Summary - Alternatives Development

C-004969

Interagency Development Team
Alternatives Development
Description of Process and Analysis
December 15, 1997

Introduction

The Interagency Development Team (IDT) was formed on September 2, 1997 to support the Management Team and Policy Group in developing complete, integrated alternatives leading to a Draft Preferred Alternative for Policy Group deliberation and decision. The IDT is composed of staff from numerous CALFED agencies with support form CALFED staff members and consultants. The membership roster is attached as Appendix II. This document represents an attempt to explain the approach taken and the logic used by the IDT in arriving at its conclusions.

Classes of Alternatives

1. For all versions of Alternative 1, water must generally make its way to the export pumps in much the same way that it does now. With this alternative, no significant channel enlargements for the purpose of enhancing export capabilities are envisioned. However, south Delta improvements near the exports pumps are allowed. Storage or operations may change.

2. For all versions of Alternative 2, water must make its way to the export pumps through existing channels, though physical changes may be made to those channels. Some use of artificial channels is acceptable. Storage or operations may change.

3. For all versions of Alternative 3, some amount of export water would be diverted North of the Delta and carried to the export pumps through artificial channels, while some portion of exports would be diverted from the South Delta. Storage or operations may change.

Base Assumptions

Except where otherwise noted, the IDT assumed:

- o System demand projected for the year 2020.
- o Existing standards and operational rules
- o Existing supply facilities

The Alternatives -- What Drives Differences in Performance?

The refined CALFED alternatives could differ from each other primarily in four areas: (1)

conveyance facilities -- the location and capacity of intakes, channels and canals; (2) transfers -- possible water acquisition through markets; (3) storage -- the location and capacity of intakes and surface/ groundwater reservoirs; and (4) operations -- how the conveyance and storage facilities would be operated.[1] Differences in these four areas cause differences in how well the various alternatives perform against the distinguishing characteristics

By contrast, the common programs -- ecosystem restoration, water quality, water efficiency and levee stability -- will not vary very much across alternatives at the current level of analysis. This is not to say that each alternative performs the same in these areas, only that the differences are driven by differences in plumbing, markets, storage, and/or operations. For example, alternative 3 provides major improvements in export water quality over alternatives 1 and 2 -- not as a specific result of the water quality program component, but as a result of changed plumbing.

Therefore, in attempting to refine each of the three alternatives, the IDT focused upon how changes in plumbing, markets, storage, and operations could be used to improve performance for each of the three alternative approaches.

The Alternatives -- How Do They Differ in Performance?

The IDT concluded that significant differences in performance may exist between different alternatives as represented by the following distinguishing characteristics:[2]

o In-Delta water quality.	Increased salinity can impact Delta farmers and urban Delta diverters (e.g., Contra Costa Water District).
o Export water quality	Increased salinity increases agricultural salt loads. Salinity, bromide and organics may cause problems for drinking water treatment.
o Diversion effects	Intake locations, screening technology, and diversion timing determine the impact of diversions on fish.
o Delta flow circulation	Flow directions in the Delta can be altered by export pumping and confuse fish during migrations.
o Water supply	How big is the "pie"? How much water is being regulated?
o Water transfer	Will buyers and sellers be able to move purchased water from north to south in an economical and reliable fashion to reduce disparities in supply versus demand?
o Operational flexibility	As scientific understanding increases, there will be a need to make

[1] Markets and storage are closely linked because they provide similar benefits (though they have different impacts). Increasing emphasis on markets reduces storage needs and vice versa. However, both storage and markets are constrained by the need to reduce redirected impacts.

[2] "Significance" in this context means that performance differences between alternatives may be large enough to affect which alternative is ultimately chosen. Note that the IDT did not attempt to determine the relative importance of the various distinguishing characteristics.

	operational changes to take advantage of the new understanding. Does the system allow for such changes in the future without harming one interest or another? Can real time management of operations be used effectively to reduce entrainment while maintaining water supplies?
o Risk to export supplies	What is the risk of major levee failure in the Delta and what would be the consequences of such a failure for export supplies?
o Assurances difficulty	The IDT concluded that a workable assurance package was possible for all possible alternatives. However, the IDT also took note of the fact that not all stakeholders would agree. Inasmuch as perceptions about assurability will affect the implementability of the program, the IDT took this factor into consideration when refining the alternatives.

In addition, the IDT noted several other areas where significant differences between alternatives may arise:

o Certainty/ predictability.	Our ability to predict biological responses varies by alternative. The greater the uncertainty in response, the greater the risk that an alternative could perform worse than expected. In general, the IDT concluded that the performance of the existing system was most easily predicted (i.e., bad), then 1, 3, and 2 (in that order).
o Flood control.	Alternative 2 provides intrinsic flood control benefits to the north Delta (due to channel widening) which are not necessarily contained in alternatives 1 and 3.

The IDT did not consider the following distinguishing characteristics in detail, because either: (1) they were felt not to differ significantly across alternatives; (2) the IDT did not have enough information to analyze the characteristic; or (3) they were outside the purview of the IDT:

o Total cost	The IDT believes that costs directly attributable to the CALFED program (e.g., the cost of storage facilities or the ecosystem program) and costs/benefits indirectly attributable to the CALFED program (e.g., water treatment costs) need to be considered by policy makers. Thus, this distinguishing characteristic would need to incorporate some of the characteristics of the "socio-economic impact" distinguishing characteristic. Until this analysis is completed, it will be difficult to use cost to distinguish between alternatives.
o Solution Principles	The IDT felt that analysis of the solution principles was best left to the Management and Policy teams. The analysis of the other distinguishing characteristics should provide a basis for determining conformance with the solution principles.
o Ability to phase facilities	The more facilities, the greater the ability to phase.
o Brackish water habitat	All alternatives have roughly similar performance..
o Storage & release of water	The operation of various storage options will have similar impacts on the hydrograph, independent of the alternative into which they are

	placed.
o S. Delta access to water	Each alternative contains barriers in the south Delta designed to meet the needs of the local agricultural diverters.
o Habitat impacts	The footprint of the conveyance facilities in alternatives 2 and 3 were not felt to be significant factors in alternative selection.
o Land use changes	Changes for ecosystem restoration will be relatively constant across alternatives. Changes due to market forces are difficult to estimate. However, one of the basic principles of the CALFED transfer program is to limit the impacts of an expanded transfer program. While Alternative 3 would result in some land use change due to the new channel, overall, land use changes are unlikely to differentiate the various alternatives.
o Socio-economic impacts	Indirect costs of the CALFED program are important, and should be incorporated into the total cost category above. Other impacts are related to land use changes discussed above.

Methodology for Refinement

The IDT analysis of alternatives proceeded in the following order:[3]

Step 1. For the first round, alternatives 1, 2, and 3 were refined using only the following considerations.[4]
- o Provide ERPP flows
- o Reduce diversion effects on fisheries
- o Create net increases in water supplies for water users

Step 2. Next, facilities were sized and operations modified in order to increase performance in the other key distinguishing characteristics identified above. The result of this step was the refined or hybrid versions of alternatives 1, 2, and 3.

Step 3. Next, alternatives 1, 2, and 3 were measured against each other using the distinguishing characteristics and the key pros and cons for each alternative were identified.

Note that these 3 steps represent a simplification of the actual process. In reality, analysis of such complex proposals cannot proceed in such a linear fashion. All the alternatives went through various iterations each step of the way. More detail is presented below.

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[3] Given the tools available and the number of distinguishing characteristics thought significant numerous approaches are possible. Still, the methodology described was thought to represent a reasonable approach to developing refined alternatives.

[4] It is very important to note that there was no attempt to equalize the benefits generated by alternatives 1, 2, and 3. Each alternative was separately balanced.

Step 1: Balance Diversion Impacts with Water Supply

In this step, the IDT tried to develop alternatives that successfully reduce diversion impacts on fish while still generating enough water to meet ERPP flow targets and increasing water supply for water users. This is not always an easy task. Diversion impacts can be reduced through screening, changed diversion timing, changed diversion volume, changed diversion location and changed flow patterns. Some of these changes may constrain water diversions (e.g., changed diversion timing and volume, changed flow patterns). Supplies can be enhanced through increased storage, other infrastructure improvements (e.g., south Delta facilities), water transfers, and changes in operational rules (e.g., changed standards, joint point of diversion for the state and federal projects). Discussion of how the IDT generated alternatives in this first iteration using these constraints is given below. Alternative 2 is discussed last since conceptually it is a hybrid between Alternatives 1 and 3.

Discussion of Alternative 1

The IDT felt that, even with proposed improvements in screening in the south Delta, entrainment would remain a major problem. Therefore, significant reductions in spring exports were proposed to reduce the problem. However, reduced spring exports cause export supply impacts. To some extent these impacts are compensated for by supply increases generated through south Delta facilities and a joint point of diversion. Additional spring export reductions could also be compensated for through new storage, though only to a point. If exports are too constrained, then south-of-Delta storage can no longer be used effectively. To truly deal with entrainment problems in the south Delta with alternative 1, major decreases in the volume of exports would be necessary. However, most IDT members felt that the overall performance of the Alternative 1 would not be significantly changed by reduced export demand unless very high demand reductions could be generated, i.e., permanent reductions in annual exports of several million acre-feet. Reductions of this size were felt to be economically and politically infeasible. A subcommittee of the IDT did investigate the possibility of a more limited approach to export demand management which would tie fallowing based upon agronomic needs to reduced exports and felt that it had some promise. For these reasons the charge to reduce diversion impacts while improving water supplies could be met only imperfectly -- some reduction in entrainment coupled to modest water supply enhancement.

Discussion of Alternative 3

Alternative 3 resolves the entrainment issue/ supply conflict much more successfully than Alternative 1. The IDT concluded that, by shifting the export intakes to a location where there are fewer resident fish and where screening can be accomplished with high efficiency and with reduced need for trapping and trucking (required in Alternatives 1 and 2), the IF could make a significant reduction in entrainment problems without the need for reductions in diversions. With respect to entrainment, therefore, full isolation would be advisable. However, there are other considerations as well. First, some amount of water must be left in the Sacramento River below the intake point to provide proper circulation for the system. But bypass requirements for the IF mean that full isolation would lead to significant reductions in export supplies. These reductions would need to be made up for as described in Alternative 1.

In any case, because Alternative 3 could potentially decouple entrainment from supply, changes in operational rules for the Delta are probably appropriate. The IDT proposed the following operational changes:

- o Expanded bypass flow requirements for the IF. The original concept was to assure positive downstream flow at the screens at all times (despite the tidal cycle) to assure maximum pump efficiency. However, that measure was determined to reduce water diversion by too much and in any case, screening experts have asserted that the IF screens can be made efficiency even with tidal reversals.
- o Requirements to pump at maximum levels from the IF before pumping from the South Delta.
- o Define diversions into the IF as being outside the export/inflow standards.

In addition, the IDT looked at relaxation of the X2 standard to estimate the associated increase in water diversions as a measure of sensitivity.

Alternative 2

Alternative 2 shares characteristics of Alternatives 1 and 3. It relies upon diversions from the South Delta as with Alternative 1, but has a screened diversion intake on the Sacramento River as with Alternative 3. In general, the standards applied in the South Delta in Alternative 1 and the standards applied at the Sacramento intake in Alternative 3 were applied to Alternative 2.

Storage Considerations

This was a subject with which the IDT struggled for a long time. It seems clear that some minimum level of storage might well be needed to assure that new operational rules can be satisfied (e.g., reductions in spring pumping) and ERPP flow targets met while still providing some improvement in water supplies for users. However, it is more difficult to determine what the maximum amount of possible storage might be. Storage is expensive compared to transfers and it is not clear how much of it water users will be willing to pay for. On the other hand, transfers themselves are limited and there is no logical breakoff point at which additional storage ceases to provide new benefits.

The IDT developed a methodology for calculating the amount of storage minimally needed by any alternative as follows: Calculate net effect of new facilities, proposed operational rules, new demands (i.e., ERPP supplies) and a reasonable amount of water transfers on supplies. If additional water is needed to assure that water supplies increase, it must come through new storage. This defines the minimum amount of storage needed. However, the IDT never actually calculated storage minima for several reasons: (1) logistical difficulties in getting model results; (2) difficulty in evaluating likely contribution from water transfers and groundwater conjunctive use; and (3) analysis of storage appeared to have little impact on evaluation of Delta conveyance alternatives. Ultimately selection of appropriate amounts of storage will require involvement of the potential beneficiaries.

Step 2: Refine Alternatives

In this step, consideration of factors other than diversion effects on fisheries, ERPP flows, and water supply were added to the mix. What resulted was a further sharpening of the alternatives.

Alternative 1. Delta island discharge reduction/management programs would be emphasized in this alternative in an attempt to reduce TOC and salinity problems at the export intakes.

Alternative 2. The size of the intake of the through-Delta facility was assumed to be 10 kcfs in order to make the analyze more comparable to alternative 3 (see below).

Alternative 3. The size of the intake of the isolated facility was assumed to be 10 ± 2 kcfs. The size of the south Delta intake was set at 5 ± 2 kcfs. Sizing was based upon the following considerations:

- o In order to reap the majority of benefits possible from the isolated facility -- reduced fish impacts, water quality benefits, seismic security -- a large fraction of total exports must come through the facility. An 8 kcfs facility operated a maximum capacity could carry about 80% of total exports. This seemed to be a reasonable lower boundary on size.
- o The upper size for the isolated facility was more difficult to determine in that a large facility can always be operated as if it were small. That is, a large facility, if operated properly, should perform as well or better than a smaller facility. Some IDT members argued for a higher size to maximize fishery benefits. Others argued that most of the benefits of an isolated facility could be generated at a size of 10 kcfs or lower and that increasing the size above 10 kcfs would essentially eliminate any assurance based upon the concept of "common pool". Another consideration was the desire to facilitate a water transfer market by reserving space in the facility for a transfer market. This might argue for a larger facility. In the end, the IDT settled on the range 10 ± 2 kcfs as being reasonable.
- o The size of the south Delta intake was set based primarily upon the belief that total export capacity (the sum of Hood +south Delta) should be at least 15 kcfs

Step 3. Analyze and Compare Alternatives.

The IDT rated and compared the three refined alternatives based upon the most important distinguishing characteristics. A complete summary of IDT findings may be found in other documents. In summary, the IDT finds that Alternative 3 ranks highest given the criteria (distinguishing characteristics) and the assumptions made by the Program for the following reasons:

- o Among the most important objectives are: (1) ecosystem restoration; (2) water quality improvement in the export areas; (3) security against supply outages for exports; and (4) water supply reliability (which we interpreted to mean increases in volume and predictability for all purposes).
- o It is probably possible to generate water supply increases for each of the three alternatives

through increased storage.

- However, major improvements in other key areas cannot be confidently projected for any alternative other than Alternative 3:

  - Ecosystem restoration. Most biologists believe that fishery losses due to diversion impacts are a major cause of fishery declines. Based upon current levels of information, it is highly uncertain whether habitat improvements will lead to species recovery absent reductions in diversion impacts. Both alternatives 1 and 2 continue to rely upon pumping at a location in the south Delta where high fishery impacts are to be expected. Modification of diversion patterns and improved screens may help reduce these impacts, but only to a limited degree. By contrast, it the IDT has determined that the isolated facility can be screened effectively with a relatively high degree of confidence. Fish screened from the intake on the Sacramento River would not be subject to trapping and trucking as is the case for South Delta diversions. This is a known source of high fish mortality. Moreover, only the isolated system can restore natural flow patterns to the Delta (i.e., allow all rivers to flow downstream through and out from the Delta)

  - Water quality. The safety of the water supply for 20 million Californians must take top priority in this category. Future drinking water standards are uncertain, but the trend has been for more stringent standards. The availability of new technologies to treat low quality source water in the future is uncertain. There is a substantial difference in the quality of water that would be diverted into the isolated facility compared to water diverted from the south Delta. The IDT concludes that the isolated facility significantly increases the protection of drinking water sources and the chances that urban areas will be able to treat export water at a reasonable cost.

    Increased water quality would also reduce salt loading in export agricultural areas and, via reduced salt in drainage, will eventually improve water quality in the San Joaquin River.

    The construction of an isolated facility would worsen salinities in the eastern and southern Delta. and could impact agricultural production. A number of alternatives are possible for dealing with these impacts, including providing water out of an isolated facility, releasing water from an isolated facility into south Delta channels, and the use of Delta storage for supplying local needs.

  - Security. The likelihood of a major, long-term loss of Delta islands due to an earthquake must be considered significant, despite levee upgrades envisioned as part of the the levee system rehabilitation program. The economic impacts to California from a multi-month to multi-year outage in south Delta pumping could be enormous. Of the alternatives considered, only alternative 3 provides strong protection against the worst effects of such an outage. Another approach would be increased south-of-Delta storage dedicated to security. But such a reservoir would not be useful for increasing supplies and would, therefore, be very costly.

- o Supply reliability. Given that ecosystem recovery is questionable without alternative 3, the likelihood that water supplies can be made reliable is similarly questionable.

Implementation Considerations

The IDT also considered a number of implementation issues and came to the following conclusions:

- o A workable assurance package is possible for all the refined alternatives. However, not all stakeholders would agree. Inasmuch as perceptions about assurability will affect the implementability of the program, policy makers will need to consider the likely reaction of stakeholders and the public to the various possible alternatives.
- o Implementation can be designed to reduce the likelihood that implementation will veer off course. By using a series of discrete, linked steps, stakeholders can be induced to support all elements of each step in order to receive their share of the benefits.
- o The use of phasing and contingency plans implies the need for some continuing decision making mechanism for the program as a whole.
- o The current recommendation is based upon limited knowledge -- of biological responses, of future water quality standards, of future technologies. Ideally, phasing should allow increased knowledge to be incorporated into the implementation program. Therefore, there should be some degree of flexibility for all elements of the program, including the facilities element. How this flexibility can be reconciled with the need to provide assurances is a problem that must be addressed.

Conclusions

The IDT adopted the following statement on December 12, 1997:

> *The Interagency Development Team has determined that Alternative 3 ranks highest given the criteria (distinguishing characteristics) and the assumptions made by the Program. Alternative 3 consists of a set of ecosystem, restoration, water quality, water use efficiency, levee system protection, and conveyance and storage elements that are analyzed, planned, and implemented in a series of discrete linked steps that demonstrate progress. Implementation should include contingencies for changes of any component where new information becomes available.*

Appendix I
Summary of Refined Alternatives

Alternative 1	Alternative 2	Alternative 3
Consolidate all export pumping in the South Delta into a single screened intake in front of Clifton Court Forebay. Intertie Clifton Court Forebay and the Tracy Pumping Plant. Requires large-scale trapping and trucking.		Screened intake on the Sacramento River far enough upstream to lie outside the habitat of most in-Delta species. South Delta modifications as in Alternatives 1 and 2, though screen capacity might be smaller.
	Consider relocating the N.Bay Aqueduct intake	Consider relocating N.Bay Aqueduct and Contra Costa Water District Intakes for improved W.Q.
	10 ± 2 kcfs intake at Hood.	10 ± 2 kcfs intake at Hood. 5 ± 2 kcfs intake in the South Delta.
		Assume that export diversions are maximized through the isolated facility before water can be exported from the south Delta.
Expanded Delta island discharge management		
Examine reducing the export/ inflow ratio (E/I) to 25% of Delta inflow from February - June. Reduce the E/I ratio to 50% in November - January.		Examine expanded Rio Vista flow requirements for July - December (assures that flows are retained below the intake of the isolated facility). Total project exports limited to 5 kcfs in May for protection of striped bass eggs and larvae.
Consolidate point of diversion for export projects		
Construct South Delta facilities		
		Assume that isolated facility does not count toward E/I ratio.
	Examine changing X2 standard to X3 for sensitivity	
Storage. Computer model runs were based upon the following storage levels: 2 MAF surface storage north of Delta. 0.25 MAF groundwater water storage north of Delta 2 MAF off-aqueduct surface storage (includes consideration of near Delta and in Delta storage) 0.5 MAF surface storage on San Joaquin Tributaries 0.5 MAF groundwater storage south of Delta. This does not necessarily represent a maximum level of storage.		

Appendix II

Members of the Interagency Alternative Integration and Development Team (IDT)

Name	**Affiliation**
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