EXHIBIT A, ATTACHMENT 2
PROPOSAL

3. Scope of Work

TASK 1 - Project Management

Investigator: Brett Kawakami, Wendy Chriss

Definition of Work: Standard project management: coordinate periodic reporting and Technical Advisory Committee (TAC) meetings; co-ordinate the timing of major Tasks; administer contracts; communication and distribution of results.

Staffing: Brett Kawakami will manage the project and Wendy Chriss will assist him. Brett Kawakami's time on this task is an in-kind contribution from CCWD.

Output/Deliverable: Production of semi-annual and final reports and coordinating communication of results to the IEP/POD and to other interested parties.

TASK 2 - Statistical Analysis: Spatial

The work for this task has been completed and there is no budget remaining.

TASK 3 - Research Historical Reservoir Releases and Operational Data

Definition of Work: Extend Noah Knowles EOF analysis to the period 1987 - 2006 by: disaggregating the various management flows, if possible, into source of water and timing (e.g., EWA or other environmental water, exports, temperature management, etc.): and, determining, as close as possible, seasonal salinity in the Delta due to both natural and the disaggregated management influences.

Staffing: Brett Kawakami will complete the EOF analysis.

Output/Deliverable: In addition to documentation of the analyses, this work will be submitted to the IEP Newsletter, or, the peer-reviewed journal `San Francisco Estuary and Watershed Science'. The output will also be used to define boundary conditions for the DSM2 modeling scenarios (see Tasks 6 and 7). In addition, the initial stages of testing the hypothesis will be documented. Note that data will be entered in the GIS database *via* Task 9.

TASK 4 - Statistical Analysis: Delta Smelt

Investigators: Brett Kawakami, Dr. Steve Cramer, Technical staff

Definition of Work: Using the historical FMWT and STN data sets, and the regions defined in Task 2, perform statistical analyses to develop regressions between the two smelt indices and regional salinity and perhaps flow data. These analyses will replicate the strategy of previous 'zero-dimensional' analyses, but in two dimensions, for example, using generalized linear models. If reasonable relationships are developed, they can be applied to the salinity patterns calculated from the DSM2 model scenarios. In addition, an attempt will be made to develop a

relationship between juvenile (STN) and subsequent FMWT indices, possibly disaggregated to yield a simple statistical predictive model between fall and summer delta smelt populations.

Staffing: Mr. Cramer will act as a statistical consultant to assist Brett Kawakami in these analyses and to ensure statistical rigor, and perform or define more difficult analyses if needed. Technical staff from Task 9 can add any relevant data to the GIS database.

Output/Deliverable: Spatially explicit regression models relating delta smelt population indices to salinity, or perhaps to flow variables. All statistical analyses will be documented. Results with statistically significant relationships, will be submitted to the IEP newsletter or for peer review, or included in the Final Report if negative. If indicated, results will be entered in the GIS dataset.

TASK 5 - Concept Development and Synthesis of Results

Investigator: Brett Kawakami

Definition of Work: Brett Kawakami will lead the task of synthesizing research results to develop a clear picture of the trade-off between delta smelt salinity issues and salmon protection measures.

Output/Deliverable: Synthesis of results to be documented in writing in the semi-annual and final reports; preparation of technical papers to be submitted either to the IEP Newsletter or to journals such as San Francisco Watershed and Estuary Science; other documentation as required.

TASKS 6 and 7 - Temperature Analysis and DSM2 Modeling

Investigators: Brett Kawakami, Dr. Mike Deas

Definition of Work: Using the historical DSM2 model and results from Tasks 2 and 3 to develop boundary conditions, we will run a series of scenarios, sketched below, and analyze the resultant salinities in the regional aggregation from Task 2, and in the delta smelt `salinity habitat regions'. If possible, we will determine the temperature effects in the Sacramento and on the San Joaquin and in the Delta (if any) under each of these scenarios based on existing studies, field data, and/or using the methods outlined above. The DSM2 Historical Model will be used as a Base case, covering the period 1986/7 - 2006 if possible. Using the regions defined in Task 2 and DSM2 volume and salinity fingerprinting, modeled salinities will be aggregated over the resultant regions using either monthly time periods or the temporal aggregation from Task 2. The source of the salinity in each of these regions will be determined using fingerprinting output, and used to calculate the costs of water associated with salinity reductions as appropriate. One set of scenarios will investigate releasing additional water down both the Sacramento and the San Joaquin Rivers to create a more favorable `salinity habitat' for delta smelt in the fall. Depending on the results of Task 3, there may be up to nine scenarios. DSM2 is easy to run, and the main DSM2 tools for analyzing output have already been developed, so this work will be relatively straightforward.

The scenarios are expected to answer the following questions, or similar ones, about the relationship between delta smelt salinity habitat and changes in reservoir operations, DCC and HORB operational changes, and changes in exports:

1. Base case - What is the source of the fall salinity shift? Reservoir releases, changes in the timing of exports, or, something else? In addition, what are the flow conditions on Old and Middle Rivers during HORB operations? One scenario.
2. Scenario `Shift' - Given the answer to the Base case questions, does shifting Sacramento temperature releases to the fall decrease salinity enough to improve delta smelt habitat, and, does it increase salinity enough in other months to degrade smelt salinity habitat? One Scenario: Run DSM2 by SHIFTING reservoir releases for winter-run Chinook salmon temperature protection, or some other operation if indicated, to the fall.
3. Scenario `Add Fall releases'- As in the previous scenario, if we ADD an equivalent amount of release down the Sacramento during the Fall to decrease salinity in the smelt `salinity habitat', how much effect would this have on fall salinity? What would happen if we send the equivalent amount down the San Joaquin River in the fall instead? In each case, can we then increase fall base case exports and decrease exports in the summer without hurting fall smelt salinity habitat? Four Scenarios: Run DSM2 by ADDING extra reservoir releases down each of the rivers. Shift the timing of exports in each case.
4. Scenario `Change Operations' - Using information from Task 3, what is the effect of operational changes on flow near the export pumps and on delta smelt regional salinity from: keeping the DCC always open or closed; or, not installing HORB in spring or fall? . Two Scenarios: Conditions TBD pending results of the base case scenario and the analysis in Task 3. Compare each change with the Base Case.
5. Scenario 'Change Exports' - How much of decrease would it take in export operations to create an optimal delta smelt salinity habitat all year? One scenario: Note that the salinity (and flow) effects will be determined regionally and temporally over each scenario, and fingerprinting results will be analyzed to quantify the magnitude of each of the changes by source location, and to quantify the potential `water cost' for relevant operations. MATLAB tools will be developed in Task 9 to automate the analyses.

Using the DSM2 Historical model as a Base case, the DSM2 salinity modeling input is the regionalized dataset from Task 2, and operational and boundary conditions for hypothetical scenarios from Task 3. For the temperature analysis, raw data

input will be meteorological data and historical temperature data in the Delta (this is sparse). Much of the data needed will have been organized in Task 3, or is available from previous analyses (Deas *at al.,* 1997).

Staffing: Dr. Deas will be responsible for all temperature-related analyses. Brett Kawakami will perform and analyze DSM2 models and scenario output. CCWD Technical staff will provide assistance, as needed.

Output/Deliverable: The main output from this work will be an analysis of contributions to seasonal salinity from various sources or operations using the regional and temporal aggregations, i.e., the delta smelt `salinity habitat', developed in Task 2. In addition, the water costs to change salinity for delta smelt habitat improvement will be calculated. For the Historical model, this work will quantify the source of seasonal salinity changes noted by Denton. For hypothetical scenarios, this work will quantify the operational changes and reservoir releases that contribute to salinity changes, as well as reservoir releases or operational changes needed to optimize delta smelt salinity habitat. The DSM2 modeling has value independent of this research - the scenarios could also be used to determine the movement of pesticides, real or hypothetical, through the Delta. CCWD currently has a beta-version of a MATLAB visualizer that is capable of visualizing DSM2 flow and salinity output, as well as the difference between two model outputs (See Task 9). DSM2 analyses will be included in the semi-annual reports and the final report. Boundary conditions for the salmon population models in Task 8 will be developed from each of the hypothetical scenarios. Results will be entered in the GIS dataset.

TASK 8 - Salmon Population Modeling

Investigators: Brett Kawakami, Mr. Steve Cramer

Definition of Work: Run the two salmon population models to predict populations on the Sacramento and the San Joaquin Rivers using the DSM2 hypothetical scenario boundary conditions and operations. Compare these populations to the base historical salmon population predictions, and document the changes. Calculate the costs of water associated with population improvements. The winter-run Chinook salmon has a higher ESA-value, so changes that improve or degrade this population naturally have higher significance.

Staffing: Mr. Steve Cramer will assist Brett Kawakami in setting up and interpreting the output from the Chinook salmon models, to ensure biological rigor and appropriate usage.

Output/Deliverable: Salmon population predictions from the Base Case model simulations will be compared to changes in salmon populations from each of the scenarios, and the associated water costs for improvements calculated. Results will be documented in the Final Report, and possibly in the IEP Newsletter if interesting.

TASK 9 - Visualization and Regional Analysis of DSM2 Output

Investigators: Brett Kawakami, CCWD Technical staff

Definition of Work: Produce visualizations of each of the DSM2 runs, as well as the salinity differences between the scenarios, i.e., `residual models'. Use MATLAB and/or GIS statistical tools to analyze spatial delta smelt regressions and other results developed in Task 4. These analyses will be combined with the results of the hypothetical DSM2 scenario models in the event a statistical model predicting fall and summer delta smelt populations can be developed using flow and salinity variables from Task 4. Two types of specialized software packages will be purchased for use - MATLAB statistical tools, and GIS Arcview tools.

Staffinq: Brett Kawakami will perform the more complex data analysis tasks. Technical staff will perform routine programming or GIS database tasks.

Output/Deliverable: The MATLAB visualization tool will be documented, and the resulting visualizations exported as `movies'. This task will develop, populate and finalize the GIS database. Statistical population models developed from the spatial analyses and DSM2 output salinities will be prepared for publication in either the IEP newsletter or in a refereed journal.

EXHIBIT A: ATTACHMENT 4
TASK TABLE

Task #	Task Title	Start Month	End Month	Personnel Involved	Description	Task Budget
	Project Management and Administration	1	18	Kawakami, Brett Chriss, Wendy	Coordinate tasks, administer contracts, coordinate reporting and TAC meetings, prepare reports, and process invoices.	6,014
2	Statistical analysis: spatial	1	5	Cramer, Steve Brauner Lando, Jody	Define statistically-relevant delta smelt capture regions for FMWT and STN capture data and relate these regions to salinity, potentially to temperature and turbidity; provide biological support for statistician; supply advice on fisheries biology, especially as pertains to delta smelt; supply advice on trawl gear efficiencies; supply advice on calculation of CPUE from raw data; perform GIS database entry and routine analysis tasks.	27,000
3	Research historical water use, salinity, and flow	1	6	Kawakami, Brett Denton, Richard	Define and document the influences and alterations on Delta salinity patterns due to various natural, mandated and adaptive management flows; using the strategy documented by Noah Knowles (ref), tease out the portions of 'management influences' that can be ascribed to Chinook salmon management actions relative to other actions - document results; research and document source and amount of water released to Delta from reservoirs for various uses including diversions, exports, salmon, temperature, and 'other; include b(2) and EWA water. Determine relative water costs for various water management actions	25,812
4	Statistical analysis: delta smelt	2	17	Kawakami, Brett Pyper, Brian	Perform statistical analyses on smelt population indices using regions and temporal aggregation from Task #2; Develop statistical regression models relating each smelt index to salinity, flow; Interpret and document results.	8,750

5	Concept development and synthesis	2	17	Kawakami, Brett Gartrell, Greg	Analysis and synthesis of research findings, contribute to report preparation, document results	0
6	Temperature modeling and analysis	2	17	Deas, Mike	Analyze potential temperature changes on the upper Sacramento, on the San Joaquin River, and in the Delta due to scenario changes in reservoir operations; Use DSM2 or equilibrium models, and calculate relative 'water costs' for various actions.	18,000
7	DSM2 historical and scenario modeling	4	17	Kawakami, Brett TBD # 2	Use DSM2 fingerprinting to document the salinity and volume contributions due to Chinook salmon protection actions relative to other water management actions; run scenarios to investigate the consequences of operational changes on 'delta smelt salinity habitat'. Analyze results from scenarios, and define boundary conditions for Task 8, salmon population models. Calculate relative water costs from various scenarios. Document results	8,638
8	Salmon population models	4	17	Kawakami, Brett Cramer, Steve	Use the existing chinook salmon models on the Sacramento R. (IMF) and the San Joaquin R. (SJR Chinook Salmon Model) to calculate the changes in population from operational changes defined by DSM2 scenarios, and calculate relative water costs in comparison with base case. Interpret and document results	9,286
9	Develop modeling tools	4	18	Kawakami, Brett TBD # 3	Develop statistical population model of delta smelt population/habitat using regression results from Task 4. Refine Matlab DSM2 model output visualization tool Perform spatial data analysis on Task 4 results. Develop and document GIS database, provide mapping results. Interpret and document results	13,427