would result in comparable costs. Approximately $56 million from Proposition 13 was earmarked for addressing local water reliability in the south Delta. If costs exceed that amount, Reclamation and the State Water Contractors may be able to contribute additional funds. This funding makes these combined alternatives feasible from a budgetary perspective. All remaining local objective alternatives have been retained.

Export Objective Alternatives

The three export objective alternatives would result in the use of existing facilities. Therefore, no capital costs would be incurred by any of these single-component alternatives. Although operational costs would vary among these alternatives, these costs would be relatively similar and would not create obstacles to the implementation and continuing operation of the project. Therefore, all export objective alternatives have been retained.

Fourth-Phase Evaluation: Development of SDIP Program Alternatives Evaluated in the EIS/EIR

Alternatives evaluated in the EIS/EIR combine the single objective components carried through the third-phase screening process. Each alternative contains components that together meet the project export, local, and fish objectives (Table A-8). The fourth-phase evaluation is carried forward in the EIS/EIR.

Table A-8. Alternatives Developed from the Screening Process

Alternative	Export Objective Component	Local Objective Component(s)	Fish Objective Component(s)
2A	Operational Scenario A	Existing Intake/Enlarge West Canal Three Permanent South Delta Flow Control Structures Dredging Extending Agricultural Diversions	Fish Control Structure at Head of Old River
2B	Operational Scenario B	Existing Intake/Enlarge West Canal Three (3) Permanent South Delta Flow Control Structures Dredging Extending Agricultural Diversions	Fish Control Structure at Head of Old River
2C	Operational Scenario C	Existing Intake/Enlarge West Canal Three (3) Permanent South Delta Flow Control Structures Dredging Extending Agricultural Diversions	Fish Control Structure at Head of Old River
3B	Operational Scenario B	Existing Intake/Enlarge West Canal Two (2) Permanent South Delta Flow Control Structures Dredging Extending Agricultural Diversions	Fish Control Structure at Head of Old River
4B	Operational Scenario B	Existing Intake/Enlarge West Canal No South Delta Flow Control Structures Dredging Extending Agricultural Diversions	Fish Control Structure at Head of Old River

The alternatives were developed by combining structural/physical components with operational components. Because only one fish objective alternative was carried forth to this phase, it is included in all project alternatives. The local objective alternatives of Existing Intake/Enlarge West Canal, Localized Dredging, and Extending Agricultural Diversions are included in all project alternatives as they are considered to be absolutely necessary in meeting the local objective, as well as essential for the implementation of any of the export objective alternatives. Variations of the remaining local objective alternative, Permanent South Delta Flow Control Structures, were combined with all the export single-component alternatives (Operational Scenarios A–C). These resultant alternatives evaluated in the EIS/EIR are presented below. Together, the alternatives evaluated reveal a reasonable range of impacts resulting from implementation of a project meeting the identified need for action.

Alternative 2A

Alternative 2A would involve the construction of head of Old River fish control barrier, and Old River, Middle River, and Grant Line Canal flow control barriers; channel dredging in Old River, Middle River, and West Canal; spot dredging for agricultural diversions in Victoria, North, and Grant Line Canals, and in Old River and Middle River; extension of agricultural diversions; and Operational Scenario A.

Alternative 2B

Alternative 2B would involve the construction of head of Old River fish control barrier, and Old River, Middle River and Grant Line Canal flow control barriers; channel dredging in Old River, Middle River, and West Canal; spot dredging for agricultural diversions in Victoria, North, and Grant Line Canals, and in Old River and Middle River; extension of agricultural diversions; and Operational Scenario B.

Alternative 2C

Alternative 2C would involve the construction of head of Old River fish control barrier, and Old River, Middle River and Grant Line Canal flow control barriers; channel dredging in Old River, Middle River, and West Canal; spot dredging for agricultural diversions in Victoria, North, and Grant Line Canals, and in Old River and Middle River; extension of agricultural diversions; and Operational Scenario C.

Alternative 3B

Alternative 3B would involve the construction of head of Old River fish control barrier, and Old River and Middle River flow control barriers; channel dredging in Old River, Middle River, and West Canal; spot dredging for agricultural diversions in Victoria, North, and Grant Line Canals, and in Old River and Middle River; extension of agricultural diversions; and Operational Scenario B.

Alternative 4B

Alternative 4B would involve the construction of head of Old River fish control barrier; channel dredging in Old River, Middle River, and West Canal; spot dredging for agricultural diversions in Victoria, North, and Grant Line Canals, and in Old River and Middle River; extension of agricultural diversions; and Operational Scenario B.