CHAPTER 1

Introduction

ABOUT THIS CHAPTER

This chapter offers historical and current contextual information about the uses and conflicts that besiege the Sacramento-San Joaquin Delta (Delta). The reader will come to understand how and why the West Coast's largest estuary has evolved from a huge tidal marsh to the maze of islands and channels it is today – shaped over more than a century and a half by the effects of hydraulic mining, flood control, agricultural and urban development, and its placement as the "hub" of California's major water systems.

The chapter then delves into the realities of decades of stand-offs among the key interests in the Delta and resulting years of relative inaction, leading finally to the bipartisan movement that created the Sacramento-San Joaquin Delta Reform Act of 2009 (Delta Reform Act or Act) and its mandate to develop a long-term sustainable management plan for the Delta. The chapter concludes with an overarching explanation of how this Delta Plan (or Plan) will bring about a fundamental and positive sustainability and reformation of this immense natural resource.

CHAPTER 1

Introduction

Throughout the past 160 years, the delta formed by California's two largest rivers, the Sacramento and the San Joaquin, has been a gateway to many of the state's collective hopes and dreams. Once the pathway to the Gold Country, it is today a critical component of the state's water supply infrastructure, a source of sustenance for farmers and fishermen, and home to half a million people and a vast array of fish, birds, and wildlife.

The Sacramento-San Joaquin Delta and Suisun Marsh are referred to throughout this Plan collectively as "the Delta," unless otherwise specified (see Figure 1-1).[1] Once a great marsh, the Delta now is a network of channels and sunken "islands" that cover—together with Suisun Marsh—about 1,300 square miles. Laid over those islands and channels is the infrastructure of a twenty-first century economy: water supply conduits; major arteries of the state's electrical grid; natural gas fields, storage facilities, and pipelines; highways and railways; and shipping channels, all surrounded by an increasingly urban landscape. Water from the vast Delta watershed, spanning over 45,000 square miles (30 million acres), fuels both local economies and those in export areas hundreds of miles away (see Figure 1-2).

Today the Delta is many things to many people, and is universally regarded in "crisis" because people have not yet been able to find balance in the tradeoffs among competing demands for the Delta's resources. Tradeoffs and integration define the Delta dilemma: water conveyance facilities that built strong urban and agricultural economies threaten ecosystem health. Water that is beneficial for fish is alive with plankton and organic material, but sources of drinking water are best in as pure a form as possible. The pollutants of upstream urban and agricultural uses cause problems for downstream fish and water diverters alike. The same ocean-going ships that opened the Central Valley to world trade also introduced nonnative species that alter the Delta ecosystem. High water flows that historically improved habitat and a diverse food web come with the threat of lost homes, flooded farmland, and disaster for Delta residents and the California economy.

Conceived decades ago, a series of water projects has engineered the Delta estuary over time to perform as a water conveyance system, moving water stored upstream to users throughout the state who hold State of California (State) or federal water contracts. This system relies on dredged channels, which at times run counter to natural flow directions as the result of export pumping that occurs in the south Delta. For a number of years, and currently at the publishing time of this Plan, State and federal agencies are exploring options to reconfigure the manner in which the Delta is used to convey water in a way that lessens ecosystem impacts and improves water supply reliability. At this time, the Delta Plan does not make recommendations regarding Delta conveyance (see Appendix A).

As a result of imperfect tradeoffs, key species are endangered or threatened, the amount of water that can be exported from the Delta is determined not just by the state's variable precipitation and storage but also by court order to protect endangered species, and geologists and engineers continue to worry that the Delta itself is one of the greatest flood risks in the West.

[1] The Sacramento-San Joaquin Delta is defined in Water Code section 12220, and Suisun Marsh means the area defined in Public Resources Code section 29101 and protected by Division 19 (commencing with section 29000).

The evolution of the Delta has come in fits and starts, driven by individual initiative, governmental incentive, and crisis. John Hart, writing for *Bay-Nature*, puts it this way:

> *The History of the modern Delta belies the image of the region as a static landscape. Reclamation was a battle with many setbacks, almost given up for lost in the 1870s. In the 1880s the 'crisis' was the clogging of channels by hydraulic mining debris. In the 1920s, salinity was on the march. A brief calm at midcentury gave way to the ever-spiraling tension over water exports and ecosystem decline. The Delta seems always to have been in crisis, under intensive study, and at the intersection of hostile interests.*

Governmental institutions have reacted to each crisis predictably, often treating individual problems rather than taking a systemwide approach. Over the years, dozens of agencies, task forces, and working groups have been created in a series of sometimes overlapping efforts to find the right combination of leadership and collaboration—incentives and regulation—to provide clean, reliable water; protect our environment; and reduce the risk of flooding.

After decades of conflict and unsuccessful efforts to comprehensively address the many problems and challenges of the Delta, the California Legislature (or Legislature), water agencies, and environmental groups throughout the state united in an unprecedented manner in 2009 to pass a series of water-related measures, including the Delta Reform Act.

The Delta Reform Act created the Delta Stewardship Council (Council) with a primary responsibility to develop and implement a legally enforceable, long-term management plan for the Delta. The Legislature required the Delta Plan to advance the coequal goals of protecting and enhancing the Delta ecosystem and providing for a more reliable water supply for California, and to do so in a manner that protects and enhances the Delta as an evolving place.

This Delta Plan is intended to be a foundational document that prioritizes actions and strategies in support of key objectives such as the State's requirement to reduce reliance on the Delta to meet future water supply needs. It also restricts actions that may cause harm; serves as a guidebook for all plans, projects, and programs that affect the Delta; and calls for further investigation and focused study of specific issues.

Successful implementation of the Delta Plan depends not only on the Council, but also on coordinated actions by other government agencies—federal, State, and local—and by the stakeholders to whom these agencies are responsible. To be effective, decision making in a dynamic context such as the Delta must be flexible and have the capacity to change policies and practices in response to what is learned over time. Through this Delta Plan, the Council details an interagency structure for decision making that fosters communication among scientists; local, State, and federal decision makers; and stakeholders. Future Plan iterations will build on successes as well as lessons learned in order to achieve the coequal goals.

The Delta and California's Water Supply

The story of California's annual water supply is one of great variability in amount, timing, and distribution, and of the human desire to impose certainty and order. Rain and snow fall mostly in the northern and eastern portions of the state, but most Californians live along the coast and in the south. Most of the state's precipitation occurs in only 5 to 15 days, and that rain and snowfall result in an annual supply that is ample in average years, too little in dry ones, and too much in wet years (see Figure 1-3).

The Sacramento-San Joaquin Delta and Suisun Marsh

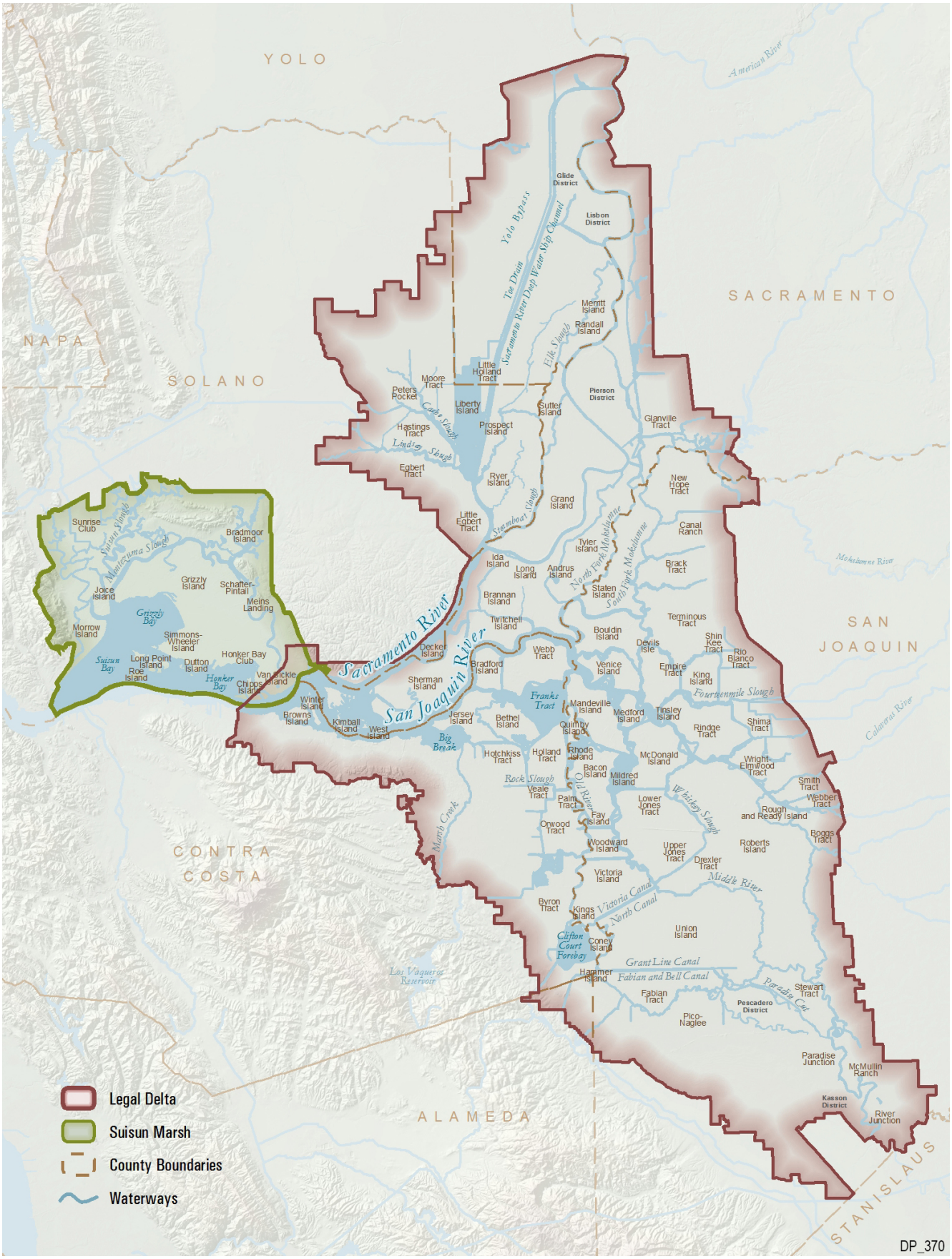

Figure 1-1 *Source: DWR 2011a*

The Delta Watershed and Areas Receiving Delta Water

Figure 1-2

To meet water demand, Californians over the past 160 years have built a vast array of reservoirs, canals, pipelines, and tunnels, all in an effort to capture water when it was available, store it for when it was not, and to move it to the people when and where they wanted it.

As residents in both Northern and Southern California feared they would outgrow their local supplies, they turned to the vast Delta watershed for relief. The river systems flowing into the Delta drain about 40 percent of the land in California and carry about half of the state's total annual runoff.

And so, at the turn of the twentieth century, San Francisco tapped the Tuolumne River, diverting water through an aqueduct that bypasses the San Joaquin River and Delta. Shortly thereafter, Oakland and the eastern San Francisco Bay Area tapped the Mokelumne River, diverting water through a pipeline across the Delta. Later, construction of the federal Central Valley Project (CVP) and the State Water Project (SWP) resulted in additional diversions directly from the Delta for the Bay Area, Central Valley, and Southern California.

California's Variable Precipitation

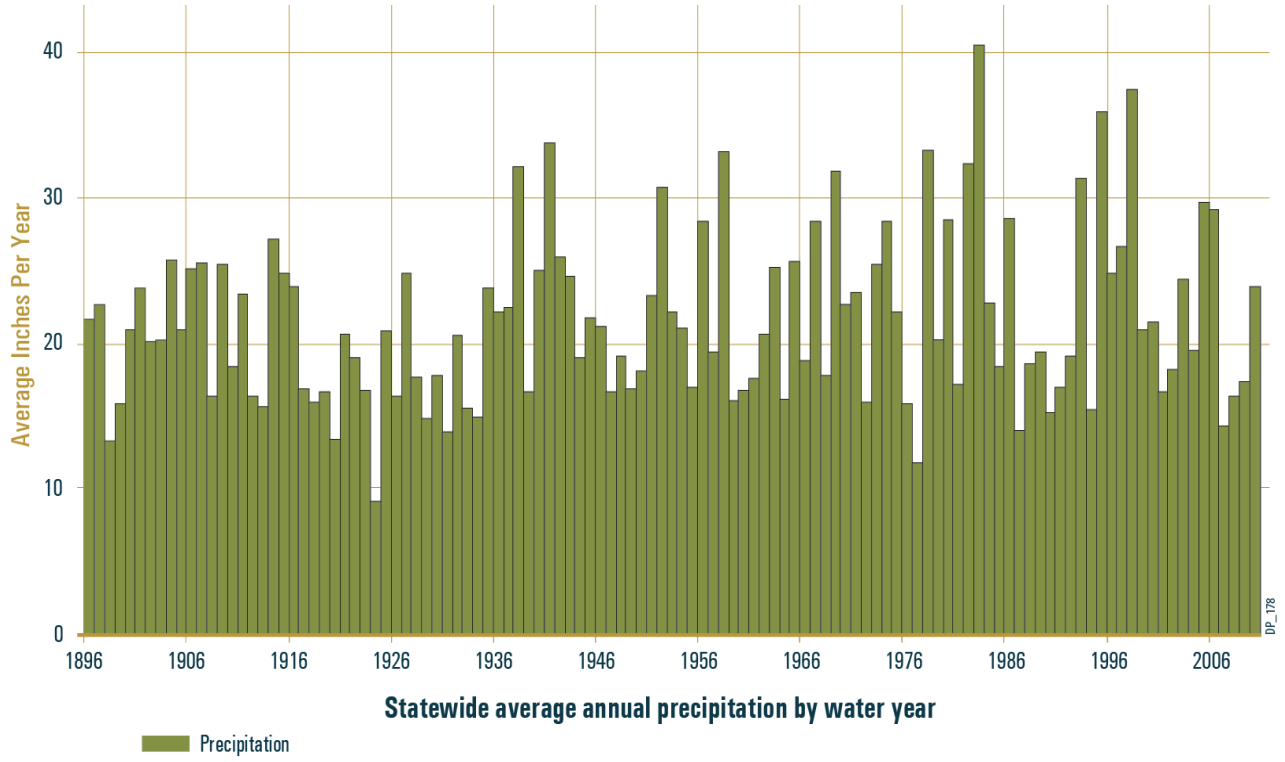

Figure 1-3 The unpredictability of the state's rainfall and its history of multiyear droughts make the management of water to reliably meet environmental and human uses extremely challenging. Yearly precipitation was calculated from the average of 95 stations located across California. Data were collected by Jim Goodridge, former State climatologist.

Source: Western Regional Climate Center 2011

Today, some two-thirds of the state's population (approximately 27 million people) depend on water from the Delta watershed for some portion of their water supply, as do more than 3 million acres of irrigated farmland that grow crops for in-state, national, and international distribution. That said, water exported through the Delta represents approximately 8 percent of the state's annual average water supply. Local and regional water resources, including surface diversions, groundwater, local and out-of-state imports, and water reuse, meet the remaining 84 percent.

Who uses all that water, how it is used, how much returns to the rivers and streams for downstream users, and in what quality, is less than certain on a statewide basis. Data for actual water use and water quality suffer from significant gaps, which may affect the ability of California's water managers to make timely and better-informed decisions. Since 1914, the State Water Resources Control Board (SWRCB) has issued permits to post-1914 appropriative-right water diverters in the Delta, but actual annual diversion amounts are not thoroughly measured or reported. Owners and operators of nearly one-third of irrigated lands in the Delta watershed do not participate in programs to meet water quality standards, and their compliance with State law is unclear.

Although groundwater and surface water are often interconnected, the SWRCB has limited authority to regulate groundwater. Groundwater is sustainably managed in some areas of the state through either adjudication or special districts, but other areas suffer from unsustainable overdraft and require improved management efforts. Attempts to correct this overdraft often put more pressure on water supplies from the Delta, demonstrating once again the interconnectedness of California's water systems.

The Delta and Its Ecosystem

Although much of the debate over the Delta has centered on events in the last 50 years, the roots of its problems run much deeper. A Delta that for millennia had been a land and waterscape of dynamic floodplain and tidal marshland, rich in flora and fauna, was changed forever by passage of the federal Swamp Land Act of 1850 and similar State legislation in 1861, which provided incentives for the "reclamation" of "nuisance" swampland to reduce threats of vector-borne disease and to gain productive land for farming. Within the Delta, seasonally and tidally flooded land impeding agricultural development led to land reclamation and channelization, and subsequent habitat loss. More than a century ago, with little or no engineering analyses and limited construction tools, Delta residents began to build an intricate levee system to channel water and dry out land, which converted hundreds of thousands of acres of seasonally and tidally flooded wetlands into fertile agricultural fields. As a result of continued land use change and urbanization, 95 percent of the historical tidal marsh in the Delta has been lost. Further detail regarding the historical Delta landscape is provided in Chapter 4.

Hydraulic gold mining, which reached its peak in the 1860s, sent tons of mercury-laden debris down toward the Delta, clogging channels and streams, and leading to devastating floods. Corrective actions—dredging and new levee construction—resulted in the loss of 90 percent of the Central Valley's riparian habitat (Katibah 1984). This massive-scale destruction has had lasting consequences for ecosystem

health and, in turn, declining ecosystem health has had direct consequences for water supply operations.

The Hetch Hetchy and Mokelumne aqueducts diverted water (as they do currently) before it reached the Delta, and water use upstream increased considerably during the mid- and late 1900s. Construction of the CVP and SWP in the 1940s and 1960s, respectively, introduced new pressures on the Delta. Indeed, it is unusual to use an estuary—normally where fresh and salt water mix according to variable tidal and tributary flows—as a conveyance system for large amounts of fresh water to meet seasonal user demands.

The resulting configuration today causes river channels at times to run backward; and some fish, lacking clear migration corridors and/or migration cues, end up in dead-end channels or, worse yet, "salvaged" at the export pumps. Conflict between these competing uses was soon apparent and continues to plague water policy today.

Fish species have changed over time in response to changing habitat and flows, and from introductions both planned and accidental. Among the first introductions, in 1879, were two eastern game fish—striped bass and American shad. Today, striped bass, which are voracious predators, both support a major sport fishery and are blamed by some for the decline of smelt and salmon. Among the accidental tourists who came to stay are Asian clams, voracious eaters who can deplete the water of nutrients for native species. Of the more than 50 species of fish in the Delta today, more than half, including the most successful, are nonnative.

In addition, growing agricultural production in the Central Valley has resulted in increased runoff of pesticides and fertilizer flowing to the Delta. Runoff and wastewater discharges from increasing upstream urbanization have altered Delta water quality and, thus, its ecosystem. Increased commercial and recreational boat traffic in the Delta, as well as other causes, have introduced many nonnative species that have altered the Delta ecosystem.

The Delta as a Unique and Evolving Place

The Delta is a unique place distinguished by geography, legacy communities, a rural and agricultural setting, vibrant natural resources, and a mix of economic activities. Much has changed over the past 160 years; and although some may desire to maintain a static picture of the Delta as it is today, the past, as well as emerging science, predict constant change.

Once a marshland that was the drain of the vast Central Valley watershed, the Delta changed dramatically following the discovery of gold on the American River in 1848. Suddenly, large numbers of prospectors and service providers were beating a pathway through the Delta to the foothills and, at the peak of the rush, more than 300 steamboats plied the waters between San Francisco and Sacramento. Twenty-one years later, completion of the transcontinental railroad in 1869 freed a huge workforce, many of whom found alternative work dredging Delta channels and building levees.

Communities developed to support river traffic to and from the gold country, and later to transport agricultural products from the newly productive farmland reclaimed from the Delta marshes. The advent of the automobile resulted in a flurry of ferry construction and bridge building in the 1920s; by the 1930s, cars and trucks were replacing steamships for transportation and commercial shipping. The Stockton Deepwater Ship Channel was completed in 1933, opening a direct connection from the San Joaquin Valley to the world, and 30 years later, the Sacramento Deepwater Ship Channel did the same for the Sacramento Valley. Not coincidentally, these channels also opened the Delta to a host of exotic invasive species that hitched rides on the bottoms and in the ballast of oceangoing freighters.

Central Valley Chinook salmon have long been a critically important part of California's fishing industry, passing through the Delta on their way from and to spawning

grounds in upstream rivers and streams. Between 1900 and 1950, the fall run numbered more than a million fish returning annually to the Sacramento and San Joaquin river systems. Drought and changing Delta and ocean conditions, however, reduced those numbers to only 66,000 in 2008, resulting in a closure of the salmon fisheries off California and restrictions that lingered into 2010, devastating fishing economies (DFG 2009).

Dredging opened many of the Delta channels for sport fishing, recreational boating, and commercial enterprise. Today there are more than 100 marinas and waterside resorts, RV parks, grocery stores, and dockside restaurants; and house boating remains popular. The Delta is dotted with numerous public parks and fishing sites as well.

The Delta now is a major producer of corn, alfalfa, pasture, and tomatoes; and wine grapes are growing in prominence. Residents and visitors alike celebrate the Delta's agricultural heritage with the Asparagus Festival in Stockton and the Courtland Pear Fair.

Today, although still largely rural, the Delta is crisscrossed by interstate electric transmission lines, natural gas pipelines, and interstate roads and railroads; and it faces increasing pressure—at least on its periphery—for additional housing development. Those elements, combined with the increasing certainty of sea level rise and changing climate patterns, mean continual change for the Delta.

The Delta Problem

In California, sustainable management of the Delta is an exceedingly complex topic fraught with longstanding conflicts and challenges. The Delta and Suisun Marsh ecosystem is the largest estuary on the West Coast and a critical stopping point on the Pacific flyway. The estuary extends westward to the Golden Gate and southward to San Jose. Delta water also flushes southern San Francisco Bay. It is also the hub of the state's major water supply systems. But the Delta today is failing to balance the tradeoffs inherent in these functions, as well as to provide a place to live, work, and play for residents and visitors alike.

Today the Delta is relied upon for many services and, as a result, is not meeting the demands of farmers and urban water users who want assurances of supply and, in some cases, more water. Nor does the Delta adequately serve the needs of fish and wildlife—some threatened or endangered species' numbers remain perilously low. And the Delta itself remains inherently floodprone.

Fish Declines. In late 2004, scientists noted that several fish species in the upper San Francisco estuary (delta smelt, young striped bass, longfin smelt, and threadfin shad) had remained unusually low since 2001. Although the numbers had historically fluctuated, this steep and lasting dropoff signaled an ecological crisis. Scientists acknowledged many causes such as invasive and predatory species, upstream agricultural and urban runoff, and diminished Delta habitat. The export pumps of the SWP and CVP were culpable as well, and restrictions ensued.

Water Exports Cut. These regulatory and court-ordered restrictions on State and federal pumping, in combination with the 2007–2009 drought, significantly reduced exported water deliveries to SWP and CVP contractors. As a result, some San Joaquin Valley farmers pumped groundwater from already overtapped aquifers, fallowed fields, and, in some cases, plowed under permanent crops. The national economic recession, combined with reduced water deliveries, hit the San Joaquin Valley hard. Although the plight of farmers captured much media attention, the salmon fishery was shut down in 2008 and was restricted in 2009–2010, causing economic hardship for the commercial and recreational fishing industries. Urban water managers in the Bay Area and Southern California drew down storage and increased conservation efforts until the rains and snows of 2011 saved the day.

DELTA BY THE NUMBERS

- The 45,600-square-mile Delta watershed provides all or a portion of surface water or groundwater supplies to more than 27 million California residents.
- Approximately 8 percent of the state's water supply is exported from the Delta (DWR 2009).
- The Delta and Suisun Marsh support more than 55 fish species and more than 750 plant and wildlife species. Of these, approximately 100 wildlife species, 140 plant species, and 13 taxonomic units of fish are considered special-status species and are afforded some form of legal or regulatory protection (CNDDB 2010, USFWS 2010, CNPS 2010).
- The Delta and Suisun Marsh are home to more than one-half million residents living in dozens of communities, including portions of 12 incorporated cities such as Stockton and Sacramento, and support more than 146,000 jobs (DPC 2010).
- Approximately 57 percent of the Delta and Suisun Marsh—more than 480,000 acres of agricultural land—currently supports a highly productive agricultural industry that is valued at hundreds of millions of dollars annually (DWR 2007a, DWR 2007b, DOC 2008, DPC 2010).
- The Delta and Suisun Marsh levees and lands support interstate and state highways and railroad tracks that support intrastate and interstate traffic, more than 500 miles of major electrical transmission lines, 60 substations, and more than 400 miles of major natural gas pipelines that provide energy throughout Northern California, as well as critical pipelines that carry transportation fuels to airports and other fuel depots throughout the San Francisco Bay Area and Sacramento (DPC 2010, DWR 2009).
- The Delta and Suisun Marsh have more than 1,335 miles of levees that protect more than 800,000 acres of land and play a role in the water supplies conveyed through the Delta.
- The Delta experiences more than 12 million visitor days annually from recreational boaters (DPC 2012).* Fishing, hunting, birdwatching, and camping draw even more visitors to the area.

* The *Sacramento–San Joaquin Delta Boating Needs Assessment* (2000-2020) estimated 6.4 million annual boating-related visitor days and 2.13 million boating trips to the Delta in 2000 (DBW 2002).

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Lawsuits. Over the years, improved understanding about water quality needs and environmental protection in the Delta launched an era of complex regulation that today governs SWP and CVP water supply operations. Litigation over a host of issues related to the CVP and SWP has created a recent spate of water management actions guided by courtroom decisions. Incomplete understanding about how water project operations, pollution, invasive species, and other factors affect native Delta fish species has resulted in a regulatory scheme affecting water supplies that is characterized by uncertainty. Changing rules to curtail pumping and increase Delta outflow have compounded water supply uncertainty for agencies that use water conveyed through the Delta, particularly in drier years when ecosystem conflicts are most pronounced. Some of those agencies have contributed to the uncertainty by becoming increasingly reliant on Delta exports that were intended to be supplemental supplies, but in some cases are now relied upon as core water supplies.

Flood Threats. Adding to the complexity of these problems is the increasing volatility of Delta water supplies as a consequence of climate change, including more rain and less snow, earlier snowmelt, and higher winter and lower spring-summer runoff patterns. The potential for catastrophic levee failure in the Delta and the risk to residents and infrastructure alike posed by floods, sea level rise, earthquakes, and land subsidence is real, growing, and has outpaced the State's ability to manage and fund risk-reduction measures.

Pursuit of Balance. Finding the right balance of these competing needs and demands on the Delta has bedeviled California policy makers for decades. The media and the political system tend to focus on water supply shortages, droughts, flood risk, and the decline of fisheries. Although notable and consequential, these events are all symptoms of a greater resource problem. Not unlike other policy areas, when it comes to natural resource issues, California has long attempted to manage symptoms rather than treat core problems.

Governance and the Delta Reform Act of 2009

California has a history of addressing each problem with yet another project and/or program, each generally left to find its own way among all others already set in motion or completed. Today, more than 200 federal, State, regional, and local agencies have responsibility for some aspect of the Delta. As each agency focuses on its specific mission, cooperation, collaboration, and cohesiveness have at times been elusive.

Although the seeds were sown in governmental decisions throughout the early twentieth century, California's water "wars" came to a head during the years 1987 through 1992, when a 6-year drought in California slowed water deliveries, water quality deteriorated, and two fish species unique to the Delta—the delta smelt and winter-run Chinook salmon—were pushed to the brink of extinction. During these 6 drought years, average runoff to the state's two largest rivers dipped dramatically: 44 percent into the Sacramento River and 53 percent into the San Joaquin.

State and federal officials tried, often in conflict with each other, to deal with issues of water quality, protection of Delta fisheries, and water impacts on the state's urban and agricultural water users. In the early 1990s, endangered species listings by federal fish agencies imposed export restrictions on water users. SWRCB efforts to address aquatic resource degradation under State water laws ground to a halt after the governor complained about excessive federal interference under both the Endangered Species Act and the Clean Water Act. In 1991, the U.S. Environmental Protection Agency (USEPA) formally disapproved the SWRCB water quality control plan; and in 1992, Congress passed the Central Valley Project Improvement Act (CVPIA), which reallocated a significant portion of federal (CVP) water supplies to environmental purposes. Virtually every action taken by a State or federal agency during this period ended up in court.

Amid this chaos of competing interests and regulations, the cornerstone for future cooperation was laid when three long-time adversarial interests—environmentalists, agriculture, and urban water users—agreed to work together to find common ground. Four federal agencies—the USEPA, Bureau of Reclamation, National Marine Fisheries Service, and U.S. Fish and Wildlife Service—began collaboration on Delta issues and became known as "Club Fed." After being on the losing side of a 5-year-long State-federal tug of war over water quality standards, the State and federal administrations negotiated updated water quality standards and, in 1995, created the CALFED Bay-Delta Program.

After 5 years of negotiations and planning, the CALFED agencies completed an ambitious 30-year plan and record of decision heavily dependent on goodwill, generous State and federal funding, and Delta conditions remaining generally as they had in the immediate past. Instead, goodwill and funding evaporated in the face of fiscal crisis, scientists learned more about looming effects of climate change and emerging stressors on the Delta, and competing interests turned back to the courts to force one viewpoint or the other.

While CALFED attempted to bring a holistic focus, it was criticized for not having authority to hold individual agencies and projects accountable for interrelationships and progress and—toward the end of its first 7 years (Stage 1, 2000 through 2008)—for not being focused enough on the Delta. And yet the inescapable truth remains: actions that affect the Delta's ecosystem and its ability to provide a reliable amount of water for export are inextricably linked. The Delta Vision Task Force, created by then-Governor Arnold Schwarzenegger in 2006 to point the path forward from CALFED, reinforced the need for integration and linkage in both its 2008 *Vision for the Delta* and its *Strategic Plan*.

IS MORE GOVERNANCE REFORM NEEDED?

Senate Bill X7 1 (SBX7 1), which included the Delta Reform Act, enacted the most significant governance reform related to water and the Delta since the mid-twentieth century. Two new bodies were formed, the Sacramento-San Joaquin Delta Conservancy and the Council; the Delta Protection Commission was reorganized; and a new Delta Watermaster position was created at the SWRCB. However, some argue that governance change should not stop there.

In recent years, two nonpartisan and independent entities have proposed new water and Delta governance models, with the State's Little Hoover Commission (LHC) releasing reports in 2005 and 2010, and the Public Policy Institute of California (PPIC) releasing reports in 2007 and 2011.* Their conclusions are summarized here.

Little Hoover Commission: LHC is an independent state oversight agency established in 1962. It has a mission to identify and spur government reform in various policy areas, and has confronted the topic of water governance multiple times. In August 2010, LHC proposed dramatic restructuring of Delta and water governance in its report *Managing for Change: Modernizing California's Water Governance* (www.lhc.ca.gov).

Public Policy Institute of California: Established in 1994, the mission of PPIC is to inform and improve public policy in California through independent, objective, nonpartisan research. In 2011, PPIC released *Managing California's Water: From Conflict to Resolution* (Hanak et al. 2011), which focused more on thematic reforms building on current practices such as increasing urban water conservation and streamlining water transfers (www.ppic.org).

Although PPIC and LHC would remake water governance differently, both proposals have considerable thematic overlap:

- California lacks a system to adequately incorporate the needs of public trust resources with water supply management and planning.
- California lacks a centralized leadership structure to set statewide policy goals and manage inevitable conflicts.
- The institutional separation of water rights planning, administration, and enforcement responsibilities from water supply management complicates policy making.
- Insufficient incentives exist to promote regional cooperation and local consistency with State policy directions.
- There is concern that the demands of California Department of Water Resources' role in managing the SWP conflicts with its overall statewide water planning responsibilities.

This Delta Plan recommends governance reform related to regional Delta participation in flood management activities. As part of its role in coordinating overall efforts in the Delta, the Council will hold hearings and recommend additional governance reform to the Legislature.

** LHC 2005, LHC 2010, Lund et al. 2007, Hanak et al. 2011*

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The recommendations from the Delta Vision Task Force, along with general understanding and support from a wide variety of competing interest groups, allowed the Legislature, in 2009, to craft a package of bills that would, for the first time, begin to define those linkages in law and require accountability for implementation. In addition to the Delta Reform Act, the package included measures that set ambitious water conservation policy (20 percent reduction in statewide urban per capita water use by 2020), ensure better groundwater monitoring, and provide for increased enforcement to prevent illegal water diversions. It also included a bond measure that would help fund implementation of various parts of the package, and local and regional water supply and ecosystem projects.

The fifth bill in the package was Senate Bill X7 1 (SBX7 1), which included the Delta Reform Act. With its passage, California embarked upon a new era in Delta governance with creation of the Council, and established as overarching State policy coequal goals of a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem. Through its hybrid approach—both regulatory and collaborative—the Council now has the task of facilitating coordination across a broad range of entities to achieve the State's water policy objectives.

The Delta Reform Act includes an important caveat: while past Delta efforts focused almost exclusively on water supply reliability or ecosystem protection, the Delta Reform Act

requires that the coequal goals be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place.

In addition, the Delta Reform Act recognized the need to change the way the Delta is viewed, asking not what can be taken, but instead what can be given back. Thus, the Legislature established that the policy of the State is to reduce reliance on the Delta in meeting future water supply needs through a statewide strategy of investing in improved regional supplies, conservation, and water use efficiency. The Delta Reform Act specifies that each region depending on water from the Delta watershed shall improve its regional self-reliance for water through investment in water use efficiency, water recycling, advanced water technologies, local and regional water supply projects, and improved regional coordination of local and regional water supply efforts.

Finally, in a distinct departure from CALFED and the status quo of disparate agencies struggling to tackle complex modern resource problems, the Council was established with the authority and responsibility to develop a legally enforceable Delta Plan, and to coordinate and collaborate across the myriad governmental agencies that have responsibility for some aspect of the Delta. The Council also was charged with ensuring that actions by State and local agencies in the Delta are consistent with the Delta Plan, and adequately incorporate the best available science and adaptive management principles.

The Delta Plan

The foundation of the Delta Reform Act is the adoption of the coequal goals and direction to the Council to develop an enforceable Delta Plan to further those goals. Figure 1-4 shows the primary area covered by the Delta Plan, including features and uses referred to in policies and recommendations. Accordingly, the Council presents a Delta Plan that is practical, foundational, integrated, and adaptive:

- **Practical:** The Delta Plan builds on years of planning efforts and incorporates actions, recommendations, and strategies developed by other entities—governmental and nongovernmental—that have already invested countless hours on Delta issues and have specialized expertise.
- **Foundational:** The Delta Plan addresses intertwined challenges and establishes foundational actions for Delta management throughout this century. It lays the groundwork for near-term actions for improvement and focuses on the immediate avoidance of further harm or increased risk to the Delta. The Delta Plan shines a spotlight on urgently needed Delta habitat projects and the significant potential for local and regional water supply development. Similarly, the Delta Plan seeks to immediately halt practices known to be detrimental to the sustainability of the Delta's many functions and services.
- **Integrated:** The Delta Plan establishes an open and accountable governance mechanism for coordinating actions across agency jurisdictions and statutory objectives.

The Delta Plan

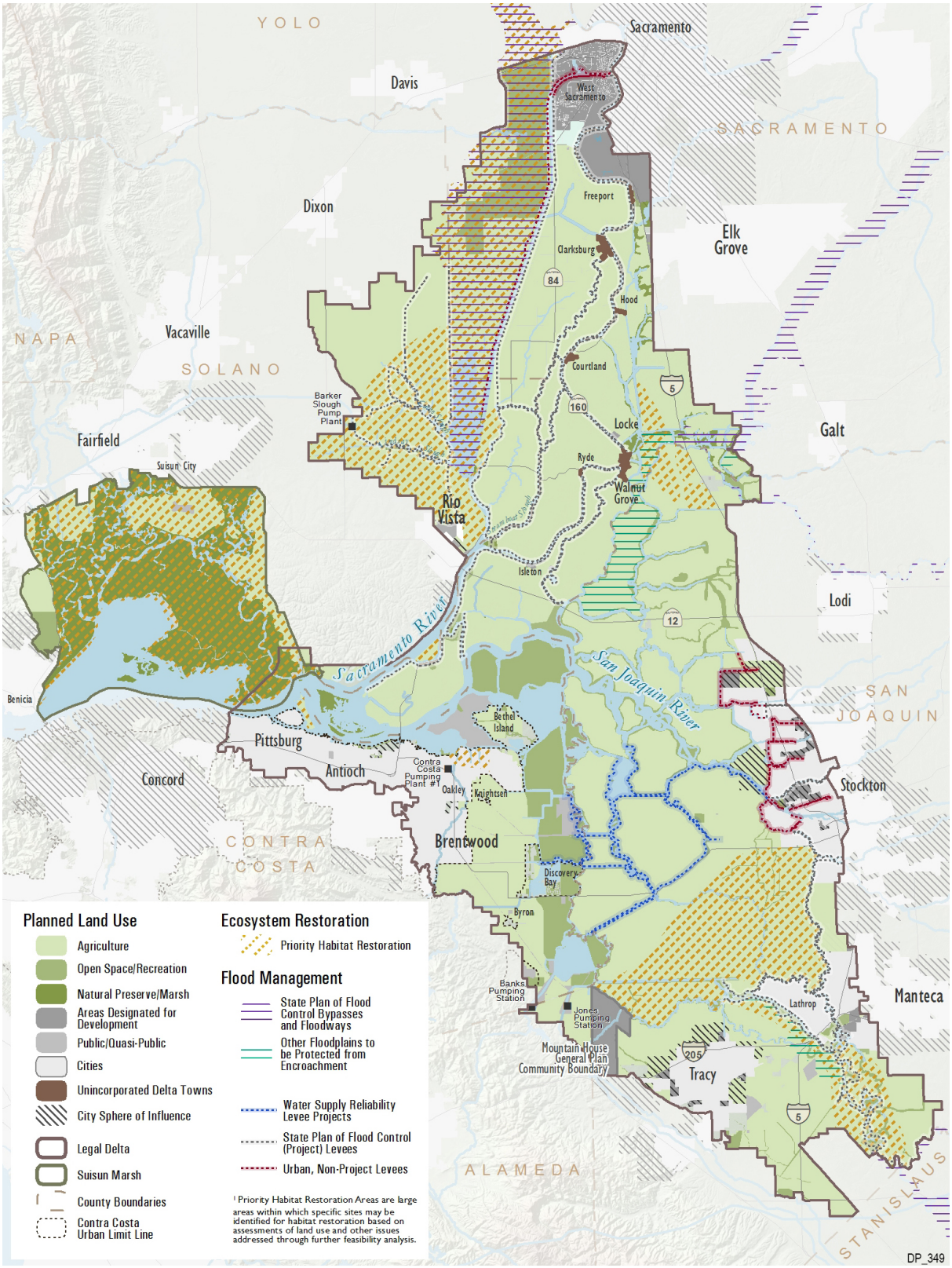

Figure 1-4 The map shows land uses designated by city and county general plans. Within cities' spheres of influences (SOIs), the map shows land use designations proposed in city general plans, where available. In cases where cities have not proposed land uses within their SOIs, the map shows land uses 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 2008, Jones & Stokes 2007, City of Lathrop 2012, City of Manteca 2012, Mountain House Community Services District 2008, City of Rio Vista 2001, SACOG 2009, City of Sacramento 2008, Sacramento County 2011, Sacramento County 2013, Sacramento County 2013, San Joaquin County 2008a, San Joaquin County 2008b, Solano County 2008a, Solano County 2008b, South Delta Levee Protection and Channel Maintenance Authority 2011, City of Stockton 2011a, City of Stockton 2011b, City of Suisun City 2011, City of Tracy 2011, City of Stockton 2011b, City of West Sacramento 2010, Yolo County 2010a, Yolo County 2010b.

- **Adaptable:** The Delta Plan sets direction through policies and recommendations and can incorporate other plans and new information as it becomes available. Informed by science and consistent monitoring, portions of the Delta Plan that do not adequately meet or make progress toward stated goals over time will be refined or revised. The Delta Plan will be updated at least every 5 years, and likely sooner, given the major changes facing the Delta under the Bay Delta Conservation Plan (BDCP) and the Council's commitment to Delta levee prioritization.

It is inevitable that the Delta Plan will generate controversy. This Delta Plan integrates existing State and federal laws and policies and ongoing programs, and is informed by the best available science to chart a course to further the coequal goals. The Council is one of many agencies with an interest in the Delta, and it was not granted unlimited authority over actions related to water supply and the environment. Specific and targeted authority and actions, however, were included by the Delta Reform Act; these form the basis for the Delta Plan's enforceable policies and nonenforceable recommendations.

The Delta Plan's policies and recommendations are based on the following imperatives:

- **Act now.** We have been studying the problems of California's water supply and the declining Delta ecosystem for decades. While all parties agree the *status quo* is not acceptable, failure to take action only prolongs a worsening *status quo*. Near-term actions must move forward while the long-term conveyance, storage, and ecosystem solutions are being decided over the next 5, 10, and 15 years. Waiting is NOT an option. We must continue to invest in the Delta ecosystem and in the improvement of California's water supplies and water use efficiency.
- **Success depends on integrated approaches and awareness of tradeoffs.** Tradeoffs are inherent in managing a supply for multiple benefits. Water exports out of the Delta can harm the ecosystem unless carefully managed. Protecting the Delta as a place means focusing development in urban areas to reduce effects on agricultural land, and risk to people, property, and state interests. Multiple stressors affect the ecosystem in ways that are not yet fully understood and which may be impossible to completely control. The most effective actions will depend upon the coordinated actions of multiple actors.
- **Improve water supply reliability.** Fundamentally, water supply reliability means that California must better match its demands for and use of water to the available supply. Everyone in California must conserve water and must increase their efforts to do so. New surface and groundwater storage is necessary to manage the timing of water for people and for fish. Done right, additional storage can make efficient water management possible and better allow for water use that is wildlife friendly. Improved Delta conveyance, including successful completion of the BDCP, is essential; and it should be done as soon as possible.
- **Commit to Delta ecosystem restoration.** We must preserve land in the Delta for future habitat restoration, and we must immediately begin restoration efforts on long-studied priority areas. In the Delta, the conflict between the way we move water and the health of native species must be resolved. A successfully permitted BDCP is key to that, including water quality objectives updated by the SWRCB for beneficial uses including the Delta's ecosystem. Without adequate water flow (the right mix of timing and amount), we cannot expect fisheries to recover, no matter how well we deal with the range of other stressors.
- **Preserve Delta as a place.** The Delta serves many demands, but we must preserve and protect a unique sense of place distinguished by geography, legacy communities, a rural and agricultural setting, vibrant natural resources, and a mix of economic and recreational activities.

What the Delta Plan Will Achieve

The Delta Plan seeks to further the coequal goals and their inherent objectives in the face of dramatically changing conditions. The Delta of 2100 likely will be very different from the Delta of today (see Table 1-1 for examples of anticipated changes). Some of the changes will be intentional or predictable, and others will be unintended and surprising. Changes are likely or expected to result from population growth, climate change and sea level rise, land subsidence, and earthquakes—most beyond human ability or willingness to control. Human-made changes in land use and water use are also expected to continue.

All of this will involve tradeoffs between competing—in some cases, mutually exclusive—values, goals, and objectives. The Delta Plan seeks to ensure that these decisions are made in a timely and open manner, and based on best available information and science as a predictor of the future. The law requires that the Delta Plan be updated every 5 years, and each update is intended to build on an evolving base of knowledge, directing near- and mid-term actions, and preserving and protecting longer-term opportunities as yet unknown.

Summary of Anticipated Changes Affecting the Delta by 2050 and 2100

TABLE 1-1

Anticipated Change	Change Predicted by 2050	Change Predicted by 2100
Population of California[a]	Increase from 37.2 million in 2010 to 51 million	Continued increase in population
San Francisco Bay/East Bay Area earthquake affecting Delta by 2032[b]	63% probability of at least one magnitude 6.7 or greater earthquake	
Probability of island flooding from high water, relative to 2005 conditions[c]	In range of 200% increase (medium risk scenario)	In range of 450% increase (medium risk scenario)
Increased weather variability, including longer-term droughts[d]	Models and analyses of tree rings and other evidence back to the year 800 suggest greater variability and long periods of drought, especially for the Colorado River Basin, a current source of some water to California.	
Sea level rise, relative to 2000[e]	14 inches	55 to 65 inches
Snow pack, relative to 1956–2000 average of 15 MAF[f]	Reduction of 25% (4.5 MAF) to 40% (6 MAF)	Continued reduction expected

a California Department of Finance 2012

b 2007 Working Group on California Earthquake Probabilities 2008

c DWR 2008

d For examples, see research by Richard Seager, Columbia University, available at http://www.ldeo.columbia.edu/res/div/ocp/drought/, or the California Global Climate Change Portal, available at http://www.climatechange.ca.gov

e California Ocean Protection Council 2011; other sources include higher projections

f DWR 2010

MAF: million acre-feet

The Delta Plan lays out 14 regulatory policies and 73 recommendations that start the process of addressing the current and predicted ecological, flood management, water quality, and water supply reliability challenges. As required by statute, the Delta Plan adopts a science-based adaptive management strategy to manage decision making in the face of uncertainty (Water Code section 85308(f)). All of these changes—some foreseeable, some not—will create a dynamic context in which the Delta Plan must adapt.

Over the life of the Delta Plan, the coequal goals of providing a more reliable water supply for California and restoring the Delta ecosystem are the foundation of all State water management policies. No water rights decisions or water contracts that directly or indirectly impact the Delta are made without consideration of the coequal goals. Over time, balanced application of the Public Trust Doctrine and the California Constitution, Article 10, Section 2 (requirements for beneficial use, reasonable water use, and no waste), have produced optimized water use, including high levels of water use efficiency and protection of public trust resources throughout the state. California has a comprehensive, fully integrated system for tracking and evaluating actual water use and water quality for both surface water and groundwater supplies.

The Delta Plan seeks first to arrest declining water reliability and environmental conditions related to the Delta ecosystem, and ultimately to improve them. It seeks to achieve a more resilient ecosystem that can absorb and adapt to current and future effects of multiple stressors. Additionally, it seeks to reduce flood risk, improve water quality, increase recreation opportunities in the Delta, and protect Delta legacy communities. Generally speaking, these are long-term goals to reduce and reverse increasing long-term environmental impacts caused by inaction. The vision of the Delta in 2100 will be realized through a series of near-term and longer-term actions informed by performance measures and overall adaptive management.

By 2100:

- **California's water supply** will be considerably more efficient, local and regional projects will be online to increase supplies and meet the demands of a growing population, and storage will have increased to meet the challenge of climate change and the needs of water transfer systems. Regions reliant on receiving some portion of their water from the Delta watershed will have reduced their reliance and improved regional self-reliance through increased conservation and diversification of their local and regional sources of supply. Delta conveyance will be managed in an adaptive manner that successfully balances ecosystem restoration and protection with more reliable water deliveries. Water quality in the Delta will support a healthy ecosystem and the multiple beneficial uses of water, including municipal supply and recreational uses such as fishing and swimming.
- **The Delta and Suisun Marsh ecosystem** will have the capacity to provide the environmental and societal benefits the public demands (viable populations of desired species, wild habitats for recreation and solace, land for agriculture, and the conveyance of reliable and high-quality fresh water). Large areas of the Delta will be restored in support of a healthy estuary. A diverse mosaic of interconnected habitats will be re-established in the Delta and its watershed. Migratory corridors for fish, birds, and terrestrial wildlife will be largely protected and restored. Actions have been taken to ensure that sufficient freshwater flows following a more natural, functional hydrograph are now dedicated to support a healthy ecosystem. Actions have reduced the impacts caused by stressors such as invasive species, poor water quality, loss of habitat, and urban development, resulting in improved conditions for native species of fish, birds, and wildlife that depend on the Delta and its watershed.

- **The Delta itself** will be a safe, nationally recognized and vibrant place, with well-defined cities and towns, a strong agricultural sector, and a well-deserved reputation as a recreational destination. Despite an increase in sea levels and altered runoff patterns, risks will be reduced, and residents and agencies will be prepared to respond when floods threaten. In 2100, the Delta will retain its rural heritage and be a place where agricultural, recreational, and environmental uses are uniquely integrated and continue to contribute in important ways to the regional economy.

Timeline for Implementing Priority Actions of the Delta Plan

Figure 1-5 contains a timeline for implementing the priority actions contained in the Delta Plan. The timeline emphasizes near-term and intermediate-term actions. In some instances, precedent or complementary actions need to be undertaken by other agencies or entities to ensure success of the Delta Plan.

Priority Action Timeline

TIMELINE CHAPTER 1: Priority Actions

	ACTION (REFERENCE #)	LEAD AGENCY(IES)	NEAR TERM 2012–2017	INTERMEDIATE TERM 2017–2025	ACTION DEPENDS ON
POLICIES	**Reduce reliance on the Delta through improved regional water self-reliance** (WR P1)	Council, DWR, SWRCB	●	●	State, local water agency cooperation and compliance
	Delta flow objectives (ER P1)	SWRCB	●	●	SWRCB completes on time
	Prioritization of State investments in Delta levees and risk reduction (RR P1)	Council, DWR	●	●	Council completion; legislative adoption and implementation
RECOMMENDATIONS	**Update Delta flow objectives** (ER R1)	SWRCB	●	●	SWRCB completes on time
	Prioritize and implement projects that restore Delta habitat (ER R2)	DFW, DWR, Delta Conservancy	●	●	Funding, multiagency cooperation
	Designate the Delta as a National Heritage Area (DP R1)	DPC	●		Federal action, Congress
	Finance local flood management activities (RR R2)	DPC	●	●	
	Actions for the prioritization of State investments in Delta levees (RR R4)	Council, DWR	●		Council completion; legislative adoption and implementation
	Complete Bay Delta Conservation Plan (WR R12)	DWR, Council incorporates	●	●	State, federal agency action
	Complete surface water storage studies (WR R13)	DWR	●	●	
	Completion of regulatory processes, research, and monitoring for water quality improvements (WQ R8)	SWRCB, RWQCBs	●		
	Development of a Delta Science Plan (G R1)	Council	●	●	
OTHER	Complete Delta Finance Plan	Council	●		Ongoing funding
	Initiate Delta Plan Interagency Implementation Committee	Council	●	●	Agency cooperation
	Evaluate and update Delta Plan	Council	●		Ongoing funding

Agency Key:

Council: Delta Stewardship Council
Delta Conservancy: Sacramento-San Joaquin Delta Conservancy
DFW: California Department of Fish and Wildlife
DPC: Delta Protection Commission
DWR: California Department of Water Resources
RWQCB: Regional Water Quality Control Board
SWRCB: State Water Resources Control Board

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Figure 1-5

Organization of the Delta Plan

The Delta Plan is organized around the coequal goals and specific subgoals, strategies, actions, and measures set forth in the Delta Reform Act. The following chapters describe in detail the problems, expected outcomes, and performance measures associated with the various policies and recommendations:

- Chapter 2, The Delta Plan
- Chapter 3, A More Reliable Water Supply for California
- Chapter 4, Protect, Restore, and Enhance the Delta Ecosystem
- Chapter 5, Protect and Enhance the Unique Cultural, Recreational, Natural Resource, and Agricultural Values of the California Delta as an Evolving Place
- Chapter 6, Improve Water Quality to Protect Human Health and the Environment
- Chapter 7, Reduce Risk to People, Property, and State Interests in the Delta

In addition, Chapter 8, Funding Principles to Support the Coequal Goals, provides history and background for water project and program financing by discussing various funding schemes and by providing some current data on water-related expenditures in California. It also outlines guiding principles for developing stable financing for Delta Plan implementation and describes urgently needed near-term funding requirements for certain critical activities.

References

2007 Working Group on California Earthquake Probabilities. 2008. The Uniform California Earthquake Rupture Forecast, Version 2 (UCERF 2). U.S. Geological Survey Open-File Report 2007-1437 and California Geological Survey Special Report 203. http://pubs.usgs.gov/of/2007/1437/of2007-1437_text.pdf, or Presentation to Delta Stewardship Council: http://www.deltacouncil.ca.gov/ delta_council_meetings/january_2011/Item_15_Presentation.pdf.

California Department of Finance. 2012. Interim Population Projections for California and its Counties 2010-2050, Sacramento, California. May. http://www.dof.ca.gov/research/demographic/reports/projections/interim/view.php.

California Ocean Protection Council. 2011. *Resolution of the California Ocean Protection Council on Sea-Level Rise*. March. http://www.opc.ca.gov/webmaster/ftp/pdf/docs/ OPC_SeaLevelRise_Resolution_Adopted031111.pdf.

City of Benicia. 2003. General Plan land use designations within Suisun Marsh. Digitized into GIS format by AECOM from City of Benicia Land Use map in 2012.

City of Fairfield. 2008. General Plan land use designations within Suisun Marsh. Received from the City of Fairfield in 2012.

City of Lathrop. 2012. General Plan Land Use map for the City of Lathrop. October. Site accessed March 14, 2013. http://www.ci.lathrop.ca.us/cdd/documents/.

City of Manteca. 2012. General Plan land use designations in GIS format. Received by Eryn Pimentel, AECOM, from Jeffrey Davis, City of Manteca, on September 4.

City of Rio Vista. 2001. General Plan land use designations in electronic non-GIS format. Site accessed 2009. http://www.riovistacity.com/images/Documents/chapter_04.pdf.

City of Sacramento. 2008. General Plan land use designations in electronic GIS format. Site accessed 2009. http://www.cityofsacramento.org/gis/data.html.

City of Stockton. 2011a. GIS layers for city spheres of influence and General Plan land use designations. Site accessed April 14, 2011. http://www.stocktongov.com/services/gis/mapdatDat.html.

City of Stockton. 2011b. General Plan land use designations in GIS format and General Plan land use designations within Suisun Marsh (digitized into GIS format by AECOM from Land Use map in 2012). Site accessed April 14, 2011. http://www.stocktongov.com/services/gis/mapdatDat.html.

City of Suisun City. 2011. General Plan land use designations within Suisun Marsh. Digitized into GIS format by AECOM from Land Use map in 2012.

City of Tracy. 2011. City of Tracy sphere of influence and General Plan land use designations provided in GIS format. Delivered via file transfer protocol from Victoria Lombardo, Senior Planner, City of Tracy, to Jessica Law, Urban and Environmental Planner, AECOM, on March 10.

City of West Sacramento. 2010. General Plan land use designations in GIS format. Site accessed December 28, 2010. http://www.cityofwestsacramento.org/services/gis/downloads.cfm. Accessed

CNDDB (California Natural Diversity Database). 2010. Records search of plan area quadrangles. California Department of Fish and Game, Sacramento, California.

CNPS (California Native Plant Society). 2010. Inventory of Rare and Endangered Plants. Site accessed February 2010. http://cnps.web.aplus.net/cgi-bin/inv/inventory.cgi.

Contra Costa County. 2008. GIS layer for Urban Limit Line for Contra Costa County. October. Site accessed June 27, 2011. http://ccmap.us/Details/asp?Product=134490.

Contra Costa County. 2010. GIS layer for City Spheres of Influence in Contra Costa County. January. Site accessed January 28, 2011. https://www.ccmap.us/catalog.asp?UserChoice=2&Layercntrl=0000000000000000000000.

DBW (California Department of Boating and Waterways). 2002. *Sacramento–San Joaquin Delta Boating Needs Assessment (2000-2020)*. Prepared by The Dangermond Group.

DFG (California Department of Fish and Game). 2009. *Outdoor California*. (page 8). July-August.

DOC (California Department of Conservation). 2008. Farmland Mapping and Monitoring Program 2008. Important Farmland designations for Alameda, Contra Costa, Sacramento, San Joaquin, Solano, and Yolo Counties. ftp://ftp.consrv.ca.gov/pub/dlrp/fmmp/.

DPC (Delta Protection Commission). 2010. *Economic Sustainability Plan Framework Study*. Final Draft. Submitted by Bay Area Economics in association with Rooney Tate Group Parus Consulting. December 6.

DPC (Delta Protection Commission). 2012. Proposal to Protect, Enhance, and Sustain the Unique Cultural, Historical, Recreational, Agricultural, and Economic Values of the Sacramento-San Joaquin Delta as an Evolving Place. January 26.

DWR (California Department of Water Resources). 2007a. *Past and Present Land Uses in the Sacramento-San Joaquin Delta and Suisun Marsh*. Water Plan Land and Water Use Work Team. November 21.

DWR (California Department of Water Resources). 2007b. Land use survey agricultural crop data for the Legal Delta and Suisun Marsh area. Developed for the Delta Vision program. Received by AECOM from DWR.

DWR (California Department of Water Resources). 2008. *Delta Risk Management Strategy. Risk Analysis Report Final.* Tables 14-12 and 14-13. Raising levees to keep up with sea level rise is assumed (page 14-28). December. http://www.water.ca.gov/floodmgmt/dsmo/sab/drmsp/ docs/Risk_Report_Section_0_Final.pdf. See also: http://www.science.calwater.ca.gov/pdf/ drms/IRP_DRMS_Review_Final_20oct08.pdf and CALFED Independent Science Board assessment of DWR Delta Risk Management Strategy Phase 1, page 22: http://www.science.calwater.ca.gov/pdf/drms/Appendix_5_executive_summary_review.pdf.

DWR (California Department of Water Resources). 2009. *California Water Plan Update 2009*. Sacramento, CA. http://www.waterplan.water.ca.gov/cwpu2009/index.cfm.

DWR (California Department of Water Resources). 2010. *Climate Change Characterization and Analysis in California Water Resources Planning Studies.* Final Report. December.

DWR (California Department of Water Resources). 2011a. Dayflow. Estimate of Average Daily Outflow. Site accessed August 2011. http://www.water.ca.gov/dayflow/.

DWR (California Department of Water Resources). 2011b. Floodplain inundation and floodways in the vicinity of the Sacramento-San Joaquin Delta.

DWR (California Department of Water Resources). 2011c. Locations and attributes of levees in California as maintained by the DWR California Levee Database.

DWR (California Department of Water Resources). 2011d. Restoration opportunity areas in the Sacramento-San Joaquin Delta.

Hanak, E., J. Lund, A. Dinar, B. Gray, R. Howitt, J. Mount, P. Moyle, and B. Thompson. 2011. *Managing California's Water: From Conflict to Reconciliation*. San Francisco, CA. Public Policy Institute of California.

Hart, John. 2010. The once and future Delta. *Bay Nature*. April 1, 2010. http://baynature.org/articles/apr-jun-2010/the-once-and-future-delta/once-future-delta.

Jones & Stokes. 2007. *Draft Environmental Impact Report North Delta Flood Control and Ecosystem Restoration Project*. Volume 2-Figures. November.

Katibah, E. F. 1984. A brief history of riparian forests in the Central Valley of California. In *California Riparian Systems: Ecology, Conservation, and Productive Management*. R. E. Warner and K. M. Hendrix, eds. (pages 23–29). University of California Press, Berkeley.

LHC (Little Hoover Commission). 2005. Still Imperiled, Still Important. The Little Hoover Commission's Review of the CALFED Bay-Delta Program. November 17.

LHC (Little Hoover Commission). 2010. *Managing for Change: Modernizing California's Water Governance*. Report 201. August.

Lund, J., E. Hanak, W. Fleenor, R. Howitt, J. Mount, P. Moyle. 2007. *Envisioning Futures for the Sacramento-San Joaquin Delta*. Public Policy Institute of California. San Francisco, CA.

Mountain House Community Services District. 2008. Mountain House Zoning map. September 18, 2008. Site accessed July 27, 2011. http://www.ci.mountainhouse.ca.us/master-plan.asp.

SACOG (Sacramento Area Council of Governments). 2009. GIS layer for spheres of influence in SACOG region. December. Site accessed January 28, 2011. http://sacog.org/mapping/clearinghouse/Mapping Center.

Sacramento County. 2011. General Plan land use designations in GIS format. Site accessed 2012. http://www.sacgis.org/GISDataPub/Data/.

Sacramento County. 2012. Letter from Sacramento County to the Delta Stewardship Council, Re: Revised Maps of the Unincorporated Delta Communities. November 20.

Sacramento County. 2013. Sacramento County Online Map, Sacramento County, California. Site accessed March 10, 2013. http://generalmap.gis.saccounty.net/JSViewer/county_portal.aspx.

San Joaquin County. 2008a. City of Lathrop sphere of influence map. March 4. Site accessed February 3, 2011. http://www.sjgov.org/lafco/SOI%20Maps/Lathrop_Sphere_new%202008.pdf.

San Joaquin County. 2008b. City of Manteca sphere of influence map. October 29. Site accessed February 3, 2011. http://www.co.san-joaquin.ca.us/lafco/Manteca%20MSR/Manteca_Sphere.pdf.

Solano County. 2008a. GIS layers for city spheres of influence and General Plan land use designations in Solano County. May. Site accessed August 10, 2011. http://regis.solanocounty.com/data.html.

Solano County. 2008b. General Plan land use designations provided in GIS format. Obtained 2009.

South Delta Levee Protection and Channel Maintenance Authority. 2011. *Lower San Joaquin Flood Bypass Proposal*. March.

USFWS (U.S. Fish and Wildlife Service). 2010. Records search of Federal Endangered and Threatened Species in plan area quadrangles. Site accessed February 16, 2010. http://www.fws.gov/ sacramento/es/spp_lists/auto_list.cfm.

Western Regional Climate Center. 2011. California climate tracker database query. Statewide annual precipitation by water year from 1896-2010. Site accessed July 2011. http://www.wrcc.dri.edu/monitor/cal-mon/frames_version_html.

Yolo County. 2010a. General Plan land use designations in GIS format. Site accessed 2010. http://www.yolocounty.org/Index.aspx?page=823.

Yolo County. 2010b. Yolo County General Plan 2030 layer provided in GIS format. Delivered via file transfer protocol from Marcus Neuvert, GIS Specialist, Yolo County DITT, to Dillon Cowan, Staff Engineer, CH2M HILL, Inc., on July 1.

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