CALFED BAY-DELTA PROGRAM
DRAFT PROCESS AND PRIORITIES FOR SELECTING ECOSYSTEM RESTORATION ACTIONS

Introduction

The CALFED Preferred Program Alternative is composed of hundreds of individual actions that will be implemented and refined in stages, over time. The challenge in implementing the Program in stages is to allow actions that are ready to be taken immediately to go forward, while assuring that everyone has a stake in the successful completion of each stage. Linkages and assurance mechanisms will facilitate successful implementation.

The eight CALFED program elements include Ecosystem Restoration, Watershed Management, Levee System Integrity, Water Quality, Water Transfers, Water Use Efficiency, Storage, and Conveyance. If fully and successfully implemented, they are intended to achieve the broad, balanced objectives of the Program. Program elements would be implemented as a series of discrete, but inter-related actions. The cornerstone of CALFED's implementation strategy is to identify and set priorities for those actions in a fair, open process involving agency, stakeholder, and public participants. Each of the eight Program elements includes broad and intensive outreach and coordination with interested agencies, stakeholders, and the public through technical advisory groups, Bay-Delta Advisory Council (BDAC), public workshops, and other forums. During Program implementation this outreach and coordination will need to continue to assure that actions selected for implementation are broadly supported and are likely to be the most cost effective at each stage of the Program.

Substantial effort has gone into describing Stage 1 of Program implementation which is expected to comprise the first seven years. Actions which are taken in Stage 1A include those which are already underway or need to be initiated immediately after the Record of Decision and Certification of the Programmatic EIS/EIR are completed. This additional effort is needed to support advance planning, including budgeting and agency staffing to allow these actions to proceed without delay after the ROD and Certification. These actions have been grouped into bundles in order to assure that they provide appropriate geographic and programmatic balance. Based on stakeholder and CALFED agency input, various bundling linkages will be applied as needed to assure that balance is maintained as implementation proceeds. Actions may be bundled for permitting or environmental review purposes as well. The bundled Stage 1A actions are those which will be considered for funding in fiscal years 2000 and 2001 (see Attachment A).

CALFED's state and federal appropriations for implementing actions during Fiscal Years 2000 and 2001 will be limited. Therefore, a credible and transparent process is needed to select eligible projects for the limited funding. This process will build on or enhance the process used previously to solicit, evaluate, and recommend project for funding. In addition, CALFED is responding to recommendations from scientists, stakeholders and the public that:

- Stakeholders, the public and local governments be involved in priority setting and project selection as early as possible in the process,
- Project selection and decision-making be conducted in a public forum to the extent possible,
- Project selection process be as "transparent" or understandable as possible, and
- Project selection should have a scientific foundation.

CALFED has also developed draft strategies which describes, over a broad scale, how the process will successfully integrate other CALFED common programs, the Multi Species Conservation Strategy, scientific review, link with completed and ongoing projects previously funded under this program, link with other agency programs, fully implement the adaptive management approach, and contribute to the CALFED Stage 1A implementation bundles.

Strategy for Setting Priorities

To achieve a reproducible and transparent selection process, CALFED is articulating individual strategies to facilitate the integration of the Ecosystem Restoration Program with the Program elements.

- Other CALFED common programs
  - -- Watershed management
  - -- Levee system integrity
  - -- Water transfers
  - -- Water quality
  - -- Water use efficiency
  - -- Storage and Conveyance
- Multi Species Conservation Strategy
- Scientific review
- Projects previously funded through earlier processes
- Other agency restoration programs
- Environmental Water Account
- CALFED Stage 1A implementation bundles
- Adaptive management
- Monitoring

Integration Strategies for Other CALFED Common Programs

During the long-term implementation period, the CALFED program elements will have varying levels of overlap and synergism which can provide significant ecological benefits. This is not the case during the early implementation phase. Some program elements can provide immediate benefits, while others will provide future benefits. The strategy for the earlier stages of implementation of the Ecosystem Restoration Program is to consider projects that provide substantial ecological benefits in addition to benefits to the individual programs.

Watershed Management Program -- Selecting and funding watershed management and restoration programs has been and will continue to be fully considered in the selection

process. The strategy is to consider funding projects that contribute to the restoration of habitat or water quality conditions required by listed species, such as chinook salmon and steelhead. Equally considered will be projects designed to resolve scientific uncertainty related to watershed, stream channel and other ecological processes.

Levee System Integrity Program -- Restoration of ecological processes and habitats in the Sacramento-San Joaquin Delta is a high priority. The strategy is to select projects that contribute to improving habitats for listed species and improve levee system integrity, or resolve scientific uncertainties related to habitat provided by aquatic and terrestrial vegetation along existing or improved levees.

Water Transfers Program -- Water transfers will be considered in the context of the management recommendations from the Environmental Water Account (EWA). The strategy is to evaluate the potential ecological benefits of water transfers through the EWA.

Water Quality -- Water quality is an extremely important element in the restoration of ecological health. The strategy is to consider funding remediation projects that reduce contaminant loadings affecting ecological resources or projects that will contribute better understanding of the role of contaminants in the health of fish and foodweb organisms. Projects that help resolve the ecological uncertainty of contaminants in the ecosystem will be high priority.

Water Use Efficiency -- During the early stages of implementation, water use efficiency may provide only minimal ecological benefits. The strategy is to not consider funding water use efficiency projects unless there is overwhelming evidence that the project could provide immediate and significant improvements in ecological health of the Bay-Delta system.

Storage -- Ecosystem Restoration Program staff will continue to work on water storage strategies which minimize ecosystem impacts and address ecosystem needs.

Conveyance -- Ecosystem Restoration Program projects will be considered in the context of a through-Delta conveyance alternative based on the existing channel configurations and hydrodynamic patterns with some modifications.

Multi Species Conservation Strategy

The selection of projects will consider the status of native species, particularly those species that have the greatest influence on the water project operations throughout the Central Valley. The strategy is to emphasize projects that can provide significant improvements in ecological processes that create and maintain habitats and the foodweb, restoration of habitats that are essential to listed aquatic species, such as delta smelt, splittail, chinook salmon and steelhead, and remediation or elimination of stressors that cause direct or indirect mortality of listed species or impair the quality of essential habitats. In addition, the strategy is to design habitat restoration projects in a manner that will universally contribute to the recovery of aquatic and terrestrial species and plants identified in the Multi Species Conservation Strategy.

Scientific Review

A key to establishing and maintaining a credible and effective ecosystem restoration program is to incorporate scientific reviews at process milestones. The strategy is to use scientific review and evaluation to evaluate the longer-term plan, select projects, develop monitoring plans and consider project information and data. The ERP provides the basis for the sequence of implementation and development of annual priorities. After draft priorities are established, projects proposed for funding will be reviewed by qualified scientists and technical experts. Outputs or deliverables from funded projects will be scientifically reviewed in the context of adaptive management.

Projects Previously Funded through Earlier Processes

CALFED has previously funded many ecosystem restoration projects in phases. Many of these projects are ongoing or nearing completion. The strategy is to fully review the results of the earlier phases of multi-part projects to assess their technical or scientific merits, determine if project implementation is consistent with annual priorities and implementation of the long-term plan, and provide next phase or development funding if appropriate.

Other Agency Restoration Programs

CALFED has maintained close coordination with other agency restoration programs, in particular the U.S. Fish and Wildlife Service's Anadromous Fish Restoration Program. The strategy is to cost share projects that meet the requirements of CALFED and to continue to coordinate the planning of future project implementation so that cost share funding is available in concurrent time frames.

Environmental Water Account -- Water Management Strategy

The Environmental Water Account (EWA) is the mechanism to acquire and manage water supplies to provide fish and environmental benefits above existing regulatory baselines. The strategy is to use the EWA as the "broker" to acquire additional environmental water. The EWA would set priorities for the expenditure of any funds set aside or available for water acquisition.

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CALFED Stage 1A Implementation Bundles

Stage 1A includes those restoration actions to be implemented in fiscal years 2000 and 2001 (see Attachment B for detailed descriptions). The preliminary CALFED actions have been grouped into ***bundles*** either to provide a balanced suite of actions for specific regions within the CALFED problem and solution areas, or to provide programmatic balance between actions which are not necessarily associated with any specific geographic area. The bundles highlight certain critical ongoing programs which will require implementation decisions in the near future, but do not include the many other ongoing monitoring and improvement programs in the Bay-Delta region. The strategy is to more heavily weigh and fund restoration projects identified in the Stage 1A implementation bundles, but to not exclude consideration and funding of projects not identified in the bundles. Because Ecosystem Restoration Program actions contained within the Stage 1A bundles exceed anticipated funding, it is expected that there will be a need to establish priorities within Stage 1A consistent with other CALFED program areas. (See Attachment C for Draft FY2000 Priorities.)

Adaptive Management

Adaptive management includes several crucial decision points. Decisions about which projects to implement and which to postpone, when to gather more information and when to proceed with large-scale restoration, when to terminate projects and when to change direction, and when to declare the success of failure of a particular restoration approach are difficult. The strategy is to emphasize those projects which lend themselves to adaptive management, have strong monitoring elements, and which will assist in resolving the ecological and scientific uncertainties present in the system.

Monitoring

Adaptive management and project evaluation both require monitoring. The strategy is to implement a comprehensive monitoring and review of previously funded restoration projects for the purpose of identifying the success or limitations of the action and to synthesize this information through the adaptive process in refining proposed restoration actions.

Demonstration Watersheds

Several watersheds are proposed as "demonstration watersheds." These areas were selected for an enhanced and accelerated program that will heavily invest early in ecosystem science, watershed support, project implementation and comprehensive monitoring. Information gained early in the program as a result of the emphasized efforts within demonstration watersheds will be transferrable to similar watershed and reduce much of the ecological uncertainty related to the overall long-term restoration program.

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Attachment A: General Descriptions of Stage 1A Bundles

Lower San Joaquin River and South Delta Region Bundle

This bundle is designed to address water management and fisheries concerns in the south Delta and lower San Joaquin River region, for local water uses as well as State and federal exporters. Specific issues to be addressed include fisheries, water quality, water supply reliability, recreation, flood control, and wildlife habitat. The preliminary actions are designed to advance feasibility and environmental evaluations and to implement corrective actions in the south Delta region as well as in upstream watersheds which affect the quality and quantity of flows in the San Joaquin River. It is also designed to address some of the scientific uncertainties related restoration of processes, habitats, and species in this geographic area.

Lower Sacramento River, Yolo Bypass, and North Delta Bundle

This bundle is designed to develop a balanced solution to concerns surrounding fishery and water quality impacts of diversions from the Sacramento River into the central Delta, to address regional flood concerns, and to substantially enhance riparian and wetlands habitat corridors in the region. Because of the concern over toxicity effects of mercury originating in the Cache Creek basin, this bundle includes substantial research to identify those sources and potential remediation tools.

Suisun Marsh and West Delta Bundle

This bundle is designed to address water quality, fisheries protection, and habitat enhancement actions for the west Delta region, including Suisun Marsh and the west Delta islands.

Delta-Wide ERP/Levees Bundle

This bundle is designed to achieve a reasonable balance between implementation of ecosystem improvement actions and levee system improvement actions. In addition this bundle includes actions to improve fisheries, water quality, and habitat throughout the Delta, including protection and enhancement of Delta in-channel islands.

Sacramento River, San Joaquin River, and Tributaries Bundle

This bundle includes ecosystem restoration primarily fisheries habitat, hatchery management, and floodplain and meander belt restoration along key river reaches.

Integrated Water Management Bundle

This bundle includes actions which can lead to improvements in water supply reliability and flexibility through improvements in water use efficiency, water transfers, water storage and conveyance facilities (groundwater and surface water), water quality, and water associated habitats. The proposed actions include the Program problem area and solution areas, including state and federal project service areas and upper watersheds. It includes key actions that comprise the Integrated Storage Investigation and implementation of the Environmental Water Account and also include actions directed at watershed management.

Attachment B: Ecosystem Restoration Program Actions in Stage 1A Bundles

Lower San Joaquin River and South Delta Region Bundle

The Ecosystem Restoration Program emphasis is on:

- creation and maintenance of a living river corridor that sustains natural ecological processes and supports sustainable habitats needed by aquatic and terrestrial species
- creation of fresh emergent wetland and riparian and riverine aquatic habitats in the Southern Delta
- evaluations to determine if habitat improvements provide sufficient ecological benefits to warrant the creation of additional fresh emergent wetland habitats, and
- evaluation of the cumulative impact of small unscreened diversions in the South Delta.

The CALFED Bay-Delta Program approach for the lower San Joaquin River and South Delta region is to implement integrated projects and programs that will either make a substantial contributions to the overall ecological health of the region or provide answers to critical ecological uncertainties, thus providing more precise direction for future actions.

Projected costs to implement the proposed ecosystem restoration projects in the South Delta Region bundle are $6.5 million in 2000 and $7.0 million in 2001. [1]

San Joaquin River Floodplain Corridor. The San Joaquin River and its tributaries once supplied the bulk of nutrients and sediments to the Delta. The San Joaquin River overflowed its channel and moved on to the vast floodplain of the San Joaquin Valley. Nutrients to support the Delta foodweb and sediment to build habitats were transported to the Delta. These ecological processes seldom occur now. Water development and flood management have substantially reduced natural overbank flooding along the San Joaquin River.

The approach for the San Joaquin floodplain corridor it to integrate ecosystem restoration actions with flood damage reduction by establishing or improving floodplain interactions along the San Joaquin River and its tributaries. Flow or flowage easements would be acquired and agricultural production would continue, but instead of building flood levees or storage facilities, land owners would be compensated for allowing their land to flood. In this manner, a surrogate for the natural floodplain process could be established.

CALFED will evaluate proposed projects based on their ability to:

- Contribute to the restoration of San Joaquin River floodplain
- Provide seasonally inundated habitat such as flood bypasses
- Acquire floodplain through conservation easements or direct purchase

[1] Source of cost estimate: CALFED Bay-Delta Program: Implementation Plan, Draft Programmatic EIS/EIR Technical Appendix, June 1999. Includes only cost estimates in which ecosystem restoration is the primary CALFED Program except for watershed management.

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- Link with previously conducted efforts or is a continuation of a successfully implemented project
- Provide an opportunity to develop and implement the project as an adaptive experiment including conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related to improving and increasing floodplain habitats in the system.

Creation and Evaluation of the Ecological Benefits of Fresh Emergent Wetland Habitat in the South Delta. Entrainment of native fish species at the State and Federal Delta pumping facilities is a significant problem that may be abated by a variety of actions including a consolidated point of diversion, new fish screens at the point of diversion, use of water through the Environmental Water Account to allow reduced diversions at critical stages to protect native fishes, and enlarged channel capacities to reduce flow velocities toward the Delta diversion facilities.

A significant ecological uncertainty is associated with the role and value of fresh emergent wetland habitat in the South Delta in providing forage, rearing and protective habitats and in reducing the probability that fish will be entrained. Emergent wetland habitat areas will be designed and created in the South Delta as an adaptive experiment using all available tools including conceptual models, hypothesis testing, and comprehensive monitoring.

CALFED will evaluate proposed projects based on their ability to:

- Create or maintain tidally influenced fresh emergent wetland habitats along major conveyance routes to the Delta pumping facilities
- Link with previously conducted efforts or is a continuation of a successfully implemented project
- Provide an opportunity to develop the project as an adaptive experiment including conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related to creating tidally influenced wetlands in the Delta.

Ecosystem Restoration Program Levee Setback Feasibility Study. A major component of the Ecosystem Restoration Program Plan is the creation of shallow, tidally influenced aquatic habitat in the Delta. The approach is to implement actions and studies that will resolve the ecological and technical uncertainties associated with levee setback actions to create tidally influenced shallow water habitats. Resolution in needed early in the program so that the long-term effort can be refined based on improved scientific information. Resolution will be achieved by geotechnical and engineering analyses to establish feasibility and estimated costs associated with levee realignments.

CALFED will evaluate proposed projects based on their ability to:

- create or maintain fresh emergent wetland and riparian and riverine aquatic habitats through levee setbacks or fill of deep water areas

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- Link with previously conducted efforts or is a continuation of a successfully implemented project
- Provide an opportunity to develop the project as an adaptive experiment including conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related to integrating levee and habitat improvements in the Delta.

Evaluate the Need to Screen Small Diversions on the South Delta. There are a large number of relatively small diversions diverting water from the South Delta. These smaller diversions have the potential to entrain juvenile fish, but there is relatively little data that can be used to identify where the biological benefits would be of the greatest benefit in a program to screen smaller diversions. Evaluations of alternative methods of preventing entrainment at larger diversions have not identified any effective solutions other than positive barrier fish screens. However, when evaluating screening at smaller diversions less that 25 cfs, there may be other techniques for preventing entrainment that could be cost effective in some situations.

Unlike the riverine environment where unscreened diversions may affect a large portion of fish populations, the benefits of screening small diversions in the South Delta is unknown. An evaluation should be undertaken to identify diversion effects on species and locations in the Delta and to identify locations where screening small diversions would be a high priority.

Two general topics are recommended for evaluation: synthesis of existing information on entrainment in the Delta at small diversions and evaluation of entrainment effects at actual diversions if willing landowners can be identified.

The approach is to determine the biological benefits of screening small diversions in a tidal environment and the technical feasibility of doing so. CALFED will evaluate proposed projects based on their ability to:

- Consolidate existing information regarding the loss of native fish in small unscreened diversions
- Consolidate existing information regarding methods or techniques to install and operate screens on small diversions in the South Delta
- Link with previously conducted efforts or is a continuation of a successfully implemented project
- Provide an opportunity to develop the project as an adaptive experiment including conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related to small unscreened diversions in the South Delta.

Lower Sacramento River, Yolo Bypass, and North Delta Bundle

The Ecosystem Restoration Program emphasis is on:

- creating and maintaining sustainable aquatic and riparian and riverine aquatic habitats needed by aquatic and terrestrial species

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- creating fresh emergent and seasonal wetland and habitats linked to flood control activities in the North Delta and Mokelumne River corridors, and
- evaluating additional fresh emergent wetland habitats.

The CALFED Bay-Delta Program approach for the lower Sacramento River, Yolo Bypass, and North Delta region is to implement integrated projects and programs that will either make a substantial contributions to the overall ecological health of the region or provide answers to critical ecological uncertainties, thus providing more precise direction for future action bundles.

Projected costs to implement the proposed ecosystem restoration projects in the Lower Sacramento, Yolo Bypass, and North Delta Region bundle are $5.5 million in 2000 and $10.0 million in 2001.

Restore Tidal Habitats along Georgiana Slough. Georgiana Slough is a natural distributary of the Sacramento River. It carries Sacramento River water to the interior of the Delta. When state and federal water project exports are high, unnaturally high volumes of Sacramento River water are drawn into the interior of the Delta. This highly modified hydrologic action exposes young fish of Sacramento River origin to high rates of predation and entrainment loss. The loss of escape cover and other aquatic habitats along Georgiana Slough increases the problem. The absence of habitat has been attributed to levee construction, boat wakes and increased flow velocities entering the Central Delta through Georgiana Slough.

The approach is to create a mosaic of riparian and riverine aquatic and tidally influenced fresh emergent wetland habitats along Georgiana Slough to provide direct benefits to fish species rearing or migration through the slough. The restoration actions will be designed and implemented as adaptive experiments complete with comprehensive monitoring for the dual purposes of helping to restore listed species while resolving some of the ecological uncertainty linked to the role of riparian and riverine aquatic and fresh emergent wetland habitats in the survival of young fish.

CALFED will evaluate proposed projects based on their ability to:
- Identify potential sites for restoration experiments
- Create or maintain shallow water and riparian habitats through setback levees
- Link with previously conducted efforts or is a continuation of a successfully implemented project
- Provide an opportunity to develop projects as an adaptive experiments including conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related to the role and value of riparian and riverine aquatic and fresh emergent wetland habitats along Georgiana Slough.

Integrate Ecosystem and Flood Control Improvements in the Lower Mokelumne River. The Mokelumne River corridor is one of four major habitat corridors proposed in the Ecosystem Restoration Program Plan for the Sacramento-San Joaquin Delta Ecological Management Zone. Acquisition of land for future conversion to a variety of aquatic habitats are

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the major focus of recently completed actions in the area. These actions are closely linked with programs and projects identified in the Long-Term Levee Protection Plan. Together, actions from these two common programs can provide significant ecological benefits including increased riparian and riverine aquatic habitats, ecologically beneficial floodplain configurations, and improved habitats for fish spawning, rearing, and migration.

The approach is to implement adaptive experiments designed to contribute to the restoration of listed fish species, improve habitat for a wide variety of other aquatic and terrestrial species, improve river-floodplain interactions and flood protection by setting back levees, and resolve ecological uncertainty by implementing a comprehensive monitoring and research program.

CALFED will evaluate proposed projects based on their ability to:

- Convert land to a variety of riparian and riverine aquatic habitats and tidally influenced fresh emergent wetland and tidal perennial aquatic (open water) habitats while providing improved flood protection in the form of wider floodplains and setback levees
- Link with previously conducted efforts or is a continuation of a successfully implemented project
- Create new habitats as adaptive experiments complete with conceptual models, hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related to integrating flood control and ecosystem improvements.

Provide Needs And Opportunities Analysis For Improving Ecosystem Restoration And Flood Bypass Habitat In The Yolo Bypass Area. Recent investigations indicate that the Yolo Bypass acts as a surrogate or alternative for natural floodplain habitat. When the bypass is operating, it effectively doubles the floodplain habitat of the Bay-Delta system. Field studies have demonstrated that the bypass supports at least 40 species of fish including delta smelt, steelhead trout, sturgeon, and chinook salmon including spring-run and winter-run chinook. The bypass appears to be particularly valuable habitat for the Sacramento splittail. It is hypothesized that the seasonal nature of the habitat serves the needs of native species and can provide a competitive advantage over non-native introduced species.

The bypass also appears to be an important link in the estuarine food chain. During periods of high flows, the bypass is a primary pathway for organic carbon to the estuary, a pathway that does not affect drinking water supplies.

The goal of the project is to complete an analysis of alternative ways to increase the frequency and duration of Yolo Bypass flooding while maintaining agricultural production and without encroaching on flood capacity. The approach is to design and implement a series of adaptive experiments to expand or enhance seasonal shallow-water habitats in the Yolo Bypass and near Delta floodplain. Habitat creation in the Yolo Bypass presents one of the best opportunities for ecosystem restoration because large areas of habitat can potentially be created at relatively small cost while retaining the flood management functions of the bypass.

CALFED will evaluate proposed projects based on their ability to:

- Maintain the flood flow capacity of the bypass
- Establish local government, agricultural, stakeholder, and agency support
- Link with previously conducted efforts or is a continuation of a successfully implemented project
- Provide an opportunity to develop the project as an adaptive experiment including conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related to the ecological value of season shallow-water habitat.

Cache Creek Mercury Source Control. Mercury-bearing ores are found throughout the upper Cache Creek watershed. These ore deposits are associated with geothermal springs and historic mines, both of which provide pathways for mercury to enter Cache Creek. Organic forms of mercury (including methylmercury) can be easily taken up into the food chain by aquatic insects. Mercury is monitored in the basin by Yolo County, Regional Water Quality Control Board, U.S. Geological Survey, and the U.S. Fish and Wildlife Service.

Monitoring in 1997 indicated that highly elevated mercury levels were present in several sub-drainages between Clear Lake and Rumsey. For example, Harley Gulch, Davis Creek and Bear Creek exhibited high mercury levels, presumably from known mercury mine sites or a stream draining a mercury mining zone.

The approach is to collaborate with ongoing investigations and the County of Yolo to identify known mercury contamination sources that could be subject to remediation through adaptive intervention. This effort would be consistent with the Cache Creek Resources Management Plan and the Cache Creek Improvement Program.

CALFED will evaluate proposed projects based on their ability to:

- Establish local government, stakeholder, and public support
- Link with previously conducted efforts or is a continuation of a successfully implemented project
- Provide opportunities to develop projects as an adaptive experiments including conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related to mercury in the aquatic environment.

Suisun Marsh and West Delta Bundle

The ecological and geographic regions encompassed in the Suisun Marsh and West Delta bundle include numerous areas of critical importance to listed fish, plant, and wildlife species. Restoration actions within this large area are designed to complement actions developed within other CALFED common programs and have strong links to programs and projects prepared by other state, federal and local agencies.

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The Ecosystem Restoration Program emphasis for the Suisun Marsh and West Delta bundle is to implement a well-integrated group of projects that will either make substantial contributions to the restoration of listed species, contribute to the overall ecological health of the regions, or provide answers to critical ecological uncertainties and, thus, provide guidance for the development and implementation of future restoration actions.

Projected costs to implement the proposed ecosystem restoration projects in the Suisun Marsh and West Delta bundle are $11.25 million in 2000 and $8.0 million in 2001.

Implement a Suisun Marsh Diversion Screening Program. There are a large number or relatively small diversions diverting water from the Suisun Marsh and the Delta. These smaller diversions have the potential to entrain juvenile fish, but relatively little data exist that can be used to identify where the biological benefits would be the greatest in a program to screen smaller diversions. Evaluations of alternative methods of preventing entrainment at larger diversions have not identified any effective solutions other and positive barrier fish screens. However, when evaluating screening at smaller diversions under 25 cfs, there may be other techniques for reducing or preventing entrainment that could be cost effective in some situations.

A serious conflict exists in the Suisun Marsh between the potential for listed fish species to be entrained and the need to divert water for managed wetlands. There is also some uncertainty related to the relative ecological benefits of screening Suisun Marsh diversions relative to the magnitude of diversions in other areas. One goal of this effort is to establish the scientific basis for a screening program in the Suisun Marsh and to establish priorities for installing screens.

The approach is to eliminate the ecological uncertainty of screening diversions in the Suisun Marsh by implementing a comprehensive program to identify screening opportunities, create collaborative efforts with local landowners and the Suisun Resource Conservation District, to develop adaptive experiments to better understand the magnitude of the problem, and to develop a long-term program to abate the problem.

CALFED will evaluate proposed projects based on their ability to:

- Identify potential sites for pre-project evaluation
- Install, operate and evaluate experimental or innovative screen designs
- Link with previously conducted efforts or is a continuation of a successfully implemented project
- Provide an opportunity to develop screening projects as adaptive experiments including conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related to small unscreened diversions.

Evaluate and Restore Tidal Wetlands in Suisun Marsh and Van Sickle Island. Suisun Marsh is the largest remaining brackish water marsh in California. It is an extremely important area for migrating waterfowl, shore birds, and wading birds. It provides important habitats for listed aquatic species such as delta smelt and chinook salmon. The marsh also

harbors several listed plant species and mammal species. Restoration and protection of these diverse species is closely centered on restoration of tidal marsh habitats and adjacent wetland, upland and riparian habitats.

The approach is to develop and implement a collaborative program to restore saline emergent wetland, tidal perennial aquatic, perennial grassland, and riparian and riverine aquatic habitats in a manner compatible with a "whole marsh concept" in which tidal marshes are well connected to adjacent wetland habitats, upland habitats, and riparian systems. The approach also is to implement marsh restoration in a manner that contributes to levee system reliability by relocating vulnerable levees or implementing habitat restoration actions in conjunction with levee reconstruction.

CALFED will evaluate proposed projects based on their ability to:

- Acquire potential restoration sites through conservation easement or purchase
- Complete technical analyses that lead to proposed restoration actions
- Link with previously conducted efforts or is a continuation of a successfully implemented project
- Provide an opportunity to develop tidal wetlands as adaptive experiments including conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related role and value of tidal emergent wetlands.

Frank's Tract Habitat Restoration. Frank's Tract is an island in the Delta which flooded in the 1930s and has never been reclaimed for agricultural production. It occupies a key location in the transition zone between brackish and freshwater habitats. Critically important habitats for aquatic species can be recreated at this site without impacting agricultural land.

A feasibility study for a pilot project to restore Frank's Tract was previously funded in 1998. That study proposed the construction of 4 mid-size channel islands totaling 45 acres. Clean dredge material would be used to increase the bottom elevation at selected locations to approximately 4-6 feet in depth. The pilot project would be monitored to evaluate the benefit for native fish species and potential colonization by non-native invasive plant species.

The approach is to fund efforts to design and construct habitat components that will make Frank's Tract and integral component of the San Joaquin River corridor connecting the western Delta with the lower San Joaquin River.

CALFED will evaluate proposed projects based on their ability to:

- Provide for the beneficial reuse of dredged materials
- Provide improved tidal perennial aquatic habitat
- Provide fresh emergent wetland habitat
- Link with previously conducted efforts or is a continuation of a successfully implemented project

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- Provide an opportunity to develop and implement habitat restoration as an adaptive management experiment complete with conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related to restoring a variety of shallow water habitats in the Delta.

Delta-wide Ecosystem Restoration/Levees Bundle

The Ecosystem Restoration Program emphasis is on:

- evaluating fish losses at small unscreened diversions in the Delta
- implementing measures to reduce the adverse affects of non-native invasive species
- evaluating total organic carbon in the system as it pertains to restoration of tidally influenced fresh emergent wetlands
- developing means to protect and restore mid-channel islands
- linking ecosystem restoration projects with Delta levee restoration actions, and
- identifying critical areas and propagation techniques for rare plants.

Evaluate the Need to Screen Small Diversions in the Delta. There are a large number of relatively small diversions diverting water throughout the Delta. (Note: Small unscreened diversions are also addressed in the Lower San Joaquin River and South Delta Region and the Suisun Marsh and West Delta bundles.) These smaller diversions have the potential to entrain juvenile fish, but there is relatively little data that can be used to identify where the biological benefits would be of the greatest benefit in a program to screen smaller diversions. Evaluations of alternative methods of preventing entrainment at larger diversions have not identified any effective solutions other than positive barrier fish screens. However, when evaluating screening at smaller diversions less that 25 cfs, there may be other techniques for preventing entrainment that could be cost effective in some situations.

Unlike the riverine environment where unscreened diversions may affect a large portion of fish populations, the benefits of screening small diversions throughout the Delta is unknown. An evaluation should be undertaken to identify diversion effects on species and locations in the Delta where screening small diversions is a high priority. Two general topics are recommended for evaluation: to synthesize existing information on entrainment in the Delta at small diversions and to evaluate entrainment effects at actual diversions if willing landowners can be identified.

The approach is to determine the biological benefits of screening small diversions in a tidal environment and the technical feasibility of doing so. CALFED will evaluate proposed projects based on their ability to:

- Consolidate existing information regarding the loss of native fish in small unscreened diversions
- Consolidate existing information regarding methods or techniques to install and operate screens on small diversions throughout the Delta
- Link with previously conducted efforts or is a continuation of a successfully implemented project

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- Provide an opportunity to develop screening projects as adaptive experiments including conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related to small unscreened diversions.

Non-native Invasive Species Management. The Bay-Delta ecosystem has been characterized as having more non-native invasive species (NIS) than any other system of its kind in the world. The impacts of NIS are a major cause of declining ecosystem health. Sources of NIS include ballast water, imported baits, accidental transport, exotic pets and deliberate and illegal introductions.

CALFED has prepared a draft management and prevention strategy to attempt to address NIS present in the system and to minimize future introductions. The early goal of the program is to offer strategies and to conduct pilot or demonstration projects that will inform the long-term program. The approach is to clarify the extent to which non-native species may preclude opportunities to reach ecosystem restoration goals and objectives.

CALFED will evaluate proposed projects based on their ability to:
- Significantly reduce additional introductions of non-native species
- Develop better understanding of how non-native species affect ecological processes and biological interactions
- Develop effective control and eradication programs
- Establish habitat conditions that favor native species
- Link with previously conducted efforts or is a continuation of a successfully implemented project
- Provide an opportunity to develop the projects as adaptive experiments including conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related controlling non-native invasive species.

Total Organic Carbon Evaluation. Rivers, wetlands, and agricultural operations are major sources of organic carbon to the Bay-Delta system. Carbon is an essential nutrient supporting the aquatic foodweb. However, high concentrations of organic material in water exported from the Delta is the source of many public health concerns. Delta waters are used by over 22 million people for drinking water. When treated with disinfectants such as chlorine or ozone, dissolved organic carbon (DOC) and naturally occurring bromine in water can form carcinogenic disinfection by-products.

The Ecosystem Restoration Program has proposed extensive restoration of tidally influenced fresh emergent wetland and other aquatic habitats that will likely increase the quantity of organic carbon present in Delta waters. At present, there is little information available regarding the amount or quantity of organic material delivered by wetland and agricultural sources in the system and the potential effects on either the Delta aquatic foodweb and drinking water treatment.

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The approach for evaluating the beneficial and adverse effects of total organic carbon in the Bay-Delta system is to design, fund, and implement a variety of research programs to clarify many of the important ecological and scientific uncertainties linked to this issue.

CALFED will evaluate proposed projects based on their ability to:

- Estimate how much and what forms of total organic carbon are produced by wetlands
- Estimate how much and what forms of organic carbon originate from agricultural activities
- Identify wetland management strategies to reduce input of organic carbon to the system
- Research to will assess the impact of restored wetlands as they mature
- Link with previously conducted efforts or is a continuation of a successfully implemented project
- Provide an opportunity to develop projects as adaptive experiments including conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related to the role and affect of organic carbon in the system.

ERP Levee Relocation, Berms, and Vegetation Management. A major component of the Ecosystem Restoration Program Plan is the re-creation of shallow, tidally influenced aquatic habitat in the Delta. The approach is to implement actions and studies that will resolve the ecological and technical uncertainties associated with levee setback actions to create tidally influenced shallow water habitats. The approach also is to conduct the geotechnical and engineering analysis necessary to establish feasibility and estimated costs associated by setting back levees in the Delta. Resolution is needed early in the program so that the long-term effort can be refined based on improved scientific information. Resolution will be achieved by geotechnical and engineering analyses to establish feasibility and estimated costs associated with levee realignments.

Setting back levees could produce shallow water habitat in the Delta with fewer impacts but it is a concept with considerable technical uncertainty. There is also a liability concern. Even though the existing levees are often characterized as unstable, most have been in place for nearly one hundred years. A new levee will require time to mature before protected landowners gain confidence.

CALFED will evaluate proposed projects based on their ability to:

- Identify areas where the underlying land forms can support levee setbacks
- Identify berm structures that can support fresh emergent and riparian vegetation create or maintain fresh emergent wetland and riparian and riverine aquatic habitats through levee setbacks or fill of deep water areas
- Link with previously conducted efforts or is a continuation of a successfully implemented project
- Provide an opportunity to develop the project as an adaptive experiment including conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related to integrating levee and habitat improvements in the Delta.

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In-channel Islands Restoration. In-channel islands are a remnant habitat type critical to fish and plant species in the Delta. Their abundance has been reduced due to dredging and boat wake and wind wave damage. A major portion of the Ecosystem Restoration Program is dedicated to the preservation, restoration and creation of this habitat type. This restoration is critical to the recovery of listed plants and may be critical to the recovery Delta native fish species.

The protection and re-establishment of in-channel islands can be accomplished without land use conversion and can provide additional protection to levees where wind fetch is a problem. Small island creation can provide a beneficial reuse option for clean dredged material.

The approach is to better understand the underlying geomorphic, hydrodynamic, or fluvial processes that create or erode channel island and to demonstrate methods by which to protect or enhance existing channel islands.

CALFED will evaluate proposed projects based on their ability to:

- Demonstrate or compare the effectiveness of several types of biotechnical approaches for shoreline stabilization and erosion abatement
- Link with previously conducted efforts or is a continuation of a successfully implemented project
- Provide a significant level of monitoring comparing natural and manipulated areas
- Will provide the type of information required to improve the longer-term approach to protecting and restoring mid-channel islands and their associated aquatic and terrestrial resources create or maintain fresh emergent wetland and riparian and riverine aquatic habitats through levee setbacks or fill of deep water areas
- Provide an opportunity to develop the project as an adaptive experiment including conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related to restoring or creating mid-channel islands.

Key Acquisition Areas For Conservation Of Special Status Plant Species. The location and condition of most special status plant species in the Bay-Delta system is poorly understood. Comprehensive reconnaissance level surveys have not been conducted. The basic information is critical to a strategic acquisition program that will have to focus on essential locations and minimal disruption to existing land uses. This survey will aid in the identification of key ecological attributes necessary for the propagation and expansion of rare plant species and plant communities.

The approach is to design, fund and conduct the appropriate level of field survey to identify critical areas for acquisition and protection.
CALFED will evaluate proposed projects based on their ability to:

- Link with previously conducted efforts or is a continuation of a successfully implemented project
- Conserve special status plant species and which will provide transitional habitat corridors

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- Provide an opportunity to develop projects as adaptive experiments including conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related to conserving special status plant species.

Propagation Techniques and Restoration Protocols of Rare Plants. Disruption of natural ecological processes make it difficult or unlikely that rare plants will be able to repopulate the Bay-Delta system. Changes in hydrologic regime, bank protection which prevents erosion and insolation of remnant populations substantially impact natural reproduction. The propagation of special status plants is not a mature science. The results of this program would provide the scientific foundation for the reestablishment of plant species of concern and a diverse native plant community. Emphasis will be placed on the protection of genetic integrity for these rare and unique plants.

The approach is to design, fund and implement research in techniques to propagate rare plants and to identify measures or protocols to establish naturally self-sustaining populations.

CALFED will evaluate proposed projects based on their ability to:
- Identifies habitat requirements of target plant species
- Locate potential sites and specific microhabitats for new populations
- Link with previously conducted efforts or is a continuation of a successfully implemented project
- Provide careful logistical, historical, biological and physical reintroduction criteria
- Identify restoration sites on publicly held lands
- Provide an opportunity to develop projects as an adaptive experiments including conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related to propagation techniques and restoration protocols of rare plants.

Sacramento River, San Joaquin River, and Tributaries Bundle

The Ecosystem Restoration Program emphasis is on:
- creating and maintaining a living river corridor that sustains natural ecological processes and supports sustainable habitats needed aquatic and terrestrial species
- improving our understanding of stream and river channel dynamics
- improving our knowledge to better manage salmon and steehead hatcheries
- improving our ability to manage the genetic baseline of existing salmon and steelhead populations.

Projected costs to implement the proposed ecosystem restoration projects in the Sacramento River, San Joaquin River, and Tributaries bundle are $36.3 million in 2000 and $28.6 million in 2001.

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Sacramento River Meander Corridor Studies and Implementation. River meander is an essential ecological process. The extent to which a river can meander is a key indicator of ecological health. The Upper Sacramento River Advisory Council has sponsored extensive study and modeling of the Sacramento River from Red Bluff to Chico Landing (the unleveed portion of the river) for 15 years. They have identified a Sacramento River Conservation Areas that includes about 213,000 acres of land which could be affected by the natural, long-term meander of the Sacramento River. Some of the land within the Conservation Area are proposed for protection by means of voluntary easements or direct fee acquisition from willing sellers. Many of the areas will require initial re-vegetation with native plant species.

The approach is to fully coordinate research and acquisition activities with the efforts of the Sacramento River Advisory Council.

CALFED will evaluate proposed projects based on their ability to:

- Use an ecosystem approach that contributes to the recovery of threatened and endangered species and is sustainable by natural processes
- Use the most effective and least environmentally damaging bank protection technique to maintain a limited meander, where appropriate
- Operate within the parameters of local, state, and federal flood control and bank protection programs
- Provide voluntary landowner participation
- Fully consider landowner, public, and local government concerns
- Provide accurate and accessible information/education to foster sound resource management
- Link with previously conducted efforts or is a continuation of a successfully implemented project
- Provide an opportunity to develop projects as adaptive experiments including conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related to restoring limited meander to the Sacramento River.

Sediment Management Program. The approach is to better understand the fluvial geomorphic processes on individual streams prior to implementing restoration actions. Coarse sediment (gravel and cobble) is an important building block for aquatic and riparian habitat in riverine systems. These sediments help create and maintain spawning habitat for a variety of fish, helps create point bar deposits for colonization by riparian vegetation, and it provides a substrate for the production of aquatic invertebrates and other aquatic foodweb organisms. Large and small dams trap sediment. Water releases below dams scour sediment and erode downstream areas. Gravel mining in the stream channels and nearby floodplains reduce the overall sediment supply and can produce pits which trap sediment from upstream sources.

General strategies to restore a healthy sediment regime include relocation of in-stream or floodplain gravel extraction activities, the introduction of gravel by trucking, and the re-activation of stream meander processes to provide for the lateral capture of gravel stored in stream banks. Gravel replenishment is very critical and very expensive. If done correctly, it can

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rebuild habitats in a sustainable and natural manner. If implemented incorrectly, it can produce only short-term benefits. It can also cause damage to property and the ecosystem or could produce no measurable benefits.

CALFED will evaluate proposed projects based on their ability to:

- conduct site specific analyses to determine the appropriate sediment budget for a given stream reach
- determine the best strategy for restoration
- determine the most cost method to improve coarse sediment depletions
- Link with previously conducted efforts or is a continuation of a successfully implemented project
- Provide an opportunity to develop projects as an adaptive experiments including conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related to the sediment and channel dynamics in the system.

Salmon and Steelhead Trout Genetic Management Program. Within the focus area of the Ecosystem Restoration Program there are five natural spawning stocks of chinook salmon. In addition, there are five hatcheries in the Central Valley that propagate salmon from each of the distinct salmon populations. There is only one evolutionarily significant unit (ESU) for steelhead which has spawning populations in numerous tributaries throughout the Central Valley, but, over the years, hatchery managers have imported steelhead stocks from a variety of sources outside the Central Valley in an attempt to increase survival, boost production, and increase angler harvest.

The Ecosystem Restoration Program proposes to facilitate anadromous fish access to important stream reaches within Battle Creek, Butte Creek, Clear Creek, Yuba River, and other locations that have been unavailable to salmon and steelhead for 50 years or more.

With an apparent high level of natural and introduced genetic diversity within the Central Valley, natural recolonization of historic spawning and rearing habitats could lead to further hybridization, introgression, and loss of genetic integrity of small natural populations.
The approach is to design, fund and implement investigations needed to develop or refine elements of a genetic management program building on existing information and programs.

CALFED will evaluate proposed projects based on their ability to:

- Establish stock specific guidelines for genetic conservation and management, including guidelines to minimize the effects of hatchery practices
- Implement a long-term genetic monitoring program
- Identify an appropriate "founder" populations to accelerate recolonization efforts
- Prepare and implement guidelines for the operation of weirs and fish ladders to protect genetic diversity and integrity
- Update existing extinction models for winter-run chinook salmon and develop similar models for other chinook and steelhead stocks

- Link with previously conducted efforts or is a continuation of a successfully implemented project
- Provide an opportunity to develop projects as adaptive experiments including conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related to genetic planning and management.

Hatchery Operations. Five hatcheries that propagate chinook salmon and steelhead are operated within the Central Valley. They were required as mitigation for the loss of spawning areas that resulted from the construction of dams. These hatcheries serve this narrow purpose well and provide a buffer to maintain viable populations during natural catastrophic events such as drought and adverse ocean conditions.

The hatcheries do not compensate for lost rearing habitat, foodweb production or habitat variability associates with the displacement caused by dams. Hatchery produced fish can compete with naturally spawning fish for food and habitat. In some instances, hatchery fish prey on wild fish. As the Ecosystem Restoration Program moves forward and succeeds in restoring naturally spawning populations of chinook salmon and steelhead, potential conflicts with hatchery programs and products will increase.

The approach is to develop an integrated hatchery management strategy that reduces the potential conflict with wild fish, maintains a viable harvest strategy, and optimizes progress toward the goals of self-sustaining populations of wild salmon and steelhead.

CALFED will evaluate proposed projects based on their ability to:
- Develop hatchery protocols to better protect naturally spawning populations
- Build on lessons learned at other salmon and steelhead hatcheries along the Pacific Coast
- Link with previously conducted efforts or is a continuation of a successfully implemented project
- Provide an opportunity to develop projects as adaptive experiments including conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related to hatchery management and potentially adverse influences on wild populations.

Fish Marking And Tagging Programs. Fish marking, tagging, and recovery programs provide important information regarding the age and origin of chinook salmon and steelhead harvested in sport and commercial fisheries. Historically, marking and recovery programs at individual hatcheries and other facilities in the Central Valley were ad hoc and driven by short term needs. Typical research needs have included timing of hatchery release, release location, race evaluations and performance, contribution rates to ocean fisheries, and experimental releases to evaluate smolt captures at Chipps Island. All these marking programs have been opportunistic and directed at answering specific questions. The information is used to refine hatchery management practices, release strategies, water management actions, and establish regulatory or compliance measures.

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A comprehensive, system-wide program to mark and recovery chinook salmon and steelhead is an essential component of managing and restoring these species. CALFED has recently funded the design of a statistically based marking and recovery program and anticipated the need to provide funding to implement the program.

The approach is to closely coordinate with the Interagency Ecological Program's Salmon and Steelhead Project Work Team and coordinate with the Department of Fish and Game and the U.S. Fish and Wildlife Service as they operate the salmon and steelhead hatcheries in the Central Valley.

CALFED will evaluate proposed projects based on their ability to:

- Contribute to improved knowledge of age structure, straying rates, survival and mortality rates, harvest rates, and other data derived from comprehensive marking programs
- Link with previously conducted efforts or is a continuation of a successfully implemented project
- Provide an opportunity to develop projects as adaptive experiments including conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related to fish population dynamics.

Butte Creek, Clear Creek, Deer Creek, and Tuolumne River Restoration. Numerous actions have been identified for these creeks. In previous years, numerous projects have been implemented. All these creeks support chinook salmon and steelhead and are clearly critical habitats for threatened and endangered species.

Butte Creek has been a focal point for early implementation of actions under Category III funding. Substantial progress has been made. All indicators of ecosystem health are moving in a desired direction. There is no suggestion in the project monitoring or at the landscape level monitoring of a need to change restoration direction.

Clear Creek has been suggested as a demonstration watershed for Stage 1A implementation of the Ecosystem Restoration Program. Flow in lower Clear Creek is controlled by the US Bureau of Reclamation and the creek has active stakeholder and agency watershed groups.

Deer Creek has been suggested as a demonstration watershed for Stage 1A implementation of the Ecosystem Restoration Program. It was proposed because it is one of only three or four streams which support spring-run chinook salmon. Deer Creek has an active local watershed organization. Deer Creek is relatively undamaged and restoration of ecological processes and functions are feasible. The principal focus of restoration on Deer Creek is the reintroduction of floodplain processes. The potential options for achieving this objective range from levee set-backs and new levee construction to flood easements and channel reconfiguration.

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The Tuolumne River has also been suggested as a demonstration watershed for Stage 1A implementation of the Ecosystem Restoration Program. It was proposed because it has great restoration potential for San Joaquin River fall-run chinook salmon.

The overall approach for these tributaries is to closely coordinate with local watershed groups and interested agencies in developing restoration actions to benefit aquatic and terrestrial resources. Spring-run chinook salmon, San Joaquin fall-run chinook salmon, and steelhead are the primary target species to benefit from restoration actions.

CALFED will evaluate proposed projects based on their ability to:

- Establish local watershed organization support
- Contribute to the recovery of listed species
- Link with previously conducted efforts or is a continuation of a successfully implemented project
- Provide an opportunity to develop projects as adaptive experiments including conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related to watershed management and species restoration.

Integrated Water Management Bundle

The Ecosystem Restoration Program emphasis is on:

- Initiating an Ecosystem Science Program
- Supplementing existing monitoring, assessment, and research programs
- Develop a long-term plan for in-stream flows
- Environmental water purchases
- Developing environmental education programs
- Fish migration barrier removal evaluation and prioritization
- Watershed Management.

Projected costs to implement the proposed ecosystem restoration projects in the Integrated Water Management Bundle are $85.5 million in 2000 and $90.5 million in 2001.

Ecosystem Science Program. Design and implementation of the Ecosystem Science Program is a very important component of the overall Ecosystem Restoration Program. The science program is needed to support the adaptive management component of the ERP. The science program will include an expert science panel, scientific workshops, direction for focused research efforts, data assessment, and a means by which to inject current scientific finding into the management process.

CALFED will evaluate proposed projects based on their ability to:

- Coordinate with the Comprehensive Monitoring, Assessment, and Research Program
- Establish support of the scientific community, stakeholders, and participating agencies
- Design and implement scientific workshops and seminars.

Supplement Existing Monitoring Programs. The Ecosystem Restoration Program will be implemented using adaptive management. Each action will be evaluated individually and as part of an integrated whole. Effective monitoring is a major component of a science-based adaptive management program.

Substantial monitoring is presently funded in the Bay-Delta system. Resource agencies and permit holders fund approximately $22 million each year. CALFED supports the development of a comprehensive monitoring program. The program is not yet finalized, but reasonable estimates of cost are about $30 million a year for the ecosystem monitoring component.

CALFED will evaluate proposed projects based on their ability to:

- Integrate with the proposed Comprehensive Monitoring, Assessment, and Research Program
- Provide an mechanism to evaluate projects as adaptive experiments including conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related to the Bay-Delta ecosystem.

Develop a Long-term Plan for In-stream Flows. The allocation of water for in-stream flow is one of the most contentious actions proposed by the Ecosystem Restoration Program. Because the plan calls for obtaining water from willing sellers and new supplies, it will be costly. At present, there is inadequate scientific consensus as to how in-stream flow needs for a broad range of ecological processes and functions should be determined. Hydrologic models are not available and comprehensive strategies cannot yet be developed.

The approach is to formulate a science-based method to determine in-stream flow needs for ecological processes, habitats, and species and to develop the modeling tools necessary to support a comprehensive ecological water management strategy. The management strategy will be firmly rooted in adaptive management. Water acquisition is described in the Environmental Water Purchase section.

CALFED will evaluate proposed projects on the ability to:

- Provide an opportunity to develop projects as adaptive experiments including conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related to instream flows and the requirements of ecological processes, habitats, and species.

Environmental Water Purchases. The volume and timing of streamflows in the Central Valley have been substantially altered. Wetted habitat area has been reduced and environmental cues and migration flows have diminished. Flow fluctuations due to dam and power operations strand and kill young fish. Reduced flows often result in elevated water temperatures. The Ecosystem Restoration Program has identified the need to augment flows on streams tributary to the Delta by about 400,000 acre-feet annually.

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The approach is to acquire water for flow augmentation on a willing seller basis. The approach include the acquisition of water rights, developing surface and groundwater storage, developing conjunctive use of groundwater, funding water conservation and purchasing water on the spot market or purchasing options. Each of these tools or opportunities will be required to reach the long-term objective of streamflow augmentation.

CALFED will evaluate proposed projects based on their ability to:

- Establish support of local governments
- Provide long-term water supplies to augment existing flows
- Provide water at ecologically important times
- Provide an opportunity to exchange water to improve ecological conditions or flows
- Provide an opportunity to develop projects as adaptive experiments including conceptual models, testable hypotheses, and comprehensive monitoring.

Environmental Education Programs. Education programs are important tools to develop broad understanding of natural resource conservation issues at the individual and community level. In particular, increased public understanding of the resource issues that led to the development of the CALFED Bay-Delta Program will increase awareness of these issues and facilitate creative solutions to environmental problems. This program could increase support for the program from all age and interest groups in rural and/or urban areas.
The approach is to increase public awareness, knowledge, and appreciation of natural resources and ecosystem activities. It is also intended to foster active participation in the development of issues and the implementation of activities that further the goals of the Ecosystem Restoration Program.

CALFED will evaluate proposed projects based on their ability to:

- Establish local government and stakeholder support
- Facilitate creative solutions to reducing environmental quality problems
- Link with previously conducted efforts or is a continuation of a successfully implemented project.

Fish Migration Barrier Removal Evaluation and Prioritization. Large and small dams serve to delay or prevent fish from moving upstream to areas of critical habitat. Steelhead trout, spring-run chinook salmon, and winter-run chinook salmon are severely impacted by delayed or denied access to cold water spawning and rearing habitats. These fish evolved reproductive strategies that allow them to over-summer in California's hot Central Valley because they occupy the cold pools of the headwater streams.

The approach is to conduct in-depth feasibility analyses on selected streams. The analyses will consist of options or alternatives to promote the upstream and downstream passage of adult and juvenile migratory fish. Actions proposed under this category are linked to the Integrated Storage Investigations (ISI) which is conducting more detailed analyses of surface storage, groundwater and conjunctive use programs, and power facilities reoperation evaluation.

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CALFED will evaluate proposed projects on their ability to:

- Link with previously conducted efforts or is a continuation of successfully implemented projects
- Provide an opportunity to develop projects as adaptive experiments including conceptual models, testable hypotheses, and comprehensive monitoring
- Contribute to resolution of some of the ecological uncertainties related to restoring listed fish species.

Watershed Management. Watershed management actions can shift the timing of flows, increase base flows, and reduce peak flows. Healthy watersheds are a key to providing the flows and the types of habitats required by aquatic and terrestrial species. Integrating watershed management and restoration actions into the overall approach to improve ecosystem health is a key element to the success of the program.

CALFED will evaluate proposed projects based on their ability to:

- Improve coordination and assistance including a broad array of collaborators comprised of landowners, local groups, and all levels of government
- Develop monitoring protocols and apply adaptive management processes including a comprehensive element that will be compatible with the IEP monitoring effort in the Delta
- Improve and expand watershed education and public outreach including training to stewardship groups regarding watershed evaluation and monitoring, and implementation techniques
- Improve watershed stewardship by establishing demonstration sited for floodplain wetland restoration, and riparian corridor redevelopment including exotic species removal
- Link with previously conducted efforts or is a continuation of successfully implemented watershed projects
- Contribute to resolution of some of the ecological uncertainties related to restoring watershed health.

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