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## Delta Independent Science Board

Date: February 4, 2020

To: Delta Stewardship Council  
Planning and Performance Division  
980 Ninth Street, Suite 1500  
Sacramento, California 95814

From: Delta Independent Science Board

**Subject: Review of the Preliminary Public Draft  
Delta Plan Chapter 4 Ecosystem Amendment**

Sent via e-mail to  
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On January 10, 2020, the Delta Independent Science Board (Delta ISB) discussed the Delta Stewardship Council's (Council's) preliminary public draft of the proposed amendment to Chapter 4 (Protect, Restore, and Enhance the Delta Ecosystem) of the Delta Plan (Amendment) at its meeting. Our aims were to ensure that the Amendment is based on the best available scientific information and that past comments from the Delta ISB were adequately addressed. After our January 10 meeting, the Delta ISB was provided external peer reviews of five performance measures (PMs) contained in the Amendment. The PMs receiving external peer reviews were PM 4.6 (Doubling Goal for Central Valley Chinook Salmon Natural Production); PM 4.12 (Subsidence Reversal for Tidal Reconnection); PM 4.13 (Barriers to Migratory Fish Passage); PM 4.15 (Seasonal Inundation); and PM 4.16 (Acres of Natural Communities Restored). Each PM received three external reviews. Delta ISB members were then given an opportunity to provide further comments on the Amendment, both on the document as a whole and on the PMs, especially those that received external review. Comments from individual Delta ISB members that were received prior to our January 10 meeting are listed anonymously in Attachment A, and comments from individual Delta ISB members received after our January 10 meeting, and after receiving the external review comments, are listed anonymously in Attachment B.

Overall, the Delta ISB felt that comments from individual Delta ISB members, as well as the Delta ISB's overarching suggestions, (as outlined in [our letter](#) to the Delta Stewardship Council staff, dated September 27, 2019) had been reasonably addressed in the latest revision provided to us, but that there are still substantial shortcomings in the Amendment. Notably, our finding that the goals set for several of the PMs in the Amendment were unrealistic or overly ambitious has not been addressed. The Delta ISB recognizes that some of this stems from the statutory language in the Delta Reform Act, but as a scientific review body it is our responsibility to point out that the best available science is not being used when unrealistic goals and targets are established. We acknowledge that addressing this issue is outside of the authority of Council staff, and

we are discussing appropriate ways in which the Delta ISB might help bring this issue before the legislature.

Additional issues were highlighted in the external review comments for the five PMs. We commend the Council for seeking those reviews, and we also commend the depth and rigor of comments provided by the external reviewers. The Delta ISB largely concurs with the [external review comments](#), and we recommend that these comments be addressed to the extent possible, or that responses be provided in places where the external review comments cannot be addressed by Council staff. Based on the external review comments, as well as individual Delta ISB member comments, we highlight some of our continuing concerns with the Amendment and associated PMs:

***Adaptive management in the face of accelerating change:***

Changes in the Delta are becoming less predictable due to increased rates of change, complex interactions, unknown thresholds and greater frequency and intensity of episodic events. Thus, factors outside the control of management could change the trajectory and usefulness of the PMs over time. One way to address this is to acknowledge that the Delta is a dynamic system and incorporate adaptive management practices into the PMs. This should include setting short- and long-range goals, sometimes paying attention to trajectories rather than setting absolute targets, and including periodic review of the effectiveness of the PMs, with updates as necessary. Building contingencies into PMs will also allow room to adapt to as yet unknown conditions that will become a feature of the Delta as change accelerates. The Delta ISB held a panel discussion at our meeting on January 30, 2020, where the issue of accelerating change and its relevance to Delta science and management was discussed in depth (see [video recording of panel discussion](#)).

***Statistical power/precision:***

Numerical metrics should incorporate estimates of statistical power and precision. The ability to document progress over time will be dependent on rigorous data and consideration of uncertainty. We recommend that uncertainties be incorporated into the goals themselves as well as the metrics for assessing progress over time.

***Broader recognition of Native American practices:***

Native Americans altered the landscapes of the Sacramento and San Joaquin valleys in ways other than using burning to maintain the Delta landscape. For example, they tended sedge beds for basketry and managed the landscape in ways that promoted native plants. A broader recognition of Native American practices should be included in the Amendment.

We recognize the challenges involved in developing the Amendment, especially in developing PMs, and we commend the Council and staff for their diligent efforts. We especially commend the commissioning of independent external reviews of several PMs. We look forward to seeing the implementation of the Amendment and PMs and their value for management of the Delta.

***Attachments***

Attachment A: Individual Delta ISB Comments Received Before the January 10, 2020 Meeting

Attachment B: Individual Delta ISB Comments Received After the January 10, 2020 Meeting

## **Attachment A: Individual Delta ISB Comments Received Before the January 10, 2020 Meeting**

### ***Individual Review #1***

I have no further comments on the draft Delta Plan Ecosystem Amendment, as revised. The authors have reasonably accommodated my concerns about the specificity of some of the performance measure targets. While I would have preferred more probabilistic performance measures, I understand the reluctance to do so at this point. I thank the authors for their revisions.

### ***Individual Review #2***

The report is well written and interesting but still contains lofty and likely unreachable goals given the early statement in the report that the Delta ecosystem continues to decline. I then looked whether the most important aspects of our prior recommendations (about assumptions, uncertainties, bracketing ranges, using annual reporting and 5-year reviews) were addressed. On first reading, it seemed like the Council hardly addressed them. However, the Council's edits to the performance measures to our earlier comments did improve the document but really didn't go as far as we had hoped.

### ***Individual Review #3***

Council staff have responded very well overall to the comments from the Delta ISB concerning the draft Delta Plan Ecosystem Amendment Performance Measures. They seriously considered our comments, made substantive and credible changes in many places to address the issues we raised, and generally explained in other places why Delta ISB concerns are not being addressed, at least at this time.

However, I do think the Council's response at a past meeting, regarding our concern about some performance measures being virtually impossible to achieve, falls short of what is needed. Setting a goal that is impossible to achieve is not inspirational in my view—it instead sets up a public expectation of failure being inevitable.

### ***Individual Review #4***

The revised Delta Plan Ecosystem Amendment performance measures have incorporated feedback from the Delta ISB and the improvements address some of the concerns that were raised in our prior review. In particular, I appreciate the addition of background information that provides the basis for selection of some of the performance measures and the description of potential uncertainties. However, I still find some of the performance measures to be overly ambitious and have concerns about the feasibility of achieving some of the outcomes that are proposed. I understand the premise for setting ambitious goals, but the goals should also be realistic and feasible because the Delta Plan will not be well-served if its goals cannot be achieved.

Although the revised performance measures incorporate some short-term targets that offer the opportunity to change course and/or re-evaluate goals, I think there is still room

to give more consideration to adaptive management and alternative actions in cases where the targets may require adjustment. There are missed opportunities for better incorporating adaptive management into the performance measures (e.g., designing projects in an experimental context and using early projects as a tool for assessing design features that lead to greater success).

### ***Individual Review #5***

The request on August 21, 2019, from the Council staff to the Delta ISB was inappropriate. Delta ISB members were asked to accept the environmental goals of the Legislature as reasonable even if those goals seemed entirely unreasonable given the scientific knowledge of Delta ISB members. The first request to the Delta ISB started with the condition:

“Given the goals and strategies for protecting, restoring, and enhancing the Delta ecosystem in the 2009 Delta Reform Act,”

The Delta ISB’s letter of September 27 conveying the shared concerns of the Delta ISB noted that the goal of preventing any new invasives from becoming established was scientifically unrealistic. The Delta ISB suggested that the performance measures be expressed in ranges to account for the uncertainties. And the Delta ISB suggested that some of the performance measures could be contingent on the rate of environmental change that unfolds, for example, the rate of sea level rise to be more scientifically defensible.

The Council staff made some adjustments to the performance measures in response to the Delta ISB’s suggestions but defended at least some of the goals as at least “feasible” given the current scientific literature.

There are two problems with this response. Being scientifically feasible and being reasonable given management capabilities and constraints are not the same. And the current literature is based on research undertaken under current conditions, not those that are likely in the future based on current science.

If the goals sought by the Legislature ten years ago are not scientifically defensible, it is the responsibility of scientists to say so.

### ***Individual Review #6***

#### *Delta Plan Chapter 4:*

1. Overall, I agree with the general direction and ideas in the chapter. Portfolio approaches, need to address ecosystems and ecosystem functions rather than single species, etc. are all good themes for an ecosystem plan. The plan seems to touch on most of the important topics and ideas that should be in an ecosystem plan element.
2. The writing generally could use a fair bit of tightening.

3. Page 4-15. In the climate change box, the issue is more altered RUNOFF patterns, or altered runoff and precipitation patterns, than altered precipitation patterns.
4. "A call for action" is an odd heading title for a "plan." Perhaps "A need for action" would be better.
5. Page 4-19. Please cite science sources for the "currently estimated" need for 60,000 to 80,000 acres of new needed habitat.
6. The core strategies are useful foci. They will need to be developed and better integrated over time.
7. Figure 4-4 and the discussion of the importance of elevation is especially welcome, as is the discussion of restoration potentials for different parts of the Delta.
8. For the non-priority areas for restoration, what kinds of ecosystems can we expect to see? I am imagining good large-mouth bass fishing, which does support some Delta goals. Are these large areas to be written-off in some sense? What long-term objectives seem realistic?
9. Some fundamental resource limitations restrict our ability to restore or maintain Delta ecosystems. These include: land, land elevations, freshwater, initial and ongoing financial resources, tidal energy, science, and the effective organization of activities. All of these resources are scarce.
10. What should be the official ecosystem policy and plan when a subsided island fails? This is a levee policy, but also an ecosystem policy. When a Delta levee fails, should it be repaired or should the land be restored, or some combination? Since there are many possibilities, identifying the general policy issues and stating some general policy directions are probably all that can be done here. We are more likely to make such large landscape changes as responses to failures than in terms of planned actions and investments, so it seems important to have an ecosystem policy (and a levee policy) for responding to such failures and opportunities.
11. It would be useful to see a bit more on the need for ongoing long-term adaptation of ecosystem management over time. How should this need for adaptation mesh with the managing institutions and the development and revision of scientific information?

### *Performance Measures*

1. Performance goals should be separated from performance measures. Several of the current performance measures are essentially performance goals, many

of which are required by statute or regulations. For example, salmon doubling is a fine policy goal, but is silly and unhelpful as a performance indicator. A performance indicator or measure for salmon might be salmon adults returning or juveniles making it to sea. My goal might be to become a millionaire, and I assess my performance towards this goal as an annual assessment of my total wealth. This annual wealth assessment is my performance indicator. If we use goals directly as performance indicators, then we will be failing a lot! Worse yet, we will be focusing on the failure itself, which is just depressing, and not on how we can learn from existing performance to improve performance towards our goals.

2. Although I appreciate the value of quantitative performance measures, I also appreciate their inadequacies. Any periodic assessment of performance should have several parts, including a formal assessment of performance indicators. Other essential components should be more qualitative and interpretive. We should be less interested in indicator numbers than in what these numbers mean (including their limitations). We will get more out of our performance indicators if they are part of a more general performance assessment, which includes some expert assessments and forward-looking interpretations.
3. Overall, if performance indicators are to be central to plan performance evaluation, it is important to organize how the performance indicators will be used in broader assessments of plan performance and improvements. How can performance indicators, which require sizable quantities of blood and treasure from the staff, best contribute to improving policy and management conversations? This will require thinking about the performance indicators themselves and their communication, as well as how the policy discussions are organized, and how they are organized to digest performance assessments and performance indicators. This might merit some more formal discussion in the Plan.

### ***Individual Review #7***

I read the latest version of Delta Plan Chapter 4. All seem to be in good order, and the authors have done a great job in revising and responding to Delta ISB comments. A few comments are in order for further consideration, although not imperative to consider for inclusion in the final draft. The current amendment is in response to a 'fundamental shift' in modus operandi with regard to conservation and restoration planning for the Delta since the implementation of the Delta Plan (2013). It would be very useful to briefly mention what paradigm shifts have taken place in planning and executing projects within the broad coequal goals.

Chapter 4 specifically addresses protection, restoration and enhancement of the Delta ecosystem within the framework of best available science. Appendix Q2 (and hopefully Appendices Q1, Q2 and Q3 to be later uploaded) nicely addresses the context and best available science as a grounding for core categories of the chapter as well as meeting

recommendations of the Delta Reform Act (Water Code section 85302c). It is worthwhile to mention a few key recent science advances that could enhance ecosystems management in the Delta, which also provide further justification for the amendment. This is particularly useful given that a good deal of peer reviewed literature mentioned are pre-2013. It is a modern Delta, calling for the use of current science and designs. Science has limited utility in this case if it cannot help meet new challenges via eco-engineering designs (Mitsch and Jorgensen 1989; Poff et al. 2016).

The vision for a restored, yet dynamic, ecosystem is admirable, and emphasis on large scale interconnected ecosystem with natural (and human) communities is appealing. Attributes of such system and core strategies for achieving it is nicely laid out. It is also pleasing to see the emphasis on functional flow to achieve the vision. While discussions on challenges and possible solutions are well worthy, and have become communal and at time repetitious, the bane is the lack of quantitative understanding of flow-ecosystem interactions at different scales. For example, the birds can thrive across disconnected land patches separated by tens of kilometers, but for aquatic species a connectivity through channelization is necessary – as far as I know quantitative information on channels for adequate performance (number of channels, geometric parameters, flow rates through them etc.) is still unknown. A statement emphasizing focused research in areas of knowledge gaps that could help project design related to Chapter 4 will be helpful.

### ***References***

Mitsch, W.J. and Jorgensen, S.E. 1989. Introduction to Ecological Engineering, In: W.J. Mitsch and S.E. Jorgensen (Editors), Ecological Engineering: An Introduction to Ecotechnology. John Wiley & Sons, New York, pages 3 to 12.

Poff, N.L., Brown, C.M., Grantham, T.E., Matthews, J.H., Palmer, M.A., Spence, C.M., Wilby, R.L., Haasnoot, M., Mendoza, G.F., Dominique, K.C., and Baeza, A. 2016. Sustainable water management under future uncertainty with eco-engineering decision scaling. Nature Climate Change, 6(1), page 25.

## **Attachment B: Individual Delta ISB Comments Received After the January 10, 2020 Meeting**

### ***Individual Review #8***

Here are some general comments on performance measures, just under the wire. Sorry not to be able to provide a more probing analysis, but the external reviewers have done a good job. My comments, which are very general, may or may not be useful; all the points have been made before in one form or another. Here are my comments:

I read over the independent external reviews of the performance measures, and reviewed Appendix E, and skimmed through the latest version of the Ecosystem Amendment. The external reviewers' comments are really excellent. I have little to add, but would reiterate some points made already:

1. Use of "best available science" involves setting realistic goals and targets, defining quantifiable ways of measuring progress toward the goals, and establishing the confidence one can place in the results. In some cases the targets are not realistic (doubling runs of Chinook salmon and holding the line on invasive species have been mentioned), especially if they are legislatively rather than scientifically set. It's hard to use best available science if it is essentially precluded legally.
2. Gauging progress also requires that the metrics be measured in ways that allow estimation of statistical power and precision. This is not included; without such assessments, numerical results are uncertain and open to challenges.
3. A robust plan should include consideration of contingencies and alternatives. The apparent assumption that actions to meet objectives will be undertaken and will be effective is not stated; the consequences of not taking actions or being effective should be included, or at least a way of assessing those consequences.
4. Perhaps most troubling, the plan and performance measures do not appear to adequately consider the potential consequences of system dynamics, especially extreme events and long-term directional changes. Changes in the Delta are accelerating, interact in complex fashions, and are likely to pass thresholds more frequently. Although it's difficult to anticipate specific changes, the veracity and usefulness of performance measures will depend on those measures continuing to provide consistent information about the state of a system variable. This is not assured. The solution is to implement a comprehensive, rigorous, and nimble practice of adaptive management. Good performance measures can tell one when the management of a system should be adjusted or changed, but adaptive management also implies that the performance measures may themselves need to be changed as circumstances change. I didn't see much acknowledgment of this possibility.

### ***Individual Review #9***

I have read the external peer reviewer comments on *Performance Measure 4.12: Subsidence Reversal for Tidal Reconnection* and have no further comment on the performance measure. The peer reviewers raise legitimate concerns about the challenge of subsidence reversal and uncertainties that hopefully will be addressed.

I have a general comment about Preliminary Draft of Chapter 4. Although the Delta Reform Act declares that the Delta Plan provide a long-term vision for restoring interconnected habitats within the Delta and its watershed by 2100 (California Water Code section 85302[e][1]), it is becoming increasingly clear that many of the processes that drive the need for restoration are accelerating. I recommend that the implication of the uncertainty in future rates (both pre and post 2100) should be acknowledged and discussed in the chapter. In a way this uncertain future creates a tension between politically driven actions and the underlying science on which the actions are based. There is no easy answer here because political policy/action requires some degree of certainty and usually becomes less likely when uncertainty increases. Science by contrast can deal with uncertainty. In fact, uncertainty often becomes a study in and of itself. I recommend that the chapter address this challenge head on as a way of alerting the legislature.

### ***Individual Review #10***

#### *Delta Plan Chapter 4 Comments on Native American Practices*

Page 4-6 states:

“Indigenous peoples have lived in the Delta for thousands of years, and they made use of many Delta plant, animal, and mineral resources (Helzer 2015). Research over the past several decades has revealed extensive indigenous knowledge of the use of burning to manage the Delta landscape. Indigenous peoples used burning to maintain grassland cover and forage for animals, to improve seed and acorn access, to aid in hunting small game, to control chaparral distribution, and to reduce pathogens and parasites such as ticks (Anderson 2005, Keeley 2002). Euro-American settlement of the Delta had a devastating effect.”

The use of fire alone greatly underestimates the influence of Native Americans. What I learned for the invasive species review describes additional tending of plant species, as described by Michelle Stevens in Zedler and Stevens (2018) along the Cosumnes River:

“This was also the home of peaceful hunter-gatherers who thrived here 260 years ago. Their landscape was not free of human impacts, given that Native American populations were estimated at 79,100 in the Sacramento Valley and 83,800 in the San Joaquin Valley when the first Spaniards arrived in 1769 (Heizer and Alsasser p. 27). But when Native Americans hunted and gathered foods and tended sedge beds for basketry materials, any disturbed spaces were filled by native plants—there were no aliens, by definition.

Then, European settlers arrived and began converting extensive tidal and freshwater wetlands to arable land. New residents engineered reticulated streams and tidal sloughs into a labyrinth of channels and levees that altered hydrological conditions to suit crops, not Nature, leaving only scattered habitat remnants with native species.”

Refer to the Zedler and Stevens (2018) article for ideas about ecocultural restoration. The Delta Plan should celebrate the region’s Native American history.

See Stevens’ references in Zedler, J.B., and M.L. Stevens. 2018. Western and Traditional Ecological Knowledge in Ecocultural Restoration. *San Francisco Estuary and Watershed Science* 16(3): 1 to 18.

#### *Other Delta Plan Chapter 4 Comments*

- Page 4-14: From my reading, not all *Microcystis* strains are toxic; rather, some strains can produce a toxin, especially those that have urease and can use urea (as a fertilizer and in cow manure) as a nutrient source.
- Page 4-19: It will be hard to evaluate this one:
  - The Delta will provide more reliable water supplies, in part because survival of its wildlife, fish, and plants do not require extraordinary regulatory protection.
    - It’s unclear how reliability relates to “extraordinary” protection.
- Page 4-19: Whom do you consider to be “the first Californians”?
- Page 4-26: In order to determine whether additional species are benefiting from restoration, it should be clear that extensive baseline data will be needed.
  - Restorationists should be directed to the Society for Ecological Restoration’s new International Standards for Ecological Restoration, now online.
  - Karen Holl’s (UCSC) new Primer of Ecological Restoration should also be recommended, especially since it is accompanied by a Delta case study that is online.
- Pages 4-35 to 4-36: The point that subsided land is hard to restore is repeated several times.
- Figure 4-5: Useful diagram
- Fix 2 references in one:
  - Palmer, M.A., J.B. Zedler, and D.A. Falk. 2016. Ecological theory and restoration ecology. pp. 1 to 10 in Palmer, M.A., J.B. Zedler, D.A. Falk (eds.). *Foundations of Restoration Ecology*. Island Press, Washington D.C.
  - Pastor, M. 2007. Environmental justice: Reflections for the United States. *Reclaiming Nature: Environmental Justice and Ecological Restoration*: 351.