# INFORMATION ITEM

Delta Independent Science Board Update: Water Supply Reliability Estimation Review

**Summary**: Dr. Jay Lund and Dr. Thomas Holzer of the Delta Independent Science Board (Delta ISB) will present the Delta ISB's findings and recommendations from the most recent Delta ISB review on water supply reliability estimation, which is the formal process of quantitatively predicting performance and water delivery from a water supply system under a variety of conditions.

## BACKGROUND

As mandated by the Sacramento-San Joaquin Delta Reform Act of 2009, California Water Code sections 85000, et seq., (Delta Reform Act), the Delta ISB is responsible for providing oversight of the scientific research, monitoring, and assessment programs that support adaptive management in the Delta (Water Code Section 85280(a)(3)) and providing independent advice on the Delta Plan (Water Code Section 85308(a)). The Delta Reform Act requires the Delta ISB to submit a report to the Council on the results of each review, including recommendations for any changes in the programs reviewed. (Water Code Section 85280(a)(4).) The findings and recommendations from the Delta ISB inform updates to and the implementation of the Delta Plan, the Science Action Agenda, the Delta Science Plan, and other Delta Stewardship Council (Council) and Delta Science Program efforts.

The Delta ISB reviews programs that support adaptive management by "thematic" or topical areas to meet its legislative mandate. To date, the Delta ISB has completed and presented the following thematic reviews to the Council: restoration (2013), fish and flows (2015), adaptive management (2016), levee hazards (2016), Delta as an evolving place (2017), water quality (2018), the Interagency Ecological Program (2019), non-native species (2021), and the monitoring enterprise review (2022). In addition, the Delta ISB also reviews specific science documents related to adaptive management or the Delta Plan. These reviews can be either self-initiated or based on a specific request from an individual or entity.

As described in the Delta ISB's operating guidelines, the comments, findings, and recommendations of the Delta ISB are expected to increase scientific credibility, improve research clarity, advance the debate about Delta issues, and seek better connectivity between science, management, and policy. The communication and

relationship between the Council and Delta ISB are critical for helping to inform the Council's work.

The Delta ISB operating guidelines can be found here (https://bit.ly/3xvCqAY).

Since the last update to the Council in April 2022, the Delta ISB completed its review on the water supply reliability estimation. A reliable water supply for California is defined in the Delta Plan as "better matching the state's demands for reasonable and beneficial uses of water to the available supply." Water supply reliability estimation, the subject of this review, is the formal process of quantitatively predicting performance and water delivery from a water supply system under various conditions.

The review, which was the first Delta ISB review to focus on water supply reliability, sought perspectives from stakeholders, managers, and experts through formal presentations and questionnaires, a workshop, and interviews. It draws heavily from these forums and the scientific literature.

## HIGHLIGHTS FROM THE WATER SUPPLY RELIABILITY ESTIMATION REVIEW

This review led to the following findings and recommendations on the science and practice of water supply reliability estimation and analysis. Implementing the recommendations can help improve reliability estimates and their communication for policy and management discussions and decisions and help identify promising alternatives for managing water. For the full report, please see Attachment 1. For the summary sheet, please see Attachment 2.

### Findings

*Broad Importance of Water Supply Reliability and Estimations*

1. Water supply reliability estimation and analyses are increasingly being applied to adaptively manage water supplies in systems with interacting changes in climate, water demands, regulations on water quality and environmental flows, and system disruptions from extreme events.

2. Most major water suppliers (urban and state projects) and regulators employ formal reliability analyses to improve water operations, planning, and policy decision-making in California and the Delta.

3. Meeting ecological goals requires reliable water supplies and will require reliability analyses for environmental purposes. Methods to quantify water reliability to meet ecological goals, including recently developed methods, need significant improvement and wider application.

4. Reducing risks to human, agricultural, and ecological systems from drought under changing future climates is a major motivation for current efforts to improve water supply reliability analyses.

*Water Supply Reliability Estimation and Analysis*

5. Improving reliability estimation and analysis for water supplies will require managing many risks and uncertainties. These risks include drought, natural catastrophes (floods, wildfires, and earthquakes), mechanical breakdowns, chemical contamination, and changing climate. It also will require addressing maladapted or inflexible management systems designed for past conditions, including regulatory restrictions, over-allocation of water, and human water use behavior.

6. A portfolio approach (i.e., integrated management of both demands and supplies) has a long history of effectiveness in California. Urban water systems, particularly in southern California, are international leaders in combining portfolio management and reliability analysis. Agricultural users are moving in this direction by using new water management approaches. Water systems that support ecosystems could become more adaptable, resilient, and effective by employing portfolio management of supplies and demands for water and habitats. Water management portfolios often include cooperation across water use sectors, regional and statewide.

7. Reliability under a changing climate depends on early and effective preparations by local and regional water agencies. In particular, sea level rise in the Delta (and its effects on encroaching salinity, flooding, and water quality) and increased water temperatures affecting ecosystems will have wide-ranging implications on the reliability of water supplies in California for all water uses.

8. Many approaches have been used in California to estimate water supply reliability. Each approach has advantages and limitations. Methods developed for narrow applications tend to be more rigorous but are not easily adapted to other applications.

9. Two approaches to estimate water supply reliability are in use. Probabilistic approaches capture much of the variability of changing conditions and, therefore, support the development of balanced water management portfolios. Non-probabilistic scenarios and sensitivity analyses are useful to explore the stability, impacts, and adaptability of water management solutions under uncertainties that cannot be reliably predicted. Results from both approaches may be challenging to communicate with decision-makers, stakeholders, and the public.

*Reliability Analyses for Management and Policy*

10. Water supply reliability estimates are sensitive to underlying assumptions, but the potential impacts of uncertainty on management recommendations are rarely made clear and explicit to managers and stakeholders.

11. Water supply reliability analyses are widely employed but could be better integrated into and communicated to water operations, planning, and policy decision-making to improve, focus, and structure deliberations on performance and trade-offs among multiple objectives.

12. State, regional, and local agency expertise in water supply reliability estimation is scarce and often not current with the state of the science and escalating challenges and opportunities. This staffing problem is likely to worsen as demands on agencies increase and senior staff retire.

Recommendations

*Practice*

1. *Most water supply reliability analyses in California should reflect more complex portfolio-based water management to improve cost-effectiveness and equity of regional water management among diverse entities*. Portfolio management includes evaluating interacting surface-water and groundwater sources, infrastructure operations, and water demand management within and across water use sectors.

2. *Performance assessment of water system reliability should be broadened beyond technical reliability to include multiple benefits that support public health, economic, ecological, and social objectives.* Performance-oriented assessments are particularly urgent for ecological objectives and will require

the co-development of performance indicators among stakeholders, regulators, modelers, and system managers.

3. *More formal quality control and documentation of water supply reliability analyses should be encouraged and sometimes required.* More formal documentation, testing, and data and model availability would improve the compatibility of results among studies and alternatives, and aid in integrating water supply reliability estimation into decision-making and policy discussions.

4. *A common State water accounting system that includes documentation, interpretation, testing, and standardization should be developed to improve analysis quality, comparability, and communication for technical and non-technical audiences.* The California Department of Water Resources and the State Water Resources Control Board could jointly administer such an accounting system and its technical expectations. Other states, such as Colorado, provide good examples.

5. *The next generation of state-sponsored water supply system models for reliability estimation should be developed, updated, and evaluated by a broad consortium of state and federal agencies and external experts that applies the best feasible science and addresses regional needs.* Well-led collaboration and coordination could reduce development costs while improving model utility and coordination across regional operations and management issues. The ongoing need for system-specific models and expertise for some decisions favors a layered approach to model integration. Developing system-specific models with different but interconnected levels of sophistication would increase model comparability, facilitate upgrades, and broaden the scope of analyses.

*Research*

6. *Specific performance metrics and analysis methods for water supply reliability estimation for environmental purposes should be further developed and employed to better inform policies that support the Delta's coequal goals.* An approach based on functional flows, assessed empirically or mechanistically, shows promise to reflect the reliability of meeting ecosystem water demands spatially and temporally and improving water management for ecosystems. In addition, meaningful engagement with additional cultural, commercial, and recreational stakeholders would deepen

understanding of broader environmental flows in water operations compatible with a range of water system users.

7. *Estimation methods should be updated to reflect accumulated and expected climate change effects and combined with uncertainty analysis.* This would improve long-term planning and policymaking as well as seasonal operations planning. Combining scenario-based and probabilistic analyses can quantify uncertainties and identify promising adaptable portfolios of management actions.

8. *Investment in research and education should increase to improve water supply reliability estimation science and practice.* Some recommended areas of research and funding emphasis include: a) nexus of water quality and water supply reliability; b) modeling portfolio planning and operation for large regional water systems with local water systems and climate uncertainties; c) applications of ecosystem performance indicators in water and environmental management; d) applying and communicating uncertainty analyses in planning and policy decisions; and e) education of staff in State agencies to promote more rigorous, advanced, and insightful analyses.

## FISCAL INFORMATION

Not applicable

## LIST OF ATTACHMENTS

Attachment 1: Review of Water Supply Reliability Estimation Related to the Sacramento-San Joaquin Delta

Attachment 2: Summary Sheet - Review of Water Supply Reliability Estimation Related to the Sacramento-San Joaquin Delta

## CONTACT

Jay Lund, Ph.D.
Past Chair, Delta Independent Science Board
Phone: (916) 902-6571