PRINCIPLES TO ASSURE
THE DURABILITY OF BAY-DELTA SOLUTIONS

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Viable alternatives will have a high likelihood of generating and protecting the benefits promised to each stakeholder group. Durability should be estimated, considering physical, biological, legal, and institutional factors. Elements which could be used to increase durability are discussed below. Obviously there is a great deal of overlap between the various categories.

- *Operational guarantees.* Various institutional mechanisms, such as legislation, Federal guarantees, and private contracts are possible to increase the likelihood that specified water operations will be adhered to in the future. However, it is debatable whether legal guarantees will be sufficient, in and of themselves, to assure a stable solution, if that solution is otherwise unstable. The *regulatory guarantees* section below discusses a similar issue.

- *Financial guarantees.* Elements which will take an extended period to implement and which cannot self fund through the sale of water, power, etc. (e.g., the environmental restoration element) should have revenue streams which are protected into the future.

- *Alignment of interests: physical* Solutions which are structured such that each stakeholder group has a similar assessment of optimal physical and biological operations will be naturally stable, provided of course, that the levels of benefits received are also acceptable.[1] Note that physical alignment of interests is similar to, but more aggressive than "resolving conflicts." It means that we might find opportunities to engineer solutions which create a mutuality of interest.[2]

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[1] The attractiveness of the current through-Delta system by Delta agriculture and many environmentalists is based upon this principle. The logic is as follows: (1) Export water quality is dependant upon strong Delta inflows and outflows and a strong levee system; and (2) Increased exports are associated with higher Delta outflows (via carriage water). Therefore, the interests of the exporters coincide with the interests of (1) Delta farmers for levee stability and water quality and (2) environmentalists for adequate instream flows. It is now clear that this system does not provide enough benefits to the environment and water users to be stable, despite this coincidence of interests. However, other configurations (e.g., an improved through-Delta facility) might increase the level of benefits while retaining the coincidence of interest of the current system.

[2] For example, a chain of lakes alternative where the chain is routed through the western Delta could result in a partial alignment of interests. If conveyance capacity from the Sacramento to the chain is limited, then exporters would have an incentive to supplement with diversions into the islands or at the existing facilities. If the islands are in the western Delta, then exporters would prefer diversions to the islands during high flow conditions to protect water quality. This operational preference would reinforce environmental preferences.

■ *Alignment of interests: management.* Water agencies have extraordinary flexibility in the management of water. They can get water rights at no direct cost, buy water, sell water, store water, control demand, impose shortages on customers, build conveyance, alter the timing of deliveries -- all funded by the economic value of water. This flexibility in management allows for enormous increases in efficiency for the system.

By contrast, the environment has historically had little direct influence on the management of environmental water. Rather, environmental protection has been generated via regulatory constraints on the operations of the various water projects. Regulatory approaches have some advantages. They can, in theory, be implemented without compensating those whose water supplies might be limited by the regulations. Moreover, they are enforceable in court. However, regulatory approaches to environmental protection are also cumbersome and inefficient. Long, expensive, contentious, and frequently unsuccessful, processes are necessary every time standards are to be changed. Then the standards need to be implemented through another difficult process. Once the new standards have been implemented, water users attempt to extract all supplies above the standards. Thus, "minimum" standards have a way of becoming "maximum" standards. If new science or particular biological needs emerge, they are not easily accommodated without going through the whole process again.[3]

Thus, under current institutional arrangements, it is difficult to expect environmental organizations to buy into the concept of efficient, optimized system management. "Efficiency" and "optimization" are simply seen as code for increased extraction of water from the environment and continued downward drift in environmental quality. Rather, because regulatory standards are, from the perspective environmental organizations, both free (i.e., no need to pay for improvements in standards) and risky (difficult to change, not well tuned to system needs), environmental organizations have strong incentives to seek standards which provide large margins of safety without regard to the cost of the standards or water management efficiency.

I conclude that a mismatch between environmental management and user management must inevitably lead to (1) inefficiency (due to crude approaches to environmental management) and (2) conflict (due to minimal incentives for environmental groups to support efficient water management). If institutional changes are not made, this mismatch will continue. Inefficient environmental management will both limit the amount of benefits which the CALFED Program can generate and will undermine the incentive of environmental groups to support the ultimate outcome.

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[3] As an analog, consider a centralized water distribution system in which water users received a percentage of annual runoff each year, with no possibility of water transfers or storage, with a rigid delivery schedule (so much per month) and no allowance for increased demand. Then consider that changes in these distribution rules could only be accomplished through long and difficult regulatory proceedings. Such a system would be highly inefficient. It would, however, approximate the system under which water is allocated to the environment.

One solution would be to align the management interests of water agencies and environmental groups by granting the management prerogatives now enjoyed by water agencies to the environment. Institutional structures which:

- o Provide a reliable revenue stream for environmental water management;
- o Allow an environmental agency to hold water rights; buy, sell, store, move, and develop environmental water; to buy and sell export capacity;
- o Restore habitat (analogous to demand management);

and otherwise play the role of water agency for the environment, might generate greater environmental benefits at lower costs than more regulatory approaches and might make the solution more stable by aligning the stakeholders around efficient management.[4]

■ *Robust solutions.* Solutions which patently allow water users to make relatively painless adjustments to future stresses -- water shortages, changing demand patterns, changing supply patterns (e.g., changed precipitation due to climate change), rising sea levels, new species introductions -- will tend to be stable. Thus, solutions will be more robust if they:

- o Provide the physical and institutional foundation for an active water market.
- o Increase the infrastructure for moving and storing water.
- o Have widely separated multiple intakes (to reduce the impacts of a possible zebra mussel invasion).

Alternatives which force California to choose between protection of the environment and protection of its economy during periods of shortages may not be stable. Also, physically robust solutions may create physical stability at the cost of creating institutional instability (e.g., a large isolated system may be a more robust solution than a small one because it allows greater management flexibility, but it creates institutional instability by increasing concerns over misoperation).

■ *Phasable implementation.* As implementation proceeds, the level of benefits received by each stakeholder group should be roughly commensurate at any time. Otherwise, an unstable situation could develop due to reduced incentives for some stakeholders to support continued implementation. In general, this argues for solutions which can be implemented incrementally or at least simultaneously. However, given strong institutional assurances, elements which are not easily phased might be possible.

■ *Adaptive implementation.* This is related to phasing. The response of the environment to significant changes in Delta configuration and operations is uncertain. If the environment does not respond as well as expected to an alternative, environmental interests might seek a rebalancing of benefits and the solution could become unstable. The likelihood of this

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[4] A shift toward more flexible environmental management has already begun. The Ops Group has the authority to shift export pumping schedules and Delta Cross Channel closures to enhance environmental protection. Water can now be purchased for environmental purposes. Still, environmental management is still fundamentally regulatory in nature.

scenario is decreased if the solution can be implemented adaptively. An adaptive solution does not lock in the final form of the solution. Rather, it specifies an initial set of steps, a process for moving forward, and the ultimate goals of the process. Thus, for example, the solution could specify:

- A number of significant pilot habitat restoration projects for immediate implementation and study.
- An institutional structure for implementing the adaptive solution.
- A funding mechanism for the habitat improvements. (see *financial guarantees*).
- The ultimate environmental goals to be pursued by the new institution.

Thus, based upon the results of the pilot programs, the restoration would fund another generation of restoration projects and so on.

Similarly, the final mode of Delta transfer could remain flexible to account for the possibility that the first attempt at a new transfer system causes unexpected biological damage.[5]

■ *Regulatory guarantees.* It might be possible to develop legal assurances that, in return for funding a major habitat restoration program, water exporters would be indemnified against water losses arising from the state or federal ESAs. Instead, the state or federal governments, or the environment itself would bear future risks to aquatic based species in the Delta. This kind of regulatory guarantee could make the solution more stable by making it more likely that during times of stress in the future the distribution of benefits generated by the solution would not be upset. Regulatory guarantees might be thought of as playing the same role for water exporters that operational guarantees do for environmental interests. As in that case, it is debatable whether a guarantee alone provides stability if the alternative is not otherwise stable. A more realistic approach might be to require that a percentage of restoration funding must be dedicated to protecting water users against supply losses due to the ESA should the need ever arise. This approach would place the initial burden on the environment for taking care of the problem without fully releasing users from responsibility.

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[5] The desirability of implementing a Delta transfer system adaptively is less clear than in the case of environmental restoration. Adaptive implementation is used to reduce the uncertainty of physical and biological outcomes. But the use of adaptive implementation creates new uncertainties -- primarily the effectiveness, survival and funding of the implementing institution. Therefore, adaptive management is most attractive when used in areas of high uncertainty. The physical and biological implications of delta transfer methods are much better understood than habitat/ population interactions. Therefore, the gain in potential certainty is smaller and the increase in uncertainty to water supplies and the success of the entire program is larger than in the case of environmental adaptive implementation.