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Written Testimony

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on Water Supply Vulnerabilities in the Sacramento/San Joaquin River System
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I am a Program Manager with the Metropolitan Water District of Southern California, with responsibilities for guiding the implementation of the CALFED Program to achieve improved water quality and water supplies from Delta export operations. From 2000 to 2002, I was CALFED's Delta Implementation Manager, where I became knowledgeable of Delta levees remediation issues as they relate to the water supply and quality at State Water Project (SWP) and Central Valley Project (CVP) export facilities and the implementation of CALFED Through Delta solution (Figure1).

This testimony covers the w ater supply and quality vulnerabilities in the Sacramento/San Joaquin Delta focusing on the water quality and supply effects at CVP and SWP export facilities, needed emergency response capabilities and any near-term and long-terms strategies which can be employed to adequately safeguard these water resources.

Strategic Overview

The Metropolitan Water District has focused increased attention on the vulnerability of the Delta levees system over the past year. The recent events in New Orleans have heightened our awareness and renewed interest of our Board of Directors on this critical issue, particularly the adequacy of emergency, short-term and long-term governmental response. It is well known that Delta i slands, drained for agriculture in the late 1800's, have subsided up to 30 feet though the oxidation of peat soils in critical portions of the western and central Delta. A system of more than 1,100 miles of levees protect major utilities, highways, and railroads and convey fresh water southerly to state and federal export pumps. The most problematic areas remain in the western and central Delta, where peat soil subsidence is greatest, levee designs and maintenance practices are varied and 11 levee breaks have occurred since 1960 (Figure 2). Overall, 162 levee breaches have occurred throughout the Delta in the past century.

Levee breaches in the western Delta can result in an extremely large volume of salt water being drawn from Suisun Bay into subsided islands like Sherman and Twitchell, moving higher salinity concentrations toward the export pumps. Unabated, subsidence on these islands will advance from a total of 30 feet today to more than 80 feet when all peat is depleted, exacerbating potential flooding and salinity problems. Significantly, multiple levees breaks in the central and southern portions of the Delta draws salt water into south Delta areas, which cannot be easily flushed seaward through the normal fresh water releases from upstream reservoirs.

"Project" levees make up about one-third of the system, which are designed, built and maintained by the Corps of Engineers. "Non-Project" levees make up about two-thirds of the system, and are built to varying standards of design, maintained by local Reclamation Districts (RD's) and situated generally in the most vulnerable areas of the Delta with respect to subsidence and adverse consequences of failure. A small fraction of the levees are privately owned.

Disruption of the levees system by earthquakes or other hazards could potentially trigger a progression of failures in the Delta levees system that would have serious consequences on Metropolitan's drinking water supply, since on average the SWP provides more than half of the supplies available to Metropolitan.

A strategic approach to emergency response, and short- and long-term actions to avert or minimize the impact of levees failure is critical. From a levees integrity standpoint, there must be a logical connection to the proposed CALFED Through Delta solution, which relies on the integrity of Delta levees for the delivery of high quality water to export pumps.

Under the *DWR S ubventions Program* , established by the state in 1988, Reclamation Districts maintain , repair, restore their levees, and receive reimbursement through bond or other funds to protect island properties. This program is not specifically aimed at providing strategic benefits to export water quality and supply. The *DWR Special Projects Program* is specifically established to focus on critical levee problems, but needs strategic direction to be properly implemented.

However, a process is emerging to reduce major risks in the short-term and develop longer-term strategies to fund levee improvements, which benefit export water quality and supply interests. A number of strategies are being embedded in the existing response system, and support is beginning to coalesce around new initiatives.

Emergency Response

DWR predicts a 100-year earthquake would initially trigger the breach of 3 to 10 levees on one or more Delta islands (Figure 3). For comparison, earthquakes causing this type of damage and failure to Delta levees would most likely be in magnitude 6 to 6.5 Richter range, either close to, or actually beneath the western Delta. Based on the progressive damage to the unarmored inside face of levees at Jones Tract (at Trapper Slough opposite the main Jones Tract breach), there is a major concern that that these seismically induced breaches will result in a broader failure of the Delta levee system through wave action from high Delta winds and erosion within the islands being flooded. The effective emergency response at Trapper Slough avoided further flooding of the adjacent tracts toward Stockton. Probability analysis reflecting a 1-in-100 chance of failure of the Delta levee system means that the risk we face in the Delta is orders of magnitude higher than the level of risk we find acceptable for other major infrastructure and critical facilities.

Impending levee failures require rapid response to prevent permanent damage and avert progressive damages leading to serious degradation to export water quality and supply. The following are some potential areas that Metropolitan could support.

Emergency response is now coordinated though a DWR Delta Area Command, linked to the state's Standardized Emergency Response System. However, DWR is evaluating and we support a Central Regional Flood Response Center in order to:

- Develop a central command, co-located in a common facility, to facilitate assignment of commands and coordinate operations among the federal, state and local agencies; this would force rapid approvals and clearances and save time in advancing emergency response measures.
- Establish a pre-set list of trigger points to ensure that the assignment of authorities moves efficiently from local, to state and federal levels, depending on the severity of the emergency.
- Allow command in catastrophic events to expeditiously escalate, if necessary to the federal level.

Federal and state legislation could be required to grant greater authority to respond to such crises. These should be explored and appropriate legislative approaches taken.

Particularly, we could support measures to reduce the time responding to an impending or actual emergency by:

- Establishing emergency contracting capability with private construction firms to respond immediately in the event of a levee breach or similar situation.
- Substantially augmenting rock stockpiles and equipment throughout the Delta to ensure rapid response to close a breached levee or selected river channels at pre-determined locations; pre-positioned rock stockpiles or barges to achieve temporarily closure could avert the most serious damage and limit salinity intrusion toward the pumps.
- Establish real-time modeling capability with up to date hydrologic data and breach locations to help predict the salinity effects of levee breaches and guide strategic channel closures to minimize salinity intrusion into the Delta.

Near-Term Strategies

There are deliberate steps that we believe can be accomplished in 2 to 5 years beginning with a comprehensive inventory to identify the levee design standards throughout the entire Delta levees system. This would identify high-risk areas and focus immediate attention. For example, at the State Water Project-owed Sherman and Twitchell Islands, significant soil subsidence caused by farming operations aggravates the risks caused varied levee designs. As note earlier, flooding of these islands would draw large volumes of salt water into the islands toward the export pumps. Here, farming leases managed by DWR need to be converted to farming practices which spread water over the islands most months the year. Rice farming or other practices may be appropriate. Where not already constructed as such, levees should be modified to include toe berms or other stability measures under acceptable design standards, making them less vulnerable to failure under ground shaking, floodwaters or other hazards.

Measures should developed in the short-term to better develop emergency response capability, such as:

- Improved levee instrumentation, inspection program, and real-time monitoring.
- A fully developed emergency breach closure and real time modeling capability to help guide emergency operations to limit salinity intrusion.
- Acquisition of island lands that provide sufficient soil, sand and gravel as a ready stockpile for any scale of emergency.

The Small Projects Authority Program, administered by the Army Corps of Engineers, is ideally suited for post-disaster repairs, maintaining the repaired levee integrity until more permanent repairs can be implemented, or repairing smaller levee problems that could get worse if left unattended.

Long-Term Strategies

A systematic process is now being undertaken to look at the consequences of different types of failures in economic terms. Alternative actions can then be taken and measured economically. Here is a long-term approach we would support, that could be accomplished in 5 to 15 years:

Delta Risk Management Strategy

An ambitious federal-state process now underway is called the Delta Risk Management Strategy (DRMS). This is a joint effort of the Department of Water Resources and the Army Corps of Engineers, with assistance from other agencies. It evaluates both h azards and system operational conditions in combination to determine the economic consequences of levee failures in the Delta and downstream. The following steps are taken to determine the most cost effective approach using DRMS:

- Statistically, develop an envelop of economic consequences resulting from multiple combinations of hazards and system conditions.
- Develop alternative remedial actions both inside and outside of the Delta.
- Determine the change in economic consequences (benefits) that results from applying a particular remedial action.
- Determine the most cost effective remedial action as an overall strategic approach.

A number of strategies can be evaluated by the DRMS process both inside and outside the Delta. Any alternative must ensure a reliable long-term Delta conveyance system, which is critical to the delivery of CVP and SWP allocations and water transfers. The following alternative strategies can be evaluated from an economic perspective using the DRMS:

- The Though Delta solution considered in the CALFED Bay Delta Program EIR/S, including the North Delta Flood Control program.
- Modified land use practices or acquisitions at strategically identified islands, along with necessary levees remediation, within the highly subsided western and central Delta.
- Pre-positioned and enhanced downstream groundwater and surface storage; Metropolitan has aggressively pursued these strategies by increasing its storage more than 10-fold over the past decade, in part to guard against emergency events.

Should additional federal authorization and appropriations be required, beyond the CALFED authorization, such authority may be considered under the Water Resources Development Act with expanded federal flood control responsibility; a greater emergency response role at the federal level may be appropriate as borne out by the recent New Orleans event.

Metropolitan Response

DWR and UC Berkeley studies indicate that from 3 to 10 breaches of the Delta levees system would statistically occur in a 100-year earthquake event. This would have the likely follow-on effect of multiple breaches caused by repeat episodes of wave action from strong Delta winds and erosion. It is unknown how extensive this type of failure scenario would be, however the progressive erosion on the inside levee face at Jones Tract, noted above, tends to substantiate the reality of this scenario. The extent of these types of scenarios would be determined in a statistical sense under the Delta Risk Management Strategy.

In a recent exercise, DWR performed multiple levee breach scenarios that assessed the consequences of 30- and 50-breaches in the Delta. Critical to Metropolitan is how long the levee repair actions would take and under what conditions export operations could resume. This determines the extent that emergency storage in the Metropolitan service area has to be utilized, as noted below.

In part to deal with these types of disasters, Metropolitan has increased its surface and groundwater storage substantially in the past decade. Total southern California surface and groundwater storage is currently about 2.8 MAF, of which about 1.7 MAF is available for emergency and non-emergency (carryover) purposes. In an emergency, such as a multiple-levee breach in the Delta, Metropolitan would draw upon both emergency and non emergency (carryover) storage at the rate of about 550 TAF per year. This could continue for 2 to 3 years depending on hydrologic conditions while remediation measures were taken in the Delta and SWP supplied were being restored. DWR has estimated that a “worst case” 50-breach scenario may take around two years to repair. It is, therefore, crucial that proper attention be given to levee repair protocols and emergency powers capabilities to complete levee remediation work as quickly as possible.

Summary

The water supply and quality vulnerabilities in the Sacramento/San Joaquin Delta can seriously affect the CVP and SWP exports. DWR predicts a 100-year earthquake, equivalent to a magnitude 6 to 6.5 Richter range, either close to or actually beneath the Western Delta, would breach 3 to 10 levees on one or more Delta islands. Progressive levee failures, initiated under this seismic event, could lead to more wide spread failures and damages. The impact to southern California would be significant since on average the SWP provides more than half of the supplies available to Metropolitan.

Emergency response capabilities, as well as near-term and long-terms strategies need to be modified and fine-tuned to adequately safeguard affected water resources. Pre-positioned materials and equipment could aid in closing beached levees or strategically restrict river channels before widespread damage occurs or adverse salinity intrusion takes place. Near-term remedial actions at Sherman and Twitchell Islands could significantly reduce overall risk to water quality and supplies at export pumps. Long-term strategies guided by the ongoing Delta Risk Management Strategy could identify cost effective actions to reduce economic risk and the potential for loss of life. Clearly, the recent events in New Orleans have heightened our awareness and renewed our interest in this critical problem on the west coast.

A Central Regional Flood Response Center, co-located in a common facility, could facilitate assignment of commands and emergency operations among the federal, state and local agencies in catastrophic events. Overall command could expeditiously escalate, if necessary, to the federal level.

Expanded federal and state authorities may be needed to respond to the scale of emergency operations anticipated in the Delta. As well, n ew federal and state legislation may be required for equivalent level response, including potential authorizations and appropriations under the Water Resources Development Act. The current Small Projects Authority Program, administered by the Army Corps of Engineers, may also be well suited for post-disaster repairs.

Metropolitan has anticipated these types of emergency scenarios that may occur in the Delta region and placed significant emphasis on the development of enhanced storage accessible to the Metropolitan to serve these and other purposes. Accessible surface and groundwater storage has been increased ten-fold in the past decade, making nearly 1.7 MAF available for emergency and non-emergency (carryover) purposes, which would be drawn on under these type events. While these emergency supplies would last 2 to 3 years, it is crucial that proper attention be given to levee repair protocols and emergency powers capabilities to complete Delta levees remediation work as quickly as possible.