
DRAFT ALTERNATIVES

INTRODUCTION

The Program now has 10 draft alternatives to present for review. The attached overviews of the alternatives are a preview of those that will be included in the progress report scheduled for distribution at the end of this month. Please keep in mind that these are *draft* alternatives and not final products. As with previous drafts, they are subject to change based on public and stakeholder input.

The 10 draft alternatives are the result of a consolidation and refinement of the 20 draft alternatives presented during meetings in February 1996. The 20 draft alternatives represented a broad range of potential solutions to Bay-Delta problems. We received considerable valuable written and verbal input on the "20" resulting from the discussions during the public workshop, the February meeting of the Bay-Delta Advisory Council, and meetings with CALFED agency staff. The Program staff considered this input, evaluated the alternatives against the Program objectives, looked for ways to refine the alternatives, and to consolidate similar alternatives.

The consolidation and refinement was *not* a screening process. We did not eliminate any concepts represented by the "20". The 10 draft alternatives represent the same broad range of potential solutions to Bay-Delta problems as represented by the 20 draft alternatives. Work will continue on refining, consolidation, and screening as we move towards a set of 3 to 5 alternatives. Just as previous refinements have changed the form of individual alternatives, you should expect that these alternatives will continue to change. Therefore, none of the current 10 draft alternatives are likely to make it to the set of 3 to 5 unchanged.

ALTERNATIVE OVERVIEWS

The attached overviews provide a brief narrative summary of the 10 draft alternatives. Not every feature of the alternatives is described in these overviews. For instance, adaptive management will be an important strategy to guide and adjust habitat restoration, but it is not specifically mentioned in the overviews. Detailed action by action listings of each alternative will be available as an appendix to the upcoming progress report. Each alternative overview includes a map showing major features.

CORE ACTIONS

As a reminder, a core action is an action at a specific implementation level that would be included as an element of *all* CALFED Program alternatives. Core actions are differentiated from other actions in the alternatives by their level of implementation and the following defining characteristics.

A core action:

- enjoys broad acceptance among stakeholders at core-level implementation
- provides a benefit to the entire Bay-Delta system
- is cost-effective
- meets one or more Program objectives
- provides some progress toward a solution but is not a satisfactory solution by itself

A core action should not:

- preclude or conflict with other actions
- increase conflicts between beneficial uses or stakeholders
- be a major program activity or major facility structure
- create significant adverse, site-specific impacts or redistribute costs (such as by infringing on existing land uses)

Because core actions are common to all alternatives, they are not described in each alternative overview. However, remember that the core actions do include significant Bay-Delta habitat restoration, upstream habitat restoration, reductions in the effects of diversions, management of anadromous fish, reduction in export reliance (demand management), water supply enhancement, increasing water supply predictability, management of water quality, and improvements to system reliability. For example, *each* alternative includes significant upstream habitat restoration such as California's cost share portion of restoration in CVPIA.

PHASING OF ALTERNATIVES

All alternatives can be phased over time. The individual actions included in each alternative offer many opportunities for phased implementation over short-term, intermediate-term, and long-term time frames. Phasing of action implementation offers great benefits in financing the overall program in installments. Phasing also offers potential fine-tuning the overall program solution in the future as more information becomes available.

Two example phasing diagrams are attached to show the general concept of how alternatives could be phased. These are only examples and are provided following overviews for alternatives A (Extensive Demand Management) and C (Dual Delta Conveyance). Core actions are very well suited for early implementation. Many core actions could potentially be implemented prior to selection of the preferred alternative.

Based on input received at public Workshop 5, another set of actions common to all alternatives may be well suited for early funding and implementation. These "essential elements" are briefly discussed in the following section.

ESSENTIAL ELEMENTS

During Workshop 5, we heard many comments that certain actions included in all the alternatives need to be implemented at levels higher than those represented in the core actions. For example, increased levels of demand management, more levee improvements, and more habitat above the core levels of implementation should be included in all alternatives. The term "essential elements" was suggested for a set of actions that was viewed by most to be essential to the success of any alternative. The essential elements should not be confused with the core actions since they are not subject to the same criteria as presented above for the core actions. These should be viewed as a starting set in addition to the core actions for planning early stages of Program implementation.

The attached overviews do not identify the essential elements, as work is continuing on this concept. However, the example phasing diagrams shown with alternatives A and C do show the types of actions that are being considered for inclusion as essential elements.

SUMMARY TABLE AND MATRIX

To help you organize the information contained in the alternative descriptions a table and a matrix are provided on the following pages. The table shows the major emphasis for each alternative.

The matrix provides more detail by highlighting each alternative's main approaches to achieving the primary objectives. Alternatives are listed in columns. The rows catalog the general approaches to resolving problems in the Bay-Delta. These approaches are grouped under the four primary objective areas: Water Supply, Water Quality, Ecosystem Quality, and System Vulnerability.

The summary table and matrix allow you to scan for draft alternatives containing actions or combined actions of high interest. They also enable you to compare draft alternatives quickly and easily at a general level, in order to differentiate them.

Table of Alternatives

No.	Alternative	Major Emphasis
A	Extensive Demand Management EQ: modest SV: modest WQ: modest	<ul style="list-style-type: none"> • Aggressive demand management upstream, in the Delta, and in export areas (BMP's and EWMP's to produce .5 to 1 MAF, Permanently fallow about 800,000 acres to produce 1.5 MAF, 1 MAF from Reclamation, Water bank and temporary land fallowing for 1 to 2 MAF) • 100 TAF in-Delta environmental storage
B	New Storage to Improve Delta Flow EQ: moderate SV: moderate WQ: extensive	<ul style="list-style-type: none"> • 1 to 2 MAF combined upstream storage and downstream storage • Improvement to address south Delta water quality, stage, and circulation • Increase groundwater conjunctive use (500 to 800 TAF) • Control water pollutant sources
C	Dual Delta Conveyance EQ: moderate SV: moderate WQ: moderate	<ul style="list-style-type: none"> • Screened diversion on Sacramento River and small east-side facility • Improved through-Delta conveyance • 1 to 2 MAF combined upstream and downstream storage • Permit maximum pumping capacity
D	Through Delta Conveyance EQ: moderate SV: moderate WQ: moderate	<ul style="list-style-type: none"> • Screened diversion on Sacramento River • East-side conveyance channel improvements • Supply 300 to 500 TAF from groundwater banking • 1 to 1.5 MAF downstream storage
E	Delta Channel Habitat and Conveyance EQ: moderate SV: moderate WQ: moderate	<ul style="list-style-type: none"> • Moderate level of habitat improvement to support sustainability of high-importance fish species (100 TAF San Joaquin water) • New diversion from Sacramento River to east-side channels • Extensive channel improvement to reduce velocities
F	Extensive Habitat Restoration with Storage EQ: extensive SV: extensive WQ: moderate	<ul style="list-style-type: none"> • High levels of habitat improvement to support sustainability of high-importance fish species (100 TAF of San Joaquin water) • 300 to 400 TAF in-Delta environmental storage • Extensive screening of diversions
G	East Side Foothills Conveyance EQ: moderate SV: moderate WQ: moderate	<ul style="list-style-type: none"> • 5,000 to 7,000 cfs conveyance facility • New screened diversion facilities on Feather and Sacramento Rivers • Improvement to address south Delta water quality, stage, and circulation • 100 TAF in-Delta environmental storage

Table of Alternatives

No.	Alternative	Major Emphasis
H	Chain of Lakes Conveyance EQ: moderate SV: extensive WQ: extensive	<ul style="list-style-type: none"> • Multiple 5,000 cfs diversion points • 300 to 600 TAF in -Delta storage • Extensive levee improvements
I	West Side Conveyance and River Restoration EQ: moderate SV: moderate WQ: moderate	<ul style="list-style-type: none"> • 5,000 to 10,000 cfs screened diversion at Shasta Lake • 2,000 to 7,000 cfs screened diversion at Lake Oroville • 6 to 8 MAF storage in Sacramento Valley • 10,000 to 15,000 cfs isolated transfer facility
J	East Side Conveyance EQ: extensive SV: extensive WQ: extensive	<ul style="list-style-type: none"> • 15,000 to 20,000 cfs screened diversion(s) • 15,000 to 20,000 cfs isolated transfer facility • Improvement to address south Delta water quality, stage, and circulation

**CALFED Bay-Delta Program
Draft Alternatives**

Component	System Reoperation Alternatives			Reoperation and New Facilities Alternatives				New Facilities Alternatives		
	Extensive Demand Management	Extensive Habitat Restoration with Storage	Through Delta Conveyance	Dual Delta Conveyance	Delta Channel Habitat and Conveyance	East Side Foothills Conveyance	New Storage to Improve Delta Flow	Chain of Lakes Conveyance	West Side Conveyance and River Restoration	East Side Conveyance
	A	F	D	C	E	G	B	H	I	J
Water Supply (for all uses)										
Reduce Demand	Extensive	Modest	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Channel Capacity Improvements			High	Moderate	High		Modest			
Small Isolated Conveyance				5-7K cfs		5-7K cfs				
Large Isolated Conveyance								10-15k cfs	10-15k cfs	15-20k cfs
Upstream Surface Storage				0.5-1 MAF			0.5-1 MAF		6-8MAF	
In-Delta Surface Storage	100 TAF	400 TAF	100 TAF			100 TAF		300-600 TAF		
Downstream Surface Storage			1-1.5 MAF	0.5-1 TAF			0.5-1 MAF			
Conjunctive Use/Groundwater Banking	Extensive	Moderate	Moderate	Moderate	Moderate	Extensive	Moderate	Moderate	Moderate	Moderate
Water Transfers	Modest	Modest	Modest	High	Modest	Modest	Moderate	Modest	Moderate	Modest
Water Quality										
Pollutant Source Control	Modest	Moderate	Moderate	Moderate	Moderate	Moderate	Extensive	Extensive	Moderate	Extensive
Increase Flows for Water Quality	Modest	Modest	Modest	Moderate	Modest	Moderate	Moderate	Modest	Moderate	Modest
Ecosystem Quality										
Bay & Delta Habitat Restoration	Modest	Extensive	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Extensive
San Joaquin River Improvements	Modest	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Upper Sacramento Restoration	Modest	Extensive	Modest	Modest	Modest	Modest	Modest	Modest	Extensive	Extensive
Obtain Water for Environment		100 TAF	100 TAF	100 TAF	100 TAF	100 TAF	100 TAF	100 TAF	100 TAF	100 TAF
Relocate Export Diversion Point				Partial	Partial	Partial	Partial	Full	Full	Full
Screening Diversions	Modest	Extensive	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Extensive
System Vulnerability										
Modest Levee Improve./ Maint.	Modest									
Moderate Levee Improve./Maint.			Moderate	Moderate	Moderate	Moderate	Moderate		Moderate	
Extensive Levee Improve./Maint.		Extensive						Extensive		Extensive

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Alternative A Extensive Demand Management

Overview

This alternative will implement an extensive program of demand management actions in all water service areas dependent on the Bay-Delta watershed. These actions will produce substantial water savings, increasing water supply flexibility. This alternative will reduce fish entrainment losses by decreasing diversions from the Bay-Delta watershed and avoiding diversions during environmentally sensitive periods when fish are more vulnerable. Total diversions from the system will be reduced, allowing reservoir operation to increase spring Delta outflow as a benefit to fish transport and enhancement of ecosystem productivity. This alternative targets those levees with the highest priority to reduce system vulnerability in the Delta and improve water quality.

Extensive demand management increases flexibility and reduces entrainment

Currently, limitations on fish entrainment (take limits) are set to avoid jeopardizing fish populations. When these limits are approached, diversions are curtailed or stopped, creating a high degree of uncertainty for water users. As habitat is improved, leading to greater fish populations, the relative effect of diversions on population will be reduced. This will consequently lessen take limit constraints on diversions, providing improved water supply reliability. A program of highest-priority habitat restoration actions will be implemented to benefit fish and wildlife species and reduce constraints on water management operations caused by protection of aquatic species. Mosaics of shallow water, riverine, and riparian habitat will be restored along the Sacramento River, in the Delta and along reconstructed Delta levees. Diked wetlands near Suisun Bay will be restored to tidal action for wet year spawning and rearing of Delta smelt and rearing of salmon.

Highest priority habitats are restored

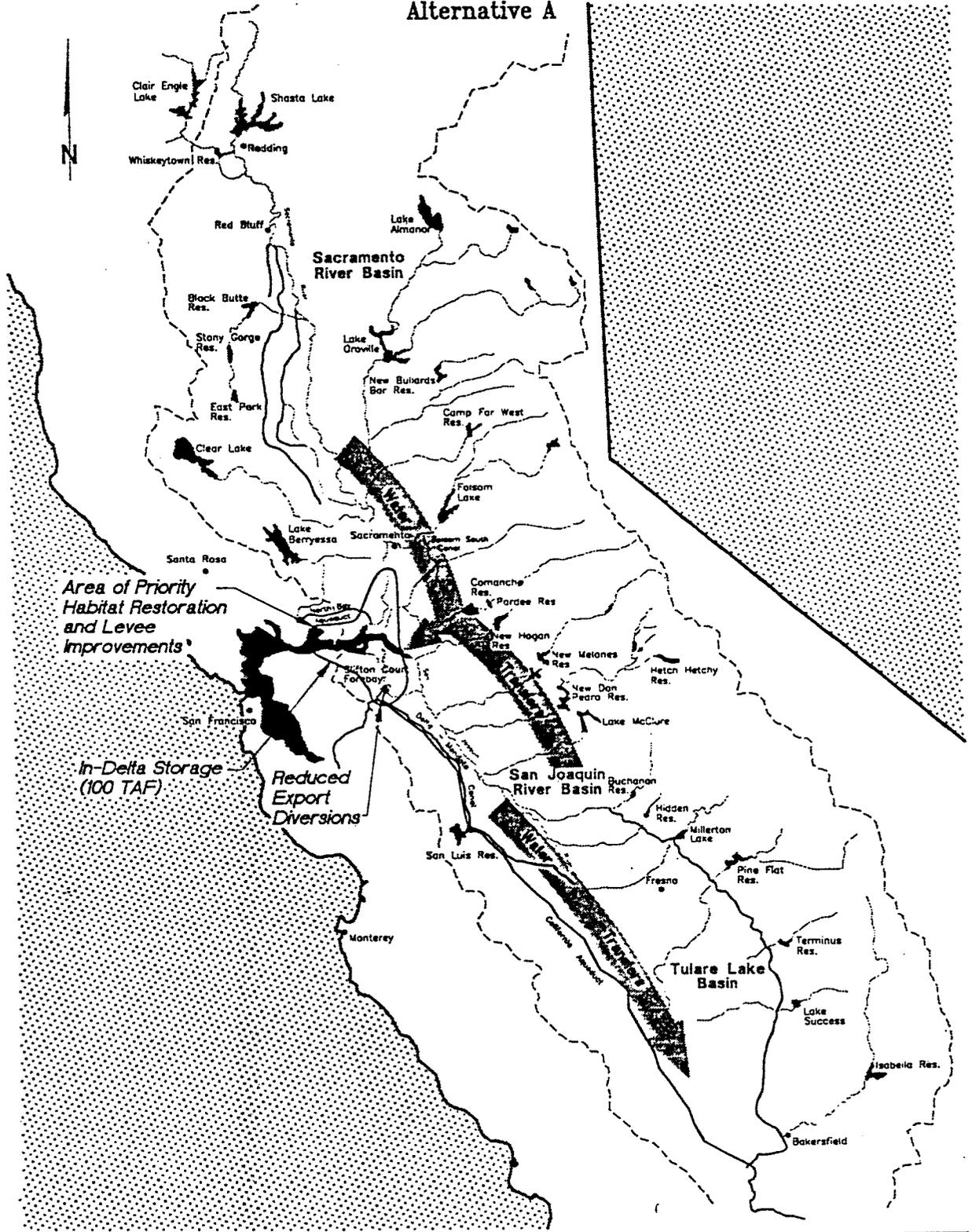
To further enhance the survival of protected aquatic species, Delta export diversions will be reduced during the spring (February-June) period to produce greater Delta outflows for fish transport and to reduce fish entrainment at the export pumps. Fish screens will be installed on high priority diversions throughout the Bay-Delta system, fish guidance facilities will be operated at the head of Old River and Georgiana Slough, and export forebay configuration and operations will be modified to reduce fish losses at the export pumps.

Several actions reduce fish entrainment

Extensive demand management including water conservation, water reclamation, and land retirement will be implemented to sustain supplies for existing water users and provide alternative supplies for other users. Intensive use of expanded urban "Best Management Practices" and agricultural "Efficient Water Management Practices" will conserve 500 TAF-1 MAF of water per year. Substantial water reclamation investments will produce approximately 1 MAF of new urban water supplies.

Extensive demand management balances supply and demand

Extensive Demand Management Alternative A



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Water pricing structures (e.g. inclining block rates) that provide incentives to conserve water will be established. About 750,000 to 850,000 acres of land will be permanently retired, reducing evapotranspiration by over 1.5 MAF per year in normal water years and conserving that water for Delta outflow and other beneficial uses. This alternative will also establish a long-term drought water bank to improve supply reliability in dry years and encourage temporary land fallowing to acquire 1 to 2 MAF for dry year transfers. Market mechanisms and incentives will facilitate water transfers.

Water management tools include pricing, land retirement, and water banking

To help allow shifts in water diversion and storage away from the spring (February-June) period, this alternative will expand conjunctive use and groundwater banking in Delta export areas. To protect Delta outflow in dry years, expanded in-lieu groundwater banking in the southern San Joaquin Valley and other areas dependent on Delta supplies will help reduce demands for surface water in those years.

Conjunctive use shifts time of diversions

Also under this alternative, approximately 100 TAF of water storage will be constructed on a south Delta island to be operated for environmental purposes. Water will be diverted onto the island through state-of-the-art fish screens at times when fish are less vulnerable. This water will be released to aid transport of fish through the Delta and to provide some water for export diversions when fish are vulnerable.

Delta water storage helps reduce entrainment

Delta water quality will be enhanced by implementing modest source-control actions for pollutants in the Bay-Delta watershed. Land retirement will focus on marginally productive lands, especially those that contribute substantially to regional drainage and water quality problems. This will improve water quality in the San Joaquin River and the south and central Delta. In addition, there will be a slight reduction in recycled salt load to the San Joaquin Valley.

Modest actions for pollutant source control

This alternative will improve high priority levees in the Delta, incorporating aquatic habitat features where levees are rebuilt. Highest priority sites will focus on islands considered critical for water quality and having both regional infrastructure facilities and valuable habitat. An emergency management plan will be established to respond to levee failure, and some funding will be made available for ongoing levee maintenance.

Levee improvements focus on high priority areas

Potential Sequencing

Stage 1. Implementation would begin with the core actions.

Core actions

Stage 2. The second stage of implementation will consist of high priority habitat restoration, installation of screens on high priority diversions, the most cost-effective actions for water conservation and reclamation, expansion of groundwater banking and conjunctive use in the highest priority sites, establishment of a long-term drought water bank, and the highest priority levee improvements. During this stage, approximately 200,000 to 300,000 acres of marginal agricultural land will be permanently retired.

Demand management, high priority habitat restoration, land retirement

Stage 3. The third stage will include expanded implementation of water conservation, reclamation, and conjunctive use actions; construction of in-Delta water storage; installation of fish guidance facilities; and retirement of 200,000 to 300,000 additional acres of agricultural land.

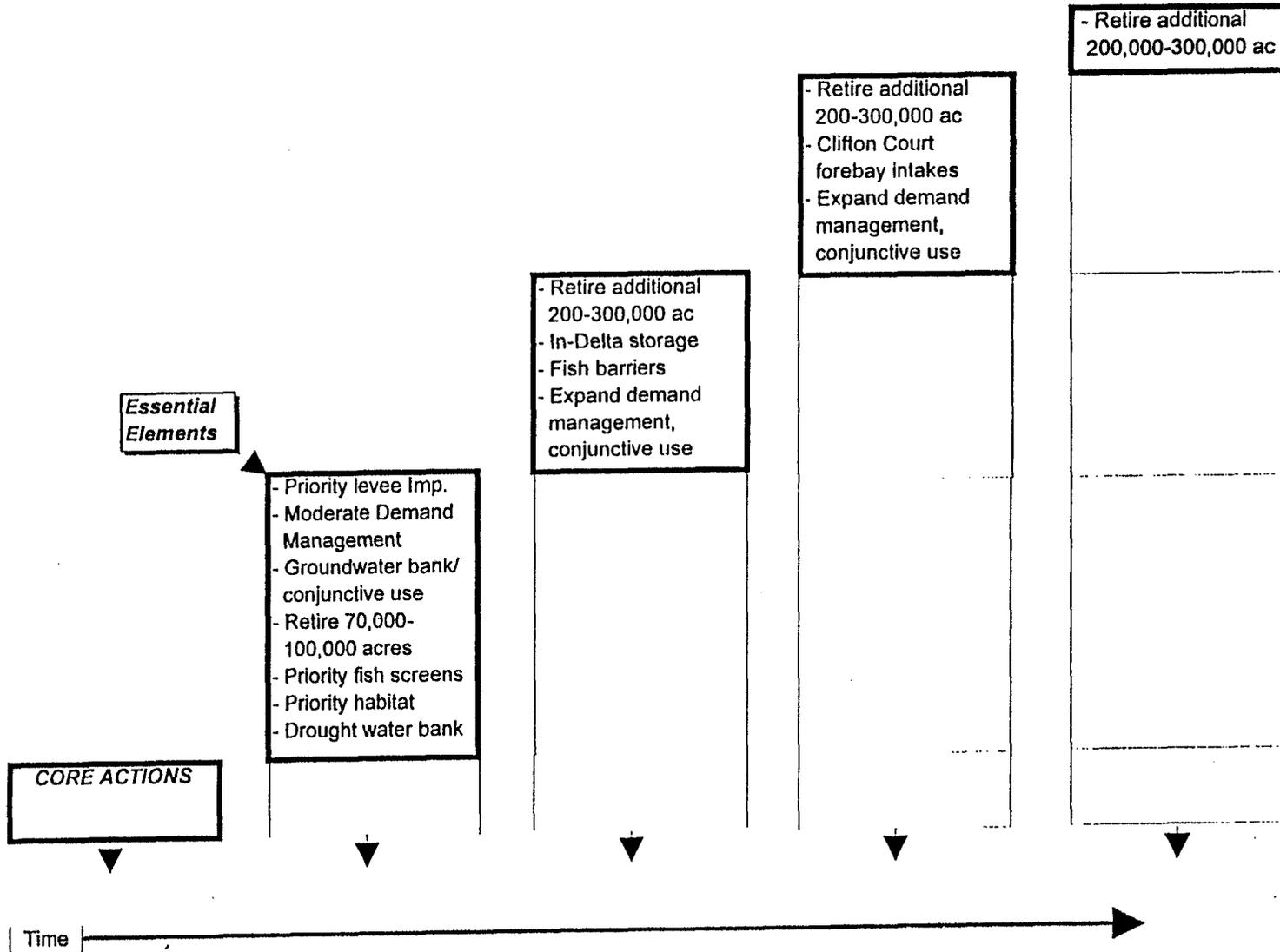
*In-Delta storage
and fish barriers*

Stage 4. In the final stage, this alternative will include achievement of the most extensive actions to expand water conservation, water reclamation, and conjunctive use. Additional agricultural land will be permanently retired to bring the total to 750,000 to 850,000 acres. Modification of the Clifton Court Forebay intake and construction of a secondary intake will be completed to reduce fish entrainment losses at the export pumps.

*Demand
management,
land retirement,
entrainment
reduction*

ALT_A

POTENTIAL PHASING (One example)
ALT A - EXTENSIVE DEMAND MANAGEMENT



Alternative B

New Storage to Improve Delta Flow

Overview

This alternative will include new surface storage upstream and downstream of the Delta combined with improved system operation in order to improve flows for fisheries, reduce entrainment, and increase water supply reliability and flexibility. Moderate habitat restoration will complement the reduction in entrainment and improvement in flow to increase fish populations. Aggressive source control measures improve water quality, and moderate levee improvements are made to reduce system vulnerability.

New storage improves reliability and flow conditions

This alternative will provide substantial increases in water storage capacities, both upstream and downstream of the Delta. Downstream of the Delta, storage of 0.5-1.0 MAF capacity will be constructed to integrate operational flexibility in the pattern of diversions from the Delta, upstream storage regulation, and water use patterns in all service areas dependent on Delta water supplies. Upstream of the Delta, storage of similar capacity will be constructed to expand abilities to capture peak flood flows during periods when not needed for instream uses and to manage releases of those flows to the Delta for anadromous fisheries, water quality, and water supply benefits.

New water storage is added upstream and downstream

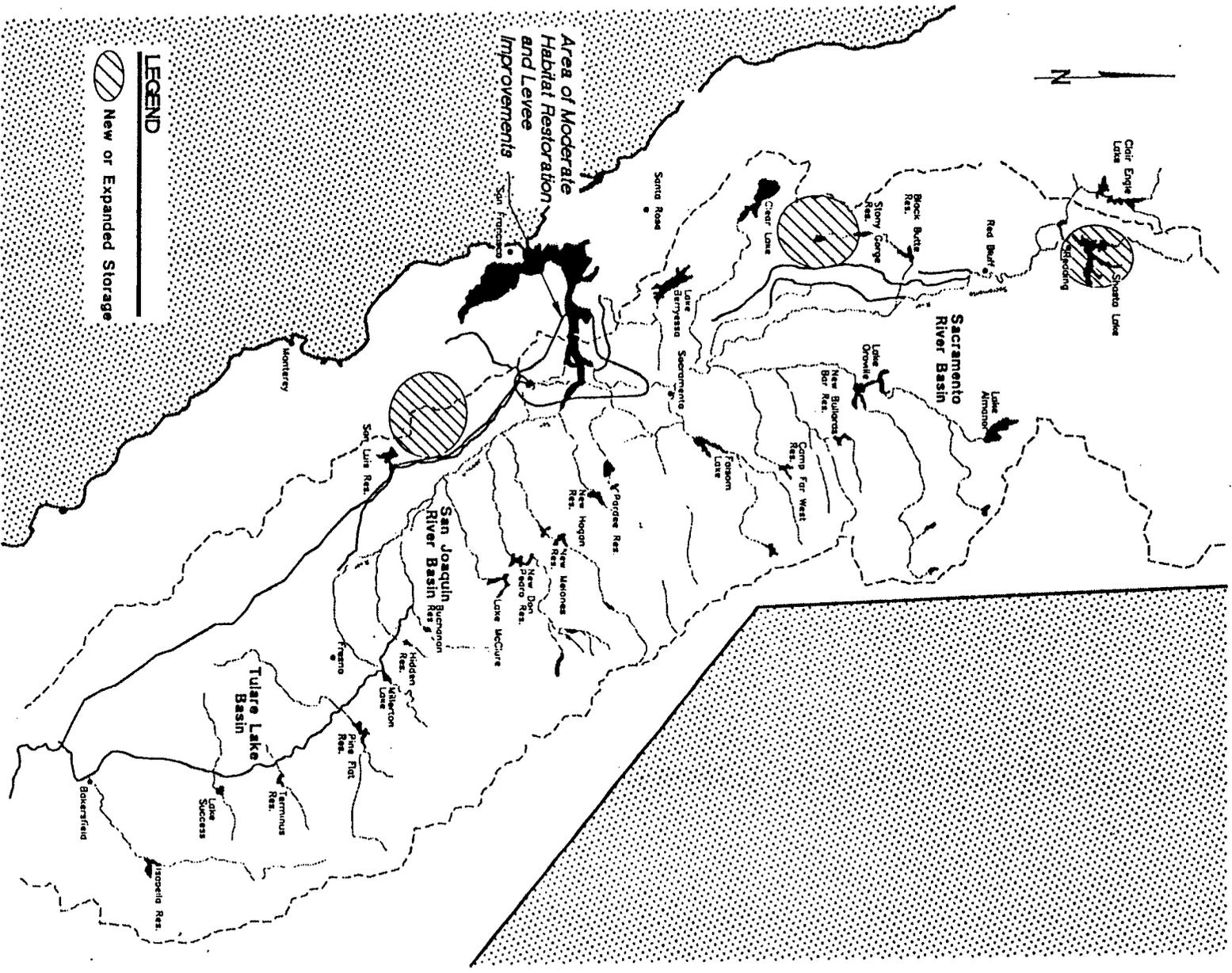
The permitted capacity of existing export pumps will be expanded to their full physical capacity, but only during windows when fish are less vulnerable during high flood runoff periods (e.g. in late fall and early winter). Real-time monitoring will be expanded to guide pumping operations, allowing pumping to be curtailed when vulnerable fish are present. Increased flexibility in diversion capabilities, increased downstream storage, and shifts in storage windows for all upstream reservoirs will allow better avoidance of fish entrainment without reducing water supply reliability and availability. This alternative will rely on the existing configuration of Delta channels for water supply conveyance. A variety of actions will be studied and implemented to reduce adverse effects of salinity in San Joaquin River inflow, to maintain water levels and circulation in south Delta channels, and to reduce the recycled salt load to the San Joaquin Valley.

System operation is improved

This alternative will provide moderate levels of habitat along the Sacramento River downstream of Sacramento and will restore channel features on the San Joaquin River to improve survival of anadromous fish. Moderate habitat restoration in the Delta will include shallow riverine and riparian habitats to improve conditions for Delta native and anadromous fish. Moderate levels of shallow tidal habitat will be developed near Suisun Bay to benefit migrating salmon and provide spawning and rearing areas for Delta smelt.

Moderate habitat restoration upstream, in the Delta, and near Suisun Bay

New Storage to Improve Delta Flow Alternative B



Approximately 100 TAF of water will be obtained or developed in the San Joaquin river basin for release as spring pulse flows to improve transport of San Joaquin River fish through the Delta. Fish screens will be installed on high and moderate priority unscreened diversions throughout the Bay-Delta system and fish guidance facilities will be operated at the head of Old River and at key locations on the Sacramento River to guide fish away from the central Delta.

Water development or purchases will improve fish transport

Expanded demand management, conjunctive use, groundwater and surface banking will improve full system operational flexibility that can further reduce fish entrainment by providing more Delta flow in the critical spring period for fish (February-June). This additional Delta flow will be provided through a combination of methods that will be implemented on a priority basis. These methods include reducing consumptive use of Delta water during those months by reducing demand and switching to alternative supplies in all service areas that are dependent upon Delta water supplies; dedicating some newly developed storage to providing Delta outflow; conjunctively using groundwater basins to provide spring Delta flows; implementing conservation and reclamation actions in ways that allow shifting the timing of the releases of conserved water into the Delta during the spring; encouraging temporary land fallowing during drought periods; and making upstream reservoir storage operational changes that will provide more direct inflow to all parts of the Delta during critical spring periods.

Water bank, improved demand management help balance supply and demand

Delta and tributary water quality will be improved through aggressive source control efforts to reduce and manage discharges from agricultural operations and urban areas throughout the Bay-Delta system. Enforcement of source control regulations and implementation of Best Management Practices for salinity and pesticide residues will be expanded (e.g retention of agricultural drainage). Retirement of marginally-productive agricultural lands that contribute substantially to instream water quality problems in the San Joaquin River will be expanded. Measures to reduce the total salt load transported to the San Joaquin Valley will be implemented. Pollutants in San Joaquin River inflow will be diluted using water purchased or developed in the San Joaquin River basin.

Aggressive pollutant source control improves water quality

This alternative provides moderate levee improvements to reduce system vulnerability, establishes an emergency management plan to respond to levee failure, and provides funds for ongoing maintenance. Levee improvements will target levees that protect infrastructure, western Delta islands that are critical for water quality, population centers, and valuable habitats.

Moderate levee improvements

New storage and improved system operations increase water supply reliability and flexibility while improving flow conditions for fish. Levee rehabilitation that incorporates habitat improvements can simultaneously reduce system vulnerability, increase ecosystem quality, and improve water quality.

Actions provide multiple benefits

Potential Sequencing

Stage 1. Implementation will begin with the core actions.

Core Actions

Stage 2. Actions implemented during Stage 2 of this alternative will include establishment of a permanent drought water bank, implementation of a moderate demand management program, high priority improvements to levees and flood channels in the Delta, high priority habitat restoration actions, and installation of high-priority fish screens. Stage 2 will include retirement of approximately 70,000 to 100,000 acres of marginally productive agricultural lands in the San Joaquin Valley. Also during Stage 2, expanded real-time monitoring will be implemented to allow the Delta export pumps to be operated at full capacity during safe periods and to minimize entrainment of sensitive fish during vulnerable periods. Groundwater banking programs in the San Joaquin Valley and other service areas dependent on Delta water will be expanded.

*Demand
management and
habitat
restoration*

Stage 3. In Stage 3, downstream water storage will be constructed to further increase capabilities to manage both Delta exports and upstream reservoir storage operations to avoid entrainment effects while maximizing the utility of Delta water. Additional San Joaquin River water for spring pulse flows will be obtained, and moderate priority levee and flood control improvements, habitat restoration actions, and fish screen installations will be implemented. An additional 200,000 to 300,000 acres of marginally productive agricultural lands in the San Joaquin Valley will be retired during this stage.

*Downstream
storage, San
Joaquin flows*

Stage 4. Stage 4 will consist of constructing water storage upstream of the Delta to maximize flexibility in managing flows through the Delta for supporting all beneficial uses. Operational standards for this storage facility will specify the sharing of stored water among environmental and water supply uses. For example, stored water will be used to improve upstream anadromous fish habitat, manage water quality in the Delta, and provide more flexible water supplies.

*Upstream
storage*

Alternative C Dual Delta Conveyance

Overview

This alternative will include a new screened diversion facility on the Sacramento River between Hood and Freeport. This diversion facility will supply a new small isolated conveyance facility that will transport water around the east side of the Delta to the existing south Delta pumping plants. The new screened diversion facility will also supply water for continued through-Delta conveyance. Fish entrainment will be substantially reduced, and isolation of some diversions from Delta channels will improve export water quality. New surface storage upstream and downstream of the Delta will be built to improve flows for fisheries while increasing water supply reliability and flexibility. Moderate habitat restoration will complement the reduction in entrainment and improvement in flow to increase fish populations. Source control measures will improve water quality, and moderate levee improvements will reduce system vulnerability.

New storage and conveyance improve reliability, flow conditions, water quality

The new dual diversion facility on the Sacramento River will be equipped with state-of-the-art fish screens to minimize entrainment of fish. Real-time monitoring will be used to shift diversions among multiple intakes and thus avoid entrainment effects during critical periods of fish out-migration or spawning. A new canal, isolated from Delta channels, will be constructed to convey water (approximately 5,000-7,000 cfs) from the new diversion point to the existing Banks and Tracy Pumping Plants. The isolated facility will be sized to supply the majority of Delta export needs during sensitive spring periods and to potentially provide drinking water supplies to some users in Sacramento County, San Joaquin County, and the Bay Area. The conveyance facility will include siphons under all important stream courses to prevent disruption of water quality and aquatic habitat values in the streams.

Dual diversion and small isolated conveyance protect water quality and fish

Improvements to north Delta channels will provide multiple benefits for flood conveyance, habitat restoration, water supply, and south Delta water quality. A variety of actions will be studied and implemented to reduce adverse effects of salinity in San Joaquin River inflow, to maintain water levels and circulation in south Delta channels, and to reduce recycled salt load to the San Joaquin Valley.

Some through-Delta conveyance continues

Water storage facilities with a combined capacity of 1-2 million acre-feet will be constructed upstream and downstream of the Delta to increase the capability to capture, store, and use flows for environmental and water supply benefits. Increased upstream water storage will be used in concert with reoperation of many upstream reservoirs to provide water to improve anadromous fish habitat and flows to transport fish through the Delta.

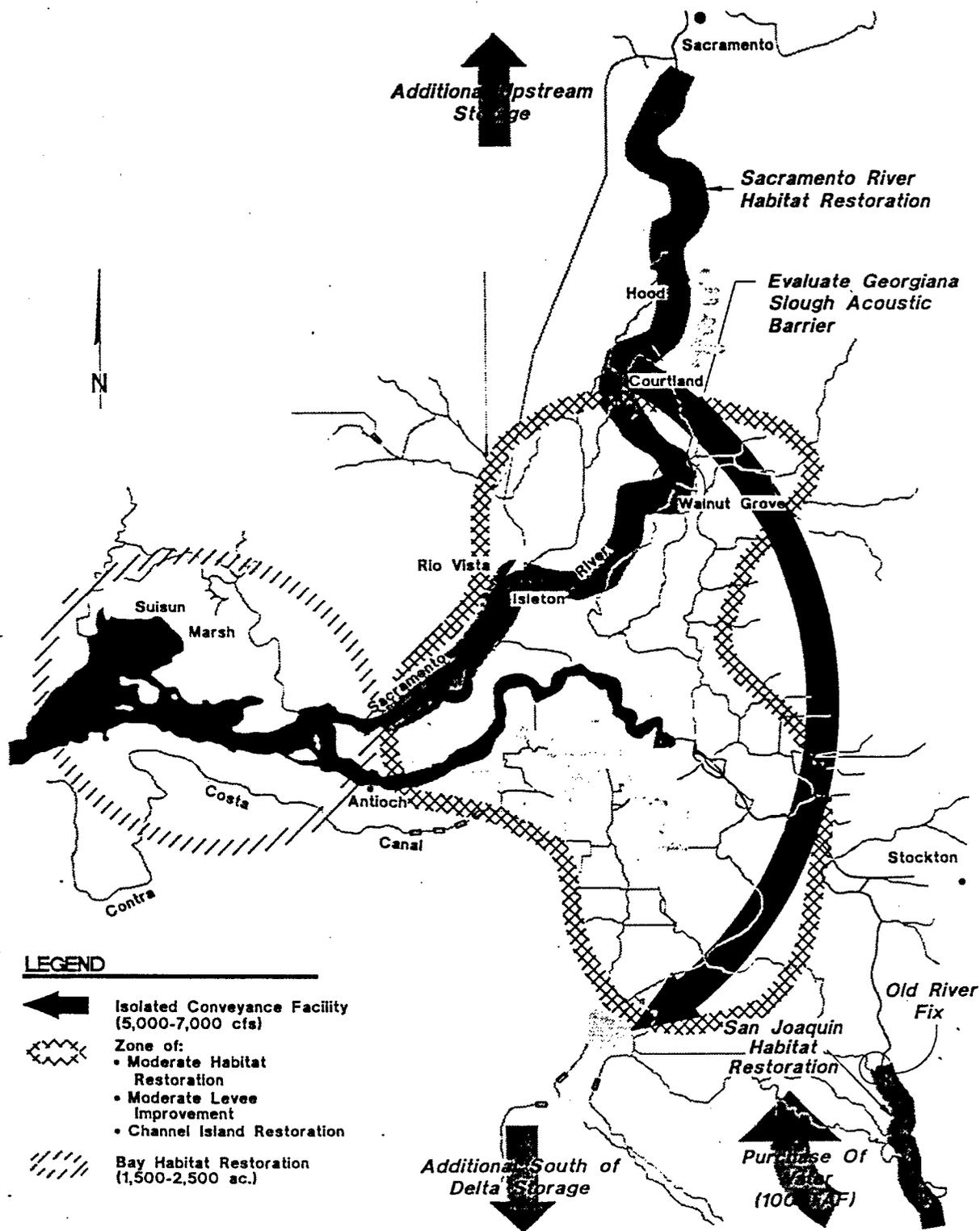
New water storage is added upstream and downstream

The permitted capacity of existing export pumps will be expanded to their full physical capacity, but only during windows when fish are less vulnerable during high flood runoff periods (e.g., in late fall and early winter). Real-time monitoring will be expanded to guide pumping operations, allowing pumping to be curtailed

System operation is improved

Dual Delta Conveyance

Alternative C



when vulnerable fish are present. Construction of water storage facilities downstream and upstream of the Delta and expanded conjunctive use programs in the San Joaquin Valley and other service areas will greatly increase water management flexibility to utilize Delta water for consumptive use during less environmentally damaging periods (e.g. late fall and early winter), thus avoiding entrainment of vulnerable fish while maintaining the total volume of Delta water use.

This alternative will provide moderate levels of habitat along the Sacramento River downstream of Sacramento and will restore channel features on the San Joaquin River to improve survival of anadromous fish. Moderate habitat restoration in the Delta will include shallow riverine and riparian habitats to improve conditions for Delta native and anadromous fish. Moderate levels of shallow tidal habitat will be developed near Suisun Bay to benefit migrating salmon and provide spawning and rearing areas for Delta smelt.

Moderate habitat restoration upstream, in the Delta, and near Suisun Bay

Reduction of San Joaquin River reverse flows during export pumping in the south Delta in combination with moving the diversion point for the balance of exports will minimize entrainment of fish during more vulnerable periods. Water (approximately 100 TAF) will be obtained or developed in the San Joaquin River basin for release as spring pulse flows to improve transport of San Joaquin River fish through the Delta. Fish screens will be installed on high and moderate priority unscreened diversions throughout the Bay-Delta system and a fish guidance system will be implemented at the head of Old River.

Improvements in flow, and new screens, reduce entrainment

Expanded demand management, conjunctive use, groundwater and surface banking will improve full system operational flexibility that can further reduce fish entrainment by providing more Delta flow in the critical spring period for fish (February-June). This additional Delta flow will be provided through a combination of methods that will be implemented on a priority basis. These methods include reducing consumptive use of Delta water during those months by reducing demand and switching to alternative supplies in all service areas that are dependent upon Delta water supplies; dedicating some newly developed storage to providing Delta outflow; conjunctively using groundwater basins to provide spring Delta flows; implementing conservation and reclamation actions in ways that allow shifting the timing of the releases of conserved water into the Delta during the spring; and making upstream reservoir storage operational changes that will provide more direct inflow to all parts of the Delta during critical spring periods.

Water bank, improved demand management help balance supply and demand

Delta and tributary water quality will be improved through source control efforts to reduce and manage discharges from agricultural operations and urban areas throughout the Bay-Delta system. Retirement of marginally-productive agricultural lands that contribute substantially to instream water quality problems in the San Joaquin River will be expanded. Measures to moderately reduce the total salt load transported to the San Joaquin Valley will be implemented. Pollutants in San Joaquin River inflow will be diluted using water purchased or developed in the San Joaquin River basin.

Pollutant source control

This alternative provides moderate levee improvements to reduce system vulnerability, establishes an emergency management plan to respond to levee failure, and provides funds for ongoing maintenance. Levee improvements will target levees that protect infrastructure, western Delta islands that are critical for water quality, population centers, and valuable habitats. Levee improvements will incorporate habitat restoration.

Moderate levee improvements

A range of diversion points from Hood through Freeport are possible on the Sacramento River below the confluence with the American River. A variation of those diversions that can be investigated is a diversion point upstream of Bryte that utilizes either the Yolo Bypass or the Sacramento Ship Channel to convey water south to Liberty Island and then crosses Ryer Grand Islands, siphons under the Sacramento River, and rejoins the previously discussed eastern canal alignment.

Optional diversion points

New storage and conveyance increase water supply reliability and water quality while improving flow conditions for fish and reducing entrainment. Levee rehabilitation incorporates habitat improvements while simultaneously reducing system vulnerability, increasing ecosystem quality, and improving water quality.

Actions provide multiple benefits

Potential Sequencing

Stage 1. Implementation will begin with core actions.

Core actions

Stage 2. Actions implemented during Stage 2 of this alternative will include establishment of a permanent drought water bank, implementation of a moderate demand management program, high priority improvements to levees and flood channels in the Delta, high priority habitat restoration actions, and installation of high-priority fish screens. Approximately 70,000-100,000 acres of marginally productive agricultural lands in the San Joaquin Valley will be retired. Expanded real-time monitoring will be implemented to allow the Delta export pumps to be operated at full capacity during safe periods and provide operational flexibility to avoid fish entrainment during vulnerable periods. Groundwater banking programs in the San Joaquin Valley and other service areas will be expanded.

Demand management and habitat restoration

Stage 3. In Stage 3, downstream water storage will be constructed to increase capabilities to coordinate Delta water use and shifted upstream reservoir storage operations to avoid entrainment effects while maximizing the utility of water for users. Storage upstream of the Delta will be constructed to maximize flexibility in managing flows through the Delta for supporting environmental, water quality, and water supply uses. Additional San Joaquin River water for spring pulse flows will be obtained or developed, and moderate priority levee and flood control improvements, habitat restoration actions, and fish screen installations will be implemented. An additional 200,000 to 300,000 acres of marginally productive agricultural lands in the San Joaquin Valley will be retired during this stage. To test screening technologies, a small screened diversion from the Sacramento River to Snodgrass Slough will be constructed.

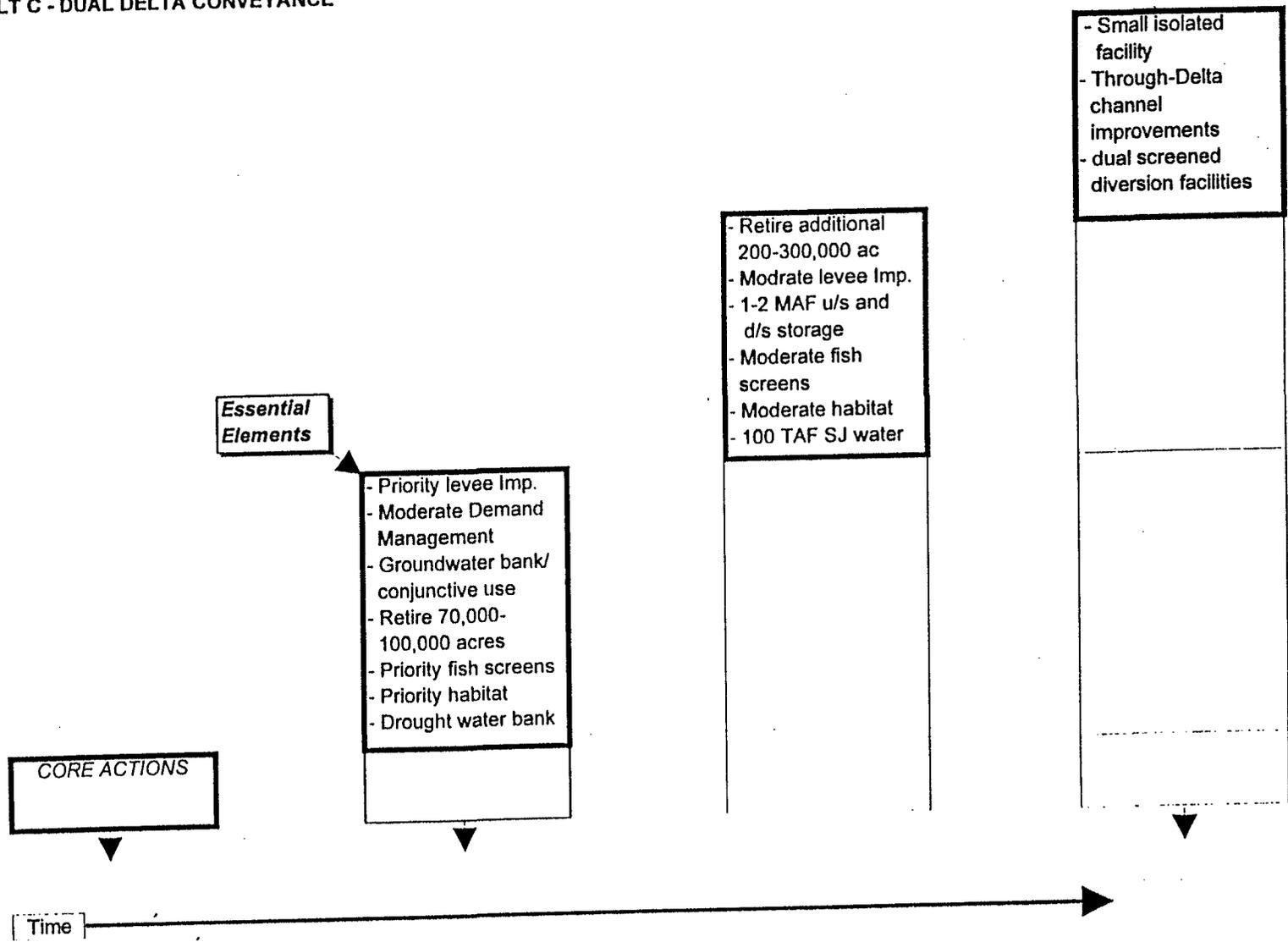
New storage, demand management, levee improvements

Stage 4. Stage 4 will consist of constructing the dual screened diversion facilities on the Sacramento River in the north Delta, a small isolated conveyance facility for a portion of Delta exports, and north Delta channel improvements.

*New screens
and isolated
conveyance*

ALT_C

POTENTIAL PHASING (One example)
ALT C - DUAL DELTA CONVEYANCE



Alternative D Through Delta Conveyance

Overview

This alternative will include a new screened diversion facility on the Sacramento River between Hood and Freeport. This diversion facility will supply water for continued through-Delta conveyance to existing south Delta pumping plants. New surface storage downstream of the Delta will be built to increase water supply reliability. This new storage will also be used to manage diversions so that entrainment can be reduced. Moderate habitat restoration will complement the reduction in entrainment to increase fish populations. Source control measures will improve water quality, and moderate levee improvements will reduce system vulnerability.

New storage and screening improve reliability, reduce entrainment

This alternative will reduce fish mortality caused by entrainment in the south and central Delta by installing a new screened facility to convey water from the Sacramento River to eastside channels. Behavioral barriers to fish movement will be evaluated for long-term operation at Georgiana Slough and the head of Old River. A new screened intake for the State Water Project will be constructed at Italian Slough to separate inflows to the export pumps from Clifton Court Forebay when diversion rates are low. Fish screens will be constructed on other moderate and high priority diversions in the Delta and on upstream rivers and tributaries.

Entrainment is reduced

This alternative will provide moderate levels of habitat along the Sacramento River downstream of Sacramento and will restore channel features on the San Joaquin River to improve survival of anadromous fish. Moderate habitat restoration in the Delta will include shallow riverine and riparian habitats to improve conditions for Delta native and anadromous fish. Moderate levels of shallow tidal habitat will be developed near Suisun Bay to benefit migrating salmon and provide spawning and rearing areas for Delta smelt. Water for environmental purposes will be purchased or developed in the San Joaquin River basin to be used for fish transport and to improve south Delta water quality.

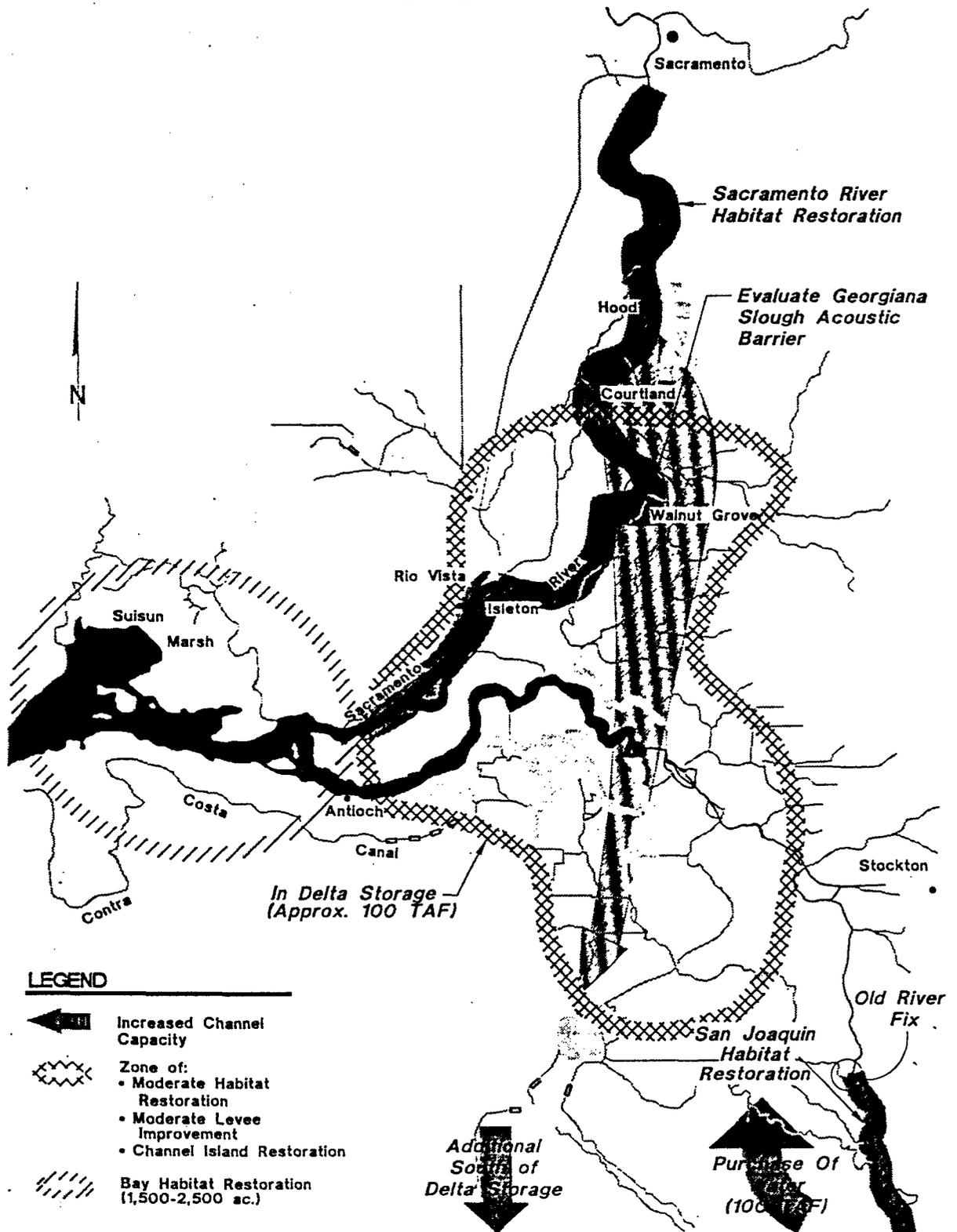
Moderate habitat restoration upstream, in the Delta, and near Suisun Bay

A moderate demand management program including water conservation, water reclamation, and land retirement will be used to sustain supplies for existing water users and provide alternative supplies for other users. Urban "Best Management Practices" and agricultural "Efficient Water Management Practices" will be expanded and substantial investments will be made in water reclamation to produce additional urban water supplies. This alternative will also establish a long-term drought water bank to improve supply reliability in dry years and encourage temporary land fallowing during dry years. Approximately 300,000 to 400,000 acres of land would be permanently retired, using willing sellers, to reduce agricultural water consumption.

Water bank, improved demand management help balance supply and demand

Through Delta Conveyance

Alternative D



To allow Delta water use patterns to be shifted away from the spring (February-June) period, this alternative will increase conjunctive use and groundwater banking in the southern San Joaquin Valley and other service areas to provide 300-500 TAF of annual supply. New water storage facilities of 1-1.5 MAF capacity will also be constructed downstream of the Delta to provide further operational flexibility in the pattern of diversions from the Delta, deliveries of water to users in export areas, and better coordination with shifted upstream reservoir storage operations. A facility to store water (approximately 100 TAF) for environmental purposes will be constructed in the south or northwest Delta. Water diverted to this facility during non-critical periods (e.g. early fall) guided by real-time monitoring will be subsequently used to improve fish transport in the Delta. The in-Delta storage facility may also be used to store reclaimed urban wastewater (northwest Delta only).

New water storage is added downstream and in Delta

North Delta channel conveyance will be improved in combination with installing a screened facility for diverting water from the Sacramento River to eastside Delta channels (one possible variation is a pump/siphon facility across Andrus Island) to increase the efficiency of water flows to the export pumps. The increased conveyance efficiency in combination with increased south-of-Delta storage capacity will allow export pumping to be curtailed during times when fish are vulnerable without reducing water supply reliability. Improvements to north Delta channels will provide multiple benefits for flood conveyance, habitat restoration, water supply, and south Delta water quality and will be designed to eliminate the reverse flow element in the lower San Joaquin River caused by export pumping.

Channel improvements increase conveyance efficiency

This alternative will implement a program to control pollutants at their sources. Delta and tributary water quality will be improved substantially by reductions in pollutant discharges from agricultural, municipal, industrial, and mine sources. Marginally productive lands that contribute substantially to regional drainage and water quality problems will be retired. Measures to reduce the total salt load transported to the San Joaquin Valley will be implemented. Pollutants in San Joaquin River inflow will be diluted using water purchased or developed in the San Joaquin River basin.

Pollutant source control improves water quality

This alternative provides moderate levee improvements to reduce system vulnerability, establishes an emergency management plan to respond to levee failure, and provides funds for ongoing maintenance. Levee improvements will target levees that protect infrastructure, western Delta islands that are critical for water quality, population centers, and valuable habitats. Levee improvements will incorporate habitat restoration.

Moderate levee improvements

New storage increases water supply reliability and increases flexibility so that fish entrainment can be reduced. Levee rehabilitation incorporates habitat improvements while simultaneously reducing system vulnerability, increasing ecosystem quality, and improving water quality.

Actions provide multiple benefits

Potential Sequencing

Stage 1. Implementation will begin with core actions.

Core actions

Stage 2. The second stage of implementing this alternative will consist of high priority habitat restoration, screening of high priority diversions, water conservation and reclamation at most cost-effective levels, substantial expansion of groundwater banking and conjunctive use, establishment of a long-term drought water bank, and high priority levee improvements. Approximately 70,000-100,000 acres of marginally productive agricultural lands in the San Joaquin Valley will be retired.

Habitat restoration and demand management

Stage 3. In Stage 3, expanded real-time monitoring will be implemented to allow the existing export pumps to be operated at their full capacities during less critical periods. The third stage will also include construction of in-Delta water storage, installation of fish guidance facilities, pollutant source controls, and permanent retirement of 200,000-300,000 acres of agricultural land. To test screening technologies, a small screened diversion from the Sacramento River to Snodgrass Slough will be constructed.

In-Delta storage, pollutant source control

Stage 4. This stage will emphasize north Delta channel conveyance improvements for multiple benefits, construction of the screened diversion from the Sacramento River to eastside channels, additional habitat restoration in the Delta and upstream. screening of moderate priority diversions, increased conjunctive use, and construction of off-stream water storage in the San Joaquin Valley.

Channel improvements, habitat restoration, new screened diversion

Alternative E Delta Channel Habitat and Conveyance

Overview

This alternative will include a new unscreened diversion facility on the Sacramento River between Hood and Freeport. This diversion facility will supply water for continued through-Delta conveyance to existing south Delta pumping plants. Extensive channel modifications will increase capacity so that velocities can be greatly reduced. Modifications will also restore broad habitat corridors to improve ecosystem function and productivity. The result will be a Delta where conditions for fish and wildlife are greatly improved. Levee improvements will be combined with channel modifications, and source control measures will improve water quality.

Reduced channel velocities and improved habitat protect fish and wildlife

The channel improvements will provide corridors of habitat along Steamboat Slough, North and South Forks of the Mokelumne River, and along the San Joaquin River. Setback levees along Steamboat Slough will provide improved transport of migratory fish through the Delta and a restored shaded riverine aquatic habitat corridor.

Steamboat Slough habitat corridor

Waterside berms along portions of Sherman, Jersey, Twitchell, and Bradford Islands will provide improved shaded riverine aquatic habitat, tidal wetland, and terrestrial habitat corridors. Setback levees along the North Fork of the Mokelumne River will create shaded riverine aquatic habitat and terrestrial habitat corridors. Setback levees along the South Fork Mokelumne River through portions of New Hope, Canal Ranch, and Brack Tract will create a large area of shallow tidal wetlands. The Mokelumne River improvements will increase flood protection in the North Delta by increasing the Mokelumne River channel capacity and provide for lower velocities towards the south Delta.

Mokelumne River habitat corridor

The size of the program along the Mokelumne River will be determined by biological criteria. The setback levees will be designed to reduce the impact of the south Delta diversions on fish populations by reducing channel velocities toward those diversions and providing attractive habitat for fish. The width of setbacks needed to meet these criteria still need to be determined. If standard setbacks are inadequate for this purpose, the conversion of islands into tidally influenced habitat will be considered. These improvements could be extended into south Delta channels.

Channels are enlarged to reduce velocities and improve conditions for fish

Setback levees along the San Joaquin River from Vernalis to Stockton provide an additional habitat corridor. Additional habitat improvements include creation of channel islands along portions of Frank's Tract to provide habitat enhancement and wave protection for neighboring Bethel, Webb, Bradford and Jersey Islands.

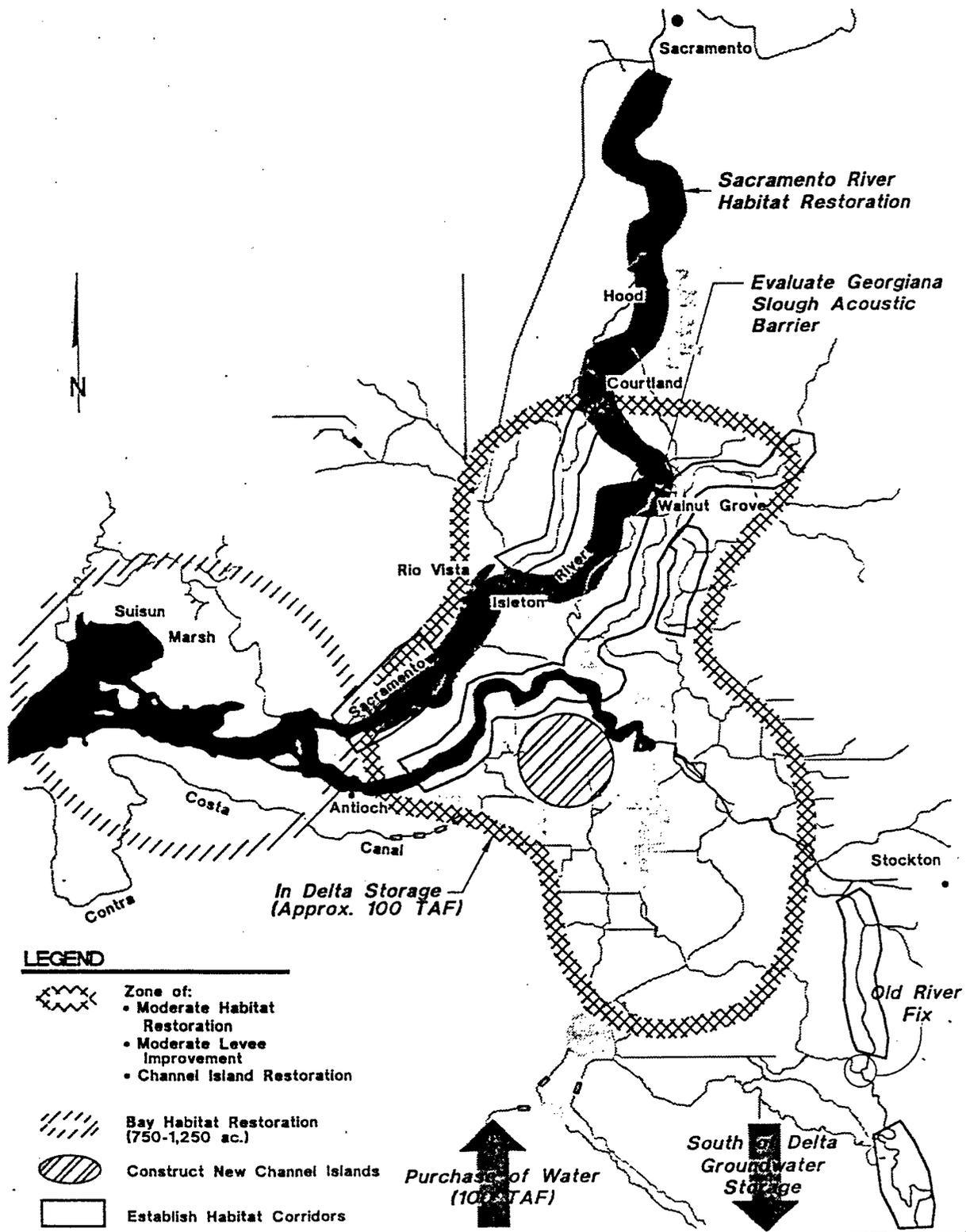
San Joaquin habitat corridor and new Delta channel islands

This alternative will provide moderate levels of habitat along the Sacramento River downstream of Sacramento and will restore channel features on the San Joaquin River to improve survival of anadromous fish. Moderate levels of shallow

Habitat, flows, and screens protect fish

Delta Channel Habitat and Conveyance

Alternative E



LEGEND

-  Zone of:
 - Moderate Habitat Restoration
 - Moderate Levee Improvement
 - Channel Island Restoration
-  Bay Habitat Restoration (750-1,250 ac.)
-  Construct New Channel Islands
-  Establish Habitat Corridors



tidal habitat will be developed near Suisun Bay to benefit migrating salmon and provide spawning and rearing areas for Delta smelt. Water (approximately 100 TAF) will be obtained or developed in the San Joaquin River basin for release as spring pulse flows to improve transport of San Joaquin River fish through the Delta. Fish screens will be installed on high and moderate priority unscreened diversions throughout the Bay-Delta system.

A moderate demand management program including water conservation, water reclamation, and land retirement will be used to sustain supplies for existing water users and provide alternative supplies for other users. Urban "Best Management Practices" and agricultural "Efficient Water Management Practices" will be expanded and substantial investments will be made in water reclamation to produce additional urban water supplies. This alternative will also establish a long-term drought water bank to improve supply reliability in dry years. Approximately 300,000 to 400,000 acres of land would be permanently retired, using willing sellers, to reduce agricultural water consumption.

Water bank, improved demand management balance supply and demand

To allow Delta export diversions to be shifted away from the spring (February-June) period, this alternative will increase conjunctive use and groundwater banking in the southern San Joaquin Valley to provide 300-500 TAF of annual supply.

Conjunctive use is increased

This alternative will implement a program to control pollutants at their sources. Delta and tributary water quality will be improved substantially by reductions in pollutant discharges from agricultural, municipal, industrial, and mine sources. Marginally productive lands that contribute substantially to regional drainage and water quality problems will be retired. Measures to reduce the total salt load transported to the San Joaquin Valley will be implemented. Pollutants in San Joaquin River inflow will be diluted using water purchased or developed in the San Joaquin River basin.

Pollutant source control improves water quality

This alternative provides levee improvements associated with channel capacity modifications and habitat corridor restoration. Other levee improvements implemented at a moderate level will protect infrastructure, western Delta islands that are critical for water quality, population centers, and valuable habitat. An emergency management plan is established to respond to levee failure, and funding is provided for ongoing levee maintenance.

Levee improvements increase channel capacity, restore habitat

Channel modifications simultaneously increase conveyance capacity, improve habitat conditions, reduce system vulnerability, and improve water quality. Habitat improvements help restore fish populations, leading to greater water supply reliability.

Actions provide multiple benefits

Potential Sequencing

Stage 1. Implementation would begin with the core actions.

Core actions

Stage 2. The second stage of implementing this alternative will consist of channel improvements along the North Fork of the Mokelumne River, screening of high priority diversions, water conservation and reclamation at most cost-effective levels, substantial expansion of groundwater banking and conjunctive use, establishment of a long-term drought water bank, and high priority levee improvements. Approximately 70,000-100,000 acres of marginally productive agricultural lands in the San Joaquin Valley will be retired. Water for environmental purposes will be purchased or developed on the San Joaquin.

*Channel
improvements,
demand
management,
conjunctive use*

Stage 3. The third stage will include channel improvements along Steamboat Slough, the Sacramento River and the San Joaquin River, pollutant source controls, and permanent retirement of 200,000-300,000 acres of agricultural land. Additional water conservation and reclamation will be implemented.

*Channel
improvements,
demand
management*

Stage 4. This stage will include creation of large areas of tidal wetland along the south fork of the Mokelumne River, screening of moderate priority diversions, and increased conjunctive use. Tidal wetlands will be restored near Suisun Bay.

*Wetlands
restoration*

Stage 5. This stage will include creation of setback levees along the San Joaquin River and restoration of channel islands in Frank's Tract.

*Setback levees,
channel islands*

Alternative F

Extensive Habitat Restoration with Storage

Overview

This alternative will restore extensive amounts of habitat in order to increase fish populations and thus improve the reliability of water supplies that are currently constrained by measures to protect fish. The purchase or development of San Joaquin basin water and new in-Delta water storage will improve water quality and fish transport through the Delta while increasing the quality and reliability of water supplies for other beneficial uses.

Habitat increases fish populations, improves water supply reliability

Currently, limitations on fish entrainment (take limits) are set to avoid jeopardizing fish populations. When these limits are approached, diversions are curtailed or stopped, creating a high degree of uncertainty for water users. Fish populations are affected by many factors including diversion effects, flow, and other habitat conditions. As habitat is improved, leading to greater fish populations, the relative effect of diversions on population should be reduced. This should consequently lessen take limit constraints on diversions, providing improved water supply reliability.

Healthy fish populations will be less affected by entrainment

Restoration of upstream habitats and establishment of extensive meander belts in the Sacramento River system will improve spawning and survival success of fish. Restoration of channel features in the lower San Joaquin River will help lower water temperatures, provide habitat, and improve survival success of fish. In the Delta, restoration of shallow riverine and riparian habitat will provide spawning areas for native fish and increase forage areas and escape cover for juvenile salmon, Delta smelt, splittail, and other species. New habitat will be constructed along Delta channels and levees. Moderate areas of shallow tidal habitat will be developed in the Suisun Bay for wet-year spawning and rearing of Delta smelt and rearing of salmon. Fish screens on all priority diversions and barriers at critical locations will be installed to reduce entrainment and keep migrating fish in the main river channel.

Habitat improved throughout the Bay-Delta system

This alternative constructs a new water storage facility in the south Delta, storing 300,000 to 400,000 acre-feet for environmental purposes. The facility will be filled through screened diversions when water is available and when fish entrainment can be avoided using real-time monitoring. Water will be released from this facility to improve fish transport conditions in the Delta and to shift the timing of diversions to avoid entrainment effects. Water will be developed in the San Joaquin basin or purchased from willing water users and released to transport fish through the Delta and improve water quality in the San Joaquin River and south Delta.

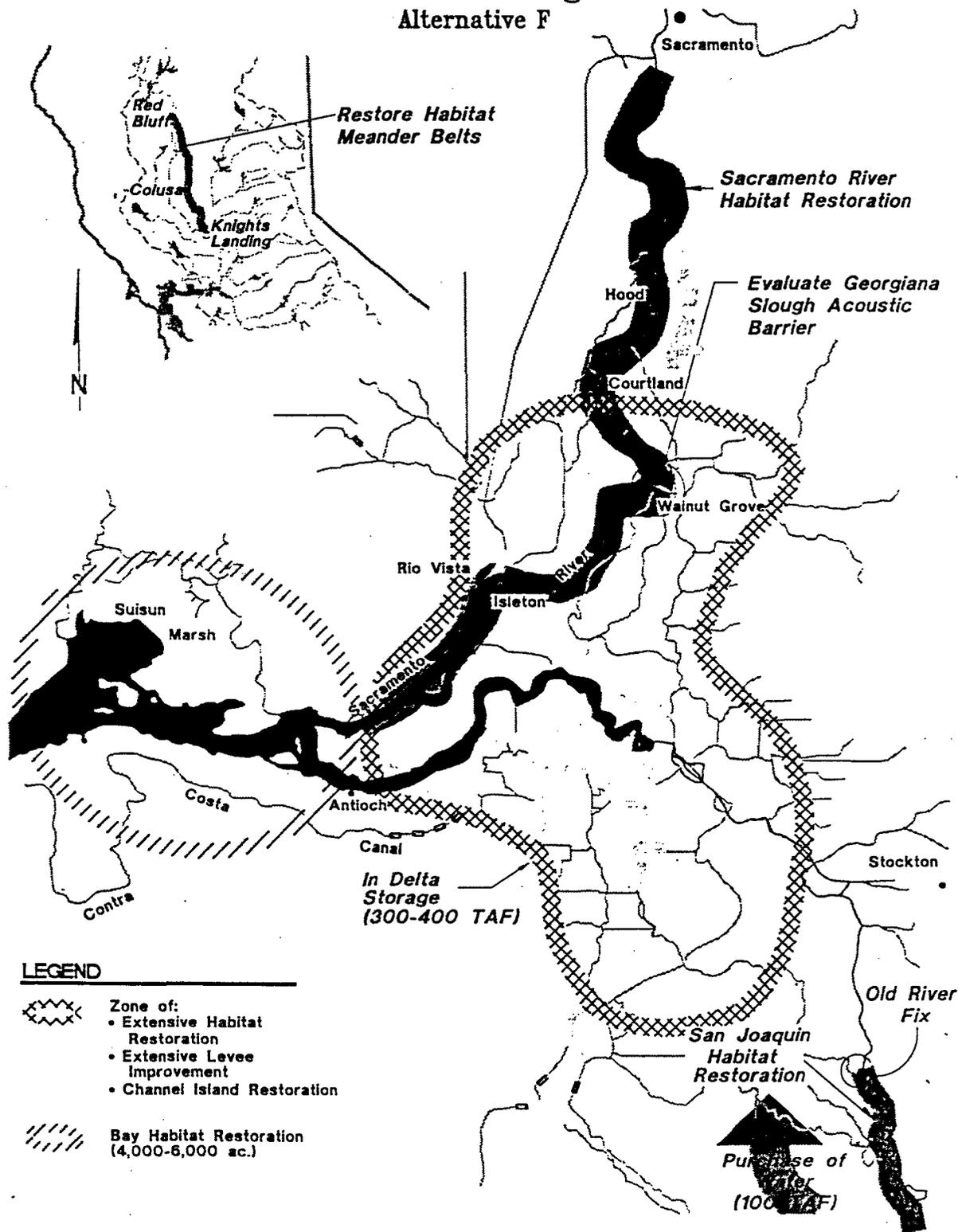
In-Delta storage and additional San Joaquin flows reduce entrainment

This alternative provides a high level of levee improvements to reduce system vulnerability, establishes an emergency management plan to respond to levee failure, and provides significant funds for ongoing levee maintenance.

High level of protection for Delta functions

Extensive Habitat Restoration With Storage

Alternative F



LEGEND

-  Zone of:
 - Extensive Habitat Restoration
 - Extensive Levee Improvement
 - Channel Island Restoration
-  Bay Habitat Restoration (4,000-6,000 ac.)



3-14-95

This alternative establishes a long-term drought water bank and provides incentives for additional land fallowing during drought years to improve supply reliability. Expanded conjunctive use and groundwater banking will improve operational flexibility and will help reduce fish entrainment by allowing some direct consumptive water use and upstream storage operation in all service areas dependent on delta water supplies to be shifted away from the spring (February-June) period. Demand management including water conservation, water reclamation, and land retirement from willing sellers will be used to reduce water shortages for existing water users and provide some additional Delta outflow during drier years.

Water bank, improved demand management help balance supply and demand

Delta and tributary water quality will be improved through source control efforts to reduce and manage discharges from agricultural operations and urban areas throughout the Bay-Delta system. Enforcement of source control regulations and implementation of Best Management Practices for salinity and pesticide residues will be expanded (e.g retention of agricultural drainage). Retirement of marginally-productive agricultural lands that contribute substantially to instream water quality problems in the San Joaquin River will be expanded. Measures to reduce the total salt load transported to the San Joaquin Valley will be implemented. Pollutants in San Joaquin River inflow will be diluted using water purchased or developed in the San Joaquin River basin.

Pollutant source control improves water quality

By linking extensive habitat restoration and levee improvements with additional storage dedicated for environmental purposes, this alternative increases fish populations while reducing system vulnerability. The conditions resulting from increased fish populations provide benefits to water supply reliability, predictability, and flexibility.

Extensive habitat restoration linked with extensive levee improvements

Potential Sequencing

Stage 1. Implementation would begin with the core actions.

Core actions

Stage 2. Actions implemented during Stage 2 of this alternative will include establishment of a permanent drought water bank, a moderate demand management program, groundwater banking and conjunctive use, high priority improvements to levees and flood channels in the Delta, high priority habitat restoration actions, and installation of high-priority fish screens. Stage 1 will include retirement of approximately 70,000-100,000 acres of marginally productive agricultural lands in the San Joaquin Valley.

Demand management and high priority habitat and levee improvements

Stage 3. In stage 3, additional San Joaquin River water for spring pulse flows will be developed or obtained, and moderate priority levee and flood control improvements, habitat restoration actions, and fish screen installations will be implemented. An additional 200,000 to 300,000 acres of marginally productive agricultural land in the San Joaquin Valley will be retired. Additional source controls for water quality improvement will be implemented.

Habitat and levee improvements, land retirement

Stage 4. During stage 4, additional levee and flood control improvements, habitat restoration actions, and fish screen installations will be completed at an extensive level of implementation. Meander belts on the upper Sacramento River, 300,000 to 400,000 AF of in-Delta storage for environmental water, and some increased flows to improve water quality complete this alternative.

*Meander belts,
Delta storage*

Alternative G East-Side Foothills Conveyance

Overview

This alternative will construct a new export diversion well upstream of the Delta to capture high flows during winter and spring. A new conveyance facility will carry diverted water along the foothills on the eastern edge of the San Joaquin Valley and eventually connect with the California Aqueduct, providing water for exchange with east side San Joaquin Valley water users and high quality supplies for other export customers. Moderate habitat restoration will complement the reduction in entrainment to increase fish populations.

New diversion and east side conveyance reduce entrainment and increase flexibility

Currently, limitations on fish entrainment (take limits) are set to avoid jeopardizing fish populations. When these limits are approached, diversions are curtailed or stopped, creating a high degree of uncertainty for water users. If a portion of water project diversions are relocated to less sensitive locations and screened to protect fish, entrainment will be reduced and fish populations will increase. Reduced entrainment will provide greater water supply reliability.

New diversion location protects fish

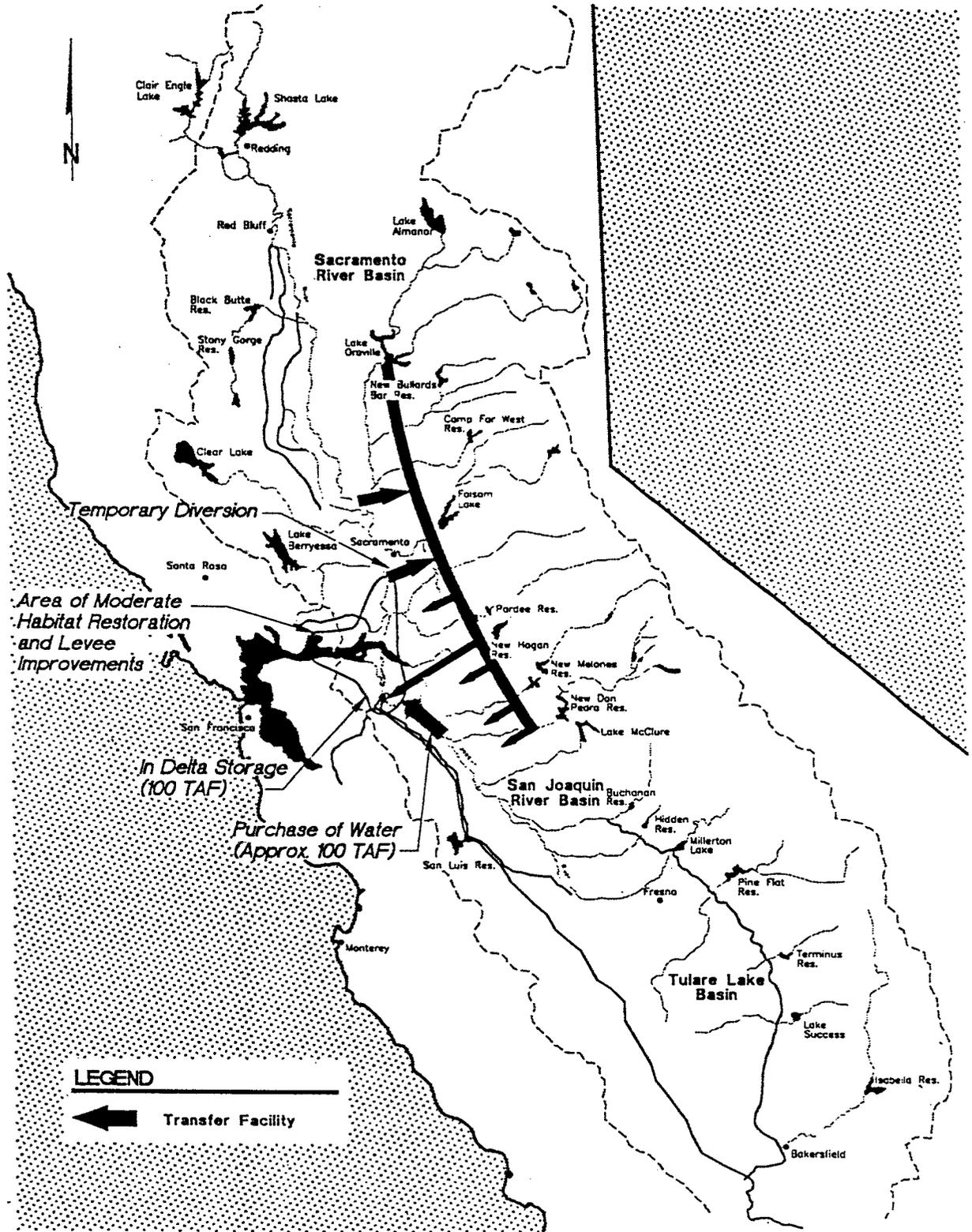
A portion of the SWP and CVP diversions will be relocated upstream of the Sacramento River/ Feather River confluence. New diversions will be constructed on both rivers with a third diversion point on the Sacramento river near Hood with a tie to supply the new canal. These locations provide high quality water. This canal will convey water south along the east side of the Sacramento and San Joaquin valleys to the Tuolumne River with a tie to the south Delta export facilities. The existing Folsom South Canal may be incorporated into the new canal. The new canal can be connected to east side projects (e.g., Mokelumne Aqueducts) to improve water supply flexibility and facilitate water transfers. Exchanges with water users will allow additional instream flows in east side rivers. Potential future extension of the canal south to Friant Dam and exchanges with additional water users could increase instream flows in other east side tributaries and the San Joaquin River. Water will also be delivered for groundwater recharge and banking in the San Joaquin Valley, including San Joaquin County. The new canal will operate mostly in the winter and spring to capture flood flows for banking and subsequent use. This will reduce the need to divert from the Delta during more environmentally sensitive periods. Some through-Delta conveyance and exports from the existing facilities will continue. These may encounter reductions in water quality as a result of upstream diversions.

A new canal runs from the Sacramento and Feather Rivers to the Tuolumne River and DMC/California Aqueducts

This alternative will provide moderate levels of habitat along the Sacramento River downstream of Sacramento and will restore channel features on the San Joaquin River to improve survival of anadromous fish. Moderate habitat restoration in the Delta will include shallow riverine and riparian habitats to improve conditions for Delta native and anadromous fish. Moderate levels of shallow tidal habitat will be developed near Suisun Bay to benefit migrating salmon and provide spawning and rearing areas for Delta smelt.

Moderate habitat restoration upstream, in the Delta, and near Suisun Bay

East Side Foothills Conveyance Alternative G



This alternative provides moderate levee improvements to reduce system vulnerability, establishes an emergency management plan to respond to levee failure, and provides funds for ongoing maintenance. The levee improvements will incorporate habitat restoration.

Moderate levee improvements

Expanded demand management, conjunctive use, groundwater and surface banking will improve full system operational flexibility that can further reduce fish entrainment by providing more Delta flow in the critical spring period for fish (February-June). This additional Delta flow will be provided through a combination of methods that will be implemented on a priority basis. These methods include reducing consumptive use of Delta water during those months by reducing demand and switching to alternative supplies in all service areas that are dependent upon Delta water supplies; dedicating some storage to providing Delta outflow; conjunctively using groundwater basins to provide spring Delta flows; implementing conservation and reclamation actions in ways that allow shifting the timing of the releases of conserved water into the Delta during the spring; and making upstream reservoir storage operational changes that will provide more direct inflow to all parts of the Delta during critical spring periods.

Conjunctive use, improved demand management help balance supply and demand

With a portion of the SWP and CVP diversions relocated, inflow to the Central and South Delta will be reduced, threatening water quality in these areas and for some export users. Therefore, this alternative includes new in-Delta storage facilities (about 100 TAF), measures implemented to maintain water levels and circulation in south Delta channels, and a water supply developed in the San Joaquin basin or purchased from willing water users. The in-Delta storage and additional San Joaquin River flow will increase the flexibility of environmental releases of water, protecting water quality in the Central and South Delta while improving fish transport through the Delta.

Water development or purchases and storage will protect water quality and improve fish transport

Delta and tributary water quality will be improved through source control efforts to reduce and manage discharges from agricultural operations and urban areas throughout the Bay-Delta system. Enforcement of source control regulations and implementation of Best Management Practices for salinity and pesticide residues will be expanded (e.g retention of agricultural drainage). Retirement of marginally-productive agricultural lands that contribute substantially to instream water quality problems in the San Joaquin River will be expanded. Measures to reduce the total salt load transported to the San Joaquin Valley will be implemented. Pollutants in San Joaquin River inflow will be diluted using water purchased or developed in the San Joaquin River basin.

Pollutant source control improves water quality

Relocating a portion of export diversions to an upstream location reduces entrainment, improves the quality of export supplies, and increases water supply reliability for all users of Delta water. Levee restoration that incorporates habitat improvements can simultaneously reduce system vulnerability, increase ecosystem quality, and improve water quality.

Actions provide multiple benefits

Potential Sequencing

Stage 1. Implementation would begin with the core actions.

Core actions

Stage 2. Actions implemented during Stage 2 of this alternative will include establishment of a permanent drought water bank, a moderate demand management program, groundwater banking and conjunctive use, high priority improvements to levees and flood channels in the Delta, an emergency levee management plan, high priority habitat restoration actions, and installation of high-priority fish screens. Stage 2 will include retirement of approximately 70,000-100,000 acres of marginally productive agricultural lands in the San Joaquin Valley and market mechanisms to facilitate water transfers.

Demand management and high priority habitat and levee improvements

Stage 3. In stage 3, approximately an additional 200,000 to 300,000 acres of marginally productive agricultural land in the San Joaquin Valley will be retired and south Delta channel measures implemented. The diversion on the Sacramento River near Hood and the first leg of the canal to the Calaveras River will be constructed. An additional increment of levee and flood control improvements, habitat restoration actions, and fish screen installations will be implemented. Additional source controls for water quality improvement will be implemented.

First leg of canal to Calaveras River

Stage 4. The canal will be extended to the Tuolumne River. The canal could be extended north to connect to the Folsom South Canal in this stage. Complete Delta levee and flood control improvements, habitat restoration actions, and fish screen installations to a moderate level of implementation.

Extend canal to Tuolumne River

Stage 5. Stage 5 will extend a spur of the canal to the south Delta export facilities.

Extend to Tracy

Stage 6. Stage 6 will extend the conveyance to the Sacramento and Feather Rivers above Verona.

Diversion on Sacramento and Feather Rivers

Potential Future Additions. Stage 6 completes the East-Side Foothills conveyance alternative. However, depending on future needs, additional enhancements could be considered. These include extending the conveyance to the north to Oroville Dam, tying into the Tehama Colusa Canal, and water storage on the west side of the Sacramento Valley. The canal could be incrementally extended to the south to the Merced River and to Friant Dam to provide exchange water.

Potential Additions - continue conveyance to the north and south

Alternative H Chain of Lakes Conveyance

Overview

This alternative will substantially restructure the configuration of the Delta. Export water supplies will be diverted from the Sacramento River into a series of Delta islands that will be flooded to provide storage and conveyance to the south Delta pumping plants. New screened diversions will reduce entrainment, thus increasing water supply reliability.

Flooded islands provide storage and conveyance

Currently, limitations on fish entrainment (take limits) are set to avoid jeopardizing fish populations. When these limits are approached, diversions are curtailed or stopped, creating a high degree of uncertainty for water users. If water project diversions are relocated to a less sensitive location and screened to protect fish, entrainment will be reduced and fish populations will increase. Reduced entrainment will provide greater water supply reliability.

New diversion location protects fish

A chain of contiguous islands from the Sacramento River in the North Delta to the existing SWP and CVP pumps will be converted into water storage reservoirs. Each reservoir will be connected to adjacent reservoirs by large inverted siphons (pipes). At its northern end, this "chain of lakes" will be fed by a screened diversion from the Sacramento River. Other screened diversions will feed the chain of lakes at various points in the north Delta. The chain of lakes, which will be isolated from Delta channels, will convey water to the SWP and CVP pumps. The chain will also deliver water to some Delta water users. At any given time, the diversion or diversions that will least impact fish will be used to fill the reservoirs. At times when fish could be most impacted, diversions will be reduced or stopped, and water users will draw on stored water. The reservoirs may be filled and emptied several times each year. Organic soils will be removed or sealed from the reservoirs to avoid potential water quality problems with the stored water.

A chain of islands will be connected into water storage reservoirs

This alternative will restore moderate amounts of habitat in the Delta and upstream on the Sacramento River and will restore channel features on the San Joaquin River to improve survival of anadromous fish. In addition, the conversion of Delta islands into storage reservoirs is designed to incorporate substantial aquatic and terrestrial habitat improvements. Extensive levee improvements associated with the lakes will incorporate habitat improvements. A moderate level of shallow tidal habitat will be developed near Suisun Bay to benefit migrating salmon and provide spawning and rearing areas for Delta smelt.

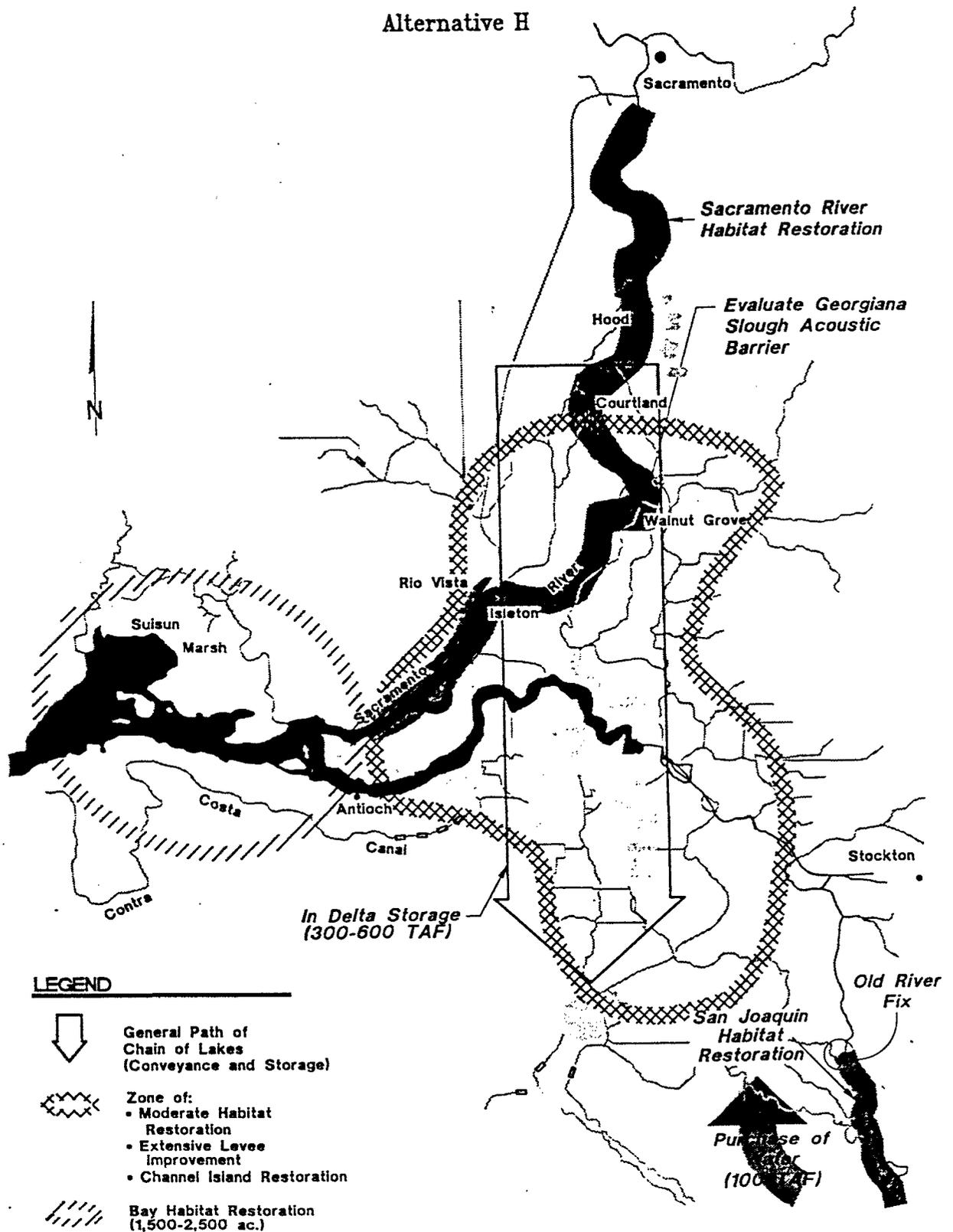
Moderate habitat restoration upstream, in the Delta, and near Suisun Bay

Extensive levee improvements will reduce system vulnerability and incorporate habitat improvements. An emergency management plan will be established to respond to levee failure, and significant funds will be provided for ongoing levee maintenance.

High level of protection for Delta functions

Chain of Lakes Conveyance

Alternative H



LEGEND



General Path of Chain of Lakes (Conveyance and Storage)



Zone of:

- Moderate Habitat Restoration
- Extensive Levee Improvement
- Channel Island Restoration



Bay Habitat Restoration (1,500-2,500 ac.)



S. LOWE, CALIF. 02-16 3-13-99

With the SWP and CVP diversions relocated, fresh water inflow to the Central and South Delta will be reduced, threatening water quality. Therefore, this alternative includes a supplemental water supply developed in the San Joaquin basin or purchased from San Joaquin basin water users. This supplemental supply will increase the flexibility of environmental releases of water, improving water quality in the central and south Delta while improving fish transport through the Delta.

Additional San Joaquin flows protect water quality and improve fish transport

Delta and tributary water quality will be improved through aggressive source control efforts to reduce and manage discharges from agricultural operations and urban areas throughout the Bay-Delta system. Enforcement of source control regulations and implementation of Best Management Practices for salinity and pesticide residues will be expanded (e.g. retention of agricultural drainage). Retirement of marginally-productive agricultural lands that contribute substantially to instream water quality problems in the San Joaquin River will be expanded. Measures to reduce the total salt load transported to the San Joaquin Valley will be implemented. Pollutants in San Joaquin River inflow will be diluted using water purchased or developed in the San Joaquin River basin.

Aggressive pollutant source control improves water quality

This alternative establishes a long-term drought water bank and provides incentives for additional land fallowing during drought years to improve supply reliability. Expanded conjunctive use and groundwater banking will improve operational flexibility and will further reduce fish entrainment by allowing some direct consumptive water use and upstream storage operation in all service areas dependent on Delta water supplies to be shifted away from the spring (February-June) period. Moderate levels of demand management including water conservation, water reclamation, and land retirement will be used to reduce water shortages for existing water users and provide some additional Delta outflow during drier years.

Water bank, improved demand management help balance supply and demand

Relocating export diversions can reduce entrainment, improve the quality of export supplies, and increase water supply reliability. Levee restoration that incorporates habitat improvements can simultaneously reduce system vulnerability, increase ecosystem quality, and improve water quality.

Actions provide multiple benefits

Potential Sequencing

Stage 1. Implementation would begin with the core actions.

Core actions

Stage 2. Actions implemented during Stage 2 of this alternative will include establishment of a permanent drought water bank, a moderate demand management program, groundwater banking and conjunctive use, high priority improvements to levees and flood channels in the Delta, an emergency levee management plan, funds for levee maintenance, high priority habitat restoration actions, and installation of high-priority fish screens. Stage 2 will include retirement of approximately 70,000-100,000 acres of marginally productive agricultural lands in the San Joaquin Valley.

Demand management and high priority habitat and levee improvements

Stage 3. In stage 3, an additional 200,000 to 300,000 acres of marginally productive agricultural land in the San Joaquin Valley will be retired. One island near the south Delta export pumps will be converted for storage of water. Additional San Joaquin River water for spring pulse flows will be obtained, and additional increments of levee and flood control improvements, habitat restoration actions, fish screen installations, and source controls for water quality improvement will be implemented.

Construct island storage near south Delta pumps

Stages 4 to 6. During stages 4 to 6, additional islands, connected by siphons, will be converted to water storage. The final stages will include additional levee and flood control improvements, habitat restoration actions, and fish screen installations to an extensive level of implementation.

Additional islands converted to storage

Alternative I West-Side Conveyance and River Restoration

Overview

This alternative will greatly increase reservoir capacity on the west side of the Sacramento Valley to increase water supply, and will isolate water conveyance from the river system in the Sacramento Valley to avoid fish entrainment. Consolidation of existing upstream diversions will further reduce entrainment. A large isolated conveyance facility connecting major new and existing reservoirs along the west side of the Sacramento Valley and extending to south Delta pumping plants will provide excellent export water quality and ensure water supply reliability.

Water supply conveyance is separated from the Sacramento River

High quality water will be diverted during high flood flows from Shasta Lake and the Feather River at Thermalito Afterbay, and conveyed to new off-stream storage facilities totaling 6 to 8 million acre-feet for "banking" on the west side of the Sacramento Valley. Operation of Shasta and Oroville reservoirs would be modified to work in concert with the new reservoirs. All reservoir operations would be required to meet flow standards that fully protect instream conditions for fisheries. The conveyance system from the new reservoirs would extend south along the west side of the Sacramento Valley, cross under the Delta, and terminate at the current south Delta pumps. Conveyance capacity would be in the range of 10,000 to 15,000 cfs.

About 6-8 million AF of new upstream storage is added

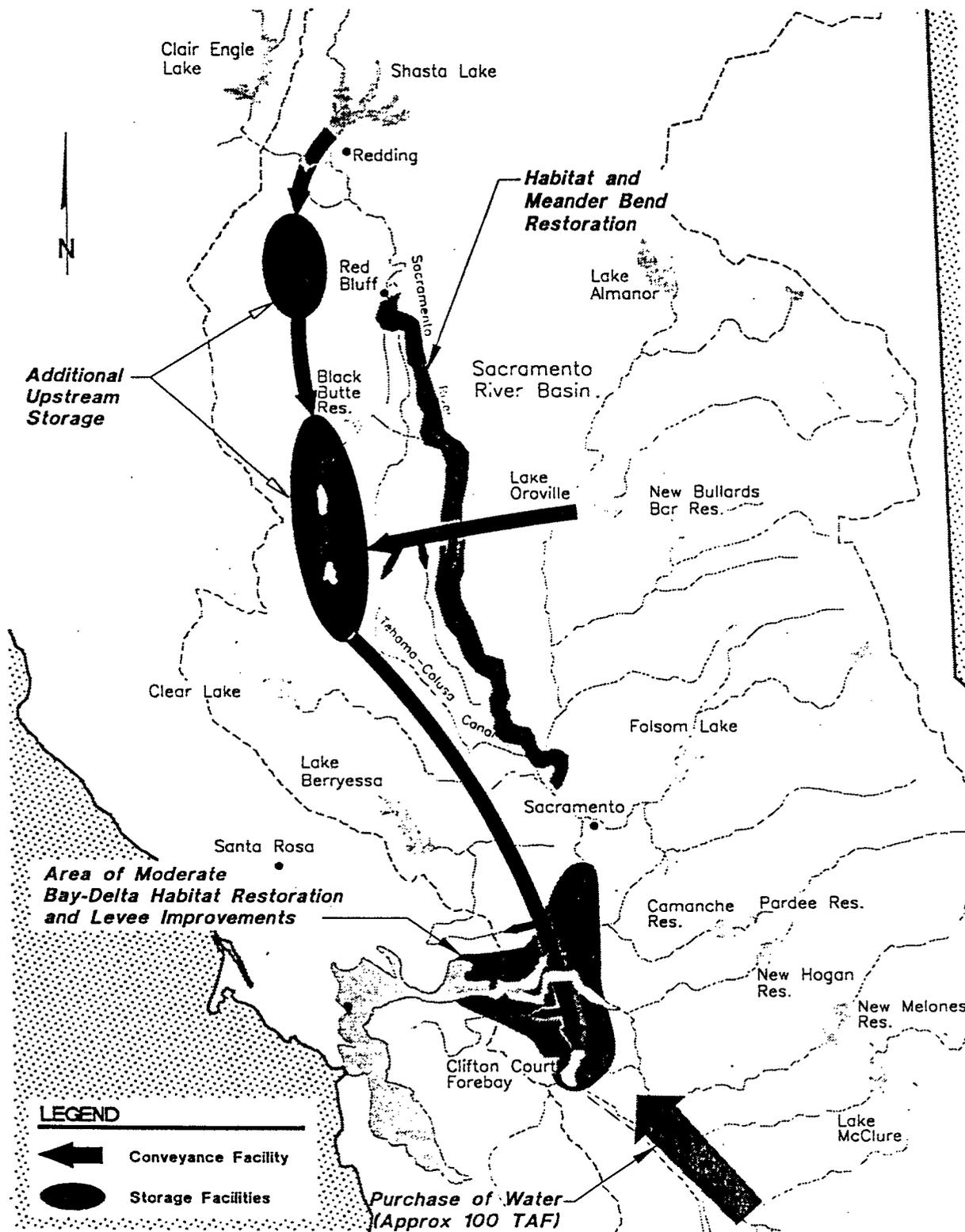
Sacramento River diversions such as Red Bluff and Glen Colusa Irrigation District would be eliminated and irrigation districts would receive stored water. Turnouts along the new conveyance system would serve west-side agriculture and groundwater conjunctive use areas. The conveyance facility could include possible additional interties to the North Bay Aqueduct, Contra Costa Canal, the Mokelumne Aqueduct, and the South Bay Aqueduct. Water will also be purchased from San Joaquin River users (or developed from expanded surface/groundwater storage) to improve fish transport through the Delta and improve south Delta water quality.

Connections to the system reduce entrainment and increase flexibility

Moderate habitat improvements including extensive restoration of meander belts will occur along the upper Sacramento River. Remaining diversions of moderate to high priority will be screened. These actions, combined with removal of major diversions from the river and compliance with strong instream flow standards, will provide excellent habitat for fisheries in the river. Moderate levels of habitat restoration will be carried out in the Delta to increase riparian and shallow water habitat. Where feasible, habitat restoration will be combined with levee improvements. Downstream, tidal wetlands will be restored around Suisun Bay to benefit migrating salmon and provide spawning and rearing areas for Delta smelt. Channel improvements along the San Joaquin River will improve conditions for anadromous fish during low flows.

Habitats are restored throughout the system

West Side Conveyance and River Restoration Alternative I



This alternative provides a moderate level of Delta levee improvements to reduce vulnerability, establishes an emergency management plan to respond to levee failure, and provides funds for ongoing levee maintenance.

Moderate protection for Delta functions

Delta and tributary water quality will be improved through source control efforts to reduce and manage discharges from agricultural operations and urban areas throughout the Bay-Delta system. Enforcement of source control regulations and implementation of Best Management Practices for salinity and pesticide residues will be expanded (e.g retention of agricultural drainage). Retirement of marginally-productive agricultural lands that contribute substantially to instream water quality problems in the San Joaquin River will be expanded. Measures to reduce the total salt load transported to the San Joaquin Valley will be implemented. Pollutants in San Joaquin River inflow will be diluted using water purchased or developed in the San Joaquin River basin.

Pollutant source control improves water quality

This alternative establishes a long-term drought water bank and provides incentives for additional land fallowing during drought years to improve supply reliability. Expanded conjunctive use and groundwater banking will improve operational flexibility. Moderate levels of demand management including water conservation, water reclamation, and land retirement will be used to reduce water shortages for existing water users and provide some additional Delta outflow during drier years.

Water bank, improved demand management help balance supply and demand

Two optional diversion points on the Sacramento River exist for westside conveyance:

1. High quality water can be diverted during flood flows from the Sacramento River at Red Bluff and from the Feather River at Thermalito Afterbay. Water from both diversions could be conveyed to a new off-stream storage facility (approximately 1.5 to 2 million acre-feet) located on the west side of the Sacramento Valley. Sacramento River water would be diverted using the pumps at the Red Bluff diversion dam and conveyed to the reservoir via the Tehama-Colusa Canal. A new conveyance facility connecting Thermalito Afterbay to the new reservoir would siphon under the Sacramento River. A transfer facility would be constructed from the new reservoir to pumps in the south Delta. Possible interties could also be created to the North Bay Aqueduct, Contra Costa Canal, the Mokelumne Aqueduct, and the South Bay Aqueduct.
2. High quality water could be diverted from the Sacramento River upstream of the Sacramento Weir and above the identified "Critical Habitat for Delta Smelt." Water would be transported through an isolated conveyance facility that connects to the Sacramento Ship channel. The ship channel will be converted to a water transport facility, or will work in concert with a parallel facility in the Yolo Bypass. Locks and/or fish barriers will be added to prevent fish from entering the channel. At the channel's southern terminus, the water would be conveyed by siphons and canals across the Delta to the southern pumps.

A new conveyance system avoids entrainment, improves reliability, and ensures excellent water quality. Additional water storage will further maximize flexibility to meet Delta needs, while moderate levee and habitat improvements will provide environmental and system infrastructure benefits.

Actions provide multiple benefits

Potential Sequencing (sequencing is described for the main alternative, sequencing for the optional diversion points is similar)

Stage 1. Implementation would begin with the core actions.

Core actions

Stage 2. Actions implemented during Stage 2 of this alternative will include establishment of a permanent drought water bank, a moderate demand management program, groundwater banking and conjunctive use, high priority improvements to levees and flood channels in the Delta, high priority habitat restoration actions, and installation of high-priority fish screens. Stage 2 will include retirement of approximately 70,000-100,000 acres of marginally productive agricultural lands in the San Joaquin Valley.

Demand management and high priority habitat and levee improvements

Stage 3. In stage 3, approximately 2-3 million acre-feet of storage on the west side of the Sacramento Valley will be constructed, additional San Joaquin River water for spring pulse flows will be developed or obtained, and moderate priority levee and flood control improvements, an emergency levee management plan, funds for levee maintenance, habitat restoration actions, and fish screen installations will be implemented. Existing conveyance facilities such as the Tehama-Colusa Canal will be used. Additional source controls for water quality improvement will be implemented. A variety of actions will be studied and implemented in south Delta channels to reduce adverse effects of San Joaquin river salinity and to maintain water levels and circulation.

Upstream storage and moderate level of habitat and levee improvements

Stage 4. During stage 4, conveyance from Thermalito Afterbay to the new storage will be constructed. Additional increments of levee and flood control improvements, habitat restoration actions, and fish screen installations will be implemented. Meander belts on the upper Sacramento River and some increased flows to improve water quality complete this stage.

Tie Thermalito Afterbay to new storage

Stage 5. Isolated conveyance from the new storage to the south Delta export pumps will be constructed. Additional increments of levee and flood control improvements, habitat restoration actions, and fish screen installations will be implemented..

Conveyance to south Delta pumps

Stage 6-8. Actions during these stages will include construction of diversion and conveyance from Shasta Dam, 4 to 6 million acre-feet of additional storage on the west side Sacramento Valley, and levee and flood control improvements, habitat restoration actions, and fish screen installations to an extensive level of implementation.

Complete conveyance, storage, habitat, and levee improvements

Alternative J East-Side Conveyance

Overview

This alternative will relocate export diversions to a new screened intake on the Sacramento River between Hood and Freeport. A new isolated conveyance facility will transport water around the east side of the Delta to the existing south Delta pumping plants. This facility will reduce fish entrainment and improve water quality for export users. Extensive habitat restoration throughout the Bay-Delta system will provide additional improvements in ecosystem quality. Extensive levee improvements will reduce system vulnerability, and extensive source controls will improve water quality.

New diversion and conveyance move water around the Delta

Currently, limitations on fish entrainment (take limits) are set to avoid jeopardizing fish populations. When these limits are approached, diversions are curtailed or stopped, creating a high degree of uncertainty for water users. If water project diversions are relocated to less sensitive locations and screened to protect fish, entrainment will be reduced and fish populations will increase. Reduced entrainment will provide greater water supply reliability.

New diversion location protects fish

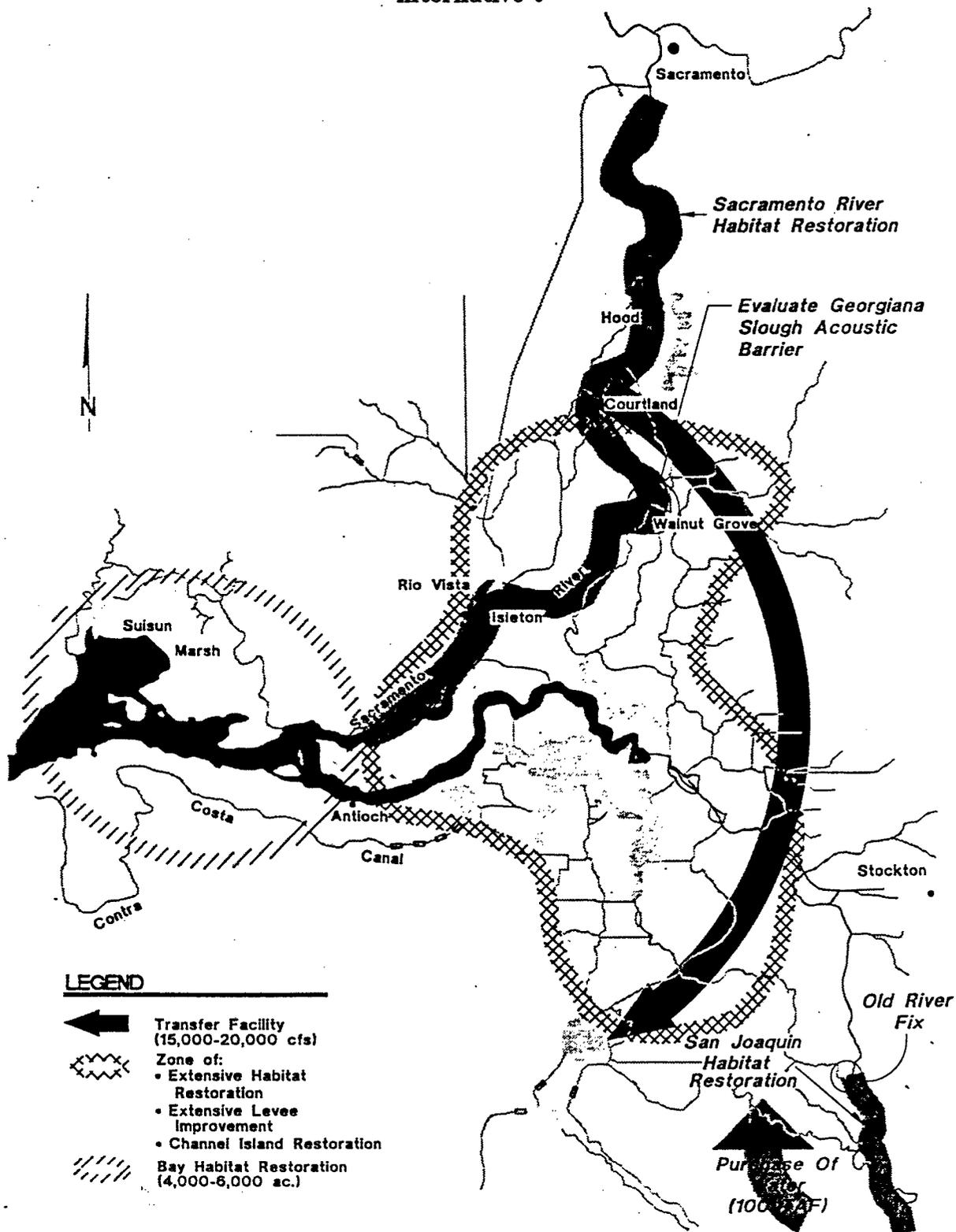
The SWP and CVP diversions will be relocated from the South Delta to the Sacramento River between Hood and Freeport. The new diversion will be equipped with state of the art fish screens and operated using real time monitoring to minimize entrainment of fish. A new canal, which will be isolated from the Delta, will be constructed to convey water from the new diversion to the existing Banks and Tracy Pumping Plants. The isolated facility will be sized to provide water service to many users in Sacramento County, San Joaquin County and the Bay Area as well as the CVP and SWP. While the new diversion location will improve water quality for most users, certain Bay Area users may find this water quality unacceptable. The conveyance facility will include siphons under all important stream courses to prevent disruption of water quality and aquatic habitat values in the streams.

Diversions moved to the Sacramento River and connected to the existing pumps with a new canal

This alternative will extensively restore habitat upstream of the Delta in the Sacramento and San Joaquin systems by constructing meander belts on the Sacramento and restoring channel features on the San Joaquin to improve spawning success and survival of anadromous fish. Extensive habitat restoration in the Delta will include improvement of shallow riverine and riparian habitats to improve conditions for Delta native and anadromous fish. Extensive levee improvements will incorporate habitat restoration. Substantial shallow tidal habitat will be developed near Suisun Bay to benefit migrating salmon and provide spawning and rearing areas for Delta smelt.

Extensive habitat restoration upstream, in the Delta, and in Suisun Bay

East Side Conveyance Alternative J



LEGEND

-  Transfer Facility (15,000-20,000 cfs)
-  Zone of:
 - Extensive Habitat Restoration
 - Extensive Levee Improvement
 - Channel Island Restoration
-  Bay Habitat Restoration (4,000-6,000 ac.)

With the SWP and CVP diversions relocated, inflow to the central and south Delta will be reduced, threatening water quality in these areas. A supplemental water supply purchased from San Joaquin River Basin water users or developed in the San Joaquin basin will increase the flexibility of environmental releases of water, protecting water quality in the central and south Delta while improving fish transport through the Delta.

Additional flow will protect water quality and improve fish transport

Extensive levee improvements will reduce system vulnerability and incorporate habitat improvements. An emergency management plan will be established to respond to levee failure, and significant funds will be provided for ongoing levee maintenance.

High level of protection for Delta functions

This alternative establishes a long-term drought water bank and provides incentives for additional land fallowing during drought years to improve supply reliability. Demand management, changes in operation of upstream storage, expanded conjunctive use, and groundwater banking will improve operational flexibility and will further reduce fish entrainment by providing more Delta flow in the spring (February-June) period. Moderate levels of demand management including water conservation, water reclamation, and land retirement will be used to reduce water shortages for existing water users and provide some additional Delta outflow during drier years.

Water banks improved demand management help balance supply and demand

Delta and tributary water quality will be improved through aggressive source control efforts to reduce and manage discharges from agricultural operations and urban areas throughout the Bay-Delta system. Enforcement of source control regulations and implementation of Best Management Practices for salinity and pesticide residues will be expanded (e.g., retention of agricultural drainage). Retirement of marginally-productive agricultural lands that contribute substantially to instream water quality problems in the San Joaquin River will be expanded through purchases from willing sellers. A variety of actions will be studied and implemented to reduce adverse effects of salinity in San Joaquin inflow, to maintain water levees and circulation in south Delta channels, and to reduce the recycled salt load to the San Joaquin Valley.

Aggressive pollutant source control improves water quality

A new diversion point and isolated conveyance reduce fish entrainment, improve water quality for export users, and increase water supply reliability. Extensive habitat restoration, incorporating levee rehabilitation, improves ecosystem quality while reducing system vulnerability and improving water quality.

Actions provide multiple benefits

Potential Sequencing

Stage 1. Implementation would begin with the core actions.

Core actions

Stage 2. Actions implemented during Stage 2 of this alternative will include establishment of a permanent drought water bank, a moderate demand management program, groundwater banking and conjunctive use, high priority improvements to levees and flood channels in the Delta, high priority habitat restoration actions, and installation of high-priority fish screens. Stage 2 will

Demand management and high priority habitat and levee improvements, meander belts

include retirement of approximately 70,000-100,000 acres of marginally productive agricultural lands in the San Joaquin Valley.

Stage 3. In stage 3, a variety of actions will be studied and implemented in south Delta channels to reduce adverse effects of salinity in San Joaquin River inflow and to maintain water levels and circulation. Additional San Joaquin River water for spring pulse flows will be obtained, and moderate priority levee and flood control improvements, an emergency levee management plan, funds for levee maintenance, habitat restoration actions, and fish screen installations will be implemented. Additional source controls for water quality improvement will be implemented. Work will begin on Sacramento River meander belts.

Moderate level of habitat and levee improvements

Stage 4. In stage 4, an additional 200,000 acres of marginally productive agricultural land in the San Joaquin Valley will be retired. The screened diversion on the Sacramento River and the isolated conveyance facility for Delta diversions will be constructed. Work will continue on meander belts.

Large isolated facility

Stage 5. During stage 5, additional levee and flood control improvements, additional habitat restoration actions, and additional fish screen installations will be completed at an extensive level of implementation. Meander belts on the upper Sacramento River will be completed. Some increased flows to improve water quality complete this alternative.

Extensive habitat and levee improvements