

APPENDIX H

*CALFED Bay-Delta Program
Appendices - Phase 1 Summary Report*

DRAFT *June 21, 1996*

32 Preliminary "Edge" Alternatives

Conflict Resolution

Thirty-two preliminary alternatives have been developed. The starting point for the development of these alternatives was the resolution of four primary conflicts among beneficial uses and resources in the Bay-Delta system. These four primary conflicts include:

1. *Fisheries and Diversions*: The conflict between fisheries and diversions results primarily from fish mortality attributable to water diversions. This includes direct losses at pumps, reduced survival when young fish are drawn out of river channels into the Delta, and reduced spawning success of adults when migratory cues are altered. The effects of diversions on species of special concern have resulted in regulations that restrict quantities and timing of diversions.
2. *Habitat and Land Use/Flood Protection*: The needs for habitat and the needs for land use are often incompatible. Development of land, and the flood control facilities to protect the land, has resulted in an overall loss of habitat to support various life stages of aquatic and terrestrial biota. The need for habitat affects land development planning and levee maintenance and planning. Efforts to try to restore the balance often require that land use for agricultural production be dedicated to habitat.
3. *Water Supply Availability and Beneficial Uses*: As water use and competition among uses with respect to water supply availability have increased during the past several decades, conflicts have increased among uses of Delta water. A major part of this conflict is between the volume of instream water needs and out-of-stream water needs and the timing of those needs within the hydrologic cycle.
4. *Water Quality and Land Use*: A conflict over water quality in the system results from the fact that land uses often do not contribute to good water quality, and ecosystem water quality needs are usually but not always compatible with urban and agricultural water quality needs.

Approaches to Conflict Resolution

Two approaches to resolving each conflict were developed. Each approach serves as the conceptual "edge," or most extreme method of resolving that conflict. The intent of defining approaches as these extremes is to assure that all such actions that could contribute to the resolution of the conflict can be classified as being "within" such extremes. The approaches used for each of the four primary conflicts described above were as follows:

1. Fisheries and Diversions: One extreme approach includes actions primarily intended to directly enhance fish productivity and increase fish populations (1A). The opposite extreme approach includes actions primarily intended to directly reduce impacts attributable to diversions (1B). Actions have been classified as either contributing to enhancing fish populations, or to reducing the impacts of diversions.
2. Habitat and Land Use/Flood Protection: One extreme approach includes actions primarily intended to preserve existing land uses (2A). The opposite extreme approach includes actions primarily intended to preserve the quality of existing habitat, and to create additional habitat area and value in the delta (2B). Actions have been classified as either contributing to the preservation of existing agricultural or flood protection land uses, or to additional habitat area or value.
3. Water Supply Availability and Beneficial Uses: One extreme approach includes actions primarily intended to reduce critical demands on delta waters (3A). The opposite extreme approach includes actions primarily intended to increase critical supply to the delta. (3B). More specifically, 3A involves

reducing diversions of Delta water by exporters (into the state and federal aqueducts in the south Delta, the Contra Costa Canal, and the North Bay aqueduct) during periods of high competition. Thus, water conservation, storage, or supply substitution would all fall within this approach. Approach 3B involves increasing the availability of Delta water during periods of high competition through all other means, including water conservation, or storage in and north of the Delta.

4. Water Quality and Land Use: One extreme approach includes actions primarily intended to control pollution at the source (4A). The opposite extreme approach includes actions primarily intended to manage instream water quality (e.g. treatment, dilution, etc.)(4B). Actions have been classified as contributing to increased Bay-Delta water quality through source discharge control or through instream quality management.

Two approaches are therefore possible for each of the four conflicts, resulting in a 2 by 4 matrix, or $[2 \times 2 \times 2 \times 2] =$ sixteen conflict/approach combinations.

Note that choosing one choice of a conflict also meant that actions which address the other side of the conflict were no longer allowed. Thus, for example, the choice of 1A (diversions) means that no measures were taken to increase fisheries productivity, even if 3B (increase habitat area) was chosen. In this case, fisheries would be improved through improved diversion impacts and increased habitat could only go toward benefits not directed at fisheries (e.g., wetlands). In this way, the various permutations of conflict approaches forced consideration of a wide variety of solutions.

Target Solutions

Each of these conflict/approach combinations was viewed as having either a "minimum" or "maximum" target solution. A minimum target solution included only those actions needed to achieve the minimum objectives of each alternative, based on a consideration of technical, cost, and policy issues. Conversely, a maximum alternative target solution included those actions needed to achieve the maximum objectives of each alternative, based on similar considerations and issues.

It is important to note that the 32 preliminary alternatives, and the actions included within each of them, were intended to capture the conceptual "edges" of possible alternatives.

Preliminary Alternative #1

Corresponding to Alternative Formulation Strategy 1A, 2A, 3A, 4A - Minimum

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-Delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

Alternative 1 includes only 11 actions primarily aimed at improving fish productivity and population abundance. Because this is a minimum edge alternative, the actions selected to increase fish populations are directed toward habitat improvement or maintenance activities. Several more proactive actions were selected which would require changes in existing instream configurations or management practices. These actions are also intended to improve habitat availability and quality as well as increase fish productivity and abundance.

Actions Selected

Habitat - This alternative is predominantly comprised of minimal actions to enhance Delta shallow water, riverine, and riparian habitat in conjunction with restoration of upstream anadromous fish habitat.

Populations - Fish populations would be improved to a limited degree through minimal restoration of habitat.

Diversions -

Water Use -

Water Quality -

Land Use/Levees/Flood Protection - This alternative would include coordination of land uses with water supplies which would ensure better management of demand.

Institutional -

Preliminary Assessment

The solution strategy identified for this alternative encompasses minimal actions to increase fish productivities, increase fish population, and improve habitat quality. No actions were selected which would directly improve the water quality of Delta inflows; however, the improvement and maintenance of riparian and wetland habitats may indirectly reduce pollutant discharges. The greatest shortfall of this

alternative is the minimum level of actions to reduce diversion demands from the Bay-Delta system. In order to be a viable solution strategy, more actions and, consequently, a more intensive effort would be required to address the issue of supply reliability and beneficial use.

Preliminary Alternative #2

Corresponding to Alternative Formulation Strategy 1A, 2A, 3A, 4B - Minimum

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-Delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

Alternative 2 includes only 11 actions primarily aimed at improving fish productivity and population abundance. Because this is a minimum edge alternative, the actions selected to increase fish populations are directed toward habitat improvement or maintenance activities. Several more proactive actions were selected which would require changes in existing instream configurations or management practices. These actions are also intended to improve habitat availability and quality as well as increase fish productivity and abundance.

Actions Selected

Habitat - This alternative is predominantly comprised of minimal actions to enhance Delta shallow water, riverine, and riparian habitat in conjunction with restoration of upstream anadromous fish habitat.

Populations - Fish populations would be improved to a limited degree through minimal restoration of habitat.

Diversions -

Water Use -

Water Quality -

Land Use/Levees/Flood Protection - This alternative would include coordination of land uses with water supplies which would ensure better management of demand.

Institutional -

Preliminary Assessment

The solution strategy identified for this alternative encompasses minimal actions to increase fish productivities, increase fish population, and improve habitat quality. No actions were selected which would directly improve the instream/in-delta water quality; however, the improvement and maintenance of riparian and wetland habitats may indirectly reduce pollutant discharges. The greatest shortfall of this alternative is the minimum level of actions to reduce diversion demands from the Bay-Delta system. In order to be a viable solution strategy, more actions and, consequently, a more intensive effort would be required to address the issue of supply reliability and beneficial use. Without increased actions in this area, this alternative may not be an equitable solution.

Preliminary Alternative #3

Corresponding to Alternative Formulation Strategy 1A,2A,3B,4A - Minimum

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-Delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

This solution strategy consists of actions that increase fish populations through the protection and enhancement of existing habitat and by improving water quality of inflows to the Delta. Water demand is primarily achieved by increases in supply north of the Delta. As this is a minimum strategy, increases in supply are derived primarily through better long-term planning and management leading to improved utilization of existing supply.

Actions Selected

Habitat - This alternative is characterized by actions to protect or enhance existing wetland and terrestrial habitat.

Populations - Actions to enhance populations are limited to removal of barriers for spawning fish in upland reservoirs.

Diversions - None

Water Use - Water supply is enhanced through institutional and regulatory actions, improved long-term planning and facilitation of water transfers.

Water Quality - Water quality is improved by source controls applied to agricultural drainage and improved enforcement of permits for wastewater and industrial discharges.

Land Use/Levees/Flood Protection - Under this alternative levee maintenance would be funded and conducted using uniform standards.

Institutional - Institutional coordination would be required to better conduct long range planning and facilitate water transfers.

Preliminary Assessment

This alternative's implementation would achieve modest improvements in water supply and minor enhancement of existing Delta habitat. It would not likely ensure ESA compliance or substantially increase the reliability of Delta supplies during critical periods. A key deficiency is that supply enhancements do not include additional surface or groundwater storage that could be utilized for water supply and environmental benefits.

Preliminary Alternative #4

Corresponding to Alternative Formulation Strategy 1A,2B,3A,4A - Minimum

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-Delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

This minimum alternative includes compatible objectives of increasing fish populations and increasing the extent of Delta aquatic and terrestrial habitat area. Action choices are not limited by the preservation of existing agricultural land uses, but are constrained in that the impacts of remaining agricultural diversions to fish populations are not proactively addressed. By constraining water quality management to the control of source discharges, this alternative precludes the management of instream water quality by treatment, dilution, and other in-water practices.

Actions Selected

Habitat - This alternative is characterized by minimal actions to improve shallow habitat area, nearshore areas, levee maintenance practices, and land-based agricultural practices (chemical applications, irrigation scheduling, tillage, etc.) that may adversely affect existing habitat.

Populations - Modifications to upstream passage obstacles and natural barriers are used to enhance fish populations.

Water Use - By seeking to reduce critical export demands, this alternative will result in additional Delta water available for beneficial uses.

Water Quality -Restricted livestock grazing, the reduction of agricultural discharges, and modification of irrigation and cropping practices could result in minimal water quality benefits.

Preliminary Assessment

This alternative's implementation would achieve minor improvements in existing Delta habitat, some increase in the extent of usable habitat, and modest increases in water quality that accompany source discharge control programs. Its weaknesses are characterized by its constraints to: reducing diversion impacts; increasing in-watershed supplies; and improving instream water quality. This alternative will not result in Delta benefits that could be obtained from supply increases that may dilute and reduce the temperature of Delta waters. Its implementation could result in some, but only negligibly measurable benefits. It is doubtful whether this alternative's implementation could fulfill federal Endangered Species Act protections for listed Delta species.

Preliminary Alternative #5

Corresponding to Alternative Formulation Strategy 1B,2A,3A,4A - Minimum

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

This minimum alternative focuses on preventing the loss of fish due to entrainment at diversions. The preservation of existing agricultural lands is chosen over increasing habitat area. Increasing export pump capacities are undertaken both to reduce diversion impacts on fish and to reduce the pumping of the of the projects during critical periods without reducing yield. The prevention of upstream pollution is favored over the post-diversion treatment of water to improve quality.

Actions Selected

Habitat - This alternative contains no discretionary actions to improve either aquatic or terrestrial habitat due.

Populations - A small number of actions to reduce the effects on fish of entrainment at diversions are included.

Diversions - A small number of actions to reduce critical export demands, are included in this alternative.

Water Use - No actions to increase the amount of water put to out-of-stream beneficial uses are included.

Water Quality - The quality of water flowing into the Delta will be modestly improved due to a few actions to reduce the pollutants in agricultural drainage..

Land Use/Levees/Flood Protection - No discretionary actions to increase flood protection are included.

Institutional - As a minimal alternative, no institutional guarantees are included.

Preliminary Assessment

No actions to increase fish productivity are included because of the emphasis on reducing the impacts of diversions and the need to preserve existing agricultural land use. These constraints and the minimal approach of this alternative result in few actions to improve the status of endangered fish species, improve Delta ecosystem health, improve water quality, or flood protection. Only negligible improvements could be expected in resolving any of the conflicts.

Preliminary Alternative #6

Corresponding to Alternative Formulation Strategy 1A,2A,3B,4B - Minimum

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversions Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-Delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

This solution strategy consists of actions that increase fish populations through the protection and enhancement of existing habitat. Water demand is primarily achieved by increases in supply north of the Delta. As this is a minimum strategy, increases in supply are derived primarily through better long-term planning and management leading to improved utilization of existing supply. This solution is similar to alternative 3, which differs only in that it utilizes pollutant source control and treatment actions for discharges into the Delta, rather than actions directed at in-stream water quality improvements.

Actions Selected

Habitat - This alternative is characterized by actions to protect or enhance existing wetland and terrestrial habitat.

Populations - Actions to enhance populations are limited to removal of barriers for spawning fish in upland reservoirs.

Diversions - None

Water Use - Water supply is enhanced through institutional and regulatory actions, improved long-term planning and facilitation of water transfers.

Water Quality - Water quality is improved by actions that are implemented in-stream.

Land Use/Levees/Flood Protection - Under this alternative levee maintenance would be funded and conducted using uniform standards.

Institutional - Institutional coordination would be required to better conduct long range planning and facilitate water transfers.

Preliminary Assessment

This alternative's implementation would achieve modest improvements in water supply and minor enhancement of existing Delta habitat. It would not likely ensure ESA compliance or substantially increase

the reliability of Delta supplies. A key deficiency is that supply enhancements do not include additional storage that could be utilized for water supply and environmental benefits.

Preliminary Alternative #7

Corresponding to Alternative Formulation Strategy 1A,2B,3A,4B - Minimum

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-Delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

This minimum alternative includes compatible objectives of increasing fish populations and increasing the extent of Delta habitat area. Action choices are not limited by the preservation of existing agricultural land uses, but are constrained in that the impacts of remaining agricultural diversions to fish populations are not proactively addressed. By seeking to reduce critical export demands, this alternative may result in additional water available for beneficial Delta purposes, but will not benefit from increased in-watershed supply increases that may dilute and reduce the temperature of Delta waters. By constraining water quality management to in-water practices (e.g. treatment, dilution), this alternative disallows the management of instream water quality by actions that control source discharges.

Actions Selected

Habitat - This alternative is characterized by minimal actions to improve shallow habitat area, nearshore areas, and levee maintenance practices that may adversely affect existing habitat.

Populations - Modifications to upstream passage obstacles and natural barriers are used to enhance fish populations.

Water Use - By seeking to reduce critical export demands, this alternative will result in additional Delta water available for beneficial uses.

Water Quality - Minimal legal/institutional measures to enforce existing discharge requirements and to "prevent toxic discharges" are included as instream water quality management actions.

Preliminary Assessment

This alternative's implementation would achieve minor improvements in existing Delta habitat, some increase in the areal extent of usable habitat, and modest increases in water quality that accompany exclusively instream water treatment and dilution programs. Its weaknesses are characterized by its constraints to: reducing diversion impacts; increasing in-watershed supplies; and reducing source discharges. Its implementation, because of these constraints and its minimal nature, could result in negligibly measurable benefits. It is doubtful whether this alternative's implementation could fulfill federal Endangered Species Act protections for listed Delta species.

Preliminary Alternative #8

Corresponding to Alternative Formulation Strategy 1B,2A,3A,4B - Minimum

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

This minimum alternative focuses on preventing the loss of fish due to entrainment at diversions. The preservation of existing agricultural lands is chosen over increasing habitat area. Increasing export pump capacities are undertaken both to reduce diversion impacts on fish and to reduce the pumping of the of the projects during critical periods without reducing yield. The post-diversion treatment of water is favored over the prevention of upstream pollution to improve quality.

Actions Selected

Habitat - This alternative contains no discretionary actions to improve either aquatic or terrestrial habitat due.

Populations - A small number of actions to reduce the effects on fish of entrainment at diversions are included.

Diversions - A small number of actions to reduce critical export demands, are included in this alternative.

Water Use - No actions to increase the amount of water put to out-of-stream beneficial uses are included.

Water Quality -No actions to improve water quality are included..

Land Use/Levees/Flood Protection - No discretionary actions to increase flood protection are included.

Institutional - As a minimal alternative, no institutional guarantees are included.

Preliminary Assessment

No actions to increase fish productivity are included because of the emphasis on reducing the impacts of diversions and the need to preserve existing agricultural land use. These constraints and the minimal approach of this alternative result in few actions to improve the status of endangered fish species, improve Delta ecosystem health, improve water quality, or flood protection. Only negligible improvements could be expected in resolving any of the conflicts.

Preliminary Alternative #9

Corresponding to Alternative Formulation Strategy 1A, 2B, 3B, 4A- Min)

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-Delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

This particular strategy relies upon boosting fish productivity, creation of habitat, increases in water availability north of the Delta, and source control of toxics -- all at a minimal level. Preliminary Alternative 9 is based almost exclusively on fisheries habitat restoration. Habitat is created in the Delta, flow and temperature conditions for anadromous fish are improved upstream, barriers to anadromous fish migration are removed, and modest reductions in agricultural pollutant discharges are achieved. This alternative should be adequate to support species at levels which reduce the conflict between the ESA and present water operations.

Actions Selected

Habitat - Habitat improvements focus on improvements in shallow water, riverine, and riparian habitats. In addition, flow and temperature conditions are improved upstream, barriers to anadromous migration are removed, and barriers are used to keep anadromous fish out of the central Delta.

Populations - The habitat measures discussed above will both provide for general habitat improvements and boost particular species (listed or potential ESA species).

Diversions - This strategy does not allow for measures aimed at reducing the impacts of diversions on fish. Moreover, at this minimal level, no changes in diversions to improve water supplies are justified. Thus, no diversion elements are included.

Water use - Flow and temperature patterns upstream are altered. No other changes in water use are made. However, the elimination of conflict over ESA will improve the reliability of export supplies.

Water quality - Several actions are taken to reduce the amount of pollutants entering the water system through agricultural runoff.

Land use/ levees/ flood control - Some existing land use, probably agricultural, is converted into habitat.

Institutions - Because the alternative does not represent a significant change from status quo conditions, institutional changes may not be necessary.

Preliminary Assessment

Preliminary alternative 9 is a modest improvement from the no action case. However, the preliminary alternative was constrained to take only minimal measures and thus, could never provide major improvements over the no action alternative. Even if the constraint on the intensity of action were lifted, this strategy would still fail to deal with diversion impacts or substitute supplies (demand management or new water) south of the Delta.

Preliminary Alternative #10

Corresponding to Alternative Formulation Strategy 1B, 2A, 3B, 4A - Minimum

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversions Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-Delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

Five actions have been identified as meeting the selection criteria for inclusion in this minimum edge alternative. Of the five selected actions, two actions involve reducing diversion impacts, one action addresses water supply reliability, and two actions address reducing pollutant discharges. These actions represent the least intensive actions which could be implemented to meet the objectives for this alternative. These actions include activities that could be implemented by member agencies or that may be part of ongoing programs by member agencies.

Actions Selected

Habitat -

Populations - Fish populations would be increased by reducing impact of diversions through installation of barriers to block fish movement into Old River.

Diversions - SWP/CVP diversion timing would be coordinated to reduce impacts of diversions which may also enhance water supplies.

Water Use -

Water Quality - Two actions selected to reduce pollutant discharges include controlling volume of agricultural drainage and avoiding use of high-salinity irrigation water.

Land Use/Levees/Flood Protection - Land uses would be coordinated with water supplies which could increase the water supply available during periods of high competition.

Institutional -

Preliminary Assessment

The shortfalls with this alternative are similar to those of other minimum edge alternatives. The actions chosen for this alternative do not adequately address increasing water supplies to reduce demand conflicts during periods of high competition in the Bay-Delta system. No actions were identified as part of this minimum edge alternative which would directly address the habitat and land use conflict area. However, no actions were selected which would violate the solution strategy for this conflict area. Additionally, the areas of land use preservation and reduced pollutant discharge are not sufficiently addressed.

Preliminary Alternative #11

Corresponding to Alternative Formulation Strategy 1B, 2B, 3A, 4A- Minimum)

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-Delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

The objective of this minimum alternative is to increase fish populations by reducing the diversion impacts on fish species. Actions included in this alternative include those to increase habitat, reduce critical-year

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Delta export demands, and manage water quality by source control. This alternative precludes preserving existing land use, increasing flow to the Delta to reduce fish impacts, or managing instream water quality.

Actions Selected

Habitat - This alternative is characterized by minimal actions to improve fisheries productivity and shallow habitat area, nearshore areas, levee maintenance practices, and source control of water quality improvements.

Populations - Fish populations are increased by reducing the impacts of diversions.

Diversions - By seeking to reduce critical export demands, this alternative will result in additional water available for Delta uses.

Water use - This alternative would not make additional water available for water supplies, but would reduce critical year demands.

Water quality - This alternative includes source treatment of pollutants.

Land use/ levees/ flood control - Land use actions will add to habitat, possibly at the expense of existing land uses.

Institutions - This alternative establishes or expands public information programs, intra-agency cooperation, and changes in Water Code.

Preliminary Assessment

This alternative would improve existing Delta habitat, increase the areal extent of usable habitat, and manage the water quality of source discharge. Because it is a minimum alternative, the actions implemented to achieve this alternative rely on existing regulations, programs, or projects. The weakness of this alternative is that it does not directly increase fish populations or critical-year flow to the Delta. Because the alternative is a minimum solution, the actions available to implementation may not be sufficient to achieve the objectives of the alternative.

Preliminary Alternative #12

Corresponding to Alternative Formulation Strategy 1A, 2B, 3B, 4B- Min)

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

This particular strategy relies upon boosting fish productivity, creation of habitat, increases in water availability north of the Delta, and source control of toxics -- all at a minimal level. As a result of the requirement that only minimal action be taken, this Preliminary Alternative 12 is based almost exclusively on fisheries habitat restoration. Habitat is created in the Delta, flow and temperature conditions for anadromous fish are improved upstream, and barriers to anadromous fish migration are removed. In combination with the cross cutting elements, this alternative should be adequate to support listed species and species of special interest at levels which reduce or remove the conflict between the ESA and present water operations.

Actions Selected

Habitat - Habitat improvements focus on the habitats most closely linked to species either listed or potentially listed under ESA. Thus, improvements are made in shallow water, riverine, and riparian habitats. In addition, flow and temperature conditions are improved upstream, barriers to anadromous migration are removed, and barriers are used to keep anadromous fish out of the central Delta.

Populations - The habitat measures discussed above will both provide for general habitat improvements and boost particular species (listed or potential ESA species).

Diversions - This strategy does not allow for measures aimed at reducing the impacts of diversions on fish. Moreover, at this minimal level, no changes in diversions to improve water supplies are justified. Thus, no diversion elements are included.

Water use - Flow and temperature patterns upstream are altered. No other changes in water use are made. However, the elimination of conflict over ESA will improve the reliability of export supplies.

Water quality -

Land use/ levees/ flood control - Some existing land use, probably agricultural, is converted into habitat.

Institutions - Because the alternative does not represent a significant change from status quo conditions, institutional changes may not be necessary.

Preliminary Assessment

Preliminary alternative 12 is a modest improvement from the no action case. However, the preliminary alternative was constrained to take only minimal measures and thus, could never provide major improvements over the no action alternative. Even if the constraint on the intensity of action were lifted, this strategy would still fail to deal with diversion impacts or substitute supplies (demand management or new water) south of the Delta.

Preliminary Alternative #13

Corresponding to Alternative Formulation Strategy 1B, 2A, 3B, 4B - Minimum

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-Delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

Only three actions have been identified which meet the selection criteria for inclusion in this minimum edge alternative. The three actions selected for this alternative only directly address two of the conflict areas: fish and diversion, Conflict 1, and water supply availability and beneficial use, Conflict 3. The solution strategies identified for Conflicts 2 and 4 are not directly addressed in any of the selected actions.

Actions SelectedHabitat -

Populations - Fish populations would be increased by reducing impact of diversions through installation of barriers to block fish movement into Old River.

Diversions - SWP/CVP diversion timing would be coordinated to reduce impacts of diversions which may also enhance water supplies.

Water Use -Water Quality -

Land Use/Levees/Flood Protection - Land uses would be coordinated with water supplies which could increase the water supply available during periods of high competition.

Institutional -**Preliminary Assessment**

While no actions were selected to resolve the habitat and land use conflict or the water quality and land use conflict, existing programs by state or federal agencies are presumed to continue addressing problems in these areas.

The shortfalls within this alternative include the absence of actions to address habitat and water quality problems. Additionally, no significant actions were selected which addressed water supply availability.

Preliminary Alternative #14

Corresponding to Alternative Formulation Strategy 1B,2B,3A,4B - Minimum

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

The objective of this minimum alternative is to increase fish populations by reducing the diversion impacts of fish species. Actions included in this alternative include those to increase habitat, reduce critical-year Delta export demands, and manage water quality by instream quality control. This alternative precludes preserving existing land use, increasing flow to the Delta to reduce fish impacts or treating source discharges.

Actions Selected

Habitat - This alternative is characterized by minimal actions to improve fisheries productivity and shallow habitat area, nearshore areas, levee maintenance practices, and instream water quality improvements.

Populations - Fish populations are increased by reducing the impacts of diversions.

Diversions - By seeking to reduce critical export demands, this alternative will result in additional water available for Delta uses.

Water Use - This alternative would not make additional water available for water supplies, but would reduce critical-year demands.

Water quality - This alternative includes source treatment of pollutants.

Land use/ levees/ flood control - Land use actions will add to habitat, possibly at the expense of existing land uses.

Institutions - This alternative establishes or expands public information programs, intra-agency cooperation, and changes in Water Code.

Preliminary Assessment

This alternative would improve existing Delta habitat, increase the areal extent of usable habitat, and manage instream water quality. Because it is a minimum alternative, the actions implemented to achieve this alternative rely on existing regulations, programs, or projects. The weakness of this alternative is that it does not directly increase fish populations or critical-year flow to the Delta. Because the alternative is a minimum solution, the actions available to implementation may not be sufficient to achieve the objectives of the alternative.

Preliminary Alternative #15

Corresponding to Alternative Formulation Strategy 1B,2B,3B,4A - Minimum

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

This minimum alternative focuses on preventing the loss of fish due to entrainment at diversions. The creation of additional habitat is chosen over the preservation of existing land uses. The reduction of demand for Delta exports during critical periods are favored over increasing Delta inflow and the prevention of upstream pollution is favored over the post-diversion treatment of water to improve quality.

Actions Selected

Habitat - A small number of discretionary actions to preserve existing habitat have been included.

Populations - A small number of actions are included to alter diversion rates and timing to reduce the effects on fish of entrainment.

Diversions - No actions to reduce critical export demands, are included in this alternative.

Water Use - No actions to increase the amount of water put to out-of-stream beneficial uses are included.

Water Quality - The quality of water flowing into the Delta will be modestly improved due to a few actions to reduce the pollutants in agricultural drainage.

Land Use/Levees/Flood Protection - No discretionary actions to increase flood protection are included.

Institutional - As a minimal alternative, no institutional guarantees are included.

Preliminary Assessment

Only a few actions to increase fish productivity are included, despite the ability to create additional habitat because of the emphasis on reducing the impacts of diversions and the minimal nature of the alternative. These also result in few actions to improve the status of endangered fish species, improve Delta ecosystem health, reduce the critical demands on the Delta, improve water quality, or flood protection. Only negligible improvements could be expected in resolving any of the conflicts.

Preliminary Alternative #16

Corresponding to Alternative Formulation Strategy 1B,2B,3B,4B - Minimum

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

This minimum alternative focuses on preventing the loss of fish due to entrainment at diversions. The creation of additional habitat is chosen over the preservation of existing land uses. The reduction of demand for Delta exports during critical periods are favored over increasing Delta inflow and the the post-diversion treatment of water is favored over the prevention of upstream pollution to improve quality.

Actions Selected

Habitat - A small number of discretionary actions to preserve existing habitat have been included.

Populations - A small number of actions are included to alter diversion rates and timing to reduce the effects on fish of entrainment.

Diversions - No actions to reduce critical export demands, are included in this alternative.

Water Use - No actions to increase the amount of water put to out-of-stream beneficial uses are included.

Water Quality - No actions to improve water quality are included.

Land Use/Levees/Flood Protection - No discretionary actions to increase flood protection are included.

Institutional - As a minimal alternative, no institutional guarantees are included.

Preliminary Assessment

Only a few actions to increase fish productivity are included, despite the ability to create additional habitat because of the emphasis on reducing the impacts of diversions and the minimal nature of the alternative. These also result in few actions to improve the status of endangered fish species, improve Delta ecosystem health, reduce the critical demands on the Delta, improve water quality, or flood protection. Only negligible improvements could be expected in resolving any of the conflicts.

Preliminary Alternative #17

Corresponding to Alternative Formulation Strategy 1A, 2A, 3A, 4A - Maximum

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-Delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

A total of 110 actions has been identified as meeting the selection criteria for inclusion in this maximum edge alternative and addressing each of the four conflict areas. Many of the selected actions are duplicative, given implementation of other similar actions. Very few actions were selected which directly address the improvement of habitat quality and preservation of existing land use patterns, the solution strategy of Conflict 2. A large number of actions were selected which would satisfy the solution strategy for Conflict 3 by reducing the demand for diversions from the Bay-Delta system was met through implementation of programs in the export areas.

Actions Selected

Habitat - Actions to improve fish productivity and population abundance include restoration of aquatic, wetland, and riparian habitats both within and upstream of the Delta.

Populations - Actions include increasing fish production through hatchery practices.

Diversions - Potential actions to reduce demands in export areas include implementing conservation, reclamation, and desalination programs as well as developing storage and conjunctive use projects.

Water Use -

Water Quality - The actions to reduce pollutant discharges include programs to manage agricultural and municipal drainage.

Land Use/Levees/Flood Protection - A large number of potential programs to control pollutant discharges could be undertaken which do not change the existing land use patterns.

Institutional -

Preliminary Assessment

The shortfall of this program is its inability to increase supplies to the Bay-Delta. In order to adequately facilitate the improvement of water quality and habitat areas, some additional water supplies would need to be developed. Additionally, the implementation of demand reduction actions in the export areas will provide additional supplies for other Bay-Delta system demands; however, to effectively utilize this saved water, other storage or conveyance facilities may need to be developed to adequately manage this saved water. Actions to develop additional storage or conveyance facilities were precluded from this alternative.

Preliminary Alternative #18

Corresponding to Alternative Formulation Strategy 1A, 2A, 3A, 4B - Maximum

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-Delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

A total of 91 actions have been identified as meeting the selection criteria for inclusion in this maximum edge alternative and addressing each of the four conflict areas. Very few actions were selected which directly address the improvement of habitat quality and preservation of existing land use patterns, the solution strategy of Conflict 2. A large number of actions were selected which would satisfy the solution strategy for Conflict 3 by reducing the demand for diversions from the Bay-Delta system was met through implementation of programs in the export areas.

Actions Selected

Habitat - Actions to improve fish productivity and population abundance include restoration of aquatic, wetland, and riparian habitats both within and upstream of the Delta.

Populations - Actions include increasing fish production through hatchery practices.

Diversions - Potential actions to reduce demands in export areas include implementing conservation, reclamation, and desalination programs as well as developing storage and conjunctive use projects.

Water Use -

Water Quality - The actions include installation of flow barriers to manage south Delta water quality and salinity intrusion.

Land Use/Levees/Flood Protection - A large number of potential programs to control pollutant discharges could be undertaken which do not change the existing land use patterns.

Institutional -

Preliminary Assessment

The shortfall of this program is its inability to increase supplies to the Bay-Delta. In order to adequately facilitate the improvement of water quality and habitat areas, some additional water supplies would need to be developed. Additionally, the implementation of demand reduction actions in the export areas will provide additional supplies for other Bay-Delta system demands; however, to effectively utilize this saved water, other storage or conveyance facilities may need to be developed to adequately manage this saved water. In addition, actions selected to manage instream water quality were limited due to inability to develop additional supplies to dilute existing pollutant discharges. Actions to develop additional storage or conveyance facilities were precluded from this alternative.

Preliminary Alternative #19

Corresponding to Alternative Formulation Strategy 1A,2A,3B,4A - Maximum

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

This solution strategy includes actions that increase fish populations through habitat enhancement, elimination of fish migration barriers, expanded and improved hatchery operations, and improved water

quality. Habitat enhancement focuses on improved management and restoration of existing habitat, rather than the creation of additional habitat, especially where such creation would affect existing land uses. Increased water supply is achieved by increases in supply north of the Delta, including on-stream and off-stream storage and conjunctive use. Preservation of existing land use and the protection of levees is a central element of this strategy. Source control actions for agricultural, wastewater, and industrial discharges are emphasized.

Actions Selected

Habitat - This alternative is characterized by actions to improve existing habitat within and upstream of the Delta, and control of agricultural practices (chemical applications, irrigation scheduling, tillage, etc.) That may adversely affect existing habitat.

Populations - Actions to increase populations include improved management and increased capacity for fish hatcheries, elimination of barriers to migration, and control of tributary flows and temperature.

Diversions - No actions related to the utilization of diversion as a management tool are permitted with this solution strategy.

Water Use - Water supply enhancement actions north of the Delta include increased on-stream and off-stream storage, conjunctive use, and improved resource management (e.g., facilitated water transfers).

Water quality - Source and treatment controls for agricultural, urban and mining sources are appropriate to this strategy.

Land use/ levees/ flood control - Existing land use and maintenance of levees to suitable standards are part of this strategy.

Institutions - A broad range of institutional measures are available, including education, regulatory reform, and the creation of a single administrative agency to assist in coordination.

Preliminary Assessment

This alternative's implementation would achieve improvements in existing Delta habitat, but limited increase in the areal extent of usable habitat. Water supply reliability would be increased substantially through the addition of upstream and in-Delta storage and conjunctive use. The weakness in this alternative derives from the lack of synergistic benefits (to water supply and fish populations) that would accrue from coupling the additional storage with improved diversion and flow pattern management within the Delta.

Preliminary Alternative #20

Corresponding to Alternative Formulation Strategy 1A,2B,3A,4A - Maximum

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-Delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

This maximum alternative includes compatible objectives of increasing fish populations and increasing the extent of Delta habitat area. Action choices are not limited by the preservation of existing agricultural land uses, but are constrained in that the impacts of remaining agricultural diversions to fish populations are not proactively addressed. By seeking to reduce critical export demands, this alternative may result in additional water available for beneficial Delta purposes, but will not benefit from increased in-watershed supply increases that may dilute and reduce the temperature of Delta waters. By constraining water quality management to the control of source discharges, this alternative precludes the management of instream water quality by treatment, dilution, and other in-water practices.

Actions Selected

Habitat: Improvements in existing habitat quality, and increases in the area of habitat in the Delta would be achieved by the implementation of several actions that would either restore, protect, convert, improve, or increase habitat in the Delta. Nineteen actions serving to restore Delta shallow water (tidal) habitat, riverine habitat, wetland habitat, and terrestrial habitat would be implemented, including but not limited to restoring tidal action in some areas, filling deep water areas, reconstructing banks, levees, and islands, reestablishing old, and establishing new habitat areas, and restoring historic riparian and wetland areas. Integrated habitat management actions, the control of nuisance species, and improved management of Delta waterfowl habitat would further improve the quality and increase habitat area. Better management of agricultural drainage and urban wastewater effluent, groundwater, and flood control channels and levees would be used to improve habitat conditions. Land acquisition programs also could be implemented to directly increase areas protected for beneficial habitat uses.

Populations - Direct benefits to fish populations would be achieved by the coordination of hatchery expansion, improved hatchery operations, reduction of hatchery effects on wild fish populations, improved captive breeding and tagging operations, and increased effectiveness in monitoring and regulation actions included in this alternative. Increases in fish populations would be achieved indirectly by better management of temperatures and flows in upstream habitats, channel modifications such as restoring

channel configurations, shoreline areas, and spawning gravel beds. Improvements to floodway drainage and passage conditions also would improve fish habitat, and therefore indirectly benefit fish populations. Water Use - Improvements in Delta hydrologic conditions would be achieved indirectly by several actions intended to reduce export area demands. Improved and expanded desalination programs and practices, increased conservation, reclamation (by agricultural, municipal, and industrial users), and public education would be achieved by several actions included in this alternative. Progressive land and water management practices (e.g. land retirement, fallowing, easement purchases) and incentives (pricing, legal and institutional controls) also would be used to reduce export area demands. Actions calling for the construction of export area on-and off-stream surface water storage facilities, and for increased groundwater recharge and storage could greatly reduce such demands, resulting in increased Delta water levels and outflows.

Water Quality: Water quality increases would be achieved by several actions intended to reduce the quantity of pollutants that enter the Delta system through runoff or groundwater leaching. These actions would seek to reduce agricultural, municipal, and industrial pollutants, either by taking land out of agricultural production, modifying practices that contribute to high pollutant loading, or increasing regulatory controls as disincentives to discharging by these user groups.

Preliminary Assessment

This alternative is characterized by several actions to improve shallow habitat, nearshore areas, levee maintenance practices, and land-based agricultural practices (chemical applications, irrigation scheduling, tillage, etc.) that may adversely affect existing habitat. It's implementation may achieve major improvements in existing Delta habitat, large increases in the areal extent of usable habitat, and substantial increases in water quality that accompany source discharge control programs. Its weaknesses are characterized by its constraints to: reducing diversion impacts; increasing in-watershed supplies; and improving instream water quality. Its implementation could nevertheless achieve substantial improvements in Delta conditions through increases to fish populations, Delta habitat area, and water quality.

This alternative seeks to achieve major increases in fish populations and Delta habitat through reducing export-area demands as a means of increasing Delta water levels and outflows. It would fall short of achieving benefits unique to those resulting from increased supplies originating in the watershed (e.g. reduced temperatures, flushing flows, etc.) that are often most beneficial to anadromous and estuarine species. It would instead place the full burden of increased levels and outflows on export area users. In the absence of increased supply actions, achievement of Delta fishery, riparian, and wetland population and habitat objectives would most likely be limited by the rapidity with which export area users could implement several demand reduction actions. Furthermore, water quality objectives would need to be achieved solely by actions directed towards reducing discharges at the source, without in-water dilution or treatment actions. Source control programs are difficult to regulate, and would be weakened without an accompanying in-water monitoring and management program.

Preliminary Alternative #21

Corresponding to Alternative Formulation Strategy 1B,2A,3 A,4A - Maximum

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

This maximum alternative provides protection for fish species through the minimization of entrainment effects at diversions and the restoration of existing habitat. The alternative attempts to balance water supply and demand by reducing the demands for water in the Delta during critical periods. Water quality is improved by managing the introduction of pollutants into watercourses.

Actions Selected

Not yet completed.

Preliminary Assessment

Not yet completed.

Preliminary Alternative #22

Corresponding to Alternative Formulation Strategy 1A,2A,3B,4B - Maximum

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

This solution strategy includes actions that increase fish populations through habitat enhancement, elimination of fish migration barriers, expanded and improved hatchery operations, and improved water quality. Habitat enhancement focuses on improved management and restoration of existing habitat, rather than the creation of additional habitat, especially where such creation would affect existing land uses. Increased water supply is achieved by increases in supply north of the Delta, including on-stream and off-stream storage and conjunctive use. Preservation of existing land use and the protection of levees is a central element of this strategy.

Actions Selected

Habitat - This alternative is characterized by actions to improve existing habitat within and upstream of the Delta and control of tributary flows and temperature.

Populations - Actions to increase populations include improved management and increased capacity for fish hatcheries and elimination of barriers to migration.

Diversions - No actions related to the utilization of diversion as a management tool are permitted with this solution strategy.

Water Use - Water supply enhancement actions including increased storage, conjunctive use, and improved resource management (e.g., facilitated water transfers) are available actions.

Water quality - In stream water quality improvement actions associated with dilution and phasing of discharges are allowed in this alternative.

Land use/ levees/ flood control - Existing land use and maintenance of levees to suitable standards are part of this strategy.

Institutions - A broad range of institutional measures are available, including education, regulatory reform, and the creation of a single administrative agency to assist in coordination.

Preliminary Assessment

This alternative's implementation would achieve improvements in existing Delta habitat, but limited increase in the areal extent of usable habitat. Water supply reliability would be increased substantially through the addition of upstream and in Delta storage and conjunctive use. The weakness in this alternative derives from the lack of synergistic benefits (to water supply and fish populations) that would accrue from coupling the additional storage with improved diversion and flow pattern management within the Delta.

Preliminary Alternative #23

Corresponding to Alternative Formulation Strategy 1A,2B,3A,4B - Maximum

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-Delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

This maximum alternative includes compatible objectives of increasing fish populations and increasing the extent of Delta habitat area. Action choices are not limited by the preservation of existing agricultural land uses, but are constrained in that the impacts of remaining agricultural diversions to fish populations are not proactively addressed. By seeking to reduce critical export demands, this alternative may result in additional water available for beneficial Delta purposes, but will not benefit from increased in-watershed supply increases that may dilute and reduce the temperature of Delta waters. By constraining water quality management to the control of source discharges, this alternative precludes the management of instream water quality by treatment, dilution, and other in-water practices.

Actions Selected

Habitat. - Improvements in existing habitat quality, and increases in the area of habitat in the Delta would be achieved by the implementation of several actions that would either restore, protect, convert, improve, or increase habitat in the Delta. Nineteen actions serving to restore Delta shallow water (tidal) habitat, riverine habitat, wetland habitat, and terrestrial habitat would be implemented, including but not limited to restoring tidal action in some areas, filling deep water areas, reconstructing banks, levees, and islands, reestablishing old, and establishing new habitat areas, and restoring historic riparian and wetland areas. Integrated habitat management actions, the control of nuisance species, and improved management of Delta waterfowl habitat would further improve the quality and increase habitat area. Better management of urban wastewater effluent and flood control channels and levees would be used to improve habitat

conditions. Land acquisition programs also could be implemented to directly increase areas protected for beneficial habitat uses.

Populations - Increases in fish populations would be achieved indirectly by better management of temperatures and flows in upstream habitats, channel modifications such as restoring channel configurations, shoreline areas, and spawning gravel beds. Improvements to floodway drainage and passage conditions also would improve fish habitat, and therefore indirectly benefit fish populations.

Direct benefits to fish populations would be achieved by the coordination of hatchery expansion, improved hatchery operations, reduction of hatchery effects on wild fish populations, improved captive breeding and tagging operations, and increased effectiveness in monitoring and regulation actions included in this alternative.

Water Use - Improvements in Delta hydrologic conditions would be achieved indirectly by several actions intended to reduce export area demands. Improved and expanded desalination programs and practices, increased conservation, reclamation (by agricultural, municipal, and industrial users), and public education would be achieved by several actions included in this alternative. Progressive land and water management practices (e.g. land retirement, fallowing, easement purchases) and incentives (pricing, legal and institutional controls) also would be used to reduce export area demands. Actions calling for the construction of export area on-and off-stream surface water storage facilities, and for increased groundwater recharge and storage could greatly reduce such demands, resulting in increased Delta water levels and outflows.

Water Quality - Water quality increases would be achieved by actions intended to improve the instream quality of the Delta system through treatment, dilution, and the management of drainage timing.

Preliminary Assessment

This maximum alternative seeks to achieve major increases in fish populations and Delta habitat through reducing export-area demands as a means of increasing Delta water levels and outflows. It would fall short of achieving benefits unique to those resulting from increased supplies originating in the watershed (e.g. reduced temperatures, flushing flows, etc.) that are often most beneficial to anadromous and estuarine species. It would instead place the full burden of increased levels and outflows on export area users. In the absence of increased supply actions, achievement of Delta fishery, riparian, and wetland population and habitat objectives would most likely be limited by the rapidity with which export area users could implement several demand reduction actions. Furthermore, water quality objectives would need to be achieved solely by actions directed towards in-water dilution or treatment actions, without reducing discharges at the source. The absence of source discharge control actions in this alternative greatly reduce its effectiveness when compared to alternative number 20, which is the same except for the manner in which water quality conflicts are approached. The complexity and enormity of the Delta system would require prohibitively expensive in-water treatment actions to substantially "fix" water quality problems in the absence of source discharge controls.

This alternative is characterized by several actions to improve shallow habitat, nearshore areas, and levee maintenance practices that may adversely affect existing habitat. Its implementation would achieve major improvements in existing Delta habitat, large increases in the areal extent of usable habitat, and substantial increases in water quality that accompany source discharge control programs. Its weaknesses are characterized by its constraints to: reducing diversion impacts; increasing in-watershed supplies; and improving instream water quality.

Preliminary Alternative #24

Corresponding to Alternative Formulation Strategy 1B,2A,3 A,4B - Maximum

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

This maximum alternative provides protection for fish species through the minimization of entrainment effects at diversions and the restoration of existing habitat. The alternative attempts to balance water supply and demand by reducing the demands for water in the Delta during critical periods. Water quality is improved by treating diverted water.

Actions Selected

Not yet completed.

Preliminary Assessment

Not yet completed.

Preliminary Alternative #25

Corresponding to Alternative Formulation Strategy 1A, 2B, 3B, 4A- Max)

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

Preliminary Alternative 25 generates substantial new benefits. This particular strategy relies upon boosting fish productivity, creation of habitat, increases in water availability north of the Delta, and reduction in the impact of toxics -- all at a maximal level. Thus, the solution generates: significant amounts of new habitat, both aquatic and terrestrial; environmental flows and user water supplies (via storage and demand management in and above the Delta); removal of some barriers and the installation of other barriers to promote fish migration; hatcheries for salmon; an environmentally friendly through Delta water transfer scheme; reductions in toxic discharges into the water system; and levee and flood control improvements.

Actions Selected

Habitat - Habitats are improved across the board. All types of aquatic, wetland, and terrestrial habitat are enhanced, both in and out of the Delta. Improvements include restoration of habitat, and removal and installation of barriers as needed to channel migrating anadromous fish away from bad habitat and into good habitat. Improvements are also made in upstream temperature patterns for salmon.

Populations - Measures are taken to boost commercial and recreational fish populations through hatcheries. Also, measures are taken to discriminate against undesirable species via exotic species control and predator control.

Diversions - This strategy does not allow for measures aimed at reducing the impacts of diversions on fish. However, the impact of existing diversion points is reduced via habitat improvements. In particular, this alternative includes significant restoration of shallow water habitat in the Central Delta. this restoration should reduce net velocities toward the pumps and should reduce the impacts of pumping from the South Delta. Also, the capacity of the export facilities is increased to allow greater diversions of water during periods of low impact. In this way, export supplies can be increased without cutting into environmental supplies.

Water use - All types of environmental flows are improved, including transport, attraction, and baseline flows. Exports also increase, as described under "Diversions". Improved flows are generated partly through demand management in and above the Delta, but primarily through major new storage elements in and

above the Delta -- a combination of on-stream, off stream, and groundwater storage. In this way, wet period flows are captured for use during periods of high competition.

Water quality - Major efforts are made to keep toxics of all kinds from getting into the system, including pollutants associated with agriculture, dredging, and mining.

Land use/ levees/ flood control - Significant amounts of existing land uses are converted into both habitat and water storage. Major efforts are made to protect levees better. The creation of floodways in the upstream areas as habitat should improve flood control protection.

Institutions - A number of institutional changes may be necessary for this alternative, including: changes in law to promote groundwater storage and conjunctive use; better regulation of commercial and recreational fishing; water pricing measures, funding mechanisms, and the development of institutions to assure that the system is operated as promised in the future.

Preliminary Assessment

The proposed alternative is a significant improvement from the no action case. It should greatly expand fish habitat and populations while allowing for increased diversions. Its weaknesses have to do with the absence of actions which are ruled out by this strategy. In particular, south of Delta storage and other methods of reducing the draw on the Delta by the export areas are ruled out. Similarly, efforts aimed at reducing the impacts of diversions (screening, shifting intake points) are also ruled out. This means that export areas continue to be heavily constrained in the Delta, with problems moving water during periods of high environmental sensitivity (because of the location of the intakes) and limitations on the ability to move and store water during periods of low environmental sensitivity.

Preliminary Alternative #26

Corresponding to Alternative Formulation Strategy 1B, 2A, 3B, 4A - Maximum

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-Delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

A total of 101 actions has been identified as meeting the selection criteria for inclusion in this maximum edge alternative and addressing each of the four conflict areas. Only 13 actions directly address

improvement of habitat quality and preservation of existing land use practices. Many of the actions selected for improvement of fish productivity would indirectly improve habitat quality. Approximately one-half of the actions achieve increases in supplies to the Bay-Delta system, the solution strategy for Conflict 3.

Actions Selected

Habitat -

Populations - Actions to improve fish productivity and population abundance include modification of Bay-Delta diversion patterns, relocation of Delta export pumps, and installation of more efficient fish screens.

Water Use - These actions include numerous potential projects to develop greater yield through construction or expansion of reservoirs or improvements to through-Delta conveyance.

Water Quality - The actions selected to manage water quality were primarily aimed at managing agricultural and municipal drainages.

Land Use/Levees/Flood Protection - The actions include reversing subsidence problems and improving levees, all to maintain existing land use practices.

Preliminary Assessment

The solution strategy of the alternative is generally very sound. The objectives to reach resolution within each of the four conflict areas compliment each other. Reducing impacts from diversions by modification of existing facilities and operation schemes would promote increased efficiency in diversions within the Delta. This is complimented by increases in supplies to the Bay-Delta which could be used to increase supplies both for diversion and environmental purposes. However, to create a more balanced approach, reduction in diversion demands should also be pursued. Increases in supplies would likely enable improvement in water quality beyond that which could be accomplished through changes in land use practices to reduce pollutant discharges. Reducing pollutant discharges while maintaining land use patterns and proactively increasing protection, improvements, and maintenance of existing aquatic, wetland, and riparian habitats would generally provide an equitable solution between various user groups.

Preliminary Alternative #27

Corresponding to Alternative Formulation Strategy 1B, 2B, 3A, 4A- Max)

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

The objective of this maximum alternative is to increase fish populations by reducing the diversion impacts on fish species. Actions included in this alternative include those to increase habitat, reduce critical-year Delta export demands, and manage water quality by source control. This alternative precludes preserving existing land use, increasing flow to the Delta to reduce fish impacts, or managing instream water quality.

Actions Selected

Habitat - This alternative is characterized by minimal actions to improve fisheries productivity and shallow habitat area, nearshore areas, levee maintenance practices, and instream water quality improvements.

Populations - Fish populations are increased by reducing the impacts of diversions.

Diversions - By seeking to reduce critical export demands, this alternative will result in additional water available for Delta uses.

Water Use - This alternative would not make additional water available for water supplies, but would reduce critical-year demands.

Water quality - This alternative includes source treatment of pollutants.

Land use/ levees/ flood control - Land use actions will add to habitat, possibly at the expense of existing land uses.

Institutions - This alternative establishes or expands public information programs, intra-agency cooperation, and changes in Water Code.

Preliminary Assessment

This alternative would improve existing Delta habitat, increase the areal extent of usable habitat, and manage the water quality of source discharge. As a maximum alternative, the actions implemented to achieve this alternative involve new regulations, programs, or projects. The weakness of this alternative is that it does not directly increase fish populations or critical-year flow to the Delta. In addition, emphasizing a reduction in critical-year demands in the export area may decrease the reliability of these water supplies.

Preliminary Alternative #28

Corresponding to Alternative Formulation Strategy 1A, 2B, 3B, 4B- Max)

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

Preliminary Alternative 28 generates substantial new benefits. This particular strategy relies upon boosting fish productivity, creation of habitat, increases in water availability north of the Delta, and reduction in the impact of toxics -- all at a maximal level. Thus, the solution generates: significant amounts of new habitat, both aquatic and terrestrial; environmental flows and user water supplies (via storage and demand management in and above the Delta); removal of some barriers and the installation of other barriers to promote fish migration; hatcheries for salmon; an environmentally friendly through Delta water transfer scheme; Some measures to reduce the impacts of salinity; and levee and flood control improvements.

Actions Selected

Habitat - Habitats are improved across the board. All types of aquatic, wetland, and terrestrial habitat are enhanced, both in and out of the Delta. Improvements include restoration of habitat, and removal and installation of barriers as needed to channel migrating anadromous fish away from bad habitat and into good habitat. Improvements are also made in upstream temperature patterns for salmon.

Populations - Measures are taken to boost commercial and recreational fish populations through hatcheries. Also, measures are taken to discriminate against undesirable species via exotic species control and predator control.

Diversions - This strategy does not allow for measures aimed at reducing the impacts of diversions on fish. However, the impact of existing diversion points is reduced via habitat improvements. In particular, this alternative includes significant restoration of shallow water habitat in the Central Delta. this restoration should reduce net velocities toward the pumps and should reduce the impacts of pumping from the South Delta. Also, the capacity of the export facilities is increased to allow greater diversions of water during periods of low impact. In this way, export supplies can be increased without cutting into environmental supplies.

Water use - All types of environmental flows are improved, including transport, attraction, and baseline flows. Exports also increase, as described under "Diversions". Improved flows are generated partly through demand management in and above the Delta, but primarily through major new storage elements in and

above the Delta -- a combination of on-stream, off stream, and groundwater storage. In this way, wet period flows are captured for use during periods of high competition.

Water quality - Barriers are installed in the South Delta to reduce the salinity of water for farming and weirs are installed to reduce salinity intrusion.

Land use/ levees/ flood control - Significant amounts of existing land uses are converted into both habitat and water storage. Major efforts are made to protect levees better. The creation of floodways in the upstream areas as habitat should improve flood control protection.

Institutions - A number of institutional changes may be necessary for this alternative, including: changes in law to promote groundwater storage and conjunctive use; better regulation of commercial and recreational fishing; water pricing measures, funding mechanisms, and the development of institutions to assure that the system is operated as promised in the future.

Preliminary Assessment

The proposed alternative is a significant improvement from the no action case. It should greatly expand fish habitat and populations while allowing for increased diversions. Its weaknesses have to do with the absence of actions which are ruled out by this strategy. In particular, south of Delta storage and other methods of reducing the draw on the Delta by the export areas are ruled out. Similarly, efforts aimed at reducing the impacts of diversions (screening, shifting intake points) are also ruled out. This means that export areas continue to be heavily constrained in the Delta, with problems moving water during periods of high environmental sensitivity (because of the location of the intakes) and limitations on the ability to move and store water during periods of low environmental sensitivity. Finally, restrictions on the ability to include actions dealing with the pollution source control mean that water quality will remain degraded.

Preliminary Alternative #29

Corresponding to Alternative Formulation Strategy 1B, 2A, 3B, 4B - Maximum

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-Delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

A total of 92 actions has been identified as meeting the selection criteria for inclusion in this maximum edge alternative and addressing each of the four conflict areas. Many of the selected actions are duplicative given the implementation of other similar actions. Only 14 actions directly address improvement of habitat quality and preservation of existing land use practices. Many of the actions selected for improvement of fish productivity would indirectly improve habitat quality. Approximately one-half of the actions achieve increases in supplies to the Bay-Delta system, the solution strategy for Conflict 3.

Actions Selected

Habitat -

Populations - Actions to improve fish productivity and population abundance include modification of Bay-Delta diversion patterns, relocation of Delta export pumps, and installation of more efficient fish screens.

Diversions -

Water Use - These actions include numerous potential projects to develop greater yield through construction or expansion of reservoirs or improvements to through-Delta conveyance.

Water Quality - The actions include flow barriers to manage south Delta water quality and control salinity intrusion and also actions aimed at diluting pollutant discharges for flows in the Bay-Delta system.

Land Use/Levees/Flood Protection - The actions include reversing subsidence problems and improving levees, all to maintain existing land use practices.

Institutional -

Preliminary Assessment

The solution strategy of the alternative is generally very sound. The objectives to reach resolution within each of the four conflict areas compliment each other. Reducing impacts from diversions by modification of existing facilities and operation schemes would promote increased efficiency in diversions within the Delta. This is complimented by increases in supplies to the Bay-Delta which could be used to increase supplies both for diversion and environmental purposes. However, to create a more balanced approach, reduction in diversion demands should also be pursued. Additional measures to result in a more balanced approach include restoration of habitat quality and reducing pollutant discharges.

Preliminary Alternative #30

Corresponding to Alternative Formulation Strategy 1B, 2B, 3A, 4B- Max)

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

The objective of this maximum alternative is to increase fish populations by reducing the diversion impacts on fish species. Actions included in this alternative include those to increase habitat, reduce critical-year Delta export demands, and manage water quality by instream quality control. This alternative precludes preserving existing land use, increasing flow to the Delta to reduce fish impacts, or treating source discharges.

Actions Selected

Habitat - This alternative is characterized by minimal actions to improve fisheries productivity and shallow habitat area, nearshore areas, levee maintenance practices, and instream water quality improvements.

Populations - Fish populations are increased by reducing the impacts of diversions.

Diversions - By seeking to reduce critical export demands, this alternative will result in additional water available for Delta uses.

Water Use - This alternative would not make additional water available for water supplies, but would reduce critical-year demands.

Water quality - This alternative includes instream methods to improve water quality.

Land use/ levees/ flood control - Land use actions will add to habitat, possibly at the expense of existing land uses.

Institutions - This alternative establishes or expands public information programs, intra-agency cooperation, and changes in Water Code.

Preliminary Assessment

This alternative would improve existing Delta habitat, increase the areal extent of usable habitat, and manage instream water quality. As a maximum alternative, the actions implemented to achieve this alternative involve new regulations, programs, or projects. The weakness of this alternative is that it does not

directly increase fish populations or critical-year flow to the Delta. In addition, emphasizing a reduction in critical-year demands in the export area may decrease the reliability of these water supplies.

Preliminary Alternative #31

Corresponding to Alternative Formulation Strategy 1B, 2B, 3B, 4A- Max)

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

This maximum alternative focuses on reducing losses to fish populations (i.e. reducing diversion losses) rather than increasing fish production. It also increases wetland, riparian, and terrestrial habitat at the expense of existing land use. It also increases inflow to the Delta especially in critical periods, while maintaining existing Delta exports and south of Delta consumption. Water quality is maintained mainly through source controls rather than by dilution.

Actions Selected

Habitat - This alternative is characterized by minimal actions to improve Delta fish habitat. High levels of riparian, wetland, and terrestrial habitat improvements would benefit many fish and wildlife species. Upstream floodway and channel enhancements would provide improved habitat for fish & wildlife.

Populations - Key fish populations are enhanced through reducing existing impacts from water diversions and increasing Delta inflow during critical periods. Maximum efforts would be made to improve diversion locations and screening and salvage measures at existing diversions.

Diversions - Diversions are limited upstream of the Delta to increase water supply to the Delta; Delta exports would be limited to reduce diversions during critical periods to reduce entrainment. Maximum efforts are proposed to reduce diversions and decrease north of Delta consumptive use.

Water Use - Exports from the Delta and south of Delta consumption are minimally affected; diversions north of the Delta are reduced to increase inflow to Delta.

Water Quality - Controlled mainly through source controls rather than dilution.

Land Use/Levees/Flood Protection - Existing landuse is modified as needed to improve habitat; levee and flood control protection are maximized.

Institutional - Measures require maximum use of institutional capabilities.

Preliminary Assessment

This alternative's implementation would achieve minor reduction in entrainment losses at existing water diversions through a combination of enhanced screening, and changes in land use and irrigation patterns. Direct physical habitat enhancements for key Delta fish species would be limited; however, habitat enhancement from improved wetlands and riparian habitats would provide minor habitat improvements for fish. Substantial benefits would be achieved in upstream fish and wildlife habitat. Existing Delta and south of Delta exports would be protected to a large extent, while some effects on north of Delta exports would occur, but could be replaced by shifts in water supply sources (ground water). Water quality in the Delta would improve through source water quality controls. More Delta inflow and outflow would be required to maintain water quality. Many of the options for habitat improvement, reduced diversion impacts (intake screening) and levee, wetland, and riparian protection would be costly.

Preliminary Alternative #32

Corresponding to Alternative Formulation Strategy 1B, 2B, 3B, 4B- Max)

Primary Conflict	Approach to Resolve Conflict
Fisheries and Diversions (Conflict 1)	Increase Fish Productivity (1A) Diversion Modification (1B)
Habitat and Land Use/Flood Protection (Conflict 2)	Preserve Existing Land Use (2A) Create Additional Habitat Area (2B)
Water Supply Availability and Beneficial Uses (Conflict 3)	Reduce Critical Export Area Demands (3A) Enhance Delta Supplies as Inflows (3B)
Water Quality and Land Use (Conflict 4)	Managing Quality of Delta Inflow (4A) Manage Instream/In-delta Water Quality (4B)
Minimum or Maximum	

Solution Overview

This maximum alternative focuses on reducing losses to fish populations (i.e. reducing diversion losses) rather than increasing fish production. It also increases wetland, riparian, and terrestrial habitat at the expense of existing land use. It also increases inflow to the Delta especially in critical periods, while maintaining existing Delta exports and south of Delta consumption. Water quality is maintained mainly through dilution rather than by source controls.

Actions Selected

Habitat - This alternative is characterized by minimal actions to improve Delta fish habitat. High levels of riparian, wetland, and terrestrial habitat improvements would benefit many fish and wildlife species. Upstream floodway and channel enhancements would provide improved habitat for fish & wildlife.

Populations - Key fish populations are enhanced through reducing existing impacts from water diversions and increasing Delta inflow during critical periods. Maximum efforts would be made to improve diversion locations and screening and salvage measures at existing diversions. Improved water conveyance facilities including through Delta or isolated options would be employed to minimize fish entrainment.

Diversions - Diversions are limited upstream of the Delta to increase water supply to the Delta; Delta exports would be limited to reduce diversions during critical periods to reduce entrainment. Maximum efforts are proposed to reduce diversions and decrease north of Delta consumptive use.

Water Use - Exports from the Delta and south of Delta consumption are minimally affected; diversions north of the Delta are reduced to increase inflow to Delta.

Water Quality - Controlled mainly through dilution rather than source controls.

Land Use/Levees/Flood Protection - Existing landuse is modified as needed to improve habitat; levee and flood control protection are maximized.

Institutional - Measures require maximum use of institutional capabilities.

Preliminary Assessment

This alternative's implementation would achieve major reduction in entrainment losses at existing water diversions through a combination of enhanced screening, isolation and relocation of diversions, and changes in land use and irrigation patterns. Direct physical habitat enhancements for key Delta fish species would be limited; however, habitat enhancement from improved wetlands and riparian habitats, as well as changes in through-Delta conveyance facilities would provide substantial habitat improvements for fish. Substantial benefits would be achieved in upstream fish and wildlife habitat. Existing Delta and south of Delta exports would be protected to a large extent, while some effects on north of Delta exports would occur, but could be replaced by shifts in water supply sources (ground water). Water quality in the Delta may suffer from the combination of an isolated water transfer facility and lack of source water quality controls. More Delta inflow and outflow would be required to maintain water quality. Many of the options for habitat improvement, reduced diversion impacts (intake screening) and levee, wetland, and riparian protection would be costly.