

## Draft Individual Review Form

Proposal number: 2001-F200-2

Short Proposal Title: Transport, Transformation, Effects of Se

### 1a) Are the objectives and hypotheses clearly stated?

Provide detailed comments in support of your conclusion [Note: in the electronic version, this will be an expandable field]

The objectives are stated in the Executive Summary and adequately reinforced in the body of the proposal: 1) determine transport and distribution of conservative materials delivered by rivers using 2D/3D models, 2) evaluate transformations of selenium and carbon in the delta, and 3) determine how transformation of Se affects the delta food chain. The body of the proposal is organized around these three objectives and how understanding of one objective reinforces understanding of the others.

*The objectives are clearly stated.*

Hypotheses are stated as questions rather than statements that are testable. This weakens the discussion of hypotheses somewhat. Nevertheless, the hypothesis questions are posed clearly with adequately detailed discussion on pages 3 and 4. The discussion of "Applicability to the CALFED ERP" (page 10) contains statements which sound more like hypotheses that will be tested in the study. The Executive Summary contains general discussion of the impacts of Se in other systems, and implies the same impacts are occurring in the San Francisco estuary. The impact of Se on restoration in the estuary is outlined on page 13. This is the first clear explanation of the need for this work. Several cogent hypotheses are implied in this section.

*Hypotheses are not very clearly stated, however, I believe the totality of the proposal suggests that the PI's are proceeding from hypotheses that are clear to them!*

### 1b1) Does the conceptual model clearly explain the underlying basis for the proposed work?

Provide detailed comments in support of your conclusion [Note: in the electronic version, this will be an expandable field]

The conceptual model is simply and clearly described on page 3. The simple model is that Se enters the Delta via the SJR, is transported by tidal flows, and is transformed by biogeochemical processes and trophic transfer into the food web. A figure (Figure 3) reflects the simplicity of the conceptual model. The conceptual model indicates however that there are many knowledge gaps within the details of the model. Tidal flows and mixing in the delta are complex, and tax even the most powerful hydrodynamics/transport models. Biogeochemical transformation of Se depends on how it is speciated in source water, and further transformed in the delta as a function of tidal transport and biogeochemical processes. Trophic transfer and bioaccumulation is species specific and depends on tidal flows and transformation of Se.

*The conceptual model clearly explains the underlying basis for the proposed work.*

**1b2) Is the approach well designed and appropriate for meeting the objectives of the project?**

Provide detailed comments in support of your conclusion [Note: in the electronic version, this will be an expandable field]

The PI's outline their approach by defining six task areas for the project. These include 1) modeling, 2) physical field experiments to measure flow and material fluxes, 3) field monitoring to characterize Se distribution and transformation, 4) laboratory studies of Se transformation by phytoplankton, 5) analysis of Se in the food web, and effects on sturgeon. I found the approach for all task descriptions to be complete and well conceived.

I have some concerns about the modeling portion of the project. The project relies on modeling to determine the transport and fate of conservative materials to provide, at a minimum, an "outer envelope" of Se mixing and fate in the delta. The proposal implies that efforts to characterize conservative constituent transport and fate with 1D models in the past have been inadequate. My impression is that the 1D models have been used to great advantage to screen more complex modeling approaches. 1D models provide the great advantage of relatively fast execution time and can therefore screen a range of alternatives quickly. Since the TRIM model does not execute rapidly for the time scales of interest (I assume over-lunar time scale simulations will be needed), perhaps a 1D model should be used for reconnaissance in guiding TRIM model applications.

The proposal also suggests the TRIM model is adequately calibrated and cites an IEP Newsletter article. I examined the article and found the present calibration of the TRIM model rather lacking in its ability to predict tidal flow, and stage. Determination of outer envelope transport in the delta will require more attention to calibration of the TRIM model. Later in the proposal, it is implied that TRIM could be calibrated more against existing dye and drifter data. I believe this should be done. Accurate transport simulation in the Delta depends on accurate prediction of tidal excursion since much of the mixing of material is "mechanical," resulting from the looped and braided structure of the system.

Accurate characterization of channel geometry is also essential. I am concerned that the proposed 50 meter grid resolution, while high for the size of this system, may inadequately characterize delta channels that are near or less than 50 meters wide. There are many miles of sloughs in this category which, taken together, represent significant volume storage, and tidal trapping potential. This is a significant disadvantage of TRIM's finite difference formulation.

The model will be advanced significantly in the study by adding Se reaction equations as determined by other components of the study. I believe this is a fine approach. However, it makes adequate calibration and verification of the model all the more urgent.

I found the approach and description of the other five tasks compelling and complete. Taken together, *the approach appears well designed and appropriate for meeting the objectives of the project.*

**1c1) Has the applicant justified the selection of research, pilot or demonstration project, or a full-scale implementation project?**

Provide detailed comments in support of your conclusion [Note: in the electronic version, this will be an expandable field]

This is clearly one of the strengths of this proposal. The pilot project areas include Three Mile Slough for hydrodynamics and transport measurement and modeling, and Frank's Tract and Mildred Island for biogeochemical field analysis of Se. Three Mile Slough is arguably the hydrodynamic heart of the delta because of the energetic exchange of waters of different chemistry between the Sacramento and SJR. Further, tidal and shallow water habitat restoration is very topical at present. Therefore, analysis of existing shallow water habitats are essential for guiding future restoration efforts.

*The applicant has adequately justified the selection of research, and demonstration projects.*

**1c2) Is the project likely to generate information that can be used to inform future decision making?**

Provide detailed comments in support of your conclusion [Note: in the electronic version, this will be an expandable field]

The applicants argue that the project has important applicability to the CALFED Ecosystem Restoration Program on page 10. They state the Se is a toxic element that has impaired reproduction and prevented restoration of native fishes in other systems. The principle value of the project lies in identifying trophic transfer mechanisms of Se that would allow "identification of predator species most and least at risk, and explain specifically where Se is or could be an issue for wildlife restoration." The authors say more than once that CALFED restoration efforts require understanding of Se transport transformation and uptake mechanisms to avoid a "Kesterson syndrome."

The project is intended to fill knowledge gaps about Se cycling among habitats. The authors suggest that phytoplankton species in the delta may transform Se differentially. This information would guide restoration by avoiding designs which would foster Se magnification in the food chain.

The project would also develop a coupled hydrodynamics and Se kinetics forecasting model that will be useful for designing restoration project geometries in the future. The model will also help researchers and decision makers interpolate and interpret field Se measurements in water, sediment and biota.

*The project is likely to generate critical information to support future decision making on delta restoration initiatives.*

**2a) Are the monitoring and information assessment plans adequate to assess the outcome of the project?**

Provide detailed comments in support of your conclusion [Note: in the electronic version, this will be an expandable field]

Assessment of monitored field and laboratory data is central to the success of this project. Biogeochemical process studies are proposed on three scales: 1) monthly biogeochemical

sampling in demonstration habitats (Frank's Tract, Three Mile Slough, Mildred Island), 2) quarterly in system boat transects for Se flux analysis, and 3) intensive (two day continuous) "process cruises" within the demonstration habitats.

This proposal appears to build on past and ongoing studies of biogeochemical processes in this estuary and others especially related to mercury, copper, and carbon. The authors appear to have extensive multidisciplinary knowledge and understanding of what is known and not known about toxic element dynamics in aquatic systems. This project will not provide the definitive picture of Se dynamics. However, it appears to represent a well conceived initiative that addresses specific knowledge gaps and will lead to better decisions. Filling those gaps will undoubtedly lead to more questions. Ah science.

*Monitoring and information assessment plans are adequate to assess the outcome of the project .*

**2b) Are data collection, data management, data analysis, and reporting plans well-described, scientifically sound and adequate to meet the proposed objectives?**

Provide detailed comments in support of your conclusion [Note: in the electronic version, this will be an expandable field]

The authors state a clear intention to write reports that are relevant to decision making, participate in peer review processes, and present findings in the IEP newsletter and CALFED and IEP conferences. My experience is that the PI's have made excellent efforts to present and report their research findings in the past.

The report is not specific on how field and laboratory data will be stored and documented so that others may use it in the future. There are important San Francisco estuary databases that offer consistent repository services that should be used including the IEP Data Server, and the SFEI Region Monitoring Program for Trace Substances. The research and data repositories are both more valuable when the repository resources are used.

*Data collection, data management, data analysis, and reporting plans are well-described and scientifically sound. However, effort should be put to making the data available through established data repositories.*

**3) Is the proposed work likely to be technically feasible?**

Provide detailed comments in support of your conclusion [Note: in the electronic version, this will be an expandable field]

The authors provide excellent detail of sampling and laboratory protocols which suggest that the work is technically feasible. Special effort will be required to calibrate and verify the TRIM model for the Bay-Delta system.

*The proposed work likely to be technically feasible.*

**4) Is the proposed project team qualified to efficiently and effectively implement the proposed project?**

Provide detailed comments in support of your conclusion [Note: in the electronic version, this will be an expandable field]

The proposal is being advanced by arguably some of the most eminent scientists in this system. *They are clearly qualified.*

**Miscellaneous comments**

[Note: in the electronic version, this will be an expandable field]

With special attention to the model and data dissemination, this proposal represents critical multidisciplinary scientific study needed to support sound restoration efforts in the system.

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<p><b>Overall Evaluation Summary Rating</b></p> <ul style="list-style-type: none"><li><input type="checkbox"/> Excellent</li><li><input type="checkbox"/> <b>Very Good</b></li><li><input type="checkbox"/> Good</li><li><input type="checkbox"/> Fair</li><li><input type="checkbox"/> Poor</li></ul>	<p><b>Provide a brief explanation of your summary rating</b></p> <p>[Note: in the electronic version, this will be an expandable field]</p>
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I believe the proposal is excellent in almost every respect. However, the proposal misses important opportunities by not taking advantage of 1D models for screening conservative transport mechanisms. Feedback between efficient, though ostensibly less accurate, 1D models and the (soon to be) more accurate TRIM model would be useful.