# Independent Panel Review of the Economic Sustainability Plan for the Sacramento-San Joaquin Delta
December 2, 2011

By

Richard M. Adams
Oregon State University

Janie M. Chermak
University of New Mexico

Robert Gilbert
University of Texas

Thomas Harris
University of Nevada, Reno

William F. Marcuson III
USACE, Retired, Vicksburg MS

Review performed for the
Delta Science Program

# Summary

As requested by the Delta Science Program (DSP), the independent review panel reviewed the Economic Sustainability Plan commissioned and funded by the Delta Protection Commission (DPC). We find that the Sustainability Plan offers useful information to policy makers on the economic viability of the Delta region and its contributions to the broader region. Although the Sustainability Plan findings should not be used to evaluate specific "futures" or alternative options regarding the coequal goals, the Economic Sustainability Plan contains valuable information and proposes strategies to improve economic viability which the Delta Stewardship Council (DSC) may consider as it attempts to meet the coequal goals while retaining the economic, cultural and legacy viability of the Delta.

In summary, we offer these observations for consideration by the DPC and the DSC. First, maintenance of the levee system is important to sustain the viability of the Delta. The sections of the levee system that protect human life from flooding should be identified and those levees should be brought up to the same standards currently being used for urban levees in Sacramento (beyond PL84-99). For other sections of the system protecting only property, lower standards could be established providing that (1) the public is involved in the process of establishing the standards, and (2) any future land development that would result in putting humans at risk would require that the levees be upgraded accordingly before proceeding. For areas where the public agrees that levees are not needed for achievement of the coequal goals, removal of the levees, and hence flooding of the protected land, should be a planned event and not left to nature.

Second, the Economic Sustainability Plan proposes that a levee system can be relied upon to achieve a reliable water supply and that upgrading this system would improve the reliability of the water supply. This premise is not supported and a comprehensive risk analysis of the entire system with the recommended levee upgrades would be required to demonstrate that it could reduce the seismic risk. In addition, the most frequent cause of disruption to the water supply is caused by enforcement of provisions of the Endangered Species Act and not related to levees. Proponents of an isolated conveyance system contend that such a system will reduce ESA issues by eliminating some of the stressors on delta smelt and endangered stocks of salmon. However, an isolated conveyance to improve water-supply reliability could potentially impact the sustainability of the Delta by increasing salinity and decreasing local water availability because it will reduce through-flow of fresher Sacramento River water in the Delta. Therefore, the Sustainability Plan and the cost of implementing isolated conveyance should include the following: mitigation of salinity impacts, mitigation of local water supply impacts and mitigation of catastrophic salt-water intrusion in the event of a large earthquake that causes widespread failure of Delta levees.

# Background

Ecological and economic problems associated with water transfers from rivers in northern California to southern California users have challenged policy makers in California for decades. As the point of transfer of northern California water, the Delta, writ large, has borne a disproportionate share of the ecological and economic costs of meeting the water export demand from areas south of the Delta. Endangered species issues associated with delta smelt and stocks of Chinook salmon intensified these concerns. In an effort to protect these species and other ecological values, a series of judicial rulings over the past decade have disrupted the export of water from the southern Delta to agricultural users in the San Joaquin Valley and municipal uses in southern California.

The state legislature passed the Delta Reform Act of 2009 in response to the documented ecological deterioration of the Delta, and declines in species which depend on this complex ecosystem, as well as the economic costs associated with disruptions of water supplies to users. This act created an institutional framework which is charged with attaining the "coequal goals of providing a more reliable water supply for California and protecting, restoring and enhancing the Delta ecosystem". The legislation also mandated that these coequal goals be achieved in such a way as to "protect and enhance the unique cultural, recreational, natural resource and agricultural values of the Delta as an evolving place". A key player in this process is the Delta Stewardship Council (DSC) which is tasked with developing the Delta Plan to achieve these coequal goals.

Another organization involved in this process is the Delta Protection Commission (DPC), which is charged with providing input to the DSC on mechanisms and programs to protect and enhance the economic sustainability of the Delta. The DPC funded an Economic Sustainability Plan in early 2011. An excerpt from the DPC's Request for Proposals, which includes the charge to the authors, is presented in Appendix 1. A draft of this Sustainability Plan was provided to the Council on October 10, 2011. Such plans are typically reviewed by external referees to assure that procedures, data, assumptions, results and policy interpretation s meet minimum scientific and engineering standards. These reviews are developed and coordinated by the Delta Science Program (DSP). The DSP commissioned this panel to review the Economic Sustainability Plan developed by the DPC.

## Charge to the Panel

The panel was charged by the DSP with several broad tasks. Specifically,

> **"The Panel will be charged with assessing the scientific and technical quality of the Economic Sustainability Plan. The Panel will make recommendations for how the plan might be improved with respect to achieving stated goals."**

In addition to these general issues regarding the Sustainability Plan, there are sixteen questions that involve scientific and disciplinary aspects of the plan. These sixteen questions, along with the entire "charge" document, are presented in Appendix 2. The first four questions relate to issues of general

technical and scientific merit and are presented here because they are the most relevant to the overall findings of this panel.

They are:

1. How well are the purpose and scope of the Plan defined and described? Is the Plan an objective analysis of economic sustainability in the Delta, consistent with the requirements stated in the Delta Reform Act?
2. Is the Plan internally consistent and scientifically valid?
3. Are the analyses and results well-presented and clear? Is the analytical approach integrated, reasonable and scientifically defensible? Are the key findings and issues supported by adequate research and analysis?
4. Is the best available science and information used in the Plan and is it defined, assembled, summarized and integrated into the analysis? Does the Plan identify gaps in data and research that limit the Plan and/or should be a priority for future research?

The following section summarizes the process used by the panel in arriving at our conclusions. This is followed by the panel's response to both general issues of technical and scientific merit, and specific disciplinary questions.

## Process

In preparation for this review, the panel was provided with the Economic Sustainability Plan and appendices by the Delta Science Program staff. Subsequent to receipt of the Sustainability Plan the panel received other supporting documents. A full listing of the documents provided to the panel is available on the Delta Science Program website.

The panel assembled in Sacramento on the morning of November 1, and traveled to Walnut Grove to hear presentations by the authors of the Sustainability Plan and to receive public comment. On the trip south to Walnut Grove, the panel visited the Freeport Regional Water Project intake facility, a diversion site for water for both Sacramento County and the Contra Costa Water District. On the trip to Walnut Grove, the panel also visited several other "legacy communities" and experienced the levee system on which the viability of the Delta depends. The morning meeting in Walnut Grove consisted of the presentations by the authors and public comments; the afternoon was devoted to panel discussions. Following the meeting in Walnut Grove, the panel again toured southern and eastern areas of the Delta.

On November 2, the panel met in private in the morning to formulate responses to the charges provided by the DSP. The panel then met in public session with the authors and the Executive Director of the Delta Protection Commission. At that meeting, the panel presented its preliminary findings. This report was prepared subsequent to the panel's meeting in Sacramento and Walnut Grove. The panel engaged in two conference calls and email exchanges to arrive at its final report. This report was submitted to the DSP on December 2, 2011.

# Panel Response to the Sustainability Plan

We start by identifying what in our judgment are the strengths and limitations of the Economic Sustainability Plan relevant to the charge that the authors were asked to address by the Delta Science Program.

## Strengths of Plan Relative to Charge

The strengths of the Plan are that it:

1. Describes clearly the intrinsic value of the Delta and its economy and documents the many public-good services provided by the Delta
2. Provides valuable baseline information about the Delta economy
3. Gives a starting point in combination with other recent studies to conduct a comprehensive, cost-benefit analysis of alternatives for improving water supply reliability and enhancing the ecosystem
4. Offers creative ideas for strengthening the Delta economy
5. Substantiates the importance of lowland levees for protecting people, property and the environment
6. Provides a potentially viable alternative to improve reliability of lowland levees

We feel that these "strengths" can be used by the DSC in terms of developing the final Delta Plan in the following ways.

**1.** The Sustainability Plan documents the economic contributions of the three key sectors to the viability of the Delta region. The economy is driven largely by agriculture, which plays an important role both within the region and as a supplier of inputs to other agricultural activities outside the region, such as dairy. The Delta provides important recreational benefits in the form of fishing, hunting, boating and other water based recreation. Given its location between the populous Bay Area and the cities of the Central Valley, the region contains important infrastructure that serves residents in these external areas, such as highways, pipelines, railroads, and utility transmission lines. Data provided in this Plan can be used as "baseline" information with which to assess trends or change in the viability of the Delta. **These data, in combination with other recent studies, can also be instructive in any process to prioritize levees for maintenance, enhancement or abandonment.**

**2.** The Plan demonstrates that the Delta provides both substantial public and private goods to the region and the state. These are varied but include such private goods features as protection of private farmland and infrastructure, to a range of public goods such as protection of human safety, commerce (e.g.; shipping routes to the ports of Sacramento and Stockton, and recreational activities associated with the Delta ecosystem. The provision of this range of goods

and services is important given that the overarching issue in terms of Delta viability is the levee system. Specifically, it is well documented that levee failure puts at risk the economic activities documented in the Plan, as well as human life (DRMS 2010). **In the panel's opinion, critical questions for policy makers include: 1) who should pay for the maintenance and enhancement of this levee system? And 2) what should the design(s) and configuration of that levee system be as the DSC adopts its final plans for meeting the coequal goals?**

## Limitations of Plan Relative to Charge

The panel also found limitations with the Sustainability Plan relative to the charge the authors were given by the DSP and, more importantly, its potential utility to the DSC. These are:

1. The Sustainability Plan is not and should not be used for benefit-cost analyses of alternatives for improving water supply reliability and enhancing the ecosystem.
2. The Plan does not explicitly provide information to prioritize how future resources are invested in the Delta.
3. The Plan does not offer a clear or viable definition of economic sustainability.
4. The Plan provides a potentially optimistic and misleading estimate for the cost of upgrading lowland levees.
5. The Plan does not address the need for evacuation planning to protect public safety.
6. The Plan's approach of upgrading the levee system will not necessarily improve Delta water supply reliability because the recommended upgrades are not shown to substantively reduce disruptions due to large earthquakes and they will have little impact on restrictions in pumping due to the Endangered Species Act.

The Sustainability Plan limitations relate to the fact that it does not address the challenge of how to prioritize investments within the Delta, either for levee maintenance or improvements. The Plan documents substantial economic and human values within the various geographical definitions of the Delta (legal, primary, secondary), but is silent on which levees are most critical; i.e.; which should be the highest priority in terms of improvements. In addition, the Plan does not define economic metrics by which to define and judge a viable or sustainable Delta. The issue of prioritization of resource expenditures is important because the likelihood of maintaining all levees strikes us as low, given resource constraints faced by the State of California and the federal government. The report offers a levee design which the authors believe can be used to replace/improve current standards and for a lower cost (the so-called "fat levee"). Subsequent to our public presentation in Sacramento on November 2, the authors provided additional comments and references to support their cost estimates for construction of the proposed levee design, for which we are grateful. However, we remain concerned that theses estimates are not consistent with (i.e., are much lower than) levee construction

costs in other settings. **In the panel's opinion, the cost of this levee design remains unsubstantiated. In addition, the more fundamental question of whether all levees within the Delta should be preserved remains unanswered.**

The Sustainability Plan proposes that the levee system can be relied upon to achieve a reliable water supply and that upgrading this system would improve the reliability of the water supply. This premise is not supported. The Delta Risk Management Strategy effort (DRMS Phases I and II) showed that strategies of upgrading the levees (including seismically-armoring levees along a through-Delta conveyance) had essentially no impact on the risk of disruptions to the Delta water supply caused by earthquakes. A similar comprehensive analysis of the entire system with the levee upgrades recommended in the Sustainability Plan would be required to demonstrate that it could reduce the seismic risk. In addition, the most frequent cause of disruption to the water supply is caused by enforcement of provisions of the Endangered Species Act and not related to levees. Proponents of an isolated conveyance system contend that such a system will reduce ESA issues by eliminating some of the stressors on delta smelt and endangered stocks of salmon. However, an isolated conveyance to improve water-supply reliability could potentially impact the sustainability of the Delta by increasing salinity and decreasing local water availability because it will reduce through-flow of fresher Sacramento River water in the Delta. **Therefore, the costs required to mitigate salinity impacts, local water supply impacts and catastrophic salt-water intrusion in the event of a large earthquake are a relevant consideration in assessing isolated conveyance.**

Another issue relates to the type of economic information provided in the Sustainability Plan. Specifically, the economic estimates provided in the Plan are what economists refer to as "impact analyses". Such estimates are useful in that they can give policy makers an understanding of the relative contributions made by economic sectors to overall economic viability, such as employment and sales, or the increase in economic activity (within a local region) that may arise from a particular investment. However, these estimates are not appropriate information on which to prioritize resource allocation decisions or options. Specifically, they are not intended for use in assessing the efficacy of trade-offs, between, say upgrading levees or building an isolated conveyance system. In fairness to the authors, they were not specifically charged with performing a benefit-cost (B-C) analysis, and as we noted above under "Strengths," there is substantial information within the report that could be used within a B-C framework: e.g.; data on the costs of agricultural production, revenues from agricultural and other economic activities and so forth). **Prioritization of expenditures on levees (maintenance, enhancement or abandonment) would require a comprehensive benefit-cost analysis of investments, within and outside the Delta, to meet the coequal goals.**

Finally, in our opinion, "sustainability" is an oft-used but typically imprecise term. For example, the attempt to design "sustainable" cities, states, or countries has captivated policy makers for decades. However, arriving at a definition which is acceptable to numerous stakeholders, with metrics which are both measurable and economically and ecologically compatible, makes this a difficult outcome to achieve in a pluralistic society. In the case of the Economic Sustainability Plan, the authors were essentially given a definition of sustainability which implies that the only sustainable economy is one with no diminution of economic output/activity from any of the three key economic sectors. **This is the**

***status quo* situation and does not allow for tradeoffs. Such a definition of sustainability would appear to be of limited use in policy decisions. Conversations with the authors in Sacramento make clear that the authors understand the limitations of this definition and would be willing to pursue other measures of viability, if requested.**

## Recommendations to the Authors of the Sustainability Plan

The panel was charged with providing specific recommendations to the authors for improving the Economic Sustainability Plan in terms of meeting its goals. In the event that the DPC or the authors wish to revise the analyses underlying the Sustainability Plan, we offer the following suggestions.

1. In terms of the public safety aspects of the Plan, we recommend that the authors provide guidance for evacuation planning and effective communication/education about the risk of flooding.

2. We recommend that the authors expand their discussion regarding the consequences of levee failure and clearly identify which areas have the highest potential and which areas have the lowest or no potential for life loss. This information would be helpful in for prioritizing levee upgrades and developing appropriate standards for upgrades.

3. We recommend that the authors investigate and evaluate what the Department of Water Resources (DWR) is doing with regard to both riverine and Delta levees. We are referring to what DWR calls their Urban Levee Evaluations (ULE), and the Non-Urban Levee Evaluations (NULE). If levees in the California Delta provide for public safety, as opposed to only agriculture, we further recommend the authors discuss and justify why Delta levees should be designed to a lower standard that ULE or NULE levees in the Sacramento-San Joaquin Valley.

4. We recommend that the cost estimate of a "fat levee" concept be better substantiated as in our opinion the current estimate of the cost of design and construction is overly optimistic. At a minimum, we recommend that a realistic upper bound be presented, assuming that the federal government is a partner and that right-of-way and borrow material acquisition are involved.

5. We suggest that the authors provide a discussion of how the lack of formal inclusion of risk and uncertainty in the analyses impacts their findings. We are not suggesting that the authors attempt a formal risk-based analysis at this time, given the availability of the DRMS analysis. However, the authors may wish to provide qualitative information relative to areas of greatest uncertainty in their estimates.

6. The authors should address the issue of what is meant by "sustainability", particularly in terms of developing a viable economic future for the area. For example, how would the programs and strategies proposed here perform if a different definition of sustainability is used?

7. The authors may wish to develop their own agricultural sectors and production function coefficients to reflect the agricultural sectors in the 5 county study area. This would require use of University of California extension budgets and following procedures outlined by Willis and Holland (1997) and Coupal and Holland (1995). The study team may find there are other production function adjustments required besides the increase in custom purchases as oppose to the national agricultural production function averages.

8. While we find the multinomial logit (MNL) model to be a useful approach to estimating the effects of salinity and other factors on agricultural activity, we suggest that the authors provide more detail on this model and incorporate more the results into the report.

## Recommendations to Delta Stewardship Council

Based on our review of the Economic Sustainability Plan, and our assessment of its relative strengths and weaknesses, we propose the following to the DSC:

1. Develop strategies to implement a user-fee system to address the public-goods nature of the Delta.

2. Conduct a comprehensive and credible cost-benefit analysis to analyze alternatives for improving water supply reliability and enhancing ecosystem services.

3. Regional, state and federal agencies work with the public to develop standards for levees in the Delta.

4. Include costs for mitigating economic as well as environmental impacts to the Delta in analyzing water export alternatives.

5. State agencies work with local stakeholders to develop a prioritization plan for investing future resources in the Delta.

6. Take immediate steps to improve maintenance and monitoring for existing levees and evacuation and emergency flood response.

As noted in the Economic Sustainability Plan and numerous other publicly funded assessments of Delta water issues (e.g.; DRMS) the critical public policy issue in the Delta revolves around the maintenance of

the levee system. The current levee system has evolved over decades; financing of maintenance features a mix of public (state and federal) and private funding (local reclamation districts, or in some cases owners of selected infrastructure, such as Pacific Gas and Electric pipelines). The Sustainability Plan and these other reports document the importance of the levee system to the region and beyond. Given the importance of this system, in whatever form it is ultimately configured, mechanisms are needed to spread the cost of that system equitably across beneficiaries. The current financing system appears to have incentivized "free-riding" behavior on the part of selected state agencies (e.g.; CALTRANS) and private parties. The California Department of Water Resources *Economic Analysis Guidebook* (2008), provides general principles concerning the distribution of costs and benefits in water resource projects, noting that among other financial feasibility criteria, "beneficiaries are able to pay reimbursable costs for project outputs over the project's repayment period" (pp viii, xii). **Consistent with this basic principle, we believe an equitable outcome concerning the distribution of benefits and costs of levee expenditures will ultimately require an agency with the authority to assign and assess beneficiaries their share of these costs.**

A current benefit of the water export system is that flows of relatively fresh water into the southern and eastern Delta have kept salinity levels sufficiently low to facilitate agricultural production. The Economic Sustainability Plan demonstrates the potential negative effects of increasing salinity levels on agricultural yields in the southern Delta. Although the Sustainability Plan does not document potential changes to salinity levels arising from the operation of an isolated conveyance system, it is reasonable to assume that diversion of up to 15,000cfs of flow from the Sacramento River (North Delta) and movement via pipelines to the Tracy pumping facilities, would alter Delta through-flows. To the extent that these alterations in flows increase south Delta salinity levels, the economic and ecosystem impacts of these alterations must be recognized, and where appropriate, mitigated. **Given that water exporters will be the primary beneficiaries of such a conveyance system, the DPC and the DSC need to ensure that the sponsors of a conveyance system fully pay for any and all Delta mitigation.**

Finally, we note that there has been a substantial amount of recent research dealing with the "economics" of water and the Delta. These include the DRMS report, which contained an economic inventory of the various values arising from the Delta system (and implicitly from the levees which provide protection for the current infrastructure). In addition, there have been a series of reports from researchers who are primarily associated with the University of California, Davis. These include three books dealing with alternative futures or "visions" for the Delta (Lund et al. 2007, Lund et al. 2010, and Hanak et al. 2011). There have also been journal articles (e.g.; Suddeth et al. 2010) on the benefits and costs associated with different configurations of levees within the Delta and reports (e.g.; Sumner and Rosen-Molina 2010) on the viability of agriculture and other economic sectors of the Delta economy. These books, reports and articles have different objectives and employ different methods than the Economic Sustainability Plan but we believe that there is commonality in the findings between these other studies and the Sustainability Plan. Specifically, in a general sense, all support the finding reported in this Plan of significant economic activity and value associated with the Delta. Another common finding is that any future would include a Delta levee system which includes the majority of the present levee system. The major difference between the Plan and these other reports tends to be on how many

of the lowland levees would be allowed to fail. As noted earlier, the Sustainability Plan baseline economic data can be helpful in discussions regarding the future of selected levees, particularly those in the middle Delta region**. We encourage the DSC to consider these common findings as it addresses the challenge of meeting the coequal goals while providing protections for the Delta economy.**

# Responses to Specific Questions

1. *How well are the purpose and scope of the Plan defined and described? Is the Plan an objective analysis of economic sustainability in the Delta, consistent with the requirements stated in the Delta Reform Act?*

   Yes. In our opinion, the purpose and scope of the Sustainability Plan are well defined. We also find the analysis of baseline economic conditions to be performed in a technically competent fashion and to be objective.

   However, we find that interpretation of the assessment overreaches since it is an impact analysis, not a benefit-cost analysis, and since the study area is confined to the Delta. Thus, it is not appropriate to use these results to measure the efficacy of alternatives outside the Delta or of levee investments within the Delta.

2. *Is the Plan internally consistent and scientifically valid?*

   As noted above, the baseline assessment of economic impacts within the Delta is consistent and defensible.

   The estimated costs for improving the levees are not defensible because (1) the standards have not yet been established by all of the stakeholders and (2) the estimates have not necessarily included all costs involved.

3. *Are the analyses and results well-presented and clear? Is the analytical approach integrated, reasonable and scientifically defensible? Are the key findings and issues supported by adequate research and analysis?*

   The analyses presented in chapters 2, 7, 8, and 9 covering the economy of the Delta are, in our opinion, well drafted and use appropriate techniques.

   In chapter 2, background information of the economy, culture and other unique characteristics of the Delta provide useful, needed information to understand the unique nature of the Delta.

   Chapters 7 (agriculture), 8 (recreation and tourism), and 9 (infra-structure) provide details of the economic baseline of the Delta. The impact analysis techniques provided in these chapters are consistent with the standard for this type of assessment. However, the aggregated impacts, which are useful, could be disaggregated into individual economic sectors. This would provide a distributional analysis as to the impacts and show economic sectors that are closely related to the Delta's agricultural and tourism sectors.

   Collectively the information provided in chapters 2, 7, 8, and 9 clearly documents the Delta's contributions to the region and to the state. This type of information does not appear to have been collected and provided within a single document prior to this time.

4. *Is the best available science and information used in the Plan and is it defined, assembled, summarized and integrated into the analysis? Does the Plan identify gaps in data and research that limit the Plan and/or should be a priority for future research?*

   The authors appear to have used the best available data in their development of the baseline and the development of the impact model. The authors draw from a wide range of data sources and augmented the IMPLAN model to account for local conditions. For example, they addressed California agricultural production practices that have a greater use of custom operations. These adjustments were made after consultation with University of California extension personnel. This is a notable accomplishment given the short timeframe of the study. We also recognize the difficulties in addressing sub-county level analysis. The authors appear to have dealt with this appropriately.

5. *How well does the Plan integrate analyses at various spatial and temporal scales?*

   The authors are consistent within the definition of the physical Delta as provided to the authors.

   It is not clear to us how the authors arrived at the basis of the forecasting time dimension. We appreciate the difficulty in making long-run forecasts, but it is not clear how they came up with the basis for the dynamic analysis. We recognize that IMPLAN is a static forecasting tool and limits the ability to consider changes and constraints overtime. The authors need to provide more details in their discussion of results and limitations.

6. *How well does the Plan address uncertainty?*

   In general, the Economic Sustainability Plan does not consider uncertainty, which we interpret to mean a probabilistic or stochastic-based analysis of economic and public health outcomes (nor was this an explicit requirement of the RFP). Risk is inherent in the choice of levee design and outcome as well as in the economic development strategy. Any levee design has a probability and consequence of failure, based on that design and future conditions. Similarly, risk is inherent in economic outcomes, as the future states of the world are not known. Point estimate analysis, as is performed in the Sustainability Plan, does not take this into account. Different assumptions and restrictions (implicit or explicit) result in different point estimates of economic measures. The exception to this abstraction from risk is the multinomial logit (MNL) model, which is statistics-based and hence has standard errors implicit in the results. However, those standard errors are not employed in the forecasting of future crop acreage.

   Although risk (uncertainty) is not considered in the Plan, in the panel's opinion, the inclusion of risk and uncertainty associated with potential policy choices (i.e., magnitude and direction of impact as well as confidence interval around the mean) provides policymakers with more complete information with which to make decisions. While the analysis could be improved by including probabilistic-based forecasts, we do not feel that it would be warranted to redo this current analysis. Instead, we encourage the Delta Stewardship Council to exercise the DRMS Risk

Model, refining it with the recent information from this report and other studies, in its deliberations for developing the Delta Plan.

7. *Is the identification of key economic sectors in the Delta sound, and the analysis of the baseline and trends for key sectors of the Delta adequate?*

   Yes, please see response to question 4. However, the table of economic, employment, and value added impacts shows information in aggregate form. More information could be provided by disaggregating impacts into economic sectors. This would show the distributional impacts among sectors in the 5 county study area and indicate those sectors closely related to Delta agricultural and tourism sectors.

8. *Is the baseline estimate of Delta agricultural production accurate and reliable?*

   Yes, see response to question 4.

9. *Is the multinomial logit model a methodologically sound approach for estimating the impacts of water policy proposals on Delta agriculture and/or on environmental change, such as salinity, on crop choice and production?*

   We commend the authors for using this approach. A multinomial logit (MNL) is a standard, recognized method in the extant literature for problems with discrete, limited dependent variables. However, the authors' discussion of key assumptions and procedures is too brief. For example, in the main text, the authors suggest that the MNL is a conditional MNL, where the conditional is on the current land use (pg 123). More detail of this assumption and its impact would be helpful in the Appendix.

10. *Is the interpretation of the model results reasonable and appropriate?*

    We have two concerns. First, the historical salinity levels used in the analysis may not be appropriate for forecasting future salinity impacts, as much of the data on salinity used in the estimated MNL model appear to be below levels evaluated by the authors. Subsequent to our November 2 presentation, the authors provided the panel with data on historical salinity levels within the Delta. The historical record reflects wide ranges in salinity, which mitigates this general concern but raises the question of what salinity levels will be in the future.

    Second, it is difficult to assess the model results due to absence of a full discussion of the model. For example, Appendix G does not include a discussion of the ranges of the data (Table G-5 is inadequate), does not provide complete model results, nor does it include an assumption of the model structure and other information that are normally included in an econometric result. The results would be more defensible if the Appendix included not only the coefficients and standard errors but also some indication of overall fit. Given the potential significance of the MNL results and in particular the salinity elasticity, we encourage the authors to expand this discussion.

Finally, given the results from an MNL and the data from which this MNL was estimated, it appears possible to generate maps from the results to forecast the areas where there is a high probability of changing crops. Given time constraints in preparing this Sustainability Plan, it is not necessary to do so now but we would encourage the authors to explore further use of the MNL model results beyond the presentation in the Plan.

11. *Is the economic impact analysis of Delta agriculture and recreation reliable? Are the multipliers reasonable and consistent with standard practice? Is the interpretation and discussion of results reasonable?*

    Yes, please see response 4 above. Additionally the multipliers for the 5 county area are reasonable and smaller than the state multipliers. This is consistent since the state economy is much larger than the study area and therefore has greater and more numerous economic linkages among economic sectors.

12. *Are the standards recommended for the various Delta levees in the Plan adequately analyzed and scientifically supported? Are the standards recommended for levees adequately analyzed and scientifically supported?*

    No, the standards are not defined sufficiently nor have they been discussed with or agreed to by all of the stakeholders.

    A critical consideration for levee standards is public safety, which is the first item to be addressed in the Sustainability Plan according to the Charge to the Authors: "The Plan will include, but not be limited to the following: 1) Public safety recommendations, such as flood protection recommendations and relationship to economic sustainability." Public safety is mentioned briefly in the draft document, with recommendations to improve "emergency response" and "preparedness for dealing with failures after they occur." However, the draft document does not address the potential for loss of life due to flooding, it does not identify which areas have the highest potential and which have the lowest or no potential for life loss, it does not recommend that evacuation planning be included in the "emergency response" efforts, and it does not provide information on the cost of improving public safety.

    Concerning public safety, we recommend the following:

    1. Evacuation related efforts are treated with high priority. The probability is not zero that in the next decade or two the Delta will experience a major flood or an earthquake that causes levee failures. The State can substantially reduce the likelihood or minimize the potential for loss of life by concentrating on evacuation related efforts.

    2. Effective communication of the risk of flooding should be emphasized. This communication needs to be clear and understandable to the general public. For example, one can talk about design for a 100-year storm or a 1% annual probability of levee failure. That does not have the same impact as discussing for designing for a 100-year storm and owning a house behind the levee with a 30-year mortgage and saying the

chances of seeing the storm during your mortgage is about 1 in 3 or similar to the risk taken while playing Russian Roulette with two bullets in the pistol cylinder. While both approaches are clear to the well-educated scientist, the second approach is likely to be more effective with the general public.

These efforts concerning public safety are important whether or not the levee system is upgraded, and they are particularly important if the levee system is not upgraded.

The draft Sustainability Plan recommends that all levees be updated to PL 84-99, as a minimum, and that a more robust cross-section (the "fat levee") be adopted in upgrading the levees further. The concept of a "fat levee" has merit and may prove to be a feasible and effective means to improve the stability of the levees. However, the devil is in the details; levees are like a chain in that they are only as strong as the weakest link. A conceptual cross-section is only one piece of an integrated system plan that addresses navigation, utility crossings, transportation, water control gates, monitoring and maintenance. There is also a lack of field data regarding levee geometry and levee and foundation soil characteristics/properties over this 1,000-mile long system. These data are needed to define "reaches "of levees that are similar in both levee and foundation cross sectional geometry and material properties; such that, a detailed plan could be developed that is appropriate for that specific reach. In this manner the levees within the Delta could be divided into reaches and separate detailed designs developed for each reach. These field data are on the "critical path" if meaningful work is to be initiated in the near future.

We recommend that levees in the Delta that protect people be upgraded to the recent flood control legislation enacted in 2007 (commonly referred to as SB 5), which calls for a minimum of 200-year flood protection for urban and urbanizing areas in the Sacramento-San Joaquin Valley. It would not be sensible or appropriate to use different standards for different people in this region. SB 5 limits the conditions for further development if this level of flood protection has not been achieved, conditions have not been imposed on development to provide this level of flood protection, or adequate progress towards achieving this level of protection cannot be shown.

We strongly recommend that regional, state and federal agencies work with the public to develop standards for levees in the Delta. These deliberations on design need to consider the consequences of failure, which will be informative in terms of levee prioritization.

### *13. Are the cost estimates for levee improvements reasonable and supported?*

In the panel's opinion, the cost estimates in the draft Plan are questionably optimistic (too low). The authors propose that current cost estimate to improve the levees to PL84-99 is $1 to 2 million per mile, and that additional improvement using the "fat levee" concept adds an additional $2 to 3 million per mile. As a point of comparison, levees in the greater New Orleans' area, after Katrina, cost about $50 million per mile to upgrade. While the comparison between New Orleans and the California Delta is obviously not perfect, we question why there is more than an order of magnitude difference in estimated cost per mile. We believe that if the

suggested improvements are supported by the federal government, then the costs will likely be similar to recent experience, such as the cost of the post-Katrina improvements. For areas where the intent is to remove classification as being within the FEMA 100-year flood zone, then the federal government will certainly be involved in establishing the standards and impacting the costs. Further, we question whether the cost of land and right-of-way acquisition, movement of utilities, permitting, and obtaining the necessary quality and quantity of borrow material have been realistically included in these estimates.

We recommend that the authors provide more substantive and defensible information concerning their cost estimates for levee improvements.

14. *Are opportunities and strategies to protect and enhance economic sustainability effectively identified?*

Yes, a range of potential strategies is identified, including enhancing agriculture, recreation and development. However, as noted above, there is no metric for economic sustainability, making it difficult to compare the value of individual strategies. For example, the authors suggest that agro-tourism and increased recreation opportunities would enhance economic sustainability. Agro-tourism in particular seems problematic, given the other opportunities for potential consumers (tourists) in adjacent areas, such as the Napa-Sonoma area, as well as areas to the south of the Delta.

15. *Are the challenges and constraints to protect and enhance economic sustainability effectively identified?*

The Economic Sustainability Plan identifies numerous potential problems that threaten the economic sustainability of the Delta. The Sustainability Plan asserts that a prominent constraint to economic sustainability is a uniquely burdensome regulatory environment in the Delta compared to elsewhere. A more detailed description of these issues and how they might be mitigated is needed.

16. *Are the recommended strategies consistent with the coequal goals of improving water supply reliability and protecting, restoring and enhancing the Delta ecosystem?*

Yes, the strategies recommended recognize the need to address the coequal goals. However, as noted earlier, this economic impact analysis is not the appropriate procedure for assessing, comparing, and selecting optimal strategies.

We believe that the recommendation for creating a regional authority responsible for levee maintenance, monitoring, improvement and emergency preparedness and response has merit, particularly if it has the ability to address the current problems of free riding behavior with respect to the financing of levees.

# References

California Department of Water Resources, Delta Risk Management Strategy (DRMS) Phase 1. 2009. Executive Summary, <http://www.water.ca.gov/floodmgmt/dsmo/sab/drmsp/phase1_information.cfm>

California Department of Water Resources, Delta Risk Management Strategy (DRMS) Phase 2. 2011. Executive Summary, and Section 18 <http://www.water.ca.gov/floodmgmt/dsmo/sab/drmsp/phase2_information.cfm>

Hanak, E., J. Lund, A. Dinar, B. Gray, R. Howitt, J. Mount, P. Moyle, B. Thompson. 2011. *Managing California's Water: From Conflict to Reconciliation*. Public Policy Institute of California. San Francisco.

Henscher, D.A., J.M. Rose and W.H. Greene. 2005. *Applied Choice Analysis*. Cambridge University Press.

Lund, J., E. Hanak, W. Fleenor, R. E. Howitt, J. Mount and P. Moyle. 2007. *Envisioning Futures for the Sacramento-San Joaquin Delta.* Public Policy Institute of California. San Francisco.

Lund, J., E. Hanak, W. Fleenor, W. A. Bennett, R. E. Howitt, J. F. Mount and P B. Moyle. 2010. *Comparing Futures for the Sacramento-San Joaquin Delta.* Freshwater Ecology Series, Pacific Policy Institute of California. San Francisco.

Michael, J. et al. 2011. Economic Sustainability Plan for the Sacramento-San Joaquin Delta. Report prepared for the Delta Protection Commission.

State of California Department of Water Resources *Economic Analysis Guidebook.* 2008.

Sumner, D. A. and J. T. Rosen-Molina. 2011. "Evaluations of Policy Alternatives to Benefit Agriculture in the Sacramento-San Joaquin Delta of California". Report commissioned by the California Department of Agriculture 31 pp.

Suddeth, R., J. Mount and J. R. Lund. 2010. "Levee Decisions and Sustainability for the Sacramento-San Joaquin Delta". *San Francisco Estuary and Watershed Science* 8 (2).

Willis, D. and D. Holland. 1997. "Translating Farm Enterprise Budgets Into Input-Output Accounts: Another Example from Washington State", Staff paper, Department of Agricultural Economics, Washington State University.

# Appendix A

**Charge to Authors of the Sustainability Plan (excerpt from the "Request for Proposal's" prepared by the DPC)**

The Commission is soliciting proposals from qualified consultants to assist in developing the Economic Sustainability Plan for the Sacramento-San Joaquin Delta (Sustainability Plan). With the passage of the Delta legislative water package in November 2009, (SB X7 1 Section 29759), the Commission was tasked with the development of an Economic Sustainability Plan to be completed by July 1, 2011. The Sustainability Plan will serve two primary functions, including providing a blueprint for a sustainable Delta economy in compliance with SB X7 1, and establishing a basis to evaluate future public policy and program decisions, and probable physical changes affecting the Delta for their potential impact upon the Delta's long-term economic sustainability. The Sustainability Plan will be a working document that shall be reviewed every five years.

In addition, the Sustainability Plan shall include information and recommendations that inform the Delta Stewardship Council's policies regarding the socioeconomic sustainability of the Delta region, specifically to protect, enhance, and sustain the unique cultural, historical, recreational, agricultural values of the Delta as an evolving place in a manner consistent with the coequal goals of protecting, restoring and enhancing the Delta ecosystem and providing a more reliable water supply for California.

The Sustainability Plan will include, but not be limited to the following:

1) Public safety recommendations, such as flood protection recommendations and relationship to economic sustainability;
2) A summation of economic goals, policies, and objectives consistent with local general plans and other local economic efforts, including recommendations on continued socioeconomic sustainability of agriculture and its infrastructure and legacy communities in the Delta;
3) Comments and recommendations to the Department of Water Resources concerning its periodic update of the flood management plan for the Delta as it relates to economic sustainability;
4) Identification of ways to encourage recreational investment along the key river corridors, as appropriate;
5) Evaluate socioeconomic sustainability of the Delta with respect to the State enacting various policy proposals or combination of policy proposals affecting the Delta (i.e. Delta Vision Strategic Plan; various studies of the Public Policy Institute of California; Bay Delta Conservation Plan; Delta Stewardship Council Plan); and
6) Recommendations as to the sustainability of Legacy Towns in the Primary Zone, including but not limited to recommendations as to land use, preservation of historical architecture, and integration with State Department of Parks' vision for the Delta.

The Commission has established an Economic Sustainability Plan Committee (ESP) to guide the preparation of the Economic Sustainability Plan. In addition to the above-mentioned items, the Committee has identified a number of areas that should be a part of the Sustainability Plan and should be taken into consideration in the establishment of the Economic Sustainability Plan, including:

- demonstrate and illustrate a Delta identity;
- recognition of Delta values, and impacts to values, including trends;
- a document of action strategy (not a reference shelf document);
- a foundation or basis to inform local, regional, state and federal policy development;
- acknowledge need for rational balance among Delta uses;
- identify priority areas in need of influence;
- recognize science and resources;
- address gaps and recognize nexus;
- integration with the Delta Protection Commission Resource Management Plan and Delta Stewardship Council's Delta Plan (consistency), other relevant plans, programs;
- recognize "Quality of Life" is measured by the 3E's (Environment, Economy, social Equity; plus public health);
- financing opportunities and planning recommendations to accomplish economic sustainability;
- entrepreneur stimulus, tools to influence and foster (public/private partnerships); and
- stakeholder influence

# Appendix B

**REVIEW PANEL CHARGE**

The Panel will be charged with assessing the scientific and technical quality of the Economic Sustainability Plan. The Panel will make recommendations for how the Plan might be improved with respect to achieving stated goals.

Specific attention will be applied to the following questions:

1. How well are the purpose and scope of the Plan defined and described? Is the Plan an objective analysis of economic sustainability in the Delta, consistent with the requirements stated in the Delta Reform Act?
2. Is the Plan internally consistent and scientifically valid?
3. Are the analyses and results well-presented and clear? Is the analytical approach integrated, reasonable and scientifically defensible? Are the key findings and issues supported by adequate research and analysis?
4. Is the best available science and information used in the Plan and is it defined, assembled, summarized and integrated into the analysis? Does the Plan identify gaps in data and research that limit the Plan and/or should be a priority for future research?
5. How well does the Plan integrate analyses at various spatial and temporal scales?
6. How well does the Plan address uncertainty? How could this aspect be improved?
7. Is the identification of key economic sectors in the Delta sound, and the analysis of the baseline and trends for key sectors of the Delta adequate?
8. Is the baseline estimate of Delta agricultural production accurate and reliable?
9. Is the multinomial logit model a methodologically sound approach for estimating the impacts of water policy proposals on Delta agriculture and/or on environmental change, such as salinity, on crop choice and production?
10. Is the interpretation of the model results reasonable and appropriate?
11. Is the economic impact analysis of Delta agriculture and recreation reliable? Are the multipliers reasonable and consistent with standard practice? Is the interpretation and discussion of results reasonable?
12. Are the standards recommended for the various Delta levees in the Plan adequately analyzed and scientifically supported?
13. Are cost estimates for levee improvement reasonable and supported?
14. Did the Plan effectively identify opportunities and strategies to protect and enhance the economic sustainability of the Delta?
15. Did the Plan effectively identify challenges and constraints to protect and enhance the economic sustainability of the Delta?

16. The coequal goals of the Delta Reform Act are “providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem. The coequal goals shall be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place.” Are the recommended strategies consistent with the coequal goals?