

Draft CVPIA Fiscal Year 2014 Annual Work Plan

May 30, 2013

Program Title:

Ecosystem and Water System Operations Models, CVPIA Section 3406 (g)

Responsible Entities:

Staff Name	Agency	Role
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Program Goals and Objectives for FY 2014

The Ecosystem/ Water Systems Operations Models, CVPIA Section 3406(g) program is a continuing program that began in 1994. The goal of the Ecosystem and Water Systems Operations Models program 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) improve scientific understanding of ecosystems in the Sacramento, San Joaquin, and Trinity watersheds; and 3) support the Interior Secretary's efforts in fulfilling the requirements of the CVPIA. The following are specific FY14 program objectives:

- A. Hydrologic Modeling – The Program plans to continue adaptation/development of hydrologic models at varying spatial and temporal scales to enable the evaluation of hydrologic effects of alternative water management scenarios. Some of the efforts listed below are to make the hydrologic models more readily usable and more broadly available. Other efforts are to better address the needs of study managers for quantitative analyses.
 - i. Continue development and application of CalSim II model in simulation studies in support of SWRCB Hearings, COA Agreement re-evaluations, SWP-CVP system reoperations, Sisk Dam re-operation, Franks Tract Project, Delta Facilities Planning, North Bay Aqueduct Alternate Intake Project, USFWS OCAP BO Remand, NMFS OCAP BO Remand, and BDCP alternative evaluations. Develop more user-friendly automated data processing packages for input/output analysis and display. Furthermore, the Program will develop modeling tools that will identify the San Joaquin River Outflows needed to meet SWRCB water quality objectives and operation of the Delta Cross Channel during October.
 - ii. Support the continued development and application of CalLite Model, including the integration of the San Joaquin system, and the Forecast Allocation module (FAM-CalLite). Apply the model in support of COA Agreement re-evaluations, evaluations of effects of implementing SWRCB mandated actions on the CVP and SWP operations, water management alternative analysis applications, and developing user-friendly automated data processing packages for input/output analysis and display. Also, develop a version of CalLite with daily time step modeling capability.

The objective of this is to develop an operation model capable of simulating the allocation processes at monthly time-step, while simulating the system operations.

- iii. Complete the integration of CalSim 3.0 sub-models - the Bureau's San Joaquin system module, the Sacramento system, Sac-SJ Delta, and SWP-CVP south-of-Delta facilities. With this integrated CalSim 3.0 (beta version), develop and QA/QC a benchmark study. Once released officially, CalSim3.0 will have more robust uses under much wider ranges of hydrologic and demand conditions and will supersede the most of the usages of CalSim II because CalSim3.0 will have advantages of more physically based (i) inputs for rim watershed hydrology, valley floor hydrology and land-use based applied water, (ii) demand unit water balance, distribution losses, return flows and salinity balance, (iii) disaggregation of demand units, conveyance system, (iv) representation of additional refuges, small tributaries, and (v) dynamic groundwater surface water interaction.
- iv. In an attempt to make these hydrologic models more readily usable and more broadly available, Reclamation will lead and coordinate with partner Agencies to develop an open source solver for CalLite, CalSim II and CalSim 3.0. This project will benefit the public by providing efficient computational methods and software for solving linear programming (LP) and mixed integer linear programming (MILP) for CalSim and CalLite. Reclamation and CVP program components have an increasing demand to use CalSim and CalLite to solve more difficult problems than what CalSim and CalLite are accustomed to. The current XA solver, that has been used for CalSim and CalLite, has reached its limitations. There are other powerful commercial solvers but they are cost prohibitive. A new solver will have versatile uses because it will have capacity for multi-year optimization i.e., the ability to optimize CalSim for 7 years (longest drought). This will help Reclamation to optimize and plan their water usage. At present the XA solver can barely do a 2 year optimization. Climate change scenarios may impose even longer droughts than 7 years. The current XA solver and other commercial solvers are general LP solvers. The solver will be customized to CalSim's structure to optimize the computations, thus increasing the speed. Increased speed would help to keep the run times at a manageable level for everyday production runs. (iii) Today more multi-Core computers are readily available. At present the XA solver can use only one Core. This solver will be able to use all the available cores to solve a given problem (parallel processing).
- v. Support continued development of the DWR surface water-ground water model, C2VSIM, including updating the generic surface water-groundwater model engine (IWFEM), calibrating the fine-mesh grid version of C2VSIM, and further developments in user-friendly automated data processing packages for input/output analysis and display.
- vi. Support the development of application of the Bureau's Central Valley HydroGeoSphere Model (CVHGSM) to assess the safe level of groundwater pumping in the Western San Joaquin Valley without inducing additional land subsidence. The current calibrated model is mainly targeted for analyzing groundwater pumping actions in terms of the risk of land subsidence they pose. The current CVHGSM will also be used for a more general groundwater safe yield analysis, stream-aquifer interaction analyses, temperature analyses, and water quality analyses. The sustainable development for such extensions of the model would mainly involve data assembly, data analysis, and model calibration for the additional processes.

- vii. Develop and test a WRIMS based daily operation model (DOM) to simulate In-Delta Storage (IDS) facilities operations, and South Delta Improvement Program (SDIP) studies. In this testing and development process, the daily diversion and release rules for IDS facilities and applying a monthly-to-daily flow mapping technique will undergo enhancement and QA/QC. The monthly-to-daily conversion technique will be used to represent daily variation of flood attenuation and timing of flows into the Delta.
 - viii. Develop and test a WRIMS based daily operation model with channel routing capability, which will be used in simulation studies of CVP/SWP reservoir releases, weir operations, water diversions, and the Delta operations with flood control and the fisheries protection constraints in the Sacramento-San Joaquin Delta. The daily simulation capability will be incorporated in CalSim, as well as the DWR water management alternative screening model, CalLite.
- B. Temperature Modeling – The Program plans to continue development of water temperature models of various rivers and at various temporal scales to enable the evaluation of conditions pertinent to ecologic analyses. Reclamation and Service will work within a modeling team framework with the consultant to develop modeling protocols, pre, post, and batch processing tools that can be used to calibrate, extend, verify the San Joaquin River (SJR) temperature model so that various studies for Central Valley Project (CVP) can be undertaken. Also, a similar monthly-to-daily flow mapping technique will be applied in the monthly CalSim-II models for the BDCP study in order to incorporate representative daily variability into the flows resulting from CALSIM II’s monthly operational decisions for the Fremont Weir, Sacramento Weir, and the North Delta intakes. The temperature models by modifying HEC-5Q are being developed to enhance the knowledge base of modelers to support the water managers’ decisions to restore fisheries in the SJR basin, to control salinity on the main-stem SJR, to analyze the effects of various water operations by CVO etc. on the water quality, and thereby to maximize the beneficial and diversified water uses in the CVP region. Modelers from Reclamation and the Service will work directly with AFRP and other Service biologists whom are responsible for reviewing the San Joaquin River HEC5Q model. The (g) program plans to integrate the modeling tools and calibration efforts that are being developed by FERC and CDFW into the efforts being proposed under the 2014 AWP (Activity 4.3.3).
- C. Central Valley Hydrodynamic Modeling - Reclamation will coordinate with partner Agencies to develop a hydrodynamic model or extend an existing model capable of modeling fish behavior, temperature, salinity and other water quality parameters for the Central Valley. The program will also support the continued development and application of the ANN Model, including training the model, whenever necessary to mimic the hydrodynamics of the Delta (channel flows and depths) that meet salinity standards in planning simulation runs and alternative analysis. Retraining of the ANN Model is required for alternatives that include either significant change in the Delta channels geometry and/or channels interconnections, and the assumptions on the potential sea level changes caused by global warming. The department has embarked on developing a daily Delta model for CalSim (mentioned above). For this process, the monthly salinity standards have to be converted. New ANN’s will have to be developed for these applications.
- D. Ecosystem Modeling – Continue to support further development of the inSALMO model relating alternative management actions (flow, temperature, gravel additions, juvenile rearing habitat restoration) to the number and size of out-migrating Chinook and steelhead. This project will build on current (FY13-14) development of the Clear Creek application of inSALMO and apply the model to another CVP river, such as the American or Stanislaus. Application of inSALMO to CVP rivers at the scale of the river reaches important for spawning and rearing will allow for comparison of alternative management scenarios, resulting in more informed decisions with respect to effects on

anadromous fish populations. In addition, the Program will continue to support NMFS' development of a salmon lifecycle model.

- E. Sharing of Costs Agreement for Mitigation Projects Improvements (SCAMPI) Task Orders – in FY14, Reclamation and Service continue to coordinate with State agencies, including DWR and CDFG, to initiate the development of the cost sharing agreement and task orders.
- F. Membership and participation in professional organizations and training.

The 3406 (g) program performance goal and objective is to produce nine types of models. Currently, 9 models of 8 model types have been developed with full or partial support from (g) program. The models are Comprehensive San Joaquin Water Quality Model (SJRSIM), CalSim II, DSM2, ECOSIM, InSALMO, C2VSIM, CalSim 3, CalLite II, RHEM and HydroGeoSphere. Some of these developed models are being modified to incorporate recent changes in water operating rules and legislative requirements, to validate and extend the models with recent data, to reflect the recent changes in water-environment and to make the models efficient and user friendly.

Status of the Program

Since 1998, this program has provided a high level of support for CalSim II model development and applications. CalSim II has been utilized for numerous large-scale water supply improvement studies as well as planning investigations associated with Reclamation's Central Valley Project Operations Criteria and Plan (OCAP). Numerous improvements have been made to CalSim II in order to incorporate the modeling of baseline conditions and also alternatives such as the Isolated Facility. Improvements were made to how CalSim II simulates CVP/SWP sharing of export restrictions under the D-1641 export-inflow ratio, and releases to meet D-1641 salinity standards in the Delta in conjunction with exports.

To respond to the periodic need for more detailed analyses, both Reclamation and DWR in a joint effort are currently developing a more detailed version of the CalSim II model, referred to as CalSim 3. The CalSim 3 version of the Sacramento and San Joaquin Basins are being developed with WRIMS modeling environment and general CalSim logic. The achievements include addressing the mass balance on the West Side and a thorough review of the role of losses, groundwater, contract limits, and applied water demands. Relationships between these elements were clarified and model code was revised to avoid infeasible solutions. The code controlling the operation of San Luis Reservoir, which is now treated as a single storage pool with two accounts instead of two separate reservoirs, has also been modified to facilitate the model solution. Mainstem San Joaquin and east side tributary operations review was first facilitated by fixing Vernalis water quality standards to enable a single-cycle run. The east side demand units are now using a standardized template that is being applied basin-wide, accommodating demands, losses, operational spills, and return flows for many different kinds of operations. Operations have been mapped between CalSim II and CalSim 3.0 to identify sources of differences in results between the two models. The disaggregated water quality mass balance calculations have been reviewed and corrected where necessary, and gaps in input salinity data were identified.

To respond to the periodic need for less detailed and more rapid analyses, a water management screening tool (CalLite) is also being developed. This tool is publicly available through DWR's website. As with any model, improvements continue to be made. Two phases of model development are proposed under the work plan. Model development in the WRIMS 2.0 framework (to be consistent with CalSim 3.0 application) and the development of a new GUI are complete under Phase I tasks. Phase II tasks, which will commence in FY14, focus on developing San Joaquin Basin logic and data, as well as implementing the ability to simulate recent biological opinions' Reasonable and Prudent Alternatives (RPAs) actions.

The program has also supported the development and application of the California Central Valley

Simulation Model, C2VSIM. This model runs in conjunction with CalSim 3.0 to include the interactions between the ground water and surface water resources of the Central Valley in a dynamic way, as CalSim 3.0 simulation proceeds. C2VSIM has been developed and calibrated in historical simulations, and is an essential link in understanding the historical evolution of the surface water and ground water resources systems of the Central Valley of California. This model, in conjunction with CalSim 3.0 will allow for carrying out future planning studies including climate change. Specific tasks to be completed in FY14, include updating the generic surface water-groundwater model engine (IWFM), further calibration and refinement of model parameters through historical simulation runs, and developing user-friendly automated data processing packages for input/output analysis and display.

In addition to supporting CalSim II, CalSim 3.0, C2VSIM, and CalLite model development, the program has supported the development and application of other types of river management, ecological and fishery models. These include water quality, hydrology, groundwater and fish population models used by Reclamation, the Service, various contractors, and public interest organizations for modeling support of operations and planning. In FY13, Federal agencies coordinated with State agencies to develop the FY14 annual work plan. The following models have either been developed or supported by the program:

Comprehensive San Joaquin Water Quality Model (SJRSIM) – for use in modeling the Electro-conductivity (EC) in the main stem of the San Joaquin River and major tributaries such as the Merced and Tuolumne, for the purpose of managing temperature and salinity in the San Joaquin Basin.

Water Temperature Modeling - modeling protocols, pre, post, and batch processing tools that can be used to calibrate, extend, verify the Sacramento or San Joaquin River (SJR) temperature model so that various studies for Central Valley Project (CVP) can be undertaken. Water temperature modeling of the San Joaquin River (SJR) basin was initiated in 1999 when the U.S. Bureau of Reclamation (USBR), Fish and Wildlife Service (USFWS), California Department of Fish & Game (CDFG), Oakdale Irrigation District (OID), South San Joaquin Irrigation District (SSJID), and Stockton East Water District (SEWD) decided to analyze the relationship between the operational alternatives, the water temperature regimes and the fish mortality in the Stanislaus River and funded the model. A hydrologic routing based reservoir operation - water temperature model was built by using HEC5 and HEC5Q model codes with daily time-steps for flows and 6-hourly time-steps for water temperatures. The model covered the Stanislaus River from New Melones Reservoir to the confluence with the San Joaquin River. The model enabled the stakeholders to evaluate water temperature objectives at critical points in the river system that would enhance habitat conditions for Fall-run Chinook salmon and Steelhead Rainbow Trout under alternative Stanislaus River system operations. The model was then extended to adjacent Tuolumne and Merced tributaries by the CALFED Bay-Delta Program by extending to the Lower San Joaquin River (ERP-02-P28), and then further extended to the entire SJR Basin below Stevinson (ERP-06D-S20).

Concurrently USBR funded for a model extension to include the San Joaquin River and bypass system between Stevinson and Millerton Reservoir to evaluate the thermal impacts of Friant restoration alternatives and then the State Water Project (SWP) and the Central Valley Project (CVP) system components (canals and storage facilities between the Delta and Mendota Pool). The capability of modeling Electrical Conductivity (EC) was also included. The SJR HEC5Q model and Graphical User Interface (GUI) were extended from Friant Dam to Mossdale on the San Joaquin River and includes the Merced, Tuolumne, and Stanislaus Rivers and main-stem reservoirs and CVP and SWP conveyance facilities. Recently, the California State Bond has funded the CDFG, to update and refine the representation of Friant Restoration, DMC and CVP / SWP infrastructures, hydropower facilities, and EC. This refined SJR HEC5Q model is expected to be released on June 7, 2013. This CDFG SJR Temperature Model will be used as the base to develop the modeling protocols, pre- and post, and Batch processors of the SJR HEC5Q

DSM2 Model – for use in conducting the hydrodynamic modeling of flow, water quality and mass transport processes of the Delta and a part of the San Joaquin Basin.

SALMOD, inSALMO and PHABSIM – for use in evaluating anadromous fish survival at various life stages and in a variety of aquatic environments. To make inSALMO useful for real world management in the Central Valley, the Program has funded a project that will validate inSALMO with field data from Clear Creek, expand the spatial scale of model, and (as an optional task) add freshwater life stages of steelhead.

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.

HydroGeoSphere (HGS) – for use in evaluating surface and subsurface hydrologic interactions related to water supply, water quality, evaluation of seepage at the interface of surface/ subsurface flow, solute and thermal transport and impact of groundwater pumping on surface-water supply, and basin scale ecosystem restoration.

This program has supported both Reclamation and Service staff participating 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 to use CalSim II, and CalLite models through funding from this program.

Adaptive Management

Modeling program staff routinely work with their State partners to: (1) refine and improve data collection, (2) develop modeling tools and strategies, and (3) explore modeling opportunities that assist federal and state managers in making viable decisions relating to water quality, hydrology, groundwater, hydropower, fish population and other aspects of the CVP and SWP systems operations. These goals are achieved by developing multi-year programs in supporting state model development activities relating to five simulation models, currently applied in planning simulation studies and/or under development for that purpose.

The present adaptive management for C2VSIM model includes developing an updated generic surface water-groundwater model engine (IWFEM) with modified computational grid (mesh) resolution and computational efficiency, and application of C2VSIM in historical simulation mode for calibration and alternative analysis in the first year, application of the model (C2VSIM) in the climate change simulation mode, as well as historical simulation mode for alternative analysis, in the second and the third year.

The present adaptive management for HGS model includes developing as well as application of HGS model comprised of a linkage of Sacramento river-basin, Delta and San Joaquin river-basin models. This application model would be known as Central Valley HydroGeoSphere Model (CVHGSM). CVHGSM will be valuable for evaluation of seepage at the interface of surface/ subsurface flow, solute/thermal transport and impact of groundwater pumping on surface-water supply, surface-water quality, and ecosystem restoration in basin scale.

The present adaptive management for CalSim II model includes simulation studies in support of SWRCB Hearings, COA Agreement re-evaluations, SWP-CVP system reoperations, Sisk Dam re-operation, Franks Tract Project, Delta Facilities Planning, and BDCP alternative evaluations, and developing user-friendly automated data processing packages for input/output analysis and display. The need for and the frequency of application of this model depends on the release date and the adoption of CalSim 3.0 as the production version of the USBR/DWR Planning Simulation Model.

The present adaptive management for CalSim 3.0 model includes developing an integrated model of the CVP-SWP system by the merging of the Reclamation’s San Joaquin system module, with the Sacramento system and Sac-SJ Delta, and SWP-CVP south-of-Delta facilities, in the first year, and application of the

model in simulation studies in support of SWRCB Hearings, COA Agreement re-evaluations, SWP-CVP system reoperations, Franks Tract Project, Delta Facilities Planning, and BDCP alternative evaluations, in the second and the third year.

The present adaptive management for CalLite model includes the development of the integrated CalLite that includes the San Joaquin system, development of the Forecast Allocation module (FAM-CalLite), application of the model in simulation studies in support of COA Agreement re-evaluations, as well as developing user-friendly automated data processing packages for input/output analysis and display in the first year, and application of the model in the re-evaluation of effects of implementing SWRCB mandated actions on the CVP and SWP operations, and various other alternative analysis applications in the second and the third year.

The present adaptive management for the ANN model includes training the model, whenever necessary to mimic the hydrodynamics of the Delta (channel flows and depths) that meet salinity standards in planning simulation runs and alternative analysis. Retraining of the ANN Model is required for alternatives that include either significant change in the Delta channels geometry and/or channels interconnections, and the assumptions on the potential sea level changes caused by global warming.

The present adaptive management for the Sacramento temperature model (SRWQM) to include the Feather River and American River for improved water temperature modeling. This will make the analytical toolset used to evaluate effects of proposed operations (planning studies) and real-time management of water temperatures more consistent. In FY14, the modelers from Reclamation and Service will work within a modeling team framework with the consultant to develop modeling protocols, pre, post, and Batch processing tools that can be used to calibrate, extend, verify the San Joaquin River (SJR) HEC5Q model so that various studies for Central Valley Project (CVP) can be undertaken. This will support the water managers' decisions to restore fisheries in the SJR basin, to control salinity on the main-stem SJR, to analyze the affects of various water operations on the water quality, and thereby maximize the beneficial and diversified water uses in the CVP region.

Development of the inSALMO model will help to inform adaptive management on Clear Creek by allowing biologists to simulate the consequences of alternative management actions, such as spawning or rearing habitat restoration, or temperature and flow management. Initial model results show that applying restoration actions to different river reaches have different effects on the number and size of out-migrating Salmonids. This information will help to prioritize management actions on Clear Creek, and inform ongoing prioritization through time.

Table 1. FY2014 Proposed Activities and Costs

CVPIA Section 3406 (g), Ecological & Water System Operations Models

	3406 (g) Requested Funding for Fiscal Year 2014				
	Restoration Fund	Water and Related Resources	State Cash	State In-Kind	Total All Sources
Total Funding	\$810,000	\$160,000	\$0	\$1,225,467	\$2,195,466
Reclamation	\$697,511	\$160,000			\$857,510
Service	\$112,489	\$0			\$112,489
CA DFG			\$0	\$0	\$0
CA DWR			\$0	\$1,225,467	\$1,225,467

1.1 Program Management												
AWP Activity Number	Activity Name	Activity Description	Agency		Program Performance Goal	FY2014 Projected Performance	3406 (g) Requested Funding for Fiscal Year 2014					
			Name	Fractional FTE			Restoration Fund	Water and Related Resources	State Cash	State In-Kind	Total All Sources	
1.1.1	Program Lead	Program Lead for Reclamation responsible for coordinating program activities, budget and work with Federal and State agencies. Coordinate with FWS co-lead to review agencies modeling needs, activities, modeling tools development for the 3406 (g) program. (Cost Authority ESM H37-0214-2030-000-00-0-0)	BOR	0.23			\$54,104				\$54,104	
							Sub-Total for Program Management, FY2014					
							Restoration Fund	Water and Related Resources	State Cash	State In-Kind	Total All Sources	
							<i>Subtotal Funding</i>	\$54,104	\$0	\$0	\$0	\$54,104
							Reclamation	\$54,104	\$0			\$54,104
							Service	\$0	\$0			\$0
							CA DFG			\$0	\$0	\$0
							CA DWR			\$0	\$0	\$0

1.2		Program Support										
AWP Activity Number	Activity	Activity Name & Description	Agency		Program Performance Goal	FY2014 Projected Performance	3406 (g) Requested Funding for Fiscal Year 2014					
			Name	Fractional FTE			Restoration Fund	Water and Related Resources	State Cash	State In-Kind	Total All Sources	
1.2.1	Program Co-Lead	Coordinating program activities within Service as well as reviewing and the development of water operation and fishery modeling tools (Cost Authority FRFR4833-0832OS0).	FWS	0.03			\$6,691					\$6,691
1.2.2	Supervisory Support	Oversee the modeling activities of Reclamation (Cost Authority ESM H37-0214-2030-000-00-0-0)	BOR	0.07			\$16,578					\$16,578
							Sub-Total for Program Support, FY2014					
							Restoration Fund	Water and Related Resources	State Cash	State In-Kind	Total All Sources	
							<i>Subtotal Funding</i>	\$23,269	\$0	\$0	\$0	\$23,269
							<i>Reclamation Service</i>	\$16,578	\$0			\$16,578
							<i>CA DFG</i>	\$6,691	\$0			\$6,691
							<i>CA DWR</i>			\$0	\$0	\$0

1.3		Technical Support									
AWP Activity Number	Activity	Activity Name & Description	Agency		Program Performance Goal	FY2014 Projected Performance	3406 (g) Requested Funding for Fiscal Year 2014				
			Name	Fractional FTE			Restoration Fund	Water and Related Resources	State Cash	State In-Kind	Total All Sources
1.3.1	CalSim Coordinator	Manage and Coordinate CalSim 3 model development tasks (Cost Authority ESM H37-0214-2030-000-00-0-0).	BOR	0.14			\$33,601				\$33,601
1.3.2	Modeler - Water Quality, Fishery, Ecosystem	Manage CalLite GUI and develop and apply water quality, fishery and ecosystem models (Cost Authority ESM H37-0214-2030-000-00-0-0) .	BOR	0.38			\$90,621				\$90,621
1.3.3	Modeler - CalLite, DSM2, HEC5Q	Develop, coordinate, perform project management and apply CalSim/CalLite Solver, DSM2, HEC5Q Temperature model and other water quality models (Cost Authority ESM H37-0214-2030-000-00-0-0).	BOR	0.38			\$99,785				\$99,785
1.3.4	Modeler - CalLite, CalSim	Coordinate CalSim II activities, develop and apply CalLite and CalSim models. (Cost Authority ESM H37-0214-2030-000-00-0-0)	BOR	0.24			\$55,946				\$55,946
1.3.5	Modeler - CalSim II, Water Quality	Develop and apply CalSim II and water quality models (Cost Authority ESM H37-0214-2030-000-00-0-0)	BOR	0.21			\$48,841				\$48,841
1.3.6	Modeler - CVP/SWP Operations	Review and improve hydrologic models regarding actual CVP/SWP operations, especially regarding implementation of CVPIA Section 3406 (b)(1), (b)(2) & (b)(3). (Cost Authority FRFR4833-0832OS0)	FWS	0.18			\$39,916				\$39,916
1.3.7	Modeler - Water Temperature	Assist the development and review of water temperature models, especially regarding the suitability for use with real-time CVP/SWP operations and planning studies (Cost Authority FRFR4833-0832OS0).	FWS	0.16			\$35,456				\$35,456
1.3.8	Modeler - Surface, Subsurface	Collaborate on the development and application of surface and subsurface model. (Cost Authority ESM H37-0214-2030-000-00-0-0)	BOR	0.14			\$34,260				\$34,260
1.3.9	Fish Model Coordination	Oversee InSalmo development and the comparison with SALMOD. Coordinate with NMFS, especially regarding their Salmon Life Cycle Model development. Expand use of inSALMO in waterways in addition to Clear Creek and apply inSALMO for additional fish species. Advise and coordinate with NMFS on the development of Salmon Life Cycle Model, a full life cycle salmon model. (Cost Authority FRFR4833-0832OS0).	FWS	0.14			\$30,426				\$30,426
1.3.10	Modeler - CVHGSM	Collaborate on the development and application of CVHGSM. (Cost Authority ESM H37-0214-2030-000-00-0-0)	BOR	0.04			\$10,000				\$10,000
							Sub-Total for Technical Support, FY2014				
							Restoration Fund	Water and Related Resources	State Cash	State In-Kind	Total All Sources
							\$478,852	\$0	\$0	\$0	\$478,852
							<i>Reclamation</i>	\$373,054	\$0		\$373,054
							<i>Service</i>	\$105,798	\$0		\$105,798
							<i>CA DFG</i>		\$0	\$0	\$0
							<i>CA DWR</i>		\$0	\$0	\$0

4.3		Modeling									
AWP Activity Number	Activity	Activity Name & Description	Agency		Program Performance Goal	FY2014 Projected Performance	3406 (g) Requested Funding for Fiscal Year 2014				
			Name	Fractional FTE			Restoration Fund	Water and Related Resources	State Cash	State In-Kind	Total All Sources
4.3.1	CalSim 3.0 Development	Water Operations Models - Completion of the CalSim 3.0 integrated model of the Bureau's San Joaquin system module, with the Sacramento system and Sac-SJ Delta, and SWP-CVP south-of-Delta facilities, and conducting QA/QC of the integrated model. Conducting and QA/QC of a benchmark study using CalSim 3.0 in the process of releasing the beta version of the model.simulations performed to evaluate alternative operations of CVP/SWP operations. Reclamation and DWR will be working together to have an integrated CalSim III will have an integrated Sacramento and San Joaquin Basin model. (Cost Authority ESM H37-0214-2030-000-00-0)	BOR	0.17	Develop 9 Eco Models	Progress toward completion of Model Type 6: Water operations models - CVP and SWP operations.		\$40,262			\$40,262
4.3.2	CalLite Development	Phase II tasks will focus on developing San Joaquin Basin logic and data, as well as implementing the ability to simulate recent biological opinions' Reasonable and Prudent Alternatives (RPAs) actions. Continued development and application of CalLite Model, including the development of the integrated CalLite that includes the San Joaquin system, further development of the Forecast Allocation module (FAM-CalLite), application of the model in simulation studies in support of COA Agreement re-evaluations, effects of implementing SWRCB mandated actions on the CVP and SWP operations, water management alternative analysis applications, and developing user-friendly automated data processing packages for input/output analysis and display. Also, testing and development of a version of CalLite with daily time step modeling capability. (Cost Authority ESM H37-0214-2030-000-00)	BOR	0.20	Develop 9 Eco Models	Progress toward completion of Model Type 9: Water management modeling to include firm CVP yield.		\$47,367			\$47,367
4.3.3	Development & Enhancement of Temperature Models	Joint San Joaquin Basin model development - the modelers from Reclamation and Service will work within modeling team framework with the consultant to develop modeling protocols, pre, post, and Batch processing tools that can be used to calibrate, extend, verify the San Joaquin River (SJR) HEC5Q model so that various studies for Central Valley Project (CVP) can be undertaken. (Cost Authority ESM H37-0214-2030-000-00-0)	BOR	0.18	Develop 9 Eco Models	Progress toward completion of Model Type 2: Related water quality conditions		\$41,577			\$41,577
4.3.4	Developing daily logics for flood control operations of major reservoirs.	To develop daily flood control (FC) operation logic for the major reservoirs that will provide better estimates of capturability of high reservoir inflows and better estimates of the frequency and magnitude of high reservoir releases (which could be of geomorphic interest as well as biological interest). The new FC logic would supplement (not incorporate) existing logic that accounts for downstream operational considerations like meeting delta outflow requirements. (Cost Authority ESM H37-0214-2030-000-00-0)	BOR	0.00	Develop 9 Eco Models	To develop daily flood control (FC) operation logic for the major reservoirs	\$100,000	\$30,794			\$130,794

4.3.5	C2VSIM Model Development & Application	Specific tasks to be completed in FY14, include updating the generic surface water-groundwater model engine (IWFEM), calibrating the fine-mesh grid version of C2VSIM, and further developments in user-friendly automated data processing packages for input/output analysis and display.	CDWR	0.00	Develop 9 Eco Models	Progress toward completion of Model Type 3: Surface-ground and stream-wetland interactions.				\$174,629	\$174,629
4.3.6	CalSim II Model Development & Application	Develop, maintain and/or develop added features and formulations to the current production version of the planning simulation model of the CVP and SWP to respond to the water resources planning needs of DWR and USBR, as well as other state, federal and local agencies. Continued development and application of CalSim II Model in simulation studies in support of SWRCB Hearings, COA Agreement re-evaluations, SWP-CVP system reoperations, Sisk Dam re-operation, Franks Tract Project, Delta Facilities Planning, North Bay Aqueduct Alternate Intake Project, USFWS OCAP BO Remand, NMFS OCAP BO Remand, and BDCP alternative evaluations. Developments will include user-friendly automated data processing packages for input/output analysis and display.	CDWR	0.00	Develop 9 Eco Models	Progress toward completion of Model Type 9: Water management modeling to include firm CVP yield.				\$318,279	\$318,279
4.3.7	CalSim 3.0 Model Development & Application	Simulation model development, and applications to evaluate alternative operations of the CVP/SWP. Reclamation and DWR will be working together to have an integrated CalSim 3.0 that merges the Reclamation's San Joaquin River Basin Model, with the Sacramento River and the Sacramento-San Joaquin Delta. Completion of the CalSim 3.0 integrated model of the Bureau's San Joaquin system module, with the Sacramento system and Sac-SJ Delta, and SWP-CVP south-of-Delta facilities, and conducting QA/QC of the integrated model. Conducting and QA/QC of a benchmark study using CalSim 3.0 in the process of releasing the beta version of the model.	CDWR	0.00	Develop 9 Eco Models	Progress toward completion of Model Type 9: Water management modeling to include firm CVP yield.				\$402,073	\$402,073
4.3.8	CalLite Model Development & Application	Simulation model development, and applications to evaluate alternative operations of the CVP/SWP. Continued development and application of CalLite Model, including the development of the integrated CalLite that includes the San Joaquin system, further development of the Forecast Allocation module (FAM-CalLite), application of the model in simulation studies in support of COA Agreement re-evaluations, effects of implementing SWRCB mandated actions on the CVP and SWP operations, water management alternative analysis applications, and developing user-friendly automated data processing packages for input/output analysis and display. Also, testing and development of a version of CalLite with daily time step modeling capability.	CDWR	0.00	Develop 9 Eco Models	Progress toward completion of Model Type 9: Water management modeling to include firm CVP yield.				\$231,673	\$231,673

4.3.9	Development & Application of ANN Model	Development of Flow salinity relationships in Key locations of the Delta. Continued development and application of the ANN Model, including training the model, whenever necessary to mimic the hydrodynamics of the Delta (channel flows and depths) that meet salinity standards in planning simulation runs and alternative analysis.	CDWR	0.00	Develop 9 Eco Models	Progress toward completion of Model Type 1: Water budget of surface and groundwater supplies					\$98,813	\$98,813
4.3.10	Multi-D Process Based Model for Central Valley	To develop, extend, calibrate, verify a multi-D model to the Central Valley region so that various studies for Central Valley Project (CVP) can be undertaken. (Cost Authority ESM H37-0214-2030-000-00-0-0)	BOR	0.00	Develop 9 Eco Models	0	\$153,775					\$153,775
							Sub-Total for Modeling, FY2014					
							Restoration Fund	Water and Related Resources	State Cash	State In-Kind	Total All Sources	
							<i>Subtotal Funding</i>	\$253,775	\$160,000	\$0	\$1,225,467	\$1,639,242
							<i>Reclamation</i>	\$253,775	\$160,000			\$413,775
							<i>Service</i>	\$0	\$0			\$0
							<i>CA DFG</i>			\$0	\$0	\$0
							<i>CA DWR</i>			\$0	\$1,225,467	\$1,225,467

Outyear activities are estimates of funding capability only and do not reflect the future Congressional Appropriations process.

Table 2. FY2015 Proposed Activities and Costs

CVPIA Section 3406 (g), Ecological & Water System Operations Models

	3406 (g) Requested Funding For Fiscal Year 2015			
	Restoration Fund	Water and Related Resources	State Cash	Total All Sources
Total	\$1,100,000	\$160,000	\$0	\$1,260,000
US Bureau of Reclamation	\$896,432	\$160,000		\$1,056,432
US Fish and Wildlife Service	\$203,568	\$0		\$203,568
California Dept of Fish and Wildlife			\$0	\$0
California Dept of Water Resources			\$0	\$0

Task	Project Name	Project Description	Federal Costs(\$)				State Cost Share (\$)		Total Costs (\$)
			BOR Restoration Fund	BOR W&RR Fund	FWS Restoration Fund	FWS W&RR Fund	CA DFW	CA DWR	
Program Mgmt & Support			\$336,432		\$97,568			\$434,000	
Project 1	CALSIM Reservoir Daily Routine Overlay	Develop a routine to better determine the capturability of inflows by the major Central Valley reservoirs and determine changes in release variability between alternatives	\$50,000	\$100,000	\$15,000			\$165,000	
Project 2	CALSIM Thru-Delta Export Daily Routine Overlay	Develop a routine to better estimate the volume of water that may be exported when operating at a sub-monthly scale	\$50,000	\$60,000	\$24,000			\$134,000	
Project 3	inSALMO evaluation and application	Review and apply the recently developed inSALMO model in support of EIR/EIS's and possibly temperature management	\$50,000		\$20,000			\$70,000	
Project 4	temperature model sensitivity analyses	Review and apply the recently developed and/or documented water temperature model(s)	\$50,000		\$25,000			\$75,000	

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Task	Project Name	Project Description	Federal Costs(\$)				State Cost Share (\$)		Total Costs (\$)
			BOR Restoration Fund	BOR W&RR Fund	FWS Restoration Fund	FWS W&RR Fund	CA DFW	CA DWR	
Project 5	NMFS Lifecycle support	Provide support to NMFS effort to develop a full lifecycle model for winter run chinook.	\$50,000		\$15,000				\$65,000
Project 6	Training	Attend conferences and take training.	\$10,000		\$7,000				\$17,000
Project 7	CalSim 3.0 Development	Water Operations Models - Completion of the CalSim 3.0 integrated model of the Bureau's San Joaquin system module, with the Sacramento system and Sac-SJ Delta, and SWP-CVP south-of-Delta facilities, and conducting QA/QC of the integrated model.	\$50,000						\$50,000
Project 8	CalLite Development	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.	\$50,000						\$50,000
Project 9	Development & Enhancement of Temperature Models	Joint San Joaquin Basin model development -develop modeling protocols, pre, post, and Batch processing tools that can be used to calibrate, extend, verify the San Joaquin River (SJR) HEC5Q model so that various studies for Central Valley Project (CVP) can be undertaken. (Cost Authority ESM H37-0214-2030-000-00-0-0)	\$50,000						\$50,000

Outyear activities are estimates of funding capability only and do not reflect the future Congressional Appropriations process.

Task	Project Name	Project Description	Federal Costs(\$)				State Cost Share (\$)		Total Costs (\$)
			BOR Restoration Fund	BOR W&RR Fund	FWS Restoration Fund	FWS W&RR Fund	CA DFW	CA DWR	
Project 10	Development & Application of ANN Model	Continued development and application of the ANN Model, including training the model, whenever necessary to mimic the hydrodynamics of the Delta (channel flows and depths) that meet salinity standards in planning simulation runs and alternative analysis.							\$0
Project 11	C2VSIM Model Development & Application	Continued development of the DWR surface water-ground water model, C2VSIM.							\$0
Project 12	CalSim II Model Development & Application	Develop, maintain and/or develop added features and formulations to the current production version of the planning simulation model of the CVP and SWP to respond to the water resources planning needs of DWR and USBR, as well as other state, federal and local agencies. Developments will include user-friendly automated data processing packages for input/output analysis and display. The need for and the frequency of application of this model depends on the release date and the adoption of CalSim 3.0 as the production version of the USBR/DWR Planning Simulation Model.	\$150,000						\$150,000

Outyear activities are estimates of funding capability only and do not reflect the future Congressional Appropriations process.

Table 2. FY2016 Proposed Activities and Costs

CVPIA Section 3406 (g), Ecological & Water System Operations Models

			3406 (g) Requested Funding For Fiscal Year 2016						
			Restoration Fund	Water and Related Resources	State Cash	Total All Sources			
Total			\$700,000	\$160,000	\$0	\$860,000			
US Bureau of Reclamation			\$536,432	\$160,000		\$696,432			
US Fish and Wildlife Service			\$163,568	\$0		\$163,568			
California Dept of Fish and Wildlife					\$0	\$0			
California Dept of Water Resources					\$0	\$0			
			Federal Costs(\$)				State Cost Share (\$)		Total Costs (\$)
Task	Project Name	Project Description	BOR Restoration Fund	BOR W&RR Fund	FWS Restoration Fund	FWS W&RR Fund	CA DFW	CA DWR	
Program Mgmt & Support			\$136,432		\$57,568				\$194,000
Project 1	CALSIM Reservoir Daily Routine Overlay	Develop a routine to better determine the capturability of inflows by the major Central Valley reservoirs and determine changes in release variability between alternatives	\$30,000	\$100,000	\$15,000				\$145,000
Project 2	CALSIM Thru-Delta Export Daily Routine Overlay	Develop a routine to better estimate the volume of water that may be exported when operating at a sub-monthly scale	\$30,000	\$60,000	\$24,000				\$114,000
Project 3	inSALMO evaluation and application	Review and apply the recently developed inSALMO model in support of EIR/EIS's and possibly temperature management	\$30,000		\$20,000				\$50,000
Project 4	temperature model sensitivity analyses	Review and apply the recently developed and/or documented water temperature model(s)	\$30,000		\$25,000				\$55,000

Outyear activities are estimates of funding capability only and do not reflect the future Congressional Appropriations process.

Task	Project Name	Project Description	Federal Costs(\$)				State Cost Share (\$)		Total Costs (\$)
			BOR Restoration Fund	BOR W&RR Fund	FWS Restoration Fund	FWS W&RR Fund	CA DFW	CA DWR	
Project 5	NMFS Lifecycle support	Provide support to NMFS effort to develop a full lifecycle model for winter run chinook.	\$30,000		\$15,000				\$45,000
Project 6	Training	Attend conferences and take training.	\$10,000		\$7,000				\$17,000
Project 7	CalSim 3.0 Development	Water Operations Models - Completion of the CalSim 3.0 integrated model of the Bureau's San Joaquin system module, with the Sacramento system and Sac-SJ Delta, and SWP-CVP south-of-Delta facilities, and conducting QA/QC of the integrated model.	\$30,000						\$30,000
Project 8	CalLite Development	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.	\$30,000						\$30,000
Project 9	Development & Enhancement of Temperature Models	Joint San Joaquin Basin model development -develop modeling protocols, pre, post, and Batch processing tools that can be used to calibrate, extend, verify the San Joaquin River (SJR) HEC5Q model so that various studies for Central Valley Project (CVP) can be undertaken.	\$30,000						\$30,000

Outyear activities are estimates of funding capability only and do not reflect the future Congressional Appropriations process.

Task	Project Name	Project Description	Federal Costs(\$)				State Cost Share (\$)		Total Costs (\$)
			BOR Restoration Fund	BOR W&RR Fund	FWS Restoration Fund	FWS W&RR Fund	CA DFW	CA DWR	
Project 10	Development & Application of ANN Model	Continued development and application of the ANN Model, including training the model, whenever necessary to mimic the hydrodynamics of the Delta (channel flows and depths) that meet salinity standards in planning simulation runs and alternative analysis.							\$0
Project 11	C2VSIM Model Development & Application	Continued development of the DWR surface water-ground water model, C2VSIM.							\$0
Project 12	CalSim II Model Development & Application	Develop, maintain and/or develop added features and formulations to the current production version of the planning simulation model of the CVP and SWP to respond to the water resources planning needs of DWR and USBR, as well as other state, federal and local agencies. Developments will include user-friendly automated data processing packages for input/output analysis and display. The need for and the frequency of application of this model depends on the release date and the adoption of CalSim 3.0 as the production version of the USBR/DWR Planning Simulation Model.	\$150,000						\$150,000