

- **Board of Directors**  
**Water Planning and Stewardship Committee**

April 10, 2007 Board Meeting

---

8-17

---

**Subject**

---

Approve Delta Levees Emergency Preparedness and Response Plan

---

**Summary**

---

Recent levee failures resulting from Hurricane Katrina have increased the awareness of the risk of catastrophic failure of California's Sacramento-San Joaquin Delta (Delta) levee system leading to the potential loss of the Delta as a drinking water supply for major population centers in the San Francisco Bay area and Southern California. The Department of Water Resources (DWR) has testified that a Delta levee system failure might not fully recover from a hypothetical 6.5 Richter scale earthquake near the western Delta. This is a relatively remote, but high consequence event, leading simultaneously to 50 levee breaches and the flooding of 20 Delta islands. The range of risks will ultimately be an output of the Delta Risk Management Strategy. In February 2006, the Board directed and staff has responded with a Delta emergency preparedness and response plan to avert the catastrophic loss of Delta water supplies resulting from this type of severe emergency. This plan minimizes water supply impacts with the most cost-effective means of prevention and response ([Attachment 1](#)).

Both pre-event and post-event strategies described below, require the dilution of saltwater trapped in Delta islands by diverting additional Sacramento River flows to re-establish a freshwater pool in the central Delta.

Pre-event Strategy

A pre-event strategy would involve advance construction of levee and river flow barriers to block salt water from entering the south Delta in a major emergency, while isolating saltwater in the central Delta where it can be flushed seaward by the freshwater pool. A pre-event approach could be developed in about three years at costs from \$330 million to \$485 million, allowing exports to be resumed around two months after the emergency event.

Post-event Strategy

The preferred post-event strategy allows saltwater to enter the entire Delta followed by the creation of an emergency freshwater pathway through existing channels from the central Delta to the export pumps. Feasibility cost estimates for this strategy are about \$50 million to pre-position materials and equipment in advance of an emergency, so that pathway development can be substantially unconstrained by other emergency work in the Delta. Costs could increase to a total of approximately \$200 million, if and when an emergency takes place and depending on the scale of the actual emergency event. By considering a variety of response priorities, it was concluded that water exports could be operational and reasonably functional in about six months under this strategy. Although somewhat longer than the pre-event strategies, it is still considered an acceptable time frame. The time to resume exports is highly sensitive to levee breach lengths, which influence levee repair times and response priorities. For smaller breaches, critical life and property needs may be able to proceed ahead of the emergency freshwater pathway development, while still developing the pathway in the above time frame. For much larger and less likely breaches, the pathway would have to be developed in parallel with other emergency response needs in the Delta to be operational in the six-month period, and would be critically dependent on the availability and use of stockpiled materials. It should be noted that this plan responds to an extreme emergency, but can be adapted in scale to smaller events.

DWR is working with Metropolitan and the State Water Contractors (SWC) to integrate these water supply protections into an interim report to the Emergency Operations Plan for the Delta over the next two months. This

will more fully define the pre-positioning of stockpiles, improved emergency contracting capabilities and response mechanisms for a severe levee failure emergency. These plans do not constitute a reliable long-term water conveyance strategy in the Delta, which will be developed through the comprehensive planning of the Delta Vision Process and the Bay-Delta Conservation Plan.

Propositions 1E and 84 both contain funds which could be used for the purposes outlined in this board letter. Some costs may not be covered by Propositions 1E and 84 funds and may be attributed to the State Water Project. In that event, Metropolitan would be responsible for its share of those costs.

## Policy

---

By Minute Item 46564, dated February 14, 2006, the Board directed staff to work with the state and other stakeholders to develop an integrated plan for emergency preparedness and response to levee failures in the Delta.

## California Environmental Quality Act (CEQA)

---

CEQA determination for Options #1 and #2:

The proposed action is exempt from CEQA and the State CEQA Guidelines, because it is a project involving only feasibility or planning studies for possible future actions that have not been approved, adopted, or funded (Section 15262 of the State CEQA Guidelines). In addition, the proposed action is not defined as a project under CEQA because it involves continuing administrative activities, such as general policy and procedure making (Section 15378(b)(2) of the State CEQA Guidelines). Future activities and projects that are developed from the feasibility and planning studies and that are subject to CEQA, applicable CEQA review, evaluation, and documentation will be processed by DWR, as lead agency, prior to DWR taking future discretionary actions.

The CEQA determination is: Determine that the proposed action is exempt from CEQA pursuant to Sections 15262 and 15378(b)(2) of the State CEQA Guidelines.

CEQA determination for Option #3:

None required

## Board Options

---

### Option #1

#### Post-event strategy of creating an emergency freshwater pathway to export pumps

Adopt the CEQA determination and direct staff to work with the SWC, DWR, and state and other stakeholders to develop a plan to implement this option substantially within the estimated time and costs described herein.

**Fiscal Impact:** Strategically directed actions will result in total expenditures of around \$200 million substantially through state and federal emergency funding provisions after the emergency event has taken place. Within this total, around \$50 million would be incurred for the pre-positioning of material and equipment in preparation for the emergency potentially funded through state bonds (Proposition 1E or 84) and cost-sharing from beneficiaries, including the State Water Contractors, as bond funds are appropriated.

**Business Analysis:** Over half of California's \$1.6 trillion economy is dependent to some degree upon water supplies from the Sacramento-San Joaquin Delta. In the event of a major earthquake in or near the Delta, these supplies could be interrupted for up to three years posing a significant and unacceptable risk to the California business economy. This option would provide necessary water supply protections to avert this catastrophe.

**Option #2**

Pre-event strategy of advance construction of saltwater intrusion barrier at Empire Cut

Adopt the CEQA determination and direct staff to work with the SWC, DWR and state and other stakeholders to develop a plan to implement this option substantially within the estimated time and costs described herein.

**Fiscal Impact:** Strategically directed actions will result in expenditures of from \$330 million to \$485 million potentially funded through state bonds (Proposition 1E or 84) and cost-sharing from beneficiaries, including the State Water Contractors, as bond funds are appropriated.

**Business Analysis:** Option #2 presents a similar business case need to that described in Option #1. Option #2 would provide necessary water supply protections to avert the predicted catastrophe.

**Option #3**

Take no action.

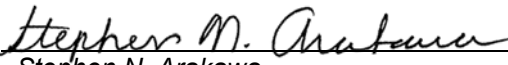
**Fiscal Impact:** Unknown until disaster occurs

**Business Analysis:** Because no water supply protections would be implemented under Option #3, California water interests would not avert the predicted catastrophe, resulting in major water and economic impacts to Metropolitan's service area.

**Staff Recommendation**

---

Option #1

  
\_\_\_\_\_  
Stephen N. Arakawa  
Manager, Water Resource Management

4/3/2007  
Date

  
\_\_\_\_\_  
Jeffrey Kightlinger  
General Manager

4/3/2007  
Date

**Attachment 1 – Delta Levees Emergency Preparedness and Response Planning**

BLA #5350

## **Delta Levees Emergency Preparedness and Response Planning**

The New Orleans levee failures resulting from Hurricane Katrina have increased the awareness of a potential catastrophic failure of California's Sacramento-San Joaquin Delta levee system, as well as the adequacy of governmental response. Delta islands were created in the late 1800s through draining and reclamation of land for agriculture. These islands have subsided up to 30 feet through farming and oxidation of peat soils. A system of more than 1,100 miles of levees protects these islands; and major utilities, highways, and railroads interlace the region. Levees that provide for the conveyance of freshwater to state and federal export pumps traverse portions of the interior Delta where subsidence is most pronounced. Levee disruption by earthquake or severe flooding could result in multiple levee failures across the Delta potentially leading to the significant loss of the Delta as a drinking water supply for major population centers in the San Francisco Bay area and Southern California. This type of disruption to the state's water delivery system would have serious consequences to Metropolitan and its member agencies, since on average the State Water Project (SWP) currently provides more than half of the imported supplies available to Metropolitan. In addition, serious water quality concerns have resulted from Delta levee failures, including elevated levels of total dissolved solids (TDS), total organic carbon (TOC) and invasive algae species.

Before a joint session of the state Legislature on October 31, 2005, Department of Water Resources Director Lester Snow testified that the Delta levees system might experience sustained damage and not fully recover from a hypothetical 6.5 Richter scale earthquake along faulting near the western Delta. This is a relatively remote, but high consequence event, simultaneously leading to 50 levee breaches and the flooding of 20 Delta islands. After one year of emergency repair efforts, the Department of Water Resources (DWR) estimates a portion of the damaged islands could be repaired, but because of the complicating effects of additional levee erosion and the compromised integrity of remaining Delta levees, further recovery may be abandoned. The full range of risks will ultimately be an output of the Delta Risk Management Strategy (DRMS).

Given DWR's testimony and the significant risk to Delta export water quality and supply, on February 14, 2006, the Metropolitan Board directed staff to work with the State Water Contractors (SWC) and DWR to prepare an emergency preparedness and response plan to avert the predicted catastrophic consequences of levees' failure. A report providing detailed analyses of emergency preparedness and response strategies has now been completed and is available upon request.

**Guiding Principles.** In preparing and evaluating the strategies, specific guiding principles were identified and applied, as follows:

1. Minimize water supply impacts with the most cost-effective means of prevention and response.
2. Resume water exports in a timely manner (less than nine months).
3. Implement within a reasonable time frame (less than three years).
4. Be durable under a full range of hydrologic or seismic conditions.
5. Minimize reservoir releases as a means of repulsing salinity intrusion.
6. Apply reasonable response priorities benefiting life and property.
7. Consider flexible and sustainable solutions, including pre- and post-disaster measures.

**Timing of Strategies.** Emergency preparedness and response planning have considered strategies that can be employed either before or after the emergency has taken place (pre-event and post-event strategies). Pre-event strategies would rely on emergency measures that are fully developed and operational prior to the emergency. Post-event strategies would be employed after the emergency has occurred, although materials and equipment may be pre-positioned in advance of the emergency. Actual plans could include elements of both strategies.

**Emergency Preparedness and Response Concepts.** An interagency emergency preparedness team, consisting of consulting firms and Metropolitan staff, has developed plans that are cost effective, optimize both pre- and post-event actions, prioritize responses, minimize the need for reservoir releases, and can be implemented in the

near term. The team has included an exceptionally qualified group of local and international design and construction firms.

Three emergency preparedness and response strategies considered under pre-event or post-event time frames would help avert the catastrophic consequences of a severe Delta levee collapse. First, saltwater trapped in Delta island waters after a levee failure can be diluted by diverting additional water through the Delta Cross Channel (DCC) and Georgiana Slough to re-establish a freshwater pool in the central Delta. This freshwater pool effectively helps flush saltwater seaward. Second, river flow and levee barriers can be deployed to quickly block the landward migration of saltwater from entering the south Delta during a severe levee collapse, which is otherwise difficult to evacuate. Finally, closing the adjoining channels to Middle River and Victoria Canal can create a pathway from the freshwater pool in the central Delta to export pumps, if saline waters do invade south Delta islands.

**Results of Analyses.** Analyses were performed using the services of the interdisciplinary team with specialized analytical tools, including the advanced Resource Management Associates (RMA) hydrodynamic model and DRMS Emergency Response and Repair (ER&R) simulation model. This analytical approach provided the ability to predict salinity intrusion and the adequacy of proposed emergency preparedness and response strategies, providing effective means of emergency water supply protection.

**Additional Freshwater Diversions to the Central Delta.** The need to dilute saltwater in the central Delta islands following a major levee collapse is common to any of the alternatives evaluated. Blocking both Sutter and Steamboat Sloughs does this by maintaining more flow in the Sacramento River, forcing greater diversions through the DCC and Georgiana Slough toward the central Delta. The buildup of a freshwater pool in the central Delta has the effect of forcing saltwater seaward toward Suisun Bay.

**Salinity Barriers.** Of the pre-event strategies developed to block saltwater from entering the south Delta, the most effective was a combined levee and river flow barrier south of Empire Cut in the central Delta. While blocking salinity at this location, it also isolates saltwater in the central Delta, where it can be flushed seaward by freshwater flows entering the Delta through the DCC and Georgiana Slough. Combined river flow and levee barrier concepts at this location were estimated to cost from \$330 million to \$485 million and could be deployed in about three years. With these measures in place, water exports could be resumed in about two months after the emergency event.

**Emergency Freshwater Pathway.** A post-event strategy was evaluated by isolating an emergency freshwater pathway from the central Delta along Middle River and Victoria Canal to the export pumps. The ER&R model provided estimates of the time and cost of repairing combined Delta-wide levee beaches, levee slumping, and wind erosion, along with freshwater pathway restoration. By considering a variety of response priorities and pre-positioning of materials and equipment, it was concluded that water exports could be operational and reasonably functional in about six months under this strategy. Although somewhat longer than the pre-event strategies, it is still considered an acceptable time frame. The time to resume exports is highly sensitive to levee breach lengths, which influence levee repair times and response priorities. For smaller breaches of several hundred feet, critical life and property needs may be able to proceed ahead of the emergency freshwater pathway development, while still developing the pathway in the above time frame. For much larger and less likely breaches of several thousand feet, the pathway would have to be developed in parallel with other emergency response needs in the Delta in order to be operational in the six-month period, and would be critically dependent on the availability and use of stockpiled materials. Feasibility cost estimates for this strategy are about \$50 million to pre-position barge and load-out equipment, and rock, stop log and sheet pile stockpiles for channel and levee breach closures in advance of an emergency, so that pathway development can be substantially unconstrained by other emergency work in the Delta. Reasonable mixes of equipment and material stockpiles will be included in the DWR Emergency Operations Plan for the Delta. Pre-positioning activity is estimated to take approximately a year. Feasibility level costs could increase to a total of approximately \$200 million, if and when an emergency takes place and depending on the scale of the actual emergency event. It should be noted that this plan responds to an extreme emergency, but can be adapted in scale to smaller events.

Either the salinity barrier or the emergency freshwater pathway concepts will experience at least some additional carriage water requirements to comply with current estuary salinity regulations. This would not substantially influence the selection of a preferred alternative under current emergency preparedness and response analyses, but may reduce water exports available from the Delta. Carriage water is the added reservoir inflows into the Delta to create a hydraulic barrier to repel ocean salts westward and protect export water quality. These reservoir releases are above and beyond the Delta inflows that can be exported.

**Integration with DWR Emergency Operations Plan.** DWR is working with Metropolitan and the State Water Contractors, to integrate these water supply protections into an interim report to the Emergency Operations Plan (EOP) for the Delta over the next two months. These efforts will ensure that emergency stockpiles of construction materials and equipment are deployed to support water export resumption in the event of severe levee failures, and that improved emergency contracting capabilities are in place. DWR would administer actual emergency activities, including emergency reconfiguration of Delta channels to route freshwater supplies to export pumps and minimize effects of ocean salinity intrusion and export water quality degradation in the event of levee failures. In addition to water export needs, the EOP is also addressing emergency response for a full range of affected services in the Delta under differing types and scales of emergencies.

**Long-Term Strategies.** These emergency preparedness and response plans do not constitute a long-term water conveyance strategy in the Delta. While these plans can effectively protect the economy from supply disruption for an interim period, they do not address the significant fishery, water quality, subsidence, or climate change and sea level rise challenges facing the Delta. Still to be undertaken is the development of a comprehensive long-term plan for the Delta through the Delta Vision Process and the Bay-Delta Conservation Plan.