Delta Risk Management Strategy (DRMS) Phase 1

Risk Analysis Report

Draft 2

Prepared by:
URS Corporation/Jack R. Benjamin & Associates, Inc.

Prepared for:
California Department of Water Resources (DWR)

June 15, 2007

June 15, 2007

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Subject: **Delta Risk Management Strategy**
Phase 1 Draft 2 Risk Analysis Report

Dear Mr. Svetich,

Please find herewith a copy of the Risk Analysis Report. Members of the Steering Committee's Technical Advisory Committee and agency staff have reviewed the draft report, and this second draft addresses their comments.

This draft report was prepared by the undersigned and the DRMS team members listed in Section 1.4. Internal peer review was provided in accordance with URS' quality assurance program, as outlined in the (DRMS) project management plan.

Sincerely,

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Topical Area: Risk Analysis

Preamble

The Delta Risk Management Strategy (DRMS) project was authorized by DWR to perform a risk analysis of the Delta and Suisun Marsh (Phase 1) and to develop a set of improvement strategies to manage those risks (Phase 2). DWR authorized DRMS in response to Assembly Bill 1200 (Laird, Chaptered, September 2005). Twelve Technical Memoranda (TMs) (two topics are presented in one TM: hydrodynamics and water management) have been prepared for topical areas for Phase 1 of the DRMS project. The Risk Analysis Report encompasses the twelve topical areas covered in Phase 1. The topical areas are as follows:

1. Geomorphology of the Delta and Suisun Marsh
2. Subsidence of the Delta and Suisun Marsh
3. Seismic Hazards of the Delta and Suisun Marsh
4. Global Warming Effects in the Delta and Suisun Marsh
5. Flood Hazard of the Delta and Suisun Marsh
6. Wind Wave Action of the Delta and Suisun Marsh
7. Levee Vulnerability of the Delta and Suisun Marsh
8. Emergency Response and Repair of the Delta and Suisun Marsh Levees
9. Hydrodynamics of the Delta and Suisun Marsh
10. Water Management and Operation of the Delta and Suisun Marsh
11. Ecological Impacts to the Delta and Suisun Marsh
12. Impact to Infrastructure of the Delta and Suisun Marsh
13. Economic Impacts to the Delta and Suisun Marsh

Note that the Hydrodynamics topical area was combined with the Water Management and Operations topical area because they needed to be considered together in developing the model of levee breach water impacts for the risk analysis. The resulting product is the Water Analysis Module (WAM) TM.

The work product described in these TMs was used to develop the integrated risk analysis of the Delta and Suisun Marsh. The results of the integrated risk analysis are presented in this technical report:

14. Risk Analysis – Report

The first draft of this report was made available to the DRMS Steering Committee in April 2007.

Background

The context of the Risk Analysis Report was defined by Assembly Bill 1200 (AB 1200). AB 1200 amends Section 139.2 of the Water Code, to read, "The department shall evaluate the potential impacts on water supplies derived from the Sacramento-San Joaquin Delta based on 50-, 100-, and 200-year projections for each of the following possible impacts on the delta:

1. Subsidence.
2. Earthquakes.
3. Floods.
4. Changes in precipitation, temperature, and ocean levels.
5. A combination of the impacts specified in paragraphs (1) to (4) inclusive."

In addition, Section 139.4 was amended to read: (a) The Department and the Department of Fish and Game shall determine the principal options for the delta. (b) The Department shall evaluate and comparatively rate each option determined in subdivision (a) for its ability to do the following:

1. Prevent the disruption of water supplies derived from the Sacramento-San Joaquin Delta.
2. Improve the quality of drinking water supplies derived from the delta.
3. Reduce the amount of salts contained in delta water and delivered to, and often retained in, our agricultural areas.
4. Maintain Delta water quality for Delta users.
5. Assist in preserving Delta lands.
6. Protect water rights of the "area of origin" and protect the environments of the Sacramento- San Joaquin river systems.
7. Protect highways, utility facilities, and other infrastructure located within the delta.
8. Preserve, protect, and improve Delta levees.…"

In meeting the requirements of AB 1200, the DRMS project is divided into two parts. Phase 1 involves the development and implementation of a risk analysis to evaluate the impacts to the Delta of various stressing events. In Phase 2 of the project, risk reduction and risk management strategies for long-term management of the Delta will be developed.

Definitions and Assumptions

During the Phase 1 study, the DRMS project team developed various predictive models of future stressing events and their consequences. These events and their consequences have been estimated using engineering and scientific tools readily available or based on a broad and current consensus among practitioners. Stressing events include the likely occurrence of future earthquakes of varying magnitude in the region, future rates of subsidence given continued farming practices, the likely magnitude and frequency of storm events, the potential effects of global warming (sea level rise, climate change, and temperature change) and their effects on the environment. Using the current state of knowledge, estimates of the likelihood of these events occurring can be made for the 50-, 100-, and 200-year projections with some confidence.

While estimating the likelihood of stressing events can generally be done using current technologies, estimating the consequences of these stressing events at future times is somewhat more difficult. Obviously, over the next 50, 100, and 200 years, the Delta will undergo changes that will affect what impact the stressing events will have. To assess those consequences, some assumptions about the future "look" of the Delta must be established.

To address the challenge of predicting impacts under changing conditions, DRMS adopted the approach of evaluating impacts absent changes in the Delta as a baseline. This approach is referred to as the "business-as-usual" (BAU) scenario. Defining a business-as-usual Delta is required, since one of the objectives of this work is to estimate whether 'business-as-usual' is sustainable for the foreseeable future. Obviously changes from this baseline condition can occur; however, as a basis of comparison for risks and risk reduction measures, the BAU scenario serves as a consistent standard rather than as a “prediction of the future” and relies on existing agreements, policies, and practices to the extent possible.

In some cases, there are instances where procedures and policies may not exist to define standard emergency response procedure during a major (unprecedented) stressing event in the Delta or restoration guidelines after such a major event. In these cases, prioritization of action will be based on: (1) existing and expected future response resources, and (2) highest value recovery/restoration given available resources.

This study relies solely on available data. Because of the limited time to complete this work, no investigation or research were to be conducted to supplement the state of knowledge.

Perspective

The analysis results presented in this technical memorandum do not represent the full estimate of risk for the topic presented herein. The subject and results are expressed whenever possible in probabilistic terms to characterize the uncertainties and the random nature of the parameters that control the subject under consideration. The results are the expression of either the probable outcome of the hazards (earthquake, floods, climate change, subsidence, wind waves, and sunny day failures) or the conditional probability of the subject outcome (levee failures, emergency response, water management, hydrodynamic response of the Delta and Suisun Marsh, ecosystem response, and economic impacts) given the stressing events.

A full characterization of risk is presented in the Risk Analysis Report. In that report, the integration of the probable initiating events, the conditional probable response of the Delta levee system, and the expected probable consequences are integrated in the risk analysis module to develop a complete assessment of risk to the Delta and Suisun Marsh.

Consequently, the subject areas of the technical memoranda should be viewed as pieces contributing to the total risk, and their outcomes represent the input to the risk analysis module.

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List of Acronyms and Abbreviations

AB	Assembly Bill
BAU	business as usual
BDCP	Bay-Delta Conservation Plan
BNSF	Burlington Northern Santa Fe Railroad
BPA	Brownian Passage Time
cfs	cubic feet per second
CDEC	California Data Exchange Center
CDFG	California Department of Fish and Game
CEM	Coastal Engineering Manual
CIMIS	California Irrigation Management Information System
cm	centimeter(s)
CPT	cone penetrometer test
CVP	Central Valley Project
CVPM	Central Valley Production Model
Delta	San Joaquin–Sacramento River Delta
DRMS	Delta Risk Management Strategy
DSM2	Delta Simulation Model 2
DWR	Department of Water Resources
EBMUD	East Bay Municipal Utility District
ER&R	Emergency Response and Repair
FEMA	Federal Emergency Management Agency
GIS	geographic information system
HD	Hydrodynamics submodel
I-O	input-output
kV	kilovolt(s)
KMEP	Kinder Morgan Energy Partners
LPIII	Log Pearson Type III
M	magnitude
MHHW	mean high higher water
MSL	mean sea level
NGA	Next Generation of Attenuation

NDAL	Net Delta Area Losses
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
OD	outside diameter
PGA	peak horizontal acceleration
PMF	probability mass function
POD	pelagic organism decline
PSHA	probabilistic seismic hazard analysis
ROD	Record of Decision
RPC	regional purchase coefficient
SA	spectral acceleration
SRRQ	San Rafael Rock Quarry
SWP	State Water Project
TDI	Total Delta Inflow
TM	technical memorandum
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
UWMP	Urban Water Management Plan
V_S	shear-wave velocity
WAM	Water Analysis Module
WGCEP	Working Group on California Earthquake Possibilities
WY	Water Year
WGNCEP	Working Group on Northern California Earthquake Potential
WOCSS	Winds on Critical Streamline Surfaces (model)