

## **Delta Levee Investment Strategy: Risk Analysis Methodology & General Updates**

---

**Summary:** This report provides information about one element of the proposed methodology for the Delta Levee Investment Strategy: risk analysis. In addition, staff will provide general updates on progress related to public outreach and communication, overall methodology development, and the independent peer review process.

---

### **Background**

In February, staff presented the Council with the concept of tolerable risk as it relates to the Delta Levees Investment Strategy (DLIS). Staff provided information about the types of risk the Delta islands and tracts face, how they propose to measure risk for these islands, and a means to develop levels of tolerable risk for the region. This month's report will focus on proposed methods and metrics for assessing risk of levee failures on State interests in the Delta and for evaluating the effectiveness of proposed levee investments in reducing risk.

### **Introduction to the DLIS Methodology: Risk Analysis**

Risk is defined as the probability of an adverse event occurring multiplied by the consequences that event might cause. In the early phases of the DLIS project, we developed an inventory of assets throughout the Delta and identified the hazards that threaten the Delta. The focus of the DLIS risk analysis is on how those assets are threatened by hazards; in this case, the consequences of flooding caused by levee breaches. As a first step in the risk analysis, the probability of flooding caused by each of two factors (hazards) – river flooding and seismic failure – is assessed. The consequences in the Delta resulting from these two independent events are calculated; risk is defined when the probability of the hazard occurring is combined with those consequences.

Specifically, the Council is interested in the risk to State interests in the Delta, broadly defined, to include risk to human life and property, risk to water supply reliability, risk to ecosystem function, and risk to the Delta as a Place, especially agriculture. The risk of property damage due to flooding, expressed as Expected Annual Damage (EAD), is a commonly used metric to illustrate how risk is calculated. In this case, EAD (or risk of property damage) is equal to the probability of a flooding event multiplied by the value of assets exposed to flooding multiplied by the proportion of those assets that are damaged by flood waters.

In addition to EAD, the DLIS project team is in the process of identifying other metrics that may be used to describe the risks to State interests in the Delta. A key metric commonly used in flood risk analysis is Expected Annual Fatalities (EAF), which describes the risks to human life. Other metrics to assess risk to State interests are

being developed to characterize unique issues in the Delta, for example flood risk to water supply reliability, to ecosystem function, and to agriculture and other unique Delta values.

The results of the risk analysis to State interests in the Delta will be illustrated in a series of maps, one each for risks to life, property, water supply, ecosystem, and Delta as a Place. Together these maps will describe baseline risk in the Delta. The baseline risk analysis will be used to assess the impact of future uncertainties on risk, including the impact of sea level rise and altered weather patterns due to climate change. Baseline risks will also be used to determine the effectiveness of proposed investments in levee improvements in reducing risks in the Delta.

### **Update on Other Delta Levees Investment Strategy Activities**

In addition to the activities above, staff also has been working on other tasks related to the Delta levees investment strategy. These include:

*Communication Strategy and Outreach Efforts.* Staff continues to meet with key stakeholders and technical experts to provide an overview of the project and to solicit input on the information being assembled. During March staff:

- Coordinated a Delta tour for visiting technical experts and a technical/policy workshop for those experts and the Council. The workshop focused on levees and risk management, State-level interests, goals and objectives related to investments in levees and sociological aspects of risk management (3/10-11 See section below for summary of this workshop).
- Met with the engineers and local stakeholders that represent the Delta's Reclamation Districts to provide updates on the project (3/12).
- Met with local stakeholders to discuss alternative approaches for guiding State investments in Delta levees (3/13)
- Hosted a Technical Resource Pool workshop to discuss methods for forecasting the probabilities of levee failures and for estimating risks to people, property, and agriculture in the Delta as well as a discussion of methods for estimating risks to water supply reliability and the Delta ecosystem (3/19).
- Will provide a presentation to Delta Conservancy Board on the DLIS (3/25).
- Will meet with local flood agencies (Sacramento, West Sacramento and San Joaquin) and with Suisun Resource Conservation District (3/25).

Upcoming events include:

- Hosting public meetings in Stockton (4/27) and Walnut Grove (4/29) to provide an update on the project.

*Data Compilation and Review.* Staff to date has received five technical memoranda from the consulting team. The memoranda, received in the order below, contain information about:

- Delta islands and tracts assets, hazards to the Delta levees, and categories of beneficiaries
- Available data and methodologies for analysis of flood risks, vulnerabilities, and consequences
- Tolerable risks to Delta islands and tracts
- Consequences of levee failures, methods and metrics for assessing these consequences
- Cost allocation methodology

Staff and various technical experts have reviewed and commented on the first two memoranda and the remaining three are currently under review. These technical memoranda are being distributed to various technical experts for review. The baseline information in these reports will carry into subsequent project work and will be the subject of the independent peer review on the methodology.

A fuller suite of methods to manage and reduce risk such as, flood proofing, emergency management, evacuation routes, etc. will be included in several of these technical memoranda and discussed in the draft levee investment strategy as “companion” recommendations to more traditional and structural methods such as levee improvements.

*Independent Scientific Review Panel (May-June 2015).* Staff continues to prepare for the peer review of the project methodology starting in April 2015.

### **Council-expert workshop about Delta levees and risk management**

As part of this ongoing discussion, the Council hosted a workshop on March 11 that focused on levees and risk management, strategies for State investments to reduce risk while meeting multiple objectives and issues related to liability. Experts from around the country and this region engaged the Council in a dialogue about these topics. The workshop was structured as a conversation between the Council members and the invited experts, with opportunities for the Council and panelists to receive public comment. Highlights of the advice the staff gleaned from the discussion includes:

- Provide the big picture. Several panelists advised that the Council’s Delta levee investment strategy should provide a technically sound “big picture” strategy for risk management and levee investments in the Delta that complements initiatives for water supply reliability and ecosystem restoration. The Delta Plan provides the foundation on which that big picture should build, Jeff Mount reminded us. In Louisiana, the “big picture” provided by the Corps’ New Orleans flood control plan and the state’s coastal restoration plan communicate how those plans pursue the common good. A map of a potential future Delta proposed in PPIC’s *Comparing Futures for the Sacramento-San Joaquin Delta* (2008) is an example of how the Delta levee investment strategy could depict a ‘big picture’ for the Delta (Attachment

2). The Council should draw the “big picture” from the top down, assembling it from actions proposed from the bottom up.

- Protecting lives, furthering the coequal goals, and protecting the economy are worthy aims. Protecting lives is an essential interest. The coequal goals of a more reliable water supply and a healthy Delta ecosystem are keys, too, said Jeff Mount. Also important is protection of the economy through Delta levees’ contributions to water supply reliability, protection of other infrastructure, and protection of other economic sectors important in the Delta, Alicia Kirchner said. Not all islands will be priorities, Jeff Mount noted. Some are important to water quality or ecosystem protection, for example, but not others.
- Plan to win allies. Identifying economic and other beneficiaries of levee investments can win allies to support public funding, Paul Kemp said. Public involvement during the strategy’s development can communicate and build the case for investment. There will be losers as well as winners. According to Ed Link, spreading the funds too widely, rather than targeting them at high priorities, dilutes the benefits. Transparency and fair treatment can blunt but not avoid losers’ disappointment, Larry Larsen said
- Use a full menu of tools to reduce risk. Reducing risk is the best measure of effectiveness, advised Ed Link and Larry Larsen. The full range of tools, not solely levee improvements, should be used to reduce risks, several panelists recommended. Dennis Mileti listed risk communication, flood warnings, evacuation planning, elevated shelters, and other emergency responses that can complement levee improvements to reduce risk. California’s earthquake risk reductions programs provide some useful models.
- Implementation matters. The strategy may be big, but implement it in fundable increments to allow adjustment based on experience and opportunity, panelists said. Too many implementing agencies dilutes responsibility and hinders execution, so consider New Orleans’ response of consolidating levee agencies, suggested Paul Kemp. The Delta levee subventions program can allow low cost, bottom-up implementation within a larger strategy’s framework.
- Cost sharing matters. Flood control is a negotiation between those who are protected and those who will pay to protect them, said Paul Kemp. Money is always short, so everyone who benefits needs to have “some skin in the game”, said Larry

Larsen. Federal funds are unlikely to be available, except for disaster response and recovery, Jeff Mount said.

- Identify and remove barriers. Acknowledge obstacles and plan to remove them, recommended Alicia Kirchner. We created the status quo, and can change it. Engaging allies to alter laws, programs, and organizations when needed builds support for plan implementation, Paul Kemp said.

### **List of Attachments**

Attachment 1: Presentation “Delta Levees Investment Strategy – Methodology and Metrics”

Attachment 2: Land and Water Use in an Eco-Friendly Future Delta figure from PPIC’s Report: *Comparing Futures for the Sacramento-San Joaquin Delta* (2008)

### **Contacts**

Dustin Jones  
Supervising Engineer

Phone: (916) 445-5891

You Chen (Tim) Chao  
Senior Engineer

Phone: (916) 445-0143