

Agenda Item: 10A
Meeting Date: June 8, 2005

JOINT MEETING WITH BAY-DELTA PUBLIC ADVISORY COMMITTEE

**CALIFORNIA BAY-DELTA AUTHORITY
INDEPENDENT SCIENCE BOARD LEVEE INTEGRITY REPORT**

Summary: The Independent Science Board (ISB) of the California Bay-Delta Authority is actively examining the use of science to support decision-making within the CALFED Program, including work on levees.

Recommended Action: This is an information item only.

Background

In 2004 an ISB fact-finding team conducted an initial investigation regarding levee integrity in the face of changing conditions in the Delta and produced a report entitled, *Subsidence, Sea Level Rise, Seismicity in the Sacramento-San Joaquin Delta: Report to the Levee Integrity Subcommittee of the California Bay-Delta Authority Independent Science Board*.

The ISB formed the Levees Subcommittee to collect more information and formulate recommendations to the Authority about what technical studies needed to be performed to assess the significance of subtle, long-term, large-scale changes occurring in the landscape of the Bay-Delta. The ISB Levees Subcommittee drafted a report entitled *Report and Recommendations Regarding Levee Integrity in the Sacramento-San Joaquin Delta* and presented it to the ISB on May 12, 2005 (Attachment 1).

Summary of Report

The potential for catastrophic failure of levees in the Delta has been apparent for many years, but has received renewed attention due the Jones Tract failure of 2004, which resulted in damages estimated at \$90 million, and recent studies pointing to the continuing nature of subsidence in the Delta. Other recent studies estimate costs associated with widespread levee failure under optimal conditions. Lower bound impacts to agricultural users in the San Joaquin valley range from \$300 to \$500 million, while costs to urban water districts and their customers will range from \$500 million to \$3 billion, depending on the scenario. The recommendations presented aim to focus studies concerned with reducing risks to the full range of CALFED interests in the Delta, ensuring that CALFED program decisions and policies are informed by the most current scientific understanding of the issues involved.

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List of Attachments

Attachment 1 – Report and Recommendations Regarding Levee Integrity in the Sacramento-San Joaquin Delta

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**CBDA INDEPENDENT SCIENCE BOARD
REPORT AND RECOMMENDATIONS REGARDING LEVEE INTEGRITY IN THE
SACRAMENTO-SAN JOAQUIN DELTA**

May 12, 2005

Background

The potential for catastrophic failure of levees in the Delta has been apparent for many years, but has received renewed attention due the Jones Tract failure of 2004, which resulted in damages estimated at \$90 million, and recent studies pointing to the continuing nature of subsidence in the Delta. Other recent studies estimate costs associated with widespread levee failure under optimal conditions. Lower bound impacts to agricultural users in the San Joaquin valley range from \$300 to \$500 million, while costs to urban water districts and their customers will range from \$500 to \$3,000 million, depending on the scenario. The recommendations presented here aim to focus studies concerned with reducing risks to the full range of CALFED interests in the Delta, ensuring that CALFED program decisions and policies are informed by the most current scientific understanding of the issues involved.

Findings

1. Mount and Twiss (2005) note that the probabilities of significant flood flows and earthquake occurring during the next fifty years are high. These events are expected to cause dramatic changes within the infrastructure of Delta levees, and to result in associated effects on land uses, ecosystem services and the ability of the state to deliver water to contractors. *The ISB agrees with the authors that the current condition of levees and rate of levee maintenance in the face of such cumulative hazard would embed high risk to ecosystems, water users, in-Delta land use, and to society in general because of the large geographic extent, and the multi-faceted nature of the consequences of both catastrophic and chronic failure patterns.*
2. A large effort is already being devoted by CALFED and associated programs to addressing some of the levee instability issues raised in Mount and Twiss (2005). Innovative studies currently being conducted for other purposes, such as ecosystem restoration, can be incorporated into the broader assessment of likely consequences of levee instability.
3. The specific risk of levee failure due to seismic activity was assessed by Torres et al. (2000). The assessment is generalized due to the lack of specific soil and substrate information available for Delta levees, exacerbated by the extent of the problem and the cost of traditional coring approaches. *The ISB recognizes that one of the fundamental limitations to assessing the risks associated with Delta levee fragility is the limited extent of geotechnical information for hundreds of miles of levees.*
4. A recent exploratory study of the economic consequences of catastrophic levee failure (Illingworth et al, 2005) included a deterministic analysis of two scenarios of breaching 30 to 50 levees in mid-summer. Their estimates of up to \$500million (in 2003\$) for agricultural users in the San Joaquin valley, and \$3 billion for urban water districts and their customers, represent a lower bound on the economic consequences of such events, as the analyses assume a short-term impact that can be easily accommodated by water users. Longer-term disruptions increase cost by at least an order of magnitude. In addition, these costs do not reflect costs to Delta agricultural lands, to infrastructure, and to ecosystem services. *The ISB*

5. *appreciates that potential costs of levee failure are significant; responding to such events after the fact would impose severe financial stress on public and private resources.*
6. The passage of the CALFED Bay-Delta Authorization Act in 2004 allows the Corps of Engineers to undertake the construction and implementation of levee stability programs or projects for such purposes as flood control, ecosystem restoration, water supply, water conveyance, and water quality. The Act also calls for the Corps to submit a report describing priority levee stability reconstruction projects for 2005 through 2010. Although the Act authorizes \$90 million for levee stability activities in this multi-purpose context, these funds have not yet been appropriated and the report has not been completed. *The ISB notes that the current authorization of federal funds is unlikely to address the problem adequately.*
7. CA Department of Water Resources, in conjunction with the CA Department of Fish and Game and the Corps, has recently initiated a Delta Risk Management Study (DRMS), which will address the ecological as well as economic consequences of levee failures. *The ISB supports the efforts of the agencies in moving this study forward so quickly and endorses the broad scope envisaged for the study.*

Recommendations

1. Additional economic studies should be conducted that:
 - Use a probabilistic framework to link the cost of various actions to the benefits of likely outcomes, and which encompass a broad range of interacting effects on Delta infrastructure, agricultural lands, recreation, water quality, and ecosystem services.
 - Consider various ways of funding levee integrity programs and policies using established objective, analytical economic tools, and paying attention to likely subtle and secondary costs and benefits in both public and private sectors.
2. Evaluation of Delta risk management strategies and policies should:
 - Consider the risk, cost, and benefits to all appropriate programs. Linkages among levee system stability, water management, navigation, agricultural practice, recreation, and ecosystem restoration must be identified to enable all interested parties to identify possible synergies and/or conflicts among their policies and plans.
 - Be undertaken in the context of a broad range of long-term future scenarios for the Delta. These scenarios should include projections of climate change and sea level rise, land use changes, and demand for exported water over the next 50 to 100 years.
3. Priority data needs should be met by the immediate development of a multi-year plan to meet the need for geotechnical information. Critical uncertainties will continue about all projections of risk until this information is collected and reviewed by a wide range of experts. This plan should address data gaps, prioritize data collection, and approaches to assimilating new information into risk assessments. It should also provide for the incorporation of emerging sensing technologies that will allow cost-effective assessment of Delta substrates over large areas.
4. Scientific credibility of products should be assured by:

- Making past and present research and analysis by CALFED agencies associated with levee integrity broadly accessible and subject to peer review, including publication in the scholarly literature as appropriate.
- External review should be incorporated into the DRMS using one or more workshops to evaluate the study's methodology, findings, and conclusions. One workshop should be conducted midcourse of DRMS, at a point where the basis for risk estimates and the set of risk management strategies to be considered are available for review and might profit from feedback. Further external review will be appropriate at the conclusion of the study.

While many of these recommendations could be incorporated directly into the existing DRMS, the ISB urges the Authority to ensure these recommendations are carried through in whatever context is necessary to ensure that future management of Delta levees can be informed by scientific understanding of future landscape changes, and state of the art science and technology. The ISB is willing to provide any additional assistance that may be necessary for the CALFED agencies to carry through these recommendations.

Summary

The integrity of Delta levees is one of the most important issues facing the CALFED Bay-Delta Program in the near-term and the long term. Levee failure portends economic damages in the tens of billions of dollars. The ISB is concerned that a broad range of alternative solutions needs to be developed and evaluated. These alternatives must reflect the implications of long-term trends in physical and anthropogenic processes, including sea level rise, climate change, human demographics and land use patterns. The DRMS is an important first step but will only provide policy-relevant guidance to CALFED if it develops and evaluates a broad range of interactions and solutions. The cost of these remedies will undoubtedly be substantial. Alternative funding mechanisms need to be evaluated using analytical tools.

References

- Mount, J. and R. Twiss. 2005. Subsidence, sea level rise, and seismicity in the Sacramento-San Joaquin Delta. *San Francisco Estuary and Watershed Science*. Vol. 3, Issue 1 (March 2005), Article 5.
- Torres, R., N. Abrahamson, F. Brovold, G. Cosio, M. Driller, L. Harder, D. Marachi, C. Neudeck, L. O'Leary, M. Ramsbotham and R. Seed. 2000. *Seismic Vulnerability of the Sacramento-San Joaquin Delta Levees*. Seismic Vulnerability Subteam, Levees and Channels Technical Team of CALFED. 30 pages plus appendices.
- Illingworth, W., R. Mann, S. Hatchett and R. Hoagland. *Economic Consequences of Water Supply Export Disruption Due to Seismically-Initiated Levee Failures in the Delta*. Executive Summary of White paper prepared for DWR, February, 2005.