Section 3. Summary Synthesis by Region

This section is organized into various subsections. The first subsection provides an overview—a "landscape level" perspective—of how progress toward substantially implementing milestones related to environmental water quality. The second subsection presents a summary synthesis of milestone progress in each of the four Ecosystem Restoration Program (ERP) regions. These regional summaries include a vision statement, recommendations on fulfilling remaining milestone obligations, discussion of region-specific water quality milestones, and milestone specific statements of status, progress, and next steps to continue progress toward substantially implementing the milestones. The final subsection presents a fifth set of milestones, "Research Milestones," that are not limited to regional boundaries and applies to research efforts with multi-regional benefits and applications.

Each of the four ERP regions are subdivided into ecological management zones (EMZs) that in turn may be subdivided into ecological management units (EMUs). The *Ecosystem Restoration Program Plan*, *Volume II* (ERPP, Vol. II), presents vision statements for each EMZ. The regional vision statements presented in this assessment package are adapted from the ERPP, Vol. II and reflect those EMZ vision statements that directly relate to the milestones for that specific region. The reader is directed to the ERPP, Vol. II, for the complete vision statement for each EMZ. (The link to the Internet based version of this document is:

http://www.calwater.ca.gov/Programs/EcosystemRestoration/EcosystemVol2RestorationPlan.shtml).

Substantial implementation of the milestones is necessary for regulatory commitments and will lay the foundation for species conservation during Stage 1. The ERP Implementing Agencies (Service, NMFS, CDFG) recognize it will take time to "achieve" the milestones or desired endpoints expressed in the milestones such as establishing new populations of plant species; restoring emergent marsh habitat; creating optimum habitat conditions for a covered species; determining flows necessary to support all life stages of fish; quantifying the ecological impacts of sediments; and determining the ecological significance of pesticide discharges. However, with substantial implementation of the milestones, including the initiation of scientific investigations and technical feasibility studies described therein, the scientific understanding of the Bay-Delta ecosystem will improve and covered species will be adequately conserved.

Assessing population and ecological responses of restoration actions will require long-term status and trends monitoring of key ecological attributes. Performance measures that are based on conceptual models, adaptive management strategies, data handling and storage protocols, and other evaluation tools will be necessary to measure how well efforts are doing in terms restoring habitats, improving flow conditions and water quality and providing what's needed for species conservation over the long-term. The Interagency Ecological Program (IEP), in coordination with the Science Program and others, currently is developing a performance evaluation and long-term monitoring program that will measure progress towards achieving CALFED Program goals, including the continuous improvement in water quality and restoration and recovery targets for covered species.

These regional summary syntheses represent a "snap-shot-in-time" on the continuum of the restoration and environmental compliance efforts by the CALFED agencies as they implement their respective programs. Review and assessment of ecosystem restoration and environmental compliance efforts as they relate to substantially implementing the milestones is and will continue to be an ongoing effort for

the ERP. Information for these summery syntheses comes from a combination of sources, including but not limited to review of ERP and Central Valley Project Improvement Act (CVPIA) contracts, information from key CALFED agencies' activities that contributed to the "single blueprint" concept, and a wide range of activities available to the Implementing Agencies and other agencies that contribute to progress in substantial implementation toward the milestones. Many of those activities may not result in contracts for projects; some of these activities include workshops, seminars and stakeholder meetings. In addition, information was collected during the process about programs or projects that are not CALFED agencies' activities but relate to the objective of making progress in substantially implementing the milestones. The ERP Implementing Agencies anticipate collecting additional information about other efforts during the public review of this assessment package.

For this section, as in the assessment package, the term "contract" is used inclusively, referring both to the actual ERP or CVPIA contract (or other programs such as the Watershed Program) itself as well as to the project the contract represents.

In determining the progress toward substantial implementation of the milestones, this section employs four categories: behind schedule, on schedule, ahead of schedule, and under evaluation. For this assessment package, the following understandings for these categories are used:

- **Behind schedule.** No ERP-related efforts were started; other entities have started projects related to the milestone. As appropriate, there may be a description as to why this designation was chosen, e.g., the milestone does not apply to this region therefore no projects were started.
- On schedule. Some ERP-related efforts started projects or studies; other entities started projects or studies related to the milestone. For example, studies to purchase land for habitat restoration—a critical step to restoration—would be part of being on schedule toward progress in substantially implementing a restoration milestone.
- **Ahead of schedule.** Some ERP-related efforts have been completed; other entities have completed projects that have met one or more aspects of the milestone.
- Under Evaluation. Evaluation is continuing for assessing progress toward substantially implementing this milestone as information is being collected and analyzed. Most likely this would be used in those cases where there are few or no ERP-related actions and staff were unable to determine if another entity has a project related to the milestone and to what extent.

Environmental Water Quality Issues. There are 46 milestones that address water quality issues for the four regions, with repetition of many topics for each region. Due to the complexity and connectivity of water quality issues, it is difficult to assess progress toward substantially implementing environmental water quality milestones on a strictly regional basis. Therefore, in the first regional summary synthesis (the Delta Region), descriptions of progress toward substantially implementing the water quality milestones will include projects that address landscape-level issues (such as research to understand mercury cycling, development of Best Management Practices (BMPs) that can be used in any region, or development of water quality criteria). In the other regions, these landscape-level contracts also support progress towards the milestone, but the description will refer to the description in the Delta Region section (to avoid duplication), and will only discuss region-specific accomplishments and projects. There are several other issues that need consideration for the water quality milestones. First, many of the milestones refer to activities that are largely addressed by water quality agencies (such as the

regional water quality control boards) that are not ERP implementing agencies; although this assessment package mainly describes the actions of ERP, there are significant efforts that are not described in this assessment package being carried out by these other agencies. Second, these water quality milestones need to be reviewed and scientifically vetted for appropriateness.

In general, across all of the regions, ERP invested more than \$59 million dollars in 50 contracts to address environmental water quality issues, although few projects actually have been completed due to contracting delays and the complexity of these topics. Preliminary results indicate that water quality issues are impacting species although the magnitude of the impact is unknown. Preliminary results indicate impacts that include interferences for migration (dissolved oxygen, pesticides), reproductive effects to fish and birds (mercury, selenium, organochlorine pesticides), and both sediment and water column toxic episodes (pesticides, toxicity of unknown origin). Work has begun to address source control or other management options to reduce impacts from many of these issues. Further work is needed in these general areas:

- More information on effects to fish and wildlife from toxics, including sub-lethal effects and population level responses.
- Better assessment of the effects of restoration actions on water quality, including mercury methylation and organic carbon in the Delta. Monitoring and adaptive management will be essential to ensure that restoration activities do not impact water quality.
- Better coordination with other water quality efforts being accomplished by State and Federal agencies and other organizations. Much of the water quality work is being done by other agencies. Work with other agencies and organizations to summarize existing efforts, identify gaps and high priority actions, and address high priority actions, as appropriate.
- Development of a coordinated regional monitoring program that includes both water and sediment quality monitoring and monitoring of effects on key indicator species. This would be valuable for evaluating the spatial and temporal aspects of ecological effects (status and trends), as well as the effectiveness of various management options to reduce sources.

Delta Region and Eastside Tributaries Region (Delta Region)

There are two Ecological Management Zones (EMZs) in the Delta and Eastside Delta Tributaries Region (Delta Region): the Sacramento-San Joaquin Delta EMZ and the Eastside Delta Tributaries EMZ.

The vision for the Delta Region is to achieve a healthier system that better provides for the ecological needs of plants and animals using the system. A restored Delta EMZ will have improved ecological processes and habitats and reduced stressors. Ecological processes that will be improved include freshwater inflow and outflow, Delta hydraulics, channel configuration, water temperature, sediment supply, floodplain processes, and aquatic and terrestrial foodweb productivity. There will be greater amounts of slough, tidal marsh and perennial aquatic habitat, seasonal and permanent nontidal wetlands, and riparian and upland habitats. Stresses from contaminants, water diversions, dredging, levees and bank protection, boating disturbance, non-native invasive species, predation and competition, and harvest will be reduced. Delta smelt, longfin smelt, splittail, green sturgeon, Chinook salmon, Steelhead trout, Sacramento Perch, giant garter snake, Swainson's hawk, greater sandhill crane, riparian brush

rabbit, Lange's metalmark butterfly, valley elderberry longhorn beetle, western yellow-billed cuckoo, Mason's lilaeopsis, Suisun Marsh aster, delta mudwort, delta tule pea, and delta coyote-thistle are some of the species that should directly benefit from ecosystem restoration work.

The vision for ecological processes within the Eastside Delta Tributaries EMZ includes improved streamflow, stream meander, gravel recruitment and cleansing, sediment transport, natural floodplain processes, and water temperature. Significant habitats include seasonal wetlands and riparian and shaded riverine aquatic habitat (SRA). Notable stressors to ecological functions, processes, habitat and resources within the zone include altered instream flows, altered water temperature regimes, separation of rivers from their floodplains, interruption of gravel recruitment and cleansing processes, reduced sediment transport, poor land use and livestock grazing practices, high levels of predation on juvenile salmonids, entrainment of aquatic organisms in water diversions, restriction of fish passage at dams and diversions structures, input of contaminants, and riparian vegetation removal. Some of the species expected to benefit from Eastside Delta Tributaries work are splittail, Chinook salmon, steelhead trout, giant garter snake, western pond turtle, Swainson's hawk, greater sandhill crane, and western yellow-billed cuckoo.

Fulfilling Remaining Milestones Obligations for the Delta Region. An important priority for the Delta Region is to synthesize hydrodynamic and hydraulic modeling information to guide preparation of ecologically-based restoration plans for restoring aquatic resources (Milestone 1) and to achieve the Delta outflow objectives (Milestone 3). Notable progress has been made with respect to improving the understanding of the Delta hydrodynamics and refining water operations models. Additional work is still needed to increase scientific understanding of what flow conditions and processes are required to support all life stages of anadromous and estuarine fish species and to support lower trophic level ecological processes. Continued interaction among fishery agencies and water management agencies also is essential for addressing fishery needs at water management facilities. This interaction should include improving coordination of environmental water management tools such as Environmental Water Account (EWA), the Environmental Water Program (EWP) and CVPIA's Water Acquisition Program (WAP).

There are several large-scale restoration and resource management projects in the Delta Region currently in the planning phase. Continued planning and subsequent implementation of these projects within an adaptive management context will greatly contribute to fulfilling remaining habitat- and processes-related milestones for the region. Meeting milestone components for specific species may require additional research to determine essential life history information. All implemented projects should be monitored to assess performance and to inform other planning and implementation efforts.

There are currently no restoration projects planned for the South Delta EMU. Restoration potential for the South Delta EMU should be evaluated.

Summary of Water Quality Milestones for Delta Region. Many of the water quality milestones in the Delta Region should be reviewed and scientifically vetted to more appropriately address the issues addressed in the milestones. Many of the milestones are difficult to assess "progress toward substantial implementation" because they represent expansive, complicated, and evolving issues that require long-term solutions and continuous improvement. Most of these milestones also are supported by the

activities of water quality agencies and watershed groups, and their progress is not accounted for in this summary.

The ERP approved 17 contracts for more than \$19 million that address ecological water quality issues in the Delta Region. The Drinking Water Quality Program (DWQP) funded an additional 14 contracts for \$17.5 million. The understanding of several large complex water quality problems has improved over the past four years, and resulted in the development of strategies for future actions to find the most effective solutions. Major studies and agency coordination supported the development of total maximum daily loads (TMDLs) and an implementation plan for the dissolved oxygen (DO) deficit in the lower San Joaquin River. A "mercury strategy" document was developed to provide a framework for future mercury investigations. Coordination efforts and more than \$20 million in ERP mercury research contracts are contributing to implementation of the mercury strategy, and significant progress is expected to be made in the next few years on evaluating ecological effects, effects of restoration, and potential management actions to reduce mercury exposure. ERP has funded three multi-region contracts to reduce pesticide inputs, and three multi-region contracts to investigate unknown toxicity, which are currently in progress. In addition, there are three contracts specific to the Delta Region to reduce pesticide usage, monitor and evaluate ecological effects from pesticides. Two major research contracts are underway to evaluate selenium cycling and ecological effects in the Delta. Although there is not a related milestone, there are a number of research contracts underway to evaluate impacts of ecosystem restoration in the Delta on drinking water quality. In all of the areas mentioned above, there are other efforts, including regulatory actions, monitoring, and BMP development and implementation that are being carried out by other agencies and groups that are not included in this milestones assessment.

Suggested priority actions for water quality milestones in the Delta Region include:

- Continue coordination and support of implementation activities to address dissolved oxygen depletion in the lower San Joaquin River.
- Continue coordination and support of implementation activities for the mercury strategy framework, with emphasis on research and monitoring to determine impacts from ecological restoration, and evaluation of ecological effects from mercury contamination.
- Improve coordination with other agencies and groups on evaluating ecological effects from pesticides, methods to reduce pesticide and nutrient impacts, and methods to reduce toxicity.
- Work with other agencies and organizations to participate in an integrated monitoring program that evaluates water and sediment pollution and toxicity, and tissue contamination, and ecological impacts to key species. The monitoring program should provide comprehensive summary reports that evaluate spatial and temporal trends, ecological effects, and effectiveness of management actions.
- Summarize water quality efforts by other agencies and organizations that address water quality milestones. Work with other agencies and organizations to identify gaps and high priority actions
- Address high priority actions, as appropriate.

Delta Region Ecological Processes

The first five milestones for this region addressed key ecological processes related to Delta hydrodynamic and flow patterns and Eastside Tributaries temperature, coarse sediment supplies and flood plain management issues.

Milestone 1. Develop a methodology for evaluating delta flow and hydrodynamic patterns and begin implementation of an ecologically-based plan to restore conditions in the rivers and sloughs of the Delta sufficient to support targets for the restoration of aquatic resources.

Status: Several ERP contracts addressed different aspects of this milestone, including contracts to develop methodologies for evaluating Delta flow and hydrodynamic patterns and planning related to specific contracts within the Delta Region. The contracts range from focused efforts on a relatively small scale within the watershed, such as developing a low flow model for the Yolo Bypass to improve or address flood capacity, to a valley wide approach by evaluating historic hydroclimatic conditions. A few contracts were focused efforts to develop a methodology for evaluating Delta flow and hydrodynamic patterns. In addition, contracts for hydrodynamic modeling projects funded by the ERP and Science Program for dissolved oxygen in the Stockton Deep Water Ship Channel will contribute to the development of methodologies for evaluating flow in the South Delta.

There are several current Delta one- and multi-dimensional hydrodynamic modeling efforts being conducted or contracted by Bay-Delta Program implementing agencies including the California Department of Water Resources (CDWR), the U.S. Bureau of Reclamation (Reclamation) and the U.S. Geological Survey (USGS). These models include CALSIM II, jointly developed by CDWR and Reclamation, which simulates much of the water resources infrastructure in the Central Valley of California and Delta Region and provides quantitative hydrologic-based information necessary to operate the State Water Project (SWP) and Federal Central Valley Project (CVP). CDWR also uses the DSM2 model for estuarine and riverine systems, including effects of land-based processes. CDWR currently is developing a new River, Estuary and Land Model (REALM) featuring map-based visualization. The model design encompasses high quality flow, transport and particle modeling in 1D -2D -3D mixed dimensions, including important Bay-Delta features such as wetting and drying, reactive constituents and stratification. CDWR has contracted with a consulting firm to perform detailed calibration of a two-dimensional numeric model (RMA Bay-Delta) for evaluating salinity responses from alternative configurations of Franks Tract and from potential consequences from levee failures.

Funds from an ERP contract contributed to the development of the DELTA-TRIM multidimensional hydrodynamic and transport numerical model by the USGS. DELTA-TRIM has been used to evaluate and compare one critical ecological function (phytoplankton biomass production and distribution) of two Delta shallow water areas, Franks Tract and Mildred Island. Other ERP-funded restoration contracts are utilizing HEC-RAS and Mike 11 models to guide restoration planning and design.

The ERP Science Board (ERPSB) is embarking on large-scale simulation modeling to examine the quantitative role of water in achieving ERP objectives and restoration opportunities. This analysis will consider various water resource decisions, as well as longer term processes such as population growth and climate change that are likely to be important over the next 30 years. The modeling framework structure has not yet been designed, but may well involve a hierarchy of models at various spatial and temporal scales, focusing on indices of the quantity and quality of:

(a) aquatic habitat; and (b) riparian and floodplain habitat in different parts of the CALFED region, for a representative and tractable set of species, including salmon.

Progress: On schedule

Next Steps: Next steps for meeting the milestone should include developing a synthesis of all existing information and compiling it into a comprehensive, ecologically-based plan designed to restore conditions in the rivers and sloughs of the Delta Region sufficient to support restoration of aquatic resources. The synthesis should include an analysis of gaps to guide future research and modeling efforts.

Milestone 2. Develop and implement temperature management programs within major tributaries in the Eastside Delta Tributaries EMZ. The goal of the programs should be achievement of the ERP temperature targets for salmon and steelhead. The programs shall include provisions to: (a) develop accurate and reliable water temperature prediction models; (b) evaluate the use of minimum carryover storage levels and other operational tools; (c) evaluate the use of new facilities such as temperature control devices; and (d) recommend operational and/or physical facilities as a long-term solution.

Status: There are no ERP or Anadromous Fish Restoration Program (AFRP) contracts that directly address developing or implementing temperature management programs as specified in Milestone 2. However, as part of their Federal Energy Regulatory Commission (FERC) Joint Settlement Agreement and Water Quality Resource Management Program, East Bay Municipal Utility District (EBMUD) currently manages releases from high and low outlets at Camanche Dam on the Mokelumne River to meet temperature criteria designed for salmon and steelhead (Smith, pers. comm.). In order to preserve the coldwater pool in Camanche Reservoir, the Camanche high-level outlet is opened during the winter and spring to release warmer water. When water temperatures downstream of Woodbridge Dam reach 18°C, the high-level outlet is closed and the low-level outlet is opened. Coldwater releases from Pardee Reservoir are made through October to maintain stratification in Camanche Reservoir. EBMUD recently hired a modeler to develop a temperature prediction model that will enable them to improve their temperature management program to better address salmon and steelhead life cycle needs. In addition, there are some projects (ERP and AFRP) for restoring riparian habitat along the Mokelumne that may indirectly affect temperature targets.

There are monitoring and research projects underway through the AFRP on the Lower Calaveras River to survey spawning habitat and analyze life history limiting factors of Chinook salmon and steelhead to help provide the scientific basis for real-time management to optimize conditions for water supply, flood control, power production, and natural production of anadromous fish. These efforts could provide a foundation for future negotiations for management of releases to improve anadromous fish habitat and conditions.

The Cosumnes River has no large dams for which temperature management programs could be developed. However, the AFRP and ERP have funded research and model development on Lower Cosumnes basin surface water-groundwater interactions that may inform water management plans for the Cosumnes River. The AFRP has also funded a study to assess flow requirements and water acquisition feasibility for fall-run Chinook salmon in the Cosumnes River.

Progress: On schedule

Next Steps: Continue interactions with water management authorities on the Cosumnes, Mokelumne, and Calaveras rivers to promote improvement of their water temperature management programs, and fund research to inform development of these programs.

Despite the presence of Granlees Dam, the Cosumnes River remains largely unregulated, so there is no "carryover storage levels and other operational tools," "new facilities such as temperature control devices," or "operational facilities" to be evaluated. However, the ongoing AFRP funded study is targeting management options for flow augmentation that may result in improved temperatures.

Milestone 3. Provide a fall or early winter outflow that emulates the first "winter" rain through the Delta.

Status: There are several water management tools available for meeting this milestone including the Bay-Delta Program's EWA and EWP, and WAP. These tools have been used for fall releases from several Bay-Delta watershed tributaries including Clear Creek and the Stanislaus, Tuolumne and Merced rivers, but these releases weren't sufficient to meet the requirements of this milestone to provide an outflow that emulates the first winter rain through the Delta.

Progress: Behind schedule

Next Steps: Achieving this milestone will require focused coordination of all water management tools. The EWA Science Review Panel 2002 report states that programmatic integration of EWP, EWA and WAP is critical and that the "integrated effects of these actions directed toward species management could be different from the sum of the effects of individual actions." Opportunities should be pursued for improving coordination and integration of the ERP with water management programs to better address species recovery and ecosystem management.

Milestone 4. Complete a fluvial geomorphic assessment of coarse sediment supply needs and sources to maintain, improve, or supplement gravel recruitment and natural sediment transport processes linked to stream channel maintenance, erosion and deposition, maintenance of fish spawning areas, and the regeneration of riparian vegetation. Develop and implement a program to reduce erosion and maintain gravel recruitment on at least one tributary within the Eastside Delta Tributaries EMZ.

Status: Research funded under an ERP contract and a few AFRP contracts provides the geomorphic assessment specified in this milestone for the Mokelumne River. The work included incorporating results from field pilot studies into a 2D model for comparing gravel augmentation alternatives. Under an AFRP contract, EBMUD utilized the geomorphic assessment to develop a five-year gravel augmentation project that will begin when the environmental documents are finalized.

An AFRP funded study suggested that gravel is not a limiting factor for salmonids on the Calaveras River. However, gravel could become limiting if additional flows are provided to restore anadromous fish populations.

The extent of gravel replenishment and erosion control measures needed for the Cosumnes River has yet to be assessed.

Progress: On schedule

Next Steps: Information gained from the Mokelumne River geomorphic assessment and monitoring of the gravel augmentation project can inform future efforts on the Mokelumne River and the other Eastside Delta tributaries.

Milestone 5. Develop floodplain management plans, including feasibility studies to construct setback levees, to restore and improve opportunities for rivers to inundate their floodplain on a seasonal basis for at least one tributary within the Eastside Delta Tributary EMZ.

Status: ERP funds contributed towards developing floodplain management plans, including feasibility studies, as specified in this milestone. Contracts fro plans include the Cosumnes and Mokelumne River Floodplains Integrated Resource Management Plan to collect geomorphic information and conduct modeling to assess hydrogeomorphic impacts of levee setback and breach designs that optimize both restoration and flood management goals on the lower Cosumnes River; developing an implementation plan for resource management actions for both the Cosumnes and Mokelumne River floodplains that will evaluate the feasibility of alternatives including setback levees, breaches, and bypasses that will restore significant natural riparian and floodplain ecosystem function while optimizing the flood attenuation and groundwater recharge capabilities of the restored floodplain; acquisitions of key properties along the Cosumnes River corridor that will provide future opportunities for floodplain restoration; and developing and maintaining a watershed stewardship plan for the Mokelumne River to guide willing or interested landowners to voluntarily implement riparian restoration, levee setback or improvement programs, floodplain agricultural practices, and wildlife buffers.

The Watershed Program recently provided funds to support the development of a comprehensive, integrated management plan for the entire Cosumnes River Preserve that consolidates plans prepared for specific parcels by current Preserve partners.

Progress: On schedule

Next Steps: Completion of the Cosumnes and Mokelumne River Floodplains Integrated Resource Management Plan should fulfill the requirements of this milestone. The contract for this project is in the approval process. These efforts should be coordinated very closely with other planning programs such as the North Delta Flood Control and Ecosystem Restoration Project to ensure full integration and maximization of potential benefits from the two efforts.

Delta Region Habitats

The next 11 milestones are related to improving, protecting, maintaining, or developing various kinds of habitat which contribute to listed species recovery. Habitat types addressed in the ERP for the Delta EMZ include: tidal perennial aquatic, nontidal perennial aquatic, delta sloughs, midchannel islands and shoals, fresh emergent wetland, seasonal wetland, riparian and riverine aquatic, inland dune shrub, perennial grasslands, freshwater fish habitat, essential salmonid habitat, and agricultural lands. Habitat types addresses in the ERP for the Eastside Delta Tributaries EMZ include seasonal wetland, riparian and riverine aquatic, freshwater fish habitat and essential salmonid habitat.

Milestone 6. In the Sacramento-San Joaquin Delta EMZ, cooperatively enhance at least 15 percent of the ERP target for wildlife friendly agricultural practices.

Status: To meet this milestone, 6,000 to 11,250 acres, which is 15 percent of the 40,000-75,000 acre target, would be managed using wildlife-friendly agriculture practices. This objective has been met. Several ERP contracts were issued to meet this milestone. In the East Delta EMU, there are contracts that deal with acquiring, continuing management of existing agriculture operation, and developing an improved water management infrastructure for 9,200 acres on Staten Island; development of a plan to manage 3,040 acres of agricultural land in a manner that optimizes habitat values; acquisition to provide floodplain restoration, where wildlife-friendly agriculture practices should be considered or applied where consistent with some of the acquisitions; and development of a watershed stewardship plan that will voluntarily implement floodplain agriculture practices, and wildlife/agriculture buffers. In the North Delta EMU, the Yolo Bypass fosters stakeholder stewardship through the Yolo Bypass working group. This working group provides a forum for stakeholders and land owners to encourage practices that protect and enhance fish and wildlife habitat consistent with economic viability of agriculture practices in the bypass. Also in the North Delta EMU, there is a contract that is developing plans for fee acquisition or conservation easement acquisition within the Jepson Prairie-Prospect Island Corridor that protects continued agriculture and encourages wildlife-friendly practices.

Progress: Ahead of schedule

Next Steps: Proposition 50 obligations for funding additional wildlife-friendly agricultural practices should be met, prioritizing projects that help meet other needs, such as providing buffers between natural or restored habitat and traditional agriculture or urban areas. This should be done in coordination with agencies with wildlife enhancement agriculture easement programs.

Milestone 7. Restore a minimum of 15 miles of slough habitat (widths less than 50 to 75 feet) in each of the North, East, South, Central and West Delta EMUs that allows for the colonization of delta mudwort and delta tule pea.

Status: Several ERP contracts address portions of the milestone for the North and East Delta EMUs. Some of the contracts focus on restoration planning in the North Delta EMU that may include favorable conditions for delta mudwort and delta tule pea. An ERP contract in the North Delta restored one mile of native riparian habitats along Barker Slough and Calhoun Cut. Other ERP contracts currently in the planning phase address the goal for the East Delta EMU. Most progress was made in the North and East EMUs and less in South and Central and West EMUs.

Progress: On schedule

Next Steps: Additional follow up is needed to determine slough widths, extent of restoration in linear miles of the restoration site in the North Delta EMU, and to determine if the restored conditions are favorable to delta mudwort and delta tule pea.

Milestone 8. Restore a minimum of 500, 250, 1,000, and 2,500 acres of nontidal emergent wetland in the North, East, South, and Central and West Delta EMUs, respectively. Establish at least one population of bristly sedge in each EMU.

Status: ERP funds and funds from other sources funded land acquisition and planning for restoration as specified in this milestone. Several large-scale regional planning projects are underway which may result in restoration of nontidal emergent wetland in the Delta. Contracts in the North Delta, in the East Delta and in the Central and West Delta EMUs include or will likely include restoration of nontidal emergent wetland. No acquisition or planning for restoration of nontidal emergent wetland has occurred in the South Delta EMU. The Stone Lakes National Wildlife Refuge (NWR) Land Acquisitions project and Dutch Slough are highlighted as examples below.

The Stone Lakes NWR Land Acquisitions project in the North Delta EMU funded the acquisition, restoration design and permitting of the 537-acre Sun River property. The acquisition protected approximately 169 acres of tule marsh, riparian and aquatic habitat, primarily open water slough, associated with South Stone Lake. The CVPIA b(1) other program recently funded restoration of the site, which will include restoring approximately 142 acres of nontidal emergent wetland habitat.

The Dutch Slough Tidal Marsh Restoration project located in the Central and West Delta EMU involves acquisition and restoration planning of 1,166 acres adjacent to Dutch Slough. Detailed, planning, design and environmental documentation are underway. The restoration design will include a variety of habitat types including nontidal emergent wetland.

No populations of bristly sedge have been established in the Delta.

Progress: On schedule

Next Steps: Good progress was made for nontidal emergent wetland restoration in North, East and Central and West Delta EMUs, but there is a need to focus more efforts for the South Delta EMU. Need to focus on establishing populations of bristly sedge in all EMUs. Next steps include continued restoration planning, implementation and monitoring of Delta restoration projects that include restoration of nontidal emergent wetland. Establishing new populations of bristly sedge will require determining specific habitat requirements and techniques for establishing populations, followed by identification of suitable sites, and development and implementation of appropriate restoration plans based on those requirements.

Milestone 9. Restore a minimum of 500, 500, 4,000, and 5,000 acres of tidal emergent wetland in the North, East, South, and Central and West Delta EMUs, respectively.

Status: The contracts associated with this milestone are mostly for land acquisition and restoration planning. Contracts cover acquisition, planning, restoration and monitoring of 5,200-acre Liberty Island in the North Delta EMU, described in more detail below. Other ERP contracts in the East Delta EMU are associated with the 1,600-acre McCormack Williamson Tract, which is being considered under a broad, multi-program planning effort, the North Delta Flood Control and Ecosystem Restoration Project. Alternatives being considered include tidal emergent wetland restoration. Other projects in the East Delta EMU include restoration planning of Canal Ranch, of which a portion of the approximately 3,000 acres could be restored to tidal emergent wetland, and contracts for protection and enhancement of habitats including tidal emergent habitat along Georgiana Slough and the North Fork of the Mokelumne River. In the Central and West Delta EMUs, contracts show progress toward the goal of 5,000 acres. There are contracts for acquiring and restoration planning of multiple habitats including tidal marsh for 1200-acre Dutch Slough, and contracts for restoration planning for about 110 acres of tidal marsh at two other sites. Restoration of Liberty Island is highlighted as an example below.

The majority of Liberty Island, 4,760 acres (out of total 5,200 acres) was acquired with ERP funding in 1999. The island has been in a tidally-flooded condition since 1998 when the levees breached, and has been passively restoring since then. Currently about 200 acres of the area consist of upland and seasonal wetlands with some riparian habitat along the northern edge of the island and remnant levees, 800 acres is tidal emergent wetland, and the remainder is tidal perennial aquatic habitat (Mager, pers.comm.). The amount of each habitat type is expected to change over time as the site evolves. Staff from CDFG, CDWR and the Service are collaborating on monitoring several aspects of the passive restoration including bathymetry, water quality, benthos, zooplankton, fish and wildlife use and vegetation.

Progress: On schedule

Next Steps: Next steps include continued restoration planning, implementation and monitoring of Delta restoration projects that include restoration of tidal emergent wetland. Need to increase focus for the South Delta EMU. Inventories should be conducted to determine if any of the sites could also potentially be suitable for delta mudwort, delta tule pea, and bristly sedge.

Milestone 10. Conduct surveys to locate potential habitat restoration sites capable of supporting Antioch dunes evening primrose, Contra Costa wallflower, and Lange's metalmark butterfly. Enhance 50 acres of low to moderate quality Antioch inland dune scrub habitat to support these species. Annually monitor establishment success.

Status: There is an ERP contract that involves acquisition of Dutch Slough, an area consisting of approximately 1,166 acres. Another contract involves restoration planning of up to 101 acres of Antioch inland dune scrub on the Dutch Slough parcel.

Progress: On schedule

Next Steps: Additional surveys should be conducted to assess the distribution of Antioch inland dune scrub habitat and identify suitable areas for restoration. Enhancement of habitat types that support populations of Antioch dunes evening primrose, Contra Cost wallflower, and Lange's metalmark butterfly may require investigating techniques for establishing plant and butterfly host plant populations. Establishment success should be monitored at restoration sites.

Milestone 11. Restore a minimum of 125 acres of channel islands and 125 acres of shoals in the Delta.

Status: ERP contracts were awarded for planning and restoration of in-channel islands consisting of approximately five acres along Webb Tract 1 and 3 and Little Tinsley Island. Various combinations of biotechnical erosion control techniques were implemented to demonstrate their effectiveness in controlling shoreline erosion and the potential for accreting new fine sediments for habitat substrate. Another contract was issued to conduct restoration planning on Franks Tract and includes the potential for restoration of shoal habitat.

The Delta In-Channel Islands Workgroup was formed in 1996 under the auspices of the San Francisco Estuary Project and has representatives from State and Federal agencies (including ERP Implementing Agencies); non-governmental organizations, landowners, and stakeholders. One of the objectives of this workgroup is to improve coordination between the workgroup participants and to look for opportunities to develop collaborative projects that will help implement the Comprehensive Conservation and Management Plan (CCMP, adopted in March 1993). The workgroup prepared a draft Framework Agreement regarding the conservation and restoration of delta in-channel islands which is currently under review by workgroup member agencies and participants.

Progress: On schedule

Next Steps: Participation in the Delta In-Channel Islands Workgroup by ERP Implementing Agencies should continue. Opportunities to coordinate projects that will meet both CCMP and ERP goals should be identified. Shoals are dynamic from season to season. A better understanding of the ecological attributes of shoals is needed to determine if this milestone is being achieved.

Milestone 12. Develop and implement a program to establish, restore, and maintain riparian habitat to improve floodplain habitat, salmonid shaded riverine aquatic habitat, and instream cover along at least one tributary within the Eastside Delta Tributary EMZ.

Status: ERP funds acquired lands along the Cosumnes River to maintain existing habitat and plan future restoration of riparian and floodplain habitats. Projects included development of an implementation plan for resource management actions for both the Cosumnes and Mokelumne River floodplains. This implementation plan will evaluate the feasibility of alternatives including setback levees, breaches and bypasses that will restore significant natural riparian and floodplain ecosystem function. ERP contracts addressed landscape level planning for potential floodplain restoration opportunities on the lower Cosumnes and Mokelumne rivers. A Watershed Program grant will support development of the Cosumnes River Preserve Management Plan, a comprehensive, integrated management plan for the entire Cosumnes River Preserve that

consolidates plans prepared for specific parcels by current Preserve partners. An ERP contract addresses this milestone for the Mokelumne River below Camanche Dam by protecting 2.3 acres of riparian habitat and providing streambank protection for improved fish habitats. An ERP contract furthers this milestone by continuing the watershed stewardship plan development for the lower Mokelumne River to guide willing and interested landowners to voluntarily implement floodplain agriculture, riparian habitat, and set back levees.

Progress: On schedule

Next Steps: Completion of the Cosumnes and Mokelumne River Floodplains Integrated Resource Management Plan and the Cosumnes River Preserve Management Plan will fulfill the milestone requirement for developing a program for the Cosumnes River and may meet the requirement for the Mokelumne River. Next steps should include further implementation of components of these plans related to riparian habitat and continued monitoring of riparian habitat resulting from breaches along the Cosumnes River.

Milestone 13. Implement 25 percent of the ERP target for diverse, self-sustaining riparian community for each EMU in the Sacramento-San Joaquin Delta EMZ.

Status: The Delta EMZ riparian and riverine aquatic habitat 30-year targets (with 25 percent of the target in parentheses) are 20-35 miles (5-8.75 miles) in the North Delta EMU, 8-15 miles (2-3.75 miles) in the East Delta EMU, and 25-45 miles (6.25-11.25 miles) in the South Delta EMU. The ERP targets also include minimum width requirements (certain percentages of either 75- or 300-foot widths) associated with the distance requirements. There are no riparian habitat targets for the Central and West Delta EMUs.

Several ERP contracts involve riparian habitat planning and implementation in the Delta EMZ. Planning projects that include shaded riverine aquatic habitat along the Sacramento River, Sutter, Steamboat and Cache sloughs were completed for the North Delta EMU. One mile of riparian habitat was restored along Barker Slough and Calhoun Cut in the North Delta EMU. Riparian woodland habitat is restoring passively on 1,300-acre Prospect Island in the North Delta EMU.

Completed projects in the East Delta EMU include implementation of bank stabilization along 0.9 and 0.4 mile stretches of Georgiana Slough and 0.6 mile stretch of the North Fork Mokelumne River and planting 7 miles of riparian tree species on waterside berms along Georgiana Slough. An additional 3.8 miles of bank protection that includes riparian and tidal wetland habitat restoration is currently underway along the Sacramento River and various sloughs in the North and East Delta EMUs. Approximately 71 acres of riparian habitat are to be restored in the East Delta on the Sun River property in Stone Lakes NWR. ERP contracts in the East Delta EMU are associated with the 1,600-acre McCormack Williamson Tract, which is being considered under a broad, multi-program planning effort, the North Delta Flood Control and Ecosystem Restoration Project. Alternatives being considered include riparian habitat restoration.

Progress: On schedule

Next Steps: Next steps include continued restoration planning, implementation and monitoring of riparian habitat restoration projects. Need increased efforts for the South Delta EMU. Protected and restored habitat characteristics should be evaluated and quantified. Additional riparian habitat protection and restoration opportunities, including partnerships with other program elements, should be explored.

Milestone 14. Restore a minimum of 300 acres of self-sustaining or managed diverse natural riparian habitat along the Mokelumne River, Cosumnes River, and Calaveras River and protect existing riparian habitat.

Status: Several ERP contracts that propose riparian restoration actions for both the Mokelumne and Cosumnes rivers are early in the planning stages. Other ERP contracts include preservation of approximately 45 acres on the Mokelumne River; addressing the Cosumnes River through acquiring property along the river to preserve existing habitat and to promote future restoration opportunities; and planning for future acquisition and restoration on the Cosumnes River.

Progress: On schedule

Next Steps: Next steps include continued restoration planning, implementation and monitoring of riparian habitat restoration projects. There is a need to increase the level of effort for the Calaveras River. Protected and restored habitat characteristics should be evaluated and quantified. Additional riparian habitat protection and restoration opportunities, including partnerships with other program elements, should be explored.

Milestone 15. Enhance, protect and restore 1,000 to 1,500 acres of seasonal wetlands in the East Delta EMU for optimum greater sandhill crane habitat.

Status: There is an ERP contract that addresses improvements in crane habitat through development of improved water control infrastructure associated with agricultural production areas. One restoration project in the planning stage will focus on restoration of natural processes for seasonal wetland regeneration and management. Another project to improve crane habitat through acquisition of agricultural easements is currently underway in the East Delta EMU. An agricultural easement on 649 acres was acquired to protect foraging areas for sandhill cranes.

Progress: On schedule

Next Steps: Future efforts should focus on protecting and restoring seasonal wetlands near suitable roost sites because of the limited availability of these sites, especially early in the fall/winter when the first birds start showing up in the Delta (Ivey and Herziger, 2003). Efforts to promote favorable agricultural management practices should continue as well, and efforts to restore permanent habitat that are managed as optimum habitat for cranes should be promoted.

Milestone 16. Restore a minimum of 500, 250, 500, and 750 acres of tidal perennial aquatic habitat in the North, East, South, and Central and West Delta EMUs, respectively.

Status: There are contracts that cover acquisition, planning, restoration and monitoring of 5,200-acre Liberty Island in the North Delta EMU. The majority of Liberty Island, 4,760 acres (out of

5,200 acres) was acquired with ERP funding in 1999. The island has been in a tidally-flooded condition since 1998 when the levees breached, and has been passively restoring since then. Currently about 200 acres of the area consist of upland and seasonal wetlands with some riparian habitat along the northern edge of the island and remnant levees, 800 acres is tidal emergent wetland, and the remainder is tidal perennial aquatic habitat of various depths (Mager, pers. comm.). The amount of each habitat type is expected to change over time as the site evolves. Staff from CDFG, CDWR and the Service are collaborating on monitoring several aspects of the passive restoration including bathymetry, water quality, benthos, zooplankton, fish and wildlife use and vegetation. These monitoring results will provide better information on species use of the tidal perennial aquatic habitat as a function of depth.

ERP contracts in the planning phase address the milestone objectives for the East Delta EMU. These contracts include the McCormick Williamson Tract acquisition and restoration planning, Canal Ranch habitat restoration planning, and Cosumnes/Mokelumne corridor restoration planning projects. ERP contracts in the Central and West Delta EMUs involve the acquisition and restoration planning of Dutch Slough, which will include restoration of shallow water habitat (tidal perennial aquatic habitat), and restoration planning for Rhode Island.

Progress: On schedule

Next Steps: Next steps include continued restoration planning, implementation and monitoring of Delta restoration projects that include restoration of tidal perennial aquatic habitat. There is a need to increase the level of activity for the South Delta EMU.

Delta Region Stressor Reduction

The last 19 milestones for the Delta Region address stressor reductions. Delta EMZ stressors relating to milestones in this region include invasive species introductions, non-native wildlife, predation and competition, water diversions, and contaminants. Eastside Delta Tributaries EMZ stressors include water diversions, dams and other structures, invasive riparian and marsh plants, predation and competition, contaminants, and artificial propagation of fish. Milestones related to environmental water quality issues account for 12 of these 19 milestones. ERP has invested more than \$59 million dollars in 50 projects at the landscape level to address environmental water quality issues; how these some of these investments relate to the specific contaminant milestone is presented below.

Milestone 17. Develop and implement a program to address inadequate instream flows for steelhead and Chinook salmon on streams within Eastside Delta tributaries. Where appropriate provide adequate flows for Sacramento splittail and green sturgeon.

Status: ERP contracts and funds from other sources contributed directly toward addressing inadequate stream flows. A contract completed design and construction modifications for both of the Granlees Diversion Dam fish ladders and the flow barrier wall on the Cosumnes River to improve low flow conditions for fish passage. Another ERP contract addresses this milestone for both the Cosumnes and Mokelumne rivers through research to develop a model to simulate the hydrological effects of historic and projected land use or land cover changes, and to identify surface and groundwater components of an integrated approach for restoration and flood control

improvements. This modeling should be further assessed as a tool for evaluating feasibility for improved flows on the Cosumnes River. This research and modeling suggests that severe depletion of the ground water aquifers could have significant impacts to river flow early in the season which prevent fall or early winter flow and subsequent fish passage in the Cosumnes River (Mount, et al., 2001). Ongoing AFRP funded studies will provide estimates of minimum flow requirements for anadromous salmonids in the Cosumnes and Calaveras rivers. A Habitat Conservation Plan (HCP) being developed for the Calaveras River includes actions to resolve fish passage concerns.

An ERP-funded contract is investigating the life history and habitat needs of green sturgeon in the Bay-Delta system including determining their movements and distribution, habitats, especially spawning grounds, and tolerance to various stressors and habitats.

The EWA is a cooperative management program, the purpose of which is to provide protection to at-risk native fish species of the Bay-Delta estuary through environmentally beneficial changes in SWP and CVP operations at no uncompensated water cost to the projects' water users. Actions that protect fish species include reduction of pumping at the Delta SWP and CVP export pumping plants. The EWA assets can also provide other benefits such as augmenting instream flows and Delta outflows.

Other non-CALFED programs may be contributing toward attainment of this milestone. For example, there are ongoing negotiations between the fisheries agencies and utility districts for operational changes, such as those with EBMUD to improve operations of the Camanche and Woodbridge Dams on the Mokelumne River to meet fishery needs.

Status: Behind schedule

Next Steps: Continue research and modeling of instream flow needs, and support interactions between fisheries agencies and water management authorities on the Cosumnes, Mokelumne, and Calaveras rivers to promote improvement of their water release programs.

Milestone 18. Provide unimpeded upstream and downstream passage for salmon and steelhead on Eastside Delta tributaries.

Status: A contract completed design and construction modifications for both of the Granlees Diversion Dam fish ladders and the flow barrier wall on the Cosumnes River to improve low flow conditions for fish passage. An HCP being developed for the Calaveras River includes actions to resolve fish passage concerns. The ERP funded contracts for feasibility analysis, permitting and design for replacement of Woodbridge Dam and inclusion of new fish ladders to improve passage on the Mokelumne River. The new dam and fish ladders currently are under construction, funded by bonds financed by Woodbridge Irrigation District's sale of surplus water to the City of Lodi. There is an ERP contract that addresses the feasibility, planning, and design for improved fish passage at 29 unscreened diversions between Bellota Weir and New Hogan Dam on the Calaveras River. One landscape level ERP contract, which could also have implications for Eastside Delta tributaries, looks at identifying and addressing the potential for dam removal.

The Watershed Program funded removal of a dam on Murphy Creek, a tributary of the Mokelumne River, opening up 2 miles of stream habitat.

Progress: On schedule

Next Steps: Need to increase the efforts for the Calaveras River. Coordinate with projects addressing instream flows, screening, and temperature programs to work towards obtaining unimpeded fish passage. Continue research and support interactions between fisheries agencies and water management authorities on the Cosumnes, Mokelumne, and Calaveras rivers to promote improvement for unimpeded fish passage.

Milestone 19. Assist in the development and implementation of a black and clapper rail impact reduction program.

Status: No ERP or other funds were identified that addressed this milestone. No clapper rail habitat extends into the Delta EMZ.

Progress: Behind schedule

Next Steps: Future evaluations of wetland enhancement, restoration, and protection projects should include potential linkages for improved conditions for black rails. Restoration planning for the Dutch Slough parcel in the Central and West EMUs is addressing black rail habitat.

Milestone 20. Develop and begin implementation of a program to reduce or eliminate the influx of non-native aquatic species in ship ballast water.

Status: Several ERP contracts in the Bay and Delta Regions were awarded to address this milestone. These contracts provide for: public education and awareness efforts; data collection to reduce the nonnative invasive species (NIS) introduction from ballast water; forming and supporting the NIS Advisory Council to promote, prevent and guide eradication of NIS; preparing five reports that are both long-range strategies and short-term guides for local eradication; a West Coast Ballast Outreach effort; and a project to determine the biological, physical, and chemical characteristics of ballast water arriving in the San Francisco Bay-Delta Estuary. Continued support, especially of operational components will be necessary, but strong progress has been made regarding this milestone.

Other non-CALFED programs that may be contributing towards attainment of this milestone are under evaluation. For example, the Service, CDFG, and the California Department of Food and Agriculture (CDFA) may be involved in ongoing negotiations with ports and shipping companies for operational changes, inspection programs, and regulations to improve control of NIS introduction from ballast water

Progress: On schedule

Next Steps: Although a program has not yet been implemented, there has been substantial progress made regarding this milestone. Continued coordination amongst the parties involved in ballast water efforts needs to continue. Efforts should be made by the NIS Advisory Council to

synthesize the efforts to date and develop a strategy for filling any data gaps and implementing a plan that focuses on better control measures for ballast water.

Milestone 21. Complete installation of fish passage facilities at Bellota Weir, Clements Dam, and Cherryland Dam on the Calaveras River and provide passage flows.

Status: An ERP contract addresses the feasibility, planning, and design for improved fish passage at 29 unscreened diversions between Bellota Weir and New Hogan Dam on the Calaveras River. An ERP implementation contract addressed improving fish passage at Bellota Weir through constructing a fish ladder.

Progress: Behind schedule

Next Steps: Continue research and support interactions between fisheries agencies and water management authorities on the Calaveras River to promote improvement of their fish passage programs. The fish passage issues at Clements Dam and Cherryland Dam on the Calaveras River need to be addressed, as does the issue of providing for fish passage flows at all locations. The need for adequate passage flows is central to any further successful restoration of anadromous salmonids in the Calaveras River.

Milestone 22. Develop and begin implementation of a demonstration program to reduce invasive non-native plant abundance within at least one EMU in the Delta.

Status: Some ERP contracts that deal with NIS in the San Francisco Bay also apply to the Delta, like the contracts that initiated and provided continued support for the NIS Advisory Council. Other contracts support comprehensive efforts to map occurrences of, eradicate, or control a variety of NIS species in the Delta Region such as perennial pepperweed (*Lepidium latifolium*), *Arundo*, purple loosestrife, and shallow water aquatic NIS species. Still other contracts provide for education and identification videos and guides to help educate the public regarding NIS plants. There is a contract that addresses eradication of NIS plants on seven miles of levee on Georgiana Slough. Other contracts control or eradicate NIS plants as a subset of Delta habitat restoration. The ERP sponsored an invasive weeds workshop to share lessons learned from existing NIS management efforts.

Other non-CALFED programs are contributing to towards this milestone. For example, CDFG and the Service conduct regular management practices to control and eradicate NIS on their properties. Additionally, County Agriculture Commissioners and Agriculture Extension Offices provide expertise and guidance for control of NIS.

Progress: On schedule

Next Steps: To date, there are several local eradication programs as well as substantial planning to map distribution of certain NIS species. Continued support of the NIS Advisory Council and local programs is needed. Regional priorities should be established, if not already available, and coordinated both locally and at the landscape level in order to implement a program. Lessons

learned from the existing efforts should be evaluated for effectiveness for both control and cost and made available.

Milestone 23. Implement a program to improve fish passage and reduce predation on juvenile salmonids below Woodbridge Dam on the lower Mokelumne River that includes the following elements: (1) improving the form and function of the stream channel; (2) rebuilding the Woodbridge Dam fish passage and diversion screening facilities to minimize losses of downstream migrating salmon and steelhead; and (3) improving the fish bypass discharge.

Status: Chinook salmon and steelhead upstream and downstream passage improvements on the lower Mokelumne River were achieved through efforts of a local irrigation district enhancing fish bypass discharge. The ERP funded two projects for feasibility analysis, permitting and design for replacement of Woodbridge Dam and inclusion of new fish ladders to improve passage on the Mokelumne River. The new dam and fish ladders are currently under construction, funded by bonds financed by Woodbridge Irrigation District's sale of surplus water to the City of Lodi. Cost share funds from Woodbridge Irrigation District provided fish bypass discharge enhancements.

Progress: On schedule

Next Steps: Future actions associated with this milestone could include improving the form and function of the stream channel.

Milestone 24. Consolidate and screen 50 small agricultural diversions in the Delta, prioritized according to size, location, and season of operation.

Status: There are contracts that were awarded that partially address this milestone. These contracts completed project planning and design for two Hastings Island diversions and carrying out and enhancing the Banta-Carbona Screen Project, which had multiple funding sources and screens a total of 250 cfs of diversions on the San Joaquin River. One screen and the planning and design for two others were accomplished through these contracts. Another contract will address the installation of fish screens at the Woodbridge Dam on the Mokelumne River. A final contract examines the feasibility to screen diversions between Bellota Weir and New Hogan Dam on the Calaveras River. Of the 2,258 diversions in the Sacramento-San Joaquin Delta EMU, 25 have been screened. Of the 384 diversions in the Eastside Delta Tributaries EMU, 4 have been screened. It was unclear if the milestone means to consolidate 50 smaller agricultural diversions before screening them.

Progress: Behind schedule

Next Steps: Focus on construction of fish screens between Bellota Weir and New Hogan Dam to follow up on the feasibility work accomplished by previous efforts.

This milestone needs to be scientifically vetted to determine if new small diversion screens are appropriate and in what priority. In their December 2001 memo (http://calwater.ca.gov/Programs/EcosystemRestoration/InterimScienceBoard/ISB_ReportOnFishScreens.pdf), the ERPSB questioned the need to screen small diversions given the paucity of scientific information

on the effectiveness and ecosystem benefits of screening small diversions. They suggest that next steps include a study on the individual, population and ecosystem benefits of screening remaining small diversions. Results from this study would inform future prioritization and funding for screens.

Milestone 25. Upgrade screens at Southern Energy's Contra Costa power plants with screens acceptable to the Fish and Wildlife Agencies.

Status: Negotiations between Mirant (formally Southern Energy) recently broke down with the fisheries agencies. Mirant is in Chapter 11 and during recent negotiations with State and Federal fishery agencies, company representatives stated that they will not install and operate a positive fish barrier at their power generating facilities to lower their take of aquatic organisms. The current fish screening system is a traveling fish screen that exceeds delta smelt criteria 0.2 fps, and Mirant is proposing to utilize a Variable Speed Device (VSD) to reduce their take of aquatic organisms into their once-through cooling systems.

Progress: Behind schedule

Next Steps: It appears that it will be a minimum of four years before progress is made towards improving fish screening at the plant because of Mirant's current financial situation.

Milestone 26. Actions to minimize or eliminate low dissolved oxygen conditions (DO sag) in lower San Joaquin River near Stockton (from Phase II Report):

- Complete studies of causes for DO sag in San Joaquin River near Stockton.
- Define and implement corrective measures for DO sag.
- Finalization of investigation of methods to reduce constituents that cause low DO for inclusion in total maximum daily load (TMDL) recommendation by the Central Valley RWQCB.
- Finalization of Basin Plan Amendment and TMDL for constituents that cause low DO in the San Joaquin River
- Implement appropriate source and other controls and other management practices, as recommended in the TMDL, to reduce anthropogenic oxygen depleting substances loadings and minimize or eliminate low DO conditions.

Status: The Stockton Deep Water Ship Channel (DWSC) is in the South Delta in the lower San Joaquin River and experiences regular periods of low dissolved oxygen. Three main factors contribute to this impairment: (1) upstream loads of oxygen demanding substances, (2) DWSC geometry, and (3) reduced flow through the DWSC. Because upstream sources of oxygen demanding substances are an important factor, this milestone is also repeated as Milestone 100 in the San Joaquin River Region.

Results from two studies funded in 1999 and 2001 provided substantial information about the sources and causes of low dissolved oxygen (DO sag) in the DWSC. This information was validated in the Peer Review Report from July 2002. These studies and the Peer Review recommendations provide the basis for further monitoring and studies on upstream sources, plans for construction of an aeration demonstration project, and consideration of future source control

pilot projects. The data from these studies also provided the basis for a stakeholder implementation plan and development of the TMDL for the Central Valley Regional Water Quality Control Board (CVRWQCB) (May 2004 Final Draft Basin Plan Amendment and TMDL Report). This Basin Plan Amendment is available for public review and is scheduled for adoption by the CVRWQCB in July 2004. The Basin Plan Amendment proposes a phased approach to correct the DO problem. The phased approach allows for the development of an additional studies and actions that will be used to consider a final solution in a revised TMDL scheduled for 2009. The demonstration aeration project is considered an interim control solution to improve water quality conditions while more detailed studies regarding the upstream sources of oxygen depleting substances are completed. The remaining studies on sources and causes (contract under development) and the current modeling projects should be completed in 2007. DO conditions should improve following completion and activation of the aeration demonstration project in 2005.

The ERP is working closely with the CVRWQCB and other agencies to facilitate technical and stakeholder efforts in support of the TMDL. More recent efforts include the integration of these efforts with other Delta actions as part of the Delta Improvements Package (DIP). Through the DIP process CDWR expressed a willingness to play a greater role in coordination and implementation of the demonstration aeration project. The ERP has awarded seven grant contracts that have or will contribute to this milestone. There are other projects under different grant programs (e.g., State Water Resources Control Board's Proposition 50 grants) that contribute to this milestone, but were not evaluated.

Progress: On schedule

Next Steps:

- Finalize contract for upstream monitoring studies project by July 2004.
- Completion of the CVRWOCB TMDL and Basin Plan Amendment by July 2004.
- Complete Draft ERP Implementation Plan by August 2004.
- Responsible parties submit a Study Plan to CVRWOCB by January 2005.
- Complete upstream monitoring studies and modeling studies by June 2007.
- DWR will design, construct and operate a demonstration aeration system (2005-2008).
- CVRWQCB complete a final TMDL/Basin Plan Amendment by 2009.

Milestone 27. Develop, implement, and support measures to reduce pollutant (oxygen depleting substances, nutrients, and ammonia) discharges from concentrated animal feeding operations (from Phase II Report).

Status: There are no ERP contracts that specifically address concentrated animal feeding operations in the Delta Region, in part because there are few large concentrated animal operations there. However, there are two projects in other regions that have contributed indirectly to the objectives of Milestone 27 through outreach and education and by developing new data about water quality impacts from animal feeding operations. Since the Delta Region is affected by upstream sources in the San Joaquin River watershed, the description under Milestone 101 (San Joaquin River Region) contains a more complete description of projects and actions that may affect Delta water quality. There may be other projects under different grant programs that would contribute more directly to this milestone that were not evaluated.

Progress: Under evaluation

Next Steps:

- Summarize and evaluate projects, actions, and monitoring being done by other agencies and
 organizations related to this issue. This includes information on the extent of the
 contamination and ecological effects, as well as potential regulatory or management actions
 to reduce sources.
- Working with other agencies and organizations, identify gaps and high priority actions to reduce ecological effects of oxygen depleting substances, nutrients, and ammonia in the Delta.
- Address high priority actions, as appropriate.

Milestone 28. Encourage regulatory activity to reduce discharge of oxygen reducing substances and nutrients by unpermitted dischargers (from Phase II Report).

Status: There are no funded ERP contracts that specifically address this milestone. However, both ERP and the CALFED DWQP have funded nine contracts for more than \$12 million that contribute to monitoring and research needs for improved regulatory controls of nutrients and other oxygen depleting substances. The ERP works closely with the CVRWQCB, which is taking steps to address this milestone using its existing authority (i.e., agricultural waiver and non-point source pollution, TMDL process and animal waste programs). There are other contracts awarded by the State Water Resources Control Board (SWRCB) under Proposition 50 that contribute to this milestone and were not evaluated.

Progress: Under evaluation

Next Steps:

- Summarize and evaluate projects, actions, and monitoring being done by other agencies and organizations related to this issue. This includes information on the extent of the contamination and ecological effects, as well as potential regulatory or management actions to reduce sources.
- Working with other agencies and organizations, identify gaps and high priority actions to reduce ecological effects of oxygen reducing substances and nutrients by unpermitted dischargers in the Delta.
- Address high priority actions, as appropriate.

Milestone 29. Actions to reduce fine sediment loading to streams, especially Tuolumne, Merced, Stanislaus, Cosumnes, Napa, and Petaluma Rivers, and Sonoma Creek, due to human activities (from Phase II Report and Water Quality Program Plan):

- Participate in implementation of U.S. Department of Agriculture (USDA) sediment reduction program.
- Implement sediment reduction BMPs in construction areas, on agricultural lands, for urban storm water runoff, and other specific sites.
- Implement stream restoration and revegetation work.
- Quantify and determine ecological impacts of sediments in target watersheds, implement corrective actions.

Status: One contract was awarded for the Delta Region. The resulting project will produce a model to simulate the hydrological effects of historic and projected land use or land cover changes and surface and groundwater management methods. This project indirectly relates to the milestone, but the information from this project could contribute to future evaluation and improvements in reducing fine sediment loading. One of the project's study areas includes the Cosumnes River watershed (a key watershed listed in the milestone). Contracts from other fund sources and programs may also contribute to this milestone, but were not evaluated.

Progress: Under evaluation

Next Steps:

- Summarize and evaluate projects, actions, and monitoring being done by other agencies and
 organizations related to this issue. This includes information on the extent of the ecological
 effects, as well as potential regulatory or management actions to reduce sources.
- Working with other agencies and organizations, identify gaps and high priority actions to reduce ecological effects of fine sediment to streams.
- Address high priority actions, as appropriate.

Milestone 30. Conduct the necessary research to determine no adverse ecological/biological effects threshold concentrations for mercury in sediments and key organisms in the Bay-Delta estuary and its watershed.

Status: Research indicates that there are many factors affecting mercury methylation and bioaccumulations, and an "effects threshold" for mercury concentration in sediments cannot be set without considering these other factors. ERP has made substantial investments in research projects to understand mercury sources, transformations, and factors controlling the methylation or demethylation and bioaccumulation processes. Two studies are completed; four more studies are recently started that will evaluate sources, processes and effects. There are still significant knowledge gaps in understanding mercury transformations, bioaccumulation and effects to fish and wildlife. A mercury strategy has been developed by independent scientists, with input from researchers, agencies and stakeholders, and it provides information on what is known and a framework for future investigations. See other milestones (48, 77 and 106) for additional projects that address this milestone at a regional level.

Progress: On schedule

Next Steps:

- Develop an implementation plan for the mercury strategy, in coordination with other agencies and research groups. Provide a framework for coordination and communication for existing mercury research groups.
- Solicit for additional projects to implement the mercury strategy, with emphasis on understanding effects of restoration on mercury availability, and evaluating ecological effects of mercury contamination.

Milestone 31. Conduct the following mercury evaluation and abatement work in the Cache Creek watershed (from Phase II Report):

Support development and implementation of TMDL for mercury.

- Determine bioaccumulation effects in creek and Delta.
- Source, transport, inventory, mapping and speciation of mercury.
- Participate in Stage 1 remediation (drainage control) of mercury mines as appropriate.
- Determine sources of high levels of bioavailable mercury

Status: One large multifaceted contract was completed to evaluate mercury in Cache Creek, including mercury loads, particularly during storm events; mercury sources and source bioavailability; mine remediation feasibility; mercury bioaccumulation; and trophic transfer in the food chain. This information was used to develop the draft Cache Creek mercury TMDL, which was discussed at a public workshop on the associated Basin Plan amendment in June 2004. Several other mercury research studies recently started will contribute information about mercury processes and its effects on birds. Significant unknowns include the extent of mercury contamination in streambed and bank sediments and its ability to mobilize, particularly during storm events. Several large mine sites in this watershed have been assessed, but no remediation has yet occurred.

Progress: On schedule

Next Steps:

- Develop an implementation plan for the mercury strategy, in coordination with other agencies and research groups. Provide a framework for coordination and communication for existing mercury research groups.
- Solicit for additional projects to implement the mercury strategy, with emphasis on understanding effects of restoration on mercury availability, and evaluating ecological effects of mercury contamination.
- Solicit for mine remediation projects.

Milestone 32. Conduct the following mercury evaluation and abatement work in the Delta (from Phase II Report):

- Determine methylization (part of bioaccumulation) process in Delta.
- Determine sediment mercury concentration in areas that would be dredged during levee maintenance or conveyance work.
- Determine potential impact of ecosystem restoration work on methyl mercury levels in lower and higher trophic level organisms.

Status: ERP made substantial investments for research projects to understand mercury sources, transformations, and factors controlling the methylation or demethylation and bioaccumulation processes. Two studies were completed; four more studies will soon begin that will evaluate sources, processes and effects. There are still significant knowledge gaps in understanding mercury transformations, bioaccumulation and its effects to fish and wildlife. These significant gaps make it impossible to determine potential impacts of ecosystem restoration work at this time. The mercury strategy document is a peer-reviewed document developed by independent scientists and provides additional information on what is known, and a framework for future investigations. The mercury strategy recommends research focused on understanding methylation processes, better coordination between researchers and restoration managers,

monitoring, and adaptive management. Scientific vetting of this milestone may result in some revisions

Progress: On schedule

Next Steps:

- Develop an implementation plan for the mercury strategy, in coordination with other agencies and research groups. Provide a framework for coordination and communication for existing mercury research groups.
- Solicit for additional projects to implement the mercury strategy, with emphasis on understanding effects of restoration on mercury availability, and evaluating ecological effects of mercury contamination.

Milestone 33. Conduct the following pesticide work (from Phase II Report):

- Develop diazinon and chlorpyrifos hazard assessment criteria with CDFG and the Department of Pesticide Regulations.
- Support development and implementation of a TMDL for diazinon.
- Develop BMPs for dormant spray and household uses.
- Determine the ecological significance of pesticide discharges.
- Support implementation of BMPs.
- Monitor to determine effectiveness of BMPs.

Status: One contract completed the development of the diazinon and chlorpyrifos hazard assessment criteria for toxicity (this part of the milestone is completed). One contract was completed to support developing and implementing a TMDL for diazinon, and to assess and reduce diazinon inputs from urban storm water runoff in Sacramento County. Three contracts were funded to evaluate and implement pesticide reduction practices for both urban storm water and agriculture. Three contracts were funded to evaluate effects of pesticides on aquatic life. One contract that developed BMPs for pesticide reductions in agriculture also monitored for effectiveness of various techniques. Recent results from studies indicate that pyrethroids are causing significant toxicity to benthic organisms in 25-60 percent of the water bodies tested (particularly creeks and drainages). Other studies have also shown that very low concentrations of organophosphate pesticides may interfere with sensory cues needed for salmonid migration. Lab studies of salmon with sublethal exposures to pyrethroids showed significant increased susceptibility to mortality from disease. More investigations are needed to evaluate episodes of both water and sediment toxicity from pesticides, including pyrethroids, as well as potential effects from sublethal exposures that may affect aquatic populations. In October 2003, the CVRWQCB amended the Basin Plan for the Sacramento and Feather rivers to include a TMDL for diazinon. There are significant efforts by other organizations to address pesticide issues, including the agricultural drainage program and TMDL implementation at the CVRWQCB, PRIZM grants from U.S. Environmental Protection Agency (USEPA), and other efforts by USDA and local groups to reduce pesticide usage and impacts from pesticides. See other milestones (49, 80 and 107) for additional projects that address this milestone at a regional level.

Progress: On schedule

Next Steps:

- Summarize and evaluate projects funded by other agencies and organizations related to this
 issue, especially for the last four bullet items of the milestone. This should include any
 source reduction activities, monitoring, or evaluation of ecological effects.
- Work with other groups and agencies to identify gaps and priorities for future research and monitoring.
- Address high priority actions, as appropriate. At this time, the highest priorities should include a coordinated monitoring program, projects that evaluate ecological effects to aquatic life, and projects that evaluate the effectiveness of BMPs to reduce pesticide impacts.

Milestone 34. Conduct the following selenium work:

- Conduct selenium research to fill data gaps in order to refine regulatory goals of source control actions;
 determine bioavailability of selenium under several scenarios (from Phase II Report).
- Evaluate and, if appropriate, implement real-time management of selenium discharges (from Phase II Report).
- Expand and implement source control, treatment, and reuse programs (from Phase II Report).
- Coordinate with other programs; e.g., recommendations of San Joaquin Valley Drainage Implementation Program, CVPIA for retirement of lands with drainage problems that are not subject to correction in other ways (from Phase II Report).
- Support development and implementation of TMDL for selenium in the San Joaquin River watershed (focus on Grassland area).

Status: Selenium is the Delta Region is derived from agricultural runoff from the west side of the San Joaquin Valley and San Joaquin River and from oil refinery wastes discharged near the Carquinez Strait. Because selenium and salinity are closely linked the ERP has worked closely with the DWQP to fund research, monitoring and source control projects to address ERP selenium milestones. The ERP and DWQP funded seven contracts for approximately \$7.2 million. The ERP contribution for this effort has been approximately \$6.2 million. These efforts contributed to this milestone for the San Joaquin River, Delta and Bay regions.

ERP funded five selenium contracts. Three of these contracts were funded to evaluate sources, fate and transport, bioaccumulation and ecological effects of selenium in the aquatic ecosystem with an emphasis on the Delta and Bay regions. One of these contracts specifically addressed ecological effects of selenium on white sturgeon. These contracts have contributed significantly to the first bullet under this milestone. ERP funded one contract for real-time monitoring and adaptive management of selenium and salt discharges from the San Joaquin River. This contract directly contributes to the second and last bullets under this milestone. The ERP real-time management project provided information to the CVRWQCB for the development of the San Joaquin River TMDLs and current implementation programs.

An additional ERP contract was funded to evaluate and demonstrate a treatment technology for selenium removal and reduction in the San Joaquin River. This project directly contributes to the third milestone bullet. In addition, the DWQP funded two contracts for salinity and selenium

treatment research and real-time monitoring and management of salinity and selenium in the San Joaquin River. These contracts also contribute to the second and third bullets of this milestone.

To directly address the fourth bullet of this milestone the ERP provided grant funds directly to CDWR (FY 2001-02 and FY 2002-03) to advance selenium treatment and source control issues in concert with the San Joaquin River Valley Drainage Implementation Program (SJVDIP) and to improve coordination of agricultural drainage issues in the San Joaquin River. Over the last few years regulatory actions by the CVRWQCB and collaboration among agencies and Grassland area farmers resulted in substantial progress towards the reduction of selenium loads and the control of agricultural subsurface discharges. Water quality monitoring conducted over the last six years has shown that selenium concentrations have decreased dramatically in some areas of the San Joaquin River watershed.

This milestone is repeated as Milestone 50 (Bay Region) and Milestone 108 (San Joaquin River Region). To avoid repetition of this discussion other milestones will reference this section.

Progress: On schedule

Next Steps:

- Summarize and evaluate existing projects and actions being done by other agencies and organizations related to this issue.
- Work with other agencies and organizations to identify remaining data gaps and priorities.
- Continue to fund projects that support or refine regulatory goals of source control actions.
- Continue to solicit determine bioavailability of selenium under several scenarios.
- Continue to evaluate projects to better understand and develop technologies to reduce impacts of irrigation drainage on the San Joaquin River and reduce transport of selenium and other contaminants carried by the San Joaquin River to the Delta and Bay.
- Address high priority actions, as appropriate.

Milestone 35. Conduct the following actions in reduce organochlorine pesticide inputs to streams (from Phase II Report):

- Participate in implementation of USDA sediment reduction program.
- Implement sediment reduction BMPs on agricultural lands and other specific sites.
- Implement BMPs for urban/industrial storm water runoff and discharges to reduce PCB and organochlorine pesticides.

Status: Organochlorine pesticides are no longer used in this watershed; these pesticides have been banned, so if the only source is the widespread contamination of existing sediments, there is little that can be done to reduce the contamination. However, they are extremely persistent and tend to bind strongly to the sediment. Therefore, efforts to reduce sediment inputs will also reduce inputs of organochlorine pesticides. One contract has been funded to reduce sediment and fertilizer usage in this watershed. See other milestones (51, 81 and 109) for additional projects that address this milestone at a regional level.

Progress: Under evaluation

Next Steps:

- Summarize and evaluate projects, actions, and monitoring being done by other agencies and organizations related to this issue. This includes information on sediment or fish tissue concentrations, sources of organochlorine pesticides, possible management or regulatory actions to reduce inputs, and ecological effects.
- Working with other agencies and interested parties, evaluate existing data and identify gaps.
 Identify highest priorities for evaluating or controlling organochlorine pesticides in the aquatic system.
- Address high priority actions, as appropriate.

Milestone 36. Conduct the following trace metals work (from Phase II Report):

- Determine spatial and temporal extent of metal pollution.
- Determine ecological significance and extent of copper contamination.
- Evaluate impacts of other metals such as cadmium, zinc, and chromium.
- Participate in Brake Pad Partnership to reduce introduction of copper.
- Partner with municipalities on evaluation and implementation of storm water control facilities.
- Participate in remediation of mine sites as part of local watershed restoration and Delta restoration.

Status: One contract produced a pilot demonstration project for a passive treatment method for acid mine drainage from a copper mine.

Progress: Under evaluation

Next Steps:

- Summarize and evaluate projects, actions, and monitoring being done by other agencies and
 organizations related to this issue. This includes information on the extent of the
 contamination and ecological effects, as well as potential regulatory or management actions
 to reduce sources.
- Working with other agencies and organizations, identify gaps and high priority actions to reduce ecological effects of trace metals in the Delta Region.
- Address high priority actions, as appropriate.

Milestone 37. Conduct the following unknown toxicity work (from Phase II Report):

Conduct appropriate studies to identify unknown toxicity, and develop management actions as appropriate.

Status: One 1997 study did 3 species toxicity testing at several monitoring locations in the Delta Region and found toxicity in 4 samples out of 29. Chlorpyrifos was identified as the cause of toxicity in one sample. (Larsen et al, 1999) A 1999 study on pyrethroids found sediment toxicity in 42 percent of locations sampled on at least one occasion, with severe toxicity in 14 percent of the sites (all Central Valley sites) (Weston et al, 2004). Several more ERP-funded studies are underway to develop methods for toxicity identification evaluations (TIE), as well as additional monitoring for toxicity throughout the watershed. A multi-agency group of water quality agencies developed a "Strategy for Toxicity of Unknown Origin" that includes recommendations on future actions to monitor, identify and reduce episodes of toxicity in the watershed. Currently,

there are activities to reduce pesticide usage and inputs to water bodies from both urban and agricultural sources. Some activities have been funded by CBDA, but there are also significant efforts by other organizations including the regional water quality control boards, USEPA, and Natural Resource Defense Council (NRDC). See other milestones (53, 83, and 111) for additional projects that address this milestone at a regional level. Additional studies are needed to determine the spatial and temporal extent of toxic events, and methods for identifying toxicants need further development. Once toxicants are identified, control programs need to be implemented to reduce affects to water bodies.

Progress: Under evaluation

Next Steps:

- Summarize and evaluate existing projects, monitoring and actions being done by other
 agencies and organizations that are related to this issue. This may include information on
 ecological effects, including sublethal effects, causes of toxicity, and methods to reduce
 impacts.
- Working with other agencies and organizations, identify gaps and high priority actions to address problem.
- Address high priority actions, as appropriate.

Suisun Marsh and North San Francisco Bay Region (Bay Region)

The vision for the Suisun Marsh and North San Francisco Bay Region (Bay Region) is developed on the concept of "whole marsh management." This vision embodies key parameters needed to successfully restore ecological processes, habitats, and to restore, maintain, or recover a wide diversity of fish, wildlife and plant species.

Habitat efforts include protecting, restoring, and enlarging remaining areas of native habitat, especially important tidally influenced aquatic and wetland habitats and adjacent uplands, and establishing connectivity among these areas. Key considerations in habitat restoration in the Bay Region include:

- large, connected patches of tidal marsh habitat centered on existing populations of species of concern (e.g., salt marsh harvest mouse, California clapper rail),
- placement of tidal marshes along the edge of the Bay and at the mouths of tributary streams to maximize benefits for aquatic organisms,
- incorporating natural features such as large tidal channels, marsh ponds, transitional pannes, and beaches to optimize habitats for many species of fishes, shorebirds, and waterfowl,
- utilize managed saline and seasonal ponds near mudflats to provide high-tide habitat for shorebirds,
- provide natural habitat transitions between bayland habitats and adjacent upland habitats to provide habitat required by many special status plant species,
- provide continuous corridors of riparian habitat along streams tributary to the Bay, and
- maintain upland buffers to protect all existing and restored wetland habitats from disturbance.

The vision also includes providing a more natural freshwater outflow pattern from the Delta in dry and normal rainfall years. Other focal points are reducing stressors, such as native marine invertebrates in ship ballast water, contaminants in municipal, industrial, and agricultural discharges into the Bay, and reducing losses of juvenile fish and their food organisms at unscreened diversions.

Habitat improvements will benefit the salt marsh harvest mouse, Suisun song sparrow, California clapper rail, and California black rail, as well as many native waterfowl and wildlife species living in and around the North Bay. Improving freshwater inflow and habitat will benefit delta smelt, splittail, Chinook salmon, longfin smelt, and other anadromous and resident marine and estuarine fishes and larger marine invertebrates (e.g., shrimp, crabs, and clams) of the Bay REgion, as well as the estuarine foodweb (e.g., algae and planktonic and bottom-dwelling animals) on which the fish depend.

Fulfilling Remaining Milestones Obligations for the Bay Region. Securing the gains in North Bay aquatic and wetland habitats (Milestones 41 and 42) and Jepson Prairie vernal pools (Milestone 43) that ERP investments have made possible is an important priority. Cooperating with others that have the lead role in implementing these projects and supporting monitoring and adaptive management of these projects as they are completed is a key ERP task. Additional effort is needed to restore riparian habitats in creeks and rivers tributary to these areas. Research about listed plants that should be benefiting from these projects can provide a more adequate basis for assessing these species' recovery in these restored marshes and vernal pools and, if necessary, for actions to rebuild their populations in these areas (Milestone 40). In Suisun Marsh, near term activity will emphasize completion of the Suisun Marsh Charter Group's Habitat Management, Preservation, and Restoration Plan for Suisun Marsh. Ecosystem research and pilot scale restorations are also needed to guide the larger scale marsh restoration that will carry out the Charter Group's plan. Actions to achieve the Delta Region water management milestones can help attain the ERPP's vision for providing more natural freshwater outflows to Suisun and the Bay. The Bay Region's water quality milestones should be pursued in coordination with other regions and through water quality management actions of the regional water quality control board and the San Francisco Bay Regional Monitoring Program. Special ERP emphasis may be warranted for studies about the extent and impact of low dissolved oxygen conditions in Suisun Marsh and actions to reduce fine sediments and associated contaminants that flow into the Napa and Petaluma Rivers, Sonoma Creek, and other Suisun-North Bay tributaries.

Summary of Water Quality Milestones for the Bay Region. Many of the water quality milestones in the Bay Region should be reviewed and scientifically vetted to more appropriately address the issues raised by the milestones and to emphasize coordination with existing programs and activities. Many of the milestones are difficult to assess progress toward substantial implementation as they represent expansive, complicated, and evolving issues that require long-term solutions and continuous improvement. In the Bay Region, there are considerable monitoring and source control efforts being performed by non-CALFED agencies and non-CALFED funded projects. CALFED Program and agency contributions to Bay water quality include support of watershed and restoration activities that improve water quality, landscape-level research and demonstration projects that have applicability to the Bay Region (such as research on mercury cycling), and reduction of upstream contaminant sources in other regions that could contribute to contaminant loading in the Bay. For mercury, the CALFED Program developed a peer-reviewed mercury strategy document with input from Bay Area groups that can provide a common framework for future investigations. The CALFED Program funded nearly \$20 million in mercury projects to understand mercury sources, cycling, ecological effects, effects from

restoration, and potential management actions to reduce mercury bioaccumulation. With the additional mercury-related studies and activities by other organizations in the Bay Region, substantial improvements may be expected in the knowledge of mercury cycling and potential management actions to control it.

Suggested priority actions for water quality milestones in the Bay Region include:

- Evaluate extent and impact of low dissolved oxygen conditions in Suisun Marsh and if warranted, develop marsh restoration and management actions to minimize them.
- Improve coordination with Bay Area groups on mercury research and monitoring, and continue support of implementation activities for the mercury strategy framework, with emphasis on research and monitoring to determine impacts from ecological restoration, and evaluation of ecological effects from mercury contamination.
- Improve coordination with other agencies and groups on evaluating ecological effects from pesticides, methods to reduce pesticide and nutrient impacts, and methods to reduce toxicity, with emphasis on areas and species that are priorities for ERP.
- Participate in the development of an integrated monitoring program that will coordinate with existing efforts in the bay, help evaluate ecological impacts occurring from contaminants, and monitor the status and trends of contaminants flowing to the bay, and effectiveness of management actions to reduce contamination.
- Summarization of water quality efforts by other agencies and organizations that address water quality milestones.
- Work with other groups and agencies to identify gaps and priorities for future research and monitoring.
- Address high priority actions, as appropriate.

Bay Region Habitats

The first five milestones for the region are habitat related; there are no key ecological processes milestones for this region. Key ERP habitats related to the milestones for the Bay Region include tidal perennial aquatic habitat, saline emergent wetlands (tidal), seasonal wetlands, vernal pools, tidal slough, essential salmonid habitat and riparian and shaded riverine aquatic habitat.

Milestone 38. Restore and maintain a minimum of three linear miles of riparian habitat along corridors of existing riparian scrub and shrub vegetation in each of the Ecological Management Units (EMUs) of the Suisun Marsh/North San Francisco Bay Ecological Management Zone.

Status: Several ERP contracts addressed restoration of riparian habitat either wholly or in part. Projects were contracted for approximately half of the three miles in the Petaluma Watershed unit, about one quarter of the three miles in the Sonoma Creek unit, a small but undetermined length in the Napa River unit, and one of the three miles in Suisun Bay and Marsh unit. Invasive giant reed was removed from riparian areas in all three watersheds. No riparian habitat has been developed in the San Pablo Bay EMU, although there was a planning proposal funded that plans for providing riparian habitat. Other projects to restore riparian habitats on the Petaluma and Napa rivers, Sonoma, San Pablo, Wildcat, and Suisun creeks, and other Suisun Marsh/North San Francisco Bay tributaries are being funded by the State Coastal Conservancy, the USDA's

Natural Resource Conservation Service (NRCS), resource conservation districts, local flood management agencies, landowners, and others.

Progress: On schedule

Next Steps: Assess extent of riparian habitat restoration funded by others. CALFED-funded riparian habitat restoration will focus on unmet portions of this milestone for the Sonoma Creek and the Napa and Petaluma River units. Actions in these areas should be based on the watershed plans that have been developed for these tributaries, and coordinated with local stakeholders, the regional water quality control board, and others. Monitoring and adaptive management of completed restoration projects will be important. Restoration of Suisun Marsh tributaries' riparian habitats will likely await completion of the Charter Group's plan for the marsh.

Milestone 39. In the Suisun Marsh/North San Francisco Bay Ecological Management Zone (EMZ), restore a minimum of 7,000 acres of Saline Emergent Wetland by restoring tidal action in the Suisun Bay and Marsh EMU (including 200 acres of muted tidal marsh along the Contra Costa shoreline) and a cumulative total of 1,000 acres in the Napa River, Sonoma Creek, Petaluma River, and San Pablo Bay EMUs. Restore high marsh and high-marsh upland transition habitat in conjunction with restoration of saline emergent wetland. Develop cooperative programs to acquire, in fee-title or through a conservation easement, the land needed for tidal restoration, and complete the needed steps to restore the wetlands to tidal action. Begin aggressive program of control of non-native plant species that are threatening the known populations of Suisun thistle, Suisun Marsh aster, soft bird's beak, and Point Reyes bird's beak.

Status: See Milestone 40.

Progress: See Milestone 40.

Next Steps: See Milestone 40.

Milestone 40. Restore suitable, occupied slough edge habitat for delta mudwort and delta tule pea by at least 5 miles in the Suisun Bay and Marsh EMU and by at least 10 miles in the Napa River EMU. Bring at least 25 percent the currently existing but unprotected occurrences of delta mudwort and delta tule pea into protection through purchase or conservation agreement, and ensure appropriate management.

Status: In Suisun Marsh, the ERP is assisting the Suisun Marsh Charter Group in development of its *Habitat Management, Preservation, and Restoration Plan for Suisun Marsh*. The plan will outline actions needed in Suisun Marsh to preserve and restore managed seasonal wetlands, restore tidal marsh habitat, implement a comprehensive levee protection/improvement program, and protect ecosystem and drinking water quality. Two hundred acres of tidal marsh have been restored along the Contra Costa shoreline the Suisun Bay and Marsh EMU, and plans for restoring 2,952 more acres are complete. In Suisun Marsh itself, 569 acres of are being acquired and planned for restoration to tidal wetlands, but the contracts are not yet implemented.

In north San Francisco Bay, the restoration target of 1,000 acres within the Napa River, Sonoma Creek, Petaluma River, and San Pablo Bay units will be exceeded. CALFED-funded cooperative projects affect 7,000 acres. To date 507 acres have been restored, a portion of 4,065 acres are

being restored, and there is planning for an additional 2,385 acres. Most sites are planned to include high marsh and high-marsh upland transition, where site conditions allow, but the proportion of these habitats at these sites needs to be determined.

Actions to control non-native plant species threatening known populations of the above listed plants include two grants to support a program to control invasive *Spartina*, which threatens occurrences of all the targeted rare species except for Suisun thistle. The project's research and planning phases are largely complete, and control actions against *Spartina* are beginning. Another recent grant will support research about how control perennial pepperweed, another weed that threatens these species in tidal marshes,

A project currently in the planning phase will seek to identify opportunities to introduce or increase overall population of Suisun Marsh aster and Suisun thistle at three or more protected and managed sites. At least one new population of soft bird's beak, with high likelihood of success in restored habitat, was established in the Suisun Bay and Marsh EMU. However, no new populations were established in the Napa River EMU and the Petaluma EMU, and no new Pt. Reyes bird's beak was established.

Many tidal marsh restoration projects include slough edges along both exterior levees and within interior marshes. Within the Napa River unit, for example, 2.3 miles of slough edge habitat are being purchased and restored with CALFED grants. The extent of habitat suitable for the delta mudwort, delta tule pea, and Suisun Marsh aster within this area is unknown and should be inventoried. A pilot scale project to test restoration actions along 1,000 feet of slough edge in Suisun Marsh has been funded. More progress was made on Milestones 39 and 40 in North Bay and the Contra Costa shoreline than in the Suisun Bay and Marsh EMU.

Progress: On schedule

Next Steps: Others play the lead role in completing the North Bay tidal marsh restoration projects whose planning or site acquisition the ERP has previously supported. Supporting monitoring and adaptive management of these projects as they are completed is also important. A more thorough assessment is needed of slough edges, high marsh, and high-marsh upland transitions in these sites. Research about delta mudwort, delta tule pea, and Suisun Marsh aster's ecology and distribution can provide a more adequate basis for assessing these species' recovery in the Napa River unit's restored marshes and, if necessary, for actions to rebuild their populations there. An inventory of habitat for these species is needed to determine where 25 percent of habitat and/or occurrences could best be protected, and a determination needs to be made of how many acres constitute 25 percent of habitat. Actions to control invasive *Spartina* should be completed and evaluated. New control actions for pepperweed are needed, beginning with pilot scale actions derived from the research now underway.

In Suisun Marsh, near term activity will emphasize completion of the Suisun Marsh Charter Group's *Habitat Management, Preservation, and Restoration Plan for Suisun Marsh*, ecosystem research, and completing the pilot scale restorations now being planed there. They can guide larger scale marsh restoration to carry out the Charter Group's plan in the future. Previously planned marsh restorations on the Contra Costa shoreline should be completed.

Milestone 41. In the Suisun Marsh/North San Francisco Bay EMZ, restore and manage a minimum of 500 acres of seasonal wetland, and improve management of a minimum of 7,000 acres of existing, degraded seasonal wetland in a manner that provides suitable habitat for salt marsh harvest mouse, San Pablo California vole, and Suisun ornate shrew.

Status: One ERP contract will update 140 landowner management plans that guide management of over 40,000 acres of the Suisun Marsh. Some of those plans will include measures to improve habitat for the salt marsh harvest mouse and Suisun ornate shrew. A future assessment will be necessary to determine the actual acreage affected. In the North Bay EMZ, 289 acres at the Bel-Marin Keys-Hamilton AFB are being planned for seasonal and freshwater emergent wetland. Restoration of seasonal wetlands is occurring or is planned on other sites in the area, including 1,290 acres in the Napa Marsh area. This restoration effort is significantly greater than that required by this milestone.

Progress: On schedule

Next Steps: Next steps include the completion of Suisun Marsh management plans. Monitoring of restored and managed seasonal wetlands to assess small mammal benefits is also needed.

Milestone 42. Restore a minimum of 400 acres of tidal perennial aquatic habitat in the Suisun Marsh/North San Francisco Bay EMZ.

Status: Thirteen ERP contracts to restore tidal marsh contribute to this milestone, but the quantity of tidal perennial aquatic habitat within these restoration areas needs to be determined to assess whether it meets the 400 acre objective of this milestone.

Progress: On schedule

Next Steps: Monitor development of marsh, channel, and perennial aquatic habitat in tidal marsh restoration projects to verify target's accomplishment.

Milestone 43. Develop a cooperative program to acquire, manage and restore 100 acres of vernal pools and 500 to 1,000 acres of adjacent buffer areas in the Suisun Marsh/North San Francisco Bay EMZ. Protect all existing known occurrences of Crampton's tuctoria through conservation easement or purchase from willing sellers (including CNDDB Element Occurrence #2 and any new populations that are found). Identify at least two protected and managed sites for introduction of additional populations; begin introduction and monitor for success. Manage at least 250 acres of the ERP target for vernal pools near the Jepson Prairie preserve as suitable habitat for alkali milk vetch. Establish new populations on protected and appropriately managed lands. Bring 50 percent of currently unprotected, existing populations into protection through purchase or conservation agreement, and ensure appropriate management.

Status: This final habitat-focused milestone emphasizes vernal pool habitat restoration. Two ERP contracts contributed toward this milestone. Both are for restoring and managing the 1,350-acre Wilcox Ranch, adjacent to the Jepson Prairie. The acreage of vernal pool habitat and the presence of Crampton's tuctoria there are unclear. Alkali milk vetch is present. Surveys for these

species are a deliverable in one of these contracts. If Wilcox Ranch contains the components necessary for this milestone, it will be considered progress towards this milestone on schedule.

Progress: On schedule

Next Steps: Complete surveys for Crampton's tuctoria and alkali milk vetch on Wilcox Ranch. If Crampton's tuctoria is present in other Solano County vernal pools, consider protecting through conservation easement or purchase from willing sellers. Evaluate need and opportunities to establish new populations of these rare plants on appropriately managed protected lands at Wilcox Ranch and in Delta (Jepson Prairie) and Sacramento (Yolo County's Grasslands Park) regions.

Bay Region Stressors Reduction

The last 10 milestones for the Bay Region deal with stressor reduction. Key ERP stressors addressed in the milestones for this region include water diversions, invasive species, disturbance from human activities and contaminants

Milestone 44. Develop a program to consolidate, screen, or eliminate 25 percent of the unscreened diversions in Suisun Marsh.

Status: Opportunities to consolidate, screen, or eliminate diversions will be considered in the Suisun Marsh Charter Group's *Habitat Management, Preservation, and Restoration Plan for Suisun Marsh.* To date, three ERP projects have contributed toward this milestone by screening or eliminating seven diversions. This represents 2 percent of diversions within the Suisun Marsh. The ERP has not yet concluded if it is beneficial to screen all 25 percent of the unscreened diversions in Suisun Marsh. In an effort to make such a determination, the ERP is a member of an interagency committee established by the CVPIA Anadromous Fish Screen Program (AFSP), whose task is to assess the benefits of fish screens on various diversion sizes, and determine if fish screens are necessary at the level suggested in this milestone. Clarification regarding the objective of this milestone may be helpful in determining the progress as it relates to this milestone.

Progress: Behind schedule

Next Steps: Complete the Suisun Marsh Charter Group's *Habitat Management, Preservation, and Restoration Plan*. Participate in the new "Interagency Fish Screen Evaluation Program" to coordinate and prioritize Central Valley fish screen efforts from a number of programs: AFRP, AFSP, CALFED, and CDFG.

Nine milestones (45-53) pertained to contaminant or sedimentation issues within the Bay Region.

Milestone 45. Develop, implement, and support measures to reduce pollutant (oxygen depleting substances, nutrients, and ammonia) discharges from concentrated animal feeding operations. (from Phase II Report).

Status: There are no ERP contracts that specifically target the objective of this milestone. However, there are two contracts in other regions that have contributed indirectly to outreach and education and new data about water quality impacts from animal feeding operations. There are few large concentrated animal feeding operations in this region. Most animal feeding operations (horses, dairies, beef) in this region are smaller and are generally (approximately 85 percent) in compliance with the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) general waste discharge requirement program. Both Sonoma and Petaluma creeks are listed as impaired under the Federal Clean Water Act 303 (d) list for sediment and nutrients. The TMDL is under development and the linkages have not been made between these animal operations and the impairments to these water bodies. See also milestone 46.

Progress: Under evaluation

Next Steps:

- Summarize and evaluate projects, actions, and monitoring being done by other agencies and organizations related to this issue. This includes information on the extent of the contamination and ecological effects, as well as potential regulatory or management actions to reduce sources.
- Working with other agencies and organizations, identify gaps and high priority actions to reduce ecological effects of oxygen reducing substances, nutrients and ammonia to the Bay.
- Solicit for additional projects that are consistent with the high priority actions.

Milestone 46. Encourage regulatory activity to reduce discharge of oxygen reducing substances and nutrients by unpermitted dischargers. (from Phase II Report).

Status: There are no funded contracts or specific actions taken by ERP to address this milestone. The CALFED Watershed Program provided funding for 17 contracts for \$6.6 million that provide education, planning, assessment, monitoring and creation or enhancement of riparian habitat, including projects in the east bay, Napa River, Sonoma Creek, Guadalupe River, and various urban creeks and streams. These watershed projects will provide improved water quality from nonpoint sources, such as urban runoff, that are unpermitted discharges. Improvement of water quality from watershed improvement projects will likely reduce inputs of nutrients and oxygen depleting substances, as well as sediment, and contaminants such as pesticides and PCBs. There are other projects funded by other agencies, such as the SWRCB nonpoint source program that would contribute to this milestone. The SFBRWQCB is working with the San Francisco Estuary Institute (SFEI) and the Bay Area Stormwater Management Agencies Association (BASMAA) to address stormwater management and monitoring from various sources. Those projects were not addressed in this evaluation.

The Suisun Marsh is affected by seasonal dissolved oxygen deficit due to the operation of the managed wetlands. Actions that can address problems of low dissolved oxygen there will be

considered in the Suisun Marsh Charter Group's *Habitat Management, Preservation, and Restoration Plan.* More studies are needed to evaluate the extent and impact of low dissolved oxygen conditions in Suisun Marsh and if warranted, develop marsh restoration and management actions to minimize them.

Progress: Under evaluation

Next Steps:

- Summarize and evaluate projects, actions, and monitoring being done by other agencies and organizations related to this issue. This includes information on the extent of the contamination and ecological effects, as well as potential regulatory or management actions to reduce sources.
- Working with other agencies and organizations, identify gaps and high priority actions to reduce ecological effects of oxygen reducing substances and nutrients by unpermitted dischargers to the Bay.
- Complete the Suisun Marsh Charter Group's *Habitat Management, Preservation, and Restoration Plan.*
- Address high priority actions, as appropriate.

Milestone 47. Actions to reduce fine sediment loading to streams, especially the ... Napa, and Petaluma Rivers, and Sonoma Creek, due to human activities (from Phase II Report and Water Quality Program Plan):

- Participate in implementation of USDA sediment reduction program.
- Implement sediment reduction BMPs in construction areas, on agricultural lands, for urban storm water runoff, and other specific sites.
- Implement stream restoration and revegetation work.
- Quantify and determine ecological impacts of sediments in target watersheds, implement corrective actions.

Status: Contracts have been let to plan for, permit, manage, and monitor five projects that will stabilize and revegetate stream banks to reduce erosion and sedimentation. Six thousand feet of fence was placed to prevent erosion of pasture land into Sonoma Creek. Contracts from other fund sources and programs (such as SFBRWQCB, SWRCB nonpoint source program, and BASMAA) may also contribute to this milestone but were not evaluated. The SFBRWQCB is currently conducting studies and working on developing TMDL plans for both the Napa River and Sonoma Creek, with a draft TMDL report due in June 2005. The Petaluma River draft TMDL report is not due until June 2007.

Progress: Under evaluation

Next Steps

Summarize and evaluate projects, actions, and monitoring being done by other agencies and
organizations related to this issue. This includes information on the extent of the
contamination and ecological effects, as well as potential regulatory or management actions
to reduce sources.

- Work with other agencies and organizations to identify gaps and high priority actions to reduce ecological effects of fine sediment loading to the Bay. Support pilot scale projects, where needed, to verify efficacy of proposed BMPs. Coordinate with watershed groups and RWQCB regarding watershed plans and TMDLs that can provide guidance for full scale implementation actions to achieve this milestone.
- Address high priority actions, as appropriate.

Milestone 48. Conduct the necessary research to determine no adverse ecological/biological effects threshold concentrations for mercury in sediments and key organisms in the Bay-Delta estuary and its watershed.

Status: Research indicates that there are many factors affecting mercury methylation and bioaccumulations, and an "effects threshold" for mercury concentration in sediments cannot be set without considering these other factors. ERP has developed a "mercury strategy" framework to help guide future research needs. ERP has made substantial investments in research projects to understand mercury sources, transformations, and factors controlling the methylation or demethylation and bioaccumulation processes and many of these research projects apply to all of the regions. The summary of the landscape-level perspective of mercury projects is described under Milestone 30 in the Delta Region. There is one mercury contract specific to the Bay Region, which will evaluate mercury cycling and bioaccumulation in Petaluma River marshes. This study will provide information on how salinity gradients and age of marsh effect mercury cycling. Another major study about to begin will evaluate mercury effects on Bay Area bird populations. There are significant efforts by other organizations in the Bay Region to address the mercury issue, including a large mercury study by the Corps of Engineers in Hamilton Air Field / Bel Marin keys planned restoration, and mercury studies related to the restoration of south bay salt ponds. The San Francisco Bay Regional Monitoring Program monitors mercury in fish tissue, water and sediment throughout the Bay Area. Many of the mercury research projects are underway and will be providing results in the next few years. The major areas that still need emphasis in the bay include: reducing mercury inputs from stormwater, mines and the rivers. thorough assessment of ecological impacts from mercury contamination, increased knowledge of mercury cycling, how it can be controlled by management actions, and evaluating how wetland restoration activities are or will impact mercury methylation and bioaccumulation. There is a need for increased coordination between the various research activities, as well as coordination with restoration efforts that may impact mercury cycling.

Progress: On schedule

Next Steps:

- Develop an implementation plan for the mercury strategy, in coordination with other agencies and research groups. Provide a framework for coordination and communication for existing mercury research groups.
- Solicit for additional projects to implement the mercury strategy, with emphasis on understanding effects of restoration on mercury availability, and evaluating ecological effects of mercury contamination.

Milestone 49. Conduct the following pesticide work (from Phase II Report):

- Develop diazinon and chlorpyrifos hazard assessment criteria with CDFG and the Department of Pesticide Regulations.
- Support development and implementation of a TMDL for diazinon.
- Develop BMPs for dormant spray and household uses.
- Determine the ecological significance of pesticide discharges.
- Support implementation of BMPs.
- Monitor to determine effectiveness of BMPs

Status: There are a number of landscape-level contracts to address this milestone; these are described under Milestone 33 (Delta Region). There are no projects addressing this milestone that are specific to the Bay Region. The SF Bay Regional Monitoring Program has been performing water quality monitoring and toxicity testing to evaluate occurrences of exceedance of pesticide water quality objectives. Most of the pesticide impairments to urban creeks are from "over the counter" purchases, which will be phased out in December 2004. The SFBRWQCB held a public scoping meeting on February 12, 2004, regarding amendment of the Basin Plan to establish a Water Quality Attainment Strategy and TMDL for diazinon and pesticide-related toxicity. The SFBRWQCB implementation plan for reducing pesticide impairment includes: (1) integration of pesticide and water quality regulation, (2) reduction of pesticide use that affects water quality through outreach and education, and (3) research and monitoring to determine successful implementation.

Progress: On schedule

Next Steps:

- Summarize and evaluate projects funded by other agencies and organizations related to this
 issue. This should include any source reduction activities, monitoring, or evaluation of
 ecological effects.
- Work with other groups and agencies to identify gaps and priorities for future research and monitoring.
- Address high priority actions, as appropriate. At this time, the highest priorities should include a coordinated monitoring program, projects that evaluate ecological effects to aquatic life, and projects that evaluate the effectiveness of BMPs to reduce pesticide impacts.

Milestone 50. Conduct the following selenium work:

- Conduct selenium research to fill data gaps in order to refine regulatory goals of source control actions; determine bioavailability of selenium under several scenarios (from Phase II Report).
- Evaluate and, if appropriate, implement real-time management of selenium discharges (from Phase II Report).
- Expand and implement source control, treatment, and reuse programs (from Phase II Report).
- Coordinate with other programs; e.g., recommendations of San Joaquin Valley Drainage Implementation Program, CVPIA for retirement of lands with drainage problems that are not subject to correction in other ways (from Phase II Report).
- Support development and implementation of TMDL for selenium in the San Joaquin River watershed (focus on Grassland area).

Status: See Milestone 34.

Progress: See Milestone 34.

Next Steps: See Milestone 34.

Milestone 51. Conduct the following actions in reduce organochlorine pesticide inputs to streams (from Phase II Report):

Participate in implementation of USDA sediment reduction program.

- Implement sediment reduction BMPs on agricultural lands and other specific sites.
- Implement BMPs for urban/industrial storm water runoff and discharges to reduce PCB and organochlorine pesticides.

Status: Organochlorine pesticides are no longer used in this watershed; these pesticides have been banned, so if the only source is the widespread contamination of existing sediments, there is little that can be done to reduce the contamination. However, they are extremely persistent and tend to bind strongly to the sediment. Therefore, efforts to reduce sediment inputs will also reduce inputs of organochlorine pesticides. In the Bay Region, significant sources of organochlorine pesticides are urban runoff and river inputs. Therefore, efforts to control organochlorine pesticides in the other regions will also benefit the Bay Region. Milestone 35 (Delta Region) has the summary for the landscape-level contracts that may help reduce organochlorine pesticides. In addition, contracts funded by the CALFED Watershed Program, SWRCB nonpoint source program, the BASMAA, and the SFBRWQCB may also contribute to reducing sediment and contaminant inputs to the Bay Region.

Progress: Under evaluation

Next Steps

- Summarize and evaluate projects, monitoring and actions by other agencies and organizations related to this topic.
- Work with other agencies and organizations to identify gaps and highest priorities for next steps. Support pilot scale projects, where needed, to verify efficacy of proposed BMPs. Coordinate with watershed groups and SFBRWQCB regarding watershed plans and TMDLs that can provide guidance for full scale implementation actions to achieve this milestone.
- Address high priority actions, as appropriate.

Milestone 52. Conduct the following trace metals work (from Phase II Report):

- Determine spatial and temporal extent of metal pollution.
- Determine ecological significance and extent of copper contamination.
- Evaluate impacts of other metals such as cadmium, zinc, and chromium.
- Participate in Brake Pad Partnership to reduce introduction of copper.
- Partner with municipalities on evaluation and implementation of storm water control facilities.
- Participate in remediation of mine sites as part of local watershed restoration and Delta restoration.

Status: No contracts were funded by the CALFED Program to support this milestone in the Bay. This issue is being addressed by the San Francisco Bay Regional Monitoring Program (RMP), and through TMDL development for metals, and the storm water runoff program in the Bay Area by the SFBRWQCB. (See latest RMP report http://www.sfei.org/rmp/pulse/POE2004.pdf).

Progress: Under evaluation

Next Steps:

- Summarize and evaluate projects, monitoring and actions by other agencies and organizations related to this topic.
- Work with other agencies and organizations to identify gaps and highest priorities for next steps.
- Address high priority actions, as appropriate.

Milestone 53. Conduct the following unknown toxicity work (from Phase II Report):

Conduct appropriate studies to identify unknown toxicity, and develop management actions as appropriate.

Status: Milestone 37 (Delta Region) contains a description of the landscape-level contracts to address this milestone. There are no contracts to address this milestone specific to the Bay Region, but the Bay Region is a downstream repository for many contaminants from the other regions. The RMP has been performing toxicity testing of both water and sediment and have found that about 13 percent of the water samples, and 58 percent of the sediment samples were toxic to at least one-test organisms (SFEI 2004). More work needs to be done to evaluate the causes of toxicity and management actions that might improve them, but this is currently being addressed by some of the Bay Area water quality agencies and groups, such as SFBRWQCB, the Clean Estuary Partnership, and US Geological Survey (USGS).

Progress: Under evaluation

Next Steps:

- Summarize and evaluate projects, monitoring and actions being done by other agencies and organizations to address this issue.
- Work with other agencies and organization to identify gaps and high priority actions to address the problem.
- Address high priority actions, as appropriate.

Sacramento River Basin Region (Sacramento Region)

There are eight EMZs in the Sacramento River Basin Region (Sacramento Region). These are: Sacramento River, North Sacramento Valley, Cottonwood Creek, Colusa Basin, Butte Basin, Feather River/Sutter Basin, American River Basin, and Yolo Basin.

The vision for the entire region can be summarized as improving, restoring or maintaining the health and integrity of the Sacramento River riverine-riparian and tributary ecosystems to sustain or support important fishery, wildlife, and plant communities. Common elements in each EMZ to attain this vision include restoring ecological processes and habitats and reducing adverse affects of stressors. In this region, ecological processes restoration includes natural streamflow patterns and flow regime management, coarse sediment recruitment and transport, and reestablishing natural floodplain and flood processes to allow for stream meander. The vision also seeks to provide sufficient flows during important periods of adult migrant and juvenile fish emigration in several creeks as well as developing watershed management plans for several streams in the region. Habitat restoration includes seasonally flooded aguatic habitats, wetland, riparian corridors, shaded riverine aguatic habitat and woody debris. Included in this region's vision is working cooperatively with landowners to develop improved wildlife benefits through wildlife friendly agricultural practices and forest and rangeland management practices. This vision seeks to diminish adverse affects of various stressors, as appropriate in respective EMZs, such as reduce or eliminate gravel mining operations, barriers or other obstacles to fish passage, screening diversions, providing suitable water temperatures for summer rearing, reducing the extent of stranding loss of juvenile fish, and limiting the adverse effects of introducing hatchery fish on endemic aquatic species.

Fulfilling Remaining Milestones Obligations for the Sacramento Region. There has been considerable progress toward substantial implementation of numerous milestones, and as in other regions, very few can be considered completed at this mid-point of Stage 1. A few of the milestones need some reconsideration and others will need additional analysis given the number of tributaries listed under each milestone. Given the broad nature of a number of the milestones for this area, an assessment by watershed would assist on focusing next steps. Coordination with associated programs such as the EWP and CVPIA's AFSP are particularly important in this region.

The importance of floodplain habitats to target fish species focuses ERP efforts to maximize those habitat benefits while reducing or elimination existing fish stranding features within floodplains. Other actions to enhance upstream and downstream migration of anadromous fishes have been taken and will continue. Cooperative efforts with multiple partners helps move these projects through the various phases of feasibility, design, engineering, permitting, and eventually, construction.

Temperature management, effects of irrigation return water, and ecological stream flow and geofluvial assessments of coarse sediment supply continue in nearly all EMZs within the Sacramento Region. The importance of a watershed approach is paramount.

The importance of floodplains and natural meander also guides habitat restoration, and there is a need to continually assess the utility of setback levees, flowage easements and wildlife friendly agriculture,

wetlands creation, and riparian habitat restoration as called for by a number of milestones that address habitats and ecological practices. ERP actions benefit from the efforts of several prominent partners, both private and public, that also may contribute to substantial implementation of these milestones.

Summary of Water Quality Milestones for the Sacramento Region. Many of the water quality milestones in the Sacramento Region should be reviewed and scientifically vetted to more appropriately address the issues raised by the milestones. Many of the milestones are difficult to assess progress toward substantial implementation because they represent expansive, complicated, and evolving issues that require long-term solutions and continuous improvement. Most of these milestones are also supported by the activities of water quality agencies and watershed groups, and their progress is not accounted for in this summary.

The understanding of several large complex water quality problems has been improved over the past four years, and resulted in the development of strategies for future actions to find the most effective solutions. A "mercury strategy" document was developed to provide a framework for future mercury investigations. Coordination efforts and over \$20 million in ERP mercury research contracts are contributing to implementation of the mercury strategy; significant progress is expected in the next few years on evaluating ecological effects, effects of restoration, and potential management actions to reduce mercury exposure. ERP funded three multi-region contracts to reduce pesticide inputs, and three multi-region contracts to investigate unknown toxicity, which currently are in progress. In addition, there are three contracts specific to the Sacramento Region to assess or develop methods to reduce pesticide inputs to waterways.

Suggested priority actions for water quality milestones in the Sacramento Region include:

- Continue coordination and support of implementation activities for the mercury strategy framework, with emphasis on research and monitoring to determine impacts from ecological restoration, and evaluation of ecological effects from mercury contamination.
- Improve coordination with other agencies and groups on evaluating ecological effects from pesticides, methods to reduce pesticide and nutrient impacts, and methods to reduce toxicity.
- Work with other agencies and organizations to participate in an integrated monitoring program that evaluates water and sediment pollution and toxicity, and tissue contamination, and ecological impacts to key species. The monitoring program should provide comprehensive summary reports that evaluate spatial and temporal trends, ecological effects, and effectiveness of management actions.
- Summarization of water quality efforts by other agencies and organizations that address water quality milestones. Work with other agencies and organizations to identify gaps and high priority actions.
- Address high priority actions, as appropriate.

Sacramento Region Ecological Processes

The first six milestones in this region deal with ecological processes. Key ERP ecological processes in the Sacramento Region are: natural floodplain and flood processes, Central Valley stream temperature, Central Valley streamflow, coarse sediment supply and stream meander.

Milestone 54. Construct a network of channels totaling 20 miles within the Sutter and Yolo Bypasses that effectively drains flooded lands after flood flows stop entering the bypasses. The channels should be designed to allow juvenile anadromous and resident fish to move from rearing and migratory areas. Develop and begin implementation of a program in the Yolo Basin to restore channel-floodplain connectivity and floodplain processes. Design natural stream channel configurations and expand floodplain overflow areas in the lower Cache and Putah Creek floodplains, as well as in channels and sloughs of the upper Yolo Bypass to provide connections with the Delta in a manner consistent with flood control requirements. Diversions (water source) into the Yolo Basin should not result in direct or indirect adverse impacts to salmonids. Project design features would include sloughs and creek channels, setback levees, and wetlands, where feasible and consistent with flood protection.

Status: ERP funded CDWR to perform the *Yolo Bypass Habitat Restoration Study* to develop recommendations for restoration actions that would improve bypass habitat for fish and aquatic organisms relative to the three hydrologic phases in the Yolo Bypass of inundation, drainage, and seasonal ponds. Results may bear on an effort to design and plan the network of channels to improve passage out of the Yolo bypass and to reduce stranding. No construction planning or construction has occurred in either the Yolo or Sutter Bypass. CDWR is also working with the Corps of Engineers to develop a two dimensional hydraulic model that will be used for determining flood conveyance impacts of ecosystem restoration projects in the Yolo Bypass. There are no specific contracts dealing with fish stranding in the Sutter Bypass, however, any projects done in the vicinity are implemented to provide a positive grade so there is drainage into the main channel (Ward, pers.comm.).

Another contract was granted to provide improved channel capacity, reduced sediment, increased habitat, lower slough and floodplain planning and restoration, and weed reduction in Union School Slough, tributary to Willow Slough, which is tributary to the Yolo Bypass. While not physically located within the bypass, efforts on this tributary may relate to water quality, temperature, sediment load and other factors germane to diversions into the Yolo Basin. Milestone 54 strives to restore Yolo Basin channel-floodplain connectivity and floodplain processes.

Progress: On schedule

Next Steps: This milestone is either behind or on schedule depending on the decisions made about whether it is needed and its relationship to other proposed work in the bypasses that create floodplain habitat and reduce fish stranding. It may be that the specified channels are not necessary in the Sutter Bypass and they remain a concept in the Yolo Bypass. A decision regarding the utility of the drain channels should be made if enough information exists. If additional studies are required, a carefully focused approach that will provide the foundation for that decision should be conducted. Recent insight into the great benefits of floodplain habitats to target fish species should drive the need for this milestone's completion.

Milestone 55. Develop and implement temperature management programs within major tributaries in the Sacramento River Basin. The goal of the programs should be achievement of the ERP temperature targets for salmon and steelhead. The programs shall include provisions to: (a) develop accurate and reliable water temperature prediction models; (b) evaluate the use of minimum carryover storage levels and other operational

tools; (c) evaluate the use of new facilities such as temperature control devices; and (d) recommend operational and/or physical facilities as a long-term solution.

Status: Progress on this milestone includes a reconnaissance level study on Battle Creek and a pilot temperature curtain study on the American River within Lake Natoma to contribute to knowledge of temperature prediction models, help evaluate the use of new facilities and devices, and help to formulate operational and physical facilities for long term solutions to achieve ERP temperature targets for salmon and steelhead. Temperature monitoring and modeling is occurring on Butte Creek as well where a water transfer from the M & T Ranch Project (40 cfs) provides for higher and cooler flows as part of the long-term solution.

Progress: On schedule

Next Steps: Continued development of temperature management programs within the Sacramento River Basin will occur and opportunities to employ the Environmental Water Program and the Environmental Water Account as a tool to foster long-term temperature solutions will grow.

Milestone 56. Develop and implement a program to address the thermal impacts of irrigation return flows in the Sacramento River Basin. The goal of the program should be achieve Basin Plan objectives for water temperature. The program should include provisions to: (a) identify locations of irrigation return flows with thermal impacts; (b) develop measures to avoid or eliminate thermal impacts from irrigation return flows; and (c) prioritize problem sites based on impacts to Chinook salmon and steelhead. If feasible, proceed with implementation of some or all actions to address thermal impacts of irrigation return flows.

Status: One contract provided funding and support for the Colusa Basin Drain Watershed project that assists landowners addressing non-point source pollution, flood control issues, exotic invasive weeds, and reactivating important ecological processes and functions of riparian corridors, including shaded aquatic habitat. The project completed work at 6 of 12 selected sites, which will implement riparian enhancement and other restoration practices.

Progress: On schedule

Next Steps: Continue to emphasize actions to achieve the program provisions and expand the geographic scope of efforts.

Milestone 57. Design and begin implementation of an ecologically based streamflow regulation plan for Yuba River, Butte Creek, Big Chico Creek, Deer Creek, Mill Creek, Antelope Creek, Battle Creek, Cottonwood Creek, and Clear Creek.

Status: Numerous ERP, AFRP, and Watershed contracts have contributed to the design or implementation of ecologically-based stream flow regulation on these tributaries: Yuba River (six contracts), Butte Creek (three contracts), Big Chico Creek (one contract), Deer Creek (two contracts), Clear Creek (one contract), Battle Creek (three contracts), Cottonwood Creek (four contracts), and none on Mill and Antelope creeks.

Interim flows of as much as 35 cfs have been maintained in both forks of Battle Creek awaiting approval and implementation of the Battle Creek Restoration Project. Once that project is complete, flows will be maintained at similar levels providing habitat for steelhead and four races of Chinook including winter-run. Streamflow modifications will be regulated under an Adaptive Management Plan implemented by the MOU agencies for the Battle Creek Restoration Project. A streamflow regulation plan was completed for Clear Creek as part of the Saeltzer Dam Fish Passage and Flow Protection Project (funded by several funding sources).

The EWP, an element of the ERP, is intended to increase instream flow on the tributaries of the Sacramento and San Joaquin rivers in support of the ERP's flow related goals. The EWP is in its initial implementation phase that is focusing on five priority streams, Clear Creek, Deer Creek, Mill Creek, Butte Creek and the Tuolumne River. The EWP currently is working with local stakeholder groups within the priority watersheds to develop biological objectives and proposals for funding increases in instream flows. The Yuba River, Big Chico Creek and Antelope Creeks are second tier priorities for the EWP and will be the focus of future efforts.

Progress: On schedule

Next Steps: No contracts to fulfill the objectives of this milestone have been funded for Mill and Antelope creeks although Mill Creek is a top priority in the EWP. There is a need to assess priorities and respond accordingly. Actions taken while implementing the EWP on Mill Creek will be compatible and contribute to this milestone.

Milestone 58. Complete a fluvial geomorphic assessment of coarse sediment supply needs and sources to maintain, improve, or supplement gravel recruitment and natural sediment transport processes linked to stream channel maintenance, erosion and deposition, maintenance of fish spawning areas, and the regeneration of riparian vegetation. Develop and implement a program to reduce erosion and maintain gravel recruitment on at least one tributary within each EMZ in the Sacramento River Basin.

Status: ERP and AFRP contracts and funds from other sources have been used to assess coarse sediment supplies and needs linked to erosion and deposition for maintaining fish spawning areas and regenerating riparian vegetation on tributaries distributed in each EMZ; Sacramento River Basin (four contracts), North Sacramento Tributaries (nine contracts), Cottonwood (three contracts), Colusa Basin (two contracts), Butte Basin (five contracts), Feather/Sutter Basin (eight contracts), and American Basin (two contracts). Plans to develop and implement erosion reduction and gravel recruitment were prepared for at least one tributary within each Sacramento EMZ, except the American Basin where a plan was developed, but not implemented.

An overall sediment budget has not been developed for the Sacramento River mainstem. Removal of Saeltzer Dam on Clear Creek added a source of gravel, and there has been some bank protection retirement done with two projects at the Flynn unit and La Barranca units on the mainstem (Roberts, pers.comm.). There also is ongoing geofluvial morphology work by Michael Singer and Eric Larsen in association with flow studies related to the North of Delta Offstream Storage Project.

There will be a sediment plan for Battle Creek once that project is implemented. There is a fluvial geomorphologic study of the lower mainstem of Cottonwood Creek by Graham Matthews. Additionally, a watershed assessment, a fire management plan and aerial photos on Cottonwood Creek will help to characterize channel characteristics and help develop a sediment management plan there.

Progress: On schedule

Next Steps: An assessment of further work on this milestone should occur to determine next steps.

Milestone 59. Develop floodplain management plans, including feasibility studies to construct setback levees, to restore and improve opportunities for rivers to inundate their floodplain on a seasonal basis for at least one tributary within each of the EMZs in the Sacramento River Basin. Among the areas to be included are the lower 10 miles of Clear Creek, Antelope Creek, and Deer Creek, and the lower reach of Cottonwood Creek.

Status: Numerous ERP and AFRP contracts and other program funds have funded numerous feasibility studies for setback levees and floodplain management plans to allow for seasonal floodplain inundation on various tributaries in each of the Sacramento Region's EMZs. While much of the work was on the upper Sacramento River itself, specific contracts were targeted for Sulfur (one), Big Chico (four), Mud (one), Battle (three), Deer (two), Butte (one) and lower Cottonwood creeks (three). Some contracts fund complete projects, including hiring watershed coordinators and other staff, while others fund only certain project phases, such as mapping, planning, or permitting. For example, feasibility and conceptual design is just getting under way on Deer Creek to improve habitat while reducing flooding in the lower part of the system. Several phases have been funded of the Lower Clear Creek Floodway Rehabilitation Project. They have completed floodplain reconstruction and riparian restoration work through Phase 2a and are seeking additional funding to complete the project.

Progress: On schedule

Next Steps: Continue restoration efforts and especially monitoring until the target is attained.

Milestone 60. Protect 15,000 acres within the Inner River Zone areas between Red Bluff and Colusa reaches within identified the Sacramento River Conservation Area. Establish between three and five habitat preserves for bank swallows along the upper reaches of the Sacramento River capable of supporting 5,000 bank swallow burrows between the towns of Colusa and Red Bluff.

Status: These contracts covered planning and design phase reports, funded land acquisition, supported permitting activities, and restored, or will restore, more than 5,800 acres of riparian habitat along the Sacramento River from Red Bluff and Colusa sub-reaches.

Nearly 20 river miles from Chico Landing to Colusa will be maintained to provide eroding riverbank that can provide suitable bank swallow habitat or other riverine or floodplain habitat because of the setback levees. Bank swallow colonies wax and wane along the vertical banks of eroding rivers. The size of colonies is often related to the surface area of eroded banks and the

precise location of colonies changes as different banks erode from year to year. Sometimes existing bank swallow colonies are lost by erosion, only to be created elsewhere where changes in river meander produce newly eroded banks. The habitat basis to support the target of 5,000 burrows for the bank swallow exists within these 20 miles of river, with 40 miles of bank, where the natural process of erosion is allowed. The precise location and number of colonies may change from year to year, but the potential habitat to support swallows will be maintained.

Progress: On schedule

Next Steps: Planning for protection is largely complete and acquisition of properties for protection continues. Assessment and evaluation of the types and quantities of habitats created by these efforts needs to continue and determination of progress and performance must occur.

Sacramento Region Habitats

The next five milestones (61-65) deal with habitat in the Sacramento Region. Key habitat types for this region include agricultural lands managed in wildlife-friendly ways, riparian and riverine aquatic habitat, freshwater fish habitat, essential salmonid habitat and seasonal wetlands.

Milestone 61. In the American River Basin, Butte Basin, Colusa Basin, Feather River/Sutter Basin EMZs, cooperatively enhance at least 15 to 25 percent of the ERPP target for wildlife friendly agricultural practices.

Status: A major premise of the work done in the Butte Basin is to provide for maintained agriculture use and where possible provide year round water (summer flooding) to benefit habitat for waterfowl, migratory birds, and wetland dependent species (Ward, pers.comm.). The Central Valley Joint Venture partners including Ducks Unlimited (DU) have been major partners in the many activities occurring in Butte Creek and in the Sacramento River Basin Region. DU has worked with individual farmland owners to provide for methods and practices to promote wildlife benefits on productive agricultural lands. Much of these benefits are a direct result of DU's work to promote and provide properly functioning screened water diversions for agriculture and wildlife benefits. See Milestones 65 and 72 for related fish passage and wetland habitat benefits. Benefits to agriculture are increased water reliability due to screening and fish passage improvements with concomitant benefits to the resource. Lands managed for wildlife friendly agriculture amount to 72,000 acres in the American River Basin, 99,000 acres in the Butte Basin, 142,000 acres in the Colusa Basin, and 33,000 acres in the Feather River/Sutter Basin EMZs (Petrie, pers. comm.).

Targets for lands managed for wildlife friendly agriculture (rounded to the nearest hundred) amount to 20,500 acres in the American River Basin, 108,800 acres in the Butte Basin, 111,300 acres in the Colusa Basin, and 57,600 acres in the Feather River/Sutter Basin EMZs, so the ERP is clearly on or ahead of schedule by this measure.

Progress: Ahead of schedule

Next Steps: Continued work with key partners (such as the Central Valley Joint Venture) will assist completion of this milestone.

Milestone 62. Develop and implement a program to establish, restore, and maintain riparian habitat to improve floodplain habitat, salmonid shaded riverine aquatic habitat, and instream cover along at least one tributary within each of the following Ecological Management Zones: American River Basin, Butte Basin, Colusa Basin, Cottonwood Creek, Feather River/Sutter Basin, North Sacramento Valley, Sacramento River, and Yolo Basin. While restoring habitat conditions in the American River EMZ, maintain continuous corridors of suitable riparian habitat for valley elderberry longhorn beetle. Protect existing known occurrences of northern California black walnut native stands through conservation easement or purchase. Identify at least 3 protected and managed sites for introduction of additional populations of northern California black walnut; begin introduction and monitor for success. Population creation should be part of a broader effort to restore riparian areas which historically contained walnut.

Status: Numerous ERP and AFRP contracts and funds from other sources have been used to fund programs which have been developed, and are currently in various phases of implementation, that restore, and maintain riparian habitat to improve floodplain habitat, salmonid shaded riverine aquatic habitat, and instream cover along at least one tributary within each of the following Ecological Management Zones: American River Basin (1 contract), Butte Basin (20 contracts), Colusa Basin (6 contracts), Cottonwood Creek (3 contracts), Feather River/Sutter Basin (3 contracts), North Sacramento Valley (12 contracts), Sacramento River (18 contracts), and Yolo Basin (8 contracts). One project is restoring habitat conditions in the American River EMZ that maintain continuous corridors of suitable riparian habitat for valley elderberry longhorn beetle. Three known native northern California black walnut stands located within their historic range on private lands in the Delta EMZ have not been protected through conservation easement or purchase. These native stands are the intended genetic source for future propagation of northern California black walnut populations, unless the results of genetic analysis reveal that there is no difference between trees from the known native populations and those that originate from root stock used for agriculture and are now widely distributed throughout the valley.

Progress: On schedule

Next steps: The need for protected or managed sites for introduction of additional populations of northern California black walnut should be guided by the results of the genetic testing referenced above. Protection of the three known native northern California black walnut populations should be discussed with the land owners of these sites.

Milestone 63. In the Cottonwood Creek EMZ, complete (1) long-term agreements with local landowners to establish, restore, and maintain riparian communities along 25 percent of the upper and 25 percent of the lower reaches of Cottonwood Creek, and (2) the development of a comprehensive watershed management plan that supports local land use decisions to protect existing riparian and restore lost riparian.

Status: A number of ERP contracts have been granted in the Cottonwood Creek watershed. One supported the development of the Cottonwood Creek Watershed Group (CCWG) and another supported the development of a Watershed Strategy. The strategy has yet to be fully implemented (Bratcher, pers. comm.). Other projects include monitoring and assessment within the watershed. In addition, the Wildlife Conservation Board (WCB) funded a riparian restoration

project at the mouth of Cottonwood Creek that is restoring 26 acres of riparian habitat. WCB also purchased about 350 acres in the same area that contains wetlands and riparian habitat.

Progress: On schedule

Next Steps: There is the need to implement the watershed strategy and continue the focus on generating long-term landowner agreements to carry out this milestone. There also the need to assess and monitor the habitats created thus far.

Milestone 64. Restore 2 miles of the 10 mile target of riparian habitat restoration along the lower reaches of each of the following tributaries: Battle, Clear, Deer, Mill, Butte, Big Chico, Antelope, Feather, Yuba, and Bear Rivers.

Status: Numerous ERP and AFRP contracts and funds from other sources have been used for riparian habitat restoration planning and implementation on Battle (nine), Clear (one), Deer (seven), Mill (three), Butte (four), Big Chico Creeks (five), and the Yuba River (two). To date, 4.5 miles are being restored on Battle Creek and 2.5 miles are under restoration on Deer Creek. Approximately 1.2 miles of riparian habitat was restored on Butte Creek. Approximately 3 miles of riparian habitat and emergent wetlands was restored on Clear Creek under the Lower Clear Creek Floodway Rehabilitation Project. Contracts were also funded by the AFRP to protect about 160 acres at the mouth of Big Chico Creek that are currently being restored. The Canterra Trust Council funded a 50-acre riparian restoration project on Antelope Creek (Bratcher, pers. comm.). This milestone is complete for some tributaries and increased efforts will be focused on those others.

Progress: On schedule

Next Steps: Continue to monitor and assess progress and ERP needs to initiate efforts on the Bear River and the Feather River and to follow through on those plans prepared for the Yuba River.

Milestone 65. Implement 25 percent of the ERP target for enhancing, protecting, and restoring seasonal wetlands in the following EMZs: American River Basin, Butte Basin, Colusa Basin, and Feather River/Sutter Basin.

Status: A major premise of seasonal wetland restoration in the Butte Basin is to protect, restore enhance and where possible provide year round water for benefit of waterfowl, migratory birds, and wetland dependent species. DU is a major partner in the many activities occurring in Butte Creek and in the Sacramento Region. DU has worked with individual landowners to provide for methods and practices to promote seasonal wetlands. Much of these benefits are a direct result of DU's work to promote and provide properly functioning screened water diversions for agriculture, wetlands, and wildlife benefits. See Milestones 61 and 72 for related fish passage and wildlife habitat benefits. Restoration, protection and enhancement of seasonal wetlands amounts to 3,187 acres in the American River Basin, 23,340 acres in the Butte Basin, 22,390 acres in the Colusa Basin, and 1,951 acres in the Feather River/Sutter Basin EMZs (Petrie, pers. comm.). Additionally, four ERP contracts addressed seasonal wetlands as part of their overall restoration or watershed plan or as a demonstration and training component of their program.

Targets for seasonal wetland restoration and enhancement amount to 5,150 acres in the American River Basin, 10,000 acres in the Butte Basin, 2,000 acres in the Colusa Basin, and 500 acres in the Feather River/Sutter Basin EMZs, so the ERP is behind for American River Basin, and ahead of schedule for Butte Basin, Colusa Basin and Feather River/Sutter Basins EMZs.

Progress: Ahead of schedule

Next Steps: Continue to promote partnerships in wetland restoration efforts and monitor the biological success of these programs.

Sacramento Region Stressors Reduction

Milestones 66-83 deal with stressors in the Sacramento Region. Key stressors in this region include dams and other structures, stranding, water diversions, and contaminants.

Milestone 66. Develop and implement a program to address inadequate instream flows for steelhead and Chinook salmon on streams within Sacramento River Basin tributaries. Where appropriate provide adequate flows for Sacramento splittail and green sturgeon.

Status: Numerous ERP and AFRP contracts and funds from additional sources have addressed some aspects of instream flow inadequacies for various Sacramento Region tributaries. Although some of these contracts may result in individual watershed plans, it is unclear whether a comprehensive program needs to be developed to address inadequate instream flow, or whether individual plans are adequate. The specific needs of Sacramento splittail and green sturgeon are coincidental in some cases to the needs of other target fish species, relative to instream flow inadequacies. More than half of the contracts supporting achievement of this milestone are also applicable to Milestone 57, calling for ecologically based stream flow regulation plans, so many of those gains of instream flow apply here, especially for flows in Butte and Battle creeks.

The EWP, an element of the ERP is intended to increase instream flow on the tributaries of the Sacramento and San Joaquin rivers in support of the ERP's flow related goals. The EWP is in its initial implementation phase that is focusing on five priority streams: Clear Creek, Deer Creek, Mill Creek, Butte Creek and the Tuolumne River. The EWP currently is working with local stakeholder groups within the priority watersheds to develop biological objectives and proposals for funding increases in instream flows.

Progress: On schedule

Next Steps: While progress has been made on some aspects, future efforts should concentrate on implementing instream flow programs and linking this milestone to others.

Milestone 67. Provide unimpeded upstream and downstream passage for salmon and steelhead on Sacramento River Basin tributaries.

Status: Several ERP, AFRP, and CVPIA contracts and funds from other sources have addressed the planning, permitting, construction, and/or monitoring of projects designed to provide

unimpeded fish passage up and downstream Sacramento River Basin tributaries for salmon and steelhead. Notably, projects funded on Butte Creek have improved passage for as much as 90 miles of habitat for salmon and steelhead, in particular spring-run Chinook. Removal of Saeltzer Dam on Clear Creek provided access to an additional 12 miles of habitat. The Battle Creek Restoration Project will provide access to an additional 42 miles of habitat in North and South Forks of Battle Creek and an additional 6 miles in tributaries to Battle Creek. Contracts funded on Big Chico Creek will provide access to valuable miles of spring-run Chinook spawning habitat. Fish passage issues were addressed by numerous contracts within the Sacramento Region EMZs; 13 contracts in the Sacramento River EMZ, 10 contracts in the North Sacramento Valley EMZ, 3 in the Cottonwood Creek EMZ, 1 in the Colusa Basin EMZ, 14 in the Butte Basin EMZ, 5 in the Feather River and Sutter Basin EMZ, and 5 in the American Basin EMZ.

Progress: On schedule

Next Steps: An assessment of gains in fish passage should be accomplished so that priorities for future actions can be established.

Milestone 68. On Big Chico Creek, repair the Lindo Channel weir and fishway at the Lindo Channel box culvert at the Five Mile Diversion to improve upstream fish passage.

Status: No contracts have been funded to address repairing Lindo Channel weir and fishway at the Lindo Channel box culvert at the Five Mile Diversion on Big Chico Creek.

Progress: Behind schedule

Next Steps: Need to address this milestone and its utility.

Milestone 69. Develop and implement a solution to improve passage of upstream migrant adult fish and downstream migrant juvenile fish Battle Creek.

Status: The Battle Creek Restoration project will provide access to an additional 42 miles of habitat in the North and South Forks of Battle Creek as well as access to an additional 6 miles of tributaries. The EIS/EIR for this hydropower restoration project (e.g., flow increases, dam removal, screening and laddering at multiple hydropower diversions) is nearly complete and expected to go to construction in 2005. In addition to this large scale hydropower restoration effort, the barrier weir/upstream ladder at Coleman National Fish Hatchery is being designed to improve additional fish passage that will complement the hydropower restoration project. The current ladder allows upstream passage six months of the year for spring-run Chinook, steelhead, and (potentially) winter-run Chinook. The newly re-designed ladder will improve the upstream passage capabilities. The current weir works to preclude fish from upstream access during unintended times (e.g., the fall- and late-fall Chinook migration seasons), but when flows are above 350 cfs, upstream fish passage can occur. The newly designed weir will preclude fish, such as fall-run Chinook, from the upper watershed even when flows are above 350 cfs.

Progress: On schedule

Next Steps: Continue working through the process to reach the solution for Battle Creek.

Milestone 70. Evaluate the feasibility of constructing fish passage facilities at the Grays Bend-Old River-Freemont weir complex at the upper end of the Yolo Bypass.

Status: No ERP, CVPIA, or AFRP contracts have been awarded to evaluate the feasibility of constructing fish passage facilities at the Grays Bend-Old River-Freemont weir complex. However, CDWR, private consultants, and CDFG staff have engaged in reconnaissance level assessments and evaluation of the feasibility of this concept. CDWR completed an analysis for developing a fish passage structure at the Grays Bend-Old River-Freemont weir complex and initial results indicate that construction of a structure is possible, but passage of fish species of concern remains an issue.

Progress: On schedule

Next Steps: Continued dialogue on the feasibility of this concept needs to occur so an informed decision to proceed can occur. There is a need to understand the dynamics and physical features of the bypass to make informed decisions.

Milestone 71. Develop a program to reduce or eliminate fish stranding in the Sacramento, Feather and Yuba rivers and the Colusa Basin drain and Sutter Bypass in the active stream channels, floodplains, shallow ponds and borrow areas. Develop protocols for ramping flow reductions. Conduct surveys of stranding under a range of flow conditions and recommend solutions.

Status: No contracts were issued to develop flow reduction ramping plans, conduct stranding surveys over a range of flow conditions, or make recommendations to reduce fish stranding on the Sacramento or Feather rivers or in the Sutter Bypass. The Colusa Basin Drain Watershed Program was funded to address riparian and floodplain restoration issues at selected sites and may reduce fish stranding, but is not a program to specifically target stranding or ramping of flows. Another watershed coordination program on the Yuba River might similarly address fish stranding issues, but the Narrows 2 project specifically addresses a fixed bypass flow that will maintain downstream flows at 3,000 cfs in the lower Yuba River and does reduce or eliminate fish stranding in the Yuba River by providing a stable flow below the power plant. It is not known if a flow reduction ramping plan was developed or if stranding surveys and recommendations were developed.

Actions via the SWRCB, Decision 1644, resulted in a Yuba River Stranding Study by consultants to evaluate benching, isolation, and stranding of salmonids that will be reviewed by the CDFG and finalized. Aerial photography and ground-truthing are included in the assessment. A joint effort by AFRP, Yuba County Water Agency and Western Aggregates (later replaced by Teichert Corporation) resulted in the Yuba County Return Channel Plug, preventing adults from being attracted into a dead end flow area where waters receded. Another environmental review was conducted by CDWR to address fish passage issues related to the Daguerre Point Dam and is awaiting the Corps of Engineers to assume the Federal National Environmental Policy Act (NEPA) lead. Tracy Agreement funds also contributed to a sediment analysis and characterization of particle size, characteristics, and degree of mercury methylization.

The CDFG and CDWR are also addressing that portion of the Feather River that is available to salmon between the afterbay and dam.

Progress: On schedule

Next Steps: More work is needed to specify fish stranding problem areas and need to focus action in those areas.

Milestone 72. Install positive barrier fish screens on all diversions greater than 250 cfs in all EMZs and 25 percent of all smaller unscreened diversions in the Sacramento River Basin. Among those diversions to be screened are the DWR Pumping Plants and 50% of small diversion located on east side of Sutter Bypass, the Bella Vista diversion in the upper Sacramento River near Redding, East-West Diversion Weir, Weir 5, Weir 3, Guisti Weir and Weir 1 in the Sutter Bypass, White Mallard Dam, Morton Weir, Drivers Cut Outfall and Colusa Shooting/Tarke Weir Outfall and associated diversion screens in the Butte Sink.

Status: Forty-six projects were funded by CALFED, CVPIA, or other funds to plan, permit, design, construct, or repair fish screens in the Sacramento Region. Of 38 diversions greater than 250 cfs, 21 (55 percent) have been screened leaving 17 (45 percent) to be screened. There are 903 smaller unscreened diversions in the Basin and 85 (9 percent) have been screened, leaving us 145 screens short of the 25 percent target. Tracy Mitigation funds studied design and engineered plans for three CDWR Pumping Plants. Construction and permit funds are needed to screen the three CDWR Plants. East/West Diversion Weir has a new ladder and water control structure. Weir 5 has been screened and laddered. Weir 3 has a water control structure in place. Guisti Weir is being addressed and will address issues at Weir 1. White Mallard Dam has completed planning and will go to construction later this year. Morton Weir is complete with a fish ladder and water control structure. Drivers Cut Outfall and Colusa Shooting/Tarke Weir Outfall will be in construction summer 2004. Not on the list, but in the vicinity are North Weir and End Weir and the Sanborn Bifurcation that have upgraded ladders and water control structures. Screening of large diversions is behind schedule. Activities within the Butte Sink are on schedule.

Progress: On schedule

Next Steps: Screening projects will continue in coordination with the CVPIA AFSP. The task of screening 50 percent of the 95 small diversions on east side of Sutter Bypass and the Bella Vista diversion in the upper Sacramento River near Redding remains.

Milestone 73. Develop, implement, and support measures to reduce pollutant (oxygen depleting substances, nutrients, and ammonia) discharges from concentrated animal feeding operations. (from Phase II Report).

Status: Two watershed contracts with nonpoint source pollution control objectives were funded for this region; however, these contracts did not specifically target runoff from animal feeding operations or runoff and control of oxygen depleting substances. These contracts emphasized improved management practices for grazing, orchards and irrigated croplands. The management practices evaluated and implemented for these land uses may indirectly contribute to improved runoff or pollutant control from animal feeding operations. There may be other contracts under

different grant programs that would contribute more directly to this milestone. See milestones 27, 45, and 101 for additional contracts that address this milestone at a regional level.

Progress: Under evaluation

Next Steps:

- Milestone needs to be scientifically vetted for appropriateness.
- Summarize and evaluate projects, actions, and monitoring being done by other agencies and
 organizations related to this issue. This includes information on the extent of the
 contamination and ecological effects, as well as potential regulatory or management actions
 to reduce sources.
- Work with other agencies and organizations and identify gaps and high priority actions to reduce ecological effects of oxygen depleting substances, nutrients, and ammonia.
- Solicit for additional projects that are consistent with the high priority actions.

Milestone 74. Actions to minimize or eliminate inter-substrate low dissolved oxygen conditions in salmonid spawning and rearing habitat, especially in the Mokelumne, Cosumnes, American, Merced, Tuolumne, and Stanislaus Rivers (from Phase II Report and Water Quality Program Plan):

- Develop inter-substrate DO testing for salmonid spawning and rearing habitat.
- Conduct comprehensive surveys to assess the extent and severity of inter-substrate low DO conditions.
- Develop and begin implementing appropriate best management practices (BMPs), including reducing anthropogenic fine sediment loads, to minimize or eliminate inter-substrate low DO conditions.

Status: Two contracts apply BMPs and undertake actions to improve soil erosion and sedimentation. There are no ERP studies that specifically address inter-substrate low DO conditions for spawning and rearing habitat. The management practices evaluated and implemented for these land uses may indirectly contribute to this milestone. There may be other contracts under different grant programs that would contribute more directly to this milestone. See milestone 102 for additional contracts that address this milestone in the San Joaquin Region.

Progress: Behind schedule

Next Steps:

- Summarize and evaluate projects, actions, and monitoring being done by other agencies and organizations related to this issue. This includes information on the extent of the ecological effects, as well as potential regulatory or management actions to reduce fine sediment sources contributing to inter-substrate low dissolved oxygen.
- Work with other agencies and organizations, identify gaps and high priority actions to reduce sediment inputs and reduce ecological effects of inter-substrate low dissolved oxygen.
- Address high priority actions, as appropriate.

Milestone 75. Encourage regulatory activity to reduce discharge of oxygen reducing substances and nutrients by unpermitted dischargers. (from Phase II Report).

Status: At this time there are no funded contracts or specific actions taken by ERP to encourage regulatory activities to address this milestone. However, ERP staff works closely with RWQCBs, which are taking steps under their own authority (agricultural waiver and nonpoint source pollution programs). In addition, the Watershed Program funded 38 projects for over \$11 million to do watershed assessments, planning, capacity building as well as specific actions that improve overall water quality, including nutrients. There may be other contracts under different grant programs such as the SWRCB nonpoint source program that would contribute more directly to this milestone. Those contracts were not addressed in this evaluation. See milestones 28, 46, and 104 for additional contracts that may be related to this milestone in other regions.

Progress: Under evaluation

Next Steps:

- This milestone needs to be scientifically vetted for appropriateness.
- Summarize and evaluate projects, actions, and monitoring being done by other agencies and organizations related to this issue. This includes information on the extent of the ecological effects, as well as potential regulatory or management actions to reduce oxygen reducing substances and nutrients by unpermitted dischargers to the Sacramento River.
- Work with other agencies and organizations; identify gaps and high priority actions to reduce oxygen reducing substances and nutrients.
- Solicit for additional projects that are consistent with the high priority actions.

Milestone 76. Actions to reduce fine sediment loading to streams, especially Tuolumne, Merced, Stanislaus, Cosumnes, Napa, and Petaluma Rivers, and Sonoma Creek, due to human activities (from Phase II Report and Water Quality Program Plan):

- Participate in implementation of USDA sediment reduction program.
- Implement sediment reduction BMPs in construction areas, on agricultural lands, for urban storm water runoff, and other specific sites.
- Implement stream restoration and revegetation work.
- Quantify and determine ecological impacts of sediments in target watersheds, implement corrective actions.

Status: These contracts, either through planning or restoration, will reduce erosion and sedimentation in several Sacramento Valley watersheds. Two contracts are in watersheds with important anadromous fish habitat. In addition, the watershed program has funded 38 projects for over \$11 million to do watershed assessments, planning, capacity building as well as specific actions that improve overall water quality, including nutrients. Contracts from other fund sources (other than CVPIA) and programs were not evaluated and may contribute to this milestone. See milestones 29, 47, and 105 for additional contracts that address this milestone at a regional level.

Progress: Under evaluation

Next Steps:

- Summarize and evaluate projects, actions, and monitoring being done by other agencies and
 organizations related to this issue. This includes information on the extent of the ecological
 effects, as well as potential regulatory or management actions to reduce fine sediment to the
 Sacramento River.
- Work with other agencies and organization: identify gaps and high priority actions to reduce fine sediment inputs to the Sacramento River.
- Address high priority actions, as appropriate.

Milestone 77. Conduct the necessary research to determine no adverse ecological/biological effects threshold concentrations for mercury in sediments and key organisms in the Bay-Delta estuary and its watershed.

Status: Milestone 30 (Delta Region) contains a summary of mercury research that applies to all of the regions. In addition to these landscape-level perspective research contracts, there are ERP-funded studies on the Upper Yuba River to evaluate mercury contamination and potential impacts for restoration actions in the Upper Yuba River watershed. The Bureau of Land Management (BLM) and others have also funded studies on mercury contamination in dredge tailings in the Clear Creek watershed. The issue of mercury contamination in dredge tailings needs more investigation to determine how mercury may be mobilized if these materials are used for restoration of spawning habitat in the tributaries. If dredge tailings cannot be used for restoration due to the mercury contamination, it may greatly increase the cost of doing restoration work in some areas.

Progress: On schedule

Next Steps:

- Develop an implementation plan for the mercury strategy, in coordination with other agencies and research groups. Provide a framework for coordination and communication for existing mercury research groups.
- Solicit for additional projects to implement the mercury strategy, with emphasis on understanding effects of restoration on mercury availability, and evaluating ecological effects of mercury contamination.

Milestone 78. Conduct the following mercury evaluation and abatement work in the Cache Creek watershed (from Phase II Report):

- Support development and implementation of TMDL for mercury.
- Determine bioaccumulation effects in creek and Delta.
- Source, transport, inventory, mapping and speciation of mercury.
- Participate in Stage 1 remediation (drainage control) of mercury mines as appropriate.
- Determine sources of high levels of bioavailable mercury.

Status: One large multifaceted contract evaluated mercury in Cache Creek, including mercury loads during storm events; mercury sources and source bioavailability; mine remediation feasibility, mercury bioaccumulation; and trophic transfer in the food chain. This contract provided information regarding mercury loads from Cache Creek and the contribution of mine

sites to the mercury loads. This information was used to develop the draft Cache Creek mercury TMDL, which will be discussed at a public workshop on the associated Basin Plan Amendment in June 2004. Significant unknowns include the extent of mercury contamination in stream bed and bank sediments and its ability to mobilize, particularly during storm events. Several large mine sites in this watershed have been assessed, but no remediation has yet occurred. See milestones 30 and 31 for additional contracts that address this milestone at a landscape level perspective. Next steps include solicitation for mine remediation projects and evaluation of other source control measures to reduce mercury inputs from this watershed.

Progress: On schedule

Next Steps:

- Develop an implementation plan for the mercury strategy, in coordination with other agencies and research groups. Provide a framework for coordination and communication for existing mercury research groups.
- Solicit for additional projects to implement the mercury strategy, with emphasis on understanding effects of restoration on mercury availability, and evaluating ecological effects of mercury contamination.
- Solicit for mine remediation projects, or other projects to control sources of mercury.

Milestone 79. Conduct the following mercury evaluation and abatement work in the Sacramento River (from Phase II Report):

- Determine, inventory, and sources of high levels of bioavailable mercury
- Refine mercury models.
- Participate in remedial activities.

Status: Two contracts were funded to inventory and assess abandoned mines in the Sacramento River watershed. One large multi-faceted study completed a "mass balance" assessment of mercury sources in the watershed, and this included some monitoring of mercury sources and loads. One study investigated mercury cycling in wetlands. Four new studies recently began to address some of the uncertainties in the mercury mass balance, including detailed studies of mercury movement between sediment, water, and air, and an in-depth investigation of methylmercury production and bioaccumulation in the food chain in different habitat types. All of these contracts will contribute towards developing a mercury model to understand mercury sources, cycling, and bioaccumulation. No remediation activities have taken place in the watershed yet, but work has been done to try to identify major sources of mercury from abandoned mines. It is expected that ERP will solicit for mine remediation projects in the next proposal solicitation. Milestones 30 and 31 (Delta Region) provide summary of additional contracts and description of the mercury strategy, which applies to all of the regions.

Progress: On schedule

Next Steps:

 Develop an implementation plan for the mercury strategy, in coordination with other agencies and research groups. Provide a framework for coordination and communication for existing mercury research groups.

- Solicit for additional projects to implement the mercury strategy, with emphasis on understanding effects of restoration on mercury availability, and evaluating ecological effects of mercury contamination.
- Solicit for mine remediation projects, or other projects to control sources of mercury.

Milestone 80. Conduct the following pesticide work (from Phase II Report):

- Develop diazinon and chlorpyrifos hazard assessment criteria with CDFG and the Department of Pesticide Regulations.
- Support development and implementation of a TMDL for diazinon.
- Develop BMPs for dormant spray and household uses.
- Determine the ecological significance of pesticide discharges.
- Support implementation of BMPs.
- Monitor to determine effectiveness of BMPs.

Status: Milestone 33 (Delta Region) contains summary information of contracts that address this milestone for all of the regions. Specific to the Sacramento Region, two ERP contracts have been funded to address pesticides in runoff. One assessed pesticide inputs from urban runoff in Sacramento County. The other ERP contract evaluated different management actions in the Colusa Drain watershed to reduce pesticide inputs from agricultural practices to the waterways. Results were presented at an agricultural forum in 2004. One contract by the Watershed Program focused on educating growers on methods to reduce pesticide runoff into waterways.

More investigations are needed to evaluate episodes of both water and sediment toxicity from pesticides, including pyrethroids, as well as potential effects from sublethal exposures that may affect aquatic populations. There are significant efforts by other organizations to address pesticide issues, including the Sacramento River Watershed Program, the agricultural drainage program and TMDL implementation at the CVRWRCB, PRIZM grants from USEPA, and other efforts by USDA and local groups to reduce pesticide usage and impacts from pesticides. In October 2003, the CVRWQCB amended the Basin Plan for the Sacramento and Feather rivers to include a TMDL for diazinon. See other milestones (33, 49, and 107) for additional contracts that address this milestone at a regional level. The first two bullet items are complete and the other bullet items are under evaluation.

Progress: On schedule

Next Steps:

- This milestone needs to be scientifically vetted for appropriateness.
- Summarize and evaluate projects funded by other agencies and organizations related to this
 issue. This should include any source reduction activities, monitoring, or evaluation of
 ecological effects.
- Work with other groups and agencies to identify gaps and priorities for future research and monitoring.
- Address high priority actions, as appropriate. At this time, the highest priorities should
 include a coordinated monitoring program, projects that evaluate ecological effects to aquatic
 life, and projects that evaluate the effectiveness of BMPs to reduce pesticide impacts.

Milestone 81. Conduct the following actions in reduce organochlorine pesticide inputs to streams (from Phase II Report):

- Participate in implementation of USDA sediment reduction program.
- Implement sediment reduction BMPs on agricultural lands and other specific sites.
- Implement BMPs for urban/industrial storm water runoff and discharges to reduce PCB and organochlorine pesticides.

Status: Organochlorine pesticides are no longer used in this watershed; these pesticides have been banned, so if the only source is the widespread contamination of existing sediments, there is little that can be done to reduce the contamination. However, they are extremely persistent and tend to bind strongly to the sediment. Therefore, efforts to reduce sediment inputs will also reduce inputs of organochlorine pesticides. One project has been funded to reduce sediment and fertilizer usage in this watershed.

Progress: Under evaluation

Next Steps: This milestone needs to be scientifically vetted for appropriateness, and there is need to summarize and evaluate existing projects and data from other organizations.

Milestone 82. Conduct the following trace metals work (from Phase II Report):

- Determine spatial and temporal extent of metal pollution.
- Determine ecological significance and extent of copper contamination.
- Evaluate impacts of other metals such as cadmium, zinc, and chromium.
- Participate in Brake Pad Partnership to reduce introduction of copper.
- Partner with municipalities on evaluation and implementation of storm water control facilities.
- Participate in remediation of mine sites as part of local watershed restoration and Delta restoration.

Status: No contracts were funded by the CALFED Program to address this milestone in the Sacramento Region. However, there have been efforts by the Sacramento River Watershed Program to monitor for metal contamination in the watershed. There have also been significant efforts by the CVRWQCB to reduce inputs of metals to the Sacramento River through regulatory actions and cleanup of mine sites, such as the Iron Mountain Mine. See milestones 36, 52, and 110 for additional contracts that address this milestone at a regional level.

Progress: Under evaluation

Next Steps:

- This milestone needs to be scientifically vetted for appropriateness.
- Summarize and evaluate projects funded by other agencies and organizations related to this
 issue. This should include any source reduction activities, monitoring, or evaluation of
 ecological effects.
- Work with other groups and agencies to identify gaps and priorities for future research and monitoring.
- Address high priority actions, as appropriate.

Milestone 83. Conduct the following unknown toxicity work (from Phase II Report):

Conduct appropriate studies to identify unknown toxicity, and develop management actions as appropriate.

Status: Milestone 37 (Delta Region) summarizes the contracts that address this milestone at the landscape level perspective. There are no contracts funded by ERP that are specific to the Sacramento Region.

Progress: Under evaluation

Next Steps:

- This milestone needs to be scientifically vetted for appropriateness.
- Summarize and evaluate projects funded by other agencies and organizations related to this issue.
- Work with other groups and agencies to identify gaps and priorities for future research and monitoring.
- Address high priority actions, as appropriate.

San Joaquin River Basin Region (San Joaquin Region)

There are three EMZs in the San Joaquin River Region (San Joaquin Region). These are: San Joaquin River, East San Joaquin and West San Joaquin.

The vision for the San Joaquin River EMZ calls for reactivating natural ecological processes, including streamflow and natural stream meander to accomplish most of the restoration. Stressors such as unscreened diversions and levee confinement of floodplain need to be reduced. Development of shaded riverine aquatic habitat will benefit migrating and resident fish, and terrestrial organisms. In the reach from the Merced River to Medota Pool, the emphasis is the reduction of contaminants loading from Westside drainage and reducing straying of anadromous fish. In the reach from Friant Dam to Gravelly Ford, the focus is on habitat improvement through streamflow restoration and stream channel configuration.

Some of the species expected to benefit from the actions are Chinook salmon, steelhead, splittail, Western pond turtle, giant garter snake, Swainson's hawk, greater sandhill crane, western yellow-billed cuckoo, riparian brush rabbit, and San Joaquin Valley woodrat.

In the vision for the East San Joaquin Basin EMZ, the vision focuses on restoring or reactivating the ecological processes that create and maintain habitats for anadromous salmonids and riparian vegetation. This will be done on each of the major rivers in this zone by protecting a self-sustaining stream corridor and associated riparian community that provides habitat through shade, nutrients, and woody debris. Because dams on each of the rivers interrupt the natural sediment supply on which natural stream form depends, it will be necessary to artificially sustain some natural sediment supply. Some of the species expected to benefit from actions in this EMZ are Chinook salmon, steelhead, giant garter snake, western

pond turtle, Swainson's Hawk, greater sandhill crane, western yellow-billed cuckoo, riparian brush rabbit, and San Joaquin woodrat.

The vision for the West San Joaquin Basin EMZ includes improved water quality and quantity from the basin to wetlands and the San Joaquin River. The vision also includes a range of sustainable aquatic, wetland, riparian, and upland habitats that support fish and wildlife production especially those migrant birds that use the Pacific Flyway each winter. Species expected to benefit from actions in this EMZ include: California red-legged frog, western pond turtle, and Valley elderberry longhorn beetle.

Fulfilling the Remaining Milestone Obligations for the San Joaquin Region. There are 27 milestones that address key ecosystem functions in the San Joaquin Region, and one presently attributed to this region that appears to apply to the Bay Region (Milestone 103). Although much of funding and effort targets improvements to the instream temperature and fluvial geomorphic processes, these are elements which link to other needs and stressors that has yet to be addressed. There is still much to do; specifically, a program addressing all aspects of temperature modeling (Milestone 84), integration of temperature modeling and management to a basin scale (Milestone 85), and instream sediment budgets (Milestones 86 and 105) are necessary for all three tributaries to the San Joaquin River. Although numerous plans, studies, engineering and feasibility projects were undertaken, there needs to be an effort to complete current projects and to evaluate all the actions to determine priority actions and future needs (Milestones 87 and 88). While there are a few contracts which address breaching San Joaquin River levees and acquiring significant land, it is necessary to determine if these contracts provide the necessary San Joaquin River floodplain habitat between the mouth of the Merced River and Vernalis (Milestone 89). Actions to establish a river meander corridor between Chowchilla Bypass and Mendota Pool (Milestone 90) recently have stalled. A directed action is recommended to encourage proposals to address this milestone.

Most of the milestones related to habitat improvements (Milestones 91 through 95) appear to be on schedule, and it is necessary to continue monitoring with detailed accounting of various habitat types and agricultural practices and ecosystem response. Even though the expectation of 100 acres of fresh emergent wetland habitat being restored or created (Milestone 92) has been met, this action should be monitored to ensure that the restoration has achieved the desired outcome. Milestone 92 and milestones in other regions related to fresh emergent wetland habitat should be vetted as a suite to assure that the target acreages by region and as a basin are appropriate. Approximately 3,985 acres of upland was restored using grants from the North American Wetlands Conservation Act (NAWCA), although it is not clear if this restoration addressed native perennial grasslands (Milestone 93). Actions should be considered which might add to this milestone through opportunistic partnerships and current contracts should be evaluated to accurately assess specific acreages that contribute to this milestone. Riparian and floodplain habitat restoration has received a lot of attention (Milestone 94), so it may be prudent to make sure that existing projects are fully completed, monitored, and properly evaluated and that future actions build on existing investments to emphasize corridor continuity. A priority in the San Joaquin Basin EMZ should include plans to increase suitable habitat and protection for delta coyote thistle (Milestone 95). Efforts to establish new riparian brush rabbit populations should be monitored and evaluated (Milestone 95).

The San Joaquin Basin EMZ milestone achievements related to stressor reductions due to dams and structures are still in the critical, but early, stages of planning and design; physical actions to enhance fish passage are on schedule (Milestone 97). While there is an agreement to purchase water on the Stanislaus River, similar programs should be established for the remaining tributaries (Milestone 96). Several habitat or geomorphic actions were undertaken to improve instream habitat or geomorphic function, which also improves fish passage. These potential project benefits need to be better documented and evaluated and a more comprehensive approach to geomorphic assessment should be pursued. There are two AFRP contracts supporting feasibility studies to restore steelhead migration into upper watershed areas (Milestone 98), but these were delayed due to access problems to the targeted river reach. Access options need to be identified to resolve these problems so the studies can be completed. As for the requirement to install positive barrier fish screens on all diversions greater than 250 cfs and 25 percent of all smaller unscreened diversions in the San Joaquin River Basin (Milestone 99), initial stages for screening the Patterson Irrigation District diversion are underway. Other funds such as the Delta Pumps Fish Protection Agreement (Four Pumps) have been obligated towards addressing a portion of the remaining 472 smaller unscreened agriculture diversions, but the available funding is insufficient to resolve the problem. Efforts should be directed towards assessing the priority and value of screening these smaller diversions.

Summary of Water Quality Milestones for the San Joaquin Region. Many of the water quality milestones in the San Joaquin River region should be reviewed and scientifically vetted to more appropriately address the issues raised by the milestones. Many of the milestones are difficult to assess progress toward substantial implementation since they represent expansive, complicated, and evolving issues that require long-term solutions and continuous improvement. Most of these milestones are also supported by the activities of water quality agencies (regulatory actions and grant programs) and watershed groups, and their progress is not accounted for in this summary. Several monitoring and control efforts currently performed in this region are not CALFED Program funded projects. CALFED Program contributions to San Joaquin River water quality include support of watershed, regulatory and restoration activities that improve water quality.

Water quality is a significant concern in the San Joaquin River because of reduced flows and inputs of agricultural drainage (irrigation return water and subsurface drainage) with high salt, selenium, nutrients, and pesticide concentrations. Other inputs from stormwater runoff, municipal sources and managed wetlands have resulted in increased concentrations of dissolved solids, nutrients, pesticides, and in some areas, trace elements. Several segments of the San Joaquin River and its tributaries are listed as impaired water bodies under the Federal Clean Water Act 303(d) list.

Development of water resources in the San Joaquin River basin has resulted in large-scale changes in the aquatic ecosystems, including fish populations. Preliminary results from ERP funded contracts indicate that water quality issues are impacting species although the magnitude and impacts are unknown. Further, the linkages between water quality and habitat degradation have not been fully addressed.

The understanding of water quality problems in the San Joaquin River has improved during the past four years and resulted in the development of strategies for future actions to find the most effective solutions. The ERP provided funding for eight water quality projects for the San Joaquin Region for approximately \$11.3 million. These projects have focused predominantly on selenium, dissolved oxygen and pesticides.

ERP funded three multi-region contracts to reduce pesticides inputs, and three multi-region projects to investigate unknown toxicity, which currently are in progress.

TMDLs have been developed (selenium) or are in progress (dissolved oxygen, organophosphate pesticides, salt and boron) to improve water quality for portions of the San Joaquin River. In some cases ERP contracts have provided information and data to support these efforts. Currently, ERP is working closely with the CVRWQCB to coordinate efforts of stakeholders and agencies to study and correct the low dissolved oxygen problem in the Deep Water Ship Channel (DWSC) near Stockton. Including a new project under contract development, nearly \$12 million in grant funds have been obligated to support the dissolved oxygen effort.

Suggested priority actions for water quality milestones in the San Joaquin Region include:

- Continue coordination and support of implementation of dissolved oxygen work in the DWSC.
- Continue coordination and support of implementation activities for the mercury strategy framework, with emphasis on research and monitoring to determine impacts from ecological restoration, and evaluation of ecological effects from mercury contamination.
- Improve coordination with other agencies and groups on evaluating ecological effects from pesticides, methods to reduce pesticide and nutrient impacts, and methods to reduce toxicity.
- Work with other agencies and organizations to participate in an integrated monitoring program that evaluates water and sediment pollution and toxicity, and tissue contamination, and ecological impacts to key species. The monitoring program should provide comprehensive summary reports that evaluate spatial and temporal trends, ecological effects, and effectiveness of management actions.
- Identify linkages between long-term implementation actions in the selenium, salt/boron, organophosphate pesticides and dissolved oxygen TMDLs and the implications for the ecosystem restoration goals for the San Joaquin River.
- Summarize water quality efforts by other agencies and organizations that address water quality milestones.
- Work with other agencies and organizations to identify gaps and high priority actions to address ecological water quality issues in the San Joaquin River watershed.
- Address high priority actions, as appropriate.

San Joaquin Region Ecological Processes

The first eight milestones for the San Joaquin Region (84-90) are ecological process oriented with a goal to improve stream temperatures, coarse sediment supplies, meander, and floodplain processes. Contracts awarded for this project type account for a significant number of all the ERP projects completed in the San Joaquin Region.

Milestone 84. Develop and implement temperature management programs within major tributaries in the San Joaquin River Basin. The goal of the programs should be achievement of the ERP temperature targets for salmon and steelhead. The programs shall include provisions to: (a) develop accurate and reliable water temperature prediction models; (b) evaluate the use of minimum carryover storage levels and other operational tools; (c)

evaluate the use of new facilities such as temperature control devices; and (d) recommend operational and/or physical facilities as a long-term solution.

Status: Progress on this milestone includes an ERP contract and an AFRP contract that initiated actions toward substantial implementation of this milestone on the Stanislaus-Lower San Joaquin River and on the Stanislaus below Goodwin Dam. Likewise, an AFRP contract resulted in the just completed Merced River Water Temperature Feasibility Investigation Reconnaissance Report which may provide the basis for an operational solution. There are no specific studies to provide a temperature management program for the Tuolumne River, but an AFRP contract that developed outreach materials as part of a long-range plan for outreach and stewardship may create interest in addressing temperature management.

Progress: On schedule

Next Steps: There is a need to begin a program to address all aspects of this milestone for the Tuolumne River, to complete ongoing planning on the Merced and Stanislaus rivers, and make recommendations for operational plans on all three tributaries

Milestone 85. Develop and implement a program to address the thermal impacts of irrigation return flows in the San Joaquin River Basin. The goal of the program should be achieve Basin Plan objectives for water temperature. The program should include provisions to: (a) identify locations of irrigation return flows with thermal impacts; (b) develop measures to avoid or eliminate thermal impacts from irrigation return flows; and (c) prioritize problem sites based on impacts to Chinook salmon and steelhead. If feasible, proceed with implementation of some or all actions to address thermal impacts of irrigation return flows.

Status: Two contracts addressing the thermal impacts of irrigation return flows occurred in the San Joaquin River Basin. One was to expand the existing San Joaquin River Real-Time Temperature collection system to include an internet network of collected data as well as temperature modeling and the second project addressed the development of a Real Time Water Quality Management Program in the Grasslands Water District near Los Banos.

Progress: On schedule

Next Steps: Need to develop and implement a formal program, including sub-programs to identify and reduce irrigation return flows that exceed Basin Plan temperature objectives for salmonids.

Milestone 86. Complete a fluvial geomorphic assessment of coarse sediment supply needs and sources to maintain, improve, or supplement gravel recruitment and natural sediment transport processes linked to stream channel maintenance, erosion and deposition, maintenance of fish spawning areas, and the regeneration of riparian vegetation. Develop and implement a program to reduce erosion and maintain gravel recruitment on at least one tributary within each EMZ within the San Joaquin River Basin. In the East San Joaquin Basin EMZ, complete fluvial geomorphic assessments on all tributaries.

Status: Several ERP and AFRP contracts funded various aspects of gravel replenishment on tributaries within EMZs of the San Joaquin Region. Geomorphic monitoring was associated

with these contracts. However, less than 6 of the 19 contracts are approaching the more comprehensive assessments that this milestone calls for. Seven contracts address erosion reduction/gravel recruitment studies and the Tuolumne River. Some of the evaluations have been only at a reconnaissance level; others are more comprehensive.

Progress: On schedule

Next Steps: An assessment and evaluation of all these contracts is necessary to determine progress towards intended objectives and project success. A strategic, science-based approach needs to be developed for this milestone. Further, a long-term project monitoring and adaptive management maintenance program for these types of projects need to be developed and implemented.

Milestone 87. Develop floodplain management plans, including feasibility studies to construct setback levees, to restore and improve opportunities for rivers to inundate their floodplain on a seasonal basis for at least one tributary within each of the EMZs in the San Joaquin River Basin. Among the areas to be included are at least 10 miles of stream channel in the West San Joaquin EMZ.

Status: Fourteen ERP and seven AFRP contracts provide for planning and feasibility studies for tributaries in all of the San Joaquin Region to seasonally inundate respective floodplains and examine opportunities to set back levees to enhance floodplains. Often, floodplain projects concurrently address geomorphic processes needs. Specifically, there were 12 contracts on the Stanislaus River: 4 floodplain management plans and 8 floodplain inundation projects. There were four contracts on the Tuolumne River: three levee set-back contracts and one flood plain inundation project. There have been six contracts on the Merced River: one levee set-back project and five floodplain inundation contracts.

Progress: On schedule

Next Steps: Complete current projects through final phases. Numerous plans, studies, engineering and feasibility projects have been undertaken by a variety of entities to develop additional project concepts, an evaluation of all actions should occur to determine what future priorities should be. Support ongoing maintenance and monitoring. This milestone may need to be revised to clarify that the 10 miles of stream channel is for the San Joaquin River rather than the West San Joaquin EMZ.

Milestone 88. Develop a cooperative program to restore salmonid spawning and rearing habitat in the Tuolumne, Stanislaus, and Merced Rivers that includes the following elements: (1) reconstructing channels at selected sites by isolating or filling in-channel gravel extraction areas; (2) increasing natural meander by removing riprap and relocating other structures that impair stream meander; and (3) restoring more natural channel configurations to reduce salmonid predator habitat and improve migration corridors.

Status: Twenty-four ERP and AFRP contracts were awarded that contribute to reconstruction and restoration efforts to create more natural stream channels, spawning and rearing habitat, natural meanders, and migration corridors by restoring gravel extraction sites and removal of riprap and other channel obstructions. Other projects funded through CVPIA and NRCS

contribute to this milestone. These actions are expected to reduce habitat for predators of salmon. Most contracts focus on the Tuolumne River which has 17 contracts: 8 develop salmon habitat restoration plans, 7 are for instream channel reconstruction, and 2 contracts target increasing natural channel meander. The Stanislaus River has two contracts which restore salmon spawning and rearing habitat. There is one contract on the Merced River which intends to restore natural channel configurations. While the contracts are independent, they are often linked or phased contracts that add to the length of restored reaches on these tributaries.

Progress: On schedule

Next Steps: Continue monitoring and adaptive management actions on completed projects. A synthesis summarizing accomplishments and defining future actions on each tributary, or a combined summary report about the tributaries, would help identify needs for future action.

Milestone 89. Restore and maintain a defined stream-meander zone and increase floodplain habitat on the San Joaquin River between Vernalis and the mouth of the Merced River.

Status: Four ERP and AFRP contracts may address this milestone of restoring floodplains by breaching San Joaquin River levees to the degree that they fall within the geographic scope of this milestone. One contract provides for a planning and outreach program for the Lower Tuolumne River and its lands, and three contracts target the feasibility analysis, planning and acquisition of nearly 3,400 acres along the San Joaquin River on San Luis NWR with the intent of breaching levees and increasing floodplain habitat.

Progress: On schedule

Next Steps: These projects should be monitored to evaluate the floodplain habitat benefits. An analysis is needed to better quantify this milestone.

Milestone 90. Establish a river meander corridor between the Chowchilla Bypass and Mendota Pool to expand the floodway corridor to convey increased anticipated flood flows and restore floodplain habitat.

Status: Milestone 90 specifically addresses the need to establish a river meander corridor between Chowchilla Bypass and Mendota Pool. Although no ERP or CVPIA contracts have specifically addressed this concern, there is an ERP contract funding an upper San Joaquin investigation (Milestone 94) for releasing experimental flows down the mainstream of the San Joaquin River. The target area of this water release was Friant to Mendota Pool, but the flow and the subsequent monitoring traveled downstream past Gravelly Ford. Recommendations in the report identify that the data can be used to evaluate river discharges at locations between Gravelly Ford and the Chowchilla Bypass. Therefore, this study can also contribute to this milestone. This milestone will be difficult to achieve without additional assessment of baseline conditions and a concerted community outreach effort. CDWR Category A, Proposition 13 contracts have contributed significant funding to feasibility studies yet to be completed.

Progress: Behind schedule

Next Steps: Pursue partnerships and activities that will address this milestone.

San Joaquin Region Habitats

There are five San Joaquin Region milestones (91-95) that are habitat specific. Key habitats for this region include agricultural land managed in a wildlife-friendly manner, fresh emergent wetland, perennial grasslands, and riparian and riverine aquatic habitats. Milestones 91-93 involve land acquisition and protection.

Milestone 91. In the San Joaquin River and West San Joaquin Basin EMZs, cooperatively enhance at least 15 to 25 percent of the ERPP target for wildlife friendly agricultural practices.

Status: One ERP contract provides for protecting and restoring 500-1,000 acres for use by riparian brush rabbit and Aleutian Canada goose that will include acreage for wildlife friendly agricultural practices. This is a recent grant and the actual acreage is not yet acquired. The ERP target from ERPP Volume II is 15,290 acres of agricultural land; therefore the goal is 2,290–3,820 acres. A variety of other fund sources (Service, CDFG, WCB) have provided for restoring more than 3,600 acres to wetland and upland habitats and agricultural easements on more than 9,950 acres of agricultural lands to benefit wildlife. There are significant opportunities to partner efforts to achieve this milestone.

Progress: On schedule

Next Steps: There is a need for continued monitoring and more detailed accounting of various habitat types and agricultural practices conserved. It is important to continued taking advantage of partnership opportunities.

Milestone 92. In the West San Joaquin Basin EMZ, restoring or create 100 acres of fresh emergent wetland habitat.

Status: There is one ERP acquisition and implementation contract that targets the floodplain revegetation and restoration of historic wetland basins and slough channels. The San Joaquin River NWR Riparian Habitat Protection and Floodplain Restoration Project-Phase II restored 300 acres of wetlands and another 200 acres of wetlands were enhanced on a 3,166-acre acquisition. In 1998 there were 56,779 acres of managed wetlands and as of 2003 there are 67,792 acres, for a total increase from 1998 to 2003 of 11,013 acres of managed wetlands in the San Joaquin Region (Fleskes, pers. comm.). This information is based on the Central Valley Habitat Joint Venture (CVHJV) map in which the San Joaquin River Basin covers a larger area than the ERP map of West San Joaquin Basin EMZ. The primary difference is the CVHJV map includes the ERP San Joaquin River Basin EMZ and East San Joaquin Basin EMZ. It should be noted that this milestone is very small for this region. This does not reflect a lack of importance of this habitat type in this region; instead, it acknowledges the significant existing wetlands initiatives underway in the region and allowed more ERP focus on other regional needs.

Progress: Ahead of schedule

Next Steps:

- Fund monitoring and adaptive management of completed projects.
- Milestone should be evaluated in context of fresh emergent wetland needs for species in the region and in the ERP solution area.

Milestone 93. In the West San Joaquin Basin EMZ, restore or enhance 1,000 acres of perennial grassland associated with existing or proposed wildlife corridors, wetlands, or floodplain habitats.

Status: No ERP contracts were developed specifically for this milestone, although ERP funded acquisitions at the San Joaquin River NWR could contribute to this milestone if the site elevations are suitable and the restoration strategy focuses on this objective. Additionally, more than 400 acres of native perennial grassland were developed by the San Luis NWR. Approximately 3,985 acres of upland was also restored or enhanced by or with grants from NAWCA. Portions of those areas are in the West San Joaquin Basin EMZ and may be classified as perennial grassland that might be enhanced or added to.

Progress: On schedule

Next Steps: There is a need to develop contracts to achieve this milestone and to explore partnerships for doing so. Restoration plans for recently acquired habitat should consider if the site is suitable for implementation of this milestone, and if so, should make perennial grassland restoration a priority. There is a need for continued monitoring and more detailed accounting of perennial grassland that has been restored.

Milestone 94. Develop and implement a program to establish, restore, and maintain riparian habitat to improve floodplain habitat, salmonid shaded riverine aquatic habitat and instream cover along at least one tributary within the East San Joaquin and San Joaquin River EMZs.

Status: Twenty-nine ERP and CVPIA contracts and funds from other sources were used to fund programs to address this milestone. In the Stanislaus EMU, nine contracts are in progress to restore up to 2,319 acres, with a goal of restoring 1.6 miles of continues miles of river frontage. Some instream work also was completed (restoring sections damaged by gravel extraction). Furthermore, there are additional contracts to restore approximately 1.3 miles of instream habitat. There are 14 contracts in the Tuolumne EMU where approximately 137 acres were restored to riparian habitat; 6,169 additional acres were acquired for restoration; 1,142 acres and portions within a 1.1-mile stretch of the Tuolumne River are in progress of being restored. There is additional planning for restoring another 6.1 miles on the Tuolumne in progress. For the six projects in the Merced EMU, 370 acres were protected and portions were restored; 2.5 miles of instream habitat were restored; and 2 miles of instream and riparian restoration is in the design and planning process. The Adaptive Management Forum provided significant review and advice to improve the restoration designs of most recent contracts.

Progress: On schedule

Next Steps:

- Continue efforts to complete establishment and restoration, and for monitoring and adaptive management of the riparian habitat created.
- Coordinate projects to optimize linkages and partnerships.
- Apply feedback from the Adaptive Management Forum.

Milestone 95. Implement 25 percent of the ERP target for diverse, self-sustaining riparian community for all EMZs in the San Joaquin River Basin. Bring at least three of the currently existing but unprotected delta coyote thistle occurrences into protection through purchase or conservation agreement, and ensure appropriate management. Increase suitable habitat for delta coyote thistle by at least 20 percent and the number of populations and individuals by at least 10 percent through habitat management and protection. Establish two new riparian brush rabbit habitat preserves within the historical range of the species. Protect and enhance a minimum of 150 contiguous acres of mature, shrub-rich riparian forest and associated highwater refugia on the San Joaquin River, between the Merced River confluence and Vernalis, and on each of the east-side tributaries (the Stanislaus, Tuolumne and Merced rivers) for habitat values and as potential riparian brush rabbit re-introduction sites.

Status: Nine ERP contracts and one AFRP contract, as well as funding from CVPIA and other sources contributed to progress on this milestone in the East San Joaquin and San Joaquin River EMZs. Because this milestone has multiple parts that are interrelated, it is difficult to assign specific contracts to particular actions. In the Stanislaus EMU, approximately 137 acres were restored to riparian habitat; several contracts are in progress to restore up to 2,319 acres, with a goal of restoring 1.6 miles of continues miles of river frontage at the San Joaquin River NWR. Some instream work also was completed (restoring sections damaged by gravel extraction). Furthermore, there are additional contracts to restore approximately 1.3 miles of instream habitat. In the Tuolumne EMU, 6,169 acres were acquired for restoration; 1,142 acres and portions within a 1.1-mile stretch of the Tuolumne River are in progress of being restored. In addition, planning for restoring 6.1 miles Tuolumne River is also in progress. In the Merced EMU, 370 acres were protected and portions were restored; 0.5 miles of instream habitat were restored; and 2 miles of instream and riparian restoration is in the process of being restored. No contracts have addressed either the protection of delta covote thistle or increasing suitable habitat for the species. Three contracts targeted habitat needs for the riparian brush rabbit, including enhancing habitat availability for one known population and acquisition of new potential habitat within its former range. Riparian brush rabbits bred in captivity were released at that site in 2002. All of the channel reconstruction projects on the Tuolumne and Merced rivers include riparian habitat enhancement. These projects and efforts by other groups need to be evaluated to assess whether and how these habitats link to one another to create wildlife corridors.

Progress: On schedule

Next Steps:

- In vetting this milestone, it should be considered how to integrate these riparian habitat linkages.
- Need to compete final phases of existing projects and concentrate on performance monitoring and adaptive management, particularly in the new riparian brush rabbit habitat area.
- Need to focus efforts to protect of delta covote thistle.

San Joaquin Region Stressors Reduction

Four milestones (96-99) address reducing stressors in the San Joaquin Region. Key stressors in the region include dams and others structures, water diversions, predation and competition, and contaminants.

Milestone 96. Develop and implement a program to address inadequate instream flows for steelhead and Chinook salmon on streams within San Joaquin River tributaries. Where appropriate provide adequate flows for Sacramento splittail and green sturgeon.

Status: One ERP contract addressed developing and carrying out a program to dealing with inadequate instream flows for steelhead and Chinook salmon on streams within San Joaquin River tributaries. An agreement to acquire 50,000 acre-feet of water per year between the U.S. Bureau of Reclamation and the Oakdale and South San Joaquin irrigation districts resulted from this program. Similar programs for the remaining tributaries need to be developed. Similar water acquisition discussions are being pursued with water rights holders on both the Tuolumne and Merced tributaries.

Progress: Behind schedule

Next Steps:

- Actively seek opportunities to improve flow on all tributaries.
- Evaluate regional flow needs for Sacramento splittail and green sturgeon.
- Engage EWP pilot to help develop opportunities.

Milestone 97. Provide unimpeded upstream and downstream passage for salmon and steelhead on San Joaquin River Basin tributaries.

Status: There are 11 ERP contracts and 5 AFRP contracts that contribute to achieving this milestone. The channel restoration projects in the mining reach and SRP 9 and 10 of the Tuolumne River (eight contracts) and the Merced River Salmon Habitat Restoration Project. River Miles 42-46 (MRSHEP) (four contracts) improve passage for salmon and steelhead. The deep in-river mining pits of SRP 9 and 10 and in the mining reach created severe passage problems for outmigrating smolts because of high numbers of predatory fish in these habitats and increased energetics. The 1997 floods caused the Merced River to avulse from a reach that supported up to 25 percent spawning effort in the Merced River and blocked adult fall-run passage to the remaining spawning habitat. MRSHEP Phase II reconstructed the river to remove this barrier and to restore spawning habitat. Phase I of the project created a setback levee to isolate a deep mining pit and associated predators to improve smolt passage. Similar projects have been considered on the Stanislaus River but planning and developing community support has progressed slowly. One ERP contract is for a landscape level plan that examines expanding anadromous fish habitat by identifying dams and diversions that could be altered or removed. A second ERP contract is a river reach reconstruction project on the Tuolumne River. One AFRP contract funded a long-range planning document to implement restoration and research on the Stanislaus River. A second AFRP contract researches the vagaries of environmental factors and

fall attraction flows as these affect up- migration and straying of Tuolumne River salmonids. Planning is an essential and critical step before physical measures or actions can be taken to enhance fish passage; the planning efforts associated with this milestone are important, however, physical restoration actions in focus reaches need to be completed and monitored to evaluate passage improvements.

Progress: On schedule

Next Steps:

- Need to complete physical restoration actions in focus area and monitor effectively.
- Need to consider flow options on tributaries as tool to improve passage.

Milestone 98. Initiate a feasibility study of restoring steelhead migration into upper watershed areas (e.g., upstream of major low-elevation dams) in at least one San Joaquin River Basin EMZ Tributary.

Status: One ERP contract evaluates opportunities for fish passage above dams on a landscape level perspective. There are two AFRP contracts that could provide a feasibility study about restoring steelhead migration into upper watershed areas (i.e., upstream of major low-elevation dams) in at least one San Joaquin River Basin EMZ tributary. One contract funds a project entitled *A Feasibility Investigation of Reintroduction of Anadromous Salmonids Above Crocker-Huffman Dam on the Merced River*. This contract could fulfill this milestone, but has been hampered by access problems to the targeted river reach and has been delayed; access options are being explored. The other AFRP contract will develop a consensus-based plan to direct the long-term implementation of prioritized restoration or research for the Stanislaus River below Goodwin Dam. Data are being analyzed and planning work continues. Determination of whether this reach of the Stanislaus River constitutes an upper watershed area must be made.

Progress: On schedule

Next Steps:

- Consider actions to assist gaining access to Merced River above Crocker-Huffman Dam.
- Continue to encourage alternative proposals to address this milestone.

Milestone 99. Install positive barrier fish screens on all diversions greater than 250 cfs in all EMZs and 25 percent of all smaller unscreened diversions in the San Joaquin River Basin. Among those diversions to be screened are the El Solyo, Patterson, and West Stanislaus irrigation district diversions.

Status: There are two contracts that directly contributes to this milestone and others that contribute indirectly. Two ERP contracts with the Patterson Irrigation District to conduct the planning, design, and environmental review necessary for installing a positive barrier fish screen; this contract is about 10 percent completed. The AFRP contract funding the *Consensus Based Plan to Direct the Long Term Implementation of Prioritized Restoration/Research in the Stanislaus River Below Goodwin Dam* could contribute indirectly to completion of this milestone by identifying how screening small diversions could contribute to fish needs, if sufficient information is available. The Four Pumps Program funded CDFG to screen up to 15 priority smaller agriculture diversions within the East San Joaquin Basin EMZ. Within the San Joaquin

River Basin, there are two diversions greater than 250 cfs and 472 smaller unscreened diversions (25 percent equals 118). As yet, no positive barrier fish screens have been installed on any diversions in the San Joaquin Region and none of the specifically targeted diversions have been screened.

Progress: On schedule

Next Steps:

- Facilitate the completion of existing screening projects.
- In their December 2001 memo (http://calwater.ca.gov/Programs/EcosystemRestoration/InterimScienceBoard/ISB_ReportOn_FishScreens.pdf), the ERPSB questioned the need to screen small diversions given the paucity of scientific information on the effectiveness and ecosystem benefits of screening small diversions. They suggest that next steps include a study on the individual, population and ecosystem benefits of screening remaining small diversions. Results from this study would inform future prioritization and funding for screens.
- Milestone needs to be scientifically vetted to determine if new small diversion screens are appropriate and to assist in establishing in what priority.

Milestone 100. Actions to minimize or eliminate low dissolved oxygen conditions (DO sag) in lower San Joaquin River near Stockton (from Phase II Report):

- Complete studies of causes for DO sag in San Joaquin River near Stockton.
- Define and implement corrective measures for DO sag.
- Finalization of investigation of methods to reduce constituents that cause low DO for inclusion in total maximum daily load (TMDL) recommendation by the Central Valley RWQCB.
- Finalization of Basin Plan Amendment and TMDL for constituents that cause low DO in the San Joaquin River.
- Implement appropriate source and other controls and other management practices, as recommended in the TMDL, to reduce anthropogenic oxygen depleting substances loadings and minimize or eliminate low DO conditions.

Status: See Milestone 26.

Progress: See Milestone 26.

Next Steps: See Milestone 26.

Milestone 101. Develop, implement, and support measures to reduce pollutant (oxygen depleting substances, nutrients, and ammonia) discharges from concentrated animal feeding operations (from Phase II Report).

Status: No ERP contracts were funded that specifically target the objective of this milestone. However, there are two contracts that have contributed more indirectly to outreach and education and new data about water quality impacts from animal feeding operations. It is unclear how the outreach and education project has impacted animal feeding practices and discharges to the San Joaquin River. A recently completed study funded for San Joaquin River DO shows animal

waste is a significant source of nitrate in the San Joaquin River and its tributaries. The CVRWQCB is in the process of putting large animal feeding operations (CAFOs) under a blanket NPDES permit. This regulatory action by the CVRWQCB should substantially reduce or prohibit discharges from animal feeding operations. There may be other projects under different grant programs that would contribute more directly to this milestone that were not evaluated. See other milestones (27, 45, and 73) for additional projects that address this milestone at a landscape level.

Progress: Under evaluation

Next Steps:

- Summarize and evaluate projects, actions, and monitoring being done by other agencies and organizations related to this issue. This includes information on the extent of the contamination and ecological effects, as well as potential regulatory or management actions to reduce sources.
- Working with other agencies and organizations, identify gaps and high priority actions to reduce ecological effects of oxygen depleting substances, nutrients, and ammonia in the San Joaquin River.
- Address high priority actions, as appropriate.

Milestone 102. Actions to minimize or eliminate inter-substrate low dissolved oxygen conditions in salmonid spawning and rearing habitat, especially in the Mokelumne, Cosumnes, American, Merced, Tuolumne, and Stanislaus Rivers (from Phase II Report and Water Quality Program Plan):

- Develop inter-substrate DO testing for salmonid spawning and rearing habitat.
- Conduct comprehensive surveys to assess the extent and severity of inter-substrate low DO conditions.
- Develop and begin implementing appropriate BMPs, including reducing anthropogenic fine sediment loads, to minimize or eliminate inter-substrate low DO conditions.

Status: There are no ERP studies that specifically address this milestone. One contract contributes to this milestone. Inter-substrate DO was measured at gravel enhanced riffles in the Knights Ferry Gravel Replenishment Project, based on the hypothesis that gravel replenishment would improve critical fisheries habitat and would improved inter-substrate DO. The ERP funded many gravel enhancement projects in this region, but this is the only gravel enhancement project funded by ERP that includes this type of monitoring. The results of this study should be evaluated and should be used to guide needed work on this milestone. There may be other contracts under different grant programs that would contribute more directly to this milestone but were not evaluated. See Milestone 74 for additional contracts that address this milestone at a landscape level perspective.

Progress: Behind schedule

Next Steps:

• Evaluate results from the current contract to determine if the methodology applied in this gravel replenishment project should be required of similar projects funded in the future.

- Solicit projects to address the extent and severity of inter-substrate low DO conditions Summarize and evaluate projects, actions, and monitoring being done by other agencies and organizations related to this issue. This includes information on the extent of the ecological effects, as well as potential regulatory or management actions to reduce fine sediment sources contributing to inter-substrate low DO.
- Work with other agencies and organizations, identify gaps and high priority actions to reduce sediment inputs and reduce ecological effects of inter-substrate low dissolved oxygen.
- Address high priority actions, as appropriate.

Milestone 103. Assess the ecological effects of low DO conditions in Suisun Marsh due to adding oxygen-depleted water from anthropogenic sources (from Water Quality Program Plan).

Status: No contracts were awarded to address this milestone. This milestone needs to be modified to fit the San Joaquin Region unless it is intended to address known effects on the Suisun Marsh by the San Joaquin River. The Suisun Marsh is affected by seasonal DO deficit due to the operation of the managed wetlands. The islands are flooded with channel water that becomes nearly anaerobic while on the islands. This water flows into the main channel on the ebb tide and can cause low DO concentrations in the channel. The Suisun Marsh is listed as impaired for flow and urban and storm runoff on the Federal Clean Water Act 303 (d) list.

Progress: Under evaluation

Next Steps:

- More studies are needed to evaluate the extent and impact of low DO conditions in Suisun Marsh and if warranted, develop marsh restoration and management actions to minimize them.
- Summarize and evaluate projects, actions, and monitoring being done by other agencies and organizations related to this issue.
- Work with other agencies and organizations and identify gaps and high priority actions to improve DO conditions in the Suisun Marsh.
- Address high priority actions, as appropriate.

Milestone 104. Encourage regulatory activity to reduce discharge of oxygen reducing substances and nutrients by unpermitted dischargers (from Phase II Report).

Status: There are no funded contracts or specific actions taken by ERP to address this milestone. However, the ERP coordinates with the CVRWQCB, which is taking steps to address this milestone using its existing authority (i.e., agricultural waiver and nonpoint source pollution and animal waste programs). There likely are other contracts under different grant programs that would contribute more directly to this milestone. Those contracts were not addressed in this evaluation. See other milestones (28, 46, 75) for additional contracts that address this milestone at a landscape level perspective.

Progress: Under evaluation

Next Steps:

- Summarize and evaluate projects, actions, and monitoring being done by other agencies and organizations related to this issue. This includes information on the extent of the contamination and ecological effects, as well as potential regulatory or management actions to reduce sources.
- Working with other agencies and organizations, identify gaps and high priority actions to reduce ecological effects of oxygen reducing substances and nutrients by unpermitted dischargers to the San Joaquin River.
- Address high priority actions, as appropriate.

Milestone 105. Actions to reduce fine sediment loading to streams, especially Tuolumne, Merced, Stanislaus, Cosumnes, Napa, and Petaluma Rivers, and Sonoma Creek, due to human activities (from Phase II Report and Water Quality Program Plan):

- Participate in implementation of USDA sediment reduction program.
- Implement sediment reduction BMPs in construction areas, on agricultural lands, for urban storm water runoff, and other specific sites.
- Implement stream restoration and revegetation work.
- Quantify and determine ecological impacts of sediments in target watersheds, implement corrective actions.

Status: Several contracts contribute to this milestone. These contracts, either through planning, education or restoration, will reduce erosion, sedimentation and fine sediment loading in several watersheds. At least four contracts include stream restoration and revegetation work in key watersheds (Stanislaus, Tuolumne and Merced) that provide important anadromous fish habitat. Salmon habitat and riparian forest was restored over a two-mile area. Contracts from other fund sources and programs may also contribute to this milestone but were not evaluated. See Milestones 29, 47, and 76 for additional contracts that address this milestone at a landscape level.

Progress: On schedule

Next Steps:

- Summarize and evaluate contracts, actions, and monitoring being done by other agencies and organizations related to this issue. This includes information on the extent of the ecological effects, as well as potential regulatory or management actions to reduce fine sediment loading to key streams and rivers.
- Work with other agencies and organizations identify gaps and high priority actions to reduce fine sediment inputs to key streams and rivers.
- Address high priority actions, as appropriate.

Milestone 106. Conduct the necessary research to determine no adverse ecological/biological effects threshold concentrations for mercury in sediments and key organisms in the Bay-Delta estuary and its watershed.

Status: Milestone 30 (Delta Region) contains a summary of mercury research that applies to all of the regions. In addition to these landscape-level perspective research contracts, there is an ERP-funded study on the Merced River to evaluate mercury contamination and potential impacts

for restoration actions in the Merced River watershed. The issue of mercury contamination in dredge tailings needs more investigation to determine how mercury may be mobilized if these materials are used for restoration of spawning habitat in the tributaries. If dredge tailings cannot be used for restoration due to the mercury contamination, it may greatly increase the cost of doing restoration work in some areas.

Progress: On schedule

Next Steps:

- Develop an implementation plan for the mercury strategy, in coordination with other agencies and research groups. Provide a framework for coordination and communication for existing mercury research groups.
- Solicit for additional projects to implement the mercury strategy, with emphasis on understanding effects of restoration on mercury availability, and evaluating ecological effects of mercury contamination.

Milestone 107. Conduct the following pesticide work (from Phase II Report):

- Develop diazinon and chlorpyrifos hazard assessment criteria with CDFG and the Department of Pesticide Regulations.
- Support development and implementation of a TMDL for diazinon.
- Develop BMPs for dormant spray and household uses.
- Determine the ecological significance of pesticide discharges.
- Support implementation of BMPs.
- Monitor to determine effectiveness of BMPs.

Status: Milestone 33 (Delta Region) contains summary information of contracts that address this milestone for all of the regions. Specific to the San Joaquin Region, ERP funded a contract to reduce pesticide inputs from agriculture, with a goal of improving pesticide and nutrient management on 35,000 acres of cotton in the San Joaquin Valley. The DWQP also funded a demonstration project on Orestimba Creek to evaluate methods to improve the water quality of agricultural runoff, including nutrients and pesticides.

More investigations are needed to evaluate episodes of both water and sediment toxicity from pesticides, including pyrethroids, as well as potential effects from sublethal exposures that may affect aquatic populations. There are significant efforts by other organizations to address pesticide issues, including the agricultural drainage program and TMDL implementation at the CVRWRCB, PRIZM grants from USEPA, and other efforts by USDA and local groups to reduce pesticide usage and impacts from pesticides. In October 2003, the CVRWQCB amended the Basin Plan for the Sacramento and Feather rivers to include a TMDL for diazinon. See other milestones (33, 49, and 80) for additional contracts that address this milestone at a regional level. The first two bullet items are complete for this milestone. Other bullet items are under evaluation because of the need to summarize and evaluate existing projects and data from other organizations.

Progress: On schedule

Next Steps:

- Summarize and evaluate projects funded by other agencies and organizations related to this
 issue. This should include any source reduction activities, monitoring, or evaluation of
 ecological effects.
- Work with other groups and agencies to identify gaps and priorities for future research and monitoring.
- Address high priority actions, as appropriate. At this time, the highest priorities should include a coordinated monitoring program, projects that evaluate ecological effects to aquatic life, and projects that evaluate the effectiveness of BMPs to reduce pesticide impacts.

Milestone 108. Conduct the following selenium work:

- Conduct selenium research to fill data gaps in order to refine regulatory goals of source control actions;
 determine bioavailability of selenium under several scenarios (from Phase II Report).
- Evaluate and, if appropriate, implement real-time management of selenium discharges (from Phase II Report).
- Expand and implement source control, treatment, and reuse programs (from Phase II Report).
- Coordinate with other programs; e.g., recommendations of San Joaquin Valley Drainage Implementation Program, CVPIA for retirement of lands with drainage problems that are not subject to correction in other ways (from Phase II Report).
- Support development and implementation of TMDL for selenium in the San Joaquin River watershed (focus on Grassland area).

Status: See Milestone 34.

Progress: See Milestone 34.

Next Steps: See Milestone 34.

Milestone 109. Conduct the following actions in reduce organochlorine pesticide inputs to streams (from Phase II Report):

- Participate in implementation of USDA sediment reduction program.
- Implement sediment reduction BMPs on agricultural lands and other specific sites.
- Implement BMPs for urban/industrial storm water runoff and discharges to reduce PCB and organochlorine pesticides.

Status: Organochlorine pesticides are no longer used in this watershed; these pesticides have been banned, so if the only source is the widespread contamination of existing sediments, there is little that can be done to reduce the contamination. However, they are extremely persistent and tend to bind strongly to the sediment. Therefore, efforts to reduce sediment inputs will also reduce inputs of organochlorine pesticides. Four of the contracts for this milestone address management practices associated with runoff and use of pesticides. Since organochlorine pesticides are no longer in use the projects most likely to affect this milestone are those that advocate and apply management practices that control runoff and sediment. The contribution of

some of the listed contracts to this milestone is indirect for that reason. See other milestones (35, 51, and 81) for additional contracts that address this milestone at a landscape level.

Progress: Under evaluation

Next Steps:

- Summarize and evaluate projects, actions, and monitoring being done by other agencies and organizations related to this issue. This includes information on sediment or fish tissue concentrations, sources of organochlorine pesticides, possible management or regulatory actions to reduce inputs, and ecological effects.
- Working with other agencies and interested parties, evaluate existing data and identify gaps.
 Identify highest priorities for evaluating or controlling organochlorine pesticides in the aquatic system.
- Address high priority actions, as appropriate.

Milestone 110. Conduct the following trace metals work (from Phase II Report):

- Determine spatial and temporal extent of metal pollution.
- Determine ecological significance and extent of copper contamination.
- Evaluate impacts of other metals such as cadmium, zinc, and chromium.
- Participate in Brake Pad Partnership to reduce introduction of copper.
- Partner with municipalities on evaluation and implementation of storm water control facilities.
- Participate in remediation of mine sites as part of local watershed restoration and Delta restoration.

Status: One contract, for a demonstration project to evaluate a method for treating acid mine drainage in Amador county, was funded by the CALFED Program to support this milestone in the San Joaquin Region. See Milestones 36, 52 and 82 for additional contracts that address this milestone in other regions.

Progress: Under evaluation

Next steps:

- This milestone should be scientifically vetted and evaluated for actions that may be most appropriate for the San Joaquin Region.
- Prioritize future actions to reduce trace metal pollutants that are causing ecological impairment.
- Summarize and evaluate projects funded by other agencies and organizations related to this issue. This should include any source reduction activities, monitoring, or evaluation of ecological effects.
- Work with other groups and agencies to identify gaps and priorities for future research and monitoring.
- Address high priority actions, as appropriate. At this time, the highest priorities should include a coordinated monitoring program, projects that evaluate ecological effects to aquatic life, and projects that evaluate the effectiveness of BMPs to reduce impacts from trace metals.

Milestone 111. Conduct the following unknown toxicity work (from Phase II Report):

Conduct appropriate studies to identify unknown toxicity, and develop management actions as appropriate.

Status: Milestone 37 (Delta Region) summarizes the contracts that address this milestone at a landscape level. There are no contracts funded by ERP that are specific to the San Joaquin Region.

Progress: Under evaluation

Next Steps:

- Summarize and evaluate projects funded by other agencies and organizations related to this issue.
- Work with other groups and agencies to identify gaps and priorities for future research and monitoring.
- Address high priority actions, as appropriate. At this time, the highest priorities are to implement a monitoring program, assessment of ecological effects on populations, improved methods to identify causes of toxicity, and development of strategies to reduce toxicity in the aquatic environment.

Research Milestones

The Research Milestones are not limited by geographical boundaries as are the regionally-based milestones; these milestones are multi-regional and were developed to address CALFED Program-wide information needs. No vision statements for research milestones were presented in the PEIS/R. In this section, the research milestones are stated followed by a description of contract information and CALFED Program accomplishments that help in progress toward substantially implementing these milestones. Gaps in milestones are also described along with suggestions on how to fulfill remaining obligations.

Fulfilling Remaining Obligations for the Research Milestones. The Interagency Ecological Program's (IEP) effort to develop a Comprehensive Long-term Monitoring Program (Milestone 112) built upon past work (such as Comprehensive Monitoring, Assessment, and Research Plan [CMARP], Terrestrial and Amphibian Monitoring Plan [TAMP] and Aquatic Monitoring Plan [AMP]) and existing foundational monitoring programs to fulfill monitoring and assessment mandates for CALFED's Water Quality, Ecosystem Restoration and Watershed programs will be critical to the success of the CALFED Program. It will need to include numerous assessments and feedback loops so management decisions can be based on sound and peer-reviewed science. Geographic information system (GIS) capability will be necessary to monitor the location and acreage of Natural Community Conservation Plan (NCCP) habitats being restored, enhanced, and protected in order to track progress toward achieving the NCCP prescriptions for natural communities. Species inventories and range-wide distributional surveys for "R and "r" plants and animals need to become a high priority for both the ERP and Science programs. This

baseline information will serve as a benchmark to measure species' response to habitat restoration projects and to complete the adaptive management loop. Monitoring the status and trends of species is necessary to inform the ERP whether species prescriptions are being met and are on a trend toward achieving recovery objectives. The Comprehensive Long-term Monitoring Program is necessary to assess projects and programs for all CALFED Program elements and to make the Action Specific Implementation Plan (ASIP) process work as intended.

Some progress has been made in better understanding the essential conditions necessary for the germination and establishment of riparian woody plants on the Sacramento and San Joaquin rivers (Milestone 113); however, the various restoration projects and programs that are contributing to this body of information do not appear be coordinating with each other as well as they could be. Well-planned, integrated studies and restoration experiments would yield greater information as compared to individual, disconnected studies. The Science Program should provide the oversight and coordination necessary needed to conduct multi-disciplinary studies that will increase the scientific understanding of riparian woody plant reproduction and development processes.

Olcott Lake contains several vernal pool-dependent species that are threatened or endangered under the Federal Endangered Species Act (FESA) and which are covered species. No projects could be identified that are conducting investigations of hydrology and vernal pool species in this unusual habitat as required by Milestone 114. The ERP Implementing Agencies (Service, NMFS, and CDFG) should consider a directed action to address this milestone if no proposals are received through the competitive proposal solicitation process.

There has been substantial work conducted on instream flow studies associated with anadromous and estuarine fish species (Milestone 115). As stated above, the ERP Implementing Agencies should continue ongoing instream flow investigations and stimulate additional partnerships among agencies, researchers and restoration ecologists, with oversight being provided by the Science Program, to initiate new studies that will investigate flow requirements necessary to support all life stages of anadromous and estuarine fish species.

Focused studies to investigate in-channel structures with respect to habitat for predator and prey fishes and predation on juvenile salmonids are lacking (Milestone 116). Only a few contracts have been identified that touch upon components of this milestone. However, no single contract or program of study could be identified that specifically addresses the complex questions relating to predator-prey interactions, their behavior, nuances of habitat suitability, and especially those aspects that would support effective recommendations for reducing predation on juvenile salmonids. Well-planned, integrated studies and experiments would yield greater information as compared to individual, disconnected studies. The Science Program should provide the oversight and coordination needed to conduct multi-disciplinary studies that will increase our scientific understanding of the influence of inchannel structures on aquatic habitat for fishes and predator-prey interactions. The ERP Implementing Agencies should consider a directed action to establish a program if no proposal is received through the competitive proposal solicitation process.

Experimental introductions of Sacramento perch into nontidal perennial aquatic habitats appear to be well on-schedule (Milestone 117). Evaluating the outcome of the initial phase of investigations being

conducted under contract by UC Davis will be the logical next step toward a decision whether to proceed with a pilot project to introduce Sacramento perch aquatic habitats.

There has been substantial progress towards assessing the impact of hatchery practices on naturally spawning populations of Chinook salmon and steelhead (Milestone 118). The CDFG and NOAA Fisheries Joint Review Committee and technical review panels convened for Battle Creek Salmon and Steelhead Restoration Project are notable examples. Outcomes of these technical reviews were recommendations for operating hatcheries in a manner that will maintain genetic integrity of Central Valley anadromous salmonid populations. Implementation of these recommendations will be an ongoing activity.

There are substantial improvements being made regarding the monitoring of adult anadromous salmonid returns to watersheds in the MSCS focus area (Milestone 119). The IEP Salmon Escapement Project Workteam tests new technologies and makes recommendations on how to improve monitoring methodologies. Monitoring techniques, data compilation and analysis, and reporting are becoming more standardized, but more work may be needed. Because each tributary is unique and requires slightly different methods, the workteam believes they have gone as far as they can with respect to standardization of methods. The ongoing evaluation and modification of monitoring techniques, data compilation and analysis, and reporting mechanisms would be an appropriate function of the Comprehensive Long Term Monitoring Program under development by IEP.

Milestone 112. Develop and implement a comprehensive monitoring, assessment and research program (CMARP) for terrestrial and aquatic habitats and species populations acceptable to the fish and wildlife agencies. Conduct rangewide surveys for all "R" and "r" covered plants and animals in the MSCS Focus Area.

Status: CMARP is an Appendix to the PEIR/EIS and it states that the original CMARP effort came from a Congressional mandate to "monitor success of CALFED restoration efforts." The CMARP document describes six principle areas of coordination that needed improvement between CALFED Program and existing programs to create a system that channels information effectively to decision-makers:

- 1. better organization of and access to information,
- 2. coordinating CALFED Program needs with existing programs,
- 3. regional focus and coordination of monitoring and research,
- 4. identify and filling gaps in data collection, assessment, quality assurance, management and reporting.
- 5. facilitating the process of converting data into condensed information usable by decision-makers, and
- 6. improving communication between scientists and decision-makers.

CMARP's role was not to interfere with what is already working well, but instead to provide a greater level of coordination and regional focus to the research and monitoring efforts currently underway in the CALFED Program solution area and integrate monitoring and research information at a regional level. CMARP was envisioned to be the entity that would provide scientific oversight and establish standards for the monitoring and reporting of data being collected throughout the CALFED Program solution area, convert these technical data into

information and facilitate the transfer of this information to decision makers and the public. The MSCS and program-level approvals issued to the CALFED Program under FESA and the Natural Community Conservation Planning Act (NCCPA) require a comprehensive aquatic and terrestrial monitoring program (components of CMARP) to be in place to assess baseline conditions and the effectiveness of CALFED program actions. The CALFED ROD gave the Science Program the responsibility to implement CMARP.

TAMP was developed for the CALFED Program, but was never finalized and implemented. AMP was commissioned by the Science Program, but to-date has not been completed. The TAMP and AMP are intended to provide the framework for protocols developed for data collected by ERP projects and for the collection of essential information on status and trends of species and habitats.

The Science Program funded a pilot monitoring project called the Integrated Regional Monitoring Wetland Monitoring Pilot Project. The project is to collect data on physical processes, vegetation, birds, fish, invertebrates, nutrients, and productivity from wetlands in the northern San Francisco Estuary and western Sacramento-San Joaquin Delta to help develop an integrated regional monitoring plan.

The Science Program has made additional progress in certain areas that relate to objectives of CMARP. These efforts include:

- An intensive effort to clarify and improve the state of knowledge on a number of specific and central issues with an emphasis on water operations and environmental resources, critical fish species, water operations modeling, and restoration science.
- Establish a practice of seeking external peer review and advice and conducted external reviews of major proposals on delta smelt salvage and south Delta diversion facility hydrodynamics.
- Initiate the use of public workshops as forums to publicly discuss complex technical issues.
- Develop a common methodology for assessing performance at different scales.
- Provide ongoing advice to individual CALFED program elements regarding independent panels, performance assessment programs, science strategies, and peer review as part of proposal solicitation processes.
- Develop and implement a basic organizational design for integrating science throughout the CALFED Program, including the establishment of a standing CALFED Program Independent Science Board (ISB), Environmental Water Account review panel, and other subject-specific review panels such as the in-Delta storage review panel.

The Science Program developed a performance measure conceptual framework along with a short list of performance measures that can be used to evaluate and communicate the progress of every CALFED program element. The conceptual framework links program goals, system process models, and performance indicators and metrics. Prototype performance measures were developed as a first attempt to describe performance across the array of CALFED program elements with a consistent approach. These measures present both quantitative and, in the case of water supply reliability, qualitative information that relates directly to CALFED Program's four main goals. The specific measures were selected based on the availability of robust monitoring

data that are expected to continue being collected (and thus selecting measures for which data are likely to be available), but by no means cover the depth and complexity of the CALFED Program. They have undergone colleague review by agency staff, and peer review from members of the ERPSB. As the CALFED Program matures, the implementing agencies will be preparing and carrying out a detailed strategy to build on these prototypes and eventually complete their desired portfolio.

The Surface Water Ambient Monitoring Program (SWAMP) was proposed in a report to the Legislature to integrate existing water quality monitoring activities of the SWRCB and RWQCBs, and to coordinate with other monitoring programs. Water Code Section 13192, established by Assembly Bill 982, requires the SWRCB to assess and report on the state monitoring programs and prepare a proposal for a comprehensive monitoring program. Water Code Section 13191, established by AB 982, requires the SWRCB convene an Advisory Group to assist in the evaluation of program structure, and effectiveness as it related to the implementation of the requirements of the Clean Water Act Section 303d, applicable Federal regulation, and monitoring and assessment programs.

Ambient monitoring refers to any activity in which information about the status of the physical, chemical and biological characteristics of the environment is collected to answer specific questions about the status, and trends in those characteristics. For SWAMP, ambient monitoring refers to these activities as they relate to the characteristics of water quality. Only a small portion of SWAMP can be implemented at its current funding level. As a result, resources are focused where monitoring information is most needed to support regional program priorities.

SWAMP is a statewide monitoring effort designed to assess the conditions of surface waters throughout California. The program is administered by SWRCB. Responsibility for implementation of monitoring activities resides with the nine RWQCB's that have jurisdiction over their specific geographical areas of the State. Monitoring is conducted in SWAMP through the CDFG and USGS master contracts and local RWQCBs monitoring contracts.

The Regional Monitoring Program for Trace Substances in the San Francisco Estuary (RMP) is the primary source of information used to evaluate chemical contamination in the Bay. The RMP is an innovative collaborative effort between San Francisco Estuary Institute (SFEI), the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB), and the regulated discharger community. In the RMP, financial resources from the discharger community are pooled and applied in a strategic, comprehensive manner toward understanding contaminant impacts on beneficial uses of the Bay. The RMP focuses on determining spatial patterns and long term trends through sampling of water, sediment, bivalves, and fish, effects on sensitive organisms, and chemical loading to the Bay, and seeks to synthesize RMP data with data from other sources to provide the most complete assessment possible of chemical contamination in the Bay.

The IEP is an interagency organization that provides information on the factors that affect ecological resources in the Sacramento - San Joaquin Estuary that allows for more efficient management of the estuary. It has been conducting cooperative investigations since 1970. The IEPs goals are:

- To provide for the collection and analysis of data needed to understand factors in the Sacramento-San Joaquin estuary controlling the distribution and abundance of selected fish and wildlife resources and make the data readily available to other agencies and the public.
- To comply with permit terms requiring ecological monitoring in the estuary.
- To identify impacts of human activities on the fish and wildlife resources.
- To interpret information produced by the program and from other sources and, to the extent possible, recommend measures to avoid and/or offset adverse impacts of water project operation and other human activities on these resources. To seek consensus for such recommendations, but to report differing recommendations when consensus is not achieved.
- To provide an organizational structure and program resources to assist in planning, coordination, and integration of estuarine studies by other units of cooperating agencies or by other agencies.

The Environmental Monitoring Program (EMP) for the Sacramento-San Joaquin Delta, Suisun Bay, and San Pablo Bay is conducted under the auspices of the IEP. The EMP was initiated in 1971 in compliance with SWRCB Water Right Decision 1379 and continued from 1978 through 1999 under D-1485. Currently it is mandated by Water Right Decision 1641. The program is carried out jointly by the two water right permittees operating the California water projects, the Reclamation and CDWR, with assistance from CDFG and USGS. Primarily, the EMP is to provide necessary information for compliance with flow-related water quality standards specified in the water right permits. In addition, the EMP also provides information on a wide range of chemical, physical and biological baseline parameters.

One hundred and eleven contracts funded by ERP stated components of project-specific monitoring, assessment, or research on terrestrial and aquatic habitats and species identified in the ERP and MSCS. Progress is being made in gathering essential project-level monitoring data, however, these data and technical conclusions need to be synthesized and integrated into an adaptive management program designed to inform the CALFED Program decision-making process.

Progress: Behind schedule

Next Steps: To date, a monitoring program necessary for ERP and MSCS purposes, as stated in the programmatic biological opinions and NCCP approval, has not been completely developed or implemented. A draft TAMP was developed, but was never finalized and implemented; a draft AMP also was never finalized and implemented. These monitoring plans are critical requirements under State and Federal law to fully evaluate progress towards achievement of CALFED Program goals including restoration and recovery targets for MSCS at-risk species. Developing conceptual models, ecological indicators, and performance measures must also be completed so monitoring, data management, assessment, research, and reporting in a manner consistent with an adaptive management implementation strategy may be attained. Essential to this strategy is the synthesis and evaluation of data being collected by existing monitoring programs conducted by IEP, SWAMP, RMP, and CDFG and the Service and fish monitoring in tributaries by CDFG and the Service.

The IEP Coordinators are developing a proposal for a detailed long-term comprehensive ecological (including water quality) monitoring program built upon past work and existing foundational monitoring programs to fulfill monitoring and assessment mandates for CALFED's DWQP, ERP and Watershed Program. The geographic scope would encompass the CALFED Program's geographic area within the watersheds that are directly connected to the Bay, Sacramento River, and the San Joaquin River and would go up these watersheds to the base of the dams on the main rivers. The proposed development of the Comprehensive Long-term Monitoring Program will fully incorporate existing conceptual models and adaptive management principles in a collaborative process while fully coordinating the elements of existing monitoring and special studies programs being carried out under the CALFED Program umbrella. It will include numerous assessments and feedback loops so that management decisions are based on sound and peer reviewed science. A final concept proposal for the development of a Comprehensive Long-term Monitoring Program will include:

- 1. An estimated annual program budget (initially thought to be \$5 to \$10 million per year above the existing IEP budget).
- 2. Coordination and collaboration with the Science Program and agencies, stakeholders, scientists, and others to develop and refine overall monitoring goals and objectives.
- 3. Updated conceptual frameworks/models necessary to understand factors affecting CALFED Program actions relative to monitoring needs of the Bay-Delta.
- 4. Preliminary designs for a Comprehensive Long-term Monitoring Program with an implementation structure (including management and scientific oversight.
- 5. Identification of key research questions and performance measures applicable to monitoring needs developed in consultation with science board reviews.
- 6. Recommendations on preliminary resource needs (money, people, equipment, etc.).

The development of the Comprehensive Long Term Monitoring Program will include extensive coordination and collaboration with all existing long-term monitoring programs, developers of monitoring plans (e.g., CMARP, TAMP, AMP, Wetland Monitoring Program), authors of papers addressing the needs of monitoring, and resource managers that would rely on these data and be completed by July 2005. Following appropriate review and subsequent approval, the proposed implementation of the full program would begin in January 2006.

Milestone 113. Develop and begin implementation of a study to determine appropriate conditions for the germination and establishment of riparian woody plants along the Sacramento River and San Joaquin River. Complete development of a cooperative program to plant vegetation on unvegetated riprapped banks consistent with flood control requirements.

Status: The loss or degradation of historic riparian vegetation from river and stream channel banks and alteration of near-shore aquatic habitat have primarily been caused by channelization, stabilization of channel banks with riprap, and construction of levees. Control of flows and diversion of water have altered the hydrologic conditions that historically supported riparian vegetation. There has also been a loss of shaded riverine aquatic habitat which helps to moderate maintain water temperatures, critical to the survival of anadromous and estuarine fish species. Levees, bridges, and bank protection structures inhibit overland flow and erosion and depositional processes that develop and maintain floodplains, and allow stream channels to

meander. Levees prevent floodflows from entering historic floodplains behind levees, stopping floodplain evolution, and eliminating or altering the character of floodplain habitats.

One contract associated with this milestone was granted for developing a methodology to evaluate Delta flow and hydrodynamic patterns and to determine the appropriate timing and conditions for optimum germination and establishment of woody riparian plants along the Cosumnes River, with expected wider application to the Sacramento River and San Joaquin River systems. Another effort utilizes pilot study results to select additional study sites for developing a conceptual model of riparian plant establishment in the San Joaquin River Basin.

The San Joaquin River Pilot Project entails monitoring the downstream effects of the augmented flows at ten recommended cross sections, including the response of riparian seedlings and saplings. This pilot project proposed to release 35,000 acre-feet of water between June and October 1999. This flow was to promote dispersal and germination of seed from native riparian plant species. Monitoring includes an assessment of tree seed maturation, the use of piezometers, alluvial groundwater monitoring wells, flow measurements and Wolman counts, and vegetation sampling.

The East Delta Habitat Corridor Tidal project will restore tidal marsh and riparian habitat in Georgian Slough. It will include the development of a restoration and monitoring plan; riparian enhancement on poorly vegetated berms; and will improve existing tidal marshes through erosion control using experimental, biotechnical revetment and revegetation with native plants.

Progress: On schedule

Next Steps: The studies described above will provide much of the foundational information needed to substantially implement this milestone; however, there needs to be additional work to develop the kinds of cooperative relationships with appropriate agencies and stakeholders necessary for the kind of program envisioned in this milestone. This will include obtaining appropriate authorization from those entities responsible for levee integrity.

Milestone 114. Conduct a study to investigate the effects of the road through Olcott Lake on vernal pool hydrology and impacts on vernal pool species.

Status: Seasonal wetlands and aquatic habitats are important habitat-use areas for many aquatic and terrestrial species in the ERP focus area. Loss of vernal pool habitat, in particular, has directly resulted in the listing of several vernal pool-dependent species as threatened or endangered under the federal Endangered Species Act. Olcott Lake, an 80-acre vernal playa in the Jepson Prairie Preserve in Solano County, contains habitat for many vernal pool species, including delta green ground beetle, vernal pool fairy shrimp, conservancy fairy shrimp, Colusa grass, Solano grass, and California tiger salamander.

The hydrology of Olcott Lake is affected by the Sacramento Northern Railroad track, which just intersects the western edge of the lake; Cook Lane, which bisects the lake; and a shallow ditch in the southeast corner of the lake. The fill under the railroad track is a barrier to water moving into or out of the lake. The ditch drains the lake, eventually discharging into Calhoun Cut. Wind also

causes wave action in the lake, which suspends lake-bottom sediments and causes erosion on the leeward shoreline.

No contracts were identified that pertain to investigations of Olcott Lake hydrology and vernal pool species as required by this milestone.

Progress: Behind schedule

Next Steps: Greater focus needs to be brought to bear on this milestone topic. The ERP Implementing Agencies may consider a directed action to address this milestone if no proposals are received through the competitive proposal solicitation process.

Milestone 115. Conduct instream flow studies to determine the flows necessary to support all life stages of anadromous and estuarine fish species.

Status: There has been significant work done on assessing instream flow requirements of fish by the Service's AFRP and CDFG's Native Anadromous Fish and Watershed Branch. The Service is implementing a program to identify instream flow requirements for anadromous fish in the streams within the Central Valley pursuant to CVPIA Section 3406(b)(1)(B). This program will provide scientific information to develop recommendations for instream flow needs for Central Valley rivers by developing improved hypotheses regarding the relationship between flows and the amount of physical habitat for indicator species of ecosystem health in Central Valley rivers. Although this will be the third year of funding for this project, this project is a continuation of work conducted under a seven-year program to identify the instream flow requirements for anadromous fish in the streams within the Central Valley. Accomplishments of the previous seven-year program include final reports on instream flow needs for spawning in the Merced and American rivers. The program is nearing the halfway point in achieving the current goals of this project (completing instream flow studies for the Sacramento, American and Yuba riverd and Butte Creek).

An AFRP study is examining the relationship of environmental explanatory variables with: (a) the annual variation in arrival timing of fall-run Chinook salmon in the lower Tuolumne River, and (b) the annual proportion of stray coded wire tag (CWT) from the San Joaquin Basin that are recovered in Sacramento River tributaries. Environmental variables include flow, water quality and regional meteorology. Annual carcass surveys of the Tuolumne River will be used to indicate the upmigration timing of the San Joaquin Basin at large because the Tuolumne River both dominates the annual escapement of San Joaquin Basin Chinook salmon, and also dominates the fall attraction flow contributions of San Joaquin tributaries in October of each year. CWT recovery of Merced River Fish Facility tag codes released in the San Joaquin Basin tributaries (Stanislaus, Tuolumne and Merced rivers) will be compared to the numbers recovered in the American, Feather and Mokelumne rivers in the Sacramento River Basin. These rivers have been selected on the basis of their consistency in recovery effort and record keeping.

Initiated by the CALFED Program in 1999, the Integrated Storage Investigations Program was launched to study increased water storage capacity in both surface reservoirs and underground aquifers, intending to meet the needs of California's growing population and to provide flexibility to improve water quality and restore ecosystems. One element of this integrated suite

of investigations is the Fish Passage Improvement Program (FPIP). Now a part of the ERP, the CDWR's FPIP is a partnership-building effort to improve and enhance fish passage in Central Valley and Bay Area rivers and streams, working with local, State, and Federal agencies and stakeholders to plan and implement projects to remove barriers that impede migration and spawning of anadromous fish. The FPIP identifies and evaluates the potential to modify or remove instream structures that impede migration and spawning of anadromous fish species within the Central Valley and Bay Area. The program utilizes interdisciplinary teams of fish biologists, hydrologists, engineers, environmental scientists and interagency staff to conduct barrier inventories, to identify and evaluate fish passage opportunities. The program can then provide environmental documentation, feasibility studies, and planning to implement fish passage enhancement projects. Coordination and consultation with stakeholders and the public ensures that the program considers all feasible opportunities to optimize fish passage while providing reliable water supplies for water users.

CDWR's Aquatic Restoration Planning and Implementation Section was established to support the ERP by developing habitat enhancement and fish passage improvement in the Yolo Bypass. The section collaborates with the Yolo Basin Foundation and other local groups to identify, study, and work to implement such opportunities on public lands and the lands of willing participants. The Aquatic Restoration Planning and Implementation Section supports efforts to create regionally significant improvements in riparian, tidal marsh, and seasonal floodplain habitats in the Yolo Bypass. This effort is compatible with maintaining or improving seasonal flood flow capacity of the bypass while improving habitat diversity and quality.

Progress: On schedule

Next Steps: The Service and CDFG will continue ongoing instream flow investigations and stimulate additional partnerships among agencies, researchers and restoration ecologists to prepare studies that would evaluate habitats for target species correlated with different flow regimes, temperature, and DO conditions and provide feed back to optimize those parameters for maximum environmental benefit balanced with other needs.

Milestone 116. Conduct an investigation of in-channel structures that focuses on the following issues: (1) habitat suitability for both predator and prey fishes; (2) predator-prey interactions; and (3) recommendations for reducing predation on juvenile salmonids.

Status: Predation and competition are natural ecological functions; however, unnatural levels of each can result in adverse effects to important sport and commercial fisheries and species of concern such as winter-run Chinook salmon. Artificial structures, such as dams, bridges, and diversions, create shadows and turbulence that tend to attract predator species and create an unnatural advantage for predators. Efforts to control the extent of unwanted predation and competition, particularly the loss of species of concern, are an important component in restoring health to the Bay-Delta system and in providing for other beneficial uses of water.

Some contracts did pertain to aspects of Milestone 116; however, no contracts were awarded to specifically address the complex questions relating to predator-prey interactions, their behavior,

nuances of habitat suitability, and especially those aspects that would support effective recommendations for reducing predation on juvenile salmonids.

An ERP contract will rebuild a select portion of the Tuolumne River channel where past instream gravel mining created a large deep lake area in the main channel. The channel will be changed from a warmwater predator species habitat to a 400 to 500 foot wide riparian floodplain—recreating a riffle and run pattern that follows the restored meander channel of the river along with native vegetation planted on fill terraces in a mix similar to that found on undisturbed segments of the river. The revegetation work will include the use of experimental, biotechnical revetment. Habitat suitability models for predatory fish species will also be developed.

Progress: Behind schedule

Next Steps: Greater focus needs to be brought to bear on this milestone topic. The ERP Implementing Agencies may consider a directed action to address this milestone if no proposals are received through the competitive proposal solicitation process.

Milestone 117. Conduct experimental introductions of Sacramento perch into nontidal perennial aquatic habitats.

Status: The Sacramento perch was once one of the most abundant fish in lowland habitats of the Central Valley. With the exception of a small population in Clear Lake, it has been extirpated from natural habitats within its native range, apparently because of competition and predation from introduced centrarchid fishes, such as large mouth bass. It would probably be formally listed as an endangered species except that it has been widely introduced into reservoirs, lakes, and ponds outside its native habitats in California and other western states. Although some of these introduced populations are probably secure, most are in artificial waters subject to dewatering and other perturbations and a number have disappeared in recent years. There is thus a need to establish populations in places within their native range that can be closely monitored to be sure this species persists in the future. The reintroduction of Sacramento perch into selected habitats in the Central Valley is closely linked to restoration of non-tidal perennial aquatic habitats, Delta sloughs, and elimination of inter-specific competitor or predator species.

The ERP funded a contract proposed by researchers at UC Davis involving the restoration of Sacramento perch to San Francisco Estuary. Little is known about the early life history, environmental tolerance, and genetics of Sacramento perch, information that is crucial to any restoration plan. This contract focuses on gaining the basic biological information needed for the Sacramento perch restoration. The first phase has five objectives:

- Objective 1. Summarize the existing information on Sacramento perch, emphasizing factors contributing to the survival of translocated populations, the collapse of native populations, and the persistence of some native populations.
- Objective 2. Document the early life history of Sacramento perch, and the factors that contribute to the survival in the early life history stages.

- Objective 3. Document physiological tolerance limits and behavioral tendencies of juvenile and adult Sacramento perch, in response to temperature, salinity, pH, dissolved oxygen, and water velocity.
- Objective 4. Determine the genetic diversity within Sacramento perch populations, and find stocks most suitable for reintroduction to the San Francisco Estuary.
- Objective 5. Develop re-establishment strategies for Sacramento perch, including analysis of institutional, physical, and biological barriers to their reintroduction into the San Francisco Estuary.

This contract will provide the conceptual understanding and models of biological processes effecting Sacramento perch. This information is needed to successfully restore the Sacramento perch to the San Francisco Estuary.

Progress: On schedule

Next Steps: Evaluate the outcome of the initial phase of investigations being conducted under contract by UC Davis. Determine whether there is sufficient knowledge to proceed with a pilot project to introduce Sacramento perch into nontidal perennial aquatic habitats.

Milestone 118. Assess the impact of hatchery practices on naturally spawning populations of Chinook salmon and steelhead and operate hatcheries in a manner consistent with safe genetic practices that will maintain genetic integrity of all Central Valley anadromous salmonid populations.

Status: Releasing large numbers of hatchery fish can pose a threat to wild Chinook and steelhead stocks. Potential consequences include genetic impacts on wild fish (e.g., outbreeding and inbreeding), competition for food and other resources between wild and hatchery fish, hatchery fish predation on wild fish, and increased fishing pressure on wild stocks as a result of hatchery production. Potential impacts to native gene pools must be evaluated in light of evidence for genetic changes in hatchery stocks (e.g., random genetic drift, selection, stock transfers, and straying), which can determine the nature and magnitude of interactions between hatchery and wild fish.

In 2003, the Science Program and ERP convened a technical review panel of fish biologists to examine the potential effects of the Coleman National Fish Hatchery (NFH) on the restoration of Battle Creek. The California Bay-Delta Authoirty convened the biological panel in response to stakeholder concerns that operation of the Coleman NFH could adversely affect the Battle Creek restoration program – a program that could provide significant benefits to all four Central Valley races of Chinook salmon and steelhead rainbow trout. Part of the workshop dealt with issues related to the potential impact of hatchery fish and wild fish. The questions posed to the technical review panel included:

- What level of genetic risk does operation of Coleman NFH and Livingston Stone National Fish Hatchery pose to the genetic integrity of spring and winter Chinook salmon and steelhead in a restored Battle Creek and the upper Sacramento River?
- Is there evidence of hybridization among salmon runs?

- Do mating, production, and release strategies increase likelihood that hybridization will occur in a restored Battle Creek?
- Are there alternative mating, production, and release strategies that can reduce risk of hybridization?
- What is the genetic composition of wild (naturally spawning) and hatchery steelhead in Battle Creek?
- What is the level of risk posed by Coleman NFH-origin fall and late-fall run Chinook and steelhead spawning in upper Sacramento River and tributaries compared to the level of risk in Battle Creek?

The major findings, conclusions and recommendations made by the technical review panel are as follows:

- 1. The Battle Creek restoration project should be described in its entirety in a single document so all stakeholders have a shared understanding of the size, scope and objectives of the effort.
- 2. The Restoration Program needs to clearly specify the species/runs of anadromous salmonids that are targeted for restoration.
- 3. In addition to the habitat analysis that has already been done, the population dynamics of each species/run targeted for restoration should be analyzed over their entire life cycle. This analysis should be used to assess the potential of a restored Battle Creek to support sustainable populations of anadromous salmonids.
- 4. Recommended strategies for reintroduction of anadromous salmonids into Battle Creek should be explicitly described and the advantages and disadvantages of these recommended strategies should be weighed against other alternatives.
- 5. The success of the Battle Creek restoration project will depend a great deal on Coleman NFH and possibly Livingston Stone NFH operations. Project planners and Servcie staff need to develop a detailed plan to ensure that hatchery operations are compatible with the recovery goals for Battle Creek.
- 6. The restoration of anadromous salmonids in Battle Creek should be phased, with spring-run Chinook, winter-run Chinook and steelhead having the highest priority. Consideration should be given to dropping fall- and late fall-run Chinook from the recovery program.
- 7. Competition between hatchery and wild fish may pose a substantial risk to the restoration effort, and thus requires further evaluation.
- 8. Handling wild fish in the hatchery before passage over the barrier weir may impose excessive stress and may encourage disease transfer to naturally-spawning fish.
- 9. The impacts of pathogens resulting from Coleman NFH operations on wild fish restoration efforts are unclear but disease control measures will be critical.
- 10. Marking programs at Coleman NFH need to be designed so as to be consistent with and contribute to successful restoration of anadromous salmonids in Battle Creek.
- 11. Coleman NFH water intakes must be screened to achieve NMFS "fail-safe" standards.

In June 2004, the Science Program convened a workshop regarding the current supplementation program for steelhead in view of risk, uncertainties, alternative opportunities and compatibility with the comprehensive recovery plan. The purpose of this workshop was to convene a discussion on steelhead supplementation in Battle Creek that includes members of the Coleman Science Panel, agencies representatives, stakeholder groups and interested members of the

public. At the workshop, the authors of *Supplementation of Steelhead in Battle Creek, California: History, Strategy, Objectives, Biological Uncertainties, and a Proposed Genetic Monitoring and Evaluation Plan,* presented the plan, described the scientific assumptions upon which the plan was founded, described all the alternatives that were analyzed, and described the reasons that alternative actions were rejected in favor of the existing supplementation plan. The fishery management objectives, uncertainties and connection of the plan to the Battle Creek Restoration Project were also discussed.

In September 1999, the CDFG and NMFS began a joint review of California's anadromous fish hatcheries. A Joint Review Committee (Committee) was established and met in various locations over the course of about a year. The review was initiated primarily in response to the listing of certain California salmon and steelhead populations under the FESA, and the resulting requirement that the effects of hatchery operations on listed species be evaluated and, if necessary, authorized under the FESA. The concern regarding the effects of hatchery fish on natural populations is largely on the loss of genetic factors that are important for survival of naturally spawning fish. If hatchery fish interbreed with natural populations, the genetic structure of the natural population may be affected if genetic differences exist between the hatchery and natural populations. In the extreme case, if fish from outside the basin have been imported and used as hatchery brood stock, there are likely to be genetic differences between the hatchery and natural populations. Even if the hatchery population is of local origin, however, some level of genetic change relative to the natural population is likely to occur in time due to the fact that hatchery rearing can change the mortality profile of a population. The resulting genetic changes, if transmitted to naturally reproducing fish, are unlikely to be beneficial to them.

The primary goals of the hatchery review were to: (1) identify and discuss programs, policies and practices that are likely to arise as important issues in permitting hatchery programs under the FESA; (2) identify opportunities to use hatcheries to help recover listed salmon and steelhead populations; and (3) discuss emerging views on the operation and management of hatcheries for the purpose of recovering depressed natural stocks. The final report was issued in December 2001. Many recommendations are contained in the body of this report. The following are considered of major importance or interest:

- 1. Feather River Hatchery spring-run Chinook salmon should be released "in-river" and not trucked to distant down stream sites. The CDFG should also explore all alternatives to reestablish a discrete run of spring run in the Feather River.
- 2. The production of fall-run Chinook salmon at Feather River and Nimbus hatcheries should be considered for "in-river" release instead of being trucked downstream.
- 3. Hatchery "in-river" releases and water management practices (including water exports from the Sacramento-San Joaquin Delta) should be coordinated so that emigration survival is maximized.
- 4. A formal process should be identified for the periodic review and assessment (e.g., every 6-9 years or 2-3 brood cycles) of hatchery production levels. It should include consideration of changing ocean or freshwater regimes, new information on hatchery/natural fish interactions, and changes in FESA status of salmonid populations.
- 5. All agencies should pursue efforts to establish a constant fractional marking program at all hatcheries.

- 6. All agencies should pursue efforts to develop adequate sampling programs to recover marked fish in the Central Valley. The CDFG should establish a process to coordinate and oversee the methodologies for estimating salmon escapements to the Central Valley.
- 7. Hatchery and Genetics Management Plans should be developed for each hatchery.

Changes made in response to the above recommendations (and others included in the report, including those at individual hatcheries) must be accompanied by evaluation and monitoring programs. The Committee recognizes that implementation of some of the recommendations contained in this report would require funding that is not yet available. Finally, it is recognized that implementation of the recommendations in this report cannot solve all future concerns about salmon or steelhead populations or hatchery operations. Hatchery production in California was not the root cause of the decline in salmon and steelhead populations to the point that they require protection under the California Endangered Species Act and the FESA. Minimizing and reversing the effects of habitat blockages, logging and agricultural activities, urbanization and water withdrawals in the river drainages that support California salmon and steelhead, will require continuing attention and effort. During its activities and deliberations, the Committee was cognizant of the biological and societal benefits that California's hatchery system provides. These benefits have to be considered when any changes are proposed to the hatchery system.

There has been significant work done to improve our understanding of hatchery practices on naturally spawning populations of Chinook salmon and steelhead. The 2003 Technical Review Panel report and recommendations on Coleman NFH and the 2001 Joint Review Committee findings and recommendations are notable examples of progress being made in this area.

Progress: On schedule

Next Steps: Continue implementing the recommendations of the Joint Review Committee and Technical Review Panel. Continue implementing recommendations made by the technical review panels convened for Battle Creek Salmon and Steelhead Restoration Project.

Milestone 119. Through the use of existing, expanded, and new programs, monitor adult anadromous salmonid returns to each watershed within the MSCS focus area. Monitoring techniques, data compilation and analysis, and reporting should be standardized among researchers and watersheds to the greatest extent possible.

Status: Several contracts are linked to this milestone and there are also many other program activities aimed at improving monitoring techniques, data compilation and analyses of adult anadromous salmonid escapement. The IEP Salmon Escapement Project Workteam makes recommendations for monitoring improvements. The Project Workteam tests new techniques and methods for measuring escapement, tests new technologies and makes recommendations on how to improve these methodologies. The Project Workteam believes they have gone as far as they can with respect to standardization of methods (Low, pers. comm.). Each tributary is unique and requires slightly different methods. It is difficult to establish a standard protocol for each stream because each stream is different and there are slightly different objectives for each stream.

The Science Program conducted a salmon escapement workshop in June 2003. Scientists and resource managers from the Pacific Northwest participated in the workshop and made presentations on methods of adult escapement monitoring being used in their area and how these methodologies might be applied in the CALFED Program solution area.

A proposal to improve our estimates of salmon escapement was collaboratively prepared by the Pacific States Marine Fisheries Commission, CDFG, NMFS and the Service and approved as an ERP directed action in 2004 (Low, pers. comm.). The objective of this proposal is to develop a long-term monitoring plan to estimate population status and trends in abundance of adult Central Valley Chinook salmon at the watershed level in a statistically valid manner. The four Chinook salmon races for which annual estimates of abundance are needed include: fall, late-fall, winter and spring-run. Each race, because of its unique adult run timing and holding conditions, may require different sampling metrics to generate adult population estimates. Each stream will also require development of unique custom escapement monitoring programs, due to the wide variety of habitat types present. While there are recognized needs for improved monitoring of other Chinook life stages, this proposal focuses on the critical need for improved monitoring of adult Chinook returning to Central Valley streams. The CDFG, Service and NMFS will collaborate on the development of this plan.

Scientists from the NMFS lab in Santa Cruz are reviewing the methods used to calculate escapement using carcass survey data and making recommendations to improve these methods based on sound statistics.

Progress: On schedule

Next Steps: The ERP Implementing Agencies need to encourage a collaborative synthesis of protocols and experimental methods to monitor adult anadromous salmonid escapement that merits adoption by all collaborators. The ongoing evaluation and modification of monitoring techniques, data compilation and analysis, and reporting mechanisms would be an appropriate function of the Comprehensive Long Term Monitoring Program under development by IEP. Development of this monitoring program will include extensive coordination and collaboration with all existing long-term monitoring programs, developers of monitoring plans (e.g., CMARP, TAMP, AMP, Wetland Monitoring Program), authors of papers addressing the needs of monitoring, and resource managers that would rely on these data and be completed by July 2005. Following appropriate review and subsequent approval the proposed implementation of the full program would begin in January 2006.