Draft CVPIA Fiscal Year 2009 Annual Work Plan

December 1, 2008

Program Title

Ecological/Water Systems Operations Models, CVPIA Section 3406(g)

Responsible Entities

Staff Name	Agency	Role
Claire Hsu	USBR	Lead, MP740
Derek Hilts	USFWS	Co-Lead

Program Goals and Objectives for FY 2009

The goal of the Ecological/Water Systems Operations Models section is to develop readily usable and broadly available models and supporting data in order to: 1) evaluate ecologic and hydrologic effects of existing and alternative water management strategies in the Sacramento, San Joaquin, and Trinity River watersheds; 2) to improve scientific understanding of ecosystems in the Sacramento, San Joaquin, and Trinity watersheds; and 3) to support the Secretary's efforts in fulfilling the requirements of the CVPIA. The following are specific FY09 program objectives:

A. CalSim III San Joaquin Quality Assessment (QA)/Quality Control (QC) review & Documentation – Coordinate with the California Department of Water Resources (DWR) in developing CalSim III San Joaquin Basin hydrology for project planning investigation
B. Water Quality and Temperature Modeling – Extend existing San Joaquin temperature model and add salinity logic and parameters to model application
C. Ecosystem Modeling – Evaluate existing fishery and riparian modeling tools and provide additional hydrodynamic modeling assistance on Delta modeling
D. HGS/CalSim Linkage – Thermal/temperature module testing and additional spatial time series data development
E. Database and GIS Framework – Develop water budget model to assist DWR for the California Water Plan update
F. Modeling Master Plan Documentation – Reclamation in coordination with FWS, to develop a modeling master plan that identifies future modeling needs
G. Membership and Participation in Professional Organizations

Status of the Program

The Ecological/Water Systems Operations Models, CVPIA Section 3406(g) program is a continuing program that started in 1994. Since 1998, this program has provided a high level of support for CalSim II model development and applications. CalSim II is now available for

public use and has been utilized for numerous large-scale water supply improvement studies. A new version of CalSim (CalSim III) is currently being developed as a joint effort by Reclamation and DWR.

In recent years, a water management screening tool (CalLite) has also been under development to assist in the screening of water management options and to provide information to decision makers on system response corresponding to hypothetical operational changes.

The U. S. Fish and Wildlife Service (FWS) has also participated in the development and application of CalSim through interagency agreements. CalSim is an integrated Central Valley Project (CVP)/State Water Project (SWP) system model for planning investigations including the most recent Central Valley Project Operations Criteria and Plan (OCAP) which includes CVPIA's provisions and the ongoing CALFED feasibility studies for storage and conveyance.

In addition to CalSim and CalLite models, the program has supported the development and application of other types of river management and ecological models including water quality, hydrology, groundwater, fish population and riparian habitat models used by the Division of Planning, FWS, contractors, and public interest organizations for modeling support of operations and planning. These models include:

- o Comprehensive San Joaquin Water Quality Model (SJRSIM) – for use in planning of reservoir releases for water temperature management in anadromous fish spawning and rearing habitats.
- o DSM2 Model – for use in conducting the hydrodynamic modeling on flow, water quality and mass transport processes of the Delta and the San Joaquin Basin.
- o SALMOD, inSALMO and PHABSIM– for use in evaluating anadromous fish survival at various life stages and in a variety of aquatic environments.
- o Ecologically Cogent Operations Suite of Integrated Models (ECOSIM) – for use in analyzing changes to the macroscopic water resources in California's Central Valley, particularly in support of CVPIA (b)(3) water acquisition investigations.
- o HydroGeoSphere (HGS) – for use in evaluating surface and subsurface hydrologic interactions related to water supply, water quality and ecosystem restoration.
- o Database and GIS Framework – for use in assessing the water budget variation corresponding to environmental or refuge demand changes. The results of the water budget modeling will be used as input to various models and for the California Water Plan update.

This program supports both Reclamation and FWS staff's participation in professional organizations, as well as training conducted by Reclamation and DWR. Beyond the regular training and coordination efforts, other stakeholders have also been trained in the use of CalSim through funding from this program.

FY 2008 Accomplishments

A. Reclamation and FWS modelers continued the development and applications of water operations and water management tools. These activities included participation in a multi-agency effort to review and improve the CalSim II & III CVP/SWP water operations models. CalSim activities included completion of a QA/QC review of the Sacramento Valley hydrology to improve the simulation of agricultural, environmental and municipal water supplies and demands.

B. The water quality modeling activities included applications of the Upper Sacramento River Water Quality Model (USRWQM) and the San Joaquin River Water Temperature Model for simulations of water temperature for several planning, operations, and river restoration projects of the Sacramento and San Joaquin Basins.

C. A GIS based interface was developed that allowed the CalSim III model to be more readily accessible to users. Other water operations modeling activities included initiation of the development of new capabilities for simulating watershed scale hydrology and water management options in the Land Atmosphere Water Simulator (LAWS) model.

D. Reclamation and FWS modelers also continued the development and application of ecosystem models to evaluate the effects of reservoir operations and river flows on anadromous fish and riparian habitats on the Sacramento River. These activities included the use of several existing models including CalSim, USRWQM and the Riparian Habitat Establishment Model (RHEM). Results from the USRWQM water model were used as inputs to the salmon habitat suitability model (SALMOD) to evaluate the effects of alternatives for the Shasta Enlargement and North of Delta Off-stream Storage Environmental Impact Statement (EIS)/Environmental Impact Report (EIR), feasibility investigations, and OCAP biological assessments. These models and possibly others (inSalmo, IOS, etc) will be used to evaluate the benefits/impacts of alternate water management strategies for the Sacramento River.

E. HydroGeoSphere (HGS) – Testing of Thermal/Temperature Transport: Temperature-transport capability has existed in the HGS subsurface flow module since development of the model. Recently, the University of Waterloo has expanded this capability to HGS surface-flow module, rendering HGS as the only numerical model with the capability to evaluate temperature in both surface- and subsurface-flow regimes. This will facilitate evaluation of the impact of groundwater on surface-water temperature. Temperature modules based on field data from the San Joaquin River Basin for the model will be tested in FY2009. Following model testing, snowmelt processes may be incorporated into HGS.

F. Reclamation and FWS modelers also participated in the California Water and Environmental Water Modeling Forum and other professional organizations; made presentations at workshops; attended conferences and training courses; prepared

publications and provided support for model application to stakeholders.

Table 1. FY 2009 Tasks, Costs, Schedules and Deliverables

Task or Subtask Number	Name of Activity	FTE's	Description of Activity	Completion Date	Total Cost	15% Cut	Funding Source Restoration Fund	Funding Source Water & Related Resources
1.1	**Program Management**							
1.1.1		0.12	(USBR) - Program Lead responsible for coordination of program activities, budget and work with federal and state agencies. Coordinate with FWS to develop modeling master plan documentation.	9/30/2009	$18,000	$15,300	$18,000	$0
	Subtotal Costs 0.12				$18,000	$15,300	$18,000	$0
1.2	**Program Support**							
1.2.1		0.30	(USFWS) - Co-lead responsible for coordinating program activities within FWS as well as reviewing and the development of CALSIM, SALMOD and other modeling tools regarding implementation of CVPIA Section 3406(b) and 3406(g). Coordinate with Reclamation to develop modeling master plan documentation.	9/30/2009	$50,000	$42,500	$50,000	$0
1.2.2		0.07	Lee Mao (USBR) – Supervisor - responsible for coordinating modeling activities within MP-740.		$10,000	$8,500	$10,000	$0
	Subtotal Costs	0.37			$60,000	$51,000	$60,000	$0
1.3	**Technical Support**							
1.3.1		0.25	(USBR) - Modeler responsible for development and application of water operations and water management models (see Tasks 1.13.1 & 1.13.2)	9/30/2009	$37,000	$31,450	$37,000	$0
1.3.2		0.25	Modeler responsible for development and applications of water operations and water quality models (see Tasks 1.13.1 & 1.13.3)	9/30/2009	$37,000	$31,450	$37,000	$0
1.3.3		0.25	(USFWS)/New Hire (USBR) – Modelers work collaboratively on the development and application of fishery, riparian habitat and ecosystem models (see Task 1.13.5 & 1.13.6)	9/30/2009	$18,500/18,500	$15,725/15,725	$18,500/18,500	$0
1.3.4		0.25	(USBR) - Responsible for developing spatially-distributed time-series data (precipitation, air temperature and radiation) for input into the linked HydroGeoSphere and CalSim model. Test thermal/temperature transport module (see Tasks 1.13.1 & 1.13.4)	9/30/2009	$37,000	$31,450	$37,000	$0

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Task or Subtask Number	Name of Activity	FTE's	Description of Activity	Completion Date	Total Cost	15% Cut	Funding Source Restoration Fund	Funding Source Water & Related Resources
1.3.5		0.25	(USBR) - Responsible for development and application of HydroGeoSphere for modeling the integrated surface/subsurface hydrologic and water quality processes of study areas. Test thermal/temperature transport module (see Tasks 1.13.1 & 1.13.4)	9/30/2009	$37,000	$31,450	$37,000	$0
1.3.6		0.15	(USBR) - Responsible for developing spatially-distributed time-series data (precipitation, air temperature and radiation) for input into the linked HydroGeoSphere and CalSim model (see Task 1.13.4)	9/30/2009	$25,000	$21,250	$25,000	$0
1.3.7		0.15	(USBR) - Modeler responsible for development and applications of GIS based hydrologic and data integration framework (see Task 1.13.7)	9/30/2009	$25,000	$21,250	$25,000	$0
1.3.8		0.25	(USBR) - Modeler responsible for development and implementation of model integration and database management activities (see Tasks 1.13.1 & 1.13.7)	9/30/2009	$37,000	$31,450	37,000	$0
	Subtotal Costs	1.8			$272,000	$231,200	$272,000	$0
	-	-						
1.7	**Outreach and Public Involvement**							
1.7.1			Membership and participation in California Water and Environmental Water Modeling Forum and other professional organizations, attend workshops and conferences, prepare publications and provide support for model application to stakeholders.	9/30/2009	$20,000	$17,000	$20,000	$0
	Subtotal Costs				$20,000	$17,000	$20,000	$0
1.13	**Modeling**							
1.13.1			Water Operations Models - CalSim II & III - simulations performed to evaluate alternative operations of CVP/SWP and effects of 3406 (b2) supplies. CalSim model can be linked to water temperature, water quality and riparian habitat models. DWR is a major cost-sharing partner and typically exceeds CVPIA funding by a factor of 5 on an annual basis. CalSim models and hydrologic data inputs are routinely updated to better represent changes in the CVP/SWP operations. CalSim model has been widely distributed and is used by Federal, State, and stakeholder organizations for planning studies (CVPIA law: model type #1). (High Priority).		Work performed by BOR Technical Staff (see Task 1.3 for staffing)	Work performed by BOR Technical Staff (see Task 1.3 for staffing	N/A	N/A

Task or Subtask Number	Name of Activity	FTE's	Description of Activity	Completion Date	Total Cost		Funding Source Restoration Fund	Funding Source Water & Related Resources
						15% Cut		
1.13.2			Water Management Screening Model - CalLite - simulates the hydrology of the Central Valley reservoir operations, project operations and delivery allocation decisions, delta salinity responses to river flow and export changes, and habitat-ecosystem flow. This tool can be used to bridge the gap between more detailed system model (CalSim) for rapid and interactive policy evaluations. CalLite can be applied to assist in the screening of a variety of water management options and to educate decision makers on system responses (CVPIA law: model type #1). (High Priority).		Work performed by BOR Technical Staff (see Task 1.3 for staffing)	Work performed by BOR Technical Staff (see Task 1.3 for staffing)	N/A	N/A
1.13.3			Water Temperature Models - proposed tasks aim to extend an existing HEC-5Q temperature model of the San Joaquin River to encompass a larger spatial domain and to add salinity to the simulation. Elements of this proposal include engaging the service of the consultants to modify the existing model to include a more comprehensive representation of infrastructure/facilities and river reaches, addition of salinity parameter logic, model calibration, and model application (CVPIA Law: model type #2). (High Priority).		Work performed by consultants 80,000	Work performed by consultants 80,000	N/A	N/A
1.13.4			Ecosystem Models - DSM2 – this is a river, estuary, and land modeling system model – model simulates stages, flows, velocities; many mass transport processes, including salts, multiple non-conservative constituents, temperature, THM formation potential and individual particles (CVPIA Law: model type #4). (High Priority).		Work performed by BOR Technical Staff (See Task 1.3 for staffing)	Work performed by BOR Technical Staff (See Task 1.3 for staffing)	N/A	N/A
1.13.5			Ecosystem Models – PHABSIM and SALMOND – PHABSIM is designed to predict the micro-habitat (depth, velocities, channel indices) conditions in rivers as a function of streamflow, and the relative suitability of those conditions to aquatic life. It can simulate the relationship between streamflow and physical habitat for various life stages of a species of fish or a recreational activity to obtain a representation of the physical stream so that the stream may be linked, through biological considerations, to the social, political, and economic world. SALMOD - simulations performed to evaluate the effects of alternative operations of CVP/SWP on anadromous fish survival. SALMOD can be linked directly to USRWQM for flow and water temperature inputs. SALMOD is a fully functional model that is regularly used for planning studies such as the CALFED storage		Work performed by BOR and FWS Technical Staff (see Task 1.3 for staffing)	Work performed by BOR and FWS Technical Staff (see Task 1.3 for staffing)	N/A	N/A

Task or Subtask Number	Name of Activity	FTE's	Description of Activity	Completion Date	Total Cost	15% Cut	Funding Source Restoration Fund	Funding Source Water & Related Resources
			investigations (CVPIA Law: model type #4). (High Priority).					
1.13.6			HydroGeoSphere (HGS) – Develop spatially-distributed time-series meteorological data for input into the new linked HydroGeoSphere and CalSim model. The linkage will provide the capability of modeling the coupled impacts on hydrology and water allocation that related to climate change (CVPIA Law: model type #3).		Work performed by consultants 50,000	Work performed by consultants 35,000	N/A	N/A
1.13.7			Database and GIS Frame work – Tasks aim to develop effective methods of managing data to be used in modeling. Reclamation, in coordination with the California Department of Water Resources (DWR) has completed development of models to manage collected agricultural and urban water use data. The results of the water budget modeling will be used as inputs to various models and for the California Water Plan update.		Work performed by BOR Technical Staff and consultants (see Task 1.3 for staffing) 50,000	Work performed by BOR Technical Staff and consultants (see Task 1.3 for staffing) 38,000	N/A	N/A
1.13.8			Unfunded Needs – Tasks to develop a basin wide San Joaquin water quality model to assess the salinity discharge to the San Joaquin River and provide real time water quality forecast capability in assisting Reclamation and stakeholders managing the timing and discharge of salinity into the San Joaquin Basin.		$300,000	$300,000	$300,000	$0

Task or Subtask Number	Name of Activity	FTE's	Description of Activity	Completion Date	Total Cost	15% Cut	Funding Source Restoration Fund	Funding Source Water & Related Resources
1.13.9			<u>Unfunded Needs</u> - Tasks to develop and/or apply fish population models on Central Valley streams beyond the Keswick-to-Red Bluff reach of the Sacramento River.		$250,000	$250,000	$250,000	$0
1.13.10			<u>Unfunded Needs</u> - Tasks to update the hydrologic data in ECOSIM-W to facilitate water acquisition and global climate change studies as well as provide a check of CalSim studies.		$100,000	$100,000	$100,000	$0
	Total Costs	**2.29**			**$550,000**	**$467,500**	**$0**	**$0**
	Reclamation	1.87			$481,500	$409,275	$0	$0
	FWS	0.42			$68,500	$58,225	$68,500	$0
	Potential 15% funding cut		Funds taken from various tasks		$82,500			
	Unfunded Needs				$650,000	$650,000	$0	$0

Table 2. Budget Breakdown

Task	Agency	FTE	LABOR			CONTRACTS		Misc. Costs	Total Costs
			Direct Salary and Benefits Costs	Overhead Costs on Salary & Benefits	FWS Overhead Assess: 22% of Direct Salary and Benefits Costs	Contract, Grant, and Agreement Costs	FWS Overhead Assess: 6% Contract Costs		
1.1 Program Management	USFWS		0	0	0	0	0	0	0
	USBR	0.12	10,800	7,200	0	0	0	0	18,000
1.2 Program Support	USFWS	0.3	26,639	14,344	9,016	0	0	0	50,000
	USBR	0.07	6,000	4,000	0	0	0	0	10,000
1.3 Technical Support	USFWS	0.12	9,857	5,307	3,336	0	0	0	18,500
	USBR	1.68	152,100	101,400	0	0	0	0	253,500
1.7 Outreach and Public Involvement	USFWS		0	0	0	0	0	0	0
	USBR		0	0	0	0	0	20,000	20,000
1.13 Modeling	USFWS		0	0	0	0	0	0	0
	USBR		0	0	0	$180,000	0	0	180,000
USFWS Total Costs		0.42	36,496	19,651	12,352	0	0	0	68,500
USBR Total Costs		1.87	168,900	112,600	0	180,000	0	0	481,500
TOTAL ALL		2.29	205,396	132,251	12,352	180,000	0	0	550,000

Table 3. Three Year Budget FY 2010-2012

($ thousands)

Year	Description of Activities	Requested RF Funding	Requested W&RR Funding
2010	1. Continue water operations/water management tools development. 2. Initiate basin wide water quality modeling scope. 3. Continue ecosystem models development and coordination. 4. Expand basin wide watershed/groundwater models development. 5. Database framework/GIS integration. 6. Develop modeling master plan document. 7. Evaluate basin wide integrated modeling needs.	$822	$0
2011	1. Coordinate water operations/water management modeling needs. 2. Evaluate basin wide water quality modeling opportunities and constraints. 3. Explore Delta/ecosystem models opportunities. 4. Conduct basin wide watershed/groundwater modeling analysis. 5. Evaluate basin wide integrated modeling needs. 6 Continue database framework/GIS integration.	$847	$0
2012	1. Coordinate water operations/water management tools development. 2. Explore basin wide water quality modeling needs. 3. Expand Delta/ecosystem modeling opportunities. 4. Investigate future basin	$871	$0

Year	Description of Activities	Requested RF Funding	Requested W&RR Funding
	wide watershed/groundwater modeling needs. 5. Evaluate future database framework needs.		

Note: The FY 2010 – 2012 Budget Plan provides estimates of capability only. The amounts are displayed are those that might be reasonably appropriated each year. These figures do not reflect the future Congressional Appropriations process. All of these estimates will be adjusted annually as RF collections are realized.