

1 **ABOUT THIS CHAPTER**

2 This chapter provides an overview of flood risk in the Sacramento-San Joaquin Delta
 3 (Delta), current flood management efforts, and the most pertinent agencies and
 4 regulations. It details the Delta Stewardship Council's (Council) core strategies to reduce
 5 risk to people, property, and State interests in the Delta. These core strategies form the
 6 basis of the four policies and fifteen recommendations found at the end of the chapter:

- 7 • Continue to prepare for Delta flood emergencies
- 8 • Modernize levee information management
- 9 • Prioritize investment in Delta flood management
- 10 • Update funding strategies
- 11 • Manage rural floodplains to avoid increased flood risk
- 12 • Protect and expand floodways, floodplains, and bypasses
- 13 • Renew assurances of federal assistance for post-disaster levee reconstruction
- 14 • Limit State liability

15 Reducing flood risks in the Delta also relies on locating urban development in the cities
 16 where levees are stronger (as proposed in Chapter 5) and retaining rural lands for
 17 agriculture, so that development in the most flood-prone areas is minimized.

18 **RELEVANT LEGISLATION**

19 Water Code sections 85305, 85306, 85307, and 85309 require the Delta Plan to include or
 20 otherwise consider specific components to attempt to reduce risk.

21 *85305(a) The Delta Plan shall attempt to reduce risks to people, property, and state*
 22 *interests in the Delta by promoting effective emergency preparedness appropriate land*
 23 *uses, and strategic levee investments.*

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

27 *85306 The council, in consultation with the Central Valley Flood Protection Board,*
 28 *shall recommend in the Delta Plan priorities for state investments in levee operation,*
 29 *maintenance, and improvements in the Delta, including both levees that are a part of*
 30 *the State Plan of Flood Control and non-project levees.*

31 *85307(a) The Delta Plan may identify actions to be taken outside of the Delta, if*
 32 *those actions are determined to significantly reduce flood risks in the Delta. (b) The*
 33 *Delta Plan may include local plans of flood protection. (c) The council, in consultation*
 34 *with the Department of Transportation, may address in the Delta Plan the effects of*
 35 *climate change and sea level rise on the three state highways that cross the Delta.*
 36 *(d) The council, in consultation with the State Energy Resources Conservation and*

1 *Development Commission and the Public Utilities Commission, may incorporate into*
2 *the Delta Plan additional actions to address the needs of Delta energy development,*
3 *energy storage, and energy transmission and distribution.*

4 *85309 The department, in consultation with the United States Army Corps of Engineers*
5 *and the Central Valley Flood Protection Board, shall consider a proposal to coordinate*
6 *flood and water supply operations of the State Water Project and the federal Central*
7 *Valley Project, and submit the proposal to the council for consideration for incorporation*
8 *into the Delta Plan. In drafting the proposal, the department shall consider all related*
9 *actions set forth in the Strategic Plan.*

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

11 Reducing flood risks to people, property, and State interests is critical to achieving the
12 Delta Reform Act’s coequal goals and protecting the Delta as a place. The Legislature
13 has found that the Delta is “inherently flood-prone,” and that further improvements and
14 continuing maintenance of the levee system will not resolve all flood risks (Public
15 Resources Code section 29704). Living with risk, whether from floods, earthquakes,
16 fires, coastal storms, or other hazards, is often part of life in California. The Delta’s
17 hazards, however, are exceptional because they affect so many State interests, including
18 the reliability of its water supplies, the health of the Delta’s ecosystem, and the qualities
19 that make the Delta an attractive place to live, work, and recreate.

20 To reduce these risks to people, property, and State interests in the Delta, the Delta
21 Reform Act requires that the Delta Plan promote effective emergency response and
22 preparedness, appropriate land use, and strategic investments in levees (Water Code
23 section 85305). The Delta Reform Act also directs the Council, in consultation with the
24 Central Valley Flood Protection Board (CVFPB), to recommend priorities for State
25 investments in levee operation, maintenance, and improvements in the Delta, including
26 both levees that are a part of the State Plan of Flood Control and nonproject levees (Water
27 Code section 85306).

28 The Council envisions a future in which risks of flooding in the Delta are reduced, despite
29 an increase in sea levels and altered runoff patterns. The Council sees a future where
30 Delta residents, local governments, and businesses are better prepared to respond when
31 floods threaten. The Council envisions a future where bypasses are expanded; channels
32 are improved; and strong, well-maintained levees protect local communities—but also
33 protect State interests in a more reliable water supply for California and a protected and
34 restored Delta ecosystem. These improvements will include new or expanded floodways
35 and bypasses, maintaining and improving levees, and floodproofing new development. The
36 Council envisions that rural areas and the Delta’s legacy communities will also be protected
37 from flood risks by careful land use planning that discourages urban development in flood-
38 threatened areas. The Council envisions that flood management will draw on a variety of
39 funding tools, including greater payments by those who benefit from the Delta’s levees.

1 State funds for desired projects will be focused at State interests in the Delta, but some of
2 that activity will protect local interests as well. Federal, State, and local agencies will
3 respond cooperatively to flood disasters, working together to recover vital infrastructure,
4 mitigate economic damage, restore the ecosystem, and encourage long-term resiliency.

5 Eliminating flood risks will be impossible, but prudent planning, reasonable land
6 development, and improved flood management will significantly reduce risk, and serve the
7 coequal goals of a more reliable water supply, and a protected and restored Delta
8 ecosystem.

9 **Delta Hazards Threaten Both Coequal Goals and the Delta as a Place**

10 The threats that flooding, earthquakes, and other hazards pose to the Delta imperil
11 California's water supplies and the health of the Delta ecosystem. The channels that
12 convey water through the Delta to users in the Bay Area, San Joaquin Valley, or Southern
13 California, and the islands that prevent saltwater intrusion into Delta water supplies depend
14 upon levees for their preservation. Should the levees that protect these channels fail, the
15 impacts on water supplies could be felt statewide. Improving these Delta levees is an
16 investment in water supply reliability. Another way to reduce these risks is for areas that
17 use Delta water to develop plans for possible interruption of these supplies in a
18 catastrophic event, as recommended in Chapter 3. Integrating water supply and flood
19 control efforts is also important to optimize the management of the multipurpose reservoirs
20 that store water for the Central Valley Project (CVP), State Water Project (SWP), and other
21 water users. For example, a potential benefit of wide flood bypasses leading to the Delta
22 may be greater flexibility in these reservoirs' operations, creating new opportunities to
23 manage water supplies or generate hydroelectric power, while also contributing to
24 ecosystem restoration as described below.

25 The Delta levees also affect the health of the ecosystem. Many birds, such as waterfowl or
26 sandhill cranes, thrive in areas that depend on levees for their management. In some
27 locations, careful removal or breaching of levees may create new habitats that benefit fish,
28 wildlife, and the ecosystem. Fish and wildlife habitats can be improved by thoughtful design
29 of levee margins bordering sloughs and river channels. Setting levees back deliberately,
30 when feasible, can create both more capacity for flood flows and more habitat for fish and
31 wildlife. But unplanned levee failures often create weed infested depths that harbor
32 nonnative species rather than refuges for smelt, salmon, or other preferred species.
33 Changes in the area protected by levees also alter water circulation through the Delta,
34 changing the benefit of flows released to protect its ecosystem.

35 The Delta's residents, farms, and businesses also depend on its levees. They shape the
36 Delta landscape, protecting its farms and communities from destruction. The levee system
37 is the foundation on which the entire Delta economy is built, the Delta Protection
38 Commission's (DPC's) *Economic Sustainability Plan* reports (DPC 2012). Delta residents
39 built the levee system over generations, and they are keenly interested in its maintenance

1 and improvement. (See sidebar, Delta Disaster Recalled, for an example of the
2 consequences of levee failure.)

3 **DELTA DISASTER RECALLED (SIDEBAR)**

4 On a moonlit Wednesday night in June 1972, the San Joaquin River flowed slowly after
5 one of the driest winters on record. It gnawed at the Andrus Island levee 6 miles south of
6 Isleton between Bruno's Yacht Harbor and Spindrift Resort, opening a small hole that grew
7 rapidly. By the time sheriff's deputies arrived on scene shortly after 1 a.m., the river had
8 carved a 100-foot break. By 3 a.m., water covered Highway 12. Shortly after sunrise, the
9 breach had grown to 300 feet, and volunteers were hard at work on a 1.5-mile-long bow
10 levee to protect Isleton.

11 The battle to save Isleton continued throughout the day, but a rising tide and waves created
12 by 30- to 45-mile-per-hour Delta winds hampered efforts. Within a few hours, officials
13 ordered the evacuation of 1,400 Isleton residents and an additional 1,500 residents of
14 Andrus and Brannan islands. At 9:45 p.m. Thursday, the bow levee breached, and a wall of
15 water rushed into the low-lying residential area of Isleton. Although the city's business
16 district was spared, almost all of Andrus Island and portions of Brannan Island were
17 flooded, in some places up to 20 feet deep.

18 Then-Governor Ronald Reagan declared the islands a disaster area and asked President
19 Richard Nixon to do the same. Over the next 6 months, the levee was repaired, the 12,000-
20 acre lake that had been Brannan and Andrus Islands was drained, and life began returning
21 to normal. A full year after the levee break, however, more than one-third of the residents
22 had neither moved back into their homes nor begun to rebuild.

23 Officials estimated that damages were \$21.8 million, slightly more than half of that from
24 crop loss and saltwater damage to farmland. The cost for levee repairs was put at
25 \$800,000, and \$500,000 went to pump the 20 square miles of flooded land dry. More than
26 \$1.5 million in federal disaster relief was made available. No definitive cause was ever
27 determined for the levee breach, and a subsequent court case absolved the State of
28 liability (DWR 1973, Sacramento River Delta Historical Society 1996).

29 **Flood Risk in the Delta**

30 The Delta is an inherently floodprone area. This section provides an overview of the causes
31 and consequences of floods in the Delta. The Sacramento and San Joaquin rivers
32 collectively drain approximately 42,500 square miles of land. Before the Delta was modified
33 by levees and other human structures, these rivers' natural flows overflowed the Delta's
34 low-lying islands and floodplains for long periods each spring. The biggest floods occurred
35 when warm Pacific storms swept in from the west and southwest, picking up moisture over
36 the ocean and causing torrential rains when intercepted by the mountains surrounding the
37 Central Valley. The risks of flooding were increased when large amounts of sediment were

1 discharged to Central Valley rivers during the Gold Rush, choking their channels and
2 raising their beds above their natural levels and surrounding lands.

3 Today, flooding of the Delta's complex labyrinth of islands and waterways is prevented by
4 its levees. This system of flood control is supplemented by the flood facilities of the
5 Sacramento River and San Joaquin River flood control projects and multipurpose
6 reservoirs such as Shasta, Folsom, and Millerton lakes and Lake Oroville on the
7 Sacramento and San Joaquin rivers and their tributaries, which hold back floodwater and
8 provide water supplies and other benefits described in Chapter 3.

9 Many Delta levees were initially constructed more than a century ago. Levee-building
10 materials and equipment that were state-of-the-art then seem primitive today. History has
11 shown that structural failures of the levee system occur as a result of extraordinary events,
12 imperfect knowledge, and imperfect materials. Delta levees face potential threats such as
13 large runoff events, extreme high tides, wind-generated waves, earthquakes, subsidence,
14 and sea level rise. Individually, each of these threats is enough to cause serious concern;
15 together, they represent the potential for catastrophic disruption of the Delta and its
16 economic and ecological services.

17 A mass or even partial failure of the levee system would have real life-and-death impacts
18 and property losses that could total billions of dollars. Delta flooding could interrupt the
19 conveyance of water through the Delta for the SWP, the CVP, in-Delta users, the Contra
20 Costa Water District, the cities of Antioch and Stockton, and others who depend on the
21 Delta for reliable water supplies (see Chapter 3 for a discussion of water supply reliability).
22 Levee failures could also damage key features of the Delta ecosystem, including managed
23 wetlands in Suisun Marsh and habitats of wintering greater sandhill cranes at Staten Island
24 and nearby tracts. Unplanned levee failure could also degrade water quality in the Delta,
25 because tidewaters would flood into the bowl created by subsidence of Delta islands.
26 These failures would draw saltwater from San Francisco Bay and pollute Delta water with
27 flood debris, farm chemicals, and other pollutants.

28 Levee failures also could flood homes, farms, and businesses, including historic structures
29 in the legacy communities, and interrupt recreation and tourism. As noted in Chapter 5,
30 about 116,000 residential structures are located in the 100-year floodplain of the Delta,
31 mostly near Sacramento, West Sacramento, and Stockton. Also, 8,000 residences are
32 below mean higher high water (DWR 2008b). Serious consequences also could result from
33 flood-related damage to critical infrastructure in the Delta, including radio, cellular
34 telephone, and television transmission towers; electrical transmission lines, including
35 Pacific Gas and Electric Company, Sacramento Municipal Utility District, and Western Area
36 Power Administration lines; natural gas pipelines serving local gas fields and regional
37 transmission systems; petroleum pipelines; the East Bay Municipal Utility District aqueduct;
38 several railroads; three state highways; and three interstate highways (DWR 2011a;
39 Arcadis 2016b).

In simplistic terms, the concept of flood risk can be described as the likelihood of a flood event occurring multiplied by the consequences of that event. To many, flood risk simply means the chance a storm event will overwhelm the flood control system to some extent. Figure 7-1 illustrates the variables, namely the probability of flooding and the financial consequences. However, there are many other causes of flood risk, and the consequences can be far more complicated than the immediate damage to property.

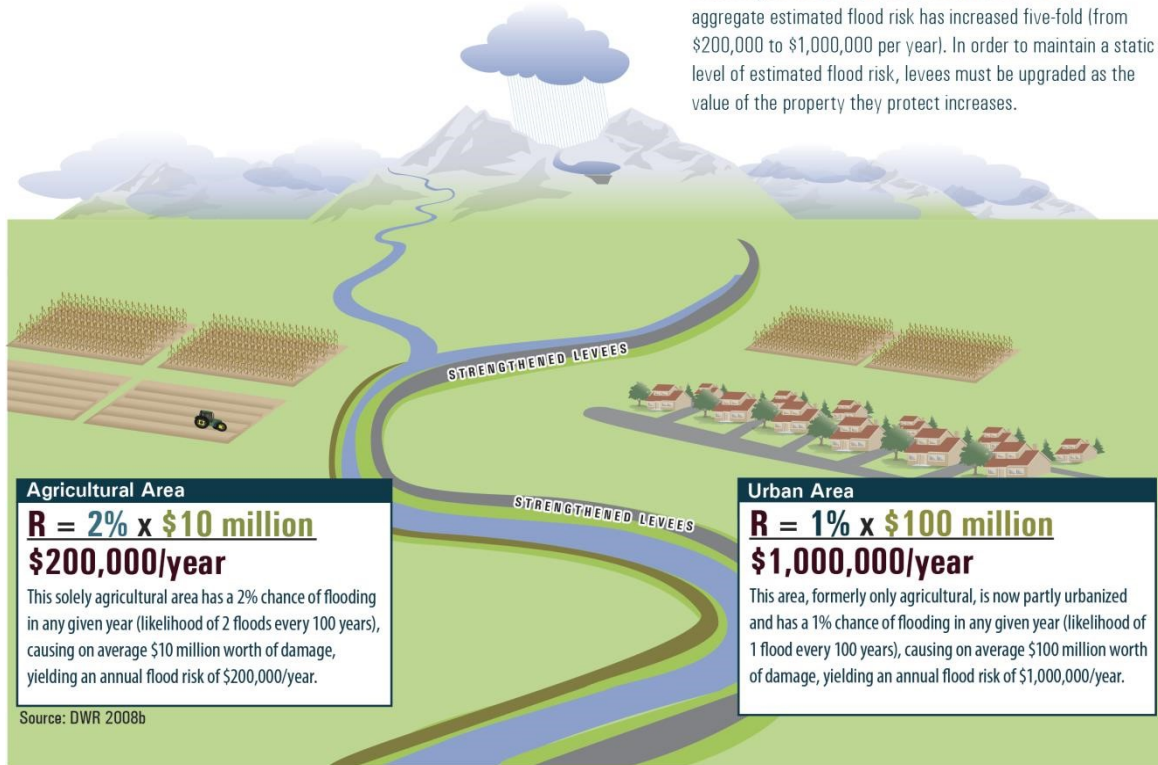
Understanding Delta Flood Risk

Flood risk reflects both the probability of flooding and the consequences that would result from flooding. Flood risk can be calculated as:

$$R = \% \times \$$$

Annual Flood Risk = Probability of Flooding X Financial Consequence

The scenario to the right of the river depicts how increasing the value of property, primarily through urbanization, will increase the flood risk in the area. Even though the levees in the urbanizing area have been upgraded to reduce the annual probability of flooding to 1% (or 1 flood every 100 years), by increasing the value of property behind these levees, the aggregate estimated flood risk has increased five-fold (from \$200,000 to \$1,000,000 per year). In order to maintain a static level of estimated flood risk, levees must be upgraded as the value of the property they protect increases.



Floods

Flooding during winter storms that result in high water surface elevations and high winds has been a common cause of levee failures in the Delta. For example, the Sacramento River at Rio Vista may flow in excess of 300,000 cubic feet per second (cfs) during winter and early spring floods, 30 times typical late-summer flows of 10,000 cfs. Peak discharges place high stress on Delta levees and can create flood conditions, especially when coupled with high tides.

1 The likelihood of levee failures caused by high water is substantial, based on the historical
2 performance of these levees over the last century. During the last century, there have been
3 more than 140 levee failures and island inundations, most of which occurred during flood
4 seasons (DWR 2005). High water in the Delta can overtop levees, as well as increase the
5 hydrostatic pressure on levees and their foundations, causing instability and increasing the
6 risk of failure due to through-levee and/or under-levee seepage. Most levee failures in the
7 Delta have occurred during winter storms and related high-water conditions, often in
8 conjunction with high tides and strong winds.

9 **Earthquakes**

10 The Delta's levees are also threatened by the active seismic zones west of the Delta,
11 including the San Andreas and Hayward faults. Less active faults underlie the Delta. A
12 strong earthquake could damage Delta levees because of the potential for deformation or
13 cracking of levees or liquefaction of levee embankments and foundations during strong
14 ground shaking. Saturated levees composed of dredged materials in other parts of the
15 country and the world have performed poorly during moderate to strong earthquake
16 shaking (DWR 2009; Delta Stewardship Council Staff 2010a). Moderate earthquakes
17 between 1979 and 1984 damaged nearby Delta levees, and many Delta islands' levees
18 failed during floods within a year after the 1906 San Francisco earthquake (Deverel 2016).
19 If a levee failed on an island subsided below sea level or during high flows or if a flood were
20 to occur soon after an earthquake, the protected area could be inundated.

21 The risks of earthquakes causing levee breaches and island inundations in the Delta have
22 long been recognized. A California Department of Water Resources (DWR) report begins:

23 There is a long history of levee failures in the Delta that have resulted in extensive
24 economic damage, but no failures of Delta levees are known to be directly
25 attributable to earthquakes. Even so, two factors indicate a possible bleak picture for
26 the future of many Delta levees. First, no serious causative quakes have occurred
27 on the nearby major faults since the San Francisco earthquake of 1906. Second, the
28 Delta levees of today are vastly different than those in the 1906 Delta, which had
29 limited size and extent (DWR 1980).

30 The DWR Delta Risk Management Strategy Phase 1 study evaluated the performance
31 of Delta levees under various seismic threat scenarios, and analyzed potential
32 consequences for water supply, water quality, ecosystem values, and public health and
33 safety. The study concluded that a major earthquake of magnitude 6.7 or greater in the
34 vicinity of the Delta Region has a 62 percent probability of occurring sometime between
35 2003 and 2032 (DWR 2009). More recent investigations suggest earthquake-induced
36 ground shaking affecting Delta levees may be less serious, but still worrisome (Delta
37 Independent Science Board 2016; Deverel. 2016).

38

1 Figure 7-2 illustrates a potential flood scenario in which a 6.5-magnitude earthquake
2 causes a 20-island failure. Although the probabilistic nature of earthquake prediction makes
3 it difficult to quantify the timing and magnitude of seismic threats, it is important to address
4 the threats posed by earthquakes to the Delta levee system because of the potential
5 adverse effects of such events.

6 **High Tides and Sunny-day Hazards**

7 Even without an earthquake or flood, Delta levees can fail during high tides or even on
8 sunny days. Generally, these failures may be the result of a combination of high tide and
9 pre-existing internal levee and foundation weaknesses caused by burrowing animals,
10 internal erosion of the levee and foundation through time, and human interventions such as
11 dredging or excavation at the toe of the levee (DWR 2008b). Examples of sunny-day
12 failures include the Brannon Andrus Tract in 1972 and Upper Jones Tract in 2004. It is
13 estimated that, based on current conditions, a sunny-day failure would occur once every 9
14 years on average

15 (DWR and DFG 2008). One-third of the failures at peaty Delta islands since 1960 have
16 been sunny-day failures (Delta Independent Science Board 2016).

17 Other hazards that affect the performance of Delta levees include encroachments,
18 penetrations, and burrowing animals. Encroachments such as structures or farming
19 practices on or close to the levee; penetrations of the levee, such as culverts or pipelines;
20 and burrows created by rodents, especially beavers, muskrats, and squirrels, can weaken
21 the structural integrity of levees. Because of unregulated historical construction, levees also
22 contain many hidden hazards. Active programs of inspection, oversight, and maintenance
23 are essential to minimize these hazards.

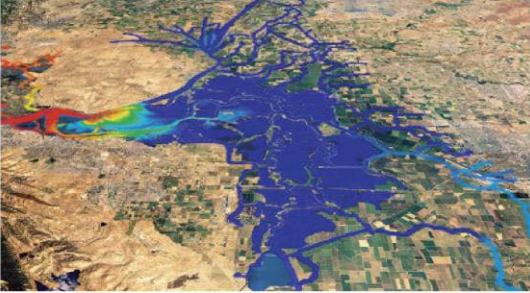
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Simulation of Delta Salinity after a 20-island Failure Caused by a Magnitude 6.5 Earthquake

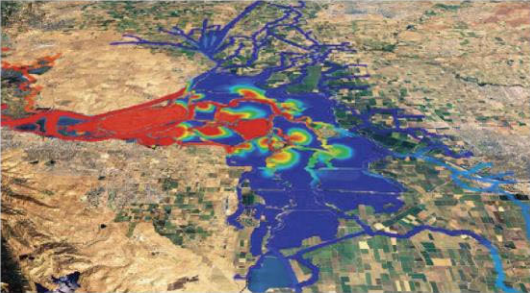
Electrical Conductivity ($\mu\text{mhos/cm}$)



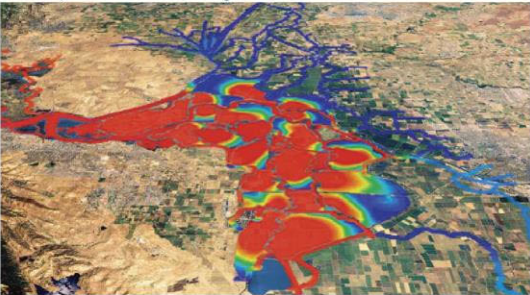
0-6 hours: Islands flood with fresh water



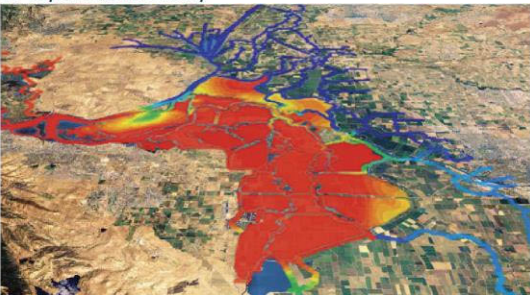
12-24 hours: Salt water intruding into Delta



1-7 days: Salt water throughout Delta



30 days: A saline estuary



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Figure 7-2 *Source: MWD 2010*

1 **Land Subsidence**

2 Because of the land subsidence described in Chapter 5, much of the central Delta is
3 below sea level. Some islands are 12 to 15 feet below sea level, requiring levees 20 to
4 25 feet in height that act as dikes, holding back water continually rather than only during
5 seasonal floods or extreme tides. As subsidence progresses, accommodation space
6 increases, and levees must be continually maintained, strengthened, and periodically
7 raised to support the increasing hydraulic stresses (Miller 2008; Mount and Twiss 2005).
8 The hydraulic stress also can drive seepage through and under levees, and place levee
9 foundations under more stress. The thinning of the peat soil layer also leads to shallow
10 or artesian groundwater conditions. More seepage onto islands will increase the
12 drainage costs associated with additional pumping and decrease levee stability (Deverel
13 and Leighton 2010; Deverel, Lucero, and Bachand 2015).

14 One approach to addressing subsidence can be the acquisition of conservation
15 easements that provide for fallowing land adjoining levees on islands with deep peat.
16 Acquisition of such easements is authorized through the Delta Levees Maintenance and
17 Special Projects (Water Code section 12987(b) and 12316(e)), enabling use of this
18 complement to levee improvement where appropriate.

19 **Climate Change and Flood Risk**

20 Climate change has major implications for the Delta, and especially for flood risk
21 management. It is estimated that by the year 2100, sea levels at the Golden Gate may
22 rise 17 to 66 inches (National Research Council, 2012; Natural Resources Agency
23 2014). Recent research suggests melting glacial ice may cause even higher rises in sea
24 levels (Dennis, B. and Mooney, C, 2016). This chapter of the Delta Plan uses the higher
25 end of the range of sea level rise forecast by the National Research Council (Arcadis
26 2015), consistent with advice from the Natural Resources Agency. The scenario
27 anticipates sea level rising by 2050 by approximately two feet at the Golden Gate and
28 the western end of Sherman Island, 20 inches at Mandeville or Venice Islands near the
29 San Joaquin River’s confluence with Middle and Old Rivers and six to eight inches at
30 Walnut Grove. These higher water levels will put additional stress on levees, increasing
31 their risk of failure. By 2050 rising sea levels will more than double the probability of
32 flooding if levees are not just well-maintained but also improved (Arcadis. 2016b;
33 Arcadis. 2017). Drainage of Delta islands will also be more difficult, impairing agriculture
34 on which the finances of many reclamation districts’ rely.

35 Climate change will also increase hydrologic variability and uncertainty, which is likely to
36 result in more severe flooding over time. (DWR 2016_

37 Additionally, scientific understanding of large-scale precipitation events is growing, as
38 demonstrated by the ARkStorm scenarios being investigated by the U.S. Geological
39 Survey, which indicate that massive storms and subsequent flooding have occurred in

1 the past and are likely to occur again (USGS 2011). Failure of significant parts of the
2 Delta’s flood management system may be unavoidable.

3 **Adequacy of Flood Risk Data**

4 The threats to Delta levees described above have been acknowledged for many years,
5 but disagreements remain about the significance of the risks they pose. This update of
6 the Delta Plan is based on the best, most up-to-date data available, compiled from more
7 than 50 data sources and provided for public review and correction. Nevertheless, some
8 Delta residents, reclamation district engineers, and scientists object that other reports or
9 their firsthand knowledge provide contradictory information. In part this reflects
10 continually changing conditions in the Delta, including land use, levee improvement and
11 maintenance, subsidence, and other factors. In addition, the information about levee
12 conditions and threats that is kept by the almost 100 agencies involved in maintaining
13 the Delta levee network is not easily shared, but rather is often retained only in paper
14 reports held by individual agencies or firms. This means that California does not have
15 the clearest possible understanding of risks in the Delta or of how they can be most
16 effectively reduced.

17 Informed decision making can be improved by gathering and widely sharing information
18 about the Delta levee network using contemporary data management technology.
19 Sharing this information has been urged for many years (DWR 1983; Central Valley
20 Flood Protection Board 2016) and is required for project levees (Water Code section
21 9140). More transparency about the benefits gained through State-funded levee
22 improvements can complement information about levee conditions, facilitating more
23 comprehensive and timely assessment and reporting about the Delta levee network.

24 **THE DELTA’S LEVEES**

25 This section summarizes the current state of flood management planning for the Delta.
26 To reduce the risk of flooding, Delta landowners, local governments, and State and
27 federal agencies have planned and built an extensive levee system in the Delta, and
28 significant flood control works upstream of the Delta. Other government flood control
29 programs plan for emergency response in the event of floods, or help manage flood
30 risks through land use planning, building standards, and flood insurance. The Delta
31 Reform Act refers to these government-sponsored flood control programs in its
32 provisions regarding covered actions (Water Code section 85057.5(a)(4)). The sidebar,
33 What Is a Government-sponsored Flood Control Program?, highlights those programs
34 referenced in statute; and proposed actions in the Delta that will have a significant
35 impact on the implementation of one of these programs may be considered covered
36 actions. Chapter 2 provides details about covered actions.

37 There are about 1,330 miles of project, nonproject, and other levees in the Delta and
38 Suisun Marsh. These levees reduce flood risk for approximately 740,000 acres of land

1 in the Delta. They define the Delta’s physical characteristics; influence the reliability of
2 its water supplies and its ecosystem health; and are critical to the Delta’s residents,
3 farms, businesses, cities, and legacy communities. Because many Delta levees protect
4 land below sea level, they hold back water all day, year-round, rather than only during
5 floods, and so are called “the hardest working levees” in America.

6 Differences in how levees are classified can influence reports about their length and
7 condition. Approximately 65 percent of the levees in the Delta and all levees in the
8 Suisun Marsh are owned or maintained by local agencies or private owners and are not
9 part of the flood control projects on the Sacramento or San Joaquin rivers. Most of these
10 are nonproject levees maintained by local reclamation districts created and funded by
11 landowners, initially for the purpose of draining (“reclaiming”) Delta islands and tracts.
12 The reclamation districts continue to maintain levees and other water control facilities
13 today. These nonproject levees are defined in Water Code section 12980(e).

14 The State-federal flood control projects on the Sacramento and San Joaquin rivers
15 include approximately one-third, or about 380 miles, of the Delta’s levees. Known as
16 “project levees,” they begin on the left bank of the Sacramento River at Sherman Island,
17 and line most of the riverbanks, as well as the Sacramento River Deep Water Ship
18 Channel and some connecting waterways, north to Sacramento and beyond. The Delta
19 Cross Channel’s control gates are an important feature of this levee system, closing
20 during high flows to keep the Sacramento River’s floodwaters out of the central Delta.
21 The flood control project also includes the Yolo Bypass, the broad, managed floodplain
22 in Yolo County west of West Sacramento. The wide bypass, which is confined by project
23 levees, draws floodwater through weirs above Sacramento to lower flood heights on the
24 Sacramento River and its tributaries, discharging back to the Delta above Rio Vista. The
25 Yolo Bypass floods about once every 3 years, between December and February. On the
26 San Joaquin River, project levees line the riverbanks from Old River to Stockton. Figure
27 7-3 shows the locations of project and nonproject levees in the Delta.

28 Recent evaluations show that some of the flood control project facilities on the
29 Sacramento and San Joaquin rivers are not adequate. Because the system was
30 intended partly to flush Gold Rush-era sediment from rivers and channels, the project
31 levees were often built close to the riverbanks, and are prone to erosion. Many of the
32 system’s channels have inadequate capacity to carry the flows for which they were
32 designed, and many levees do not meet contemporary design standards (DWR 2011c).

33 The CVFPB, as part of its responsibility to oversee the flood control projects on the
34 Sacramento and San Joaquin rivers, has adopted regulations to control encroachments
35 on the project and some of the streams that flow into it. It also regulates encroachments
36 within designated floodways, which are the channels of a river or other watercourse and
37 the adjacent land areas that convey floodwaters (California Code of Regulations [CCR],
38 Title 23, Division 1, Chapter 1, Article 2, Section 4). In the Delta, designated floodways
39 include the Cosumnes River’s floodplain and the confluence of the San Joaquin River
40 and the Stanislaus River upstream from Paradise Cut.

1
2 Some levees are neither project levees nor nonproject levees. These “unattributed
3 levees” include hundreds of miles of levees in Suisun Marsh and the Delta, and are not
4 part of any State-financed flood control program. They also include some levees that are
5 no longer maintained along the perimeter of permanently flooded islands and no longer
6 serve flood control or drainage purposes.

7 Other facilities throughout the Delta drain rainfall runoff from land into Delta channels.
8 Local cities and districts own and maintain urban storm drains in developed areas.
9 Stockton, Sacramento, West Sacramento, Lathrop, Manteca, and Tracy are Delta cities
10 with storm drainage facilities. Most Delta islands have a network of agricultural drains
11 and pumps to convey runoff to the Delta channels. Some Delta channels have been
12 dredged to increase their capacity to carry floodwater and to obtain material for levee
13

14 Multipurpose reservoirs in the Sacramento and San Joaquin river watersheds that play
15 a role in California’s water supply also serve critically important roles in managing floods
16 that affect the Delta. The CVP’s Shasta, Folsom, and Millerton lakes and New Melones
17 Reservoir; the SWP’s Lake Oroville; and other reservoirs are operated in accordance
18 with flood control rules established by U.S. Army Corps of Engineers (USACE),
19 reserving space to capture flood flows that can be released downstream gradually so
20 that channels are not overwhelmed.

21 **Planning for Flood Management**

22 Many planning efforts addressing flood management and emergency preparedness,
23 response, and mitigation are under way, including the following:

- 24 • **Central Valley Flood Protection Plan (CVFPP).** This strategic plan for
25 improving the flood control projects on the Sacramento and San Joaquin rivers
26 recommends approaches for reducing flood risk and improving the flood control
27 project, including expansion of the Yolo Bypass and setting back levees along
28 Paradise Cut (DWR 2016b) (see sidebar, Central Valley Flood Protection Plan).
- 29 • **DWR’s FloodSAFE Initiative.** In 2006, DWR launched FloodSAFE California—a
30 multifaceted initiative to improve public safety through integrated flood
31 management.
- 32 • **Sacramento-San Joaquin Delta Multi-Hazard Coordination Task Force**
33 **Report.** This report responds to Water Code section 12994.5, which called for
34 the task force to make recommendations to the Governor about Delta multi-
35 hazard emergency response and recovery issues.

- 1 • **CVP and SWP Reoperation Studies.** DWR’s Forecast-coordinated Operations
2 Program and Systems Reoperation Program address reservoir operational
3 criteria, as noted in Chapter 3.

4 The U.S. Army Corps of Engineers (USACE) has completed recent studies (2015)
5 recommending improvement to the Delta’s project levees protecting Sacramento’s
6 Pocket neighborhood and West Sacramento. Congress authorized federal participation
7 in these projects in 2016. USACE studies are underway of potential improvements to
8 Delta levees protecting metropolitan Stockton and at the Yolo Bypass. Another USACE
9 study (2014) concluded there is no federal interest in the Delta’s nonproject levees’
10 improvement.

11 The Council considered the findings of these studies and incorporated them into the
12 update of this Delta Plan chapter. The CVFPP and FloodSAFE include many concepts
13 relevant to flood protection in the Delta.

14 The CVFPB, DWR, and USACE each play unique and critical roles in Delta flood risk
15 management. Because of this, the Council’s role in facilitation, coordination, and
16 integration of various agencies and other parties is of particular importance. Frequent,
17 ongoing collaboration with other State, federal, and local agencies to improve
18 communication and coordination is essential to meeting the Delta Plan’s flood
19 management objectives.

20 **WHAT IS A GOVERNMENT-SPONSORED FLOOD CONTROL PROGRAM?**
21 **(Sidebar)**

22 Any State or federal strategy, project, approval, funding, or other effort that is intended
23 to reduce the likelihood and/or consequence of flooding of real property and/or
24 improvements, including risks to people, property, and State interests in the Delta, that
25 is carried out pursuant to applicable law, including, but not limited to, the following code:

- 26 • State Water Resources Law of 1945, Water Code section 12570 et seq.
27 • Sacramento-San Joaquin River Flood Control Projects (Flood Control Act of
28 1941, Public Law 77–228)
29
30 • Local Plans of Flood Protection (Water Code section 8201)
31 • Central Valley Flood Protection Plan (Water Code section 9600 et seq.)
32 • Delta Levees Special Flood Control Projects Program (Water Code section
33 12300 et seq.)
34 • Delta Levees Maintenance Subventions Program (Water Code section 12980 et
35 seq.)

- 1 • Central Valley Flood Protection Board Authority (California Code of Regulations,
2 Title 23, Division 1)
- 3 • National Flood Insurance Program (National Flood Insurance Act of 1968, 42
4 United States Code 4001 et seq., Public Law 90-448)

5 **Central Valley Flood Protection Plan (Sidebar)**

5 The Central Valley Flood Protection Act of 2008 directed DWR to prepare the CVFPP.
6 The CVFPP is a flood management planning effort that addresses flood risks and
7 ecosystem restoration opportunities in an integrated manner. It specifically proposes a
8 systemwide approach to flood management for the areas currently protected by facilities
9 of the State Plan of Flood Control (SPFC). The CVFPP was adopted by the CVFPB in
10 June 2012. It is expected that the CVFPP will be updated in 2017 and every 5 years
11 thereafter.

12 The CVFPP proposes a system-wide approach to address the following issues:

- 13 • Physical improvements in the Sacramento and San Joaquin river basins
- 14 • Urban flood protection
- 15 • Small community flood protection
- 16 • Rural/Agricultural area flood protection
- 17 • System improvements
- 18 • Non-SPFC levees
- 19 • Ecosystem restoration opportunities
- 20 • Climate change considerations

21 The geographic scope of the CVFPP includes the portions of the Delta covered by the
22 SPFC, including about 65 miles of urban, nonproject levees at Stockton; approximately
23 two-thirds of Delta levees are not addressed in the CVFPP. The effects of systemwide
24 improvements directed by the CVFPP and the potential of redirected impacts to areas
25 within the Delta will be monitored by the Council to ensure alignment with the coequal
26 goals and the Delta Reform Act. Additionally, the Council may, at its discretion,
27 incorporate those portions of the CVFPP into Delta Plan to the extent that those portions
28 promote the coequal goals (Water Code section 85350).

29 The 2017 CVFPP is a strategic, long-range plan describing a programmatic vision for
30 flood system improvements over time. Because it is descriptive, not decisional feasibility
31 studies and project-specific development activities will be conducted to implement it over
32 the coming years. The Council will continue to monitor and provide input to those
32 activities to ensure that Delta flood risk issues are considered. Flood system

1 improvement actions undertaken upstream of the Delta are of particular concern if not
2 coupled with in-Delta actions that reduce overall system wide flood risk.

3 **EXISTING LEVEE STANDARDS AND GUIDANCE**

4 It is more important than ever that the Delta’s levees are designed, constructed, and
5 maintained to provide a level of flood risk reduction commensurate with the coequal
6 goals and protection of the Delta’s unique values as a place. Over the last few decades,
7 State and federal agencies have developed guidelines and standards for levees. These
8 standards and guidelines generally establish minimum criteria for levee design and
9 maintenance. The standards include (1) the level of flood protection California has
10 prescribed for the Central Valley’s urban areas, (2) whether sufficient protection is
11 provided by the levees to exempt development financed with federally backed
12 mortgages from requirements to obtain flood insurance, and (3) whether property and
13 infrastructure protected by the levees (including the levees themselves) may be eligible
14 for assistance in the event of a catastrophic emergency, including aid from USACE to
15 rehabilitate levees damaged in an emergency.

16 Five levee standards and guidelines applicable to the Delta are discussed below (and
17 shown on Figure 7-4); they are ordered from highest to lowest level of flood protection:

18 DWR 200-year Urban Levee Protection (DWR - 200 Year): This standard goes
19 beyond criteria for levee height and geometric design to include requirements for
20 freeboard, slope stability, seepage/underseepage, erosion, settlement, and
21 seismic stability (DWR 2011b). It is intended to protect against a flood that has a
22 0.5 percent chance of being equaled or exceeded in any given year (a 200-year
23 level of flood protection). This urban levee standard is the only levee standard
24 that specifically links land uses to levee criteria. State law requires that by 2025,
25 floodprone urban areas with over 10,000 residents must meet this 200-year flood
26 protection standard (Government Code section 65865.5(a)(3)). Compliance
27 likely will be achieved by upgrading levees to meet DWR’s 200-year design
28 standard. Sacramento, West Sacramento, and Stockton are planning levee
29 improvements to attain this level of protection.

30 Very few levees in the Delta meet this standard because most Delta levees do
31 not protect urban areas. Under existing law, rural levees are not required to meet
32 this standard.

33 FEMA 100-year (Base Flood) Protection (FEMA – 100 Year): This “insurance”
34 standard, often called the “1 percent annual chance flood” level of protection,
35 provides criteria that levees must meet to protect against the flooding that is the
36 basis for FEMA’s flood insurance rate maps (44 Code of Federal Regulations
37 65.10). It is often used with established USACE criteria to prescribe
38 requirements for levee freeboard, slope stability, seepage/underseepage,

1 erosion, and settlement. The standard generally does not address seismic
2 stability. In communities where levees provide this level of flood protection, new
3 developments are not required to meet federal floodproofing standards and can
4 obtain federally guaranteed mortgages without purchasing flood insurance.
5 Few Delta levees outside of cities meet this standard, and some urban levees
6 need improvement to meet it.

- 7
- 8 • Bulletin 192-82. The plan for Delta levee improvement proposed by DWR when
9 State funding for Delta levees began, Bulletin 192 (DWR 1975), proposed two
10 levels of improvement: 100-year protection roughly equivalent to the FEMA
11 100-year standard for levees protecting areas with legacy communities, other
12 unincorporated Delta towns, and other islands with more residents – Brannan,
13 Andrus, and Bethel Islands and Hotchkiss, Shima, Wright-Elmwood, Walnut
14 Grove, and Sargent Barnhart Tracts. Levee improvements on other islands used
15 primarily for agriculture were to provide 50-year protection, with 1.5 feet of
16 freeboard above the expected 300 year flood elevation. The plan anticipated that
17 on a few islands, levee improvements would be uneconomical, a conclusion with
18 which the Legislature concurred (Water Code section 128981(b)). Bulletin 192 is
19 endorsed as a conceptual plan to guide the formulation of projects to preserve
20 the Delta levee system (Water Code section 12225). Bulletin 192-82, its update,
21 provides guidance for the Delta Levees Maintenance Subventions Program
22 (Water Code section 12987).
 - 23 • Public Law 84-99 (PL 84-99): The PL 84-99 guideline is a minimum requirement
24 established by USACE for levees that participate in its Rehabilitation and
25 Inspection Program (33 United States Code 701n) (69 Stat. 186). The standard
26 for levee geometry implies a minimum levee height and a slope stability factor of
27 safety, but is not associated with a level of protection (such as a 100-year flood)
28 and does not address seismic stability. Delta islands or tracts that meet the PL
29 8499 criteria may be eligible for USACE funding for levee rehabilitation, island
30 restoration after flooding, and emergency assistance, provided that the
31 reclamation district is accepted into the USACE’s program and passes a
32 rigorous initial inspection and periodic follow-up inspections. Eligibility for PL 84-
33 99 was formerly based primarily on levee geometry with minimum freeboard and
34 maximum steepness of slopes. USACE’s periodic inspection program
35 incorporates other elements into eligibility, including presence of structure
36 encroachments, vegetation, rodent control programs, and more. The PL 84-99
37 cross section is roughly equivalent to that proposed in Bulletin 192-82.

38 The CALFED Record of Decision set a goal of improving Delta levees to meet
39 the PL 84-99 criteria, as does the DPC Economic Sustainability Plan, but funding
40 has been inadequate to attain this objective. Five Delta reclamation districts,
41 protecting about 3 percent of the legal Delta’s land behind about 41 miles of

1 levees, meet or exceed the Delta-specific PL 84-99 criteria, and 24 more districts
2 are more than half-way to improving levees to this standard (Arcadis 2016a;
3 Arcadis 2016b)¹.

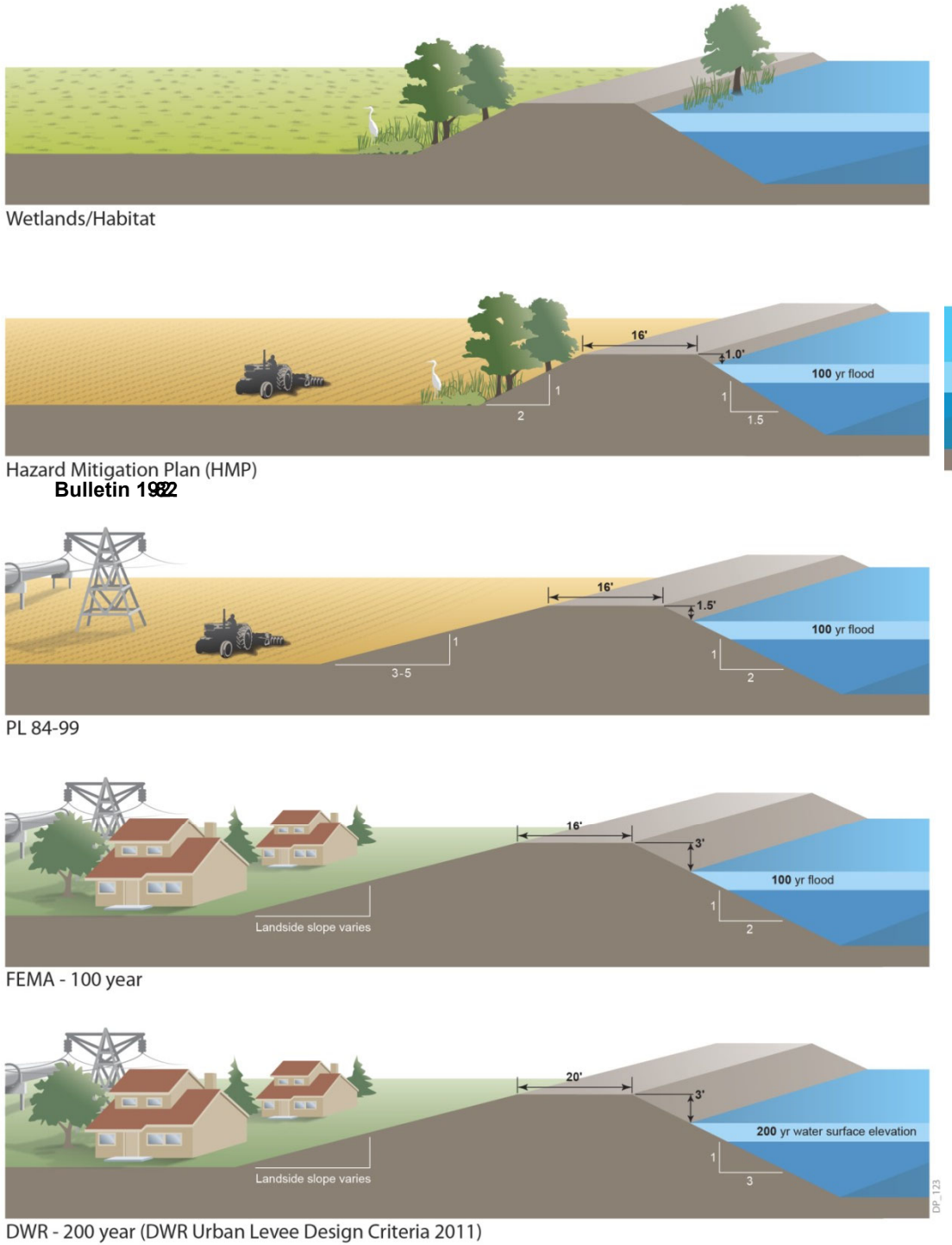
- 4 • Suisun Marsh. Guidelines for levees in Suisun Marsh are established in the 1980
5 *Suisun Marsh Local Plan of Protection*, and are approved by the San Francisco
6 Bay Conservation and Development Commission. The crowns of exterior levees
7 are to be 2 feet above expected high water levels. Where wave action is
8 expected, the freeboard must be at least 3 feet. The more recent *Suisun Marsh*
9 *Plan* (U.S. Bureau of Reclamation 2012) also proposes habitat levees -- low,
10 wide, gently sloping vegetated levees, which may be overtopped during storm
11 surges with nominal eroding or destabilizing. Habitat levees would include
12 benches or berms that provide wind- and wave-action protection as well as
13 opportunities for high marsh/upland transition habitat.

14 From 1987 until 2014, levee upgrades often sought improvement to meet the Federal
15 Emergency Management Program's Delta hazard mitigation plan (HMP), as a step
16 towards the PL 84-99 or Bulletin 192-82 standards. Good progress was made, with
17 more than half of Delta reclamation districts meeting the HMP criteria (CALFED
18 BayDelta Program 2000; Delta Stewardship Council 2013).

19 No State standards currently address design criteria for flood protection of the state
20 highways and interstate highways that traverse the Delta. Federal standards require
21 that interstate highways must be protected from 50-year flood events to qualify for
22 Federal Highway Administration funds (23 Code of Federal Regulations 650.115). The
23 levee investment priorities of this chapter applied this Federal Highway Administration
24 standard to identify acceptable risks of flooding to the Delta's interstates and State
25 highways 160, 4, and 12. Because most roads in the Delta were constructed before
26 these standards were developed, they do not meet the standards. For example,
27 sections of State Route 12 are 10 feet or more below sea level. A flood on the islands
28 this highway traverses could interrupt transportation and trade, and put motorists at risk.
29

¹ The 2013 Delta Plan reported that 25 reclamation districts had levees improved to the PL 84-99 criteria according to a report by DWR. That report was based only on the PL 84-99 criteria for freeboard above the base flood elevation, but did not account for the backslope required by the Delta-specific PL 84-99 criteria.

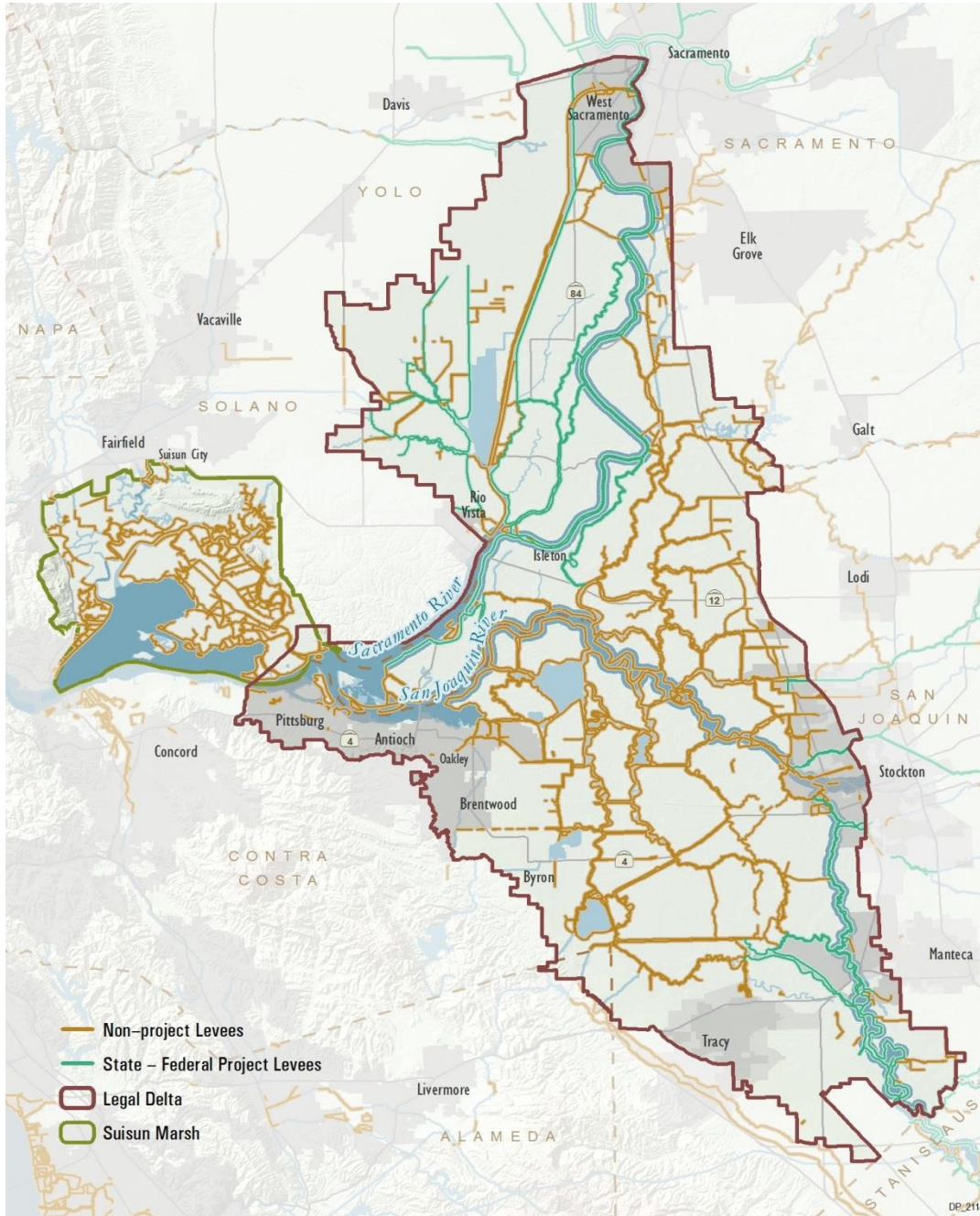
Levee Guidance



Source: Adapted from Delta Vision Blue Ribbon Task Force 2008 and DWR 2011b (update from 2013 Delta Plan - added Bulletin 192 and deleted HMP)

Figure 7-4

1 Map of the Delta showing where non-project levees and state-federal project levees are
2 placed throughout the legal Delta and Suisun Marsh.



LEVEES AND ECOSYSTEM

3
4 Historically, most discussion of levees has emphasized reducing flood risks to life and
5 property.

1 Discussion has also occurred on how to more effectively accommodate ecosystem
2 function with the current levee system, highlighting the following issues (Healey and
3 Mount 2007):

- 4 • Current levees tend to be narrow, with steep waterside slopes that provide little
5 upland habitat value.
- 6 • Setback levees may provide habitat value and increased levee integrity.
- 7 • Levees can be used to promote specific habitat types (such as waterfowl habitat)
7 by ensuring that some areas of freshwater marsh are sustained.
- 9 • Where lands are not heavily subsided, levees can allow for multiple land uses
10 including habitat management and wildlife-friendly agriculture.
- 11 • Allowing levees to fail on deeply subsided islands would not generate any
12 obvious ecological benefits.
- 13 • Subsidence reversal on deeply subsided islands would rely on levees to
14 appropriately manage water levels during tule growth.

15 Habitat and ecosystem values and functions can provide multiple benefits, and must be
16 considered in flood management planning and actions. For example, the CVFPP
17 includes a conservation framework that outlines how environmental elements can be
18 integrated into flood management (DWR 2016a). Setting levees back from the riverbank
19 can expand flood conveyance capacity and reduce flood risk while providing ecosystem
20 restoration and recreational opportunities (USACE 2002). Setback levees also allow
21 opportunities for construction of an improved levee foundation and section using
23 modern design and construction practices, thereby reducing risk of failure. Integrating
24 fish-and wildlife-friendly channel margin treatments into levee improvements can also
25 help (Davenport, Austin, Duryea, Huang, and Livsey 2016).

26 As management efforts in the Delta proceed, it will be important to consider ecosystem
27 functions and their interactions with the levee system, as discussed in Chapter 4. An
28 example where these interactions are already being debated is the USACE's current
29 policy requiring removal of vegetation from levees. Scientific support for and against this
30 policy is mixed. Concerns with maintaining woody vegetation on levees include
31 difficulties with inspection and flood fighting, potential for root holes, and trees toppling
32 from erosion. Other evidence, however, suggests that woody shrubs and small trees on
33 levees enhance levee structural integrity while providing environmental benefits. A study
34 on a channel levee along the Sacramento River concluded that roots reinforced the
35 levee soil and increased shear resistance by providing increased stability against slope
36 failures (Shields and Gray 1992). In either case, the widespread removal of vegetation
37 from Delta levees could have significant adverse environmental impacts that are not
38 well understood.

39

1 **RECREATION**

2 The Delta’s levees line its greatest recreation asset – the rivers and sloughs that attract
3 boaters, anglers, nature lovers, and other visitors. In appropriate locations, publicly
4 owned levees and their crown roads can provide access for bank fishing, walking, or
5 bicycling. Private waterside resorts also provide recreation on sites adjoining Delta
6 levees. Where levees adjoin busy highways or farmland or on private levees, and where
7 no entity is responsible for managing recreational use, access may create conflicts that
8 cannot be effectively mitigated. The Delta Plan’s chapter 5 calls for considering
9 recreation and access opportunities when levee investment decisions are made.

10 **FLOODPLAINS AND CHANNELS**

11 Floodplains and channels that provide the capacity to carry and store flood flows are
12 critical for managing flood risks, and for overall Delta water management and
13 ecosystem integrity. Projects planned for Yolo Bypass and Paradise Cut are examples
14 of improvements that could add capacity to convey flood flows and help manage flood
15 risks. The CVFPB and FEMA both play roles in designating floodways and floodplains
16 to accommodate flood flows.

17 The CVFPB regulates encroachment in floodplains by designating floodways in the
18 Sacramento River and San Joaquin River drainages, including the Delta (Water Code
19 section 8609). A “designated floodway” is the channel of the stream and that portion of
20 the adjoining floodplain, as shown on Figure 7-5, reasonably required to provide for the
21 passage of a specified flood. It may also be the floodway between existing levees as
22 determined by the CVFPB.

24 The CVFPB regulates encroachments within designated floodways and regulated
25 streams through its permitting authority. The encroachment permit process applies to all
26 projects, existing and proposed (including habitat restoration projects), within
27 State/federal flood control project levees, designated floodways, bypasses, and
28 regulated streams (CCR, Title 23, Division 1). The CVFPB should be consulted prior to
29 the consideration of any projects that may be in a designated floodway in the Delta.
30 Appendix L includes a map of the CVFPB’s jurisdictional areas in the Delta.

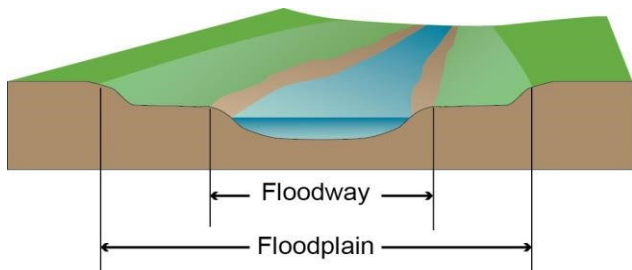
31 Additionally, under the National Flood Insurance Program, FEMA maps floodplains that
32 have a 1 percent chance of flooding in any year (a 100-year flood). FEMA works with
33 participating communities to regulate development within these floodplains according to
34 federal regulations. No new construction, substantial improvements, or other
35 development (including fill) may be permitted within specified flood zones on the
36 community’s Flood Insurance Rate Map unless it is demonstrated that the cumulative
37 effect of the proposed development, when combined with all other existing and
38 anticipated development, will not increase the water surface elevation of the base flood
39 more than 1 foot at any point within the community.

1 In some flood channels and bypasses, dredging may have benefits because it increases
2 channel capacity and also provides material that can be used for levee maintenance
3 and other flood risk management activities. Because some portions of the Delta are
4 within a tidal pool and other areas are riverine, the efficacy of dredging must be
5 addressed on a site-specific basis and cannot simply be considered useful on a
6 Deltawide basis.

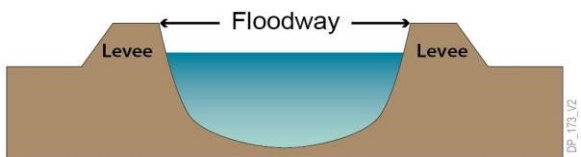
7 The benefits and impacts of dredging Delta channels are being investigated by a
8 consortium of federal and State agencies, including U.S. Environmental Protection
9 Agency, USACE, DWR, and the Regional Water Quality Control Boards, under the
10 Delta Dredged Sediment Long-Term Management Strategy (LTMS) Program. The
11 LTMS is designed to improve operational efficiency and coordination of the collective
12 and individual agency decision-making responsibilities resulting in approved dredging
13 and dredged material management actions in the Delta. Approved dredging and
14 dredged material management actions will take place in a manner that protects and
15 enhances Delta water quality, identifies appropriate opportunities for the beneficial
16 reuse of Delta sediments for levee rehabilitation and ecosystem restoration, and
17 establishes safe disposal for materials that cannot be reused (USACE 2007).

18

Conceptual Diagrams of Floodways



Conceptual Diagram of a Floodway within a Floodplain



Conceptual Diagram of Floodway within a Leveed Channel

19

Figure 7- 5 The floodway is the channel of the stream and that portion of the adjoining floodplain reasonably required to provide for the passage of a specified flood; it is also the floodway between existing levees as determined by the CVFPB or the Legislature.
20
21
22
23
Source: FEMA 2006

Delta Flood Management Facilities

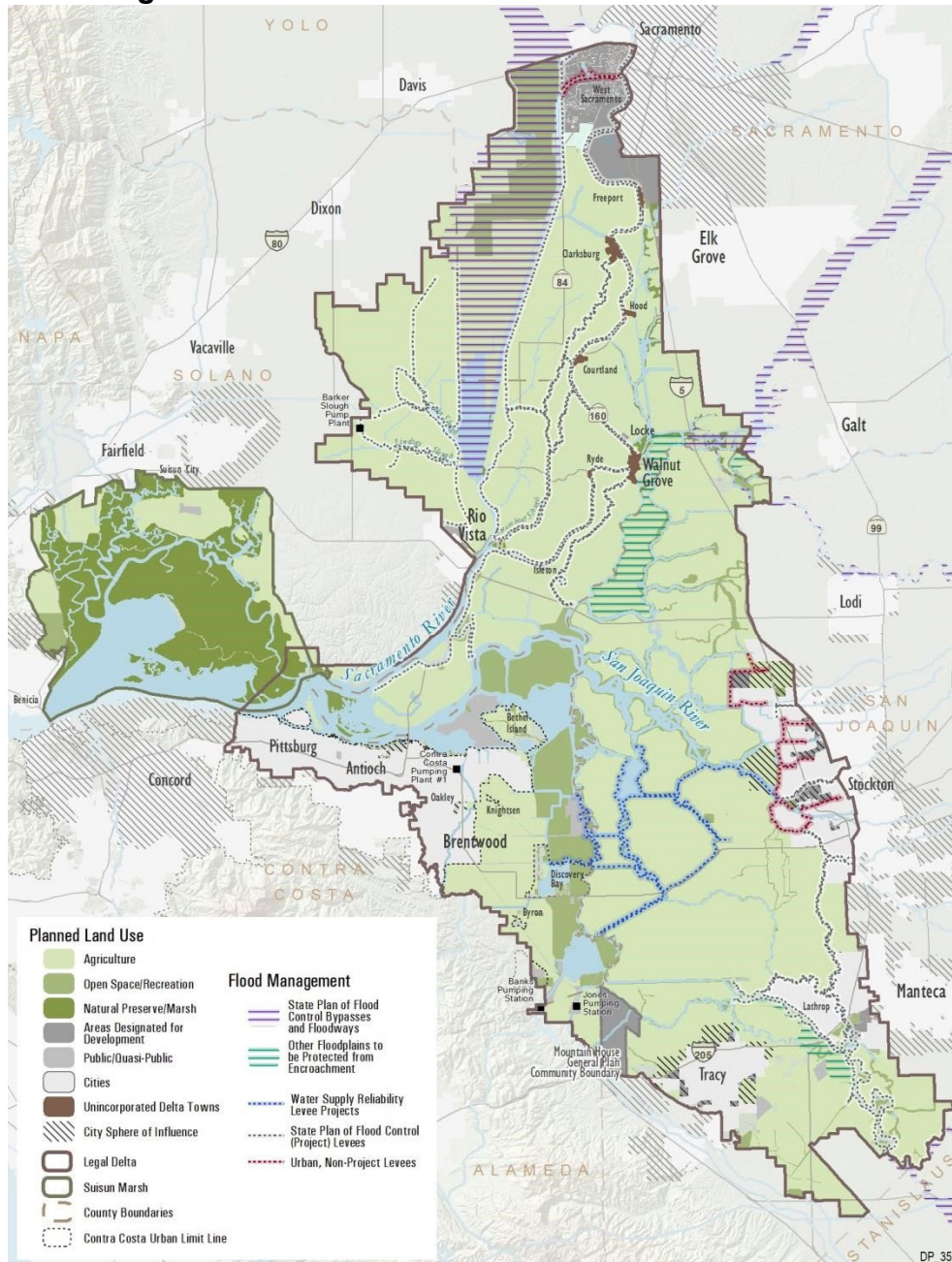


Figure 7-6 The map shows land uses designated by city and county general plans. Within cities' spheres of influences, the map shows land use designations proposed in city general plans, where available. In cases where cities have not proposed land uses within their spheres of influence, the map shows land uses designated by county general plans. Sources: City of Benicia 2003, Contra Costa County 2008, Contra Costa County 2010, DWR 2011b, DWR 2011c, DWR 2011d, City of Fairfield

1
2 2008, Jones & Stokes 2007, City of Lathrop 2012, City of Manteca 2012,
3 Mountain House Community Services District 2008, City of Rio Vista
4 2001, SACOG 2009, City of Sacramento 2008, Sacramento County
5 2011, Sacramento County 2012, Sacramento County 2013, San Joaquin
6 County 2008a, San Joaquin County 2008b, Solano County 2008a,
7 Solano County 2008b, South Delta Levee Protection and Channel
8 Maintenance Authority 2011, City of Stockton 2011a, City of Stockton
9 2011b, City of Suisun City 2011, City of Tracy 2011a, City of Tracy
10 2011b, City of West Sacramento 2010, Yolo County 2010a, Yolo County
11 2010b.

12 13 **INVESTMENT IN REDUCING RISK**

14 Maintaining the Delta's levees and improving them to reduce risk to desired levels will
15 cost billions of dollars. State-subsidized expenditures to maintain rural Delta levees,
16 including local matching funds, averaged \$11.6 million annually between FY 2010 to FY
17 2014. More is spent by State and local agencies to maintain project levees. Costs to
18 improve Delta levees towards desired criteria total about \$3 billion: \$1.77 billion for
19 urban levees, according to estimates from the Central Valley Flood Protection Plan
20 regional flood management plans, and \$1.26 billion, adjusted for inflation, for rural
21 levees (URS Corporation/Jack R. Benjamin & Associates 2011).

22 Because the Delta's levees reduce risk to residents; agricultural land; water supplies;
23 and energy, communications, and transportation facilities, the State has invested
24 considerable funding to maintain and improve them over several decades through
25 various legislative actions. For rural non-project levees, two State programs provide
26 matching funds to maintain and improve Delta levees. The principal State programs are:

- 27 • DWR's Delta Levees Maintenance Subventions Program provides technical and
28 financial assistance to local levee maintaining agencies in the Delta for the
29 maintenance and rehabilitation of Delta levees. It pays up to 75 percent of levee
30 maintenance and improvement costs after a minimum cost threshold has been paid
31 by that district. In practice most recent funding is used to subsidize maintenance,
32 with only modest amounts disbursed for major levee rehabilitation. While the
33 Subventions Program is primarily for non-project levees, project levees qualify if
34 more than 50 percent of the island acreage is within the Delta primary zone. Funding
35 assistance provided by the subventions program is governed by guidelines

1 developed by DWR and adopted by the CVFPB. The subventions program does not
2 fund levee maintenance or improvement in Suisun Marsh.

- 3
4 • DWR's Delta Levees Special Flood Control Projects Program provides financial
5 assistance to local levee maintaining agencies to improve or rehabilitate levees in
6 the Delta, portions of Suisun Marsh (approximately 12 miles of levees on islands
7 bordering Suisun Bay from Van Sickle Island westerly to Montezuma Slough) as
8 well as the town of Thornton (Water Code section 12311). It can fund up to 100
9 percent of project costs.

10 An estimated \$530 million of State taxpayer money has been spent by DWR on Delta
11 levee maintenance and improvements through the subventions and special projects
12 programs since the 1970s. No federal funds are available for these non-project levees.

13 Outside of the primary zone, almost all Delta levees are maintained by local levee
14 maintaining agencies without State assistance.

15 Because the Delta's project levees are authorized as part of the federal flood control
16 project, they are eligible for federal funding for improvements and significant repairs.
17 The CVFPB serves as the nonfederal partner to USACE for the Delta's project levees.
18 The federal government pays between 50 and 75 percent of the total costs of flood
19 control projects authorized by Congress, with the non-federal costs typically shared by
20 State (70 percent) and local entities (30 percent) (Water Code 44 section 12310-12318).
21 The cost sharing ratio varies with the kind of benefits provided. For example, federal
22 cost-share for ecosystem restoration projects can be as much as 65 percent in urban
23 flood risk reduction projects. Water supply, recreation, and other benefits included in
24 flood risk reduction projects can further modify federal cost sharing. The State share of
25 nonfederal costs also depends on the mix of benefits. State funds are distributed
26 through several DWR programs, including its Early Implementation Program, Local
27 Levee Assistance Program, Urban Flood Risk Reduction (UFRR) Program, and Small
28 Communities Flood Risk Reduction Program. \$613.3 million has been committed
29 through DWR's Early Implementation Program to improve levees that protect urban and
30 urbanizing areas in the Delta.

31 The State programs that support Delta levee maintenance and improvement have
32 grown and adjusted incrementally over the years, reflecting new needs and institutions.
33 DWR plays the prominent role. The CVFPB approves guidelines for the Delta Levees
34 Maintenance Subventions Program (Water Code sections 12984 and 12991). The
35 California Water Commission is authorized to approve lists of projects that are priorities
36 for the Special Projects Program (Water Code section 12313(b)). The Department of
37 Fish and Wildlife guides mitigation impacts to fish and wildlife and improvement of their
38 habitats (Water Code sections 12314 and 12987(c)). The Natural Resources Agency
39 maintains a recreation plan to be considered in maintenance and improvement plans
40 funded under subventions program (Water Code section 12987(e) and is responsible for

1 supervising implementation of the special projects program (Water Code section
2 12306.5). Simplifying these responsibilities in fewer agencies could both improve
3 oversight and reduce the complexity of interagency coordination.

4 ~~Prioritizing State Investment in Levees~~

5 ~~The Delta Reform Act requires that the Delta Plan attempt to reduce risk to people,~~
6 ~~property and State interests in the Delta by promoting strategic levee investments and~~
7 ~~recommending priorities for State investments in the Delta's project and non-project~~
8 ~~levees (Water Code sections 85305(a) and 85306). Priorities are needed because the~~
9 ~~funds needed to complete desired levee improvements significantly exceed the funds~~
10 ~~currently available. History provides little reason to expect that all the funds needed will~~
11 ~~soon be provided. Even if more funds were provided, projects providing greater benefits~~
12 ~~ought to proceed before those with fewer benefits. Given the uncertainty over the~~
13 ~~amount and availability of future Delta levee program funding, the most prudent~~
14 ~~approach is to prioritize those that reduce the most significant risks, provide the most~~
15 ~~benefits and avoid the costliest consequences. Prioritizing investment ensures that~~
16 ~~limited public funds are expended first for improvements that are most critical to~~
17 ~~protecting lives, property, and State interests. These priorities, in combination with the~~
18 ~~Delta Reform Act directive that State agencies act consistently with the Delta Plan and~~
19 ~~the requirement that reimbursements for major rehabilitation of levees through the Delta~~
20 ~~Levees Maintenance Subventions Program conform to the Delta Plan (Water Code~~
21 ~~section 12986), will ensure that State spending on Delta levees reflects these priorities~~
22 ~~in the future. The Delta Reform Act provides that activities of the Council in determining~~
23 ~~priorities for State levee investments in Delta levees do not increase the State's liability~~
24 ~~for flood protection in the Delta or its watershed (Water Code section 85032(j)).~~

25 ~~This 2013 Delta Plan envisioned that State funds for flood management would be~~
26 ~~focused at State interests but that some of that activity would protect local interests as~~
27 ~~well. The Plan outlined a process to prioritize State investments in levee operation,~~
28 ~~maintenance, and improvements in the Delta. The Council, following a workshop with~~
29 ~~flood risk management experts and extensive agency and public comment, adopted a~~
30 ~~set of principles to provide further guidance for priority setting (Delta Stewardship~~
31 ~~Council, 2015). Principles relevant to prioritization of levee investments include:~~

- 32 1. ~~The goals of State law and the Delta Plan—and, therefore, the Delta Levee~~
33 ~~Investment Strategy—are to better protect life, property, and the State's coequal~~
34 ~~goals for the Delta.~~
- 35 2. ~~State funding should not assist further urbanization of flood-prone Delta land.~~
- 36 3. ~~Expenditures should reduce risk. Reducing the probability of flood damage, for~~
37 ~~example, by improving levees or creating floodways, and lowering the~~
38 ~~consequences of flooding with actions like evacuation planning or floodproofing~~
39 ~~are both important.~~

- 1 4. State flood management investment to protect urban areas is the first priority.
- 2 5. Water conveyance and diversion infrastructure is a high priority.
- 3 6. State funds must enhance the ecosystem even if projects cost more to the State
- 4 and to reclamation districts. A programmatic approach that locates ecosystem
- 5 enhancements where they provide high benefits is preferable.
- 6 7. Consider systemwide needs. Specific recommendations of the Delta Plan and
- 7 the State Plan of Flood Control should be considered. These include the
- 8 proposed Paradise Cut Bypass recommended in the Delta Plan, and other
- 9 specified non-project levees.
- 10 8. Impacts to the Delta's unique values should be taken into account. These include
- 11 the Delta's farmlands, historic communities, and natural and cultural resources.
- 12 9. State investments in the Delta's flood management system must consider post-
- 13 flood recovery responses by local, state, and federal agencies and the efficacy
- 14 and likelihood of financial assistance after flood damage.
- 15 10. Owners of non-project levees seeking State funding have the burden to prove that they
- 16 protect many people and/or assets or help achieve the coequal goals.

17 This guidance was applied, following an independent science review (Mitchell,
18 Asselman, Bolte, Cutter, McCann, Michelson, and Rose 2015), to develop a method for
19 assessing potential levee investment priorities in this plan amendment (Arcadis 2016b).
20 The fragility of the Delta's levees to threats from flooding, earthquakes, and sea level
21 rise was carefully evaluated, and the population and property the levees protect were
22 inventoried, using census data, land use maps, assessment information, and other
23 sources. Metrics were developed to weigh the State interests that the Council
24 determined investments should safeguard: water conveyance and diversion
25 infrastructure and the Delta ecosystem. Information about transportation and utility
26 infrastructure and the Delta's unique values including farmland and legacy communities
27 was also gathered, so that risks to these assets could be considered. This information,
28 totaling 1.5 million data points, was assembled into a database that is analyzed by a
29 computer-assisted decision support tool to aid in evaluating alternative priorities. Islands
30 and tracts where levee improvements further multiple objectives, such as protecting
31 both water supply and the Delta ecosystem, were preferred to projects that advance
32 only a single interest. Also considered in setting priorities were information about
33 system wide needs, including recommendations of the Delta Plan, the Central Valley
34 Flood Protection Plan and other proposals for the State Plan of Flood Control, and the
35 California EcoRestore initiative. Advice from the Central Valley Flood Protection Board,
36 DWR, other flood agencies, and Delta stakeholders has also been considered.

37 Gathering and evaluating the information used to recommend investment priorities has
38 been a considerable and controversial effort. Despite the limitations of the data
39 available, the effort has been more thorough, comprehensive, and transparent than

1 prior studies. As data is updated and levee conditions change with improvements, the
2 Council intends to maintain and improve its data base and decision support tool, both to
3 track the performance of State levee investments and to support periodic reviews of the
4 Delta Plan.

5 **Continue and Improve the Delta Levees Maintenance Subventions Program**

6 Confirmation that continued maintenance of Delta's levees remains important is one
7 result of this evaluation. This maintenance, including ongoing State financial support
8 through the Delta Levees Maintenance Subventions Program, should continue. It
9 reduces risks to lives, property and State interests and contributes to preservation of the
10 Delta's unique agricultural, natural, and cultural resources. This maintenance of the
11 Delta levee network also reduces the risk that failure of one island's levees could
12 expose adjoining islands to increased wind waves or seepage.

13 **Prioritize State Levee Investments**

14 Investments that improve Delta levees towards applicable standards and guidelines are
15 critical to protecting lives, property, and State interests. Priorities for these
16 improvements are recommended in Figure 7-X and Table 7-Y. The very highest
17 priorities are improvements to levees protecting urban and urbanizing areas of
18 Sacramento, West Sacramento, and metropolitan Stockton, where the most lives and
19 property are at risk. Another very high priority is improving levees on Sherman,
20 Twitchell, Brannan Andrus, Upper Andrus, and Grand islands along the Highway 160
21 corridor, where the quality of water supplies, restored marshes, transportation routes,
22 the communities of Isleton, Ryde, and Walnut Grove, and farmland are at risk. Further
23 north along Highway 160 levee improvement in the rural southern portion of
24 Maintenance Area 9 is ranked as a very high priority because of risks to life, property
25 including the communities of Freeport and Hood, and Stone Lakes National Wildlife
26 Refuge. Bethel and Jersey Islands rank as very high priorities because both islands are
27 important to the quality of water supplies, many people and much property are at risk on
28 Bethel Island, and Jersey Island holds important wildlife habitat. Improving Byron Tract's
29 levees is a very high priority because of risks to both lives and water supply
30 infrastructure. At Dutch Slough and the McCormack Williamson Tract, the very high
31 priority is retiring outmoded levees by restoring the sites to marsh, contributing to the
32 net improvement of aquatic habitats required of the Delta Levees Special Flood Control
33 Projects Program (Water Code section 12311).

34 Thirty-three other islands and tracts are identified as high priorities for levee
35 improvements. On many of these, water supplies or ecosystems are at risk, but benefits
36 to multiple interests are not significant. Improvements on other high priority islands and
37 tracts may reduce risks to multiple values, but benefits are lower than on very high
38 priority areas. Levees at the Yolo Bypass (including levees bordering the bypass in
39 Reclamation Districts 2068 and 2098), the proposed Paradise Cut Bypass, and levees

1 protecting interstates and State highways 160, 4, and 12 are also identified as high
2 priorities to indicate their improvement will be important when feasibility studies or
3 CalTrans' climate change vulnerability studies indicate upgrades are the best
4 alternative.

5 Stockpiling material for emergency repairs of levees on the water export corridors along
6 Middle and Old Rivers toward the pumps of the State Water Project and Central Valley
7 Project or at sites serving local reclamation districts can complement these levee
8 improvements. No foreseeable amount of improvement will make the Delta's levees
9 invulnerable to failures in large floods or earthquakes. Placing levee repair materials
10 where they are readily available to repair damage is prudent preparation for disasters
11 that may come. In the unfortunate event that a levee failure occurs, the coequal goals of
12 providing a more reliable water supply and protecting, restoring, and enhancing the
13 Delta ecosystem should be evaluated as part of the post-disaster response process.

14 ~~Every levee is important to those whose safety or property is protected. The islands
15 and tracts of the legal Delta that are listed as "other priorities" are not unimportant. State
16 funds for improving their levees ought to be considered after worthy projects on very
17 high priority and high priority islands are funded. Some of these islands and tracts hold
18 valuable property or have important water supply or ecosystem values, but face lower
19 risks of failure, often because of previous State-funded levee improvements. Others
20 may have levees with high probability of failure, but have few residents, less valuable
21 property, or lower water supply or ecosystem values. Suisun Marsh levees, except for
22 those bordering Suisun Bay from Van Sickle Island westerly to Montezuma Slough, are
23 ineligible for State funds for levee improvement (Water Code section 12311), a
24 restriction that should be maintained.~~

25 ~~In awarding State funds to improve these levees, DWR may vary from these priorities
26 when necessary to protect lives, property, or the State's interests in water supply
27 reliability, the Delta ecosystem, considering the Delta's unique agricultural, natural,
28 cultural, or recreational values. The reasons for any variations should be explained.~~

29 *[Text restored from Delta Plan, 2013]*

30 **-Prioritizing State Investment in Levees**

31 The Delta Reform Act requires that State investments in Delta levees be prioritized to
32 reduce risks to people, property, and State interests in the Delta (Water Code sections
33 85305(a) and 85306). Prioritizing investment is necessary to ensure that limited public
34 funds are expended responsibly for improvements critical to State interests, rather than
35 simply applying one objective to all Delta levees regardless of priority. These priorities,
36 in combination with the Delta Reform Act directive that State agencies act consistently
37 with the Delta Plan, will ensure that State spending on Delta levees reflects these
38 priorities in the future. The Delta Reform Act provides that activities of the Council in

1 determining priorities for State levee investments in Delta levees do not increase the
2 State's liability for flood protection in the Delta or its watershed (Water Code section
3 85032(j)).

4 This Delta Plan outlines a process to prioritize State investments in levee operation,
5 maintenance, and improvements in the Delta. It is also important to prioritize interim
6 actions while longer-term guidelines are being established. Interim actions taken should
7 consider and, where feasible, incorporate habitat and ecosystem values and
8 enhancement in their development and implementation. This will allow for a more
9 coordinated, effective approach to reducing Delta flood risk and prioritizing both
10 immediate and long-term State investments. This approach will also take into account
11 future actions that may be proposed through other planning efforts such as the
12 CVFPP and Bay Delta Conservation Plan.

13 To effectively prioritize State investments in levees, a frame- work is needed to
14 adequately assess Delta flood risk. This framework should include the following steps:

- 15 • Assess existing Delta levee conditions. Initially, a sufficient understanding of the
16 current status of Delta levees is needed to establish baseline conditions against
17 which future risk reduction efforts can be gauged. Because Delta levee conditions
18 change, it is critical to conduct periodic assessments so that maintenance and
19 improvement actions can be directed rationally. Assessment methods should be
20 used that provide sufficient information to portray a reasonable snapshot of
21 conditions.
- 22 • Develop an economics-based risk analysis for each Delta tract and island. This
23 analysis must address several critical parameters, including life safety, private
24 property impacts on State water supply, critical infrastructure, Delta water quality,
25 ecosystem values, and system wide integrity. Accepted risk analysis methods
26 should be used, such as those developed by USACE (1996, 2006). This analysis
27 could include expected annual damage" assessments as a metric for analyzing
28 flood risk. This approach, which integrates the likelihood and consequences of
29 flooding, provides values that are useful for comparing flood risk at various
30 locations and for ranking alternative levee projects
- 31 • Conduct ongoing Delta flood risk analyses in an open manner for the public.
32 Baseline and subsequent analytical efforts should always be conducted in manner
33 open to scrutiny, with results being readily available for decision makers, interested
34 parties, and the general public. Flood risk analyses will need to take into account
35 future actions that may be proposed through other planning efforts such as the
36 CVFPP and Bay Delta Conservation Plan.
- 37 • Develop an updated understanding of Delta hydrology. An updated understanding
38 of water surface elevations in the Delta is critical for levee design purposes and
39 should be addressed.

1 The approach must be based on sound scientific and engineering principles, and
2 corporate appropriate economic and hydrologic data. As these long-term priorities for
3 State investments in levee operation, maintenance, and improvements are developed
4 State funds for Delta levee projects should focus on the interim priorities set forth in RR
5 P1, including the following actions:

- 6 • Provide a 200-year level of flood protection for existing urban and adjacent
7 urbanizing areas (Water Code section 9600 et seq.).
- 8 • Improve the levees that protect aqueducts crossing the Delta and the freshwater
9 pathway to Clifton Court Forebay, as depicted on Figure 7-6, to improve the
10 reliability of these water supplies.

11 *[Delta Plan as amended in 2018]*

12 **UPDATE FUNDING STRATEGIES**

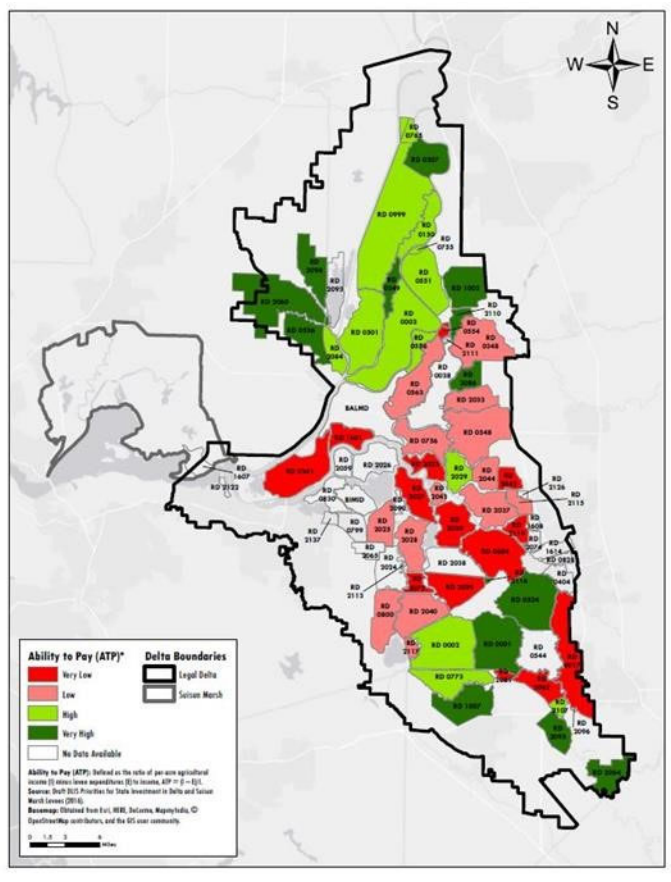
13 “Who pays what” is a key to financing all public works. The Delta Plan endorses the
14 principles that “beneficiaries pay” and “stressors pay.” The Council’s levees investment
15 strategy principles include:

- 16 1. The Delta Levee Investment Strategy should be based on the Delta Plan
17 principle that beneficiaries pay. The State share of levee improvements should
18 reflect the State interests at stake. Levee maintenance is primarily the
19 responsibility of local reclamation districts and their property owners, not the
20 State. The State should also take into account the ability to pay of local agencies.
- 21 2. The State should create a Delta Flood Risk Management Assessment District
22 with the authority to charge all beneficiaries.

23 In practice, almost all funds for most Delta levees’ maintenance and improvement have
24 come from two sources – landowners through assessments on lands or other property
25 protected by the levee network, and the State’s general fund, both through direct
26 appropriation and through the repayment of general obligation bonds. Annual funding
27 for levee improvements and maintenance is constrained currently by annual
28 appropriations of State funds, statewide bond measures, and by affordability and
29 budgeting at the local level, where jurisdictions, whether urbanized or rural, face
30 budgetary constraints and competition for tax dollars from a multitude of public needs.

31 Although the State contributes the majority of funds for maintaining and improving
32 nonproject Delta levees, the concept of shared responsibility with local landowners is
33 key to the Delta’s levees long term viability. The continued participation and financial
34 support of local reclamation districts is essential. As noted in the Delta Reform Act’s
35 Section 85003(b), “Delta property ownership developed pursuant to the federal Swamp
36 Land Act of 1850, and State legislation enacted in 1861, and as a result of the
37 construction of levees to keep previously seasonal wetlands dry throughout the year.
38 That property ownership, and the exercise of associated rights, continue to depend on

1 the landowners' maintenance of those nonproject levees and do not include any right to
2 state funding of levee maintenance or repair." Local cost shares are paid from property
3 assessments. In the rural Delta, assessments, which also cover reclamation districts'
4 drainage expenses, often average \$10 to \$40 per acre annually, with higher
5 assessments in districts that are matching significant State funds for levee improvement
6 (Delta Stewardship Council 2015). Local agencies have varying ability to pay,
7 influenced by the value of land that can be assessed and the desires of their voters,
8 who are usually property owners. In the rural Delta, where the productivity and use of
9 agricultural land strongly influences land values, districts' ability to pay varies widely
10 (Arcadis 2017).



11 Most recent State funds have come from general obligation bonds, such as those,
12 authorized by Proposition 1E for flood risk reduction. The reliance on State bonds to
13 fund 75 to 100 percent of levee improvement and maintenance costs not only limits the
14 amount of annual funding available but is an uncertain source of future funding for these
15 very costly long term capital and maintenance needs. Another drawback of relying
16 primarily on statewide bond measures to fund Delta levee improvements and
17 maintenance is that the Delta's needs must compete with other regions, increasing the
18 uncertainty of bond-funded appropriations.
19

1 Prior to the availability of bond funds, the subventions program was supported with
2 modest levels of general funds. The reliance on general fund reflects in part a proper
3 allocation to the State of costs to protect broad-based public benefits such as protecting
4 public safety, enhancing fish and wildlife habitat or safeguarding water quality. Without
5 another way to collect funds from water users, highway and railroad users, or utility
6 customers, the general fund may also approximate these broad-based classes of
7 beneficiaries.

8 The State's cost share for levee maintenance and improvement varies among
9 programs. The Delta Levees Maintenance Subventions Program pays up to 75 percent
10 of local costs, above \$1,000 per levee mile, to maintain and rehabilitate nonproject and
11 some project levees. The \$1,000 per levee mile deductible, last updated in 1981, is an
12 approach to State-local cost sharing. This deductible equates to approximately \$3 per
13 acre for reclamation districts within the Delta. If the deductible were updated for inflation
14 since 1981, it would be \$2250 to \$2500 per mile, depending on the index used to
15 measure rising costs or crop prices. At the upper limit of \$2500 per mile, this would
16 equate to approximately \$7 per acre for Delta reclamation districts. Studies of a local
17 agencies' ability to pay are supposed to inform cost-sharing between local districts and
18 the State, but in practice are seldom completed or applied.

19 Most project levees are maintained without State support by local agencies or
20 Stateimposed maintenance areas funded by local landowners.

21 Improvement of nonproject levees is usually funded through the Delta Levee Special
22 Projects Flood Control Program, although occasionally the Delta Levees Maintenance
23 Subventions Program funds rehabilitation projects that improve levees. The Special
24 Flood Control Projects Program may pay up to 100 percent of improvement costs,
25 subject to cost sharing agreements it may enter into with the beneficiaries or owners of
26 infrastructure, such as utilities or highways that benefit from the improvement. The
27 USACE's conclusion that there is no federal interest in improving non-project Delta
28 levees removes the CALFED Bay-Delta Program's expectation that the federal
29 government might pay up to half the cost of these levees' improvement. Improvements
30 to project levees usually include at least a 50 percent federal cost share, with greater
31 federal support when improvements provide ecosystem restoration or other benefits.

32 To widen other levee beneficiaries' participation in funding levee maintenance and
33 improvement, the 2013 Delta Plan and the DPC's Economic Sustainability Plan
34 proposed creating a regional agency with fee assessment authority to assist with the
35 financing, planning, and implementation of Delta flood risk reduction activities. It was
36 hoped that this alternative funding mechanism could provide a more stable, long-term
37 approach to funding in which local participation by all beneficiaries of flood risk
38 management is more broadly incorporated. Phase 1 of the DPC efforts, however,
39 suggests that such a district is infeasible because it cannot capture revenue from all
40 beneficiaries of Delta levees and the significant legal and political hurdles of creating an

1 assessment district crossing so many jurisdictional boundaries. Instead, the DPC is
2 exploring other approaches to involving beneficiaries in paying for levee improvements
3 (M.Cubed 2016). Phase 1 of the DPC effort suggests that the most feasible portfolio of
4 finance mechanisms is one that could generate revenue to pay for levee maintenance,
5 repair, rehabilitation and improvements, including new fees that would bring in revenue
6 from beneficiaries that do not currently pay for Delta levees in proportion to the benefits
7 they receive. Candidates include contributions from the State Water Project or Central
8 Valley Project for improvements protecting the conveyance of water through the Delta
9 for export, a water use fee linked to improvement of levees protecting water quality, fees
10 on energy or telecommunication utilities with infrastructure protected by levees,
11 contributions from CalTrans as it implements strategies to reduce its highways'
12 vulnerability, reactivation of the Sacramento-San Joaquin Drainage District as proposed
13 in the draft Central Valley Flood Protection Plan, or regional assessments to respond to
14 sea level rise. This potential portfolio of finance mechanisms may help move toward a
15 levee funding system based on the "beneficiary pays" principle, increasing the funds
16 available to pay for levee maintenance or priority levee improvements. These
17 approaches should be further investigated by the DPC in the next phase of work and
18 pursued, if viable, along with action by the Public Utilities Commission recommended in
19 the Delta Plan to promote cost-sharing of levee improvements by investor owned
20 utilities.

21 **PLANNING FOR FLOODPLAIN LAND USE**

22 The most important step in reducing risk to people in the Delta is to stop putting more
23 people at risk behind levees that do not meet minimum modern standards for flood
24 protection. Actions that increase the demand for higher public spending on flood risk
25 reduction and exacerbate flood risk (for example, urbanizing floodprone areas) should
26 be discouraged (Galloway, et. al. 2007).

27 The DPC Land Use and Resource Management Plan for the Primary Zone of the Delta
28 also includes important policies to limit development in floodprone areas of the Primary
29 Zone:

30 *Local governments shall carefully and prudently carry out their responsibilities to*
31 *regulate new construction within flood hazard areas to protect public health, safety,*
32 *and welfare. These responsibilities shall be carried out consistent with applicable*
33 *regulations concerning the Delta, as well as the statutory language contained in the*
34 *Delta Protection Act of 1992. Increased flood protection shall not result in*
35 *residential designations or densities beyond those allowed under zoning and*
36 *general plan designations in place on January 1, 1992, for lands in the Primary*
37 *Zone. (DPC 2010)*

38
39 As noted in Chapter 5, the legacy community of Bethel Island warrants a special note
40 because of its flood hazards. About 2,100 people reside on the island in about 1,300

1 residences concentrated on the south-central shoreline and four mobile home parks.
2 The island, which is below sea level, is surrounded by approximately 15 miles of levees,
3 limiting the drainage of floodwaters in the event of a levee breach. A single road, Bethel
4 Island Road, links the island to the mainland at the city of Oakley, complicating
5 emergency response or evacuation in the event of flooding. Because developments on
6 Bethel Island are proposed to be served by the Bethel Island Municipal Improvement
7 District or other adjacent public services, the entire island is within the urban limit line
8 adopted by Contra Costa voters in 2006. The high flood risks on the island and the
9 restricted evacuation opportunities, however, indicate the island has greater hazards to
10 lives and property than the Delta's other areas designated for development. For this
11 reason, it is not excluded from the Delta Plan policy prohibiting new subdivisions unless
12 adequate flood protection is provided. This is consistent with provisions of the Contra
13 Costa County General Plan, which require that development other than a single home
14 on existing parcels await resolution of several issues, including improvement of the
15 community's public services, levees, and emergency evacuation routes.

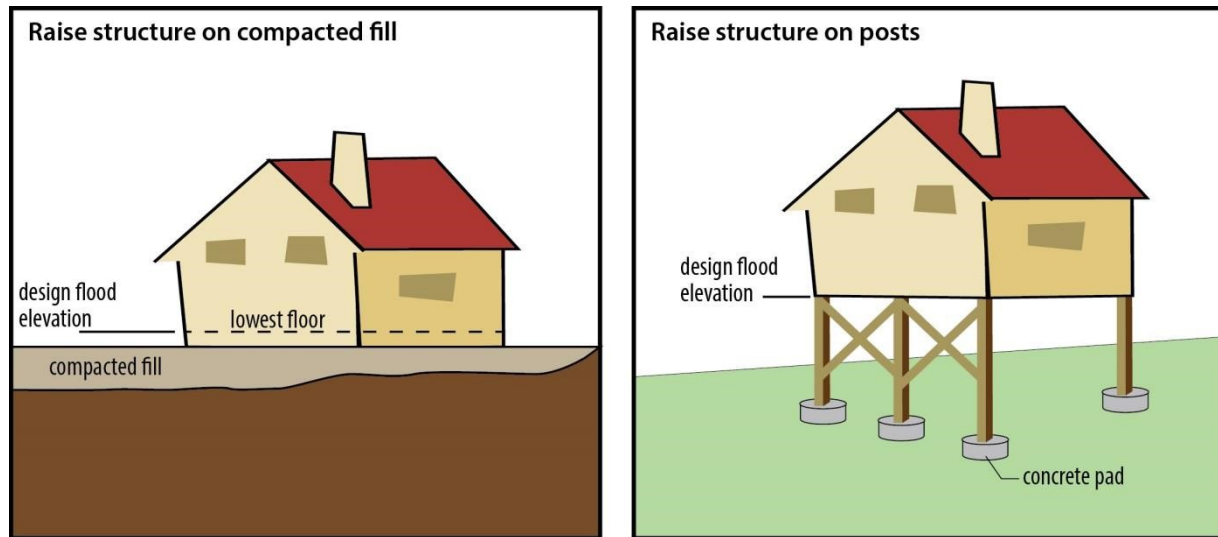
16 As described in Chapter 5, urban residential, commercial, and industrial uses should be
17 located in cities, other urban areas, and their spheres of influence, where strong levees
18 can be provided, rather than in rural lands protected only by nonproject levees. Outside
19 of these urban and urbanizing areas and the legacy communities, the Delta Plan
20 prohibits major subdivisions of five or more parcels where 200-year flood protection is
21 not available. In rural areas, any new rural residential subdivisions should anticipate
22 rising sea levels by going beyond FEMA standards to designate home sites that will be
23 above the sea level anticipated in 2100. Recognizing legacy community needs for
24 incidental growth to maintain their unique cultural values, development within
25 community boundaries should continue consistent with existing general plans, and
26 federal and local flood protection laws. Appendix B provides maps of Delta community
27 boundaries. Maintaining most of the Delta in rural, agricultural land use, as described in
28 Chapter 5, complements policies that reduce the number of properties and the
29 population exposed to high flood risks.

30 Finally, the participation of Delta counties and cities in the National Flood Insurance
31 Program brings with it a requirement that all residential, commercial, agricultural, and
32 industrial buildings comply with FEMA floodproofing standards, including elevating
33 structure ground floors above the 100-year flood elevation. Examples of floodproofing
34 are shown on Figure 7-7

35
36
37
38
39
40
41

1

Examples of Floodproofing



2

3

Figure 7-7 Floodproofing in accordance with the National Flood Insurance Program can be achieved through several methods. The illustration on the left shows an example of floodproofing by constructing the lowest floor within a structure above the design flood elevation. The illustration on the right shows floodproofing by raising the bottom of the structure above the design flood elevation.

9

Source: FEMA 1994; FEMA 2001

10

FUNDING FOR NON-STRUCTURAL RISK REDUCTION

11

Flood risks to lives and property can be reduced by investing in emergency evacuation routes, flood proofing, or other actions in addition to levees. In the Delta's unincorporated towns or rural developments, these non-structural risk reduction activities may be preferred when improving levees is not affordable or cost effective. Pursuing these alternatives can be difficult, however, because State funds are primarily available for levee improvements, rather than the full range of risk reduction activities. As the State makes additional funds available for flood risk reduction, providing funds for nonstructural risk reduction as well as levee improvement can give Delta residents more choices about how to reduce flood risks.

20

EMERGENCY PREPAREDNESS AND RESPONSE

21

Even with the best-engineered levees, channels, and floodways, a residual risk from flooding will always remain; flood risk can never be eliminated. Although investment in

22

1 flood protection infrastructure can considerably reduce the likelihood of a catastrophic
2 levee failure, failures are inevitable and will require well-coordinated and carefully
3 developed emergency response efforts. A 200-year flood or earthquake could badly
4 damage levees at up to 10 to as many as 40 islands (Arcadis 2016b). To reduce
5 response time and optimize effectiveness of response efforts after such a disaster
6 emergency plans need to leverage the unique capabilities of each agency with a mission
7 in the Delta. This section provides an overview of the agencies and planning
8 involved in emergency preparedness and response in the Delta. Emergency plans need
9 to leverage the unique capabilities of each agency with a mission in the Delta. This
10 section provides an overview of the agencies and planning involved in emergency
11 preparedness and response in the Delta.

12 Responsibilities for preparing for, declaring, and responding to flood emergencies are
13 distributed among local, State, and federal agencies. Federal agencies with authority
14 include USACE and FEMA. In California, State and local responsibilities fall to county
15 offices of emergency services, local reclamation districts, Cal EMA, and DWR. In a
16 Delta flood emergency, the response efforts by local and State emergency management
17 professionals are guided by California's Standardized Emergency Management System
18 (SEMS). SEMS was established by Government Code section 8607(a), and provides for
19 effective management of multiagency and multijurisdictional emergencies in California,
20 including flood emergencies. This system consists of five organizational levels, which
21 are activated as necessary: (1) field response, (2) local government, (3) operational
22 area, (4) regional, and (5) State. These levels are activated stepwise as the events
23 warrant additional response and resources, meaning that each level of emergency
24 responder contacts the next level above them should they deem the emergency beyond
25 their capabilities to control. Federal resources are called upon if State resources are
26 exhausted or additional assistance is needed. SEMS incorporates the functions and
27 principles of the Incident Command System, the Master Mutual Aid Agreement, existing
28 mutual aid systems, the operational area concept, and multiagency or interagency
29 coordination. A detailed discussion of SEMS can be found in Cal EMA SEMS
30 Guidelines (Cal EMA 2009). Local governments must use SEMS to be eligible for
31 funding of their response-related personnel costs under State disaster assistance
32 programs.

33 At the State level, Cal EMA's *California Emergency Plan* is the current guiding plan for
34 all State emergencies. The California Emergency Plan incorporates and complies with
35 the principles and requirements found in federal and State laws, regulations, and
36 guidelines. Cal EMA typically defers to DWR for emergency management during floods.
37 DWR emergency flood management actions are guided by its 2007 *Interim Flood*
38 *Emergency Operations Plan*. DWR is in the process of developing its Delta Flood
39 Emergency Preparedness Response and Recovery Program (EPRRP), which will be

1 the overall guiding flood emergency management program for DWR activities for project
2 and nonproject levees in the Delta. The Delta Flood EPRRP consists of three
3 components: (1) the plan for flood emergency preparedness, response, and recovery
4 actions in the Delta; (2) multiagency plan coordination, which coordinates DWR's plan
5 with the plans of other Delta flood response agencies; and (3) response facilities
6 implementation, which includes the development of flood emergency response facilities
7 in the Delta.

8 At the federal level, USACE has a standing All-Hazards Emergency Response Plan and
9 standing contracts for emergency response work in the Delta region, and is ready to
10 assist the State, as requested through PL 84-99. These existing plans and procedures
11 are considered in DWR's flood emergency operations plans and are a critical part of the
12 Delta Flood EPRRP Plan. FEMA is responsible for coordinating the response of several
13 federal agencies to a large natural disaster that overwhelms the resources of State and
14 local authorities. The primary duty of FEMA is to ensure services to disaster victims
15 through operational planning and integrated preparedness measures.

16 To further address emergency preparedness and response issues in the Delta, Water
17 Code section 12994.5 calls for developing and implementing multi-hazard preparedness
18 and response strategies for the Delta. This legislation requires the Office of Emergency
19 Services (CalOES) to establish the Sacramento-San Joaquin Delta Multi-Hazard
20 Coordination Task Force. Led by CalOES, the task force consists of representatives
21 from the DPC, DWR, and the five Delta counties. The task force was directed to do the
22 following:

- 23 • Make recommendations to CalOES about creating an interagency unified
24 command system organizational framework, in accordance with the guidelines of
25 the National Incident Management System (NIMS) and the Standardized
26 Emergency Management System (SEMS);
- 27 • Coordinate development of a draft emergency preparedness and response
28 strategy for the Delta; and
- 29 • Develop and conduct all-hazard emergency response exercises and training in
30 the Delta that would test or facilitate implementation of regional coordination
31 protocols.

32 The recommendations prepared by the task force include identifying potential threats
33 and consequences affecting the Delta, developing a Delta catastrophic flood incident
34 plan to guide integrated emergency response in the Delta, and the preparing a regional
35 mass evacuation plan.

1 **RENEWING FEDERAL ASSURANCES OF ASSISTANCE IN RECOVERING FROM**
2 **FLOOD DISASTERS**

3 Following a flood disaster, various federal programs can provide disaster assistance.
4 The federal agencies have repeatedly helped fund post-disaster repairs of Delta levees
5 and other public infrastructure, providing aid after floods in 1980,1982,1983,1986, 1997,
6 2004, and 2006. FEMA’s Hazard Mitigation Plan (HMP) criteria must be met to be
7 eligible for its assistance (Delta Stewardship Council Staff 2010b). USACE has specific
8 criteria concerning eligibility for assistance to repair levees under PL 84-99. The Delta
9 HMP agreed to between California agencies and FEMA was intended to reduce risks to
10 the property that Delta levees protect, so that federal aid would be needed less often.

11 The State’s investment in Delta levee maintenance and improvement has in part been
12 in fulfillment of its responsibilities under the HMP.

13 Today, however, California can no longer rely on federal assistance to rebuild Delta
14 levees damaged in floods. Following Hurricane Katrina and other expensive disasters,
15 eligibility requirements for FEMA and USACE post-disaster assistance for levee repairs
16 have been tightened and more rigorously enforced. Most rural Delta project levees were
17 either removed from the Corps’ PL 84-99 program or are expected to become ineligible
18 soon. In 2014, the Delta HMP was not renewed, despite the considerable State
19 investment in its implementation. The agreement’s termination partly reflected FEMA’s
20 concern that sufficient progress had not been made toward its long-term goal of bringing
21 levees up to the USACE Delta specific PL 84-99 standard and growing realization of the
22 costs that flood disasters nationwide are imposing on the federal government.

23 Planning for levee improvement and maintenance is difficult without more certainty
24 about the reliability of federal post-disaster recovery programs, including the criteria that
25 could be imposed on reclamation districts seeking whatever federal levee repair
26 assistance may be available. Revising assistance criteria to reflect the Delta’s unique
27 setting and its water supply and ecosystem values is an important aspect of seeking
28 renewed federal commitments. Without federal assistance, post-disaster recovery would
29 be difficult and expensive. Landowners alone would be unlikely to repair levees
30 damaged in a disaster on 18 to 23 Delta islands where the cost of repairs is likely to
31 exceed the value of the islands’ property (Suddeth, et. al. 2010). Federal assistance in
32 rebuilding these levees could significantly lower landowners’ repair costs, increasing the
33 likelihood that damaged islands would be reclaimed. The lack of federal assistance
34 shifts to the State the cost of aiding local agencies in levee repairs, because State law
35 provides that post-disaster levee repair claims not paid by federal agencies may be
36 reimbursed by the State through DWR’s Delta Levees Maintenance Subventions

1 Program (Water Code section 12993). As risks grow with rising seas, the importance of
2 FEMA's hazard mitigation assistance will only increase proportionately.

3 **LIABILITY CONCERNS**

4 USACE and other federal agencies are generally afforded some immunity from liability
5 for damages from flood events under the concept of sovereign immunity and provisions
6 of the Flood Control Act of 1928 (33 United States Code section 702c). Congress
7 provided immunity to federal agencies for some but not all tort damages. However, this
8 immunity does not apply to nonfederal agencies.

9 As the risks of levee failure and corresponding damage increase, California's courts
10 have generally exposed public agencies, and the State specifically, to significant
11 financial liability for flood damages (DWR 2005). The most notable recent court decision
12 on flood liability was the California Court of Appeal decision in *Paterno v. State of*
13 *California* (2003) (113 Cal. App. 4th 998). The court found the State was liable for
14 damages caused by the failure of a project levee on the Yuba River that the State did
15 not design, build, or even directly maintain. This decision makes it possible that the
16 State will ultimately be held responsible for the structural integrity of much of the federal
17 flood control system in the Delta and Central Valley. The *Paterno v. State of California*
18 decision will ultimately cost State taxpayers approximately \$464 million in awarded
19 damages.

20 In *Arreola v. County of Monterey* (2002) (99 Cal. App. 4th 722), the court held local
21 agencies and the California Department of Transportation (Caltrans) liable for 1995
22 flood damages to property owners that resulted from a failure to properly maintain
23 levees of the Pajaro River project.

24 One way to reduce State liability is to expand participation in flood insurance programs.
25 Flood insurance premiums are increasing as Congress reacts to steady program losses
26 from recent flood disasters. High premiums, however, make flood insurance less
27 affordable for many Delta residents. Local government participation in the flood
28 insurance program's community rating system can help lower rates as communities
29 undertake activities that reduce flood risks, like evacuation planning, floodproofing, or
30 buying out repetitively damaged properties.

31 The California *FloodSAFE Strategic Plan* states, "Local communities are responsible for
32 land use decisions, but generally have not been found liable for failure of the flood
33 protection system. Continued local actions to approve development within floodplains
34 may increase flood risk, even if levees and other flood protection improvements are
35 made. This creates liability issues which the State is concerned about. Legislation

1 passed in 2007 addresses the need to connect land use planning with diligent and
2 factual consideration of flood risks for areas of proposed development” (DWR 2008a).

3 In 2007, the Legislature amended the Water Code to address local community liability
4 for approving development in floodprone areas. It provides that “a city or county may be
5 required to contribute its fair and reasonable share of the property damage caused by a
6 flood to the extent that the city or county has increased the state’s exposure to liability
7 for property damage by unreasonably approving new development in a previously
8 undeveloped area that is protected by a state flood control project” (Water Code
9 sections 8307(a) and (b)).

10 *Ultimately, however, it is important to note that the State does not own,*
11 *operate, control, or maintain nonproject levees, and does not have*
12 *authority to do so. The Delta levee subventions program grants financial*
13 *assistance to local reclamation districts for their levees. The State*
14 *conducts evaluations to make sure subventions program funds have been*
15 *spent appropriately, but not to ensure the quality of the work or the stability*
16 *or structural integrity of nonproject levees. Rather, the nonproject levees*
17 *are the sole responsibility of the reclamation districts, and the State is not*
18 *liable for damages caused by their failure.*

19 **POLICIES AND RECOMMENDATIONS**

20 These policies and recommendations are based on the Council's core strategies for
21 reducing flood risks in the Delta, which are:

- 22 • Continue to prepare for Delta flood emergencies
- 23 • Modernize levee information management
- 24 • Prioritize investment in Delta levees
- 25 • Update flood management funding strategies
- 26 • Manage rural floodplains to avoid increased flood risk
- 27 • Protect and expand floodways, floodplains, and bypasses
- 28 • Renew assurances of federal assistance for post disaster response
- 29 • Limit State liability

30 Reducing flood risks also relies on locating urban development in the Delta's cities
31 where levees are stronger as discussed in Chapter 5, and retaining rural lands for
32 agriculture, so that development in the most floodprone areas is minimized.

1 **Continue to Prepare for Delta Flood Emergencies**

2 To effectively and reliably reduce risks to people, property, and State interests in the
3 Delta and to respond rapidly to flood disasters, a multifaceted strategy of coordinated
4 emergency preparedness, appropriate land use planning, and prioritized investment in
5 flood protection infrastructure is necessary (Water Code sections 85305(a) and 85306).
6 Federal, State, and local governments -- and Californians -- must be prepared for a
7 variety of emergency situations.

8 The recommendations prepared by the Sacramento-San Joaquin Delta Multi-Hazard
9 Coordination Task Force play an important role in planning efforts for the Delta.

10 **Problem Statement**

11 Levee failures and flooding can and will place human life and property in danger, and
12 can have potentially significant implications for the State's water supply and
13 infrastructure, and the health of the Delta ecosystem. Investments in levee maintenance
14 and improvement can reduce but not eliminate these risks. Appropriate emergency
15 preparedness and response planning and implementation activities need to continue
16 and expand.

17 **Policies**

18 No policies with regulatory effect are included in this section.

19 **Recommendations**

20 **RR R1. Implement Emergency Preparedness and Response**

21 The following actions should be taken to promote effective emergency preparedness
22 and response in the Delta:

- 23 • Responsible local, State, and federal agencies with emergency response
24 authority should continue to implement the recommendations of the Sacramento-
25 San Joaquin Delta Multi-Hazard Coordination Task Force (Water Code section
26 12994.5). Such actions should support the development of a regional response
27 system for the Delta.
- 28 • Materials should be stockpiled in appropriate locations to make post-disaster
29 repairs of breaches in levees along the water supply reliability corridor identified
30 in the Delta Plan's Figure 7-6, the western islands important to protection of

1 water quality, and other levees, to complement improvement of levees as
2 provided in RR P1.

- 3 • Local levee-maintaining agencies, with assistance from DWR, should develop
4 their own emergency action plans, training, and floodfight material stockpiles.
- 5 • State and local agencies, and regulated utilities that own and/or operate
6 infrastructure in the Delta should prepare coordinated emergency response plans
7 to protect the infrastructure from long-term outages resulting from failures of the
8 Delta levees. The emergency procedures should consider methods that also
9 would protect Delta land use and ecosystem.

10 **Modernize Levee Information Management**

11 **Problem Statement**

12 Information about levee conditions is held by many parties. Data is not gathered
13 consistently or shared widely or easily, leading to disagreements about maintenance
14 needs and progress towards objectives for risk reduction and levee improvement.
15 Without adequate information, planning is hindered and program performance is difficult
16 to judge (Committee on Integrating Dam and Levee Safety and Community Resilience.
17 2012)

18 **RR R2. Modernize Levee Information Management**

19 **A. Require Adequate Levee Inspections.** In order to gather information about Delta
20 levee conditions and maintenance needs, the Central Valley Flood Protection Board
21 should update its guidelines for the Delta Levees Maintenance Subventions Program to
22 require local levee maintaining agencies participating in the program to annually inspect
23 their Delta levees in accordance with DWR's guidelines for Local Agency Project and
24 Nonproject Levee Maintenance Inspection and to file their inspection reports
25 electronically with DWR. Costs of inspections should continue to be reimbursable
26 through the Delta Levees Maintenance Subventions Program.

27 **B. Provide Delta Levee Investment Decision Support.** The Delta Stewardship
28 Council should use information from levee inspections reported to DWR and from
29 DWR's annual reports about its levee investments pursuant to this plan's policy
30 regarding levee investment priorities (RR P1) to maintain the decision support tool
31 developed during preparation of this Delta Plan amendment.

1 **Prioritize Investment in Delta Flood Management Investment**

2 The Delta Reform Act of 2009 charges the Council to attempt to reduce risks to people,
3 property, and State interests in the Delta (Water Code section 85305) by promoting, in
4 part, strategic investments in Delta levees. The Council is required to recommend in the
5 Delta Plan priorities for investments in levee operation, maintenance, and improvements
6 in the Delta, in consultation with the Central Valley Flood Protection Board (Water Code
7 section 85306). The Council's policy is to reduce flood risk in the Delta with cost-effective
8 investments that further the coequal goals of California law: "a more reliable water
9 supply for California and protecting, restoring and enhancing the Delta ecosystem", in a
10 manner that protects and enhances the "unique cultural, recreational, natural resource,
11 and agricultural values of the Delta as an evolving place" (Public Resources Code
12 section 29702).

13 **Problem Statement**

14 The Delta Reform Act (Water Code section 85306) requires the Delta Plan to
15 recommend priorities for State investments in Delta levees, including project and
16 nonproject levees. Currently, no comprehensive method exists to prioritize State
17 investments in Delta levee operations, maintenance, and improvement projects. Without
18 a prioritization, the apportionment of public resources into levees may not occur in a
19 manner that reflects the risks to lives, property, and State interests.

20 **Policies**

21 **RR-P1. Prioritization of State Investments in Delta Levees and Risk Reduction**

22 **A. Fund levee maintenance.** Funding for maintenance of levees shall continue to be
23 available throughout the Delta where authorized by Water Code section 12980 et. seq.

24 **B. Prioritize levee improvements.** The priorities listed below shall guide State
25 discretionary investments in the improvement and major rehabilitation of Delta levees.
26 As DWR selects levee improvement projects for funding through its levee funding
27 programs, it should fund projects at the very high priority islands or tracts, subject to its
28 consideration of the benefits, costs, engineering considerations, and other factors,
29 before approving projects at high priority or other priority tracts. If available funds are
30 sufficient to fully fund levee improvements at the very high priority tracts, then funds for
31 improvements or major rehabilitation of levees on high priority islands and tracts may be
32 provided, and after those projects have been fully funded, then projects at other priority
33 islands and tracts may be funded.

34 The Department of Water Resources shall certify projects' consistency with this
35 regulatory policy when its funding decisions are made and shall report annually to the

1 Council about its decisions to award State funds for Delta levee improvements,
 2 including the location of each funded improvement, the priority of the affected islands or
 3 tracts, the improvements funded, including the relevant levee improvement type,
 4 habitat mitigation or enhancement features, estimated reduction in levee fragility,
 5 expected reduction in annual fatalities and damages, State funds awarded, and local or
 6 federal matching funds.

7 Preliminary Draft Delta Levees Investment Priorities
 8

Very High Priority	BETHEL ISLAND, BISHOP/DLIS 14 (NORTH STOCKTON), BRANNAN ANDRUS, BYRON TRACT, CENTRAL STOCKTON, DUTCH SLOUGH, GRAND ISLAND, JERSEY ISLAND, MAINTENANCE AREA 9 NORTH, MAINTENANCE AREA 9 SOUTH, MCCORMACK WILLIAMSON TRACT, NORTH STOCKTON, RECLAMATION DISTRICT 17, SHERMAN ISLAND, TWITCHELL ISLAND, UPPER ANDRUS ISLAND, WEST SACRAMENTO
High Priority	BACON ISLAND, BOULDIN ISLAND, BRADFORD ISLAND, CLIFTON COURT FOREBAY, DLIS 08 (DISCOVERY BAY AREA), DLIS 20 (YOLO BYPASS), DLIS 22 (RIO VISTA), DLIS 63 (GRIZZLY ISLAND AREA), DREXLER TRACT, GLANVILLE, HASTINGS TRACT, HOLLAND TRACT, HONKER BAY, HONKER LAKE TRACT, HOTCHKISS TRACT, JONES TRACT (LOWER AND UPPER), LITTLE EGBERT TRACT, MANDEVILLE ISLAND, MCDONALD ISLAND, MIDDLE & UPPER ROBERTS ISLAND, MOSSDALE ISLAND, NEW HOPE TRACT, PALM ORWOOD, PARADISE CUT, PARADISE JUNCTION, PESCADERO DISTRICT, STATEN ISLAND, STEWART TRACT, TERMINOUS TRACT, TYLER ISLAND, UNION ISLAND WEST, VICTORIA ISLAND, WEBB TRACT, WOODWARD ISLAND
Other Priority	ATLAS TRACT, BIXLER TRACT, BRACK TRACT, CACHE HAAS AREA, CANAL RANCH TRACT CHIPPS ISLAND, CONEY ISLAND, DEAD HORSE ISLAND, DLIS-01 (PITTSBURG AREA), DLIS 06 (OAKLEY AREA), DLIS 07 (KNIGHTSEN AREA), DLIS10, DLIS 15, DLIS 17, DLIS 18, DLIS 19 (GRIZZLY SLOUGH AREA), DLIS 25, DLIS 26 (MORROW ISLAND), DLIS 27, DLIS 28, DLIS 29, DLIS 30, DLIS 31 (GARABALDI UNIT), DLIS 32, DLIS 33, DLIS 34, DLIS 35, DLIS 36, DLIS 37 (CHADBOURNE AREA), DLIS 39, DLIS 40, DLIS 41 (JOICE ISLAND AREA), DLIS 43 (POTRERO HILLS AREA), DLIS 44 (HILL SLOUGH UNIT), DLIS 46, DLIS 47, DLIS 48, DLIS 49, DLIS 50, DLIS 51, DLIS 52, DLIS 53, DLIS 54, DLIS 55, DLIS 56, DLIS 57, DLIS 59, DLIS 62, DREXLER POCKET, EGBERT TRACT, EHRHEARDT CLUB, EMPIRE TRACT, FABIAN TRACT, FAY ISLAND, GLIDE DISTRICT, HOLT STATION, KASSON DISTRICT, KING ISLAND, LIBBY MCNEIL, LISBON DISTRICT, LOWER ROBERTS ISLAND, MCMULLIN RANCH, MEDFORD ISLAND, MEIN'S LANDING, MERRITT ISLAND, NETHERLANDS, PEARSON DISTRICT, PETERS POCKET, PICO NAGLEE, PROSPECT ISLAND, QUIMBY ISLAND, RANDALL ISLAND, RINDGE TRACT, RIO BLANCO TRACT, RIVER JUNCTION, ROUGH AND READY ISLAND, RYER ISLAND, SHIMA TRACT, SHIN KEE TRACT, STARK TRACT, SUNRISE CLUB, SUTTER ISLAND, UNION ISLAND EAST, VEALE TRACT, VENICE ISLAND, WALNUT GROVE, WALTHALL, WETHERBEE LAKE, WINTER ISLAND, WRIGHT ELMWOOD TRACT, YOLANO

1 **DLIS Priorities**

2 ~~When DWR's contributions towards levee improvements vary from these priorities, it~~
3 ~~shall identify how the funding is inconsistent with this guidance, describe why variation~~
4 ~~from the priorities is necessary, and explain how the funding nevertheless protects lives,~~
5 ~~property, and the State's interests in water supply reliability and restoration, protection,~~
6 ~~and enhancement of the Delta ecosystem while considering the Delta's unique~~
7 ~~agricultural, natural, historic, and cultural values. That determination is subject to review~~
8 ~~by the Delta Stewardship Council on appeal.~~

9 ~~-(a) For purposes of Water Code section 85057.5(a)(3) and section 5001(j)(1)(E) of this~~
10 ~~Chapter, this policy covers a proposed action that involves discretionary State~~
11 ~~investments in the improvement and major rehabilitation of Delta levees. Nothing in this~~
12 ~~policy establishes or otherwise changes existing levee standards. NOTE: Authority~~
13 ~~cited: Section 85210(i), Water Code.~~

14 ~~Reference: Sections 85020, 85300, 85305, and 85306, Water Code.~~

15 **Definitions**

16 ~~Add the following definitions to the Delta Plan glossary~~

17 **Levee Maintenance:**

18 ~~Annual or routine levee maintenance is work intended to preserve the levee system in~~
19 ~~its current condition. Examples of maintenance work include patrols, surveys and~~
20 ~~inspections, extermination and control of burrowing animals, work on the levee crown to~~
21 ~~improve access or drainage, removing vegetation or debris, control of seepage and~~
22 ~~boils, cleaning drains and toe ditches, restoring rock protection, and maintenance of~~
23 ~~levee-related habit improvements sites.~~

24 **Levee Rehabilitation:**

25 ~~Rehabilitation is levee repair work needed to improve the levee integrity and preserve~~
26 ~~existing flood risk reduction benefits. Examples of rehabilitation work include raising the~~
27 ~~levee crown to offset subsidence, flattening waterside slopes, constructing landside~~
28 ~~berms, and widening levee crowns.~~

29 **Levee Improvement:**

30 ~~Levee improvements are intended to reduce the probability of flooding. An example of a~~
31 ~~levee improvement would be changing a levee geometry to meet a higher levee~~
32 ~~standard such as improving a levee to reach a 200-year level of protection.~~

33 ~~[Text restored from Delta Plan, 2013];~~

1 **Prioritize Flood Management Investment**

2 A method is needed for prioritizing State funds for use in operating, maintaining, and
3 improving Delta levees with a systemwide approach. Although the State has expended
4 millions of dollars since the early 1970s on Delta levees, almost half of the Delta’s
5 acreage is not protected by levees that meet the HMP guidance today. Efforts by
6 landowners, reclamation districts, and other parties using local resources to perform
7 levee upgrades, beyond the standards that may be funded by the State, are
8 encouraged and would be consistent with the goal of reducing Delta flood risk. The
9 Delta Reform Act provides that activities of the Council in determining priorities for State
10 investments in Delta levees do not increase the State’s liability for flood protection in the
11 Delta or its watershed.

12 **Problem Statement**

13 The Delta Reform Act (Water Code section 85306) requires the Delta Plan to
14 recommend priorities for State investments in Delta levees, including project and
15 nonproject levees. Currently, no comprehensive method exists to prioritize State
16 investments in Delta levee operations, maintenance, and improvement projects. Without
17 a prioritization methodology, the apportionment of public resources into levees may not
18 occur in a manner that reflects a broader, long-term approach.

20 **Policies**

21 **RR P1. Prioritization of State Investments in Delta Levees and Risk Reduction**

22 (a) Prior to the completion and adoption of the updated priorities developed pursuant
23 to Water Code section 85306, the interim priorities listed below shall, where applicable
24 and to the extent permitted by law, guide discretionary State investments in Delta flood
25 risk management. Key priorities for interim funding include emergency preparedness,
26 response, and recovery as described in paragraph (1), as well as Delta levees funding
27 as described in paragraph (2).

28 (1) Delta Emergency Preparedness, Response, and Recovery: Develop and
29 implement appropriate emergency preparedness, response, and recovery strategies,
30 including those developed by the Delta Multi-Hazard Task Force pursuant to Water
31 Code section 12994.5.

32 (2) Delta Levees Funding: The priorities shown in the following table are meant to
33 guide budget and funding allocation strategies for levee improvements. The goals for
34 funding priorities are all important, and it is expected that over time, the California
35 Department of Water Resources must balance achievement of those goals. Except on
36 islands planned for ecosystem restoration, improvement of nonproject Delta levees to
37 the Hazard Mitigation Plan (HMP) standard may be funded without justification of the
38 benefits. Improvements to a standard above MP, such as that set by the U.S. Army
39 Corps of Engineers under Public Law 84-9, may be funded as befits the benefits to be
40 provided, consistent with the California Department of Water Resources’ current

1 practices and any future adopted investment strategy.

2
3
4 **Priorities for State Investment in Delta Integrated Flood Management Categories of**
5 **Benefit Analysis**

<u>Goals</u>	<u>Localized Flood Protection</u>	<u>Levee Network</u>	<u>Ecosystem Conservation</u>
<u>1</u>	<u>Protect existing urban and adjacent urbanizing areas by providing 200-year flood protection</u>	<u>Protect water quality and water supply conveyance in the Delta, especially levees that protect freshwater aqueducts and the primary channels that carry fresh water through the Delta.</u>	<u>Protect existing and provide for a net increase in channel-margin habitat.</u>
<u>2</u>	<u>Protect small communities and critical infrastructure of statewide importance (located outside of urban areas).</u>	<u>Protect floodwater conveyance in and through the Delta to a level consistent with the State Plan of Flood Control for project levees.</u>	<u>Protect existing and provide for net enhancement of floodplain habitat.</u>
<u>3</u>	<u>Protect agriculture and local working landscapes.</u>	<u>Protect cultural, historic, aesthetic, and recreational resources (Delta as Place).</u>	<u>Protect existing and provide for net enhancement of wetlands.</u>

6 (b) For purposes of Water Code section 85057.5(a)(3) and section
7 5001(j)(1)(E) of this Chapter, this policy covers a proposed action that
8 involves discretionary State investments in Delta flood risk management,
9 including levee operations, maintenance, and improvements. Nothing in
10 this policy establishes or otherwise changes existing levee standards.

11 23 CCR Section 5012

1 NOTE: Authority cited: Section 85210(i), Water Code.

2 Reference: Sections 85020, 85300, 85305, and 85306, Water Code.

3 *[Delta Plan as amended in 2018]*

4 **Update Flood Management Funding Strategies**

5 The responsibility for securing funding for Delta levee maintenance, repairs, and
6 improvements lies with the numerous local levee- maintaining agencies (primarily
7 reclamation districts). These local agencies have varying ability to pay which is
8 influenced by the value of land within the district that can be assessed and the desires
9 of the district's voters, who are usually property owners. Funding is generated through
10 property assessments of local landowners and also is provided by the State under
11 programs administered by DWR, including the Delta Levees Special Flood Control
12 Projects and Delta Levees Maintenance Subventions programs. Federal investments
13 match State and local funds to improve project levees that protect urban and urbanizing
14 areas. The record of declining flooding damage and testimony to the Council reflect
15 these programs' value. These programs should be continued with adequate funding to
16 provide State matching funds for addressing Delta flood risk.

17 Many other entities that benefit from flood risk management are not assessed, nor do
18 they contribute to maintenance and upkeep of Delta levees, including owners of
19 regional infrastructure that crosses the Delta. The duty of providing for Delta flood risk
20 management should be borne by all entities benefitting from these actions, and an
21 equitable methodology of defining and apportioning assessments should be developed
22 and implemented.

23 **Problem Statement**

24 Currently available funds are insufficient to meet needs for levee maintenance and
25 improvement in the Delta. Further funds are needed. Additional funding strategies need
26 to be fully evaluated. No mechanism exists for ensuring that costs of levee maintenance
27 are borne by all beneficiaries. Current financing emphasize levee maintenance and
28 improvement, rather than a full array of flood risk reduction measures.

29 **Policies**

30 No policies with regulatory effect are included in this section.

1 **Recommendations**

2 **RR R3. Provide adequate State funds to support levee maintenance and**
3 **improvement**

4 Adequate State funds to support levee maintenance and improvement should continue
5 to be provided through the Delta Levees Maintenance Subventions Program, the Delta
6 Levee Special Projects Program, and through programs that implement the Central
7 Valley Flood Protection Plan.

8 **RR R4. Update Delta Levees Maintenance Subvention Program’s Cost-sharing**
9 **Provisions**

10 A. **75 percent State cost share.** The Delta Levees Maintenance Subvention
11 Program’s maximum 75 percent State cost share for maintenance and major
12 rehabilitation projects should be extended indefinitely.

13 B. **Update the Delta Levees Maintenance Subventions Program Deductible**
14 **Provision.** The Legislature should amend the Water Code section 12986(a)-(b) to
15 adjust the current \$1000 per mile deductible amount to account for inflation since the
16 provision was enacted in 1981. The deductible amount should be reevaluated
17 periodically to reflect current inflation and the needs of the program and its
18 participants.

19 C. **Simplify Consideration of Local Levee Maintaining Agencies’ Ability to Pay for**
20 **Levee Maintenance and Improvement.** The Central Valley Flood Protection Board
21 should revise its guidelines for the Delta Levees Maintenance Subventions Program
22 to provide a simplified approach to the consideration of a local levee agency’s ability
23 to pay for the cost of levee maintenance or improvement, as required by Water
24 Code section 12986(a)(3), so that reclamation districts with little ability to pay
25 receive the full 75 percent State cost share recommended above, with reduced
26 State cost shares for reclamation districts that are able to pay more to maintain and
27 improve their levees.

28 **RR R5 Finance Local Flood Management Activities**

29 The Council, DWR, CVFPB, and the DPC, in consultation with the Corps of Engineers
30 and the Department of Finance, should cooperate to further develop levee finance
31 mechanisms, including those studied by the DPC, that create opportunities for
32 “beneficiary pays”-based funding approaches that supplement State-funding for levee
33 maintenance and improvements. Because no single financial mechanism can meet the
34 requirements of a beneficiary-pays approach to address the full range of beneficiaries

1 and financing needs, a portfolio of mechanisms targeted to particular levee
2 improvements should be evaluated. These mechanisms could include assessments,
3 public funding, water use fees, water conveyance fees, and flood prevention fees.

4 **RR R6. New State Funding for Non-structural Risk Reduction**

5 A hazard mitigation program, funded by the State, should be established to make grants
6 to local governments and flood management agencies to support emergency
7 preparedness actions, such as evacuation planning or prepositioning of flood fight
8 materials, and non-structural flood hazard mitigation actions, such as flood-proofing of
9 public or private buildings or the purchase and removal of flood-prone structures.

10 **RR R7. Fund Actions to Protect Infrastructure from Flooding and Other Natural** 11 **Disasters**

- 12 • The California Public Utilities Commission should immediately commence formal
13 hearings to impose a reasonable fee for flood and disaster prevention on
14 regulated privately owned utilities with facilities located in the Delta. Publicly
15 owned utilities should also be encouraged to develop similar fees. The California
16 Public Utilities Commission, in consultation with the Delta Stewardship Council,
17 the California Department of Water Resources, and the Delta Protection
18 Commission, should allocate these funds among State and local emergency
19 response and flood protection entities in the Delta. If a new regional flood
20 management agency is established by law, a portion of the local share would be
21 allocated to that agency.
- 22 • The California Public Utilities Commission should direct all regulated public
23 utilities in their jurisdiction to immediately take steps to protect their facilities in
24 the Delta from the consequences of a catastrophic failure of levees in the Delta,
25 to minimize the impact on the State's economy.
- 26 • CalTrans should be given authority by the Legislature to enter into agreements
27 with local levee maintaining agencies to fund improvement and maintenance of
28 levees adjoining interstates and State highways when that is the least cost
29 approach to reducing flood risks to those roads.
- 30 • State agencies with projects or infrastructure in the Delta should set aside a
31 reasonable amount of funding to pay for flood protection and disaster prevention.

32 **Manage Rural Floodplains to Avoid Increased Flood Risk**

33 To reduce the risk to lives, property, and State interests in the Delta, additional
34 standards are needed to address new residential development. Sea level rise,

1 subsidence, and new residential development combine to potentially put many more
2 lives at risk. The policies in this section are designed to reduce risk while preserving the
3 Delta's unique character and agricultural way of life. These policies should be construed
4 as those required to provide the minimum level of flood protection, and should not be
5 viewed as encouraging development in floodprone Delta areas. Flood insurance, and
6 awareness of local emergency preparedness and response policies is strongly
7 encouraged for all who live in floodprone areas of the Delta.

8 Consistent with existing law, urban development in the Primary Zone should remain
9 prohibited. Urban development in the Secondary Zone should be confined to existing
10 urban spheres of influence where the 200-year design standard will be fully
11 implemented by 2025. The 2007 flood risk management legislation (SB 5) contained
12 provisions affecting city and county responsibilities relating to local planning
13 requirements, such as general plans, development agreements, zoning ordinances,
14 tentative maps, and other actions (Government Code sections 65865.5, 65962, and
15 66474.5).

16 Future land use decisions should not permit or encourage construction of significant
17 numbers of new residences in the nonurban Delta. For the legacy communities in the
18 Delta, structures developed in these areas are required to meet the legal standard of a
19 100-year minimum level of flood protection. However, developing and maintaining
20 adequate flood protection remains difficult.

21 **Problem Statement**

22 Continued residential development without adequate flood protection increases risk to
23 lives, property, and State interests in the Delta. Flood risks are expected to grow in light
24 of anticipated climate change effects related to peak flows and sea level rise.

25 **Policies**

26 The appendices referred to in the policy language below are included in Appendix B of
27 the Delta Plan.

28 **RR P2. Require Flood Protection for Residential Development in Rural Areas**

- 29 a) New residential development of five or more parcels shall be protected through
30 floodproofing to a level 12 inches above the 100-year base flood elevation, plus
31 sufficient additional elevation to protect against a 55-inch rise in sea level at the
32 Golden Gate, unless the development is located within:

- 33 1) Areas that city or county general plans, as of May 16, 2013, designate for
34 development in cities or their spheres of influence;

- 1 2) Areas within Contra Costa County’s 2006 voter-approved urban limit line,
2 except Bethel Island;
- 3 3) Areas within the Mountain House General Plan Community Boundary in San
4 Joaquin County; or
- 5 4) The unincorporated Delta towns of Clarksburg, Courtland, Hood, Locke,
6 Ryde, and Walnut Grove, as shown in Appendix 7.
- 7 b) For purposes of Water Code section 85057.5(a)(3) and section 5001(j)(1)(E) of
8 this Chapter, this policy covers a proposed action that involves new residential
9 development of five or more parcels that is not located within the areas
10 described in subsection (a).

11 23 CCR Section 5013

12 NOTE: Authority cited: Section 85210(i), Water Code.

13 Reference: Sections 85020, 85300, 85305, and 85306, Water Code.

14

15 **Recommendation:**

16

17 **RR R8. Maintain Lower Risk Uses of Flood-Prone Rural Lands**

18 Agricultural and natural resource land uses and recreational marinas, resorts, or parks
19 are the most appropriate uses for floodprone rural lands and should be maintained,
20 consistent with the regulatory policy Locate New Development Wisely (DP P1).

21 **Protect and Expand Floodways, Floodplains, and Bypasses**

22 Local land use policies guiding development in floodways are not consistent across
23 Delta counties. Floodways have not been established for many of the channels in the
24 Delta by FEMA or by the CVFPB. In light of these inconsistencies, the Delta Plan
25 addresses these issues and highlights the need for the protection of floodplains and
26 floodways consistent with improved flood protection. Over the next 100 years, Delta
27 floodways may expand and deepen because of sea level rise and changing precipitation
28 patterns. Development in existing or potential future designated floodplain or bypass
29 locations in the Delta or upstream of the Delta can permanently eliminate the availability
30 of these areas for future floodplain usage. It is important to identify floodplain areas now
31 for immediate protection and eventual integration into the flood protection system.

32 **Problem Statement**

33 The carrying capacity of the existing flood control system is diminished by
34 encroachments into floodways, critical floodplains, and existing floodplain or bypass
35 locations in the Delta. Local land use policies guiding development in floodways are not

1 consistent across Delta counties. The existing system is already at suboptimal capacity.
2 Expected changes in sea level rise and runoff patterns due to climate change are
3 expected to exacerbate the problem.

4 **Policies**

5 **RR P3. Protect Floodways**

- 6
- 7 a) No encroachment shall be allowed or constructed in a floodway, unless it can be
8 demonstrated by appropriate analysis that the encroachment will not unduly
9 impede the free flow of water in the floodway or jeopardize public safety.
- 10 b) For purposes of Water Code section 85057.5(a)(3) and section 5001(j)(1)(E) of
11 this Chapter, this policy covers a proposed action that would encroach in a
12 floodway that is not either a designated floodway or regulated stream.

13 23 CCR Section 5014

14 NOTE: Authority cited: Section 85210(i), Water Code.

15 Reference: Sections 85020, 85300, 85302, and 85305, Water Code.

16 **RR P4. Floodplain Protection**

- 17 a) No encroachment shall be allowed or constructed in any of the following
18 floodplains unless it can be demonstrated by appropriate analysis that the
19 encroachment will not have a significant adverse impact on floodplain values and
20 functions:
- 21 1) The Yolo Bypass within the Delta;
- 22 2) The Cosumnes River-Mokelumne River Confluence, as defined by the North
23 Delta Flood Control and Ecosystem Restoration Project
24 (McCormackWilliamson), or as modified in the future by the California
25 Department of Water Resources or the U.S. Army Corps of Engineers
26 (California Department of Water Resources 2010); and
- 27 3) The Lower San Joaquin River Floodplain Bypass area, located on the Lower
28 San Joaquin River upstream of Stockton immediately southwest of Paradise
29 Cut on lands both upstream and downstream of the Interstate 5 crossing. This
30 area is described in the Lower San Joaquin River Floodplain Bypass
31 Proposal, submitted to the California Department of Water Resources by the
32 partnership of the South Delta Water Agency, the River Islands Development
33 Company, Reclamation District 2062, San Joaquin Resource Conservation

1 District, American Rivers, the American Lands Conservancy, and the Natural
2 Resources Defense Council, March 2011. This area may be modified in the
3 future through the completion of this project.

4 b) For purposes of Water Code section 85057.5(a)(3) and section 5001(j)(1)(E) of
5 this Chapter, this policy covers a proposed action that would encroach in any of
6 the floodplain areas described in subsection (a).

7 c) This policy is not intended to exempt any activities in any of the areas described
8 in subsection (a) from applicable regulations and requirements of the Central
9 Valley Flood Protection Board.

10 23 CCR Section 5015

11 NOTE: Authority cited: Section 85210(i), Water Code.

12 Reference: Sections 85020, 85300, 85302, and 85305, Water Code.

13 **Recommendations**

14 **RR R9. Fund and Implement San Joaquin River Flood Bypass**

15 The Legislature should fund the California Department of Water Resources and the
16 Central Valley Flood Protection Board to evaluate and implement a bypass and
17 floodway on the San Joaquin River near Paradise Cut that would reduce flood stage on
18 the mainstream San Joaquin River adjacent to the urban and urbanizing communities of
19 Stockton, Lathrop, and Manteca in accordance with Water Code section 9613(c).

20 **RR R10. Continue Delta Dredging Studies**

21 The current efforts to maintain navigable waters in the Sacramento River Deep Water
22 Ship Channel and Stockton Deep Water Ship Channel, led by the U.S. Army Corps of
23 Engineers and described in the Delta Dredged Sediment Long-Term Management
24 Strategy (USACE 2007, Appendix K), should be continued in a manner that supports
25 the Delta Plan and the coequal goals. Appropriate dredging throughout other areas in
26 the Delta for maintenance purposes, or that would increase flood conveyance and
27 provide potential material for levee maintenance or subsidence reversal should be
28 implemented in a manner that supports the Delta Plan and coequal goals. Coordinated
29 use of dredged material in levee improvement, subsidence reversal, or wetland
30 restoration is encouraged.

31 **RR R11. Designate Additional Floodways**

32 The Central Valley Flood Protection Board should evaluate whether additional areas
33 both within and upstream of the Delta should be designated as floodways. These efforts
34 should consider the anticipated effects of climate change in its evaluation of these
35 areas.

1 **Integrate Delta Levees and Ecosystem Function**

2 Setback levees can provide additional levee system stability, more complex land-water
3 interface structure, and shaded riverine aquatic habitat that benefit ecosystem function
4 in appropriate settings. They can also provide flood control benefits in those areas of
5 the Delta not subject to strong tidal influences where channel capacity improvements
6 can actually increase flood-carrying capacity. Not all locations are amenable or useful
7 for setback levee placement. Each site should be investigated for its potential to provide
8 ecological benefits consistent with levee integrity.

9 **Problem Statement**

10 **Policies and Recommendations**

11
12 An updated problem Statement, policies and recommendations regarding the
13 integration of Delta levees and habitat functions will be considered as part of an
14 amendment to the Delta Plan’s Ecosystem Restoration chapter.

15 **Renew Federal Assistance for Post-disaster Response**

16 Federal agencies have been essential partners in recovering from prior Delta floods.
17 Changes in these federal programs have reduced confidence about these agencies’
18 assistance in recovering from future floods.

19 **Problem Statement**

20 The loss of federal assurances of assistance in post-flood disaster response hinders
21 planning and may result in significant loss of Delta property and resources.

22 **RR R12. Renew Federal Assistance for Post-disaster Response**

23 The Council, Office of Emergency Services, DWR, Central Valley Flood Protection
24 Board, and Delta Protection Commission should advocate for reforms of the Federal
25 Emergency Management Agency’s rehabilitation assistance program, including a
26 renewed hazard mitigation program for Delta levees, and the Army Corps of Engineer’s
27 Rehabilitation and Inspection Program (PL 84-99) to account for the economic value of
28 the Delta’s water supplies and transportation services and for the State’s commitments
29 to reducing Delta flood risk and improving Delta levees.

30
31 To facilitate this consideration, priority should be given to research to quantify the
32 economic value of reliable water supplies and transportation services protected by the
33 Delta’s levees, including consideration of the levees’ contributions to the protection of
34 water quality, water supply infrastructure, and the conveyance of water for export
35 through levee-lined channels.

1 **Limit State Liability**

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

9 Consequently, no action taken by a State agency as required or recommended by, or
10 otherwise in furtherance of, this Delta Plan shall affect State flood protection liability in
11 the Delta or its watershed. Therefore, the Legislature should consider requiring an
12 adequate level of flood insurance for residences, businesses, and industries in
13 floodprone areas.

14 **Problem Statement**

15 As the risks of levee failure and corresponding damage increase, California courts have
16 generally exposed public agencies and the State, specifically, to significant financial
17 liability for flood damages. DWR’s 2005 white paper recommends one way that the
18 State should reduce its liability is to require houses and businesses to have flood
19 insurance (DWR 2005).

20 **Policies**

21 No policies with regulatory effect are included in this section.

22 **Recommendations**

23 RR R13. Require Flood Insurance

24 The Legislature should require an adequate level of flood insurance for residences,
25 businesses, and industries in floodprone areas.

26 **RR R14. Improve Delta Communities’ National Flood Insurance Program
27 Community Rating System (CRS) Program Rankings**

28 Delta communities should improve their current National Flood Insurance Program
29 Community Rating System (CRS) ranking through the implementation of risk reduction
30 management practices, when feasible, in order to receive additional discounts on flood
31 insurance premium rates.

32 **RR R15. Limit State Liability**

33 The Legislature should consider statutory and/or constitutional changes that would
34 address the State’s potential flood liability, including giving State agencies the same

1 level of immunity with regard to flood liability as federal agencies have under federal
2 law.

3 This recommendation would be added to the Delta Plan's Chapter 5,
4 which addresses Delta as Place issues, including recreation:

5 **DP RXX. Provide Public Access on Appropriately-located Delta Levees** When
6 using state funding to improve levees in the Delta that border urban areas,
7 unincorporated Delta towns, publicly-owned nature areas, or other public lands or that
8 intersect with state highways, the levee designs and associated land purchases should
9 consider public access, including but not limited to bank fishing, nature observation, or
10 pedestrian and bicycling trails. When agencies make decisions about funding levee
11 improvements they should identify the types of public access or recreation that may be
12 feasible at the levee and explain how they have considered those opportunities in their
13 decision.

14 **Issues for Future Evaluation and Coordination**

15 The following list of issues should be considered in future updates of the Delta Plan.
16 These and other issues will need to be considered as additional information and
17 materials become available. The various activities called for in this Delta Plan, as well
18 as issues that arise from other planning efforts, such as the Central Valley Flood
19 Protection Plan, will be considered. Additional areas of interest and concern related to
20 flood risk in the Delta may deserve consideration in the development of future Delta
21 Plan updates, including:

- 22 • **Reoperation of Upstream Reservoirs and Peak Flow Attenuation:** Reservoir
23 operations upstream of the Delta can have substantial impacts on flood flows
24 through the Delta; therefore, operation procedures among government agencies
25 should be well coordinated and, where possible, focused more on flexibility to
26 prevent flooding in the Delta. Water Code section 85309 directs DWR to develop
27 a proposal to coordinate flood and water supply operations with appropriate State
28 and federal agencies, and this shall be considered by the Council for future
29 inclusion in the Delta Plan.
- 30 • **Post-disaster Recovery:** Future reviews of this chapter should more thoroughly
31 consider post-disaster flood responses, including whether not reclaiming some
32 flooded islands could provide ecological benefits that might outweigh the
33 advantages of recovering and dewatering the islands.
- 34 • **Utility Corridor Consolidation:** An attempt to consolidate infrastructure into
35 "utility corridors" as facilities are added and upgraded over time should be further

1 investigated to determine whether this can allow for better management of flood
2 risk consequences to these critical assets.

- 3 • **Strategies to Accommodate To Climate Change and Rising Sea Levels:** The
4 Council should continue to (a) participate in the Natural Resources Agency's
5 Climate Action Team and adapt to changing estimates of sea level rise when
6 they become available and (b) consult with Caltrans regarding the potential
7 effects of climate change and sea level rise on the three state highways that
8 cross the Delta (Water Code section 85307(c)). Opportunities to assist local
9 Delta agencies in assessing their vulnerability to rising sea levels should be
10 explored.
- 11 • **Governance.** Because the number and diversity of agencies involved in levee
12 maintenance, improvement, and oversight complicates coordination and
13 effective management of the Delta's levee network, opportunities to improve
14 governance should be explored. This could include reorganization of State
15 agencies' oversight responsibilities in fewer agencies. Opportunities for joint
16 powers agencies or other consolidations of reclamation districts or other local
17 levee maintaining agencies should also be considered.

18 **Science and Information Needs**

19 The Delta system and its influencing factors are not static. The analysis and data
20 gathered to support the Delta Levees Investment Strategy provided an updated
21 foundation of information regarding risk of levee failure in the Sacramento-San Joaquin
22 Delta and the impacts to State interests. However, newer data are always being
23 developed and methods of analyzing it or estimating impacts can always be improved;
24 therefore, research is needed to better understand dynamic issues such as climate
25 change, seismicity, sea level rise, subsidence, and other areas. Continuing
26 investigations into the science, engineering, and economic aspects of the Delta are
27 critical to adaptively managing for expected and unexpected changes, and can provide
28 decision makers and stakeholders with key information for future planning and decision
29 making. Specifically, additional information will be needed in the following areas:

- 31 • Levee conditions, including their geometry and structural makeup, in order to provide
32 better estimates probability of failure.
- 33 • Updates of information about the population protected by Delta levees, coordinated
34 with periodic censuses, and about Delta assets such as land use, property value and
35 infrastructure as data becomes available.
- 36 • Possible levee failures' potential to (a) impair water quality and disrupt water
37 supplies, including supplies for in-Delta users and regional suppliers in addition to
38 the SWP and CVP and (b) damage neighboring islands.

- 1 • Interactions between Delta levees and ecosystem function, including the impacts of
- 2 levee failures on important Delta ecosystems.
- 3 • Improved forecasts of sea level rise and other climate change impacts on flood risk,
- 5 and incorporation into risk reduction criteria.
- 5 • Effects of seismicity on levee integrity, including expanded observations of Delta
- 6 ground motions, improved estimates of geologically recent displacement on faults
- 7 beneath the Delta, and further identification of liquefiable materials and mechanisms
- 8 beneath levees.
- 9 • Updated flood stage-probability functions.
- 10 • Understanding the impacts on floodplain ecosystems and Delta flood management
- 12 from upstream flood management infrastructure operations, including reservoir
- 13 operations.
- 14 • Technologies for assessing levee integrity.

15 Efforts to address these needs and others that arise during Delta Plan implementation
 16 should be undertaken in a systematic fashion so that information developed and lessons
 17 learned can be incorporated into future Delta Plan updates.

18 **Performance Measures**

19 Final administrative performance measures are listed in Appendix E.

20 **Outcome Performance Measures**

21 No increase in loss of life in the Delta as a result of flood emergencies and decrease in
 22 expected annual fatalities or expected annual property damages. (Strategy 7.1)

23 Target:

- 24 • Zero lives lost from floods.
- 25 • 50 percent decrease in expected annual fatalities by 2025.
- 26 • 50 percent decrease in expected annual property damages by 2025.

27 Metrics:

- 28 • Number of lives lost in the Delta as a result of flood emergencies. □ Expected
- 29 annual fatalities (EAF) for the Delta
- 30 • Expected annual damages (EAD) in the Delta).

1 Baseline:

- 2 • Number of lives lost within the Delta in recent history is zero according to the
3 National Oceanic and Atmospheric Administration's Storm Events Database,
4 which details events dating back to 1950.
- 5 • Expected annual fatalities and expected annual property damages reported in
6 2017, as reported in Delta Levee Investment Strategy final report.

7 Water delivery interruptions by floods or earthquakes in the Delta. (Strategy 7.3)

8 Target:

- 9 • No water delivery interruptions.

10 Metrics:

- 11 • Number of water delivery interruptions caused by floods or earthquakes in the
12 Delta.
- 13 • Acre-feet of water not delivered due to disruptions caused by floods or
14 earthquakes in the Delta.

15 Baseline:

- 16 • N/A because this measure has a prescribed target and is not showing a change
17 from a baseline.
- 18 • Increase in community credit points in National Flood Insurance Program (NFIP)
19 Community Rating System. (Strategy 7.3 and Strategy 7.7)

20 Target:

- 21 • Increase in community credit points in the NFIP Community Rating System by
22 2025.

23 Metrics:

- 24 • Community Rating System credit points of Delta communities participating in the
25 NFIP.

26 Baseline:

- 27 • Community Rating System credit points at the time of Delta Plan adoption, May
28 2013 or nearest available date.

1 **Output Performance Measures**

2 Responsible local, State, and federal agencies with emergency response authority
3 implement the recommendations of the Sacramento-San Joaquin Delta Multi-Hazard
4 Coordination Task Force (Water Code section 12994.5) by January 1, 2014. (Strategy
5 7.1)

6 Target:

- 7 • 100 percent (11/11) of recommendations implemented.

8 Metrics:

- 9 • Percent of recommendations implemented.

10 Baseline:

- 11 • 0 percent (0/11) of recommendations implemented.

12 Level of flood risk reduction provided by Delta levees. (Strategy 7.3)

13 Target:

- 14 • 100 percent of urban communities in the Delta protected by levees meeting
15 DWR's urban level of flood protection criteria. 100 percent of rural Delta islands
16 and tracts protected by levees at or above Bulletin 192-82/ PL 84-99 criteria.

17 Metrics:

- 18 • Percent of urban communities in the Delta protected by levees meeting DWR's
19 urban level of flood protection criteria.
20 • Percent of Delta land protected by levees at or above the Bulletin 192-82/PL
21 8499 standard.

22 Baseline:

23 Percent of urban communities in the Delta protected by levees meeting DWR's urban
24 level of flood protection criteria and percent of Delta islands and tracts protected by
25 levees at or above the Bulletin 192-82/PL 84-99 standard at the time of Delta Plan
26 adoption, May 2013.

27 Consideration of sea level rise in flood protection planning for new residential
28 development. (Strategy 7.4)

29 Target:

- 1 • 100 percent of proposed actions to which RR P2 are applicable meet the
2 requirements of RR P2.

3 Metric:

- 4 • Number of proposed actions covered by the Delta Plan policy to require flood
5 protection for residential development in rural areas (RR P2).

6 Baseline:

- 7 • N/A because this measure has a prescribed target and is not showing a change
8 from a baseline.

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