

Chapter 7. IMPLEMENTATION OF CMARP

CMARP will continue to evolve with the CALFED program. Prior to CALFED's record of decision (presently in June, 2000), an expected implementation structure for CMARP must be developed as part of the organizational structure needed for implementing the CALFED program. During this period, a few high priority tasks will begin, such as tasks related to diversion effects on fish and source quality of drinking water. In addition, monitoring and research program designs will be refined and focused as the actions of Stage I of CALFED implementation become firm. Finally, CMARP program costs need to be established, and program financing needs to be solidified so that CMARP can be implemented. This chapter describes activities that will take place during 1999 and early 2000 toward these ends.

MANAGING CMARP DURING DEVELOPMENT OF A CMARP IMPLEMENTATION STRUCTURE

In the absence of a CALFED implementation structure, Chapter 6 focused on defining CMARP organizational ingredients and outlining how those ingredients might relate to resource managers, decision-makers, and stakeholders. As a CALFED implementation structure becomes defined, a permanent structure for CMARP must be created. Prior to a CALFED record of decision and a permanent organizational structure, someone must continue to manage CMARP implementation and refinement activities.

The CMARP Steering Committee will continue to provide interim management of CMARP, and during 1999 will carry out the following:

- finalize and implement 1999 actions as proposed under "Implementation Tasks" below,
- oversee refinement and prioritization of

monitoring designs and research questions as described under "Refinement of CMARP elements" and "Estimating Program Costs" below,

- coordinate anonymous peer-reviews of proposals to the Restoration Coordination Program (as described in Chapter 6),
- design an organizational structure to implement CMARP in collaboration with CALFED, agencies, and stakeholders, and
- coordinate review of monitoring activities for projects funded by the Category III program.

The Steering Committee will report its progress to the CALFED Management Team and Policy Group through the CALFED Executive Director. The committee will designate an agency person and appropriate support staff to direct the program during this interim period. The committee will integrate CMARP more fully with CALFED and agency programs during 1999.

Funding of CMARP is needed during 1999 to manage the program, to implement a few high-priority tasks, and to refine monitoring and research program designs. About \$400,000 will be necessary to manage and refine the program during 1999. The costs of interim implementation tasks described next have yet to be estimated.

IMPLEMENTATION TASKS FOR 1999

In the absence of a chief scientist, the interim Steering Committee will work closely with CALFED's Restoration Coordination Program during interim implementation. Several projects funded through the Restoration Program directly involve monitoring and research and others have monitoring components. For example, in 1999 this program expects to fund designated actions involving organic carbon in the Delta, monitoring a newly constructed

flooded island, determining the sources of mercury in the Cache Creek watershed, and reducing predation in the Tuolumne and Merced Rivers by isolating gravel mining pits from the streams. These projects will provide critical information needed by CALFED in Stage 1. The Integration Panel and the CMARP Steering Committee have several common members, who will facilitate coordination. The results of these examples and other similar programs will be integrated into the CMARP database.

In addition, the Steering committee, in consultation with CALFED and agency staffs and stakeholders, will recommend selected tasks for interim implementation. The following tasks are among those being considered:

- **Diversion effects on fish.** Salvage of threatened species at the SWP and CVP facilities demonstrates that the facilities entrain fish. How important the facilities are relative to other mortality factors, however, is not clear. An assessment of fish entrainment in concert with real-time monitoring results is needed to better define flexibility of project operations and use of the Environmental Water Account. CMARP would establish teams to develop monitoring and analysis efforts as described more fully below.
- **Municipal source water quality.** An expert panel, urban water purveyors, and CALFED and CMARP staffs have recognized the need to answer several questions regarding the feasibility of reducing source water concentrations of bromide, organic carbon, and dissolved solids during Stage I of implementation. A committee of selected agency and stakeholder personnel will develop questions and priorities for directed actions or proposal solicitations during 1999 as described in greater detail below.
- **Fish screen evaluation.** The IEP Fish Facilities Technical Team will be asked to develop monitoring and research needed to evaluate the two proposed Stage 1 fish screens.
- **Marking hatchery salmon.** A constant fractional marking program of salmon smolts released from Central Valley chinook hatcheries will be designed to permit evaluation of hatchery contributions to spawning escapement and ocean and inland recreational fisheries. The goal is to have the program implemented by fall of 2000.
- **Factors affecting salmon.** The IEP's Central Valley Salmonid Project Work Team and its satellite teams will develop proposals to refine understanding of factors affecting survival of juvenile chinook salmon living in and traveling through the Delta.
- **Factors affecting delta smelt.** An interdisciplinary agency/stakeholder team will use the results of the 3rd Delta Smelt Workshop as a basis for determining if additional research on delta smelt is needed to support CALFED goals and adaptive management. The prioritized list and subsequent proposals will be peer-reviewed.
- **Fish/X2 relationships.** Consonant with external peer review panel recommendations, studies to document physical and biological mechanisms involved in the Fish/X2 relationships will be selected and started.
- **Delta topography and bathymetry.** A committee of selected agency and stakeholder personnel will direct a short-term feasibility study of using new techniques to improve the topographic and bathymetric coverage of the delta. The committee will also set up a continuing process to update locations and elevations of recently-established GPS benchmarks.
- **Documenting and assessing effects of aquatic species introductions.** CMARP will take an active role in documenting introductions and determining the ecological effects of these introductions. The efforts will be closely coordinated through CALFED's nuisance and introduced species group.

- **Review of streamflow network.** All common programs have identified needs for streamflow information, and a consolidated assessment of program requirements is needed to specify what the streamflow measurement network in the Central Valley and the delta should be. During 1999, a multi-agency committee will be appointed to undertake this review with the objective of finalizing essential gage sites and any additional funding needs.

Diversion effects on fish and Municipal source water quality are described in greater detail below.

Diversion effects on fish (DEFT).

Although there is fair agreement on the relative magnitude of fish losses from direct entrainment by the SWP and CVP pumps, there is much less agreement over the importance of indirect effects of these diversions in controlling population abundance and the recovery of threatened and endangered fish species. Accurate information about south Delta diversion effects is essential to CALFED, however, for determining if additional facilities, such as an isolated conveyance channel, are needed to recover fish species. Such information is also important in developing greater flexibility of project operations necessary for implementing the Environmental Water Account, increasing fish protection, and thereby reducing conflicts over water. CMARP must develop the information to support these critical CALFED activities and decisions.

The CALFED DEFT Team developed programmatic actions to restore habitat, improve food availability, reduce entrainment, provide migratory fish cues, and identify and reduce contaminant effects. During 1999, the CMARP program will refine existing monitoring, assessment, and research to ensure that it assesses the feasibility and relative effectiveness of such management actions. To the extent that additional funding is made available,

CMARP will expand these efforts to include the following monitoring and research tasks. From specific to general, they are to:

- make real-time monitoring more effective in helping to reduce entrainment and to increase operational flexibility;
- assess influences of diversion locations and delta hydrodynamics on food web dynamics;
- increase understanding of ecological processes in the estuary and the population dynamics of chinook salmon, delta smelt, splittail, striped bass and steelhead;
- distinguish for fish the consequences of the through-delta alternative from those of the other alternatives; and
- develop an integrated conceptual model of the bay-delta watershed that includes the most essential elements and processes, and that illustrates the most important indicators and scientific issues.

Ultimately, all of these tasks must be done to resolve CALFED questions about diversion effects on fish, and CMARP must develop and make extensive use of adaptive management tools to accomplish most of the tasks during Stage I.

Municipal source water quality.

Information on sources, transport, and transformations of DOC in the Delta are critical for determining how to reduce loads of DBP precursors at drinking-water diversions in the Delta. Seawater is the primary source of bromide in the Delta so that an understanding of the influences of tidal exchange and other hydrodynamic processes in the Delta are necessary to determine the concentrations of bromide transported to drinking-water diversions in the Delta.

Of particular concern is the unknown effect of CALFED's proposed restoration of up to 100,000 acres of wetlands in the Delta. Wetlands most likely produce organic carbon (TOC/DOC) that differs in unknown

ways in quality and quantity from that being generated by farming in the Delta. CALFED needs information on these differences before deciding to rehabilitate wetlands on a large scale.

The Integration Panel asked a committee of agency and stakeholder personnel to develop a designated action to assess effects of wetland restoration on drinking-water quality. The committee developed a list of five questions. In order of highest to lowest priority, the questions are:

1. How much and what forms of TOC do wetlands generate?
2. To what extent is TOC released from wetlands altered and consumed in Delta waters?
3. By comparison, how much and what forms of TOC are released from agricultural activities?
4. What wetland management strategies may be used to limit introduction of TOC into Delta waters?
5. How will the impacts of restored wetlands change in the future as they mature?

Answers to two additional questions are needed to assess relative loads of DBP precursors from different land uses and to model the transport of precursors to drinking water intakes:

6. Based on accurate land use and vegetation surveys, what is the relative contribution of agricultural activities, wetlands, and other land uses to DBP precursors in Delta channel waters?
7. How will the transport of DBP precursors to drinking water intakes be changed by wetland restoration in the Delta.

CMARP will collaborate with the Integration Panel to facilitate and augment whatever studies are undertaken to address these questions.

REFINEMENT OF CMARP ELEMENTS DURING 1999

All monitoring programs need refinement, but some programs require more than others. For example, monitoring to meet the needs of the Conservation Strategy has only been described in the most general terms and cannot be developed further until the Conservation Strategy has been completed.

Design of mitigation monitoring awaits selection of actions that require mitigation. The Watershed Management Program needs more specificity for CMARP to design and implement monitoring, and much more stakeholder involvement will be needed to help develop details. Monitoring and research for the rest of the common programs have been developed to a significant degree, and need refining as described below. In addition to these refinements, these almost-independent program designs need to be integrated into one program.

Refinements of the ERP monitoring program. Continued development of the ERP monitoring recommendations is needed to address general issues that cut across all the CMARP work teams, and refinement of specific monitoring recommendations within each work team.

The general issues that need further development for CMARP to proceed with implementation include:

- refining indicators,
- integrating identified monitoring elements,
- integrating monitoring elements with CALFED's Conservation Strategy.

In Table 7-1, the CMARP-ERP work teams are grouped based on the need for additional refinement of their monitoring recommendations prior to implementation, group 1 needing the least refinement and group 3 the most.

Refinements of the water quality program. The water quality monitoring and research program will be refined in the following ways:

Refinement of Specific Elements of the Water Quality Monitoring Plan. (See Appendix VII.B.)

- Refine sampling strategy for organochlorines in fish tissue.
- Identify sediment-sampling sites in the Delta.
- Analyze results of pilot fish tissue studies in the San Francisco Bay, Sacramento watershed, and the southern Delta.
- Conduct necessary preparatory work for the pesticide-monitoring program.
- Develop a tributary monitoring program in collaboration with local stakeholders.

Refinement of Sampling Strategies, Sampling Sites, Sampling Methods, and Archival of Biological Organisms. The strategies on which the different elements of the monitoring plan are based need to be specified. Sampling strategies need to be reviewed based on the CMARP objectives of monitoring. Locations of sampling sites need to be refined based on the sampling strategies. Methods need development for sampling constituents previously not sampled. A review of tidal influence on water quality sampling is needed. A policy for storage and archiving of biological samples needs to be developed.

Quality Assurance and QA Intercalibration. A QA/QC program with participation of all monitoring programs will be necessary to combine data from several programs. Performance standards are critical and should be based on the goals and objectives of the program. Immediate implementation of QA and intercalibration exercises among all existing programs is recommended so that when the program is implemented, comparability will be assured.

Integration of Monitoring. Monitoring will need to be well coordinated and integrated to address the multiple purposes of all of the common programs. For example, benthic monitoring will be conducted to evaluate ecosystem characteristics, ecosystem productivity and contaminant effects.

Development of Indicators. Indicators of system productivity and contaminant effects need to be refined. An important issue to be resolved is inclusion of measurements for which there are no regulatory standards. In addition, some standards have an unknown relationship to ecological or human health effects.

Refinements of the water transfers and water use efficiency programs. During 1998 many monitoring networks were inventoried that may provide data important for evaluating the effects of water transfers. However, assessment of the suitability of existing networks for CALFED purposes has just begun. 1999 will be a critical year for assessment activities.

The suitability of more than 10,000 groundwater-level observation wells in existing networks for use as part of a CALFED regional groundwater-level monitoring network will be evaluated. The suitability of more than 5,000 previously sampled wells for use as part of a CALFED regional groundwater-quality monitoring network will be evaluated. Groundwater level and quality network assessments will consider the period of record, well construction details, well location, frequency of measurement, interagency coordination of monitoring, and digital availability of monitoring data. The feasibility of using the Environmental Agency's STORET database as a surrogate network of groundwater quality information could be evaluated. The feasibility of reactivating sediment compaction recorders constructed decades ago will be determined. Coordination of new horizontal and vertical geodetic control networks in the Central Valley will continue.

Table 7-1. Summary of CMARP's ERP work team accomplishments and tasks needing further development for implementation of recommended monitoring elements.

Group	Work Teams	Accomplishments	Additional Steps
1	<ul style="list-style-type: none"> Hydrodynamics Chinook Salmon & Steelhead 	<ul style="list-style-type: none"> Identified what needs to be monitored & why Linked to existing monitoring programs Recommended new monitoring & modifications to existing programs Specified locations, timing and methods for new monitoring Prioritized recommendations Estimated costs 	<ul style="list-style-type: none"> Obtain outside review Evaluate monitoring in relation to CALFED priorities & actions Determine process for initiating new monitoring
2	<ul style="list-style-type: none"> Fish-X2 System Productivity: Lower System Productivity: Upper Central Valley Steelhead Delta Smelt Non-Indigenous Organisms Benthic Macroinvertebrates River Resident Fish Species Fish in Shallow Water Habitats 	<ul style="list-style-type: none"> Identified what needs to be monitored & why Linked to existing monitoring programs Recommended new monitoring & modifications to existing programs Provided some general guidance on locations, timing & methods for new monitoring 	<ul style="list-style-type: none"> Complete Group 1 steps + Develop greater detail on location, timing & methodology Prioritize recommendations Estimate costs
3	<ul style="list-style-type: none"> Shallow Water Habitats Fluvial Geomorphology & Riparian Issues 	<ul style="list-style-type: none"> Identified what needs to be monitored & why Provided some general guidance on locations, timing & methods for new monitoring 	<ul style="list-style-type: none"> Complete Group 1 & 2 steps + Link to existing monitoring programs

Refinement of the watershed management program. Monitoring at smaller scales – scales of particular interest for adaptive management feedback – depends heavily on local participation and must serve the needs of local decision-makers and the public. Refinement of objectives and specific implementation plans for monitoring of biophysical parameters at these scales will require full participation of local stakeholders. Stakeholders have already identified

economic and social aspects of watershed management as central to the Watershed Program, but have not reached a consensus on how these issues should be addressed in the monitoring program. Upcoming work will focus on organizing stakeholder input into defining a conceptual framework for monitoring of economic and social elements, as well as working with stakeholders to refine monitoring plans for all plan elements at smaller scales.

Refinement of the data assessment and reporting process. Assessment of data and reporting of scientific information will play a critical role in guiding Stage I and in informing the public about responses of the natural resources to CALFED efforts. Much work remains to fulfill this role. During 1999, CMARP will focus on the following activities:

Improve access to the data of present monitoring programs. The variety of data and analysis reporting activities that exist among the different organizations active in the Bay/Delta will be linked through the CMARP/CALFED web site. The data assessment and reporting team will coordinate with the reporting efforts of the major monitoring programs identified by the inventory of monitoring efforts in chapter 2.

Facilitate the use of geographical information system tools to provide summaries of important features of the natural resources. GIS personnel of agencies, universities, and stakeholder groups have already made extensive efforts to develop common sets of GIS coverages. In addition, many of the existing databases are already geo-referenced. A team will be organized to:

- Organize access to existing inventories of GIS data and organize filling in gaps related to CALFED needs.
- Identify important data themes that need to be developed, including themes that currently exist for only parts of the needed geographic areas in the CALFED planning area
- Develop examples of GIS-based overlays of data critical to Phase I actions

Plan a first annual CALFED Science Conference. CMARP will design a conference for autumn of 2000 with presentations and a published proceedings on active research and monitoring activities related to CALFED, including science projects funded by Category III.

Develop fact sheets describing conceptual models. CMARP will collaborate with other programs to prepare fact sheets for CALFED program managers and agencies that illustrate some of the conceptual models used for designing CMARP.

Develop management-oriented indicators. Most of the indicators developed by the workteams qualify as base level indicators as described in figure 1 of Chapter 5. Development of intermediate, or management-oriented, indicators would continue during 1999.

Developing active adaptive management partnerships. CMARP is presently designed to fulfill the needs of a traditional passive adaptive management program (Chapter 1, Figure 1-1). Although this program will reduce scientific uncertainties over a period of decades, CALFED needs to reduce key uncertainties at a more rapid rate to meet program objectives. Using a more active form of adaptive management, CALFED can accelerate the learning process. Active adaptive management as defined by Holling (1978) and Walters (1986), and as recommended in the ERP Strategic Plan (1998), involves carefully designed and monitored management actions that are valid scientific experiments. The purpose of the management actions is to reduce uncertainties by demonstrating how and why natural resources respond to those factors that affect them.

For example, some knowledge already exists about causes and effects, but knowledge about infrequent or extreme conditions is often limited or non-existent. Such unusual conditions, however, simultaneously can be circumstances when risks of irreversible resource changes are greatest and ideal times for observing important effects. Active adaptive management can create opportunities to document and evaluate unusual conditions in a controlled context, thereby accelerating learning and reducing long-term risks.

As implied, however, active adaptive management necessarily involves taking short-term risks with resources. In addition to the practical problems of acquiring control of enough resources to create unusual conditions, active adaptive management can conflict with regulatory and management policies, which are usually designed to avoid risks and to maximize short-term economic and social benefits. These circumstances partially explain the infrequent use of active adaptive management (Walters, 1997).

Thus active adaptive management, if employed by CALFED, will require policy-level recognition of scientific uncertainties and acceptance of resource risks. CMARP envisions active adaptive management as a partnership among policy makers, stakeholders, resource managers, and scientists. Given CALFED Policy Group agreement, CMARP will help develop partnerships to design active experiments.

ESTIMATING PROGRAM COSTS

A substantial commitment to an integrated monitoring and research program will be required because of the size and complexity of the physical, chemical, and biological systems of the Bay-Delta and Central Valley, about which there is much uncertainty. However, because such a program would have significant short- and long-term benefits, it will be necessary to develop a political consensus to fund a program of sufficient size and scope to resolve the critical uncertainties. Once a funding commitment has been made, the initial program can be created based on the size of that commitment, on the assumption that existing agency programs will continue and on a set of monitoring and research priorities established for each of the CALFED programs.

Setting monitoring and research priorities among CALFED programs is a subjective and continuing task. During 1999, the CMARP steering committee will assemble a

team of stakeholders and CALFED and agency staff to develop a set of initial implementation priorities for CMARP. These priorities and a total program cost estimate will be subsequently provided to CALFED.

FINANCING CMARP

Beyond agreement on a total program cost, CMARP needs assurance that funding for existing monitoring and research programs will continue at inflation-adjusted current levels of spending. These programs include those listed in Table 2-3. Although agencies are under no obligation to CALFED to continue these programs at current levels, future changes to these programs should trigger reevaluation of CMARP's level of effort.

In addition, an inflation factor is needed to sustain the level of effort agreed on for CALFED's monitoring and research activities supplemental to these programs. More substantial adjustments to this program should be contemplated as the program is reviewed periodically.

Finally, public funds are probably a primary source for CMARP because everyone benefits from the information generated. Category III and CALFED projects requiring mitigation monitoring will be a secondary source. Which agencies will eventually receive the State and Federal appropriations that fund CMARP depends on what organizational structure becomes responsible for implementing the common programs and the preferred alternative.

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