

## Work Plan for Fiscal Year 2003

I. Program Title: Ecological/Water Systems Operations Models, CVPIA Section 3406 (g)

II. Responsible Entities

	Agency	Name	Role
Lead	USBR	Lloyd E. Peterson Chief, Reservoir System Analysis Branch	Program Manager
	USBR	James Cornwell	Hydraulic Engineer
	USBR	Randi Field	Hydraulic Engineer
	USBR	David Haisten	Hydraulic Engineer
	USBR	Claire Hsu	Hydrologist
	USBR	Kurt Keilman	Economist
	USBR/Denver	Nancy Parker	Hydraulic Engineer
	USBR	Russell Yaworsky	Water Temperature
	USBR	Kenneth Yokoyama	Water Quality
Co-Lead	USFWS	Andrew Hamilton	Program Manager
	USFWS	Derek Hilts	Hydraulic Engineer

III. Program Objectives for FY 2003

The objectives are to develop readily usable and broadly available models and supporting data to evaluate the ecologic and hydrologic effects of existing and alternative management strategies of public and private water facilities and systems in the Sacramento, San Joaquin, and Trinity watersheds. Specific to FY 03 are:

- A. CALSIM II Development Continuing support for the development of CALSIM II. CALSIM II is a reservoir system model jointly developed (Reclamation and DWR). It is an application of the CALSIM software developed by the California Department of Water Resources (DWR). CALSIM II is now receiving wide application in the Water Supply Improvement Program, analysis of the Environmental Water Account and analysis of 3406(b)(2) implementation.
- B. Process Based CALSIM Module Development CALSIM II manages water supply but depends on processed based modules, such as delta water quality, to calculate constraints and requirements.
- C. Reservoir and River Temperature Model Development Temperature models of reservoirs and rivers of the Central Valley; and of Trinity River system support operations and planning in meeting requirements of biological opinions.
- D. CALSIM Review and Documentation Rigorous quality control and documentation are required to preserve credibility. Documentation includes development of a GIS interface.
- E. Fishery Model Development Completion of a distributive version of the Sacramento River Chinook Salmon Individual-Based Model.

## F. Membership and Participation in Professional Organizations

### IV. Status of the Program

The Ecological/Water Systems Operations Models, CVPIA Section 3406(g) program is a continuing program that started in 1994.

The program has supported the Ecosystem Modeling Consensus Project, designed to identify needed development of a credible consistent set of tools for supporting water resources and biological management decision; review and update of the Central Valley Ground-Surface water model (CVGSM); development of a graphical user interface (GUI) and database for PROSIM and SANJASM (note: This GUI effort was abandoned because CALSIM replaced PROSIM and SANJASM, as well as DWRSIM); development of the 3-D temperature model for Whiskeytown Reservoir, development of CALSIM II, and hydrologic input for CALSIM.

Since 1998 this program has supported a steadily increasing level of support for CALSIM II development and application with FY 2002 demanding more staff and resources than any earlier year. The California Department of Water Resources and Reclamation have made a large investment in CALSIM and it is essential for Interior to participate in and guide its development and application. CALSIM II is now available for public use and has been applied to water supply improvement studies.

This program also supports new development of reservoir and river temperature models used by the Division of Planning for modeling support for operations and planning. Also important is the development of staff capable of developing and implementing these models. The Reservoir System Analysis Branch has six professionals capable of CALSIM development and application; and two reservoir and river temperature modelers; and one water quality modeler.

This program has also provided a platform for staff to solicit and manage funds from other sources.

### V. FY 2002 Accomplishments

The staff of the River Systems Analysis Branch (MP-710), Reclamation's Technical Service Center, Derek Hilts (USFWS), and private contractors developed code and data and reviewed CALSIM II, and conducted one three day training session. Benchmark studies of CALSIM II were publicly released in September.

Updated present and future conditions hydrology was developed for the San Joaquin Valley.

A manual was developed describing the procedure for developing the various time series of input that are required for CALSIM supporting review of data and serves to replace what had been left to corporate memory.

The nutrient-food resources modeling project has nearly completed its third year of data collection at 25 sites throughout the Central Valley. Concentrations and fluxes of nutrients (phosphorus, nitrogen, silica) and lower trophic level food resources (sestonic algal biomass, fine particulate organic matter, dissolved organic carbon) have been

measured biweekly for 12 systems in the Sacramento basin and 13 systems in the San Joaquin basin. Sampling and lab analysis for FY 2002 will be completed by September 30, 2002. Data analysis and draft report preparation are underway. Reservoir System Analysis Branch professionals solicited funds from other sources for model development for nearly \$400,000 for temperature modeling, \$100,000 for CALSIM development, and \$150,000 for consumptive use modeling under the Land Air Water Simulation (LAWS) program. This is a 3406(g) accomplishment as it is due to 3406(g) funding that staff became aware of these needs, the funding provided the time to solicit and write contracts, and this model development augments 3406(g) development.

IV. Tasks, Costs, Schedules, and Deliverables  
 Narrative Explanation of Tasks

Program Objective ID*	Task #	Narrative Explanation of Task
A-F	1	Program management – Managing this program and administration of contracts
D	2	Comprehensive review and documentation of CALSIM II code. This code has been developed by CADWR, Reclamation, and private sector staff. Reclamation, with CADWR, recognizes the need for this quality control effort
B	3	DWR has developed an algorithm, using Artificial Neural Network (ANN) technology, that estimates the salinity-flow relationships at several locations in the Sacramento-San Joaquin Delta for the CALSIM II model. This task is Reclamation’s participation in the CALSIM ANN Refinement Team (CART) , 1-year study that commenced in March 2002, to review and refine the predictive capability of the ANN.
D	4	US Fish and Wildlife Service staff provides CALSIM oversight and review
C	5	Initiate development of a water temperature model of the American River from Folsom Lake to the confluence of the Sacramento River. The model will operate on a daily, or shorter (6-hour), time-step. Both Folsom Lake and Lake Natoma should be modeled explicitly. The model will be used for planning studies and real time operation.
D	6	Contribution to a peer review of CALSIM jointly funded by Reclamation, CADWR and CALFED
A	7	Continuing Reclamation development of CALSIM
B	8	Support for a module of the Land-Atmosphere-Water-Simulator (LAWS) model that provides simulation of historic or current consumptive use. These data may be incorporated into the CALSIM II. LAWS integrates geographical information systems (ArcGIS), satellite remote sensing (LANDSAT), historic and near real-time weather data collection (CIMIS), and weather forecasting (MM5) technologies. This modeling system utilizes software that can extract from LADSAT imagery crop types and acreage thus supporting development of data to more accurately model consumptive use. These results will be useful for studies on reservoir operations, conjunctive use of surface and ground water, water transfers involving water conservation or land fallowing, and re-use of agricultural drainage.
E	9	Develop distribution copy of Sacramento River chinook salmon life-history model. This task includes development of a windows-based desktop version of the preliminary chinook salmon model prepared under 3406(g) in past years. Package is to include a standard baseline input data set, a windows interface for input, output, and parameter and variable manipulation, and output formatting compatible with standard spreadsheet formats.
F	10	Membership and Participation in Professional Organizations including membership in the California Water and Environmental Modeling Forum and conferences with organizations such as American Society of Civil Engineers and American Water Resources Association
D	11	Hydrology documentation as a continuation of work largely completed with in FY 02 which will result in instruction or specifications to develop the input to CALSIM and continuation of GIS CALSIM interface

Additional Program Needs

- E Sacramento River chinook model Calibration and analysis. Calibration and analysis will include testing of existing model output and individual examination of two life stage modules, calibrating them against available data and then using the calibrated modules for pilot analyses of important management issues.

Key to Objective ID

- A. CALSIM II Development
- B. Process Based Module Development
- C. Reservoir and River Temperature Model Development,
- D. CALSIM Review and Documentation,
- E. Fishery Model Development
- F. Membership and Participation in Professional Organizations

3406(g) Schedule and Deliverables				
#	Task	Start	End	Deliverable
1	Program Management	10/1/02	9/30/03	Annual work plans; awarding and management of grants; supervision of staff on 3406(g) funded projects
2	CALSIM Review/Documentation	10/1/02	3/31/03	Refined and commented WRESL code in CALSIM
3	CART Review and Refinement	10/1/02	2/2/03	Refined ANN CALSIM module for delta water quality
4	USFWS CALSIM Oversight	10/1/02	9/30/03	Reviews of CALSIM, participation in development meetings
5	American River Temperature Model	11/1/02	9/30/03	Initial version of shorter time step temperature model
6	CALSIM Peer Review	1/1/03	5/31/03	Review report from committee of experts
7	CALSIM Development (USBR)	10/1/02	9/30/03	Coding to improve elements of model such as EWA, (b)(2), and allocation simulation
8	LAWS Consumptive Use Module	1/1/03	5/31/03	Coding and process for consumptive use calculation
9	Salmon life-history model	1/1/03	8/31/03	Windows based software
10	Participation in Prof. Organizations	10/1/02	9/30/03	Shared technology
11	Hydrology Documentation	1/1/02	9/30/03	Completed manual (75% completed in FY 02)
Additional Program Needs				
	Salmon life-history model	9/1/03	3/1/04	Sacramento River chinook model Calibration and analysis.

#	Task	Total Cost	W&RR	DWR	CALFED	Other Reclamation Funds
1	Program Mgt	\$75,000	\$75,000			
2	CALSIM Review/Documentation	\$250,000	\$125,000	\$125,000		
3	CART Review and Refinement	\$200,000	\$50,000	\$150,000		
4	USFWS CALSIM Oversight	\$70,000	\$70,000			
5	American River Temperature Model	\$50,000	\$50,000			
6	CALSIM Peer Review	\$100,000	\$25,000	\$50,000	\$25,000	
7	CALSIM Development (USBR)	\$189,500	\$189,500			
8	LAWS Consumptive Use Module	\$300,000	\$65,000			\$235,000
9	Salmon life-history model	\$100,000	\$100,000			
10	Participation in Prof. Organizations	\$5,000	\$5,000			
11	Hydrology Documentation	\$45,000	\$45,000			
Additional Program Needs						
	Salmon life-history model	\$150,000	\$150,000			

#	Task	FTE	Direct Salary and Benefits Costs	Contracts Costs	Misc Costs	Admin Costs	Total Costs
1	Program Management (USBR)	0.63	\$37,500			\$37,500	<b>\$75,000</b>
2	CALSIM Coding Review	1.06	\$62,500			\$62,500	<b>\$125,000</b>
3	ANN Review and Refinement	0.42	\$25,000			\$25,000	<b>\$50,000</b>
4	USFWS Modeling Support (CALSIM)	0.47	\$56,000			\$14,000	<b>\$70,000</b>
5	American River Temperature Model	0.08	\$10,000	\$36,000		\$4,000	<b>\$50,000</b>
6	CALSIM Peer Review			\$23,000		\$2,500	<b>\$25,500</b>
7	Reclamation development of CALSIM	1.27	\$150,000	\$36,000		\$3,500	<b>\$189,500</b>
8	LAWS module development	0.04	\$5,000	\$56,000		\$4,000	<b>\$65,000</b>
9	Salmon life-history model			\$95,500		\$4,500	<b>\$100,000</b>
10	Participation in Prof. Organizations	0.02	\$2,000		\$3,000		<b>\$5,000</b>
11	Hydrology Documentation	0.08	\$10,000	\$35,000			<b>\$45,000</b>
	<b>Total by Category</b>	<b>4.08</b>	<b>\$483,000</b>	<b>\$281,500</b>	<b>\$3,000</b>	<b>\$32,500</b>	<b>\$800,000</b>
	<b>Additional Program Needs</b>						
	Salmon life-history model (calibration)			\$143,250		\$6,750	\$150,000

## VII. Future Years Commitments/Actions

Certain CALSIM applications will require a smaller time step than a month. DWR has initiated development at a smaller time step (especially useful for the delta part of the model and assessment of flood operation). Reclamation will participate as time and funding permit. The ANN delta water quality module will be expanded to simulate more stations. A more process based simulation of San Joaquin water quality is needed to more correctly assess projects affecting irrigation drainage or added storage at Friant. CALSIM routines for managing ground water will require refinement as specific conjunctive use projects are identified. Current CALSIM II treats deliveries on the Friant-Kern canal as a time series (based on historical demand). Future development will explicitly include the Friant service area.