

**CENTRAL VALLEY FLOOD PROTECTION BOARD**

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Ms. Terry Macaulay, P.E.  
Acting Deputy Executive Officer  
Delta Stewardship Council  
980 9th Street, Suite 1500  
Sacramento, CA 95814

Dear Ms. Macaulay,

The Central Valley Flood Protection Board hereby submits the following comments on the Fourth Staff Draft of the Delta Plan, dated June 14, 2011. The comments address matters discussed in **Chapter 7 – Reduce Risk to People, Property, and State Interests in the Delta.**

Page 137, add RR P3, after Line 30

Encroachments located within project levees and project levee right-of-way need to be permitted through the Title 23 permitting process managed by the Central Valley Flood Protection Board. Maps included in Title 23, California Code of Regulations define project levee alignments.

Federal and State project levees within the Delta are illustrated on the following map links:

[http://www.water.ca.gov/floodmgmt/lrafmo/fmb/docs/SanJoaquinRiver\\_LFPZ\\_Map.pdf](http://www.water.ca.gov/floodmgmt/lrafmo/fmb/docs/SanJoaquinRiver_LFPZ_Map.pdf)

[http://www.water.ca.gov/floodmgmt/lrafmo/fmb/docs/SacramentoRiver\\_LFPZ\\_Map.pdf](http://www.water.ca.gov/floodmgmt/lrafmo/fmb/docs/SacramentoRiver_LFPZ_Map.pdf)

Page 138, after Line 34; insert the following as a fifth bullet:

- ◆ **USACE 1955/1957 Profile:** Levees built under the 1955/1957 profile incorporate a minimum crown elevation equal to the 1955/1957 original Corps design profiles resulting from modeling results listed in the Corps 2002 Comprehensive Study. There is no consistent level of protection associated with the 1957 profile other than the fact that the height of levees were designed using the 1955 flood of record.

Page 141, Table 7-1; add another row to the table:

“Class 6; USACE 1955/1957 Profile” Levees within this class allow all land uses (therefore, a “checkmark” in each column). The Central Valley Flood Protection Board standards for levees are included in California Code of Regulations, Title 23 Waters, Division 1 Central Valley flood Protection Board.

Page 147, RR R7, after Line 20, insert the following as a sixth bullet:

- ◆ The Delta Levee Subvention Program shall be included as an investment tool used to fund maintenance activities on Delta levees.

Thank you for allowing the Central Valley Flood Protection Board to comment on the Draft Delta Plan. If you have any questions, please contact Mr. Len Marino at (916) 574-0608 or email at [lmario@water.ca.gov](mailto:lmario@water.ca.gov).

Sincerely,

Jay Punia, P.E.  
Executive Officer

Cc:

All Board members  
Deborah Smith

## Chapter 7

# Reduce Risk to People, Property, and State Interests in the Delta

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Water Code sections 85305, 85306, 85307, and 85309 require the Delta Plan to include specific objectives.

*85305. (a) The Delta Plan shall 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.*

*(b) The council may incorporate into the Delta Plan the emergency preparedness and response strategies for the Delta developed by the California Emergency Management Agency pursuant to Section 12994.5.*

*85306. The council, in consultation with the Central Valley Flood Protection Board, shall recommend in the Delta Plan priorities for state investments in levee operation, maintenance, and improvements in the Delta, including both levees that are a part of the State Plan of Flood Control and non-project levees.*

*85307. (a) The Delta Plan may identify actions to be taken outside of the Delta, if those actions are determined to significantly reduce flood risks in the Delta.*

*(b) The Delta Plan may include local plans of flood protection.*

*(c) The council, in consultation with the Department of Transportation, may address in the Delta Plan the effects of climate change and sea level rise on the three state highways that cross the Delta.*

*(d) The council, in consultation with the State Energy Resources Conservation and Development Commission and the Public Utilities Commission, may incorporate into the Delta Plan additional actions to address the needs of Delta energy development, energy storage, and energy transmission and distribution.*

Based upon Water Code Section 85309, the Council shall consider a proposal from the Department of Water Resources, in consultation with the Corps of Engineers and the Central Valley Flood Protection Board, to coordinate flood and water supply operations of the State Water Project and the federal Central Valley Project.

# Chapter 7

## Reduce Risk to People, Property, and State Interests in the Delta

### Introduction

The Delta is an inherently flood-prone area at the confluence of the Sacramento and San Joaquin River watersheds, which collectively drain approximately 43,000 square miles. As discussed in Chapter 5, the Delta was a historically complex and variable system formed through the interaction of fluctuating sea levels and an influx of alluvial sediments from river floods. It is now a complex labyrinth of reclaimed islands and waterways created through the construction of levees, many of which were initially constructed over a century ago using primitive materials and equipment.

The Delta (the legal Delta and Suisun Marsh) includes more than 1,335 miles of levees that protect approximately 839,591 acres of land. These levees face potential threats such as large runoff events, earthquakes, extreme high tides, wind-generated waves, subsidence, and sea level rise. Individually, each of these threats is enough to cause serious concern; together, they represent a potential for catastrophic disruption of the Delta. A mass failure of the levee system would have real life-and-death impacts, and property losses that could total billions of dollars. Levee failures not only create direct damage and potential loss of life from flooding, but also change the configuration of the Delta—both water and land—and alter the mixing of fresh water with salt water. A failure could also have significant effects on California's economy from interruption of service to 25 million urban water users and to approximately 3 million acres of irrigated farmland that depend, in part, on water conveyed through the Delta.

Preventing floods is impossible, but prudent planning and management of flood management activities can significantly reduce vulnerabilities and risk. A portfolio of risk-reduction strategies for the Delta must consider urban and rural communities as well as agricultural lands during the process of identifying, evaluating, and prioritizing investments in the levee system. Risks can be reduced through an emergency preparedness, response, and recovery system; appropriate land uses; water management changes; reservoir reoperation; and strategic levee improvements.

This chapter begins with a general discussion of flood risk in the Delta and descriptions of ongoing State, federal, and local flood management efforts. Eight subsections follow, which together present policies and recommendations to reduce risk to people, property, and State interests in the Delta:

- ◆ Floodplain and Floodway Protection
- ◆ Levee Classifications for Protection of Land and Resources Uses
- ◆ Flood Management Investment
- ◆ Emergency Preparedness and Response
- ◆ Limitation of Liability
- ◆ Financing and Implementation of Local Flood Management Activities

- 1       ♦ Subsidence Reduction and Reversal
- 2       ♦ Reoperation of Upstream Reservoirs and Peak Flow Attenuation

### 3       **Flood Risk in the Delta**

4       Flood risk is assessed in terms of the likelihood of a flood event occurring, the chance of failure from that  
5       flood event, and the associated consequences. Consequences can entail loss of life and economic and  
6       environmental damage. Risk of flooding in the Delta is likely to increase over time as a result of several  
7       factors:

- 8       ♦ Continued development within the floodplains
- 9       ♦ Inadequate levees
- 10      ♦ Inadequate channel capacities
- 11      ♦ Seismic vulnerability
- 12      ♦ Continuing subsidence
- 13      ♦ Climate change
- 14      ♦ Sea level rise

15      It is estimated that by the year 2100, sea level rise may reach 55 inches (California Climate Action Team  
16      2010, California Ocean Protection Council 2011). Additionally, understanding about large-scale  
17      precipitation events continues to grow, such as the ARkStorm scenarios being investigated by the U.S.  
18      Geological Survey (USGS), which indicate that massive storms and subsequent flooding have occurred  
19      and are likely to occur again (USGS 2011). Failure of significant parts of the Delta's flood management  
20      system may be unavoidable.

21      Flood risk reduction cannot absolutely prevent harmful inundation from floods, but can reduce its  
22      likelihood and social and economic impacts. History has shown that unavoidable structural failures in the  
23      system will occur as a result of extraordinary events, imperfect knowledge, and imperfect materials. Risks  
24      must be well understood, and then managed and controlled to the extent possible through public  
25      awareness, adequate emergency management planning, and enforcement of existing flood management  
26      regulations, as well through physical repair, improvements, and levee rehabilitation efforts.

27      Risks must also be quantified, to the extent practicable, to better understand them and to facilitate the  
28      prioritization of flood management activities. Measures such as Expected Annual Damage have great  
29      potential and should be incorporated into Delta flood risk management. Expected Annual Damage is  
30      discussed in greater detail later in this chapter.

### 31      **Ongoing Flood Management Efforts by Other Agencies**

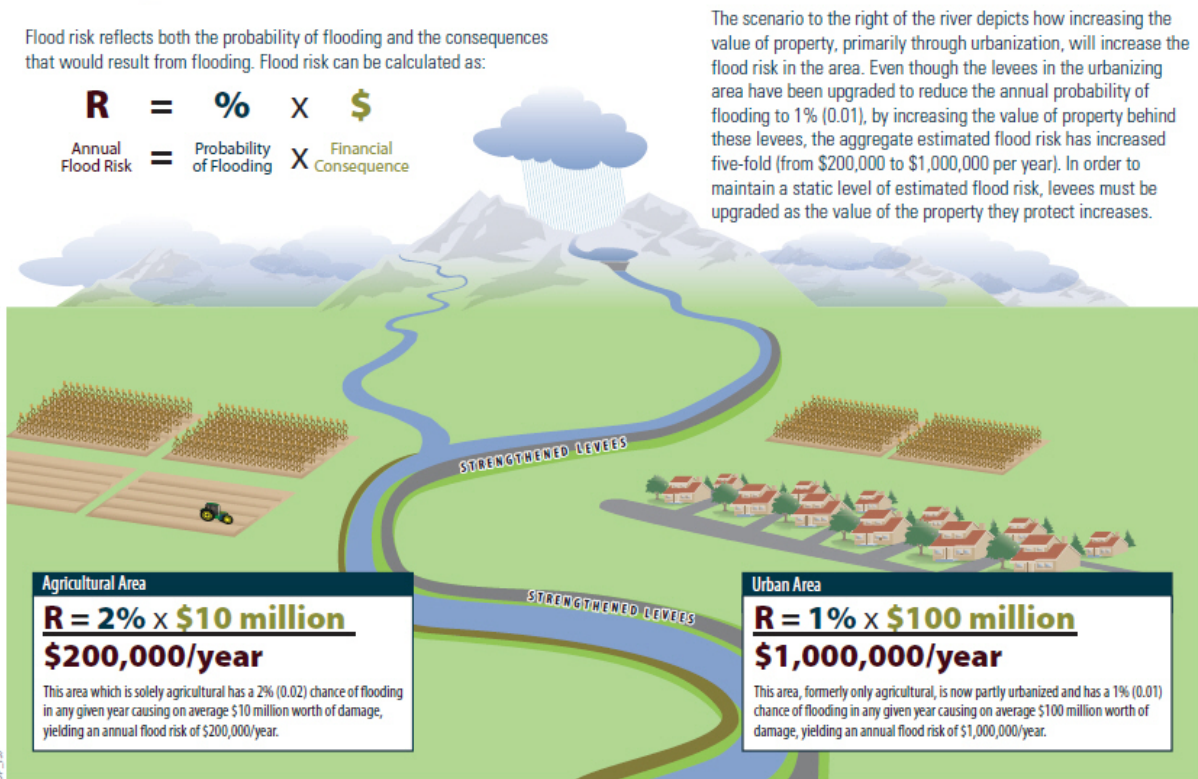
32      Many studies and planning efforts addressing flood management and emergency preparedness, response,  
33      and mitigation are underway, and will be considered by the Council for ongoing Delta flood risk  
34      management. These studies and efforts include:

- 35      ♦ Central Valley Flood Protection Plan
- 36      ♦ FloodSAFE
- 37      ♦ Sacramento-San Joaquin Delta Multi-Hazard Coordination Taskforce Report
- 38      ♦ U.S. Army Corps of Engineers (USACE) Delta Islands Levees Feasibility Study, Long Term  
39      Management Strategy for Dredging and Dredge Material Placement, Periodic Inspection (PI)  
40      system, and Levee Safety Portfolio Risk Management System.

41      The Council will consider the findings of these studies and may elect to incorporate them into future  
42      updated versions of the Delta Plan. It is important to note that the Central Valley Flood Protection Plan

1 (due January 1, 2012, to the Central Valley Flood Protection Board for adoption by July 1, 2012) and  
 2 FloodSAFE include many concepts relevant to the Delta Plan; however, they largely focus on issues  
 3 outside of the Delta. At the federal level, the National Committee on Levee Safety (2009) has recently  
 4 submitted a report to Congress on levee standards that is currently under review.

5 **Figure 7-1**  
 6 **Understanding Delta Flood Risk**



7  
 8 **Policies and Recommendations**

9 **Floodway and Floodplain Protection**

10 Adequate flood flow capacity is critical for managing flood risks, and for overall Delta water management  
 11 and ecosystem integrity. Both the Federal Emergency Management Agency (FEMA) and the State’s  
 12 Central Valley Flood Protection Board play a role in designating floodways to accommodate flood flows.  
 13 “Designated Floodway” refers to the channel of the stream and that portion of the adjoining floodplain  
 14 reasonably required to provide for the passage of a design flood; it is also the floodway between existing  
 15 levees as adopted by the Central Valley Flood Protection Board or the Legislature.

16 The Central Valley Flood Protection Board, under Water Code section 8609, has the authority to  
 17 designate floodways in the Central Valley. The authority of the Central Valley Flood Protection Board in  
 18 the Delta is limited to the State-Federal levee system. Under the National Flood Insurance Program,

1 FEMA works with participating communities to regulate development within their floodways in  
2 accordance with federal regulations.<sup>32</sup>

3 Land use policies guiding development in floodways are not consistent across Delta counties.  
4 Additionally, floodways have not been established for many of the channels in the Delta by FEMA or by  
5 the Central Valley Flood Protection Board. In light of these problems, the Delta Plan should address these  
6 issues and highlight the need for policies and recommendations that accommodate floodplain and  
7 floodway protection. Concerns that floodways may expand and deepen because of sea level rise and  
8 changes to precipitation patterns over the next 100 years must be addressed and accommodated.  
9 Development in existing or future floodplain or bypass locations in the Delta or upstream can  
10 permanently eliminate the availability of these areas for future floodplain usage.

### 11 ***Problem Statement***

12 Encroachments into floodways, critical floodplains, and potential future floodplain or bypass locations in  
13 the Delta could reduce the flood carrying capacity of the Delta. Future Delta floodways and bypasses  
14 have not been formally identified and protected.

### 15 ***Policies***

16 The following are policies as to the lands in the Delta, and recommendations as to the lands outside the  
17 Delta:

18 RR P1 Floodways<sup>33</sup> shall not be encroached<sup>34</sup> upon nor diminished without mitigating for future flood  
19 flows. This policy would not pertain to ecosystem restoration projects or any ongoing  
20 agricultural or flood management activities.

21 RR P2 The following areas shall not be encroached upon because they are critical floodplains<sup>35</sup> and  
22 may also provide ecosystem benefit. This policy would not pertain to ecosystem restoration  
23 projects or any ongoing agricultural or flood management activities, provided they do not  
24 decrease the existing level of flood protection:

- 25 ◆ Areas located in the Yolo Bypass from Fremont Weir through Cache Slough to the  
26 Sacramento River including the confluence of Putah Creek into the bypass
- 27 ◆ The Cosumnes River/Mokelumne River confluence, as defined by the North Delta Flood  
28 Control and Ecosystem Restoration Project (McCormack-Williamson), or as modified in  
29 the future by Department of Water Resources or the U.S. Army Corps of Engineers. (DWR  
30 2010a)

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<sup>32</sup> 44 Code of Federal Regulations 60.3(b)(6,7,10) requires the following:

- Notify, in riverine situations, adjacent communities and the State Coordinating Office prior to any alteration or relocation of a watercourse, and submit copies of such notifications to the Administrator;
- Assure that the flood carrying capacity within the altered or relocated portion of any watercourse is maintained;
- Require until a regulatory floodway is designated, that no new construction, substantial improvements, or other development (including fill) shall be permitted within Zones A1-30 and AE on the community's Flood Insurance Rate Map (FIRM), unless it is demonstrated that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one foot at any point within the community.

<sup>33</sup> As defined by California Code of Regulations, Title 23, Division 1, Chapter 1, Article 2, Section 4: (n) Floodway. "Floodway" means the channel of a river or other watercourse and the adjacent land areas that convey flood waters.

<sup>34</sup> As Described in DWR's "Interim Levee Design Criteria for Urban and Urbanizing Areas in the Sacramento-San Joaquin Valley", (DWR 2010b): Encroachments and vegetation should be evaluated and managed so as to not impact levee safety, while recognizing their benefits.

<sup>35</sup> As defined by the FEMA National Flood Insurance Program: Floodplain: Any land area susceptible to being inundated by flood waters from any source. <http://www.fema.gov/business/nfip/19def2.shtm>.



1           ♦ The Lower San Joaquin River Flood Bypass, located on the Lower San Joaquin River  
2           upstream of Stockton immediately southwest of Paradise Cut on lands both upstream and  
3           downstream of the Interstate 5 crossing. This area is described in the Lower San Joaquin  
4           River Flood Bypass Proposal, submitted to the Department of Water Resources by the  
5           partnership of the South Delta Water Agency, the River Islands Development Company,  
6           RD 2062, San Joaquin Resource Conservation District, American Rivers, the American  
7           Lands Conservancy, and the Natural Resources Defense Council, March 2011. This area  
8           may be modified in the future through the completion of this project.

9           Policy ER P4 also addresses this problem statement by recommending that levee rehabilitation or  
10          construction include alternatives that increase the extent of floodplain and riparian habitats.

### 11          **Recommendations**

12          RR R1    The Legislature should fund and the Department of Water Resources and the Central Valley  
13          Flood Protection Board should complete their investigation of the bypass and floodways in the  
14          San Joaquin River to reduce potential flooding near Paradise Cut, as required by Water Code  
15          section 9613(c).

16          RR R2    The current efforts to maintain navigable waters in the Sacramento River Deep Water Ship  
17          Channel and Stockton Deep Water Ship Channel, led by the U.S. Army Corps of Engineers—  
18          the *San Francisco Bay Long Term Management Strategy for Dredging and the Delta Dredged*  
19          *Sediment Long-Term Management Strategy*—should be continued and supported so that  
20          desirable dredging to support the Delta Plan and the coequal goals might be achieved.  
21          Appropriate dredging throughout other areas in the Delta might also increase flood conveyance  
22          while at the same time acquiring material that might be used for levee maintenance (USACE  
23          2002).

## 24          **Levee Classifications for Protection of Land and Resource Uses**

25          The 1992 Delta Protection Act designated the Delta as a flood-prone area and defined the most  
26          appropriate land uses as agriculture, wildlife habitat, and where specifically provided, recreation (Public  
27          Resources Code section 29704). Although levees were constructed in the Delta to reduce the risk of  
28          flooding, the historical performance of many levees in the Delta is poor (DWR 2005). Many levee failures  
29          have been attributed to high flood flows, and some levees have failed in the absence of any type of flood.  
30          If a significant earthquake does occur on faults near the west Delta, one or more levees could fail or  
31          subside (DWR 2009). Figure 7-2 illustrates a flood scenario in which a 6.5-magnitude earthquake causes  
32          a 20-island failure. With this in mind, it is more important than ever that the levees in the Delta are  
33          designed, constructed, and maintained to provide the level of flood risk reduction commensurate with the  
34          land and resource uses they protect.

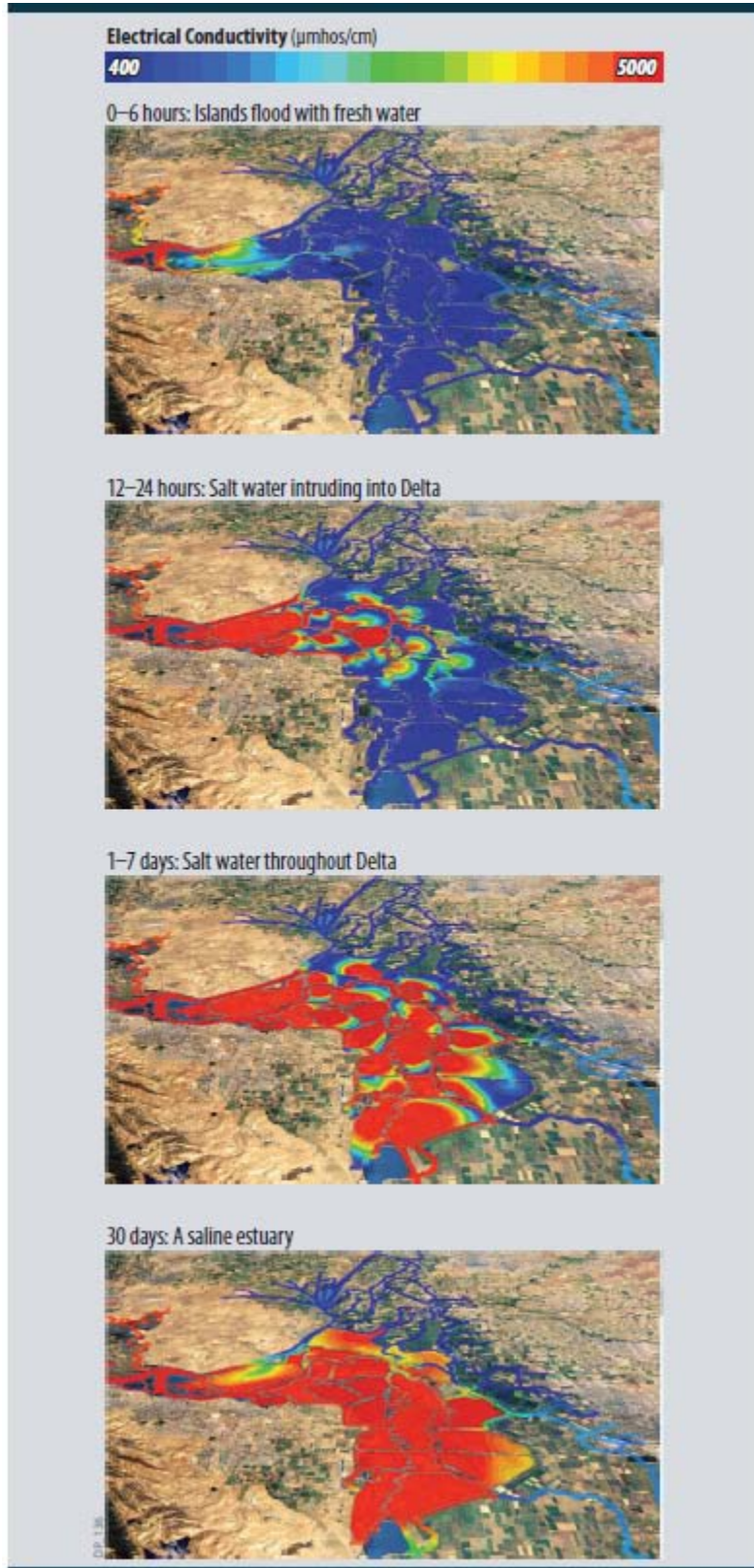
35          It is irresponsible to make future land use decisions that permit and encourage construction of significant  
36          numbers of new residences in the Delta in the face of the flood hazards that exist there. Current  
37          engineering knowledge indicates that those hazards cannot be overcome, and the safety of such new  
38          residents cannot be guaranteed, without the expenditure of massive funds for flood protection. Yet,  
39          developers and homeowners are unable or unwilling to bear those costs, and the public should not be  
40          required to subsidize them. The impacts of climate change—especially rising sea level and increased  
41          precipitation and runoff patterns—will only exacerbate future threats to public safety associated with such  
42          new residential development in the Delta.

43          The level of flood protection provided by levees should be related to an acceptable risk for the types of  
44          land use located behind the levee (Delta Vision Blue Ribbon Task Force 2008). A classification system is  
45          needed that aligns levee design with corresponding appropriate land and resource uses ranging from

1 habitat or ecosystem protection up to protection of large urban areas comprising thousands of people and  
2 homes. During the last few decades, State and federal agencies have developed various levee standards.  
3 These standards were designed to either establish minimum criteria that would make the levees and the  
4 properties protected eligible for FEMA grants or USACE rehabilitation funds, or set minimum criteria  
5 that would allow development behind the levees. The four most prominent existing standards and  
6 guidance are listed below:

- 7       ♦ **FEMA Hazard Mitigation Plan Guidance:** To be eligible for FEMA disaster grants and  
8       assistance following levee failures and island inundation, local communities must prepare a  
9       Hazard Mitigation Plan and maintain their levees in accordance with the plan.
- 10       ♦ **U.S. Army Corps of Engineers Public Law 84-99:** Meeting this standard allows the Delta  
11       island or tract to be eligible for USACE funding for levee rehabilitation and island restoration  
12       following levee failures and island inundation, provided that the reclamation district applies for  
13       and is accepted into the program and passes a rigorous initial inspection and periodic follow-up  
14       inspections. Eligibility for PL 84-99 was formerly based primarily on levee geometry with  
15       minimum freeboard and maximum steepness of slopes. The new USACE Periodic Inspection (PI)  
16       program has incorporated many other elements into eligibility, including presence of structure  
17       encroachments, vegetation, rodent control programs, and more. Although the geometry implies a  
18       minimum slope stability factor of safety, this standard is not associated with a level of protection  
19       and does not address seismic stability.
- 20       ♦ **FEMA 100-year (Base Flood) Protection:** This “insurance” standard, often called the 1 percent  
21       annual chance flood level of protection, is based on criteria established in the Code of Federal  
22       Regulations (44 CFR 65.10) and is often used with established USACE criteria to meet certain  
23       freeboard, slope stability, seepage/underseepage, erosion, and settlement requirements. Meeting  
24       this level of flood protection means that communities will not be required to purchase flood  
25       insurance or be subject to building restrictions. This standard generally does not address seismic  
26       stability. Very few levees in the central Delta meet this standard.
- 27       ♦ **DWR 200-year Urban Levee Protection:** This standard (currently under development within  
28       the Central Valley Flood Protection Plan) is similar to the FEMA standard, but for a 200-year  
29       level of flood protection. It is generally based on established USACE criteria. However, unlike  
30       USACE criteria, the DWR 200-year Urban Levee Protection requires that seismic stability be  
31       addressed. Not meeting this standard, or not making adequate progress toward it, will generally  
32       prohibit further development. Although almost none of the levees in the central Delta meet this  
33       standard, most do not protect urban areas, with the exceptions of the outer fringes of the Delta  
34       near West Sacramento, Sacramento’s Pocket Area, and Stockton.
- 35       ♦ Properly aligning land and resource uses with specific levee design criteria can help ensure that  
36       land and resource uses realize appropriate flood risk protection, but also signal that future  
37       alterations and changes to land and resource uses must remain in alignment with appropriate  
38       levee design criteria. To that end, this section provides policies that address the alignment of land  
39       and resource uses with appropriate levee design criteria.
- 40       ♦ While most of the attention is typically directed toward flood risk reduction for life and property,  
41       flood protection is also a consideration for habitat and ecosystem values and goals. Setback  
42       levees that expand flood conveyance capacity and reduce flood risk while providing ecosystem  
43       restoration and recreational opportunities are worthwhile (USACE 2002). Setback levees allow  
44       opportunities for construction of an improved levee foundation and section using modern design  
45       and construction practices, thereby reducing risk of failure.

- 1 **Figure 7-2**
- 2 **Magnitude 6.5 Earthquake Causing 20-island Failure**
- 3 *Source: MWD 2010*



4

1 ***Problem Statement***

2 Many Delta levees are not adequately designed and/or maintained to protect the existing land and  
3 resource uses.

4 ***Policies***

5 RR P3 Covered actions shall conform to the classifications defined in Table 7-1. Covered actions  
6 protected by Class 5 levees must conform by 2025 in accordance with the Central Valley Flood  
7 Protection Act of 2008 (Government Code section 65865.5(a)(3)).

8 ***Recommendation***

9 RR R3 The Department of Water Resources, in conjunction with the Department of Fish and Game  
10 and Delta Conservancy, should adopt criteria to define locations for future setback levees in the  
11 Delta and Delta watershed. Until then, any action located next to the land side of a levee should  
12 demonstrate adequate area is provided to accommodate setback levees, as determined by a  
13 registered civil engineer.

14 **Flood Management Investment**

15 The Delta is inherently flood-prone, but its levees protect its residents, its agricultural land, water  
16 supplies, and energy, communications, and transportation facilities vital to the economic health of  
17 California (Public Resources Code section 32301(h)). Levee maintenance and levee improvements in the  
18 Delta are critical for reducing risks to acceptable levels. Depending on the ownership of the levee, the  
19 responsibilities for these activities—and the financial investment required—are assigned to federal  
20 agencies, State agencies, and/or local landowners and reclamation districts.

21 Approximately one-third of the levees in the Delta are “project” levees. Project levees were authorized as  
22 part of a federal flood-control project and are eligible for rehabilitation by the USACE under PL 84-99.  
23 The Central Valley Flood Protection Board (formerly the Reclamation Board) serves as the non-federal  
24 partner to the USACE for all project levees in the Delta. Approximately 65 percent of the levees in the  
25 Delta and all levees in the Suisun Marsh are non-project (local) levees owned or maintained by local  
26 agencies or private owners. This means they are not part of the State-Federal levee system and are not  
27 usually eligible for rehabilitation by the USACE. Local agencies (primarily reclamation districts) receive  
28 partial reimbursement for levee maintenance and rehabilitation from the State when funding is available.  
29 It is often difficult for local agencies to raise funds for the local cost share of State and federal assistance  
30 programs. In addition, few Delta properties have federal or private flood insurance; consequently, these  
31 uninsured property owners may be solely responsible for repairs and losses following a levee failure.

32 With the passage of the Delta Reform Act, the State is now required to promote effective strategic levee  
33 investments and recommend prioritization of State investments (Water Code section 85305(a), 85306).  
34 Although the State has expended over \$250 million since the early 1970s on Delta levee operation,  
35 maintenance, and improvement, significant funding would be necessary to raise all Delta levees to  
36 PL 84-99 standards. Given the potential threats faced by Delta levees, risk must be reduced through a set  
37 of management policies that prioritize strategic and focused investments of resources into levees in a  
38 manner that best balances the multitude of uses in the Delta.

39 ***Problem Statement***

40 To promote strategic State investments in levee operations, maintenance, and improvements in the Delta,  
41 a Delta-wide prioritization framework is needed.

**Table 7-1**  
**Levee Classifications for Protection of Land Uses**

Levee System Goals								Minimum Design Criteria
Levee System Classification	Description	Land Use						
		Recreation and Wetlands Habitat	Agricultural	Infrastructure	Residential Development in Non-Urbanized Areas <sup>a, b</sup>		Urban Area <sup>c</sup>	
					Development of 4 or fewer parcels <sup>c</sup>	Development of 5 or more parcels		
<b>Class 1</b>	No specific goal	Acceptable	Not Acceptable	Not Acceptable	Not Acceptable	Not Acceptable	Not Acceptable	Designed to manage the flood risk to the level appropriate for individual ecosystem restoration projects.
<b>Class 2</b>	HMP (Hazard Mitigation Plan)	Acceptable	Acceptable	Not Acceptable	Not Acceptable	Not Acceptable	Not Acceptable	In accordance with Hazard Mitigation Plans approved by FEMA and defined with geometric levee criteria.
<b>Class 3</b>	PL84-99 (Public Law 84-99)	Acceptable	Acceptable	Acceptable	Not Acceptable <sup>d</sup>	Not Acceptable	Not Acceptable	USACE PL 84-99 Standards as developed by the US Army Corps of Engineers.
<b>Class 4</b>	FEMA 100 year	Acceptable	Acceptable	Acceptable	Acceptable <sup>d</sup>	Not Acceptable	Not Acceptable	In accordance with the FEMA and NFIP regulations, including criteria in 44 CFR 65.10 for Levees accredited by FEMA as providing 100 year flood protection.
<b>Class 5</b>	DWR 200 year	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable <sup>e</sup>	Acceptable <sup>e</sup>	Current DWR urban levee design criteria for the 200-year flood event water surface elevation. In accordance with the Central Valley Flood Protection Act of 2008 (Senate Bill 5, Machado)

<sup>a</sup> Urbanized Areas and Non-Urbanized Areas as defined in California Government Code section 65007(e).

<sup>b</sup> Levee protection for legacy towns should be based on reduction of risk to the town, determined by Expected Annual Damage.

<sup>c</sup> Minor subdivision development as defined in California Government Code section 66445(e).

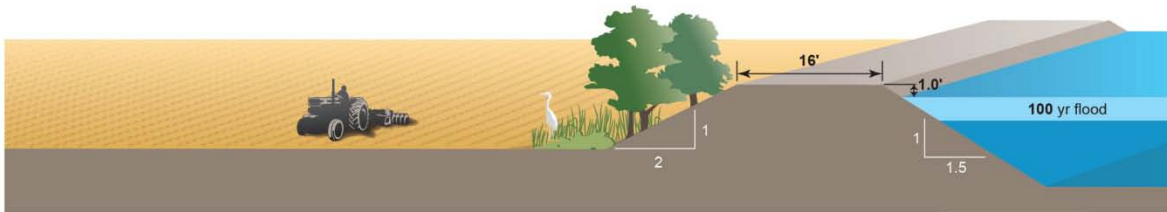
<sup>d</sup> Other actions which provide 100 year flood protection, such as flood proofing or structural elevation, may be considered on a project specific basis by appropriate local agencies.

<sup>e</sup> Levees for non-urban and urban residential areas should comply with requirements contained in the DWR's "Interim Levee Design Criteria for Urban and Urbanizing Areas in the Sacramento-San Joaquin Valley." The 200 year level of flood protection will need to accommodate sea level rise due to climate change.

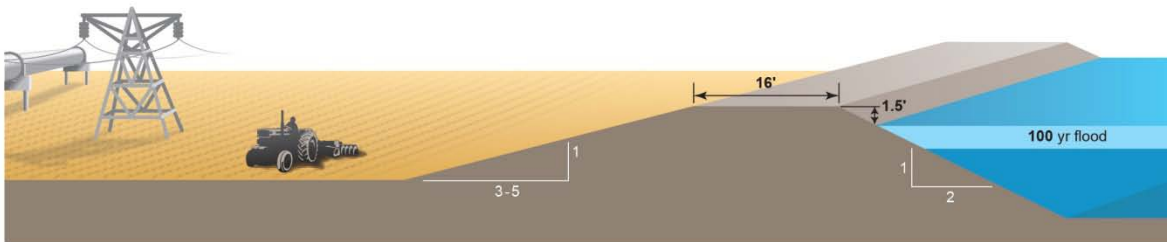
- 1 **Figure 7-3**
- 2 **Levee Classifications and Land Uses**
- 3 *Source: Adapted from Delta Vision Blue Ribbon Task Force 2008*



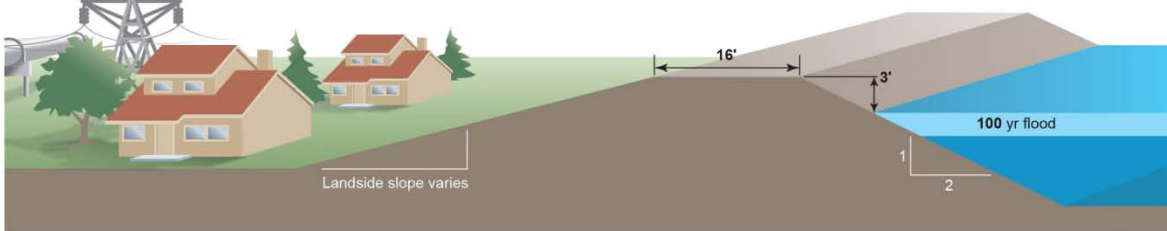
Class 1: Wetlands/Habitat



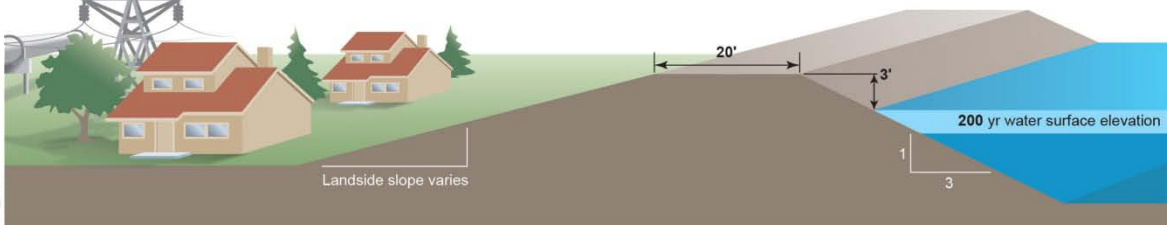
Class 2: Hazard Mitigation Plan (HMP)



Class 3: PL 84-99



Class 4: FEMA - 100 year



Class 5: DWR - 200 year<sup>1</sup>

<sup>1</sup>DWR Interim Levee Design Criteria, 2010

4

## 1 **Policies**

2 RR P4 State investments for levee operation, maintenance, and improvements in the Delta shall be  
3 directed by the Department of Water Resources'’ *A Framework for Department of Water*  
4 *Resources Investments in Delta Integrated Flood Management*. This draft Framework shall be  
5 completed by DWR, in consultation with the Central Valley Flood Protection Board, by  
6 January 1, 2013. The Framework shall:

- 7 ◆ Define State interests related to flood and levee management in the Delta. These State  
8 interests shall, at a minimum, include:
  - 9 • Reducing risk of loss of life
  - 10 • Protecting water supply
  - 11 • Protecting water quality and the ecosystem
  - 12 • Protecting critical infrastructure
- 13 ◆ Define a long-term levee policy for the Delta, which, at a minimum, shall determine those  
14 levees critical for protecting State interests.
- 15 ◆ Recognize the wide variability of conditions across the Delta including depth of inundation  
16 upon failure; current condition of existing levees; and degree of exposure to seismicity, sea  
17 level rise, climate change, and river flood levels.
- 18 ◆ Define a methodology for assessing initial Delta levee conditions, as well as on a  
19 systematic, routine, and coordinated basis, to develop a sound technical understanding and  
20 assessment capability to base levee related decisions. This information shall be collected  
21 and reported in a transparent manner, and shall include the production of a Delta levee  
22 conditions map.
- 23 ◆ Define a methodology for proactively identifying, developing, prioritizing, and scheduling  
24 specific levee operations, maintenance, and improvement projects.
- 25 ◆ Define a method for determining project costs, cost share, and project partners, if  
26 appropriate.
- 27 ◆ Define procedures that distinguish Delta Levees Special Flood Control Projects from  
28 routine levee maintenance projects.

## 29 **Emergency Preparedness and Response**

30 Even with the best-engineered levees, channels, and floodways, there will always remain a residual risk  
31 from flooding. Therefore, it is imperative that federal, State, and local governments—and the citizens  
32 themselves—be prepared for a variety of emergency situations. Emergency response should be routinely  
33 tested and practiced (Delta Vision Blue Ribbon Task Force 2008).

34 To effectively and reliably reduce risks to people, property, and State interests in the Delta, a multifaceted  
35 strategy of coordinated emergency preparedness, appropriate land use planning, and prioritized  
36 investment in flood protection infrastructure is necessary and prudent. Delta levees not only protect life  
37 and personal property, but also play a large role in protecting vital infrastructure, including the State’s  
38 water conveyance system. Despite the risks of levee failure, no published emergency action plan exists  
39 that addresses the consequences to federal and State water supply deliveries in the event of catastrophic  
40 levee failure in the Delta. Such a failure could lead to long-term salinity intrusion in the southern Delta  
41 where the federal and State water supply pumps are located. Although investment in flood protection



1 infrastructure can considerably reduce the likelihood of a catastrophic levee failure, failures are inevitable  
2 and will require the implementation of well-coordinated and carefully developed emergency-response  
3 planning efforts. To reduce response time while optimizing the effectiveness of the response effort, such  
4 plans will need to harness the unique capabilities of each agency with a mission in the Delta.

5 Despite the vital importance of adequate preparation, no Delta-wide emergency response plan exists. The  
6 California Emergency Management Agency, DWR, and several local agencies are preparing individual  
7 emergency response plans for the Delta, but the development of these should be coordinated, tested, and  
8 practiced. Strategies being prepared as directed by SB 27 (Water Code Section 12994.5) are anticipated to  
9 address this issue and will be considered in the Delta Plan.

10 As an example of planning efforts being conducted at the local agency level, San Joaquin County has  
11 developed flood contingency maps and urban evacuation maps as part of its coordinated flood emergency  
12 planning efforts. These maps and plans could be used as an example by other Delta counties and State and  
13 federal agencies to prepare a Delta-wide emergency response plan.

### 14 ***Problem Statement***

15 Levee failures and flooding can and will place human life and property in danger, and can have  
16 potentially significant implications for the State's water supply and infrastructure and the health of the  
17 Delta ecosystem. Currently, no coordinated Delta-wide emergency response plan exists to address levee  
18 failures and flooding.

### 19 ***Policies***

20 There are no policies with regulatory effect included in this section.

### 21 ***Recommendations***

22 RR R4 The following actions should be taken to promote emergency preparedness in the Delta:

- 23 ♦ Responsible Emergency Management Authorities should consider and implement the  
24 recommendations of the Delta Multi-Hazard Coordination Task Force (Water Code  
25 section 12994.5). Such actions should support the development of a regional response  
26 system for the Delta.
- 27 ♦ The Department of Water Resources, the California Emergency Management Agency, and  
28 local flood management agencies should prepare and regularly update a Delta-wide  
29 emergency response plan and the Inland Region Mass Evacuation Plan. These agencies  
30 should participate in emergency response exercises for both periodic and catastrophic flood  
31 events, inland mass evacuation exercises, and emergency preparedness public training,  
32 notification, and flood risk education and outreach programs. The U.S. Army Corps of  
33 Engineers should be a part of all emergency preparedness activities.
- 34 ♦ All personnel prepared to respond to Delta flood emergencies should be trained in the  
35 Statewide Emergency Management System (SEMS) and the National Incident Management  
36 System (NIMS) procedures. All emergency response plans and emergency response  
37 training exercises involving the Delta should be SEMS- and NIMS-compliant.
- 38 ♦ In consultation with local agencies, the Department of Water Resources should expand its  
39 emergency stockpiles to make them regional in nature and usable by a larger number of  
40 agencies in accordance with Department of Water Resources plans and procedures. The  
41 Department of Water Resources, as a part of this plan, should evaluate the potential of  
42 creating stored material sites by "over-reinforcing" west Delta levees.



- 1           ♦ State and local agencies and regulated utilities that own and/or operate infrastructure in the
- 2           Delta should prepare coordinated emergency response plans to protect the infrastructure
- 3           from long-term outages resulting from failures of the Delta levees. The emergency
- 4           procedures should consider methods that also would protect Delta land use and ecosystem.

## 5   **Limitation of Liability**

6   The Delta Reform Act requires that the Delta Plan attempt to reduce risks to people, property, and State  
7   interests in the Delta by, among other things, recommending priorities for State investments in levee  
8   operation, maintenance, and improvements in the Delta, including project and non-project levees (Water  
9   Code sections 85305, 85306, 85307). The Act expressly states that its provisions do not affect the liability  
10   of the State for flood protection in the Delta or its watershed (Water Code section 85032(j)).

11   Consequently, no action taken by a State agency as required or recommended by, or otherwise in  
12   furtherance of this Delta Plan, shall affect the State’s flood protection liability in the Delta or its  
13   watershed.

14   The USACE and other federal agencies are generally afforded some immunity from liability for damages  
15   arising from flood events through the concept of sovereign immunity and through provisions of the Flood  
16   Control Act of 1928 (FCA 1928) 33 U.S. Code Section 702c. Congress provided immunity to federal  
17   agencies for some but not all tort damages, and not for inverse condemnation. However, this immunity is  
18   not enjoyed by agencies outside of the federal government.

19   The most notable recent court decision on flood liability was the California Court of Appeal decision in  
20   *Paterno v. State of California* (2003) 113 Cal.App.4th 998. The court found the State was liable to  
21   flooded landowners for inverse condemnation damages caused by the failure of a Yuba River levee that  
22   the State did not design, build, or even directly maintain. This decision makes it possible that the State  
23   will ultimately be held responsible for the structural integrity of much of the federal flood-control system  
24   in the Central Valley—approximately 1,600 miles of State-federal project levees that protect more than  
25   half a million people and property exceeding \$50 billion in value.

26   In *Arreola v. County of Monterey* (2002) 99 Cal.App.4th 722, the court held local agencies and the  
27   California Department of Transportation liable in July 2002 for 1995 flood damages to property owners  
28   that resulted from a failure to properly maintain the Pajaro River project. This case also held the  
29   California Department of Transportation liable for some of the damages.

30   The State’s FloodSAFE Strategic Plan (DWR 2008) stated, “Local communities are responsible for land  
31   use decisions, but generally have not been found liable for failure of the flood protection system.  
32   Continued development within the floodplains can increase flood risk, even if levees and other flood  
33   protection works are improved. Recent legislation passed in 2007 addresses the need to connect land use  
34   planning with diligent and factual consideration of flood risks for areas of proposed development.”

### 35   **Problem Statement**

36   As the risks of levee failure and corresponding damage increase, California’s courts have generally  
37   exposed public agencies, and the State specifically, to significant financial liability for flood damages  
38   (DWR 2005).

### 39   **Policies**

40   Although there are no policies with regulatory effect included in this section, implementation of the levee  
41   standards in Table 7-1 and protections of floodways as provided in RR P1 and RR P2 may substantially  
42   limit liability for the State of California.

## 1 **Recommendations**

2 RR R5 The Legislature should provide specific immunity for public safety flood protection activities,  
3 similar to that provided for police and fire protection services.<sup>36</sup>

4 RR R6 The Legislature should require an adequate level of flood insurance for residences, businesses,  
5 and industries in flood-prone areas.

## 6 **Finance and Implementation of Local Flood Management** 7 **Activities**

8 No regional authority currently exists to facilitate the assessment and disbursement of funds for Delta  
9 levee operations, maintenance, and improvements, or to collect and provide timely data and reporting on  
10 levee conditions. Such an authority could act to consolidate activities relating to levees conditions  
11 assessment, data collection efforts, emergency preparedness, public notification, and fee authority. This  
12 could provide for a more centralized and responsive entity managed on a local basis for Delta interests.

13 Traditionally, local levee maintaining agencies have managed the financing and ongoing maintenance,  
14 rehabilitation, and repair of Delta levees, and have done an admirable job in improving the levels of levee  
15 integrity and reducing overall Delta flood risk. Additional assistance has been provided by the State over  
16 the last few decades through DWR's Delta Levee Special Flood Control Projects Program and its Delta  
17 Levees Maintenance Subventions Program. These programs have most recently been funded through  
18 State general obligation bond financing, which faces an uncertain future. The development of an  
19 alternative funding mechanism and authority may have the ability to provide for a more stable funding  
20 process in which local direction is more broadly incorporated.

21 Currently, standardized flood risk measurement data is not being developed for the Delta. Standardized  
22 methods such as Expected Annual Damage should be incorporated into Delta flood risk management, and  
23 can help serve to identify those areas most critically in need of resources, and then allow for the allocation  
24 of resources to the most appropriate areas. A systematic process for data collection and reporting should  
25 be developed in order to support an ongoing understanding of overall Delta levee conditions. This can  
26 then facilitate an orderly allocation of resources to those areas most in need.

## 27 **Problem Statement**

28 Financing of local levee operations, maintenance, and related data collection and reporting efforts needs  
29 improvement in order to provide for a more functional, regional based approach to Delta flood risk  
30 management.

## 31 **Policies**

32 There are no policies with regulatory effect included in this section.

## 33 **Recommendations**

34 RR R7 A Delta Flood Risk Management Assessment District should be created with fee assessment  
35 authority (including over State infrastructure) to provide adequate flood control protection and  
36 emergency response for the regional benefit of all beneficiaries, including landowners,

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<sup>36</sup> Sections 850 – 850.8 (Fire Protection Services). Section 850 provides immunity for the government not providing fire protection services. Sections 850.2 through 850.8 provide governmental immunity related to the actual provision of fire protection services (i.e., failure to maintain sufficient fire protection facilities, injuries sustained while transporting a person from a fire to medical facility, etc.).

Section 845 (Police Protection Services). Section 845 provides governmental immunity for the failure to provide police protection services or the provision of insufficient police protection services.

1 infrastructure owners, and other entities that benefit from the maintenance of the levees, such as  
2 water exporters who rely on the levees to protect water quality.

3 This district should be authorized to:

- 4 ♦ Develop, fund, and implement a regional plan of flood management for both Project and  
5 non-project levees of the Delta in cooperation with the existing reclamation districts, cities,  
6 counties, and owners of infrastructure and other interests protected by the levees;
- 7 ♦ Conduct levee elevation surveys and inspections at least every 5 years, and report data to  
8 DWR;
- 9 ♦ In coordination with Department of Water Resources and the U.S. Army Corps of  
10 Engineers, establish standardized flood risk measurement data. This data should support the  
11 development of Expected Annual Damage and loss of life values for the Delta, to be  
12 conducted by the District on an annual basis. Expected Annual Damage is a measure of risk  
13 that integrates the likelihood and consequences of flooding, and is a standard measure of  
14 the benefits of reducing flood risk (USACE 1996, USACE 2006). The U.S. Army Corps of  
15 Engineers is currently developing a levee risk management system, including means to  
16 evaluate and rank risk of loss of life and flood damages for levee systems;
- 17 ♦ Notify residents and landowners of flood risk and emergency preparedness on an annual  
18 basis; and
- 19 ♦ Potentially implement the recommendations of the Delta Multi-Hazard Coordination Task  
20 Force (Water Code section 12994.5).

## 21 Subsidence Reduction and Reversal

22 Portions of Delta lands are composed of peaty soils that exist naturally as fibrous, low-density,  
23 compressible soils usually in a saturated state. Agricultural practices have promoted deep subsidence over  
24 the last 150 years to the extent that many islands more closely resemble bowls. To grow crops in such  
25 soils, farmers constructed levees and dikes around the tracts and drained the fields. This process of drying  
26 saturated peat reduced its volume by approximately 50 percent. Early cultivation practices included  
27 burning, which further reduced the volume and altered the structure. Over time, long-term oxidation  
28 reduced the peaty soils to small particles and gases. Although subsidence has slowed or halted in many  
29 areas, some regions of the Delta continue to subside. However, some recent practices that can reverse  
30 subsidence have been investigated. The State is participating in subsidence-reversal pilot studies on  
31 Sherman and Twitchell islands and other areas (Miller 2008).

32 Today, much of the central Delta is below sea level, with some islands commonly 12 to 15 feet below sea  
33 level, requiring levees that are 20 to 25 feet high to hold back water every day (Figure 7-4.) As  
34 subsidence progresses, levees must be continually maintained, strengthened, and periodically raised to  
35 support the increasing hydraulic stresses being placed upon them.

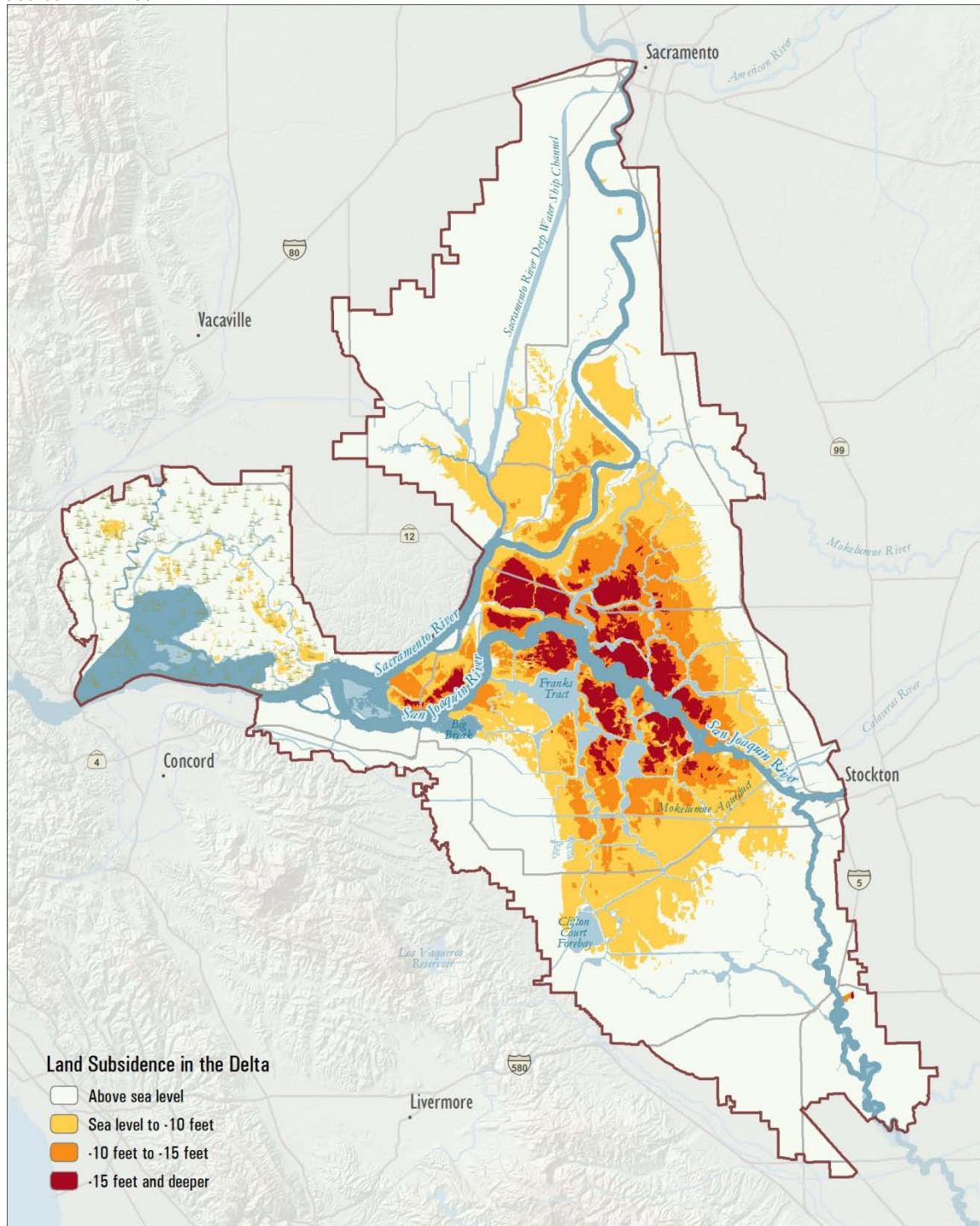
### 36 *Problem Statement*

37 Deep subsidence has led to increasing stress on Delta levees.

### 38 *Recommendations*

39 RR R8 State agencies should not renew or enter into agricultural leases on Delta or Suisun Marsh  
40 islands if the actions of the lessee promote or contribute to subsidence on the leased land,  
41 unless the lessee participates in subsidence-reversal or reduction programs.

1 **Figure 7-4**  
2 **Subsidence in the Delta**  
3 *Source: DWR 2007*



4

## 1 Reoperation of Upstream Reservoirs and Peak Flow Attenuation

2 Reservoir operations upstream of the Delta can have substantial impacts on flood flows through the Delta;  
3 therefore, operation procedures among government agencies should be well coordinated, and where  
4 possible, focused more on flexibility to prevent flooding in the Delta. Some non-federal, non-State  
5 upstream reservoirs can offer some flood control benefits even when they have no specific designated  
6 flood control space in their reservoir. Federal and State agencies have initiated evaluations to modify  
7 flood control management procedures on an individual stream basis but have not completed a  
8 comprehensive, coordinated Delta watershed analysis. Factors caused by climate change will likely  
9 modify runoff patterns, including the timing and duration of runoff, which highlights the need for  
10 additional attention to reservoir operations.

11 Currently, DWR, the National Weather Service California-Nevada River Forecast Center (CNRFC) and  
12 USACE are undertaking efforts to improve flood operation coordination among Central Valley reservoirs  
13 through DWR's Forecast-Coordinated Operations program.

14 Reoperation of upstream reservoirs requires intense planning and environmental studies as well as dam  
15 safety studies to ensure no increase in dam safety risk. Reoperation evaluations would need to be  
16 coordinated with federal, State, and local agencies and with hydropower utilities.

17 Development of increased upstream (and possibly offstream) storage can also help to attenuate peak flows  
18 during major storm events, reducing pressure on Delta levees.

### 19 *Problem Statement*

20 Flood and water supply operations of upstream reservoirs are coordinated among USACE, DWR, the  
21 federal Bureau of Reclamation, local agencies, and hydropower utilities. However, these operations need  
22 to be revised, modeled, evaluated, and improved based on the coequal goals and changing conditions,  
23 including climate change and other factors.

### 24 *Policies*

25 There are no policies with regulatory effect included in this section.

### 26 *Recommendations*

27 RR R9 U.S. Army Corps of Engineers, federal Bureau of Reclamation, California Department of Water  
28 Resources, and local agencies and hydropower utilities should evaluate and modify flood  
29 control management procedures for reservoirs upstream of the Delta considering sea level rise,  
30 changes in timing and form of precipitation, and changes in water supply operations to alleviate  
31 potential Delta flooding.

## 32 Performance Measures

33 Performance measures for reducing flood risk in the Delta are placed into two general classes: 1)  
34 administrative performance measures and 2) outcome performance measures. In general, administrative  
35 performance measures describe what resources (funds, programs, projects) are being implemented (or  
36 plan to be implemented) for a program or group of related programs. Outcome performance measures  
37 evaluate responses to management actions. The distinction between performance measure types is not  
38 rigid.

39 Recommended performance measures for reducing risk to people, property, and State interests in the  
40 Delta are described below.

## 1 Administrative Performance Measures

- 2 ♦ Progress toward increasing the percentage of Delta levees that comply with the protection  
3 classifications shown in Table 7-1 based on corresponding land and resource uses. Trends in  
4 Delta levee miles complying with the Table 7-1 classifications will be upward as Delta levees are  
5 improved while maintaining appropriate land uses.
- 6 ♦ Progress toward increasing the percentage of residential and commercial structures covered by  
7 flood insurance in the Delta. This trend will be upward should the Legislature require insurance  
8 coverage in flood prone areas.
- 9 ♦ Completion and implementation of DWR's A Framework for Department of Water Resources  
10 Investments in Delta Integrated Flood Management by January 1, 2013.
- 11 ♦ Implementation of the Delta Multi-Hazard Coordination Task Force recommendations by the  
12 appropriate authority (Water Code section 12994.5).
- 13 ♦ Development of a Delta Flood Risk Management Assessment District.
- 14 ♦ Development of a Delta-wide levees conditions map that allows for the assessment of levees on  
15 an ongoing basis. The trend will indicate an improvement in Delta levee conditions over time.

## 16 Outcome Performance Measure

- 17 ♦ Progress toward decreasing Delta area flood risk over time as measured by Expected Annual  
18 Damage. The Expected Annual Damage methodology is intended to more clearly quantify flood  
19 risk in terms of expected damages given probabilities of flooding. Trends in the reduction of  
20 Expected Annual Damage will be developed using data collected by appropriate State and local  
21 authorities.

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