



Joint Legislative Committee on Emergency Management

Assembly Select Committee on Regional Approaches to Addressing the State's Water Crisis

Informational Hearing: *Water Reliability and Seismic Risk*

October 19, 2011 – 2 p.m.

Background Paper

I. Introduction

California has a long history of experience with earthquakes and long distance, water supply projects, but they are not often connected, at least in the view of the public. Yet, that connection is very real, and presents a substantial challenge in ensuring water supply reliability, especially for Southern California, if a major earthquake should occur. Most of Southern California's water canals cross the San Andreas Fault, where an earthquake could take one or more canals out of service. Although inconvenient, water agencies could move to alternative conveyance facilities, and rapid repair work could possibly return those canals to service within days or weeks.

That said, the Sacramento-San Joaquin Delta (Delta) presents a more serious seismic challenge. The Delta forms the heart of the California water system, by transferring fresh water from Northern California to the San Francisco Bay Area, San Joaquin Valley and Southern California. In fact, this region receives about one-third of its water supply from the Delta via the State Water Project. The Delta is a labyrinth of islands and water channels created by levees built over the last 150 years. Those levees, which endure under a range of conditions, provide a critical – and tenuous – link to Southern California's water supply.

It is a very real possibility that, after a major earthquake in or near the Delta, multiple levees and the water conveyance system that relies on them could fail. Recovery of these levees and the Delta would be much more complicated than canal repairs. It could take years to complete levee repairs – or build an alternative conveyance system (*e.g.* pipeline or canal) – and fully restore water exports to Southern California.

Since one Delta levee failed on a clear June day in 2004, the State has focused more attention on the water supply risks of Delta levee failures. That 2004 levee break at Upper Jones Tract caused the state and federal water projects to reduce exports for weeks, requiring Southern California to rely on water reserves in storage. The State spent \$45 million to repair the levee and pump out the island.

Hurricane Katrina's destruction of New Orleans' levees created new concerns over Delta levees, especially after estimates of a 62% chance that the Delta region would suffer a serious earthquake in the next 30 years. The collapse of the Delta ecosystem put water and the environment at the center of legislative debate in 2009. The Legislature adopted a new plan for the Delta that addressed, in part, Delta levee stability. Despite all the State's efforts to address Delta water supply risks, the seismic risk – and an uncertain emergency response – remains.

II. Southern California Water Supply System

With a Mediterranean climate, Southern California's development has depended on development of its water supply. Spanish settlers located the City of Los Angeles on its namesake river. As the region grew, farmers and developers drew water from other streams and from groundwater. A significant part of Southern California still relies on groundwater, at least to some extent. Native supplies, however, are not sufficient to support a large urban community. Groundwater managers therefore rely on imports to recharge groundwater aquifers.

This limitation on water supply led early visionary leaders to search for water far from Los Angeles. The City of Los Angeles went to the Owens Valley, starting deliveries in 1913. In 1928, 13 cities created the Metropolitan Water District of Southern California (MWD), to deliver water from the Colorado River via the Colorado River Aqueduct, which began deliveries in 1941. In 1960, MWD signed a contract with the California Department of Water Resources (DWR) to deliver more than half of the water from the State Water Project (SWP), which stores water in Lake Oroville on the Feather River and then moves it south, through the Delta, to export pumps and the California Aqueduct to Southern California.



All of these water import systems cross seismic faults, and may be subject to interruption due to an earthquake. Those interruptions, however, may arise out of isolated breaks in the conveyance system, which may be repaired relatively quickly. The most vulnerable to a long-term outage

would be the SWP, which relies on water conveyance through the Delta. The Delta is subject to collapse of multiple levees. Without the levees, the streams that convey SWP water south disappear. A multi-levee collapse in the Delta may cause an interruption in Southern California water supply of many months or even years. This hearing therefore focuses on the seismic risks to water supply flowing through the Delta.

III. The Sacramento San Joaquin Delta

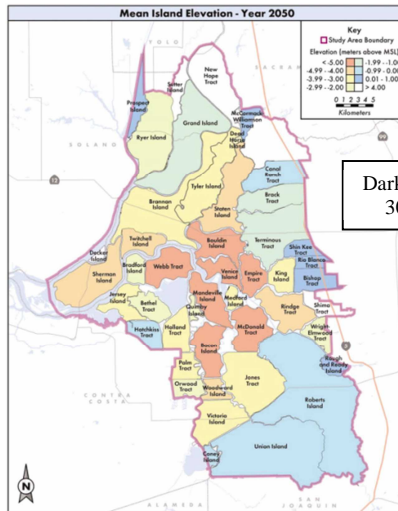
The Delta ecosystem is the most valuable estuary ecosystem on the west coast of North or South America, and a natural resource of hemispheric importance. Created by the confluence of the Sacramento and San Joaquin rivers as they flow into San Francisco Bay from the north and south, respectively, the estuary is a maze of tributaries, sloughs, and islands. It contains the largest brackish estuarine marsh on the West Coast. The Delta ecosystem, the largest wetland habitat in the western United States, supports more than 750 wildlife species and more than 120 species of fish, as well as one of the state's largest commercial and recreational fisheries. The Delta estuary also provides migration corridors for two-thirds of the state's salmon and nearly half of the waterfowl and shorebirds along the Pacific flyway.

The Delta also serves as the heart and critical crossroad of California's water supply and delivery structure. California's precipitation falls predominantly north and upstream of the Delta, whereas much of the state's urban and agricultural water uses occur south of the Delta. The state's two major water projects, the federal Central Valley Project (CVP) and California's State Water Project (SWP), store water in major reservoirs upstream of the Delta, convey water through the Delta, and export the Delta's water south from project pumps in the south Delta. As the water flows from the Sierra toward the Delta, cities and farms draw water from the system.

A. Delta's Origin and Development: Shallow Wetland to Deep, Leveed Islands

The Delta developed at the confluence of California's two largest rivers the Sacramento and the San Joaquin, as sediment came downstream over thousands of years and was trapped behind the Carquinez Strait leading to San Francisco Bay. When Americans arrived during the Gold Rush, they found a "swamp" that they traversed on their way to Sacramento. This large wetland was shallow, and during the summer, some islands would emerge, protected by small natural levees. Two weeks after California became a state, Congress passed the "Swamp Lands Act" to transfer certain swamplands to the states, including the Everglades to Florida and the Delta to California. A decade later, the State Legislature passed legislation to allow anyone to buy Delta lands for \$1 per acre, provided they built a levee around the land to keep it dry year around. That began the development of the Delta as we know it today – islands surrounded by levees with small streams, called sloughs, between the islands. In the 20th Century, landowners formed "reclamation districts" to maintain the levees around each island, in an effort to prevent levee failures.

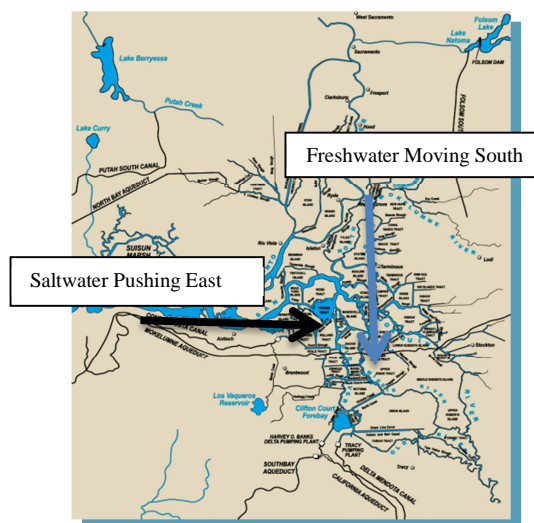
In the 150 years since Delta levees and their islands began developing, Delta islands have suffered substantial subsidence. The natural peat, resulting from thousands of years of deposits of organic material, oxidized and compacted when plowed, leading to some islands lying as much as 30 feet below the adjacent water level. This 24/7 water pressure on the levees make the levees more vulnerable to failure. The map on the next page illustrates the depth of Delta lands below sea-level.



B. Delta Water Supply Infrastructure: Sacramento River Water Exports

The design of the Delta began to change more dramatically with the Legislature’s adoption of the California Water Plan in 1933. The federal CVP, which Congress authorized in 1935, moved water from large reservoirs in the Sacramento River basin south through the Delta to export pumps for users in the San Joaquin Valley. San Joaquin River water was shipped south to the Kern and Tulare basins, where it does not return to the Delta. Then the federal Bureau of Reclamation built the “Delta Cross-Channel” (DCC), which puts fresh Sacramento River water into the eastern part of the Delta so it can flow toward the Delta export pumps and not out to the ocean.

These developments formed, in effect, a “hydraulic barrier” to saltwater intrusion from San Francisco Bay. Instead of fluctuating freshwater flows during the annual winter/summer cycle, fresh Sacramento River water now traveled south consistently, even in the middle of the summer. The narrow stream channels created by Delta levees now guided water through the Central Delta and South Delta to the CVP and SWP water export pumps. The saltwater would not break through that barrier in most years, allowing farmers in the Central Delta and the state and federal water projects to enjoy freshwater year-around. Those Delta levees became a critical part of California’s water infrastructure.



C. Wake-up Call on Delta Emergency Response: Collapse of Jones Tract

The debate over CVP/SWP reliance on Delta levees emerged more forcefully on a beautiful summer day in June 2004, with the sudden and unexpected collapse of the levee surrounding Upper Jones Tract (a Delta island). The Delta debate, especially during consideration of the proposed Peripheral Canal in the 1970s and 1980s, had long included discussion about the importance of Delta levees to the state and federal water projects. At that time, however, the debate about seismic risks did not arise, as the advocacy for the Peripheral Canal focused on expanding exports from the Delta. The Peripheral Canal would allow conveyance of more water more directly to the export pumps, without the circuitous movement through sloughs and channels and across the San Joaquin River. The CVP and SWP would not have to rely on levees that could fail during Delta flood conditions.

The Jones Tract levee failure, however, raised a different concern – levee collapse during warm summer months when conveyance was most critical. Over the more than two decades since the Peripheral Canal debate, the Delta had changed. Due to subsidence, Central Delta islands had become 3-4 feet deeper. The Delta reclamation districts had improved some levees, but the cause of their failure could be unpredictable. Even the best built levees could fail unexpectedly, due to causes such as animal burrowing or unrecognized levee seepage. When Jones Tract failed, neither the local reclamation district nor the State was prepared for the emergency. The federal Army Corps of Engineers provided some assistance by fighting the immediate risk of flooding nearby islands, but it had no responsibility for repairing the levee and recovering the island. Most Delta levees are not federal levees and fail to meet federal levee standards that might allow some federal assistance.

When the Jones Tract levee collapsed, DWR planned to only cap the breach and then determine whether there were sufficient State interests in rebuilding the levee and restoring the island. Former Governor Arnold Schwarzenegger, however, arrived by helicopter and, after hearing the pleas of local landowners, decided that the State would use State taxpayer funds to fix the levee. The total costs of restoring the island eventually totaled \$45 million, for an island whose land value was approximately \$42 million. The island included a state highway, the Burlington Northern Santa Fe railroad tracks, and the East Bay MUD water aqueduct. Following the State's repair of the levee, multiple parties, including those responsible for maintaining the levee, sued the State to recover their costs, alleging inadequate State oversight of local levee maintenance. This conflict over who pays for Delta levee failures continues today, simultaneous with debate over how to prepare for future levee failures.

IV. Seismic Risks to Water Supply from the Delta

The seismic risks in the Delta remain the most significant disaster risk to Southern California water supply reliability. While all water import conveyance facilities cross earthquake faults, a single failure at some point along a canal may be fixed relatively quickly. Southern California also enjoys multiple water import sources, which would allow for redundant systems to temporarily substitute water supply or alternative conveyance structures, when one system fails. Multiple levee failures in the Delta, however, could require months or even years to restore the water quality and conveyance system to deliver water to the San Francisco Bay Area, San Joaquin Valley and Southern California. Or, the current Delta water conveyance system may never be restored and the water projects would need to build an alternative water conveyance facility that does not rely on Delta levees and channels.

A. Seismic Risks in the Delta

The Delta suffers from multiple seismic risks. There is at least one small fault in the Delta, but the more significant risks are the major faults nearby. Faults in the East Bay pose the greatest risk to the Delta, including the Hayward, Calaveras, Greenville, Concord-Green Valley and Mount Diablo faults. In January 2011, the United States Geological Survey (USGS) gave a presentation on Delta earthquake risks to the Delta Stewardship Council (Council) suggesting that the Delta earthquake risk may be more significant than previously estimated. In a follow-up letter, USGS agreed with DWR conclusions that seismic hazard in the Delta is “high.” The letter from USGS explained the uncertainty:

[T]here remains considerable uncertainty in any characterization of hazards due to our community’s limited understanding of: (1) the potential seismic sources in the East Bay and beneath the Delta; (2) the effects that peat and soft soils will have on earthquake energy as it is transmitted to the ground surface; and (3) the deeper three-dimensional geology of this part of the Central Valley and the presence of thick, soft basin materials.

After hearing several presentations on seismic risks to Delta levees, the Council’s latest draft Delta Plan concludes: “Levee failures and flooding can **and will** place human life and property in danger, and can have potentially significant implications for the State’s water supply and infrastructure and the health of the Delta ecosystem” (emphasis added).

1. Implications of Delta Earthquake Risks

The Council’s conclusion only hints at the substantial implications of a Delta earthquake and multiple levee failures. The damage would be broad, deep and multi-faceted. Because of the depth below water level of the Central Delta levees, DWR projects many of the levee failures in that part of the Delta, which is where Sacramento River water flows toward the South Delta export pumps. Failures in that region would affect multiple resources in the Delta:

- *Water Quality.* Inundation of these deep islands would act like a vacuum, drawing salt water from San Francisco Bay deep into the Delta. A west-east saltwater flow would replace the north-south “hydraulic barrier.” Substantial upstream reservoir releases of freshwater could push the saltwater back out toward the Golden Gate, but those massive supplies may not be available. The depth of these islands – and therefore the water inundating them – also may create a sump for contaminants coming downstream from the San Joaquin and Sacramento Rivers. These contaminants, from upstream urban and agricultural runoff, would flow toward the Delta and settle at the bottom of a deep “inland sea.” Tidal action would have less effect on moving the contaminants out to the ocean.
- *Water Supply.* The collapse of levees and inundation of saltwater would immediately cut off water project exports. First, the saline water would not meet water quality standards required for export. When Jones Tract failed, higher salinity forced the federal and state water projects to substantially reduce export pumping from the Delta. Second, upstream federal/state project supplies of freshwater would be needed for pushing the saltwater back out of the Delta, so the projects may not have sufficient additional storage. Finally, the narrow channels that move Sacramento River water relatively quickly to the South Delta export pumps would be gone, making it difficult for the projects to move upstream reservoir water toward the Delta pumps.
- *Delta Ecosystem.* With a multiple levee failure, the Delta ecosystem would change in an instant. The mix of fresh and salt water typical of a riverine estuary would be replaced by a deep inland sea. Riverine habitat along the many stream channels would disappear.

- *Delta Agriculture.* Delta agriculture on the subsided and then-inundated islands would cease. According to a recent Delta Protection Commission report, agriculture in the five Delta counties leads to about \$1 billion annually in total economic output. The cost to restore multiple islands would be substantial, possibly not justifying restoration of agricultural lands. The saltwater inundation, for example, may be difficult to eliminate from the soils, even if the levees were repaired and the salt water pumped out.
- *Infrastructure.* The Delta supports more than water conveyance and an ecosystem. A wide range of infrastructure crosses the Delta – electrical power lines, natural gas pipelines, railroads, and state highways. All of these assets would be at risk in a Delta collapse.

2. Debate Regarding Responsibility for Delta Levees

Debate as to the responsibility for maintaining and rebuilding Delta levees has continued for decades. A 2003 ruling in the *Paterno v. State of California* lawsuit held that the State had liability for a breach on an upstream state-federal flood control project levee does not apply to levees in the Delta, where the State has never accepted responsibility for levee maintenance and operation. Others argue, however, that because the State relies on those levees to convey SWP water to its pumps, it has a responsibility to protect the Delta levee system for conveyance purposes.

Delta property rights were established based on the landowner's responsibility to build and maintain levees to "reclaim" the land from the swamp and keep it dry. A state appellate court held that a landowner whose levees failed at Frank's Tract lost his property rights to the State's public trust interests. If he rebuilt his levees, he could reclaim his property rights, but in the meantime, he had no right to exclude fisherman in boats from the water covering "his" island.

While Delta land ownership remains contingent on the landowners (or their reclamation district) maintaining the levees surrounding their land, the State has provided funding for Delta levee maintenance since 1983. The Department of Water Resources (DWR) operates two programs to help with maintaining Delta levees – the Delta Levee Subventions Program and the Special Projects Program. DWR provides financial "subventions" to Delta landowners and their reclamation districts to maintain their levees. DWR funds its own Delta levee "special projects" to protect certain state interests, including the SWP interest to move water through the Delta. While Delta levees failed on many occasions in the 20th Century, the levee failures have been far less since the State started providing levee maintenance funding.

As shown in the Jones Tract litigation, however, this funding has led some to claim that the State has responsibility for maintaining all Delta levees. The argument is that the State is liable for failing to oversee how the Delta landowners use State money to invest in maintaining their levees. Others have suggested that once the State started investing in Delta levees, it could no longer pull out that investment or deny any landowner funding for its levee by applying the State's own priorities for limited Delta levee funding. Senate Bill 1 X7 (Simitian) of the 2009 Delta/Water Legislation, however, requires that the new Delta Plan, currently under development by the Delta Stewardship Council, recommend priorities for State investments in Delta levees, and explicitly rejected any suggestion that Delta landowners' property rights include the right to State funding. The debate about State responsibility nevertheless continues.

V. State Emergency Management Programs for the Delta

Since the Jones Tract failure – and more importantly Hurricane Katrina – the State has paid increasing attention to emergency response to levee failure in the Delta. A California Senate subcommittee on the Delta, chaired by then-Senator Mike Machado, held the first Delta emergency response hearing in October 2005, just after Hurricane Katrina. At that hearing, DWR unveiled its projected scenario of multiple levee failure. Then-San Joaquin County emergency services director, Ron Baldwin, testified that the Delta Counties, who are responsible for the first level of emergency response, had not prepared a Delta emergency response plan. The Counties had considered various emergency response scenarios for multiple hazards for their counties generally, but had not focused on the risks of multiple levee failures in the Delta. These County plans fit within the framework of the larger State Emergency Management System.

A. State Emergency Management System

The Standardized Emergency Management System (SEMS), developed as a result of the 1991 East Bay Hills Fire, is California’s system for managing emergencies. SEMS provides a consistent template to enable State, tribal and local governments, nongovernmental organizations, and the private sector to protect against, respond to, and recover from all emergencies and disasters regardless of scope, cause, location, or complexity. It is a core set of doctrines, concepts, principles, terminology, and organizational processes that enables effective, efficient, and collaborative incident management. This framework forms the substructure for interoperability and enables diverse agencies and organizations to conduct coordinated and efficient incident response operations.

All state government agencies must use SEMS when responding to multi-jurisdictional or multi-agency emergencies. All local government agencies must use SEMS in multi-jurisdictional or multi-agency emergency responses to be eligible for state reimbursement of response-related personnel costs.

Similarly, the National Incident Management System (NIMS) was established via Homeland Security Presidential Directive in 2004 to establish a systematic, proactive approach by which to guide governments and agencies (including the federal government) at all levels to work seamlessly during a disaster. Together, SEMS and NIMS provide the basis of California’s Emergency Response System.

That said, incidents typically begin and end locally, and are managed on a daily basis at the lowest possible geographical, organizational, and jurisdictional level. For this reason, every county is responsible for the development of its own Emergency Operations Plan, utilizing SEMS and NIMS, which takes into account each local government’s resources and unique hazards and terrain. Should an earthquake or other such disaster occur in the Delta, it is expected that first responders will adhere to SEMS and NIMS and respond accordingly – thereby seeking regional, state and federal assistance as needed.

B. Senate Bill 27 (Simitian/2008) & Cal EMA

In 2006, legislation to address the Delta-specific risk of levee failure impacting water supply began developing. Assembly Bill 1200 (Laird) required DWR to evaluate the potential impacts on water supplies from any combination of risks, including earthquakes. The bill also required DWR to report to the Legislature on a comparison of options for addressing those risks. That report, which DWR already had proposed to prepare, was intended to assess the risk of levee failures and provide options for minimizing those risks. DWR named the program the “Delta

Risk Management Strategy” (DRMS or “Dreams”). AB 1200 was the first of several bills to address the mounting crisis in the Delta. The risk of Delta levee failure and emergency response to such failure continued to draw the attention of the Legislature in the years that followed.

In response specifically to the seismic risk of mass levee failure in the Delta, Senator Simitian introduced legislation to develop a Delta emergency response plan in 2008. SB 27 (Simitian) originally proposed to require the Delta Protection Commission (DPC) to develop a unified Delta emergency response plan. Interested agencies and stakeholders in the Delta argued over who should lead development of the plan. The Delta Counties and DWR had opposing ideas about what the emergency might be – an occasional levee breach or a mass failure. DWR did not want to take over the counties’ duty to provide the first response to emergencies. The Governor’s Office of Emergency Services (OES) indicated it relied on DWR for Delta emergency response.

DPC staff tried to manage all the Delta interests, but ultimately the bill put responsibility to lead a task force with OES. [Later that same year, OES and the Office of Homeland Security became the California Emergency Management Agency (CalEMA), as a result of Assembly Bill 38 (Nava, 2008)]. Water Code Section 12994.5 requires CalEMA to submit the report by the beginning of this year. Subsequent legislation maintained the 2011 deadline, but allowed the task force to continue in operation until 2013 unless the report was submitted. According to other State agencies, CalEMA completed the report earlier this year, but has not released the report publicly. It is unclear why CalEMA has refused to release the report, although recent reports indicate that the acting CalEMA secretary has asked to reconvene the task force.

C. Department of Water Resources

While CalEMA chaired the “Sacramento-San Joaquin Delta Multi-Hazard Coordination Task Force” and developed its report, DWR continued working on DRMS as required by AB 1200. DRMS provides information on the risk and advises on strategies to address those risks. DWR issued Phase 1 of DRMS in February 2009, which received substantial criticism as to its assessment of the risk, particularly from in-Delta interests. DWR has continued working on its DRMS study, with a worldwide consulting firm, URS, taking the lead.

In 2006, voters approved general obligation bonds for flood protection, including Delta emergency preparedness. DWR used those bond funds, as well as funding from its SWP contractors (*e.g.* MWD), to acquire and store emergency response supplies, such as rock to repair failed Delta levees. Over the years, there has been some dispute as to who can access those supplies in case of a local emergency.

DWR also is currently developing an emergency response plan for Delta floods. DWR expects to complete a “Delta Flood Emergency Preparedness, Response and Recovery Program” by March 2012. In recent months, DWR has reported its progress on this Delta emergency response plan to the Delta Stewardship Council. DWR’s presentation in September suggested that at least some who work on the flood emergency plan may have little knowledge of SWP operations and how water supply operations would be affected. The flood emergency response planning seemed disconnected to water supply issues.

D. Delta Protection Commission and the Delta Counties

The Delta Counties also have continued their efforts to prepare for a Delta emergency. The 2009 Delta/Water Legislation reformed the Delta Protection Commission (DPC) to make it more clearly the voice of the Delta Counties. DPC hired former Senator Mike Machado as its Executive Officer. State bond also provided funding for the Delta Counties to acquire a unified

emergency communication system for the Delta. In the last year, DPC has made some effort to help lead all local agencies in the Delta in developing a coordinated emergency response plan. San Joaquin County's former director of emergency services, Ron Baldwin, retired in 2011 and is working with the DPC to coordinate a unified application to DWR for federal FEMA funding for a regional emergency response plan.

E. Delta Stewardship Council "Delta Plan"

The 2009 Delta/Water Legislation addressed several issues related to Delta levee investment and emergency response. The "Sacramento-San Joaquin Delta Reform Act of 2009," in SB 1 X7 (Simitian), Cal. Water Code § 85000 *et seq.*, addressed a number of issues related to earthquake and levee risks in the Delta:

- Stated a legislative finding that Delta "property ownership, and the exercise of associated rights, continue to depend on the landowners' maintenance of those nonproject levees and do not include any right to state funding of levee maintenance or repair."
- Set a State policy objective of reducing risks to people, property, and state interests in the Delta by effective emergency preparedness, appropriate land uses, and investments in flood protection.
- Required the Delta Plan, which is due at the end of this year, to "attempt to reduce risks to people, property and state interests in the Delta by promoting effective emergency preparedness, appropriate land uses, and strategic levee investments."
- Allowed the Delta Stewardship Council to incorporate the emergency response and preparedness strategies in the SB 27 report into Delta Plan.
- Required the separate Bay-Delta Conservation Plan to consider the "resilience and recovery of Delta Conveyance alternatives in the event of catastrophic loss caused by earthquake or flood or other natural disaster."

The Delta Stewardship Council is on track to adopt the Delta Plan by the deadline, January 1, 2012. The current Fifth Draft Delta Plan includes no enforceable regulatory requirements for a unified State emergency response plan, but does recommend that DWR work with CalEMA to prepare one consistent with CalEMA's SB 27 report. The Council has not made this an enforceable policy due to lack of clarity in its authority to require another State agency to take a particular action. The 2009 Delta/Water Legislation gave the Council authority to review state and local agency actions in the Delta for "consistency" with the Council's Delta Plan. That bill, however, withheld authority to affirmatively direct other State agency actions. The statute creating the Council, however, would allow them to adopt a policy requiring a unified State plan for emergency response and then find other DWR actions inconsistent with that policy.

VI. Conclusion

The Legislature has focused California's attention on the seismic risks to water supply reliability in the Delta, with several bills addressing the issue in the last five years. The State continues to develop information and plans for emergency response to earthquakes and multiple Delta levee failures. With the failures of Hurricane Katrina still on much of the nation's mind, the Legislature must work to ensure that these multiple plans coincide with each other. Additionally, it is crucial that the diverse agencies and organizations that comprise the Delta governance structure communicate and coordinate with each other to adequately prepare for, manage, and respond to a disaster of any kind. Finally, the proposals for improved infrastructure and water conveyance in the Delta are numerous. It is clear that, while considering all of these plans in the future, the Legislature and people of California must do so through a filter of emergency management and drinking water safety.