California Bay-Delta Program

Science Program
Multi-Year Program Plan (Years 6 – 9)

Implementing Agencies:

Science Program:

California Bay-Delta Authority

IEP:

California Department of Fish and Game
California Department of Water Resources
California State Water Resources Control Board, U.S. Bureau of Reclamation
U.S. Fish and Wildlife Service
U.S. Geological Survey, National Marine Fisheries Service
U.S. Army Corps of Engineers
U.S. Environmental Protection Agency

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CALIFORNIA
BAY–DELTA
AUTHORITY

Goals, Objectives and Targets

Goals and Objectives:

Three documents set the framework and establish the goals/objectives for the Science Program: The California Bay-Delta Programmatic Record of Decision and the attached Implementing Memorandum of Understanding ("ROD", August 28, 2000); the California Bay-Delta Authority Act ("CBDA-Act", 2003); and the charge to the Executive Science Board of the CALFED Bay-Delta Authority ("CBDA ISB Charge", approved by the CBDA August 14, 2003). The ROD established the CALFED Science Program and mandated it to bring world-class science to all elements of the CALFED program and track their progress with performance measures and indicators. This alone is a huge task, requiring a collaborative process across all CALFED program elements, 20-plus state and federal agencies, diverse and numerous stakeholders and the general public. This in turn requires transparency, open recognition of scientific uncertainties, and discussion and communication of scientific findings amongst all CALFED agencies/programs.

As defined in the ROD, the long-term goal of the CALFED Science Program is to establish a body of knowledge directly relevant to CALFED actions and their implications. That body of knowledge must be unbiased, relevant, authoritative, integrated across program elements, and communicated to the scientific community, CALFED agency managers, stakeholders, and the public. The ROD states the broad objectives of the Science Program:

- Provide a comprehensive and integrated scientific context for CALFED activities.
- Ensure continuous advancement of credible scientific information that will guide regulatory decisions, adaptive management, and water project operations.
- Establish a framework to identify and articulate areas of scientific uncertainty relevant to key issues both before and after actions.
- Develop strategies to reduce uncertainties and track performance and progress toward CALFED goals.

The CBDA Act restated and codified Science Program functions and the role of the Lead Scientist. The Lead Scientist is charged with ensuring scientific application of adaptive management, monitoring, and investigations to reduce uncertainties and illuminate the interconnections between CALFED program elements. The Lead Scientist must also promote peer review throughout CALFED to ensure the quality of program planning, implementation and evaluation. The CBDA Act assigns four main functions (tasks) to the Science Program:

- Provide implementing agencies and the CBDA with authoritative and unbiased reviews of the state of scientific knowledge relevant to management and decision making for the California Bay-Delta Program.
- Implement programs and projects to articulate, test, refine, and improve the scientific understanding of all aspects of the Bay-Delta and its watershed areas.

- Provide a comprehensive framework to integrate, monitor, and evaluate the use of adaptive management and the best available scientific understanding and practice for implementing the California Bay-Delta Program.
- Independently review the technical and scientific performance of the California Bay-Delta Program.

The CBDA Act also gives the Lead Scientist, and therefore the Science Program, the responsibility to nominate/establish independent review panels or standing boards of experts and fund and support their activities as part of independent science review of the entire CBDA Program. The Lead Scientist nominates, for Authority approval, a CALFED-wide Independent Science Board (ISB). The ISB is given the broad charge to advise and recommend to the Authority and the Bay-Delta Public Advisory Committee (BDPAC) the science relative to implementation of all CALFED program elements. The ISB Charge directs the ISB to ensure the application of world-class science to the Bay-Delta system and sets nine specific objectives for the ISB:

- Understand the technical underpinnings of the CALFED Bay-Delta Program.
- Evaluate and provide insights on progress toward addressing underlying premises of the Bay-Delta Program
- Annually evaluate the science agenda of the entire CALFED Bay-Delta Program.
- Assure balance and credibility of analyses in programs under the purview of the CBDA.
- Approve performance measures for the CALFED Bay-Delta Program.
- Assure science is used in all CALFED program elements.
- Identify impending issues and significant interconnections to help the Authority anticipate important issues.
- Work with the National Research Council to develop broad questions suitable for outside review by the National Academy of Sciences.
- Help select the Lead Scientist when the Lead Scientist position is vacant.

The ISB is directed to submit a bi-annual written report on the state of science across the entire Bay-Delta Program. The Science Program is given the task of supporting the ISB in all these efforts as well as creating and supporting any technical/scientific review panels needed to address specific issues important to the CBDA Program.

In support of the above broad-based and very specific objectives, the Lead Scientist and Science Program staff has designed an organizational structure for the Science Program that would categorize program activities, and allow for tracking the level of effort and progress. The following five organization tasks are part of that structure:

- Investment in Priority Scientific Information Needs
- Communication of Scientific Understanding
- Performance Evaluation of CALFED Programs
- Application of Scientific Practices
- Program Planning/Reporting/Administration
- Interagency Ecological Program Coordination.

Targeted Activities

The ROD identified discrete targets for the Science Program to accomplish in Stage 1 of program implementation (years 1-7):

- Appoint an independent science board for the CALFED Bay-Delta Program as a whole by the middle of 2001.
- Appoint an independent science panel for the EWA by the middle of 2001.
- Coordinate existing monitoring and scientific research programs.
- Refine the set of ecological, operational and other predictive models that will be used in the evaluative process by the end of 2001.
- Establish performance measures and indicators, and a consistent strategy of on-going development of these, for each of the program areas.
- Develop an annual science report.

As well as these specific targets listed in the ROD, the various objectives presented above have been interpreted by the Lead Scientist and the Science Program staff to produce a set of activities to meet the five organizational tasks listed above, i.e., *Science Program Activities*:

- Investment in Priority Scientific Information Needs:
    - Develop and fund research directed at specific management questions/issues of importance to CALFED agencies/programs (Directed Research).
    - Solicit proposals and fund applied research applicable to the broad and future needs of CALFED agencies/programs (PSP).
    - Establish and fund post-doctoral and graduate research fellowships to further collaboration between agency/stakeholder and academic scientists and generate new information from existing data sets (CALFED Science Fellows).
    - Convene workshops and symposia to exam specific management questions and research needs (Workshops).
    - Solicit and sponsor whitepapers/reports to elucidate immediate or long-term questions relevant to the broad CALFED community (Whitepapers).

- Communication of Scientific Understanding:
    - Implement and fund an open-access scientific journal dedicated to Bay-Delta and watershed issues/science (San Francisco Estuary and Watershed Science).
    - Convene a biennial science conference on CALFED program and related science results (CALFED Science Conference).
    - Support biennial science and policy conference on Bay-Delta issues (State of the Estuary Conference).
    - Support specific scientific meetings that discuss topics of near- and long-term importance to the CALFED Bay-Delta Program (e.g., American River Conference, Mountain Climates Conference, American Fisheries Conference, National Conference on Ecosystem Restoration).
    - Publish short layperson-accessible accounts of important scientific discoveries within the Bay-Delta system accessible to a broad audience of stakeholders, managers and the general public (Science-in-Action).

- Communicate current relevant scientific advances to managers and policymakers highlighting important new conclusions and relevant working hypotheses in non-technical language (Management Cues).
- Make Science Program activities and products broadly available to the general public (Website).
- Develop a seminar series to bring outside experts to speak about topics relevant to the CALFED programs, agencies, and stakeholders (Seminar Series).
- Support science consortia that foster broad interaction among stakeholders and agency and academic scientists (Science Consortium).

- Performance Evaluation of CALFED Programs:
  - Establish and support independent technical/expert review panels addressing specific programs/issues as needed (e.g., the EWA technical review panel).
  - Coordinate development of performance measures/indicators for CALFED program elements.
  - Produce annual science report including status and trends of the system and assessment of progress and effectiveness of each program element.
  - Coordinate design of CALFED-wide monitoring program.
  - Coordinate development of a monitoring, data aggregation, storage, retrieval, integration, distribution and modeling system (data assimilation systems).

- Application of Scientific Practices:
  - Support ISB activities including funding, staff and research support and development of the ISB annual work plan.
  - Nominate replacement members to the Independent Science Board (ISB) for approval by the CBDA.
  - Coordinate and/or implement peer review of proposals, program plans of other CALFED program elements.
  - Provide guidance in the development of conceptual models.

- Program Planning/Reporting/Administration:
  - Develop the Science Program Strategic Plan.
  - Develop annual Science Program multi-year program plans.
  - Coordinate development of science component of other CBDA program elements multi-year program plans.
  - In conjunction with the ISB develop a science agenda for the Science Program.
  - Develop annual budgets and finance plans for the Science Program in consultation with CBDA financial administrators.
  - Administer Science Program and produce information as needed for CALFED Bay-Delta Program annual report.

- Coordination with the Interagency Ecological Program:
  - The Science Program coordinates with the Interagency Ecological Program (IEP) to ensure efforts in obtaining new scientific information are compatible and beneficial to the CALFED Bay-Delta Program.

The IEP is a collaborative, multi-agency program with the mission of providing ecological information and scientific leadership for use in management of the San Francisco Estuary. The IEP fulfills its mission through three major activities: monitoring, special studies, and program management. In the context of the CALFED Bay-Delta Program, the IEP is considered a category A program, and IEP activities contribute directly to meeting the goals and targets of the Science, Conveyance, and Environmental Water Account program elements. IEP activities are included as part of the Science Program's multi-year program plans with specific information incorporated in each of the plan's sections.

Performance Measures

The immense scale of the CALFED program makes it extremely difficult to design and implement a universal protocol and a series of methodologies to analyze the cumulative effects of its varied actions ranging from restoration projects to water management actions. To address this challenge, the Science Program is working with CALFED program managers and staff to develop guides and indicators of performance assessment that can be used to evaluate and communicate the progress of every CALFED program. Currently, this effort is building on the results of a collaborative effort from a Performance Measures workshop (May 2003) that yielded a first set of prototype performance measure for a number of the program elements. The Science Program, jointly with CALFED program managers, is refining the set of instructions to clarify the approach taken in the prototype process and develop a set of tools for broader application across the CALFED Bay-Delta Program. The staff effort is being complemented by the work of the Independent Science Board. The ISB has formed a Performance Measures subcommittee to survey past and present attempts at performance measure development and aid in design of a standardized methodology appropriate at any level of performance evaluation for each program element. With a final methodology expected by fall 2005, the subcommittee will test the methodology by applying it to select program elements.

While at this time the Science Program does not yet have a set of program-specific indicators and metrics, beyond simple project and fund tracking, the program is committed to full performance measures development and is continuing to invest time and resources to this endeavor. The program recognizes that a successful development of performance measures and subsequent performance evaluations require commitment of qualified technical staff. The Science Program continues ifs efforts to expand its staff capacity with new technical hires, including a staff person specifically dedicated to performance measures development.

With increasing investment into new knowledge on system-wide relationships through research grants and collaborative projects, the program has long recognized that its current system of project tracking is too simplistic and ultimately inadequate to answer the pressing questions from the public and legislators on the value and significance of these investments. The Science Program has begun work over the past year to develop a comprehensive tracking database that will allow for clear determination of project accomplishments and aid in the synthesis of information gained for program-wide assessment. The database is being designed with the ability to integrate information from other program element databases, such as ERP and the Watershed programs, and will incorporate various levels of metrics from simple administrative tracking to more multifaceted metrics that would evaluate system-wide changes. This database is expected to be completed by 2007.

New technical staff and tracking database development are part of the infrastructure necessary to building a comprehensive suite of program specific performance measures. The Science Program has

also begun to develop a framework which will guide the subsequent development of the suite of indicators and metrics. This framework includes development of a conceptual model that ties the program activities as outlined in the multi-year program plan to the program's goals and main objectives and an initial set of metrics that would help evaluate the program's effectiveness. This framework will build on and incorporate efforts already underway. For example, one of the Science Program's main objectives is the effective communication of new scientific information to a wide audience, ranging from the public, policy makers, and scientific community and integration of that information into management decisions within the CALFED Program. To aid in meeting this objective and help tie together existing, and sometimes disparate, tracking efforts, the program has developed a comprehensive communication strategy, which will include measures (indicators and metrics) of program effectiveness. Currently, the program's communications efforts can only be measured in simple metrics such as number of articles published in the SF Estuary and Watershed Science on-line journal, number of "hits" to the Science Program website, and number of workshops organized. The strategy, to be completed by the end of 2005, aims to bring together the currently used metrics, and build on them to provide the program with an effective way to evaluate its communications efforts.

Accomplishments

Science Program accomplishments are based on the previously listed targeted activities.

ROD Targets

- Appoint an Independent Science Board: The Science Program completed this task in 2003 with the Interim Lead Scientist nominating thirteen members that were approved by the CBDA. The ISB began meeting in 2004. The Lead Scientist nominated five more members that were approved in 2005 to bring the present total membership to eighteen.

- EWA Science Panel: The Environmental Water Account Technical Review Panel was established in 2001 and has conducted annual reviews of the EWA since that time. In 2004 it conducted a review of the first four years of the EWA program.

- Coordinate Monitoring and Research Programs: The Science Program joined with the Ecosystem Restoration Program to establish a proposal solicitation process (PSP) to fund applied research in the ERP Program during years 1-4. That process was used in 2004 to fund monitoring of ERP projects and the Science Program released a PSP for research addressing CALFED Program goals in 2004 as well.

- Refine Predictive Models: The Science Program implemented and completed a review of the CALSIM II water resources model. The Science Program also supported the Pacific Climate Change Conference that presented research on models predicting future climate change in California in the 21st Century and also supported development of splittail population dynamics model through its directed research process.

- Performance Measures and Indicators: The development of performance measures for all of the program elements has not been accomplished. However, the Science Program is working with CALFED program managers and staff to develop guidelines and identify indicators of performance assessment that can be used to evaluate and communicate the progress of every CALFED program. This effort is building on the Performance Measures workshop conducted in 2003 that yielded a set of prototype performance measures for a number of the program elements.

- Annual Science Report: A separate annual science report has not been written. This task was subsumed into the science section of the CALFED Bay-Delta Program's Annual Report. The Science Program contributes to this report each year along will all the other program elements. Cross program status and trends of species and indicators of progress had not been included in the annual reports as requested in the ROD because of lack of technical staff to conduct the needed research.

Science Program Target Activities

- Investment in Priority Scientific Information Needs:
    - *Directed Research:* The Science Program has solicited, peer reviewed and funded approximately nineteen directed research projects in years 1-5 totaling approximately $10 million (Table 1).
    - *Proposal Solicitation Process:* In 2004 the Science Program implemented its first broad call for research proposals covering cross program needs and future change as mandated in the ROD and CBDA Act. The PSP will be completed in August of 2005 and it is anticipated that approximately $18 million will be granted to researchers for up to 3-year projects. This PSP will provide information from applied research through the end of Stage I.
    - *CALFED Fellows:* The Science program has completed one round of granting funds (approximately $2 million) to post doctoral scholars and graduate researchers through the first CALFED Fellows program of 2003-2004. The call for the second round of CALFED Fellows grants was released in March 2005. This program will grant approximately $6 million in fellowships from 2005 and through 2012.
    - *Scientific Workshops:* The Science Program funded and convened thirty workshops dealing with CALFED priority issues in years 1 – 5 (Table 2). The workshops concentrated on water operations and fish but also included modeling and contaminants and restoration techniques.
    - *Whitepaper and Reports:* Forty-six reports and whitepapers have been solicited for and produced during years 1-4 (Table 3). Another four are in completion in year 5. These cover a wide range of topics related to CALFED goals but concentrate on water operations and species of interest to CALFED agencies.

Table 1. Peer-reviewed Directed Research projects funded by the Science Program (some jointly with other CALFED Program Elements, © = co-sponsored).

• Delta Cross Channel ©
• Indicators Linking Toxicants to Wetland Health ©
• Effects of Toxicants on Juvenile Salmon
• Twitch Island Subsidence ©
• Sediment Transport Model of Sacramento River
• Delta Hydrodynamics ©
• Delta Hydrodynamics—Franks Tract modeling ©
• Delta Hypoxia Study
• IEP Data Analysis
• Invasive Species
• Delta Water Quality Baseline Analysis
• Mercury in Clear Creek Bed Sediments
• Spatial Ecology and Population Dynamics of delta smelt
• Yolo Bypass Ecological Evaluation
• Effects of Toxicants on Splittail
• Genetic Identification of Splittail in the Sacramento Watershed
• Pilot Wetland Monitoring
• Peat Accretion Study

Table 2. Workshops conducted by the Science Program (some joint with other CALFED Program Elements and Agencies, © = co-sponsored workshop; more details are available on the Science Program Website).

2005

- Central Valley Salmonid Escapement Monitoring Workshop. ©
- Predation at the Delta Intakes to the State and Federal Water Projects (scheduled).
- PIT Tags—New Approaches to Evaluate the Survival and habitat Preferences of Juvenile Salmon (scheduled).

2004

- The Environmental Water Account—Evaluating the first four years and science needs for a long-term EWA.
- Rivers, Rocks and Restoration: Learning from the Past and Questions for the Future. ©
- Contaminant Stressors in the Bay-Delta Watershed.
- Suisun Marsh Workshop. ©

2003

- Battle Creek Seminar. ©
- CALSIM Review. ©
- Central Valley Salmonid Recovery Planning ©
- Environmental and Ecological Effects of Proposed Changes in Water Operations.
- Delta Smelt Population Biology.
- IEP Salmonid Escapement Seminar. ©
- In-Delta Storage Feasibility Review. ©
- Mercury Strategy Review. ©
- Performance Measure Workshop.
- Planning for Hydrologic Change in California: USGS Scenarios for Delta Water Resources through the 21st Century. ©
- EWA Salmonid III.
- EWA Review III / Water Operations Science Symposium II.
- Water Operations Science Symposium I.

2002

- EWA Delta Smelt II.
- EWA Review II.
- EWA Salmon II.
- Mercury Workshop. ©
- Water Operations and Environmental Protection in the Delta: Scientific Issues.

2001

- Adaptive Management.
- EWA Delta Smelt I.
- EWA Review I.
- EWA Salmon I.
- Hydrodynamic Modeling.

Table 3. Whitepapers and Reports Produced by or for the Science Program during Years 1-5 (most documents available on the Science Program Website).

Whitepapers:

- Mercury Strategy for the Bay-Delta Ecosystem
- Microsatellite DNA genetic structure and diversity of Chinook salmon in the Central Valley
- Delta Smelt Workshop 2001 Summary
- EWA Chinook Salmon Workshop 2003 Interpretive Summary
- EWA Delta Smelt Report 2003
- EWA Reviews I, II, III
- Water Operations Science Symposium II
- EWA Review Criteria
- EWA Salmonid Workshop 2001 and 2002
- EWA Summary of the Annual Delta Smelt Technical Workshop
- Response to the 2002 EWA Panel Report
- The Use of EWA for the Protection of Salmonids in the Sacramento/San Joaquin Delta
- CALSIM II Briefing Material
- CALSIM II in California's Water Community: Musing on a Model
- CalSim II Simulation of Historical SWP-CVP Operations
- In-Delta Storage 2003 Workshop Summary
- In-Delta Storage 2002 Reports Summary
- Science Symposium on Environmental and Ecological Effects of Proposed Long-term Water Project Operations Summary Report
- Water Operations and Environmental Protection in the Delta: Scientific Issues Workshop
- Battle Creek Workshop Summary
- Splittail Population Ecology
- Goals, Objectives, Performance Measures of EWA for salmon and recommended relevant analyses October 2003
- Open Water Processes
- Lower Tuolumne River Adaptive Management Forum Report
- IEP Salmonid Escapement Seminar Abstracts
- Mark Recapture Experiments
- Splittail Workshop Summary
- Required Level of Effort Sampling at the Delta Fish Protective Facility
- Delta Subsidence in California: The sinking heart of the State
- Data Management Strategy

Performance Measures Prototypes:

- Drinking Water Quality: Bromide
- Drinking Water Quality: Organic Carbon
- Ecosystem Restoration: Sacramento River Processes
- Ecosystem Restoration: Systemwide Central Valley Chinook Salmon
- Ecosystem Restoration: Delta Smelt
- Ecosystem Restoration: Fall-Run Chinook Salmon in the Tuolumne River
- Ecosystem Restoration: Winter-Run Chinook Salmon in the Sacramento River
- Ecosystem Restoration: Spring-run Chinook Salmon in Butte Creek
- Levees Program: Acres Flooded
- Water Supply Reliability

- Communication of Scientific Understanding:
    - *Open Access Journal:* The Science Program publishes the journal *San Francisco Estuary and Watershed Science*. The journal began in 2003 and a volume has been published in each year since. *San Francisco Estuary and Watershed Science* is an

open access journal on science and resource management of San Francisco Bay, the Sacramento-San Joaquin River Delta, and the upstream watersheds. It is accessible to anyone without charge through the World Wide Web. It can be accessed at the following URL: www.estuaryscience.org.

- *CALFED Science Conference:* The Science Program has sponsored three biennial science conferences that cover the range of science generated in the CALFED Program and Agencies. The CALFED Science Conference is a forum for presenting scientific information and ideas relevant to the Program's goals and objectives in the Bay-Delta and its watershed. The organizers of the 3rd Science Conference sought presentations in all four of CALFED program areas: ecosystem restoration, levee system integrity, water quality, and water supply reliability. The goal of the conference was to provide new information (i.e., results, models, syntheses, analyses) to the broad community of scientists, engineers, managers, and stakeholders working on CALFED Bay-Delta Program-related issues. The conference program featured both oral and poster presentations that provided scientific information and ideas relevant to the broad themes of the Bay-Delta Program, listed below, as well as the overall conference theme, "Getting Results: Integrating Science and Management to Achieve System-Level Responses." Over 1200 people attended the conference.

- *State of the Estuary Conference:* The Science Program co-sponsored with the S.F. Estuary Project, among others, two State of the Estuary Conferences in 2001 and 2003. The 2001 conference was a three-day conference held in San Francisco which was attended by nearly a thousand scientists, resource managers, activists and decision-makers. The 2003 conference focused on the dramatic changes to the Bay-Delta Estuary, the rapidly changing state of scientific knowledge about the Estuary and the implications of these changes on its future.
- *Support of Other Scientific Meetings*: The Science Program has supported and continues to support scientific conferences that address important CALFED issues. These include the annual American River Conference, Pacific Climates Conference, American Fisheries Society Conference, and the National Conference on Ecosystem Restoration.
- *Layperson-accessible Science Documents: Science-in-Action* is a publication to bring important scientific discoveries and understanding to the general public and anyone interested in the state of science in the Bay-Delta. They are published in print and on the Science Program website to be able to reach as wide an audience as possible. Four issues have been published to date: Reviving Central Valley Rivers; Scrutinizing the Delta Cross Channel; Demystifying the Delta; and, Puzzling Over the Shallows. Science-in-Action stories on mercury contamination and grassland management will be published in 2005.

- *Communicate Scientific Advances to Managers:* The CALFED Bay-Delta Program has invested heavily in science to increase the understanding of the complexities of the Bay-Delta system, but this work is not always accessible to managers working to meet CALFED goals. *Management Cues* is a new tool to help communicate relevant scientific advances to managers and policymakers. These Cues highlight important new

conclusions and relevant working hypotheses in non-technical language. They synthesize cutting edge science, and point to its potential application in the Bay-Delta System. All the Cues are current and reflect concepts that scientists hope resources managers will use in their planning. Management Cues are written by Science Program staff and reviewed by scientists and managers for accuracy. Three *Management Cues* have been completed in years 1-4.

- *Accessibility to the General Public:* The Science Program website is used as the primary tool to inform the public on all program products and activities. The website has a wide range of resources including links to technical panels and the Independent Science Board, so the public can access information they need to attend public meetings. There is also a large library of products generated by the Science Program and other program elements. The URL for the website is: *www.science.calwater.ca.gov*.
- *Seminar Series:* The Science Program has supported speakers for individual seminars on topics relevant to CALFED programs, agencies and stakeholders.
- *Science Consortia:* The Science Program has supported the San Francisco Bay Delta Science Consortium which was formed to help catalyze increasing cooperation and collaboration among institutions, to prevent the overlap of projects and resources, and to produce a quality and quantity of science unattainable by institutions working alone. The Consortium is an organization composed of fourteen government, university, and private institutions that have joined forces to share scientific information and resources on the aquatic ecosystem of the San Francisco Bay-Delta Estuary and its associated watersheds.

- Performance Evaluation of CALFED Programs:
  - *Technical Review Panels:* Technical Panels provide expert input on individual issues, most of which have a short timeline. These groups meet over the full term of the issue they are addressing and work at the greatest level of detail. Each panel includes the full range of disciplinary expertise that spans the particular issue. Balanced perspective is a key in all groups. Review panels were sponsored by the Science Program or co-sponsored with other programs in years 1-4 including: Suisun Marsh Levee Breach Modeling Panel; EWA Technical Review Panel; Delta Cross Channel; San Joaquin Dissolved Oxygen; In-Delta Storage; Splittail Population Biology; Upper Yuba River Restoration; and Battle Creek Restoration.
  - *Coordinate Performance Measures:* In collaboration with CALFED program managers, the Science Program worked to develop performance measures for each of the program elements. This effort built on existing prototype performance measures and Performance Measure workshop (May 2003). Science Program staff prepared guidelines for the inclusion and discussion of performance measures in the 2005 CALFED Program Plans. This is a first step in applying uniform criteria across program elements. As well the ISB at the request of the Lead Scientist has established a sub-committee to help the Science Program develop a set of guidelines to apply to all CALFED program elements.

- *Annual Science Report:* The Science Program has provided information to the CALFED Bay-Delta Program's annual report but has not written a separate annual report describing the status and trends of the Bay-Delta system and assessment of each program.

- *CALFED-wide Monitoring Program:* The development of a plan for a CALFED-wide monitoring program has not been developed. The Science Program is working with IEP and the ISB to establish the basic needs for such a program and how best to assimilate any data produced from such a system while assuring the quality of the information collected.

- *Data Integration System:* In conjunction with the San Francisco Bay Delta Science Consortium, the Science Program sponsored a preliminary concept paper describing a CALFED-wide data integration and distribution system. The Lead Scientist requested that the ISB review this concept and how best to coordinate a monitoring, data assimilation and modeling system across agencies and programs. This is part of the ISB's 2005 work plan and they plan to complete a report by the end of 2005.

- Application of Scientific Practices:

  - *Support of ISB Activities:* The Science Program supports all aspects of the Independent Science Board including funding ISB meetings, research of topics, and development of work plans. All ISB information and products are made accessible to the public and other CALFED programs through an ISB website accessed through the Science Program website. The site includes all correspondence to the ISB or the Lead Scientist regarding the ISB. The Lead Scientist has nominated new members to the ISB for approval by the Authority and that effort is also supported by the Science Program.

  - *Peer Review:* Outside scientific advice and review play critical roles in review of CALFED program elements. The Science Program has applied peer review at several levels: Proposal review; priority issues; and programs. Peer review has been used extensively in the ERP's proposal solicitation process (PSP) as well as in the Science Program PSP and directed research. In 2002, over 300 experts from around the country completed external reviews of ERP proposals. In 2005, over 400 reviewers conducted external reviews of proposals submitted to the Science Program PSP. Peer reviews have also been conducted annually since the inception of the Environmental Water Account. Priority issues that have been peer reviewed by the Science Program include Mercury, Splittail, and Hydrodynamics and Levee Breaches. In each of these cases external reviewers provide independent analyses and constructive suggestions about the strengths and weaknesses and how to improve the activity/project/program. Peer review is a crucial component of making science open and accountable.

  - *Development of Conceptual Models:* The Science Program provided information and guidance as needed for the development of the conceptual model for ERP regional planning.

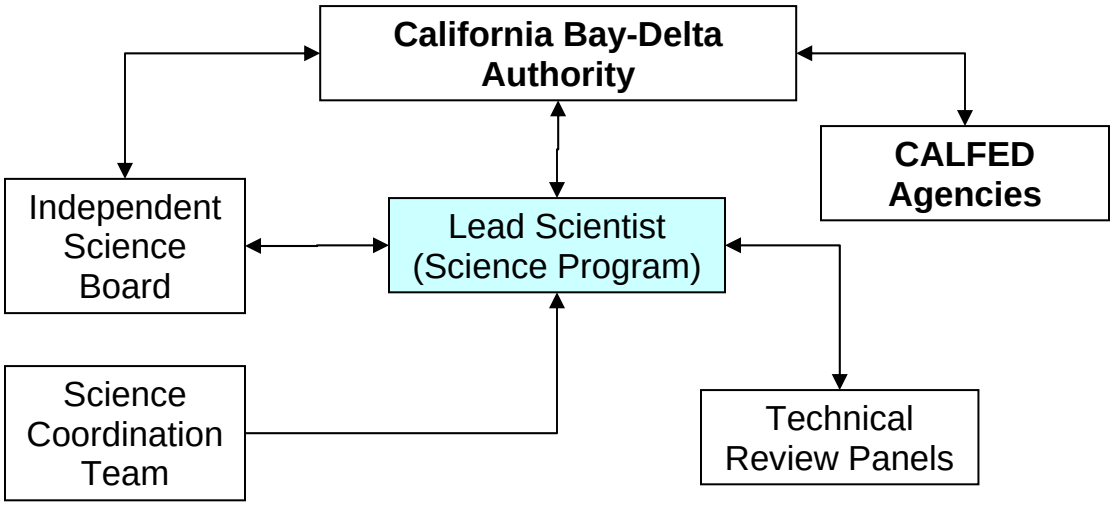
- Program Planning/Reporting/Administration:
    - *Strategic Plan:* A strategic plan has not been completed but development was started in 2005 with oversight of the Independent Science Board. This requires both administrative and technical staff within the program.
    - *Multi-year Plans:* The Science Program has constructed annual multi-year plans as part of the overall CALFED planning process. This requires both administrative and technical staff within the program.
    - *Coordinate Science in other CALFED Program Elements:* Coordination of science in the other program elements has been in the form of conducting workshops and developing performance indicators. This has required the commitment of substantial staff resources over the last four years.
    - *Science Agenda:* A science agenda was developed for the PSP and is included in that documentation. This agenda will be used to develop a new agenda with oversight from the Independent Science Board. The program is also in the first steps of development (exploration and scoping) of a CALFED-wide science agenda to address the needs of the entire CALFED Bay-Delta Program.
    - *Finance Plans:* The Science Program contributed over the last year to development of the overall CBDA finance plan and continues to use staff, management and technical resources in modification of the finance plan.
    - *Administer Program:* Major administration changes have taken place in the Science Program in the last six months. This includes the hiring of a new program manager (a State position), some internal reorganization, and the recruitment of new staff scientists. Administration of grants and contracts continues to take a large investment in staff time and administrative resources. The Science Program has also administered the PSP including over 400 external expert reviews, development and review by a technical synthesis panel and final selection by a selection panel, all via a web-based system that provides detailed accounting of all aspects of the PSP project. That has taken substantial staff resources as has the development of the CALFED Fellows program. The Science Program also continues to support requests from the Authority and legislature on emerging science topics. A large administrative effort is underway to document and make accessible information on all activities within the program through a web-based database system being developed by staff. The staff continues to support the development of sections on science activities in annual reports and multi-year program plans for other program elements. Science Program staff have also aided in administration of the San Francisco Bay Delta Science Consortium. Administrative resources have been substantial for the Independent Science Board as well as for scientific review panels and interaction with the Ecosystem Restoration Science Board and the Water Management Science Board. The Science Program has also used administrative resources for interaction with other programs including the Interagency Ecological Program and the EWA technical review. These include efforts by administrative staff and technical staff for organization, review and analyses.

- Coordination with the Interagency Ecological Program:
    - For details and specific information about the IEP see below.

Impediments to Reaching Goals/Objectives

The ROD anticipated that the Science Program would receive funding of $172 million through year four. The CBDA estimate of actual funding through year four is instead $43 million, or only 25% of anticipated funding. The ROD also indicated that the Science Program would have an adequate number of technical staff to conduct the large number of tasks and activities set for the program. This included staff scientists dedicated to each CBDA program element and capable of conducting research focusing on the broad scientific issues cutting across CALFED program elements. The Lead Scientist estimates this would require approximately 12 staff scientists and associated support staff. This level of staffing has never been even approximated in the Science Program. Through year four, there was only one staff scientist in addition to the Lead Scientist and the Special Assistant to the Lead Scientist (the latter two positions funded by the U.S. Geological Survey). Only two Science Program staff positions are permanent State of California positions, and only one of those is a staff scientist. CALFED-wide difficulties in contracting have also impeded program implementation.

Program Structure



Agency/Entity	Roles and Responsibilities
California Bay-Delta Authority	• Oversees the Science Program. • Reviews, modifies and approves annual budget and program plan. • Establishes the Independent Science Board (ISB). • Responds in writing to advice and reviews prepared by the Independent Science Board.
Science Program/Lead Scientist	• Lead Scientist appoints ISB members for approval by CBDA and the Science Program supports all aspects of the ISB. • Establishes independent science panels to assist the implementing agencies and the CBDA on scientific issues. • Provides implementing agencies and the CBDA with authoritative and unbiased reviews of the state of scientific knowledge relevant to management and decision making for the Bay-Delta Program. • Implement programs and projects to articulate, test, refine, and improve the scientific understanding of all aspects of the Bay-Delta and its watershed areas. • Provide a comprehensive framework to integrate, monitor, and evaluate the use of adaptive management and the best available scientific understandings and practices for implementing the Bay-Delta Program. • Independently review the technical and scientific performance of the Bay-Delta Program.
Independent Science Board (ISB)	• A standing board of distinguished experts (scientists, engineers, economists, social scientists). • Ensures the application of world-class science to the Bay-Delta system. • Advise and make recommendations to the CBDA and the Bay-Delta Public Advisory Committee on the science relative to implementation of all program elements.
Science Coordination Team (SCT)	• Composed of technical experts and scientists from the CALFED agencies and stakeholder communities implementing and/or monitoring major elements of the CALFED Program. • The SCT assists in implementing the Science Program.
Technical Review Panels	• Composed of local, regional and national scientific experts. • Assist and advise the implementing agencies and the CBDA on scientific issues associated with individual program elements, multiple program actions with scientific geographic areas and defining the state of knowledge relative to specific scientific issues.

Major Activities

The Science Program's strategy for years 6 - 9 is to focus on the six targeted activites identified above. The planned effort is discussed below for each of these activities in the context of projected funding for the program based on the CBDA finance plan. The first four major activities are expected to contribute to the "science activities" identified in the Delta Improvements Package.

Investments in Priority Scientific Information Needs

One of the basic aspects of this activity is to fund research important to CALFED Program scientific needs. The Science Program will complete its first request for cross-cutting research proposals (PSP) in 2005 with funds to be granted in early 2006. It was originally expected that the Science Program would continue to release a PSP each year for years 6 - 9. However, that schedule will be changed in the following years, alternating between releasing a general PSP and funding directed research. This will allow the Science Program more flexibility in meeting CALFED Bay-Delta Program needs and better respond to emerging issues and problems identified by the Science Coordination Team, CALFED implementing agencies, staff and stakeholders. It will also allow development of important projects that were not funded in the PSP to be considered in the directed research review. Directed research will be solicited in years 6 and 8 and the PSP in years 7 and 9.

The CALFED Fellows Program will continue through years 6 – 9. The Science Program will continue to support the fellows program with the aid of the Sea Grant Program, which manages the fellowships. The Science Program is involved in review and selection of candidates and identification of potentially important collaborations with agency, stakeholder and academic scientists. This program will fund 5 – 7 new fellows each year for years 6 – 9.

Workshops and symposia on priority topics will continue through years 6 – 9. The Science Program expects to develop and sponsor from 4 to 6 workshops each year. Outcomes of the workshops will be used to inform the requests for directed research and the PSP as well as address the scientific questions underlying priority management issues. Support will include staff resources to produce workshop summaries and position papers from workshop outcomes.

Analyses of both long-term and emerging issues will be a new emphasis of the Science Program. In the past, the Science Program relied on workshops, symposia, research grants and solicited whitepapers to inform the CALFED community on the science underlying important issues. We will be much more proactive in years 6 – 9, relying more on Science Program staff scientists to analyze and develop understanding of emerging issues. This will require an expansion of the scientific staff and an increased commitment of resources to the development of these analyses. The Science Program will coordinate these efforts with implementing agency and stakeholder scientists to leverage future resources. These results will be published in position papers authored by Science Program staff and the Lead Scientist. This commitment will replace the production of whitepapers and reports by outside consultants of past years.

Communication of Scientific Understanding

The Science Program will continue to support publication of the *San Francisco Estuary and Watershed Science* open access electronic journal through years 6 - 9. This will entail a dedicated Science Program staff, support of the journal editors and publication costs for the journal. The goal is to expand the content to publish 4 issues per year by the end of year 7.

The biennial CALFED Science Conference and the State of the Estuary Conference will continue to be sponsored in alternate years by the Science Program. It is expected that CALFED Science Conference attendance will grow and will require substantial staff support and resources from the program to develop the agenda and content of the conference in years 6 and 8. Resources and support will be used in years 7 and 9 for the State of the Estuary Conference.

The Science Program will continue to support regional and local scientific conferences that communicate science addressing CALFED Program needs. We expect to give some support to the American Fisheries Society California-Nevada Chapters meeting, the Pacific Climate conference and the American River Conference, among others.

The content of the Science Program website will be expanded in years 6 – 9 to include more content-rich material useful to a broader audience. We will redirect the resources now dedicated to the Science-in-Action and Management Cues publications to expand the presentation of scientific results on the web site so they are more accessible to managers and the general public at less cost. This will require scientific staff resources as well as web development and editorial support. We expect to expand capability of the website to better highlight program scientific results, including animations to better illustrate concepts and dynamic systems.

The program will create a permanent seminar series to bring outside experts to present information of interest to agency and stakeholder scientists. The topics and speakers of the seminars will be determined through consultation with staff, Independent Science Board members, technical panel members, agency and stakeholder scientists, and scientific advisors. The goal is to have bi-monthly seminars on both emerging issues of specific interest to practicing scientists and cross cutting issues addressing broad management/policy concerns.

Performance Evaluation of CALFED Programs

Technical Review Panels will continue to be the largest segment of this program activity. The Science Program will continue support of the EWA Technical Review Panel in a new and expanded version to review the science underlying all environmental water programs. A bigger effort will be made to share the expense of technical reviews of program elements and specific projects within programs, but the Science Program expects to wholly or partially organize and fund on the order of 2 – 3 technical review panels each year in addition to the EWA technical review panel. We expect to convene technical review panels on continuing and emerging issues, such as the scientific underpinning of the X2 relationship and VAMP, potential changes resulting from land use and climate change and delta subsidence.

The Science Program will substantially expand its effort in years 6 – 9 to develop consistent performance measures of CALFED program elements. Science Program staff are working with a subcommittee of the Independent Science Board (ISB) to develop a set of guidelines that can be used

to facilitate development of goals, objectives and indicators of each program element. As well as facilitate the development and application of performance measures, the staff will develop with the ISB a procedure for external assessment of performance once specific indicators are in place.

The Science Program will continue to supply information for the CBDA annual report. The program does not have the staff or resources to develop and produce an annual report describing the status and trends of species within the Bay-Delta system and assess the effectiveness of each program element as directed by the ROD. There are no plans to attempt such a report during years 6 – 9.

Planning for a CALFED-wide comprehensive monitoring and assessment program (CMAP) and data integration system (DIS) is proposed in coordination with the Interagency Ecological Program and overseen by the Independent Science Board. These will be based on previous work funded by the Science Program on data integration and distribution. An initial evaluation of the present system and future needs will be completed in year 6. It is expected that a strategic plan to create a more integrated, efficient and accessible system will be completed by the end of year 6 or the beginning of year 7 and implementation can begin in years 8 and 9 consistent with new funding and staff resources allocated for CMAP and DIS. This effort will require substantial staff and financial resources from the program for research, analysis and development. Resources for infrastructure (hardware, software and staff) for a completed CMAP-DIS have not been identified or budgeted in this program plan, but will be developed in the strategic plans.

Application of Scientific Practices

Support of the Independent Science Board, peer review of direct research and PSP proposals, outside review of programs and program projects, and coordination with the IEP will continue to require substantial investments in staff and financial resources.

The ISB has a very ambitious work plan that demands large amounts of staff time and financing to cover ISB efforts. The Science Program will be involved in support and analyses of all the work plan topics for 2005 and those that the ISB will tackle in years 6 – 9 that are a continuation of these topics and any additional topics. The 2005 work plan topics include:

- Performance Measures
- Delta Improvements Package
- Levee Stability
- Integrated Use of Environmental Water
- Use of Science In System-wide Decision Making
- Water Quality
- Development of Research Agenda for Science Program
- Development of Communication Strategy for the Science Program
- Annual Review of Science
- Development of Annual Report

Similarly, the EWA Technical Review panel will require substantial staff and financial resources. The Science Program will continue to sponsor all aspects of the EWA review including organizing and hosting the annual workshops and reviews, supporting science advisors to EWA and the organizational and financial support of the expert panel. This also requires substantial interaction with agency

scientists, the development of reports and presentations for the panel and analyses of information and documents generated by the review process for presentation to the CBDA.

Each year the Science Program will require substantial staff and financial resources to manage the peer review of either the PSP or directed research. The 2004 PSP required the review of over 140 proposals using more than 400 outside expert reviewers; we expect similar numbers in future PSPs. Although directed research will likely involve a smaller number of proposals, we still expect a substantial number (50-75 proposals) that will require resources similar to the full PSP effort. Review of research proposals will require a staff of about 5 people for approximately 6 months to complete the major review process and then a lesser number of staff for the remainder of the year to finalize the process and write and present reports to the CBDA. Similarly, the program will use staff and financial resources to supply peer review to other projects as requested by the CBDA and implementing agencies as we have done in the past four years for Mercury, Splittail, Hydrodynamics, CALSIM II, etc.

The development of conceptual models is not only a mandated activity but also critical to understanding the complex Bay-Delta system. The Science Program will dedicate staff to research the scientific underpinnings of conceptual and quantitative models for various aspects of the Bay-Delta system. Much of this work will be in conjunction with review of the monitoring and modeling being conducted by the ISB, but we also expect to develop efforts with implementing agencies, especially on the constraints on modeling the effects of climate change (temperature, precipitation, sea level rise) on water management and distribution. In association with ISB activities we are planning similar efforts on: the use of correlative relationships to establish water management policy; the large scale transformation of the Bay-Delta ecosystem by invasive species; system-wide resiliency of Delta levees under continuing subsidence and climate forcing; and similar emerging issues as they arise in years 6 - 9.

Program Planning/Reporting/Administration

A strategic plan will be developed in 2005 with the oversight of the Independent Science Board and applied to program activities through years 6 – 9. It is expected to be an evolving document and require continual commitment of both administrative and technical staff in the foreseeable future. Similarly, the development of annual multi-year plans as part of the overall CBDA planning process will require administrative and technical staff. The Science Program will continue to coordinate Science in other CALFED program elements by conducting workshops and developing performance indicators. This will require the commitment of substantial staff resources over the next four years and the program is in the process of hiring two staff primarily dedicated to performance measure/indicator development. The Science Program will develop a science agenda for the program and begin working with the ISB and SCT to develop a CALFED-wide science agenda to address the needs of the broader CALFED Bay-Delta community. Science Program staff will contribute to, as needed, the development of CALFED finance plans and help develop co-sponsorship of individual projects for the Science Program and other program elements.

Program staff will administer grants and contracts generated from both the PSP and directed research actions. This will require a large investment in staff time and administrative resources as we expect to have bi-annual calls for proposals through the PSP and additional proposals through the Directed Research Process in alternate years to the PSP. This will result in many tens of contracts/grants active in years 6 - 9. We expect minimal administrative costs for the CALFED Fellows program because it is finalized through years 6 – 9 and managed by the Sea Grant Program. The Science Program will continue to support requests from the Authority on emerging science topics. A continuing effort to

document information on all activities within the program will require staff efforts throughout years 6 – 9 as will development of descriptions of science activities for inclusion in annual reports and multi-year program plans for other program elements and the Science Program. Substantial administrative resources will be required for management of the Independent Science Board as well as for scientific review panels and interaction with the Ecosystem Restoration Science Board and the Water Management Science Board. The Science Program will continue to need administrative and management resources to better coordinate and ultimately integrate activities with the Interagency Ecological Program.

Coordination with the Interagency Ecological Program

The Science Program will continue to support IEP monitoring and directed actions and collaboratively work to expand multidisciplinary studies, monitoring program review, and transformation of monitoring program information into knowledge. The Science Program will collaborate with the IEP to conduct a programmatic review of the IEP, including review of its governance structure and design of increased Science Program/IEP integration. See attachment I for more information on the IEP Multi-year program plan.

Public Involvement and Outreach

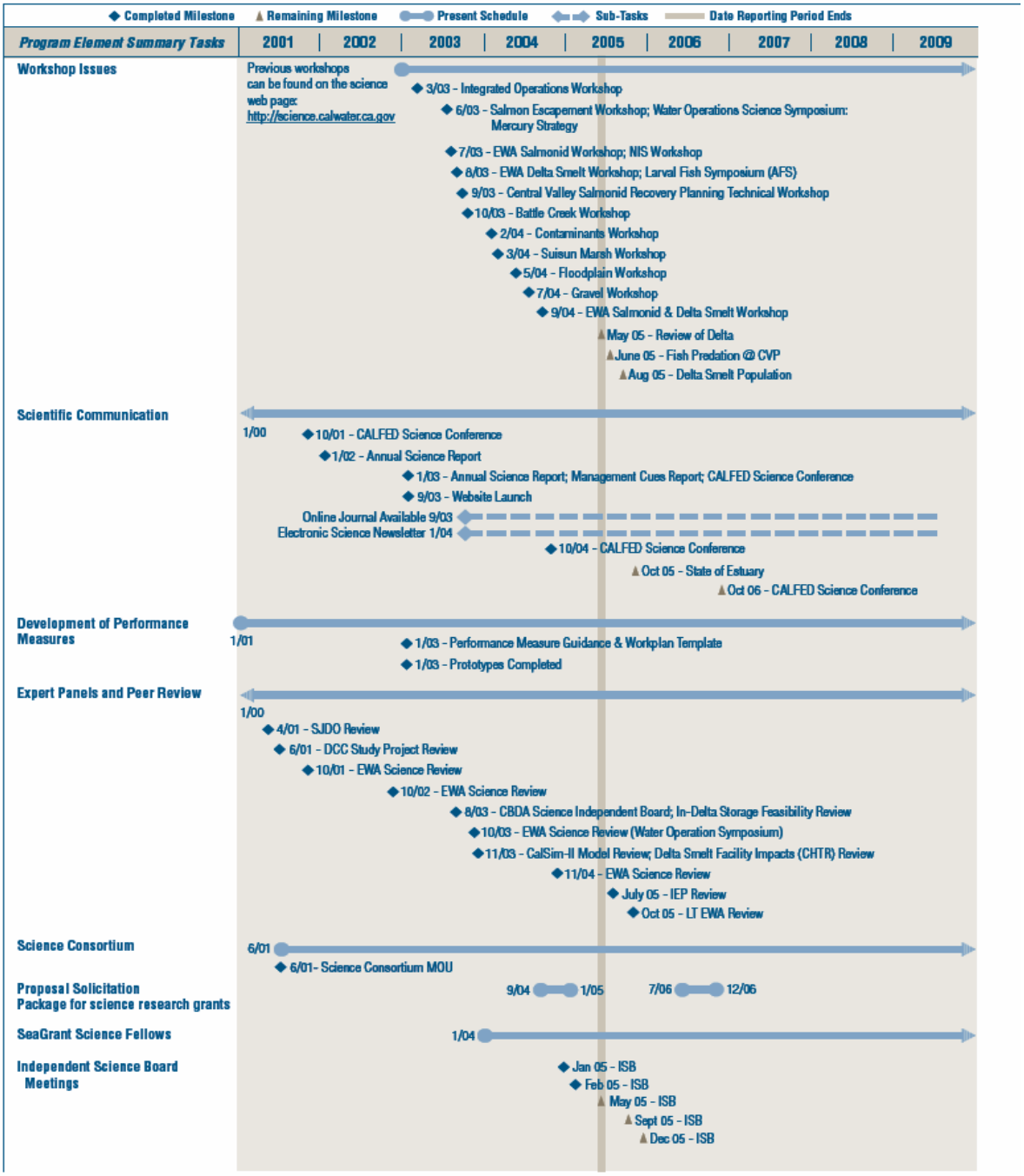
The Science Program has a long-standing commitment to function in an open, transparent, and collaborative process to allow for and facilitate transmission of relevant scientific information to diverse audiences and to allow for stakeholder and public involvement. All of the activities that the Science Program engages in are convened in an open forum with extensive opportunities for public involvement. Such activities include:

- 3rd Biennial CALFED Science Conference (October 2004).
- Upcoming biennial State of the Estuary Conference (October 2005).
- All Independent Science Board meetings are public and encourage public comment and participation.
- Recent Finance Plan effort included broad public input and participation through public workshops.
- All Science Program workshops, including:
    - Contaminant Issues in the Bay-Delta
    - Suisun Marsh Restoration
    - Gravel Augmentation and River Restoration
    - Salmonid Escapement
    - EWA related Delta smelt and salmonid workshop and EWA Technical Review
- Independent Science Board meetings and ISB subcommittee meetings.
- Open access electronic journal, *San Francisco Estuary and Watershed Science,* available free on the world wide web.

In addition to continuing public discussion on the state of science in the form of meetings and events, the Science Program also attempts to reach broad audiences by disseminating information through publications such as Management Cues, Science-in-Action, the Science Program website, and the Science Program electronic newsletter. The program has also invested in and is developing a Science Communication Strategy that will address effective communication methods of scientific information and outline recommendations for increased effectiveness, including outreach efforts. The program expects to develop workshops in years 6 – 9 on *Creating Effective Science Outreach Programs* and *Connecting Scientists and the Public* that bring together scientists, managers, and public groups in the design of successful outreach implementation plans.

Schedule

SCIENCE



Integrating Environmental Justice and Tribal Relations and Science

Environmental Justice:

The Science Program will continue working with the Environmental Justice Coordinator and members of the Environmental Justice subcommittee in the development of performance measures, communicating EJ specific issues to the scientific community via conference sessions, and continue efforts to incorporate science-based processes and peer review into the EJ work plan. During the past year, Science Program staff have provided input into the Environmental Justice subcommittee efforts on EJ Implementation Guidelines, and begun a collaborative effort that resulted in an organized special session at the 3rd Biennial CALFED Science Conference on integrating science and environmental justice called: "Data and Advocacy—What is the Role for Environmental Justice?"

Tribal Relations:

As with Environmental Justice program, Science will continue to work with the Tribal Relations Coordinator to help identify tools for performance assessment, support potential research collaborations, and establish a strong education/information transfer element. During the past year, the Science Program held a number of outreach and informational workshops for tribal representatives on the program's Proposal Solicitation Package (PSP). Additionally, program staff engaged in outreach efforts to solicit abstracts from tribal scientists for the 3rd Biennial CALFED Science Conference, and in coordination with the Tribal Coordinator, will continue to improve these outreach efforts for future conference and other forums of scientific communication. The Science Program will also remain an information resource to the Tribal Relations Program.

Science Integration:

The Science Program focuses on large-scale issues that cut across multiple program elements and regions and the integrated application of scientific practices across the Program. Within each program element, however, there are also specific science and project technical needs that the Science Program facilitates. These include:

- Peer review of specific study designs, proposals submitted through proposal solicitations (PSPs), and final technical reports.
- Review boards and technical experts to review program and project ongoing and proposed actions and identify knowledge gaps and information needs to help set program priorities.
- Identifying critical unknowns needed to assess program performance or define classes of activities needed to reach program goals.
- Cross-program coordination that includes substantive coordination (including cost-sharing) between two or more CBDA programs.

Cross-Program Relationships

The Science Program has made efforts to build cross-program relationships. Those include:

Environmental Water Account: Technical reviews to clarify the state of knowledge and identify uncertainties and information needs for the program.

Conveyance: Identify and refine critical unknowns and implement directed actions to decrease that uncertainty (i.e., Delta Cross Channel and South Delta studies).

Ecosystem Restoration Program: Joined the ERP to develop a PSP to identify research needs and establish a review process for the PSP; continued coordination with the ERP in its latest PSP and the first Science Program PSP; collaborative efforts to produce white papers (wetlands, open water processes, Delta Smelt, Salmonids, etc.) and development of prototype performance measures.

Levee Stability: Supported the Independent Science Board levee subcommittee in the development of a report on the long-term stability of levees in the Delta.

Funding

Funding for the Science Program is a major concern. Although funding for the Program has never matched funding targets, available funds for the Science Program decline substantially beginning in year 6 (Table 4). The expected declines in program funding are mainly due to lack of a continuing revenue source, and commitment of most remaining Proposition 50 funds in year five to research projects selected through the Science Program PSP, and to grants selected through the Science Program fellows program.

Table 4. Comparison between Science Program funding targets and funding obtained or available.

ROD Target ($300m, yrs. 1-7)	Funds Obtained ($57.5m, yrs. 1-5)	Finance Plan Target ($304m, yrs. 5-14)	Available Funds ($11.9m, yrs. 6-9)
$42.9m/yr.	$11.5m/yr.	$30.4m/yr.	$2.98m/yr.
---	27% of ROD Target	71% of ROD Target	10% of Fin. Plan Target

This program plan describes the major activities and level of effort that would occur assuming full funding for the Science Program (i.e., funding consistent with the Finance Plan target). Here we describe the activities that we expect to pursue given the level of available funding listed in Table 5. We also note the activities that will not occur given the reduced level of funding. Finally, this section describes how the Science Program proposes to allocate additional funding should it become available. The proposed funding distribution for each major activity in years 6-9 is provided in Table 6.

Table 5. Uncommitted funding available to the Science Program by source for years 6-9.

Science ($ in millions)	Yr 6	Yr 7	Yr 8	Yr 9	Total
State	$4.7	$2.0	$1.2	$1.2	$9.1
Federal	$0.7	$0.7	$0.7	$0.7	$2.8
Local/Water User	$0.0	$0.0	$0.0	0.0	$0.0
Available Funding Total	$5.4	$2.7	$1.9	$1.9	$11.9
Finance Plan Targets (Science Program)	$30.4	$30.4	$30.4	$30.4	$121.6
Unmet Needs	$25.0	$27.7	$28.5	$28.5	$109.7

Funding by Task

Table 6. Proposed allocation of uncommitted Science Program funding among its major activities.

Science ($ in millions)	Yr 6	Yr 7	Yr 8	Yr 9	Total
Investment in High Priority Information Needs	$3.0	$0.9	$0.9	$0.7	$5.5
Communication of Scientific Understanding	$0.2	$0.5	$0.2	$0.5	$1.4
Performance Evaluation	$1.0	$0.8	$0.3	$0.3	$2.4
Applications of Scientific Practices	$1.0	$0.3	$0.3	$0.2	$1.8
Program Planning/ Reporting/ Administration	$0.2	$0.2	$0.2	$0.2	$0.8
Available Funding --Science Program	$5.4	$2.7	$1.9	$1.9	$11.9
IEP (see IEP Funding Tables, Attachment I)	$14.2				
Science Program support for IEP monitoring and research	$0.8				
Available Funding --IEP	$15.0				
Total Funding	$20.4	$2.7	$1.9	$1.9	$26.9
Finance Plan Targets*	$44.4	$30.4	$30.4	$30.4	$135.6
Unmet Needs	$24.0	$27.7	$28.5	$28.5	$108.7

*Finance plan target for year 6 = funding proposed for the Science Program and IEP. Finance plan targets for years 7-9 = funding proposed only for the Science Program. IEP funding for years 7-9 is unknown.

Investment in Priority Scientific Information Needs

This plan proposes to alternate funding for new research between release of a new PSP and selected directed research through a directed actions program. Since the PSP occurred in year five, year six will be a year to select and fund directed research. Roughly $2.5 million of the funding available in year six would go to directed research. The remaining $0.5 million of the Science Program funding for this major activity would go towards workshops and symposia on priority topics (1-2 per year) and analyses of both long-term and emerging issues by the Science Program staff. The CALFED Fellows Program is fully funded, so no new funding is proposed for this activity. The Science Program does not expect to initiate any new PSP's in years 7 or 9, given the limitations in available funding. Some funds, on the order of a few hundred thousand dollars, may be allocated to fund directed research. Funding additional research to obtain information needed to inform management decisions or evaluate the consequences of decisions made is the highest priority for the science program if additional funding becomes available. The Finance Plan targets $23m/yr. to fund investments in priority scientific information needs.

Communication of Scientific Understanding

Funding for this activity in years 6-9 will go to: 1) support for the journal *San Francisco Estuary and Watershed Science*, 2) support for specific local and regional science conferences (e.g., American Fisheries Society, CA Estuarine Research Society, or the American River Conference), 3) support for the maintenance and update of the Science Program website, and 4) support for a permanent seminar series on topics of special interest. Additional funding (~$0.3m) is allocated to support the biannual CALFED Science Conference in years 7 and 9. Some additional funding (~0.2m/yr.) to implement other aspects of the Science Program communication strategy would be proposed if additional funding becomes available. In particular, this additional funding would go to increase efforts to communicate new science to managers and policy makers. This is a high priority activity.

Performance Evaluation of CALFED Programs

Funding for this activity in years 6-7 will go to: 1) development of performance measures for CALFED program elements, 2) more comprehensive efforts to conduct performance assessments, 3) technical review panels (e.g., the EWA technical review panel), 4) development of the Science Program section of the annual report, and 5) joint planning with IEP for a CALFED wide comprehensive monitoring and assessment program. Reduced funding in years 8-9 will likely result in the Science Program focusing any remaining resources on items 2 and 4. Performance evaluation is the Science Program's second highest priority after investments in high priority information needs. If fully staffed, the Science Program could reasonably spend an additional $1m/yr. on performance evaluation across all CALFED programs.

Application of Scientific Practices

Funding for this activity in year 6 will go to the Independent Science Board (funding for board member activities and staff support). Funding in year 6 will also go to two science advisors who will assist the Lead Scientist in pursuing specific technical issues raised by the ISB, in technical workshops, and in technical review panels. The two science advisors work closely with agency staff and this is one of the main ways the Science Program has of bringing science practices to the CALFED agencies. Funding in years 7-9 will go to funding the ISB at a substantially reduced level of activity (e.g., 1-2 meeting per year and limited program involvement). A portion of any additional funding would go to funding the ISB, so that it can fulfill its commitments identified in the Bay-Delta Authority Act. Funding for the two science advisors would be the second priority under this activity.

Program Planning/Reporting/Administration

Funding for this activity in year 6-9 will go to development and implementation of a Science Program strategic plan, and development and administration of contracts for the PSP and CALFED Fellows program. The Science Program will also need to develop and implement a projects tracking system. Funding and efforts for these activities are expected to remain relatively constant in years 6-9. Efforts under this activity would begin to decline after year 9 as contracts for research grants conclude.

Attachment I: Interagency Ecological Program Plan

Goals and Objectives

The mission of the Interagency Ecological Program (IEP) is, in collaboration with others, to provide ecological information and scientific leadership for use in management of the San Francisco Estuary.

The long-term goals and objectives of IEP are to fulfill its mission by:

(1) describing the status and trends of aquatic ecological factors in the estuary;

(2) developing an understanding of environmental factors that influence observed aquatic ecological status and trends;

(3) using knowledge of the previous information in a collaborative process to support natural resource planning, management, and regulatory activities in the estuary;

(4) continually reassessing and enhancing long-term monitoring and research activities that demonstrate scientific excellence;

(5) providing scientific information about the estuary that is accurate, accessible, reliable, and timely; and

(6) responding to management needs in a timely fashion.

In the next five years, the IEP objectives are to:

(1) complete its monitoring program elements;

(2) conduct technical reviews of its delta smelt and Chinook salmon monitoring programs and conduct an external review on the structure and function of the program. In the program review, the IEP will work with CBDA Science Program to define the relationship of these two programs;

(3) provide near-real time data for use in water operations management, and continue providing data from the sampling programs to the public, via website access or personal requests;

(4) report the abundance and distribution of numerous estuarine organisms in the annual Status and Trends issue of the IEP Newsletter; and

(5) in collaboration with the Science Program, develop a plan for implementation of a comprehensive monitoring and assessment program.

Accomplishments

In 2004, the IEP was able to accomplish many tasks despite constrained funding. The IEP was able to maintain its long-term monitoring studies as well as all of its on-going special studies, however, no new special studies were added to the program due to funding constraints. The IEP technical staff participated in several forums to share information about the estuary and its living resources, including IEP and Science Program sponsored workshops, Environmental Water Account (EWA) workshops, agency meetings on new biological opinions for the CVP/SWP operations, the CALFED Science Conference, the State Water Resources Control Board water quality control plan workshops and other professional conferences. IEP continued to maintain its data sets available on through the Bay Delta and Tributaries website (BDAT, http://bdat.ca.gov/) and the California Department of Fish and Game website (http://www.delta.dfg.ca.gov/). Two IEP monitoring programs also provided near-real-time data on delta smelt abundance and distribution needed to make day-to-day water operations decisions during Data Assessment Team (DAT) conference calls and Water Operations Management Team (WOMT) meetings. The status and trends of fish, shrimp, crabs, zooplankton and phytoplankton as well as water quality parameters were reported in the annual Status and Trends issue of the IEP Newsletter. Several journal articles and peer-review technical reports were completed for specific studies. The latest bibliography of IEP publications can be found at http://www.iep.ca.gov/report/iep_bibliography.html.

The Interagency Ecological Program's commitment to collaborative work of direct relevance to CALFED program issues is demonstrated with two major undertakings in 2004. Investigative studies in the South Delta that integrate biology and hydrodynamics were critically reviewed and orchestrated by the IEP. The series of collection, handling, trucking, and release studies being conducted at Skinner Fish Facility were also developed with the technical guidance and supervision of the IEP. Furthermore, studies at the Tracy Fish Collection Facility have been incorporated into IEP so proposals are reviewed by a larger science community and to foster the exchange of information.

Accomplishments for the major categories of IEP activities are summarized below.

Mandated Monitoring

Mandated monitoring includes those IEP monitoring program elements required through regulatory processes (e.g., SWP and CVP water right decision or biological opinions for SWP and CVP operations). Monitoring programs under this category include the fall midwater trawl fish survey, the 20 mm survey for delta smelt, larval fish sampling at the North Bay Aqueduct, Summer townet survey, Spring Kodiak trawl, upper estuary zooplankton/neomysid monitoring, juvenile Chinook salmon monitoring at Knights Landing, Mill and Deer creeks, Bay salinity monitoring and the Estuarine and marine fish, shrimp and macro-invertebrate study ("Bay study"), and the environmental monitoring program. Annual accomplishments include the successful completion of all mandated monitoring programs, processing, quality assurance, and posting of all monitoring data, data analyses, and reporting of status and trends. The IEP also reported data from key monitoring programs on a near-real-time basis to aid in decisions about when to take EWA actions.

Water Operations Monitoring

Water operations monitoring includes those IEP monitoring program elements that generate data and information used in managing SWP and CVP water project operations. Reservoir releases, Delta export levels, and operation of the Delta cross channel gates are all part of water project operations. Monitoring programs under this category include Delta flow and water temperature monitoring and database management, Sacramento and Chipps Island fish trawl surveys, SWP and CVP fish salvage programs. Annual accomplishments include the successful completion of all monitoring programs. Successful near-real time reporting of data on water conditions (e.g., flows and temperature) and fish distributions to the Data Assessment Team (DAT) and Water Operations Management Team (WOMT) for used in managing water project operations.

Fish and macro-invertebrate monitoring

IEP programs under this category include monitoring to determine the abundance and distribution of bay shrimp and crabs, and mitten crab monitoring and reporting. Annual accomplishments include the successful completion of all monitoring programs, data analyses, and annual reporting of status and trends and Delta resident shoreline fish sampling.

Salmonid migration and survival studies

This category of IEP activities includes genetic studies to determine which salmon run (e.g., winter-run, spring-run, or fall-run) emigrating young Chinook salmon captured at various locations in the system belong to. In addition, there are several projects that mark and recapture young salmon to determine survival rates over various portions of their life cycle. Data and information from these studies is used to evaluate the effectiveness of various actions occurring under the Environmental Water Account program and the Vernalis Adaptive Management Plan. These studies also provide baseline life history information of wild and hatchery steelhead collected at the CVP and SWP salvage facilities, and provide data to determine if environmental differences can be detected when the two groups are entrained.

Studies of Ecological Processes

These studies are aimed at increasing our understanding of how water flow and circulation affect the estuary environment and its living resources. Studies under this category include development and application of a 3-dimensional hydrodynamic model of the upper estuary and Delta, use of a particle-tracking model to understand how SWP and CVP exports may affect the distribution and entrainment of young fishes, and detailed modeling studies to determine how water flows and Delta cross channel operations may affect the distribution of young salmon emigrating from the Sacramento River watershed. The IEP is also completing studies to define and better understand predator-prey dynamics of fishes inhabiting near-shore habitats in the Delta. All of these studies are in-progress.

Fish Facilities Studies

IEP efforts under this category include studies to investigate the stress, predation, and acute mortality of delta smelt during the collection, handling, trucking and release phases of the fish salvage process. IEP scientists also collaborate with researchers conducting studies of fish salvage dynamics at the CVP facilities, including peer-reviews of proposals, technical reports and articles. All of these studies are in-progress.

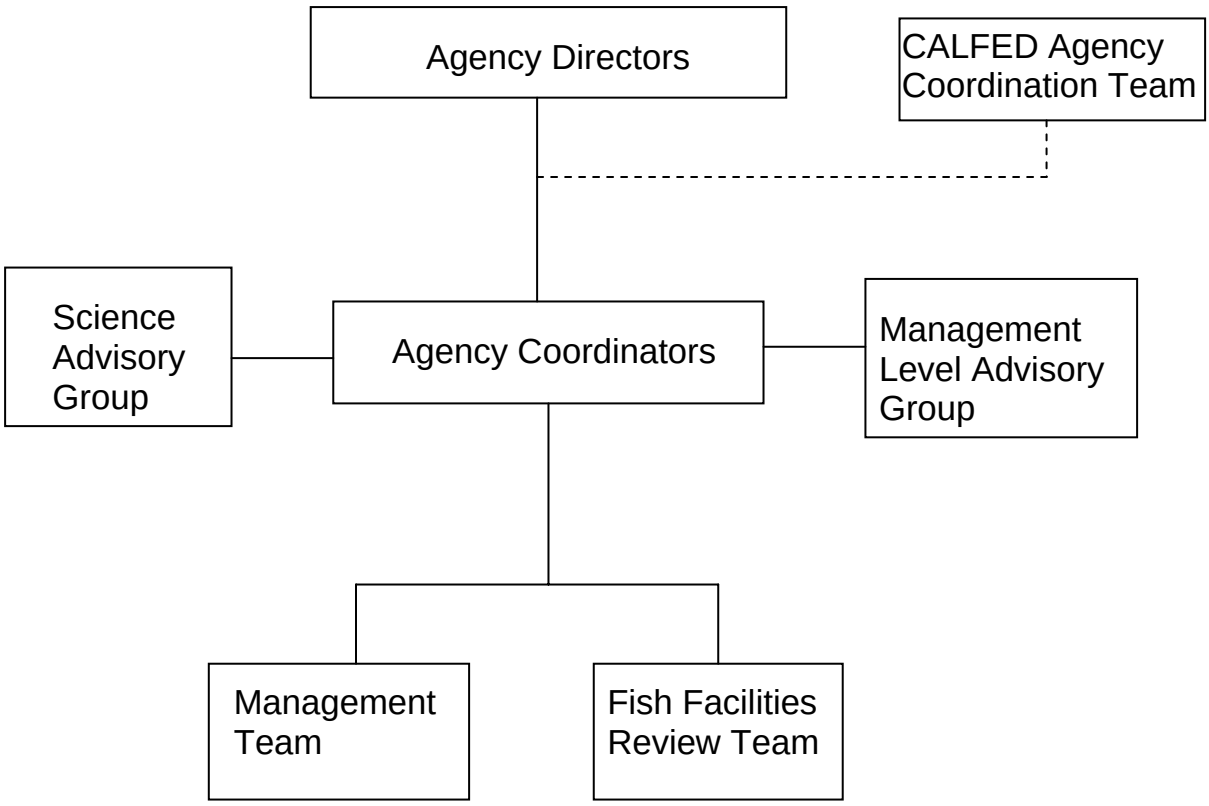
Habitat Restoration Studies

Over the years, the IEP has offered technical assistance in the development, review, and monitoring of various projects to restore aquatic habitats in the San Francisco Estuary. IEP scientists also collaborated in the completion of the *Napa River Fisheries Monitoring Program Annual Report 2004*.

IEP Program Management and Communication

As with any large, multidisciplinary program, a portion of the IEP effort goes to ongoing program management and planning. Activities under this category include development and approval of the annual IEP work plan, ongoing management during implementation, program element reviews, IEP database and website management, support for the IEP Newsletter and annual science meeting, and support of the external Science Advisory Group (SAG). Accomplishments in 2004 include successful implementation of the program, development of the 2005 work plan, publication of the quarterly Newsletter, completion of the annual meeting, and continued functionality of the public database and website.

Program Structure



Agencies	Roles and Responsibilities
CA Department of Fish and Game	Representative in Coordinators and Management Team. A large number of staff performs IEP work.
CA Department of Water Resources	Representative in Coordinators and Management Team. A large number of staff performs IEP work.
US Fish and Wildlife Services	Representative in Coordinators and Management Team. A large number of staff performs IEP work.
US Geological Survey	Representative in Coordinators and Management Team. A medium number of staff performs IEP work.
US Bureau of Reclamation	Representative in Coordinators and Management Team. A small number of staff performs IEP work.
NOAA Fisheries	Representative in Coordinators and Management Team. No staff performs IEP work.
US Environmental Protection Agency	Representative in Coordinators group. One staff performs IEP work.
US Army Corps of Engineer	Representative in Coordinators group. No staff performs IEP work.
CA State Water Resource Control Board	Representative in Coordinators group. No staff performs IEP work.
CA Bay-Delta Authority	Representative in Coordinators group. No staff performs IEP work.
San Francisco Estuary Institute	Representative in Coordinators group. No staff performs IEP work.

Major Activities

The Interagency Ecological Program has been comprised of long-term monitoring, water operations monitoring and special studies. As mentioned previously, the special studies component has been cut back due to funding constraints; monitoring studies will be impacted as well if more funding is not identified. Major activities in the future will be dependent on how these funding issues are resolved. The IEP is committed to conducting the mandated monitoring studies required by NOAA Fisheries and FWS biological opinions and SWRCB Water Rights Decision D-1641. There is also a commitment to continue providing the "real-time" data needed to make water operation decisions. If additional funding is available, special studies will be evaluated and selected for implementation. At this time, IEP is not soliciting any proposals for special studies.

Following are the major tasks the IEP plans for 2005 and out-going years.

Monitoring

IEP monitoring activities focus on aquatic habitats and living resources in the San Francisco Estuary, Sacramento River, and San Joaquin River. Monitoring activities address all of the goals and objectives established for IEP. Monitoring activities and estimated funding are:

- Hydrodynamics monitoring*
- Environmental monitoring*
- Fish and macro invertebrates monitoring*
- Water operations monitoring*
- Estuarine monitoring*

Special Studies

The IEP special studies component provides mechanistic understanding of the physical, chemical and ecological processes and evaluates current and new technology, sampling methodology and overall study design. These studies will provide additional information on how alterations of physical conditions and ecological interactions (e.g., predator-prey interactions) affect native and resident fishes in the estuary. These special studies address IEP goals 2, 3, 5, and 6. Special studies and estimated funding are:

- Salmonid migration and survival studies*
- Resident fishes studies
- Ecological processes studies*
- Fish facilities studies*

* IEP activities that provide data and information of direct relevance to Delta Improvements Package activities.

- Agricultural and municipal diversion evaluation
- Habitat restoration evaluation

Program Management

Ongoing program management activities are dedicated to annual program planning and program implementation, IEP database and website management, and program element reviews. Program management activities address IEP goals 4-6. Program management activities and funding are:

- Program planning and implementation
- Data Management and utilization
- Program element reviews of: 1) the delta smelt monitoring program, 2) the salmon monitoring program, and 3) the structure and function of IEP and IEP-Science Program integration
- Initiate activities to develop a comprehensive monitoring and assessment plan

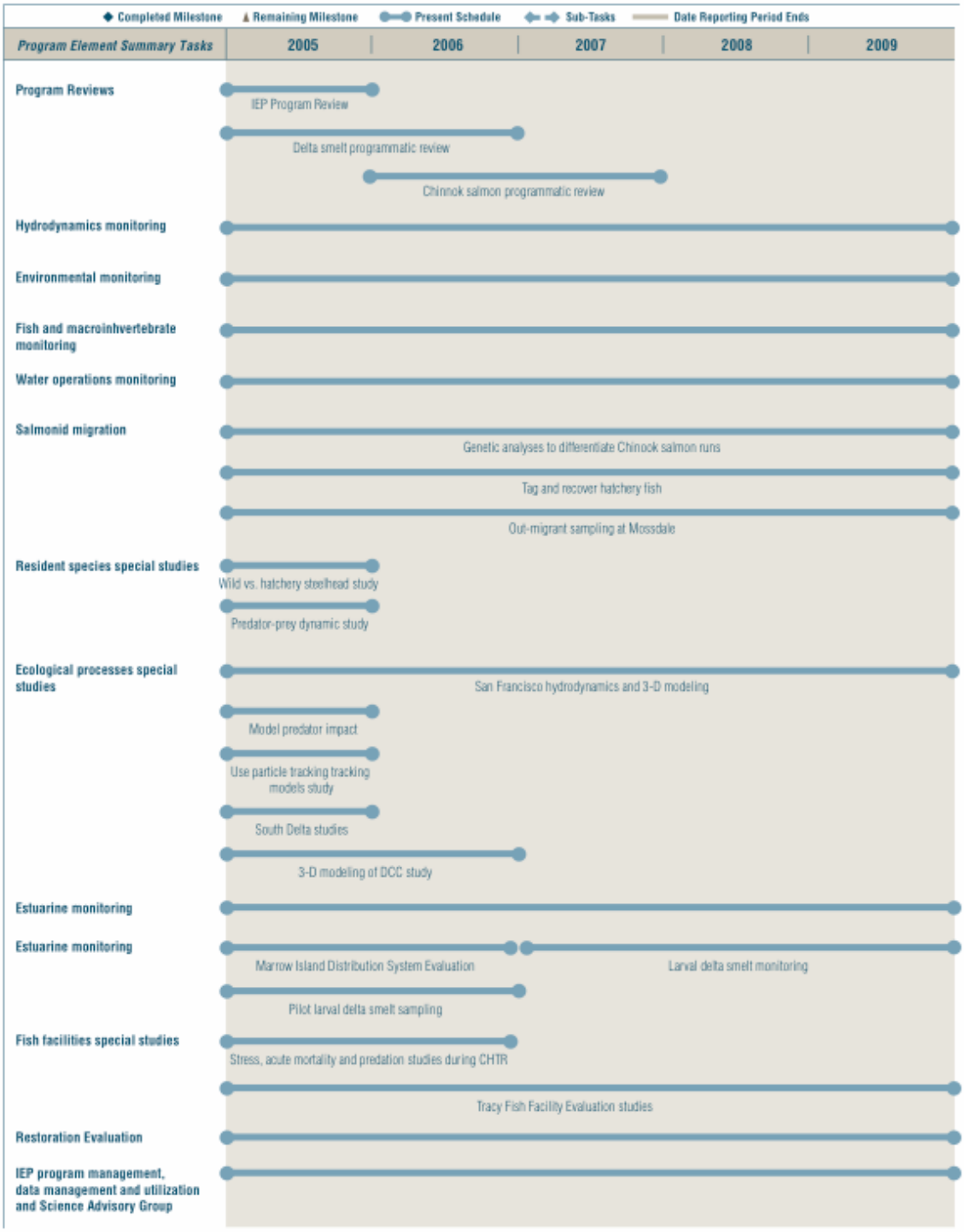
Public Involvement and Outreach

The Interagency Ecological Program incorporates a number of steps to ensure public involvement in its annual planning process, including: 1) input and review by the Management-level Advisory Group (MLAG), which is comprised of state and federal water contractors and operators, agency regulatory representatives and environmental stakeholders; and 2) participation in CALFED Agency Coordination Team, BDPAC, and Authority program plan review processes.

The IEP technical staff regularly participates in open forums to share its understanding of the estuary, including IEP and Science Program sponsored workshops, Environmental Water Account (EWA) workshops, agency meetings on new biological opinions for the CVP/SWP operations, the CALFED Science Conference, the State Water Resources Control Board water quality control plan workshops and other professional conferences. Many of the IEP data sets are available on the IEP Bay Delta and Tributaries website (BDAT, http://bdat.ca.gov/) and California Department of Fish and Game website (http://www.delta.dfg.ca.gov/). The IEP also publishes the quarterly Newsletter and a number of journal articles and peer-review technical reports to communicate new findings and technical information.

Schedule

IEP



Cross Program Relationships

The Interagency Ecological Program provides information that supports a variety of CBDA program elements. The close coordination and collaboration between IEP and CBDA are directly supported by having managers from both the CALFED Science and Conveyance programs participating in IEP at the Coordinators-level. Several IEP agency directors are also members of the California Bay-Delta Authority.

The two CALFED program elements most related to IEP activities are the Science Program and the Environmental Water Account (EWA) Program. In the past, IEP has provided seed money and technical staff for numerous studies. The success of these studies often becomes larger scale projects funded by the Science Program or Conveyance Program. In this way, the IEP has and continues to develop information of direct relevance to the Delta Improvements Package (DIP). The work IEP conducts also identify studies and information gaps that need to be completed to understand and explain fish trends. The IEP works collaboratively with Science Program by sharing resources when possible. The IEP studies have collected specimens for histopathology and genetic analyses or water quality measurements for Science Program-funded studies. Alternatively, the Science Program funded IEP special studies in 2005 due to funding shortages. Two of the Science Program's objectives are to clarify the state of knowledge through issue-specific workshops and ensure proposals are peer-reviewed for technical feasibility and soundness. The IEP staff has participated in several of these workshops and reviewed proposals as well as final technical reports and papers.

The EWA Program uses its water assets to pay for export curtailments undertaken at critical periods for Chinook salmon and delta smelt. The IEP provides the data to determine when these critical periods are and IEP staff actively participates in the decision on how EWA assets can be used to maximize benefits for fish.

The IEP crosses other program elements more broadly as well. The CBDA Ecosystem Restoration Program has numerous restoration efforts underway for the San Francisco Estuary. One measure of success of the program is showing these efforts are improving the system. The long-term data sets from IEP provide a basis for comparison to determine if progress is occurring.

The IEP hydrodynamics studies provide useful information to CBDA Conveyance Program. Understanding the flow regimes and how salinity and temperature are dispersed through the water will help the Conveyance Program manage a program that maintains water quality standards, protects fish and improves pumping operations as proposed in the DIP. In 2005, the Conveyance Program took over the funding for IEP 3-dimensional modeling of the flows at the Delta Cross Channel study because of its relevance and importance to the DIP.

IEP Funding

Interagency Ecological Program ($ in millions)	Yr 6	Yr 7*	Yr 8*	Yr 9*	Total
State	$ 0.608				$ -
Federal	$ 6.433				$ -
Local	$ 0.706				$ -
Water User	$ 6.456				$ -
Available Funding Total	$ 14.203				$ -
Finance Plan Targets (IEP)	$ 14.000	$ 14.000	$ 14.000	$ 14.000	$ -
Unmet Needs	$ (0.203)				$ (0.203)
Note: IEP Funding by source in years 7-9 is expected to remain about the same but estimated values are unknown at this time.					

IEP Funding by Task

Interagency Ecological Program ($ in millions)	Year 6	Year 7	Year 8	Year 9	TOTAL
Program Review	$ -				
Hydrodynamics monitoring	$ 0.997				
Environmental monitoring	$ 1.951				
Fish and macroinvertebrates monitoring	$ 3.497				
Water operations monitoring	$ 2.133				
Salmonid migration and survival	$ 0.752				
Resident species special studies	$ -				
Ecological processes special studies	$ 0.445				
Estuarine monitoring	$ 0.209				
Fish facilities	$ 2.080				
Agricultural and municipal evaluation	$ 0.285				
Restoration evaluation	$ 0.220				
IEP program management, data management and utilization and Science Advisory Group	$1.63				
Available Funding Total	$14.20				
Finance Plan Targets (IEP)	$ 14.000	$ 14.000	$ 14.000	$ 14.000	$ 56.000
Unmet Needs	$ (0.20)				