June 23, 2012

Gerald W. Bowes, Ph.D.
Manager, Cal/EPA Scientific Peer Review Program
Office of Research, Planning and Performance
State Water Resources Control Board
1001 I Street
Sacramento, CA 95814

Dear Dr. Bowes,

Attached please find my peer review of the draft report: *Agricultural Economic Modeling for the Phase 1 Update to the 2006 Bay-Delta Plan.*

I have read the draft report and reviewed the supplemental reference documents. My general assessment is that the process utilized for the evaluation is sound and the report is well within the standards of objective economic impact modeling.

I am submitting a few minor comments regarding the need for improved clarification of specific assumptions and results. My comments are provided below under the assumptions and conclusions listed in: *Attachment 2. Listing of Economic Conclusions or Assumptions Subject to Review*.

Please note that due to the Memorial Day Holiday, I did not receive the review packet until Tuesday, May 29th. I have since received clarification from Ms. Patricia Hernandez that I have 30 days post receipt of the materials to submit my review.

Thank you for the opportunity to review the draft report. Please contact me if you have any questions regarding my comments.

Sincerely,

Rex H. Caffey
Professor of Natural Resource Economics
Department of Agricultural Economics & Agribusiness
Louisiana State University Agricultural Center
Baton Rouge, LA 70803

Attachment 2: Listing of Economic Conclusions or Assumptions Subject to Review

The statutory mandate for external scientific peer review (Health and Safety Code, § 57004) states that the reviewer's responsibility is to determine whether the scientific portion of any proposed rule is based upon sound scientific knowledge, methods, and practices.

Similarly, for this review of the agriculture-related economic effects, we request that you make a determination whether the subject economic analysis is based upon sound economic knowledge, methods, and practices. This determination should be made for each of the following issues regarding the analyses in the draft report titled "Agricultural Economic Effects of Lower San Joaquin River Flow Alternatives" (Agricultural Economics Report). An explanatory statement is provided for each issue to focus the review.

For those work products which are not proposed rules, such as the case with the review that is the subject of this document, reviewers must measure the quality of the product with respect to the same exacting standard as if it was subject to Health and Safety Code section 57004.

The State Water Board requests that the peer reviewers review the Draft Agricultural Economics Report, which includes estimates of the potential effects on agricultural production and related Lower San Joaquin River (LSJR) watershed economy from estimated changes in allowable surface water diversions needed to meet potential LSJR flow alternatives. This peer review is requested to assure that the best economic analysis and available models are appropriately used and interpreted.

Please note that the analysis and results reported in the section of the report titled "Surface Water Diversion Estimates" are used as inputs to the economic analysis, and are not the subject of this peer review. These inputs were generated using methods described in a previously peer-reviewed document, titled "Draft Scientific Basis for San Joaquin River Flow and Southern Delta Salinity Objectives (Scientific Report) which can be found at:
http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/water_quality_control_planning/docs/scientific_report.pdf.

In the event peer reviewers have a question on a topic or issue in the Draft Agricultural Economics Report, which requires further clarification from the State Water Board, they are asked to submit their request for clarification to Patricia Fernandez via email at pfernandez@waterboards.ca.gov. All requests for clarification will be responded to via email and will be made a part of the report.

Economic Conclusions or Assumptions Regarding the Analysis Approach in the Draft Agricultural Economics Report

1. **Use of the Statewide Agricultural Production (SWAP) model was based on sound economic knowledge, methods, and practices.**

   State Water Board staff reviewed models for estimating agricultural production and revenues associated with the surface water diversions potentially needed under the LSJR flow alternatives and baseline conditions. Staff found that the SWAP model was an appropriate model for estimating the effect of the LSJR flow alternatives and baseline conditions. For the purposes of this analysis, the SWAP model was calibrated to the Department of Water Resources (DWR) estimates of land use and applied water data for water year 2005, because this water year represented the most recent normal water year in terms of both water availability and crop prices. This data is presented in Table X-7 of the report. Annual surface water diversion changes estimated in the section of the report titled "Surface Water Diversion Estimates" were input to the SWAP model to estimate the associated agricultural production and revenues. For each water year, SWAP uses a Positive Mathematical Programming (PMP) methodology to calculate the crop acreage mix that would maximize revenue from the annual available surface water diversions. The output from the SWAP model was used as input to the IMPLAN model. State Water Board staff believes the use of the SWAP model with the described assumptions and approach was based on sound economic knowledge, methods, and practices.

   Reviewer: I agree that the use of WSE modeling based on previously documented LSJR flow alternatives is an appropriate method for developing the aquatic input needed to parameterize an agricultural production effects model. Although I have not utilized the Statewide Agricultural Production (SWAP) model specifically, I am familiar with the Positive Mathematical Programming (PMP) approach and the economic optimization theory on which it is based.

   The SWAP model has been used by both public and private entities for a wide variety of similar assessments in California. The ability of the model to adjust to changes in water input price, application, and scale make it particularly well-suited for an economic analysis of the potential effects on agriculture resulting from LSJR diversion alternatives.

2. **Use of version 3 of the Impact Analysis for Planning (IMPLAN) model was based on sound economic knowledge, methods, and practices.**

   Version 3.0 of the IMPLAN model was used to predict the indirect, and induced economic effects associated with the changes to agricultural direct revenue estimated by the SWAP model. Output from the SWAP model, appropriate region-specific multipliers, and other assumptions, were input to IMPLAN to estimate the indirect and induced economic activity on the agricultural industry in the LSJR, and related effects on other connected sectors of the economy. State

Water Board staff believes the use of the IMPLAN model with the described assumptions and approach was based on sound economic knowledge, methods, and practices.

Reviewer: I agree that the use of IMPLAN 3.0 is appropriate. This software is commonly used by economists for conducting regional economic impact analysis. The State Water Board Staff has appropriately limited the application and effects of this model to mirror the CVPM regions utilized in the SWAP model.

3. **The LSJR flow alternatives have the potential to affect the amount of allowable surface water diversions from within the LSJR watershed. The economic analysis assumes that construction or installation of alternative water supplies would not be implemented in response to changes in estimated allowable surface water deliveries. Staff believes this is a conservative assumption.**

   For the purposes of this analysis it was assumed that irrigation water from alternative water supplies, such as groundwater pumping or Central Valley Project water deliveries, would not be increased to make up for any decrease in surface water diversions. This is a conservative assumption that would result in higher economic impacts than an analysis that assumes implementation of alternative water supplies.

   Reviewer: I understand the rationale for this assumption given the potential complexity involved in characterizing the variable quantities (and the range of agricultural impacts) that might result from development of alternative irrigation sources in response to the proposed LSJR flow alternatives. Nevertheless, I find the description of this assumption (as used here) to be a bit misleading - though not necessarily intentionally so. I would suggest that this assumption is more "convenient" than "conservative" because its use (as the Staff points out) ultimately results in higher economic impacts.

   By incorporating some element of incremental substitution, the economic impacts of the LSJR alternatives could be partially offset. Thus, use of this assumption potentially exaggerates the upper bounds of economic impact produced via the IMPLAN model.

   I am not arguing that the assumption is invalid, merely suggesting it be characterized differently in the final report. I cannot say how realistic it would be to assume (and account for) any incremental substitution effects, but describing this assumption as "conservative" seems odd at best and strategic at worse - especially given its acknowledged inflationary effect. A more appropriate description might involve commenting on the reality of this assumption given underlying constraints - such as the well-documented crisis of sub-surface aquifer depletion in the LSJR watershed.

4. **Reasonableness of other assumptions.**
Other assumptions beyond those identified above were utilized in the analysis. For example, a time series of 82 annual estimates of differences in crop acreages and revenue was used to estimate effects on crop acreages and agricultural revenue. It was also assumed that surface water diversion reductions can be applied equally across the Central Valley Production Model regions analyzed. Another key assumption in the IMPLAN analysis was that trading patterns between industries were fixed. State Water Board staff believes these assumptions and others, as described in the report, are conservatively valid and are consistent with those used in similar types of economic analyses.

Reviewer: I agree with the validity of these assumptions. Their use here appears to be non-strategic, consistent with data availability, and standard for an economic impact analysis of this nature.

5. **The level of effort used in analyzing the potential economic effects to agriculture covers a reasonable range of economic factors and considerations.**

As a certified regulatory program, the State Water Board is required to take economic considerations into account, but is not required to perform a cost/benefit analysis. Therefore, State Water Board staff believes the level of detail in the report's analysis appropriately considers a reasonable range of economic factors and economic considerations as they relate to the impacts of the proposed project on agriculture, is consistent with the requirements of a certified regulatory program, and provides adequate input to the State Water Board's decision-making process.

Reviewer: I would generally agree that the State Water Board has met its legal expectations for analyzing the potential economic effects of the pending flow regimes for the LSJR watershed. However, I would have liked to have seen at least some basic narrative included to explain the results depicted in Tables X-9 and X-10.

For example, in Section 4.3 (Summary of Results) the report includes a sufficiently detailed narrative of the "Effects to Crop Acreage" resulting from the SWAP model crop mix under the various LSJR flow alternatives. A similar section would have been very helpful for addressing and interpreting the output of the IMPLAN model.

It would have been particularly helpful to have some commentary on the net-positive effects to output and revenue resulting under the 20% alternative. This effect seems somewhat counter-intuitive, especially given the general thesis of the report and the underlying assumption of profit maximization embodied in the PMP approach. Moreover, this result seems to be in direct conflict with last sentence at the bottom of page X-2, which basically suggests an inverse correlation between in-stream water retention and agricultural production and profitability.

In the absence of a detailed explanation, one might assume that initial, small-scale reductions in water availability under the 20% alternative are only disproportionally negative towards the lower value commodities that have a higher per unit water demand (e.g. rice and alfalfa).

Likewise, one might assume that as water availability moves from the baseline scenario to the 20% reduction scenario, the crop mix forecasted by SWAP and measured by IMPLAN shifts towards more higher-value crops with lower water demand.

Moreover, as surface water availability for crop irrigation continues to diminish (to 40% and 60%), any economic redistribution advantages within the crop mix are exceeded, and production and revenue effects become negative across the board.

Again, I can only assume such dynamics. The final and most important section of the report ends abruptly with no real summary or discussion of results.

6. **The results of the analysis are valid.**

The Draft Agricultural Economics Report contains conclusions regarding the agricultural economic effects of the proposed flow alternatives. Table X-9 of the report displays the predicted changes in economic output for crop production that would be associated with the proposed flow alternatives. Estimates of total sector output changes from baseline conditions ranged from an increase of 0.3 percent to a decrease of 4.1 percent. Table X-10 of the report displays the estimated change in regional employment that would be associated with the proposed flow alternatives, which ranged between an increase of 0.3 percent to a reduction of 4.1 percent from baseline conditions. State Water Board staff believes these results are valid estimates of the effects of the proposed flow alternatives on the regional economy of the LSJR watershed.

Reviewer: Though I would have liked to have seen additional explanation of the IMPLAN results, I do believe the results are valid and I have no reason to doubt the veracity in which the estimates were developed.

7. **Other Issues**

Additionally, reviewers are not limited to addressing only the specific issues presented above, and are asked to contemplate the following "Big Picture" questions:

- In reading the Draft Agricultural Economics Report, are there any additional agriculture related economic issues that should be a part of the report's analysis that are not described above? Effects of the LSJR flow alternatives on other non-agriculture related sectors of the economy will be addressed elsewhere in the SED.

Reviewer: I don't have any additional agriculture related sectors to suggest for this analysis; however, I do believe the report would be greatly improved by including a narrative to summarize and explain the results of the IMPLAN model.

- Taken as a whole, is the report's analysis based upon sound economic knowledge, methods, and practices?

  Reviewer: Yes

Reviewers should note that some conclusions or proposed actions, for instance selection of flow alternatives for the amended Bay-Delta Plan, may rely significantly on professional judgment in instances where economic data and our understanding of the underlying processes are not as extensive as may be ideal. Nonetheless, the evaluation of the economic data and use of professional judgment are appropriate in the context of current economic knowledge regarding such actions. In these situations, the proposed course of action is favored over no action. The preceding guidance will ensure that reviewers have an opportunity to comment on all aspects of the agriculture-related economic effects of the proposed State Water Board action. At the same time, reviewers also should recognize that the State Water Board has a legal obligation to consider and respond to all feedback on the proposed rules. Because of this obligation, reviewers are encouraged to focus feedback on economic issues that are relevant to the central regulatory elements being proposed.