**Attachment**

## Program Component Update
## Ecosystem Restoration

### Background

The primary program objective for ecosystem quality is *"to improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta system to support sustainable populations of diverse and valuable plant and animal species."*

An early, three-volume version of the Ecosystem Restoration Program Plan (ERPP) was released for public review during Summer 1997. Volume I described important ecosystem elements (ecological processes, habitats, species, and stressors) (Attachment A). Volume II provided our visions for integrating restoration actions within 14 ecological zones, and Volume III presented our first attempt to initiate dialog on adaptive management, indicators, monitoring, and focused research. Subsequently, Volumes I and II of the ERPP were revised based on many of the comments received and were again released in March 1998 as technical appendices to the Programmatic EIS/EIR.

Volume III was not revised nor released with the EIS/EIR in order to accommodate recommendations provided by the Facilitated Scientific Review Panel (October 1997). The panel's primary recommendations directed CALFED to simplify and focus the presentation of the program and its goals on the basis of conceptual models, embed scientific expertise in the adaptive management process, and pointed out that the program lacked overarching principles and goals.

### On-going Tasks

1. Develop a Strategic Plan for Ecosystem Restoration
2. Coordinate and integrate ERPP with Conservation Strategy and Restoration Coordination
3. Revise ERPP based on public comments
4. Develop Ecosystem Indicators

1. Develop a Strategic Plan. In response to stakeholder and Scientific Review Panel concerns and recommendations, CALFED commissioned a groups of scientists to develop a Strategic Plan for Ecosystem Restoration (Table 1). These scientists are working under contract and will provide a draft of their effort in late August 1998. Specific work products are listed below. The initial team meeting was conducted May 20-22, 1998 and a second meeting was held July 7-8, 1998.





E-003261

Table 1: List of Strategic Plan Core Team Members

| Team Member | Expertise | Employer/University |
|---|---|---|
| Steve Chainey | Project Manager | Jones & Stokes Associates, Inc. |
| Michael Healey | Adaptive Management, Salmonid Fishes | University of British Columbia |
| Matt Kondolf | Fluvial Geomorphology | University of California, Berkeley |
| Rod Meade | ESA Compliance and Planning, HCP/NCCP Preparation | R.J. Meade Consulting |
| Peter Moyle | Native Fishes | University of California, Davis |
| Bob Twiss | Environmental Planning, Geographic Information Systems | University of California, Berkeley |
| Wim Kimmerer | Estuarine Modeling | San Francisco State University, Romberg Tiburon Center |

Additional resources available to the Strategic Plan Core Team include assistance from CALFED staff, suggestions from the Ecosystem Restoration Work Group, Friends of the ERPP, and input from the Indicators Work Group and CMARP team (Attachment B).

Strategic Plan Elements

- Introduction
  - Problem statement
  - Purpose and overview
  - Integration with other common programs
  - Definition of terms

- Goals and Objectives for Ecosystem Restoration (Attachment C)

- Bay-Delta Ecosystems: Descriptions, History, and Conceptual Models
  - Ecosystem classification
  - Attributes
  - Historical conditions and human interventions
  - Current status and trends
  - Hypotheses and conceptual models
  - Analytical tools

- Adaptive Management Strategy
  - Description
  - Components
  - Ecosystem Science Program/Scientific Review

- Implementation
  - Priority setting
  - Conflicts and constraints
  - Implementation strategies and conflict resolution
  - Implementation plan

The adaptive management component of the Strategic Plan will likely be comprised of many integrated components which are dependent upon each other. These components include monitoring, focused research, foundational research, conceptual models, and indicators (Attachment D). Failure to implement one component may jeopardize the other components.

2. Coordinate and Integrate ERPP with Conservation Strategy and Restoration Coordination
Consistent with the Strategic Plan, the ERPP is developing improved descriptions of its close linkages to other CALFED common programs. Water quality and watershed management have been embedded in the ERPP since its conception and the ERPP stresses the need to develop and implement watershed management programs and to control contaminant input to the system for the benefit of a wide variety of aquatic and terrestrial organisms. The ERPP also is strengthening its ties with the levee program by developing an integrated approach to levee rehabilitation and creation of shallow water, riparian, and shaded riverine aquatic habitats.

In addition, the ERPP has very strong connections with the early implementation program (Restoration Coordination) and with the development of the Conservation Strategy (Attachment E). For all three programs, the Strategic Plan functions as the hub that brings them together. The Strategic Plan is designed to provide a vehicle for the seamless transition of the near-term restoration program into the long-term program. From the outset, endangered species compliance is a keystone of the Strategic Plan which links the near-term and long-term restoration programs and the development and refinement of the conservation strategy.

3. Revising the ERPP. Volumes I and II of the ERPP are being revised based on six sets of suggested changes.

- Public comment letters
- Suggestions from the Agency Revision Team (ART)
- Suggestions from the Conservation Strategy team
- Suggestions from the Facilitated Scientific Review Panel
- Suggestions from the Indicators Workgroup, and
- Suggestions from the Strategic Plan Core Team.

ERPP staff expect to complete a draft revision of Volumes I and II by the end of August 1998.

Public and agency comments are being incorporated into the revised draft as appropriate. Initial work on the Conservation Strategy has identified additional species which should be directly addressed in the revised ERPP. For example, we are developing descriptions of additional species, such as California freshwater shrimp, that will be included in Volume I and restoration/protection actions that will be included in Volume II.

Comments from the Facilitated Scientific Review Panel are being addressed by the efforts of the Strategic Plan Core Team, Indicators Workgroup, and Comprehensive Monitoring, Assessment and Research Program (CMARP). Cumulatively, these efforts will be integrated and presented as a significantly revised version of our original Volume III which will be titled "Strategic Plan for Ecosystem Restoration."

4. Develop Ecosystem Indicators. Development of ecosystem indicators is more complex than originally envisioned. The Indicators Work Group has accomplished much but more work is needed to complete the task. In developing indicators, the Group first had to redefine the ecosystem descriptions (typology) and then describe the ecological attributes of each. Presently, the typology includes 5 ecological zones: the mountain-river-riparian system, the alluvial river-floodplain system, the Delta system, the Greater San Francisco Bay system and the near shore ocean system. Except for the near shore ocean, the Group developed ecological attributes for each system that included the following categories: general hydrologic attributes, general geomorphic attributes, habitat attributes, native biological community attributes, and community energetics/nutrient cycling attributes.

The next step for the Group was to develop conceptual models for each of the four systems. The development and refinement of conceptual models at the ecosystem, habitat, process, and species level is occurring as part of many ongoing actions. The Indicators Work Group has developed draft landscape and ecosystem conceptual models, the Strategic Plan Core Team is developing a landscape model, the Interagency Ecological Group is developing conceptual models through its project work teams (e.g., Salmon Project Work Team is developing a conceptual model of chinook salmon life history), and CMARP will develop finer scale conceptual models of species, habitats, and ecological processes.

The development of these useful models is considered a work-in-progress. Each model will be subject to much change and refinement through time as more scientists review them and as additional information is developed through monitoring and research. These models will function as tools to display our understanding of the system but will never be fixed or considered complete.

Although the conceptual models are not refined, they provide a basis for the development of one type of indicator: landscape indicators. The Group has nearly completed listing these landscape (ecosystem level) indicators. It has become apparent that there are various types of indicators all of which have a high degree of importance to the CALFED Program. Three

potential types of indicators include the landscape indicators, management indicators, and success indicators (Attachments F-I).

**Issues/Concerns**

Two major issues and concerns regarding the refinement of the ERPP include the extent of agricultural land identified for habitat restoration/rehabilitation and flow recommendations.

Habitat restoration/rehabilitation acreages.

Issue. Delta stakeholders and agricultural interests in general have expressed concern regarding the potential magnitude of habitat restoration proposed in the ERPP.

Discussion. Given the role of the ERPP as a public disclosure document, we are comfortable that we have presented the best prediction possible of the extent to which the Program may need to provide habitat in the Delta for a variety of plant, fish, and wildlife species. This habitat is needed to meet the CALFED mission of developing a long-term comprehensive plan which will restore ecological health and improve water management for beneficial uses of the Bay-Delta system and to meet the ERPP objective of improving and increasing aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta system to support sustainable populations of diverse and valuable plant and animal species.

Present and future development of habitats in and upstream of the Delta will occur in a 30-year span during which we will implement the appropriate monitoring and research programs to test our hypotheses regarding the role of habitat and ecological health of plant and animal species. This information will be an integral component of the adaptive management program by which we plan to adjust our targets and expectations accordingly regarding habitats throughout the Delta watershed. The intent of the ERPP is to improve ecological health, particularly for species dependent on the Delta, and not to create habitat just for the sake of creating habitat. There is a fair amount of scientific uncertainty regarding the role and effectiveness of restoring habitat in a highly invaded system such as the Delta. However, we cannot answer those questions or appropriately judge the ecological benefits of restoring habitat until we actually implement programs and monitor the results.

Resolution. To resolve issues regarding Delta habitats, our intent is to rely heavily on the development of a geographic information system (GIS) and local workshops to identify restoration areas, sequencing of potential actions, and identify genuine constraints to habitat development. We do not have the wherewithal to fully address this issue prior to the release of the draft final EIS/EIR and are deferring refinement of Delta acreages until such time that we can develop the GIS databases needed to accurately display potential scenarios for habitat development in the Delta.

Flow Recommendations.

Issue. Urban, agricultural, and environmental stakeholders have expressed concern regarding the scientific validity of the flow recommendations presented in the ERPP.

Discussion. Like many elements of the ERPP, agreement for a science-based process to determine the ecological needs for water in the system may have more value in the long-term than an a priori agreement on flows. We don't believe that we can conduct the necessary workshops and modeling studies in time for inclusion in the revised draft EIS/EIR.

As background, hydrologic characteristics of the ecosystem determine the amount, depth, and speed of water flowing at any place in the ecosystem at any season, and therefore the hydrodynamic environment in which aquatic organisms live and biogeochemical cycles operate. These characteristics also determine the depth and duration of inundation of floodplains and other off-channel habitat. Thus, the most important hydrologic characteristics that directly influence the physical aquatic environment are the amount and timing of flows released into the delta and the disposition of these flows through the complex network of delta channels.

In the longer term, the methods for determining the hydrologic characteristics that serve ecological functions involve a combination of: models of streamflow modulated by reservoir storage management; hydrodynamic modeling of flow in channels, floodplains, and estuaries; and stochastic modeling of unpredictable extreme events. The techniques, developed mainly by various federal agencies (Corps of Engineers, Bureau of Reclamation, and U.S. Geological Survey), are reliable and adequate for these purpose, although they will probably require an intensive computing effort; some augmentation of the network for gauging discharges (or at least water levels); and conflation of all discharge records from the U.S. Geological Survey and other agencies. In particular, the deterministic hydrodynamic models will have to be verified in the field through the use of chemical tracers, and flow sensors.

A second set of hydrologic characteristics that influence ecosystem functions involve the transfer of solutes and solid materials by water. Flow sources and volumes influence the origin, recruitment, and chemical processing of soluble nutrients and of sediment with adsorbed nutrients. There are fewer studies and routine monitoring of these transfer processes, especially of sediments. Therefore, although the techniques for determining which hydrologic processes are important are fairly well understood, there is almost certainly a lack of empirical field evidence for constraining such calculations.

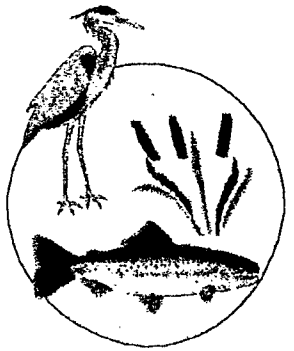
The problem of data availability and methods of prediction will become particularly strong as CALFED addresses the role of water in creating and maintaining habitat through the erosion, selective transport, and deposition of sediments of various sizes from gravel to silt-clay. There appears to be much uncertainty about the role of hydrology in remolding the morphology of channels and their riparian zones, with only the most traditional of geomorphic concepts about river channel form and behavior being applied. The flow evaluation effort should reflect morphologically important processes in the leveed channels and tidal channels of the delta, in

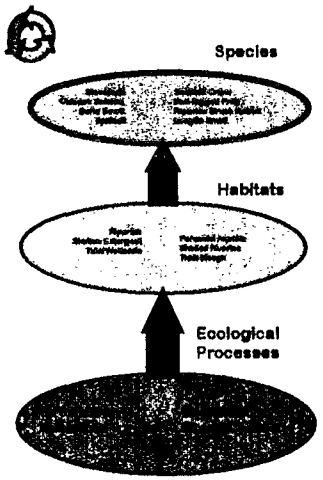
rapidly migrating point-bar-dominated channels further upstream, at tributary junctions at the base of the uplands, and in channels along which levees will be breached..

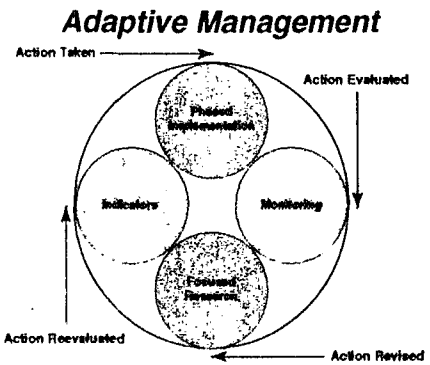
Although hydrologic techniques are available for making the model-based predictions necessary for ecosystem rehabilitation, it cannot be over-emphasized that CALFED needs to take advantage of and augment monitoring efforts, including existing gauging networks, new methods for monitoring such processes as channel migration and morphological change, and the new generation of remote sensing techniques using satellites and airplanes. The large size of the Bay-Delta ecosystem requires that advantage be taken of modern, spatially extensive monitoring techniques that have been used to study functions and change in wetlands and large floodplains elsewhere.

Resolution. The ecological value of stream flow is an extremely important component of the ERPP. In view of our present understanding of how the system operates and our initial design of an adaptive management program, it seems premature to lock-in any set of flow requirements at the onset of the program. Flow needs, for an environmental restoration program of the scope proposed by CALFED, must be strongly based on science and an be integral component of the proposed adaptive management program. In many respects, existing flow agreements and biological opinions form the base of ERPP flows. Additional ERPP flows may result from additional upstream storage and the acquisition of water from willing sellers.

# Organization of the ERPP






**Volume I:** Describes the need to restore ecological health to the Bay-Delta watershed

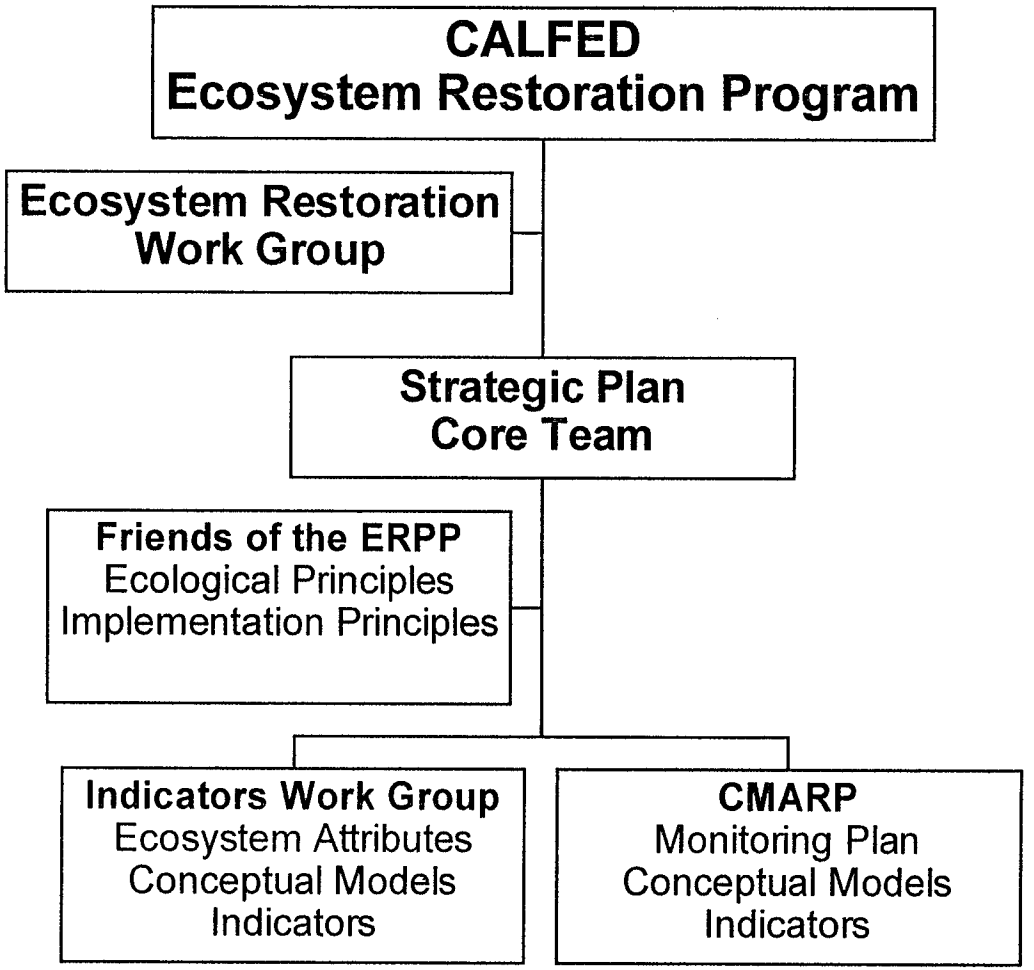
**Volume II:** Integrates restoration actions within manageable geographic units to provide ecological health

**Volume III:** Provides a Strategic Plan for ecosystem restoration based on adaptive management

Attachment A

CALFED BAY-DELTA PROGRAM

# Advisory Relationships






Attachment B

E-003269

Attachment C

# Draft
# Proposed Ecosystem Restoration Goals
## July 8, 1998

1. Achieve large, self-sustaining populations of at-risk native species dependent on the Delta and Suisun Bay, support similar recovery of at-risk native species in San Francisco Bay and the watershed above the estuary, and minimize the need for future endangered species listings by reversing downward population trends of non-listed native species.

Alternate wording:

*Achieve recovery of listed native species dependent on the Delta and Suisun Bay, support recovery of listed native species in the Bay-Delta estuary and its watershed, and avoid the need for future endangered species listings.*

2. Rehabilitate the capacity of the Bay-Delta estuary and its watershed to support, with minimal ongoing human intervention, natural aquatic and associated terrestrial biotic communities, in ways that favor native members of those communities.

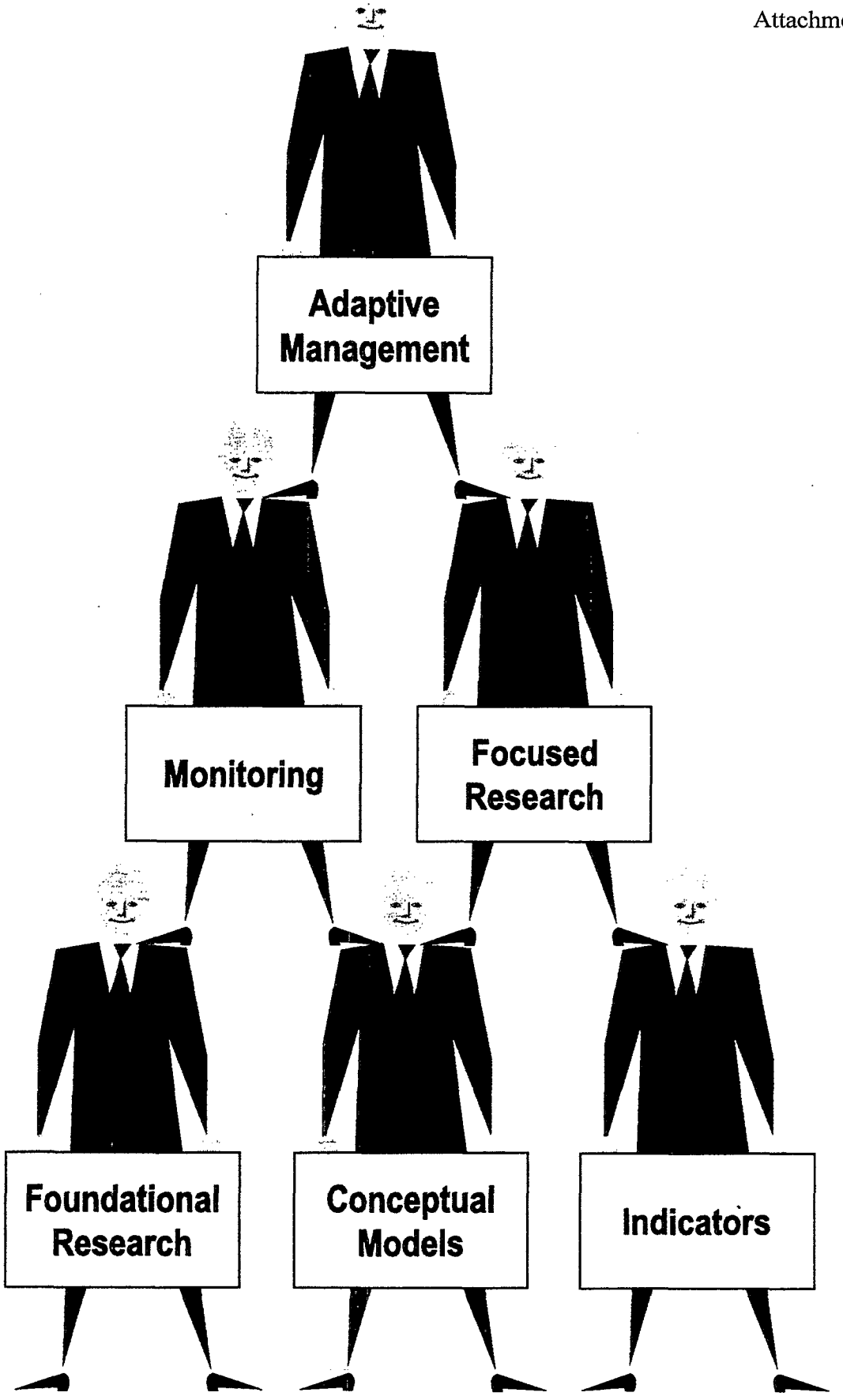
3. Maintain and enhance populations of selected species for sustainable commercial and recreational harvest, consistent with goals 1 and 2.

4. Protect or restore functional habitat types throughout the watershed for public values such as recreation, scientific research, and aesthetics.

5. Prevent establishment of additional non-native species and reduce the negative biological and economic impacts of established non-native species.

6. Improve and maintain water and sediment quality to eliminate, to the extent possible, toxic impacts [alternate wording: *to minimize the risk of negative effects of toxic substances*] on organisms in the system, including humans.

Attachment D

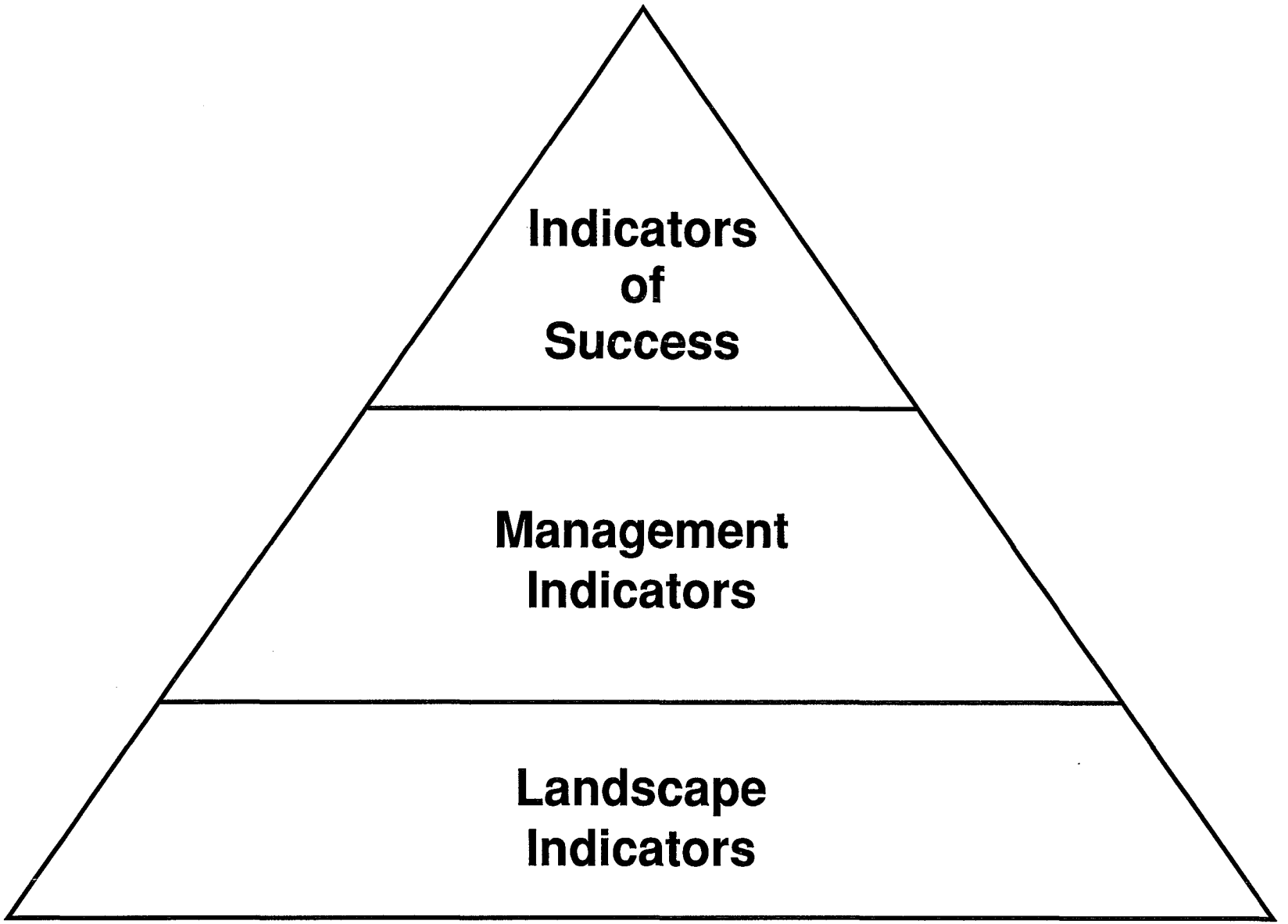


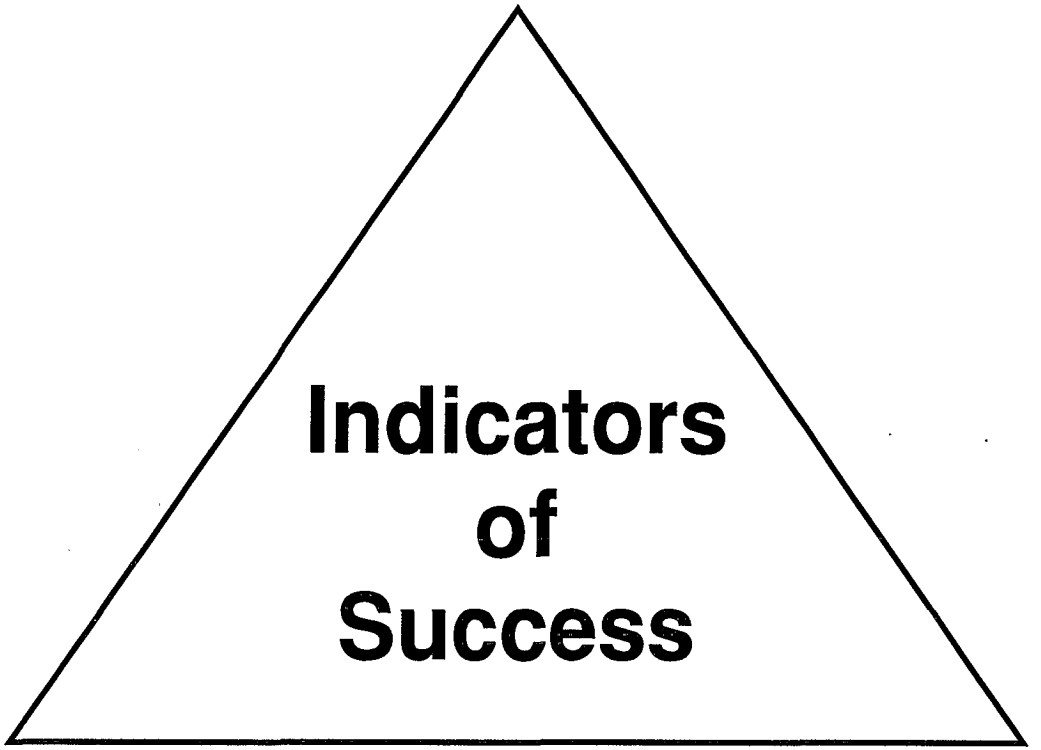



E-003271


ERP
•long-term restoration plan for the Bay-Delta
•BDAC ERWG
Implementation priorities, restoration strategies, funding
Restoration Coordination
•near-term implementation of the ERP
•Ecosystem Roundtable
Strategic Plan for Ecosystem Restoration
•restoration goals, quantifiable objectives
•adaptive management
•implementation strategy
Long-term species and habitat actions, priorities, indicators, monitoring, legal compliance
Near-term species and habitat priorities
Conservation Strategy
•ensure CALFED ESA/CESA compliance
•refine ERPP species actions
•additional actions to conserve species and habitat
•project mitigation

# Indicators of Ecosystem Health






1. Index of flow objectives
2. Miles or acres added
3. Time table for delisting or recovery
4. ± Exotic species

CALFED
BAY-DELTA
PROGRAM

Attachment G

# Management Indicators

1. Minimum flows
2. Extent of floodplain habitat
3. Degree of listed species recovery
4. Index of invasive exotic organisms

CALFED BAY-DELTA PROGRAM

# Landscape Indicators

1. Landscape/Watershed Hydrograph
2. Ecosystem Connectivity
3. Listed/Rare Species Index or Ratio
4. Rate of Invasion of Exotic species

CALFED BAY-DELTA PROGRAM

Attachment I