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# Planning Future Science Reviews

Draft (7/30/2020)

Delta Independent Science Board

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## Background

By legislative mandate, the Delta Independent Science Board (Delta ISB) reviews the adequacy of the science in support of adaptive management of the Sacramento-San Joaquin Delta and Suisun Marsh (the Delta). Completed reviews covered habitat restoration, water quality, fish and flows, the Delta as an evolving place, levee hazards, adaptive management, and the Interagency Ecological Program (IEP). Ongoing reviews on the monitoring enterprise, water supply reliability, and non-native species are expected to be completed by the end of 2020.

The Delta ISB review topics have been guided by both the Delta Plan and input from the Delta community through retreats, public comments, and surveys. Based on previous Delta ISB planning retreats, meetings, and [recent stakeholder feedback](#), below are a few topics that the Delta ISB is considering in the future. Topics are broken out by the chapters of the Delta Plan, and general topics that span the chapters of the Delta Plan.

With 12 topics under consideration, the Delta ISB is exploring whether to prioritize the following reviews, as discussed at the Delta ISB's May 2020 meeting:

- Subsidence Reversal (Led by Thomas Holzer)
- Water Quality and Hydrodynamic Modeling (Led by Harindra Fernando)

In addition, there is a strong interest to consider a review of the Delta Science Program itself. Whether to move forward with these topics will be discussed at a future Delta ISB meeting once current reviews have wrapped up.

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### Review Scope

As described in the Delta Stewardship Council's charge to the Delta ISB ([Appendix A in the Operating Guidelines](#)), "*The Delta ISB will review activities of science programs and projects for balance, rigor, and use of best available science.*" Prior to pursuing a major review topic, the Delta ISB will prepare a prospectus on the scope of the review and expected outcomes. During the [planning retreat in July 2017](#), the Delta ISB discussed the idea that each new major review should consider including the following items:

1. Climate change impacts,
2. Connections upstream and to the Bay,
3. Modeling and forecasting capabilities,
4. State of science integration,
5. Broad science vision on the topic,
6. Uncertainty, and
7. Science and social system linkages.

In 2019, there was a suggestion to also consider management tradeoffs in every review, while stressing the importance that each review should cover climate change, degree of uncertainty, and social science linkages.

## **Water Supply (Chapter 3) Review Topics**

The Delta ISB is in the process of finishing up its review on the science used to estimate water supply reliability. At this time, there are no specific ideas on future review topics.

## **Delta Ecosystem (Chapter 4) Review Topics**

Current and past Delta ISB reviews have centered around the core strategies presented in the Delta Plan from 2013:

- Create more natural functional Delta flows
- Restore habitat
- Improve water quality to protect the ecosystem
- Prevent introduction of and manage non-native species impacts
- Improve hatcheries and harvest management

With the exception of hatcheries and harvest management (resource use), the Delta ISB has undertaken reviews on each of the core strategies. Ideas under consideration are below.

### ***Restoring Ecosystem Function***

Restoration was the very first thematic review completed by the Delta ISB, and remains a core strategy in the upcoming amendment of Chapter 4 of the Delta Plan. There will be an opportunity to assess how the Delta ISB recommendations from 2013 were addressed, whether they are still relevant, and explore new ways of thinking on restoration in the context of novel ecosystems, resilience, and field experimentation.

### ***Climate Change***

Climate change will have major impacts on the ecosystem, which could result in higher temperatures, changes in the flow regime, sea level rise, changes in salinity, and other implications. Given the broad scope, the Delta ISB can break out the review in two parts:

- Sea Level Rise: This issue will affect water quality (temperature, salinity and dissolved oxygen), flows, habitats and food webs.
- Temperatures, Precipitation and Extreme Events: The Delta is undergoing rapid change and the planned workshop to inform a science needs assessment will identify some of the fundamental issues that could trigger a scientific review.

### ***Environmental Forecasting***

Adaptive management requires identification of expected outcomes and threshold triggers for action. The Delta ISB can review how well the science enterprise can forecast environmental changes, and at what time and spatial scales. This review could identify gaps in research to improve environmental forecasting.

## ***Subsidence Reversal***

*Potential Lead: Thomas L. Holzer*

The land surface of much of the Sacramento-San Joaquin Delta is below sea level (subtidal) because of oxidation of underlying organic soils that was caused by their dewatering for agriculture. Based on current projections of sea level rise, additional intertidal land areas underlain by organic soil are threatened to become subtidal as well from relative subsidence. This review will examine both the state-of-the-science and state-of-practice of subsidence reversal activities. These activities include nurturing growth of native tidal vegetation and accumulation of organic matter at a pace sufficient to achieve and to maintain an intertidal land surface elevation. Such activities are recognized in the Delta Reform Act as one of the strategies to restore interconnected habitat within the Delta. Subsidence reversal is explicitly addressed by Performance Measure 4.12 of the 2020 Ecosystem Amendment to Chapter 4 in The Delta Plan. The proposed Delta ISB review will consist of a report based primarily on a two-day workshop that will summarize current practice and understanding of organic-soil subsidence reversal and identify technical challenges to its successful implementation. The review will be primarily topical and will include experience in Southern Louisiana and other areas as well as the Delta. The review will also include subsidence reversal in deeply subsided islands that would be unlikely to reach intertidal elevation by 2100, the planning horizon of The Delta Plan, as well as an assessment of agricultural practices to reduce subsidence rates in deeply subsided islands.

## **Delta as an Evolving Place (Chapter 5) Review Topics**

In 2017, the Delta ISB finished a review on the research of the social and natural processes that sustain the unique values of the Delta as an evolving place. Current ideas on this review topic are below.

### ***Socio-Economic Drivers***

The Delta ISB is in the process of reviewing the monitoring enterprise in the Delta and assessing whether information obtained from monitoring are meeting the needs of management. Given the potentially vast scope of socio-economic monitoring related to the Delta, the Delta ISB's current review will only focus on the direct socio-economic drivers of ecosystem change, such as hydrologic alterations (e.g., water exports), habitat alterations (e.g., levees), biological resource use (e.g., fishing), human intrusion and disturbance, and transportation and service corridors. It will not focus on indirect socio-economic drivers of ecosystem change, such as demographics, economics, politics or religion. The Delta ISB could conduct a review on socio-economics drivers that were considered out of scope for the current monitoring review.

## **Water Quality (Chapter 6) Review Topics**

In 2018, the Delta ISB finished a review on contaminants and nutrients research in the Delta, and on how research findings have been used in decisions related to ecosystem health in the Delta. Current ideas on this review topic are below.

### ***Water Quality and Hydrodynamic Modeling***

*Potential Lead: Harindra Fernando*

Hydrodynamic and water quality modeling is key to evaluating the short and long term future of the Sacramento–San Joaquin Delta in terms of the California co-equal goals of ecosystem health and reliable water supply. Water operations in the Delta depend on planning and operational understanding as well as analyses of the interaction of Delta hydrodynamics and water quality. Different types of hydrodynamic models are used to calculate spatial and time distribution of water velocities (speed and direction) and water levels with suitable space-time resolutions, and it is customary to couple hydrodynamics with salinity and temperature calculations.

Additional variables of water quality concerns include transport of sediments (turbidity), nutrients and species. Such variables are calculated by passing on information from hydrodynamic to water quality models, where transport and mixing as well as rates of chemical and biological processes are computed. Several computer models are commonly employed for Delta hydrodynamics and water quality calculations, including DSM2, SCHISM, RMA2, UNTRIM, and Deltares codes. These models have different complexity (1D, 2D and 3D), architecture, institutional origins and support, performance, applicability, and capabilities. The diversity of applications as well as differing performance of these models seem to indicate that a review of their efficacy for Delta applications, particularly based on the experiences of the user community, is timely.

## **Risk Reduction (Chapter 7) Review Topics**

In 2016, the Delta ISB finished its review on earthquakes and high water as hazards to Delta levees. At this time, there are no specific ideas on future review topics.

## **General Review Topics**

### ***Professional Support for Science and Quality of Scientific Communications in the Delta***

Two common concerns for Delta science and its involvement in decision support are the professional support and development of scientists and science communications among agencies. These topics have been mentioned as important and perhaps less than optimally effective in the Delta. The first concern commonly involves access to professional journals, incentives for peer reviewed publication, management training, and travel to conferences. The communications concern can have many aspects,

including: effective professional communications, communications of science across agencies and programs involved in the Delta, and effective communications generally among scientists, managers, policy-makers, and the public.

This is an important topic and it should be done as an external review if it is not undertaken as a review of the Delta ISB.

### ***Emerging Tools***

New technologies can enable scientists and managers to assess the status of critical resources and the condition of Delta ecosystems more rapidly, more precisely, and more efficiently, thereby enhancing monitoring and adaptive management. This review would focus on how technologies, such as environmental DNA (eDNA), remote sensing and tracking, uses of drones, artificial intelligence, risk assessment and decision-support, and other technologies can contribute to the effective management of the Delta and its resources. It might also explore the potential uses of genomic tools, such as CRISPR-Cas9 and gene drives to control or eradicate invasive species.

### ***Data Management***

This review could focus on how data are collected and managed in the Delta to inform adaptive management. A recent article by [Pendelton et al. \(2019\)](#) looked at the challenges of data management, sharing, and analysis to inform management of ocean ecosystems. The article provided solutions to overcome these challenges and how to make better use of all the collected data. A similar review could be pursued in the Delta. The Delta ISB could review the implementation of Assembly Bill 1755 (“The Open and Transparent Water Data Act”), and the efforts of the California Water Quality Monitoring Council and the IEP’s Data Utilization Workgroup to improve data management and usability in the Delta. Aspects of data management have been covered in the Delta ISB’s adaptive management review and IEP review, and will likely also be covered in the Delta ISB’s review on the monitoring enterprise.

### ***Endangered Species Act Regulations***

The Endangered Species Act and the regulations to enforce it have led to conflicts between various stakeholders in the Delta, particularly as implementation of the Act has affected the allocations of water between fishes and farmers. A deep analysis of the provisions of the Act, what the Act requires, where there is flexibility in implementing its requirements, what the trade-offs entail for whom, and the implications of political challenges to the Act could provide clarity and define potential pathways toward resolving conflicts.

### ***Performance Measures***

Performance measures have become central to the Delta Plan and its implementation. This Delta ISB review would examine the process of developing, adopting, implementing, employing, and improving performance measures for various aspects of

the Delta, and their potential for value and standardization across Delta management and regulatory agencies. The review would also include an assessment of the use of science and scientific programs to support, improve, and supplement performance measure assessments. Generic and specific weaknesses of performance measures would also be addressed.

## **Program Reviews**

### ***Delta Science Program***

The Delta ISB recently reviewed a specific science program, the IEP, because of its importance to the overall Delta science enterprise. Another very broadly influential science program in the Delta is the Delta Science Program. Thus, it may be appropriate for the Delta ISB to review this critical science program. Whether the Delta ISB should conduct the review itself, or work with others to commission and conduct a review, should be the subject of additional discussion.