DRAFT
For Discussion Only
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DESCRIPTION OF THE ADDITIONAL MEASURES THAT WILL ACHIEVE REASONABLE CONTINUED PROGRESS TOWARD RECOVERY OF FISH RESOURCES

OVERALL THEME: Although there is currently insufficient knowledge to write the detailed master plan for recovery of Bay-Delta endangered species and ecological health, the steps towards these goals can be defined. Recovery of listed species and rehabilitation of Bay-Delta system ecological function will require a wide variety of actions over an extended period of time. These actions must be implemented under a rigorous scientific protocol that reduces scientific uncertainty while concurrently attempting to increase populations and enhance ecological health.

1. More Effectively Manage Introduced Species

- Problem:
  - Analysis of data clearly shows that exotic species invasions to the Bay-Delta system have been increasing and will likely increase in the future without appropriate action.
  - A select academic science team considered the problem of invasive species to be of paramount importance. **"In the last three decades, introduced species have had a greater impact on the species composition and function of this region than any other single human activity."** ***CALFED Strategic Plan for the Ecosystem Restoration Program, Strategic Plan Core Team, 1998.***
  - The efforts of CALFED's Non-Native Invasive Species Team are in their early stages of development; a draft strategic plan and an implementation plan are in preparation. The plans do not yet show a high sense of urgency to deal with the problem. Allocated funding has been insufficient to respond adequately to the problem.
  - Evidence demonstrates that exotic species have substantially modified the ecological functioning of the Bay-Delta system. The extent to which such changes have altered the basis for regulating the Bay-Delta system is speculative. Non-native species have clearly altered the functioning of the system to some degree, but this information has not yet been incorporated into the management and regulatory framework.

- Recommendations:

- Promptly develop and implement a robust, thorough set of actions to
  - understand the nature and extent of the non-native species introductions,
  - minimize future introductions,
  - manage existing invaders to the extent possible,
  - determine how exotic species have changed ecological relationships in the Bay-Delta system and,
  - incorporate this information into how the system is managed.
- Boost the level of urgency and funding to respond to the exotic species invasion.

1. Implement an Environmental Water Account (EWA)

- Problem:
  - There is widespread agreement in the scientific community that alterations to the Bay-Delta system hydrology over the last 150 years have contributed to the decline of ecological health of the system and the listing of endangered species.
  - There is generally not agreement over the nature and magnitude of actions needed to correct the adverse effects of historical flow related changes to the system. The justification of additional environmental flows has generally not been developed with sufficient scientific rigor. An experimental approach to develop the needed scientific data and management plans is essential.
  - The dedication and acquisition of additional environmental water will be controversial, expensive and difficult. The water community has previously dedicated about 1.3 million acre-feet (MAF) to this purpose, which may increase to 1.6 MAF.
  - To function effectively, an EWA needs access to real-time monitoring (RTM) data. The IEP RTM program is changing. The ability of the program to provide data needed to mange the EWA effectively is unclear.
- Recommendations:

- Develop the Environmental Water Account to manage a block of water to be allocated for environmental flow purposes in the Bay Delta system. An important function of the account should be to support the necessary experimentation to identify the right combination of factors to maximize ecosystem benefits in ways compatible with other uses of water.

- Conduct any alteration of flows under a rigorous scientific protocol to reduce uncertainty. Develop the scientific justification for flow increases through scientifically well-designed experimental manipulations of flow.

    - On-going independent scientific review is an essential component of rigorous science. It must be comprehensive and sustained for at least the first several years of the program, not just a cursory annual review

    - Water allocations need to be large enough to cover agreed upon experimental manipulations and to contribute to continuous improvement.

    - Experiments are needed to quantitatively define the relationship between flow and ecological benefits. This forms the basis for identifying associated acquisition, easements, mitigation and assurances.

    - Experiments are needed to identify the frequency and magnitude of flows associated with more natural floodplain inundation, channel migration and in-stream flows and to demonstrate the associated benefits.

    - Need to determine the extent to which entrainment effects population size and reduce diversion effects of pumps.

- Assure that a comprehensive real-time monitoring program will provide the essential information to guide adaptive management decisions.

1. Implement Habitat Restoration

- Problem:

    - The scientific justification for additional habitat restoration is building, but is far from complete. For example, widespread scientific support is developing for habitat improvements to the Yolo By-Pass (seasonally inundated habitat), but scientific uncertainty remains high about the advantages of habitat restoration in the Delta due to non-native fish predators potentially favoring permanently inundated habitat.

    - The process of awarding CALFED funds for restoration projects is changing. Stakeholder involvement in the project selection process is decreasing.

- Recommendations:

- Develop a solid research and monitoring program and link it tightly to well-designed pilot studies. This is essential to resolve controversies about habitat restoration plans and reduce scientific uncertainty.

- Incorporate habitat into the redesigned flood control infrastructure. Redesign and expansion of the flood management system provides a unique opportunity to create important habitat. Incorporate habitat into existing bypasses and design into new or expanded bypasses and managed flood basins.

- Implement large-scale pilot projects with intensive monitoring to determine design, location and benefits of shallow water and tidal habitat restoration

- Develop an assurances package for landowners and water users to mitigate all adverse effects from habitat restoration.

    - CALFED should coordinate all environmental acquisitions
    - All acquisitions will be voluntary
    - Partnerships between acquisition and management entities and local interests be required
    - Adjacent landowners will not be subjected to unmitigated increased liabilities

- Develop a process for awarding restoration project funds that involves all stakeholders.

1. **Strengthen science-based management of the Bay-Delta**

    - Problem:

        - The effectiveness of the Bay-Delta science process in producing information to support management decisions needs to be increased to achieve reasonable continued progress toward recovery of fish.

        - Management institutions need to systematically learn from their actions and embrace the scientific uncertainty associated with the ecological problems of the Bay-Delta system.

        - Need broad-based support, funding, organization and governance of science to manage the Bay-Delta system adaptively.

            - Scientific uncertainty is higher than most managers acknowledge and can be reduced only through the conduct of science under rigorous protocols that have not been generally put into place.

            - Monitoring is not effectively integrated with management.

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- The research program is not uniformly driven by hypotheses.

- Independent scientists are generally not invited to review Bay-Delta science that underpins management actions.

- Quantitative measures of success for ecosystem actions have generally not been developed.

- Recommendations:

  - Develop an on-going, independent scientific review process to address the scientific uncertainties associated with the Bay-Delta system. It should include the following elements:

    - Identify and compare factors affecting Bay-Delta fish populations
    - Recommend measures most likely to improve fish abundance
    - Ensure that data collection and analysis protocols are adequate to test unproven hypotheses underlying recommended measures
    - Review results of data collection and analysis, and
    - Recommend changes in measures as needed based on results
    - Must involve independent experts, comprehensive and multi-year in scope

    - On September 23, 1999, the National Research Council of the National Academy of Sciences announced formation of a 16-member Committee on Restoration of the Greater Everglades Ecosystem to "... ensure that the best possible science leads the way in our efforts to restore the Everglades." Earlier this year the Task Force endorsed establishment of an on-going outside scientific review panel to ensure effective adaptive management for South Florida ecosystem restoration. ***Is this concept appropriate for the Bay-Delta?***

  - Give high priority to experimental testing with appropriately designed supporting research and monitoring of environmental management actions.

  - Acknowledge and incorporate scientific uncertainty and changing conditions. The Bay-Delta system is complex and changing continually due to non-native invasive species. Yesterday's management techniques can't be expected to work today; the system and the ecological relationships are changing too rapidly.

  - Develop and demonstrate the ability of the existing science infrastructure in the Bay-Delta to contribute to managing adaptively.

  - Develop a robust multi-level set of indicators to measure success of the program.

1. Address the Critical Research, Planning and Management Issues

- Problem: Several areas of vital management importance are not receiving adequate funding and attention.

- Recommendations:
  - Contaminants – Resolve the importance of toxicity to the abundance of fish and invertebrates. Develop appropriate management tools to reduce toxicity to fish and food organisms.
  - Management standards – Determine the underlying mechanisms of the X2 relationships and other management standards, by validating and refining conceptual models.
  - Decline in productivity – Identify creative solutions to increase primary productivity
  - Importance of the Delta for Salmon – Determine the extent to which fry rear in the Delta and the degree to which they contribute to the adult populations.