The State Water Project

Draft Delivery Reliability Report 2013

December 2013

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Natural Resources Agency
Department of Water Resources

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Director's Message

This *State Water Project Delivery Reliability Report 2013* updates the estimated water delivery capability of the State Water Project (SWP) for current conditions and two decades from now. The estimates include the best-known future effects of climate change and the anticipated changes in Sacramento River basin land uses. Climate change will alter the timing and magnitude of inflows to upstream storage facilities including Shasta, Folsom, and Oroville reservoirs. In addition, rising sea levels will pose operational challenges to maintaining suitable salinity levels in San Francisco Bay and the Sacramento–San Joaquin Delta (Delta).

Other factors in our analysis of SWP reliability have been assumed to not change over time. They are too uncertain to incorporate into the analysis. For example, regulatory restrictions issued by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service in their biological opinions are assumed to remain unchanged. The opinions dictate the timing and amounts of the SWP's Delta exports. These restrictions are undergoing further review and analysis under a federal court order. Also, the Delta water quality and flow requirements contained in the State Water Resources Control Board's water quality control plan for the Delta are assumed to remain unchanged. However, the board is revising its water quality control plan. Revisions to the plan and their subsequent inclusion into the California Department of Water Resources' (DWR's) water rights for the SWP could have a significant effect on SWP deliveries.

The estimates in this report can be used by water districts as part of the analyses for their water management plans, which are required by State legislation to be updated in 2015. The report includes estimates for a range of hydrologic conditions that should be considered in water management plans. These estimates do not incorporate the risk of a disruption in SWP deliveries caused by catastrophic failure of Delta levees. Delta levee failure as a result of floods, earthquakes, erosion, or rising sea levels could interrupt water deliveries from the Delta for weeks, months, or even years, depending on the nature and the scope of the failure. Water management plans should describe the response to this potential scenario.

This assessment of current and future SWP reliability is one of several efforts by DWR to help plan for reliable future water supplies in California.

DWR's *California Water Plan 2013* assesses the reliability of management options to reduce the potential for future statewide water shortages. The plan focuses on helping decision makers identify and design strategies that are robust and adaptive over time.

The draft *Bay Delta Conservation Plan* (BDCP), 7 years in the making, is designed to contribute to the recovery of threatened and endangered species in the Delta and to prevent the potential disruption of water deliveries by sending export flows through underground tunnels to the SWP's pumps. The BDCP would not eliminate the need for individual regions in California to become more self-sufficient by investing heavily in water conservation, water-use efficiency, water recycling, and conjunctive use of a region's surface or underground storage.

On a broader scale, to help achieve sustainable management of California's water resources and increase the resiliency of its water management systems, DWR advances the Integrated Water Management

(IWM) approach. IWM is a framework for planning and implementation that melds objectives of improving public safety, fostering environmental stewardship, and supporting economic stability. The framework encourages multi-benefit programs and projects that leverage limited resources and balance needs such as flood risk reduction, ecosystem enhancement, and water supply reliability in an integrated manner across jurisdictional and watershed boundaries.

This *State Water Project Delivery Reliability Report 2013* narrows its focus to the SWP's delivery capability from the Delta, given current Delta regulatory restrictions, expected future climate change, and projected changes in land use in the Sacramento River basin. The results emphasize the ongoing need for local agencies to develop resilient and robust water sources and infrastructure to maximize the efficient use of a variable water supply.

[signature]

Mark Cowin
Director
California Department of Water Resources
December 2013

Summary

This report is intended to inform the public about key factors important to the operation of the State Water Project (SWP) and the reliability of its water deliveries.

For many SWP water contractors, water provided by the SWP is a major component of the water supplies available to them. SWP contractors include cities, counties, urban water agencies, and agricultural irrigation districts. These local utilities and other public and private entities provide the water that Californians use at home and work every day and that helps to nourish the state's bountiful crops. Thus, the availability of water from the SWP is an important component to the water supply planning of its recipients and ultimately affects the amount of water that local residents and communities can use.

The availability of these water supplies may be highly variable. A wet water year may be followed by a dry or critically dry year. Knowing the probability that they will receive a certain amount of SWP water in a given year—whether it be a wet water year, a critical year, or somewhere in between—gives contractors a better sense of the degree to which they may need to implement increased conservation measures or plan for new facilities.

The Delta is the key to the SWP's ability to deliver water to its agricultural and urban contractors. All but five of the 29 SWP contractors receive water deliveries from the Delta (pumped by either the Harvey O. Banks or Barker Slough pumping plants).

Yet the Delta faces numerous challenges to its long-term sustainability. For example, climate change poses the threat of increased variability in floods and droughts, and sea level rise complicates efforts to manage salinity levels and preserve water quality in the Delta so that the water remains suitable for urban and agricultural uses. Among the other challenges are continued subsidence of Delta islands, many of which are already below sea level, and the related threat of a catastrophic levee failure as water pressure increases on fragile levees.

Protection of endangered and threatened fish species, such as the delta smelt, is also an important factor of concern for the Delta. Ongoing regulatory restrictions, such as those imposed by federal biological opinions on the effects of SWP and Central Valley Project (CVP) operations on these species, also contribute to the challenge of determining the SWP's water delivery reliability.

Two large-scale plans for the Delta that are being developed could affect SWP water delivery reliability: the Delta Plan and the Bay Delta Conservation Plan (BDCP). When complete, the BDCP will provide the basis for issuing endangered species permits to operate the SWP and CVP. The BDCP seeks to improve the health of the ecological system as a whole.

The analyses in this report factor in all of the regulations governing SWP operations in the Delta and upstream, and assumptions about water uses in the upstream watersheds. Analyses were conducted that considered the amounts of water that SWP contractors use and the amounts of water they choose to hold for use in a subsequent year.

Many of the same specific challenges to SWP operations described in the *State Water Project Delivery Reliability Report 2011* (2011 Report) remain in 2013. Most notably, the effects on SWP pumping caused by issuance of the 2008 and 2009 federal biological opinions (BOs), which were reflected in the 2011 Report, continue to affect SWP delivery reliability today. The analyses in this report consider climate change and the effects of sea level rise on water quality, but do not incorporate the probability of catastrophic levee failure. The differences between the 2011 and 2013 Reports can be attributed primarily to updates in the assumptions and inputs to the computer simulation analyses.

As noted in the discussion of SWP exports in Chapter 4 of this report, estimated average annual Delta exports (that is, SWP water of various types pumped by and transferred to contractors from the Banks Pumping Plant) have decreased since 2005, although the bulk of the change occurred by 2009 as the federal BOs went into effect, restricting operations. These effects are also reflected in the SWP delivery estimates provided in Chapters 5 and 6 of this report. Chapters 5 and 6 characterize the SWP's water delivery reliability under existing conditions and future conditions, respectively. The most salient findings in this report are as follows:

- The estimated average annual SWP exports decrease from 2,612 thousand acre-feet (taf)/year to 2,466 taf/year (146 taf/year or about 5.6%) between the existing- and future-conditions scenarios.
- Under existing conditions, the average annual delivery of Table A water estimated for this 2013 Report is 2,553 taf/year, 29 taf (1%) more than the 2,524 taf/year estimated for the 2011 Report.
- Under future conditions, the average annual delivery of Table A water estimated for this 2013 Report is 2,400 taf/year, about 1% less than the 2,465-taf/year estimate for the future-conditions scenario presented in the 2011 Report.
- The likelihood of existing-condition SWP Article 21 deliveries (supplemental deliveries to Table A water) being greater than 20 taf/year has decreased relative to the likelihood presented in the 2011 Report. The same can be said for the estimated likelihood of Article 21 deliveries greater than 20 taf/year under future conditions. Both this report and the 2011 Report show a likelihood ranging between 21% and 26% of Article 21 water deliveries greater than 20 taf/year under both existing and future conditions.

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Chapter 1

Water Delivery Reliability: A Concern for Californians

California's water supplies are crucial to maintaining a high quality of life for the state's residents. The State Water Project (SWP), operated by the California Department of Water Resources (DWR), is an integral part of the effort to ensure that business and industry, urban and suburban residents, and farmers throughout much of California have sufficient water at all times.

Local water agencies in the southern Central Valley's farming areas and in Southern California's urban-industrial regions have undertaken major efforts to increase their self-sufficiency and reduce their reliance on imported sources of water supply. Implementing measures to conserve and recycle water, increase water-use efficiency, and improve the use of groundwater basins has helped local water districts to manage better in dry years, when only limited water supplies are available to import into their service areas.

Despite these efforts, water deliveries by the SWP continue to play an indispensable role in supplying water to meet major portions of the demands in the SWP service areas in the southern San Francisco Bay area, Kern County, the Tulare Lake basin, and Southern California. Thus, the reliability of SWP water deliveries is a vital component of California's economic growth and quality of life.

This *State Water Project Delivery Reliability Report 2013* (2013 Report) describes the expected existing and future SWP water deliveries to its service areas. The term "water delivery reliability," as used in this report, is defined as the annual amount of SWP water that can be expected to be delivered with a certain frequency—that is, the likelihood (probability) that a certain amount of water will be delivered by the SWP in a year.

Reasons to Assess SWP Water Delivery Reliability

Two major factors underscore the importance of assessing the SWP's water delivery reliability: the effects of population growth on California's balance of water supply and demand, and State legislation intended to help maintain a reliable water supply.

Population Growth, Land Use, and Water Supply

California's population has grown rapidly in recent years, with resulting changes in land use. This growth is expected to continue. From 1990 to 2005, California's population increased from about 30 million to about 36.5 million. Based on this trend, California's population has been projected to be more than 47.5 million by 2020. The "current trends" scenario depicted in the *California Water Plan 2013* for year-2050 conditions, based on the California Department of Finance's projections of 2010 U.S. Census data, assumes a population of nearly 51 million—a 75% increase in the 1990 population.

The amount of water available in California—or in different parts of the state—can vary greatly from year to year. Some areas may receive 2 inches of rain a year, while others are deluged with 100 inches or more. As land uses have changed, population centers have emerged in many locations without sufficient local water supplies. Thus, Californians have always been faced with the problem of how best to conserve, control, and move water from areas of abundant water to areas of water need and use.

Population growth and resulting development in California since World War II have been substantial, fueling the need for increased water supply.

Legislation on Ensuring a Reliable Water Supply

The laws described below impose specific requirements on both urban and agricultural water suppliers. These laws increase the importance of SWP water delivery reliability estimates to water suppliers.

California Urban Water Management Planning Act

The California Urban Water Management Planning Act was enacted in 1983. As amended, this law (California Water Code, Sections 10610–10656) requires urban water suppliers to adopt water management plans every 5 years and submit those plans to DWR. DWR is required to review local water management plans and report on the status of these plans. DWR published a guidebook to preparing urban water management plans in March 2011. Guidance documents are available at http://www.water.ca.gov/urbanwatermanagement.

Adoption of the most recent (2010) round of urban water management plans was required by July 1, 2011; the plans were due to DWR by August 1, 2011. The municipalities and water districts that have adopted these plans and submitted them to DWR in 2011, 2012, and 2013 are listed at http://www.water.ca.gov/urbanwatermanagement/2010uwmps/.

Water Conservation Act

The Water Conservation Act of 2009 (Senate Bill X7.7, Steinberg), enacted in November 2009, includes distinct requirements related to both urban and agricultural water use.

This law requires that the State of California reduce urban per capita water use statewide by 10% by the end of 2015 and 20% by the end of 2020. DWR is required to report on progress toward meeting these urban per capita water use goals.

In addition, as part of the Water Conservation Act, agricultural water suppliers with 25,000 acres or more of irrigated land were required to prepare and adopt agricultural water management plans and submit the plans to DWR by the end of 2012. In November 2012, DWR released a guidebook for developing agricultural water management plans: http://www.water.ca.gov/wateruseefficiency/sb7/docs/AgWaterManagementPlanGuidebook-FINAL.pdf.

Water agencies filing agricultural water management plans as of July 2013 are listed on a Web page maintained by DWR's Water Use and Efficiency Branch: http://www.water.ca.gov/wateruseefficiency/sb7/docs/2012_AWMPs_Received_07-16-2013.pdf.

DWR is reviewing these plans for consistency with Water Conservation Act requirements. The plans must be updated by the end of 2015 and every 5 years thereafter.

Background of This Report

This 2013 Report is the sixth in a series of reports on the SWP's water delivery reliability. DWR is legally required to prepare and distribute this report every 2 years to all SWP contractors (recipients of SWP water), city and county planning departments, and regional and metropolitan planning departments in the SWP's service area. Reports were previously produced for 2002, 2005, 2007, 2009, and 2011.

The requirement for a biennial water delivery reliability report was established in a settlement agreement among the Planning and Conservation League, DWR, SWP contractors, and others that was approved by the 3rd Circuit Court of Appeals in May 2003. The settlement agreement was reached in the aftermath of the "Monterey Amendments" case, which resolved a dispute about the environmental analysis of amendments to the long-term water supply contracts for the SWP that were entered into by DWR and most of the SWP contractors in the 1990s. The terms of the SWP contracts were amended after water shortages during the 1987–1992 drought drastically reduced SWP water deliveries to SWP contractors in the San Joaquin Valley and Southern California.

Attachment B to the settlement agreement specifies that each SWP delivery reliability report must include the following information:

- the overall water delivery capacity of the SWP facilities at the time of the report;
- the allocation of that SWP water to each SWP contractor;
- a discussion of the range of hydrologic conditions, which must include the historic extended dry cycle and long-term average; and
- the total amount of SWP water delivered to all contractors and the amount of SWP water delivered to each contractor during each of the 10 years immediately preceding the report.

DWR's water delivery reliability reports are used by various entities for water planning purposes. The reports must be presented in a format understandable by the public. The information presented in the reports is intended to help local agencies, cities, and counties that use SWP water to develop adequate, affordable water supplies for their communities.

Contents and Use of This Report

The following topics are addressed in this 2013 Report:

- The Summary at the front of this report briefly summarizes the updated findings on water delivery reliability detailed in proceeding chapters.
- Chapter 1, "Water Delivery Reliability: A Concern for Californians," summarizes important issues (including selected State legislation) that underlie the need to assess the SWP's water delivery reliability and provides background on DWR's water delivery reliability reports.
- Chapter 2, "State Water Project and Water Delivery Contracts," describes the SWP's purpose, background, facilities, and SWP water contracts and contractors.

- Chapter 3, "Factors that Affect Water Delivery Reliability," explains generally how water delivery reliability is calculated. The chapter then describes a variety of factors that make forecasting water delivery reliability inherently challenging, such as:
  - water availability at the source,
  - water rights with priority over the SWP,
  - climate change,
  - regulatory restrictions on SWP Delta exports,
  - ongoing environmental and policy planning efforts, and
  - Delta levee failure.
- Chapter 4, "SWP Delta Exports," discusses how the delivery estimates for the SWP have been reduced as a result of more restrictive operational rules. This chapter also presents the results of DWR's analysis of SWP exports from the Harvey O. Banks Pumping Plant for existing conditions (2013) and future conditions (2033).
- Chapter 5, "Existing SWP Water Delivery Reliability (2013)," estimates the SWP's delivery reliability for existing conditions (2013) and compares these estimates with the existing-condition results presented in the *State Water Project Delivery Reliability Report 2011* (2011 Report).
- Chapter 6, "Future SWP Water Delivery Reliability (2033)," estimates the SWP's delivery reliability for conditions 20 years in the future (2033), reflecting potential hydrologic changes that could result from climate change. This chapter also compares these estimates with the future-condition results presented in the 2011 Report.
- Appendix A, "Historical SWP Delivery Tables for 2003–2012," presents the historical deliveries for SWP contractors over the last 10 years.

In addition, a technical addendum prepared for this report includes more specific details of the technical analyses and results. The technical addendum also describes the computer simulation assumptions and lists the updates to the computer model since the 2011 Report. The technical addendum is available upon request and is posted online, along with this 2013 Report, at http://baydeltaoffice.water.ca.gov.

Urban and agricultural water suppliers can use the information in this report and the technical addendum when they prepare or amend their water management plans. These details will help them decide whether they need new facilities or programs to meet future water demands. Urban water suppliers can also use this information when, as required by the California Environmental Quality Act (CEQA), they analyze whether enough water is available for proposed subdivisions or development projects.

Chapter 2

State Water Project and Water Delivery Contracts

Purpose and Background of the SWP

The SWP is the largest state-built, multipurpose, user-financed water project in the United States. Almost two-thirds of California's residents—25 million people—receive at least part of their water from the SWP. Project water also supplies thousands of industries and irrigates about 750,000 acres of California farmland. Of the SWP's contracted water supply, 70% goes to urban users and 30% goes to agricultural users.

The primary purpose of the SWP is to provide a water supply—that is, to divert and store water during wet periods in Northern and Central California and distribute it to areas of need in Northern California, the San Francisco Bay area, the San Joaquin Valley, the Central Coast, and Southern California. Other SWP purposes include flood control, power generation, recreation, fish and wildlife enhancement, and water quality improvement in the Delta.

In 1959, the Legislature passed the California Water Resources Development Bond Act. This law, also known as the Burns-Porter Act, authorized $1.75 billion in bonds to build the SWP's initial facilities, contingent on voter approval. After California voters approved the Burns-Porter Act in November 1960, construction of the SWP by DWR began. The first water deliveries were made to the Alameda County Flood Control and Water Conservation District (Zone 7) and Santa Clara Valley Water District in 1967.

SWP Facilities

Today, the SWP includes 33 storage facilities, 21 reservoirs and lakes, 20 pumping plants, four pumping-generating plants, five hydroelectric power plants, and about 700 miles of canals and pipelines. Figure 2-1 shows the primary SWP facilities.

Facilities North of the Delta

The SWP's watershed encompasses the mountains and waterways around the Feather River in Plumas County. Rain and melting snow run off mountainsides and

Source: Data provided by DWR in 2011

Figure 2-1. Primary State Water Project Facilities into waterways that flow into Lake Oroville, where the SWP officially begins.

With a capacity of about 3.5 million acre-feet, Lake Oroville is the SWP's largest storage facility. When water is needed, Oroville Dam releases water into the Feather River, which converges with the Sacramento River north of the city of Sacramento. Releases from Shasta and Folsom Reservoirs, facilities of the federal CVP, also flow into the Sacramento River. The Sacramento River flows into the tidally influenced Delta, where inflows from the Sacramento and San Joaquin Rivers are mixed with water from San Francisco Bay. Some of this water is pumped by the Barker Slough Pumping Plant into the North Bay Aqueduct for municipal use by Napa and Solano Counties.

Oroville Dam.

Facilities in the Delta and Central California

The SWP's primary pumping plant, the Harvey O. Banks Pumping Plant, is located in the south Delta in Alameda County. The pumps at the Banks Pumping Plant lift Delta water stored in the Clifton Court Forebay into the California Aqueduct, which at 444 miles long is the longest water conveyance system in California. At Bethany Reservoir, some SWP water is diverted from the California Aqueduct into the South Bay Aqueduct, which serves urban and agricultural uses in Alameda and Santa Clara Counties.

Harvey O. Banks Pumping Plant.

A portion of the water that flows down the California Aqueduct is diverted into the San Luis Joint-Use Complex located in Merced County, which is jointly owned by the SWP and the CVP. Generally, water is pumped from the California Aqueduct into the 2-million-acre-foot San Luis Reservoir from late fall through early spring and is stored temporarily before being released back to the California Aqueduct to meet the higher summertime water demands of SWP (and CVP) contractors.

Facilities in the San Joaquin Valley and Southern California

After leaving the San Luis Joint-Use Complex, water travels through the central San Joaquin Valley via a jointly owned federal/State portion of the California Aqueduct. Along the way, deliveries are made to San Joaquin Valley contractors of both the SWP and the CVP. Near Kettleman City in Kings County, the SWP's Coastal Branch Aqueduct branches off to serve SWP contractors in San Luis Obispo and Santa Barbara Counties. The California Aqueduct continues southeast until, at the base of the Tehachapi Mountains in Kern County, it reaches the A. D. Edmonston Pumping Plant. This pumping station lifts water from the California Aqueduct 1,926 feet to enter 10 miles of tunnels and siphons that cross the Tehachapi Mountains. After crossing the mountains, the water splits into two branches, the West Branch and East Branch, and is delivered to SWP contractors in Southern California.

A. D. Edmonston Pumping Plant.

SWP Contractors and Water Delivery Contracts

During the 1960s, as the SWP was created, long-term contracts were signed by DWR and 29 urban and agricultural water suppliers in various locations within California. The contracts are essentially uniform and most will expire in 2035. These urban and agricultural water suppliers are referred to in this report as the "SWP contractors" or "contractors." This section introduces the SWP contractors, briefly explains the basics of SWP water contracts and the various types of project water.

For a more comprehensive discussion of the various types of water deliveries, refer to the 2011 Report, available at http://baydeltaoffice.water.ca.gov/swpreliability/FINAL_2011_DRR.pdf.

About the SWP Contractors

The SWP contractors are located along the Feather River north of the Delta, in the north and south San Francisco Bay Area, along the Central Coast, in the San Joaquin Valley, and in Southern California. They include cities, counties, urban water agencies, and agricultural irrigation districts. Most contractors use the project water they receive for municipal purposes; several use the water for agriculture. The SWP contractors mostly use project water to supplement local supplies, including groundwater, or other imported water. The 29 SWP contractors and their service area boundaries and locations are shown in Figure 2-2.

How Water Contracts Work

Under the terms of their long-term water supply contracts with DWR, the 29 SWP contractors receive specified amounts of water from the SWP each year, called "annual allocations."

The SWP's long-term water supply contracts define the terms and conditions governing water delivery and repayment of project costs. In return for the allocated water, the SWP contractors repay principal and interest on both the bonds that initially funded construction of the SWP and the bonds that paid for additional facilities.

The contractors also pay all costs, including labor and power, to maintain and operate project facilities. In addition, they pay transportation charges based on the distance between the Delta and each contractor's water delivery point. Further, the contractors contribute mitigation costs for any environmental impacts of SWP operations on fish and wildlife.

Source: Data provided by DWR in 2011

Figure 2-2. State Water Project Contractors

"Table A" Water

Table A is an exhibit to the SWP's water supply contracts. The current combined maximum Table A amount is 4,172 thousand acre-feet per year (taf/year). Of this amount, 4,133 taf/year is the maximum Table A water available for delivery from the Delta. It is recognized that deliveries will be less than the established maximum Table A amount in some years and more than this amount in other years.

The maximum Table A amount is the basis for apportioning water supply and costs to the SWP contractors. Once the total amount of water to be delivered is determined for the year, all available water is allocated in proportion to each contractor's annual maximum SWP Table A amount. The established maximum Table A amounts for the 29 SWP contractors vary widely; those amounts are listed in Table 2-1.

The deliveries of Table A water to each of the SWP contractors in the last 10 years are shown in Appendix A.

Other Types of SWP Water

Regardless of water year type, Table A water is given first priority for delivery over other types of SWP water. Contractors have several options for what to do with the water that is allocated to them: use it, store it for later use, or transfer it to another contractor.

Each long-term water contract describes several types of SWP water that are available to SWP contractors to supplement Table A water: "Article 21" water, carryover water, and turnback pool water. These other types of project water are briefly discussed below. Deliveries of these project water types over the last 10 years are listed in Appendix A.

Article 21 Water

Article 21 water (so named because it is described in Article 21 of the water contracts) is water that SWP contractors may receive on a short-term basis in addition to their Table A water, if they request it. Article 21 water is used by many SWP contractors to help meet demands when allocations are less than 100%. The availability and delivery of Article 21 water cannot interfere with normal SWP operations.

Carryover Water

"Carryover water" is SWP water that is allocated to an SWP contractor and approved for delivery to that contractor in a given year, but not used by the end of the year. This water is exported from the Delta by the Banks Pumping Plant, but instead of being delivered to the contractor, it is stored in the SWP's share of San Luis Reservoir, when space is available, for the contractor to use in the following year.

Turnback Pool Water

SWP contractors may offer a portion of their Table A water that has been allocated in the current year and exceeds their needs to a "turnback pool," where another contractor may purchase it. Contractors that sell their extra Table A water in a turnback pool receive payments from contractors that buy this water through the turnback pool.

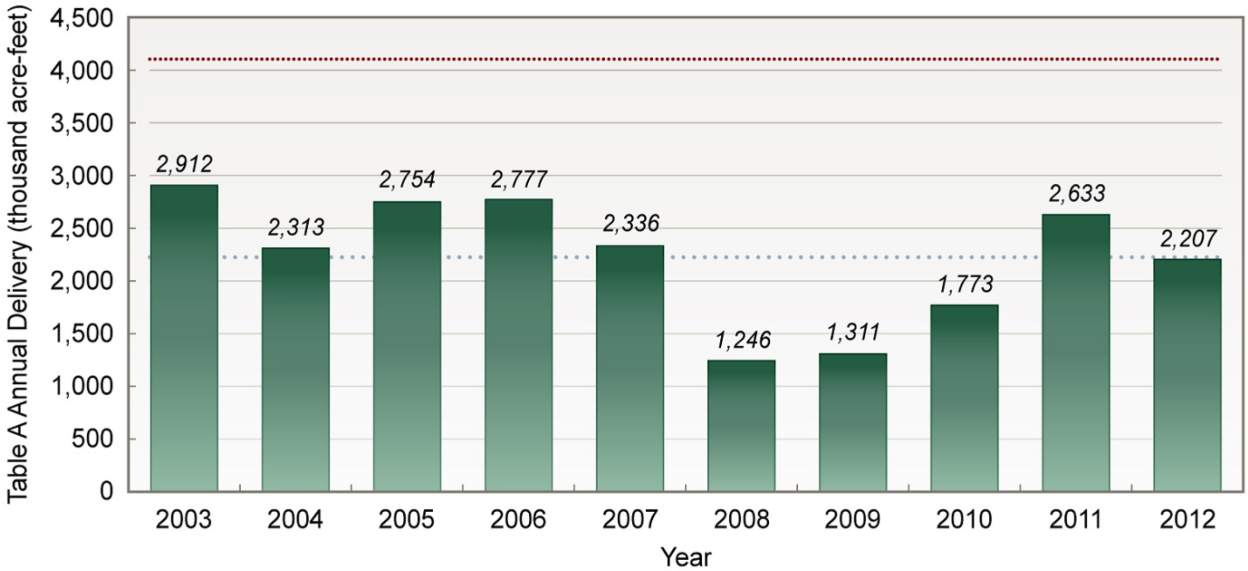
Historical SWP Deliveries (2003–2012)

Please see Appendix A for tables listing annual historical deliveries by various water classifications for each SWP contractor for 2003–2012.

Figure 2-3 shows that deliveries of SWP Table A water for 2003–2012 range from an annual minimum of 1,246 taf to a maximum of 2,912 taf, with an average of 2,226 taf. Historical deliveries of SWP Table A water over this 10-year period are less than the maximum of 4,172 taf/year.

Total historical SWP deliveries, including Table A, Article 21, turnback pool, and carryover water, range from 1,362 to 3,730 taf/ year, with an average of 2,719 taf/year for the period of 2003–2012 (Figure 2-4).

Table 2-1. Maximum Annual SWP Table A Water Delivery Amounts for SWP Contractors	
Contractor	Maximum Table A Delivery Amounts (acre-feet)
Feather River Area Contractors	
Butte County	27,500
Yuba City	9,600
Plumas County Flood Control and Water Conservation District	2,700
Subtotal	**39,800**
North Bay Area Contractors	
Napa County Flood Control and Water Conservation District	29,025
Solano County Water Agency	47,506
Subtotal	**76,531**
South Bay Area Contractors	
Alameda County Flood Control and Water Conservation District, Zone 7	80,619
Alameda County Water District	42,000
Santa Clara Valley Water District	100,000
Subtotal	**222,619**
San Joaquin Valley Area Contractors	
Dudley Ridge Water District	50,343
Empire West Side Irrigation District	2,000
Kern County Water Agency	982,730
Kings County	9,305
Oak Flat Water District	5,700
Tulare Lake Basin Water Storage District	88,922
Subtotal	**1,139,000**
Central Coastal Area Contractors	
San Luis Obispo County Flood Control and Water Conservation District	25,000
Santa Barbara County Flood Control and Water Conservation District	45,486
Subtotal	**70,486**
Southern California Area Contractors	
Antelope Valley–East Kern Water Agency	141,400
Castaic Lake Water Agency	95,200
Coachella Valley Water District	138,350
Crestline–Lake Arrowhead Water Agency	5,800
Desert Water Agency	55,750
Littlerock Creek Irrigation District	2,300
Metropolitan Water District of Southern California	1,911,500
Mojave Water Agency	82,800
Palmdale Water District	21,300
San Bernardino Valley Municipal Water District	102,600
San Gabriel Valley Municipal Water District	28,800
San Gorgonio Pass Water Agency	17,300
Ventura County Watershed Protection District	20,000
Subtotal	**2,623,100**
TOTAL TABLE A AMOUNTS	**4,171,536**

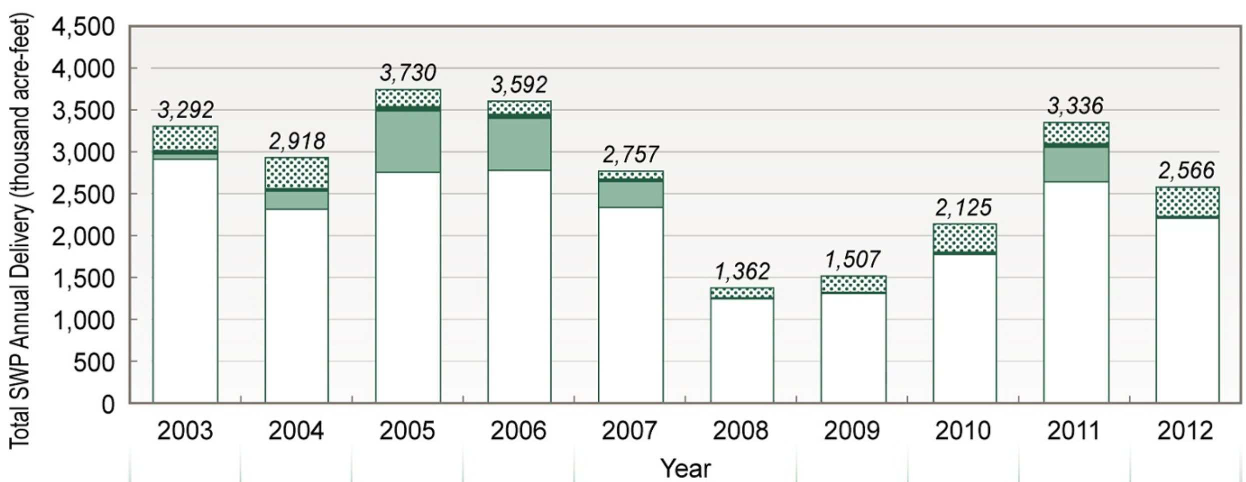


Maximum Possible SWP Table A Delivery (4,172 thousand acre-feet)

Long-term (10-year period) Average (2,226 thousand acre-feet)

Note: The differences in historical deliveries from the State Water Project Delivery Reliability Report 2011 are due to reclassification of the various components of water delivered to SWP contractors.

Figure 2-3. Historical Deliveries of SWP Table A Water, 2003–2012



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Carryover	290	370	207	160	95	110	188	333	251	350
Turnback	30	17	38	34	16	3	2	11	31	8
Article 21	60	218	731	621	310	3	6	8	421	1
Table A	2,912	2,313	2,754	2,777	2,336	1,246	1,311	1,773	2,633	2,207

Note: The differences in historical deliveries from the State Water Project Delivery Reliability Report 2011 are due to reclassification of the various components of water delivered to SWP contractors.

Figure 2-4. Total Historical SWP Deliveries, 2003–2012 (by Delivery Type)

Chapter 3

Factors that Affect Water Delivery Reliability

This chapter explains the concept of SWP water delivery reliability and how it is calculated by DWR, and describes the most important factors that combine to affect SWP water delivery reliability. Among these natural and human-created factors are the availability of source water, regulatory restrictions on SWP operations, and the effects of climate change.

Uncertainty also exists because of the potential for an emergency such as an earthquake striking in or near the Delta, which, if substantial enough, could interrupt SWP exports from the Delta. This chapter also describes various statewide efforts by DWR and other agencies to reduce risks to the Delta and enhance emergency response capabilities.

What Water Delivery Reliability Means to SWP Contractors

Water delivery reliability is the annual amount of SWP water that can be expected to be delivered to SWP contractors with a certain frequency. But what does that actually mean in practice?

In essence, it is a matter of probability—specifically, the likelihood that a contractor will receive a certain amount of water from the SWP in a particular year. From the contractor's perspective, water delivery reliability indicates an acceptable or desirable level of dependability of water deliveries to the people receiving the water. This information is vitally important to SWP contractors for their long-term water planning and operations. Will farmers have the amount of water they will need to plant permanent crops? Will urban and suburban water districts have sufficient water to serve planned development, or will they need to call for greater conservation measures by residents and businesses? These are examples of critical questions to which SWP contractors must have answers to serve their customers.

Calculating SWP Water Delivery Reliability

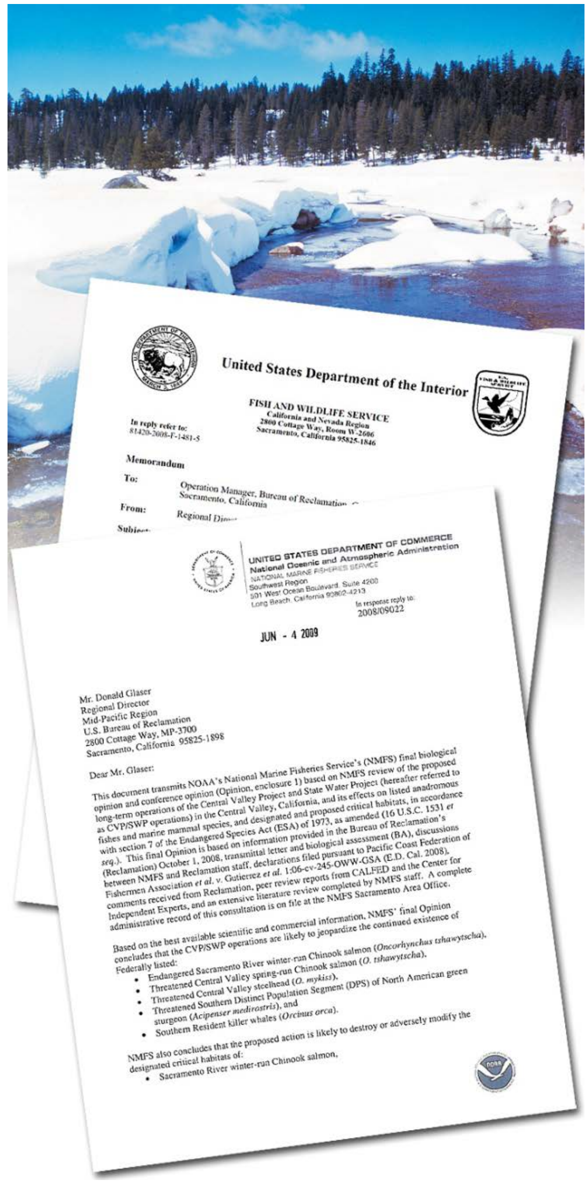
DWR calculates the water delivery reliability of the SWP using the CalSim-II computer model, which simulates existing and future operations of the SWP. No model or tool can predict what actual, natural water supplies will be for any year or years, but a system of probability can be used to calculate water delivery reliability.

The analyses of SWP delivery reliability contained in Chapters 4, 5, and 6 of this report are based on modeling conducted using 82 years of historical data (water years 1922–2003) for rainfall and runoff. Those data have been adjusted to reflect current and future levels of development in the source areas. The resulting data have been used to forecast the amount of water available to the SWP under current and future conditions (with the effects of climate change factored into the modeling for future conditions).

The annual amounts of estimated SWP water deliveries are ranked from smallest to largest; the probability that various quantities of SWP water will be delivered to each SWP contractor is estimated and listed by water type.

Factors that Can Influence the SWP's Water Delivery Reliability

Forecasting water delivery reliability is a difficult task because California is such a large state with numerous microclimates. In a typical year, some areas receive as little as 2 inches of rain, while others receive more than 100 inches. In addition, the determinants of water delivery for a specific water supply system continually change over time and can be difficult to determine and/or model. For example, water use in Sacramento River watersheds has increased over time. The historical data upon which a water supply forecast is based must be adjusted to reflect the current and, if necessary, future use in these watersheds.



Natural factors such as snowmelt and human influences such as federal biological opinions can both influence the SWP's water delivery reliability.

The following factors affect the ability to estimate existing and especially future water delivery reliability:

- water availability at the source,
- water rights with priority over the SWP,
- climate change,
- regulatory restrictions on SWP Delta exports (imposed by federal biological opinions [BOs] and State water quality plans),

- ongoing environmental and policy planning efforts, and
- Delta levee failure.

Water Availability at the Source

This factor affects the SWP's water delivery reliability because it is inherently variable. Availability of water at the source depends on the amount and timing of rain and snow that fall in any given year, the amount and timing of runoff, and the level of development (that is, the use of water) in the SWP's source areas. The location, amount, and form of precipitation in California in any given year cannot be accurately predicted, introducing the greatest uncertainty to the availability of future SWP source water and hence future SWP deliveries.

Generally, during a single dry year or two, surface water and groundwater storage can supply most water deliveries, but dry years can result in critically low water reserves.

DWR measures the water content of snowpack in the northern Sierra Nevada to forecast snowmelt runoff.

Greater reliance on groundwater during dry years results in high costs for many users and increases groundwater overdraft. Further, the ability of some contractors to use local groundwater may be limited; some groundwater basins may be contaminated by toxins such as methyl tertiary butyl ether (commonly known as MBTE), an ingredient in gasoline, and other aquifers may be too deep to reach economically. This makes the availability of the SWP's surface water to contractors especially important.

DWR manually measures snowpack in the northern Sierra Nevada monthly between early January and early May to forecast snowmelt runoff. These surveys and real-time electronic measurements taken throughout the winter measure the snowpack's water content. The size of the snowpack in the Feather River watershed on April 1—when snowpack water content normally is at its peak before the spring runoff—and the storage in Lake Oroville are key components of the SWP's delivery capabilities from April through September.

However, in some years, even measurements taken in the northern Sierra Nevada earlier in the year can demonstrate an apparent trend in water delivery reliability for the rest of the year (assuming that the weather follows typical patterns in spring). For example, manual readings conducted by DWR on December 28, 2009, off U.S. Highway 50 near Echo Summit showed snow-water equivalents in the northern mountains at 77% of normal for the date and 26% of the normal value for April 1. By contrast, the readings taken on the same date in 2010 showed snow-water equivalents in the state's northern mountains at 169% of normal for that date and 57% of the normal value for April 1. These findings indicated the potential for SWP deliveries in 2011 to increase relative to deliveries that occurred in 2010, a below-normal water year.

Water Rights with Priority Over the SWP

California's water rights system affects the SWP indirectly. There are two types of legally protected rights to surface water in California:

- *Appropriative* water rights allow the user to divert surface water for beneficial use. The user must first have obtained a permit from the State Water Resources Control Board (State Water Board), unless the appropriative water right predates 1914. Appropriative water rights may be lost if the water has gone unused for 5 years. The SWP diverts water from the Delta under appropriative water rights.
- *Riparian* water rights apply to lands traversed by or bordering on a natural watercourse. No permit is required to use this water, which must be used on riparian (adjacent) land and cannot be stored for later use.

Generally, the priority of an appropriative water right in California is "first in time, first in right"; therefore, an appropriative water right is subordinate to all prior water rights, whether appropriative or riparian. This means that if another entity with a prior water right increases its use of one of the SWP's sources of water supply—the Delta, the upstream Sacramento or San Joaquin River, or a tributary to either river—the overall amount of water available to the SWP will decrease. Thus, water users with prior water rights are assigned top priority for water in DWR's modeling of the SWP's water delivery reliability, even ahead of SWP Table A water deliveries.

Climate Change

The *California Water Plan Update 2009* identified climate change as a key consideration in planning for the State's water management. California's reservoirs and water delivery systems were developed based on historical hydrology; future weather patterns have long been assumed to be similar to those in the past. However, as climate change continues to affect California, past hydrology is no longer a reliable guide to future conditions. This section discusses effects on the SWP that could result from specific aspects of climate change.

Decreased Water Availability with Reduced Snowpack

As the effects of climate change continue, mean temperatures are predicted to increase, both globally and regionally. Climate projections used to assess the reliability of California's future water supply forecast average air temperature increases for California of about 1.8 to 5.4 degrees by the middle of the 21st century and 3.6 to 9 degrees by the end of the century (Cayan et al. 2009:Figure 3; DWR 2013:Figure 5-5). Climate change is anticipated to bring warmer storms that result in less snowfall at lower elevations, reducing total snowpack. Loss of snowpack is projected to be greater in the northern Sierra Nevada—and thus closer to the Feather River watershed, the origin of SWP water—than in the southern Sierra Nevada because of the relative proportions of land at low and middle elevations.

Snowmelt provides an average of 15 million acre-feet of water for California per year, slowly released from about April to July each year (DWR 2006:2-22; DWR 2013:3-29). Much of the state's water infrastructure, including the SWP, was designed to capture slow spring runoff and deliver it during the drier summer and fall months. However, during the 20th century, the average early-spring snowpack in the Sierra Nevada decreased by about 10%, resulting in the loss of 1.5 million acre-feet of snowpack storage (DWR 2008:3). Using historical data and modeling, DWR projects that by 2050 the Sierra snowpack will be reduced from its historical average by 25% to 40% (DWR 2008:4). Increased precipitation falling as rain instead of snow during winter could result in a larger number of "rain-on-snow" events. This would cause the snow to melt earlier in the year and over fewer days than historically, thus adversely affecting availability of water for pumping by the SWP during summer.

Such reductions in snowpack could have dire consequences. Under climate change and in some years, water levels in Lake Oroville, the SWP's main supply reservoir, could fall below the lowest release outlets, making the system vulnerable to operational interruption. DWR expects that a water shortage worse than the one during the 1977 drought could occur in 1 out of every 6–8 years by the middle of the 21st century and in 1 out of every 3–4 years at the end of the century (California Climate Change Center 2009a:46). In those years, it is estimated that an additional 575,000–850,000 acre-feet per year of water would be needed to meet current regulatory requirements and to maintain minimum system operations (California Climate Change Center 2009a:Table 1). This could preclude the SWP from pumping as much water as it would otherwise.

Climate change is also expected to reduce the SWP's median reservoir carryover storage. Carryover water is like a water savings account for water managers to use during shortage periods. Thus, a climate change–generated reduction in the amount of carryover water available to SWP contractors would reduce the system's flexibility during dry and critical water years.

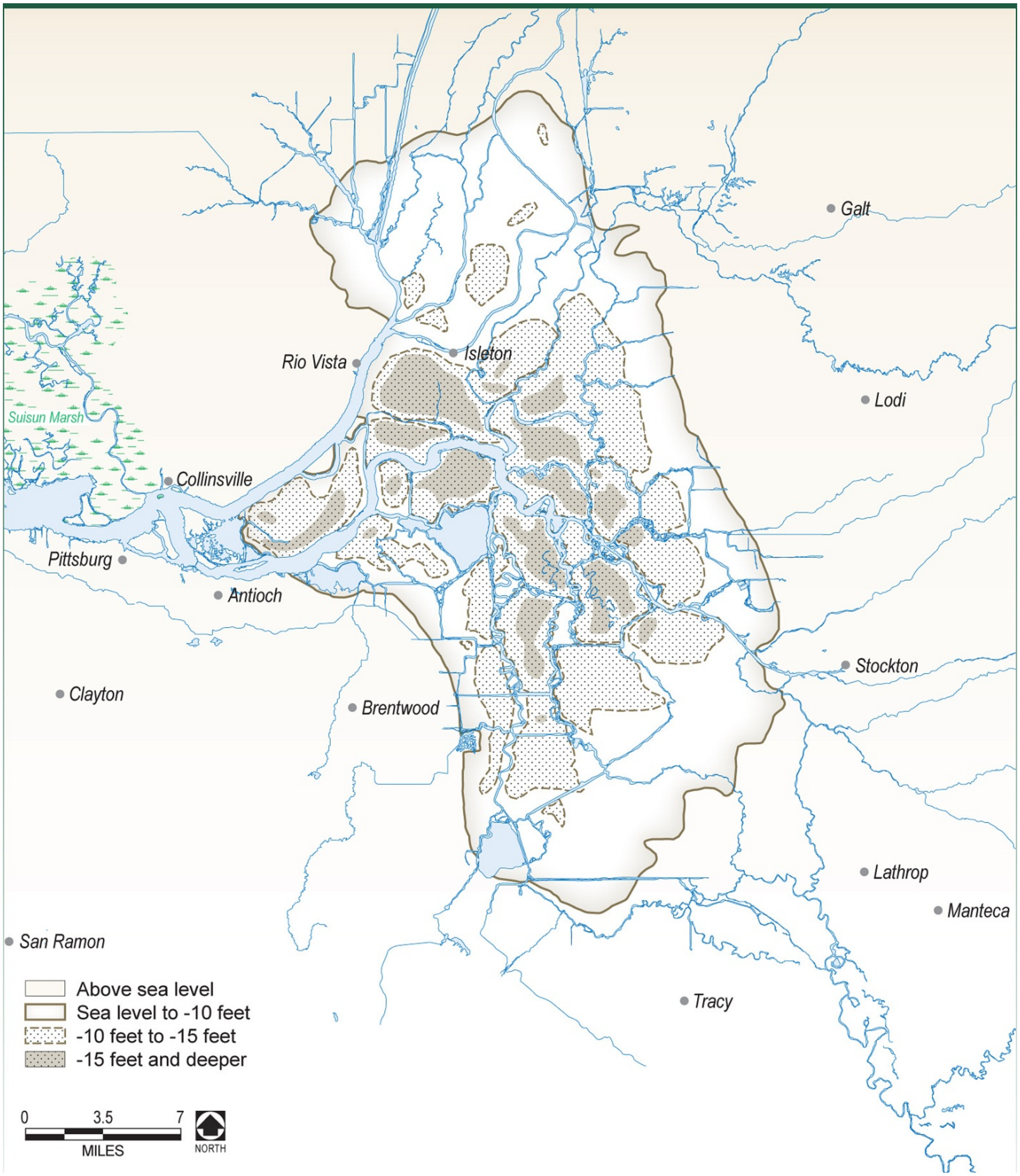
Increased SWP Water Demands

Even as water shortages may result from reduced snowpack, climate change may also cause water demand by SWP contractors to increase. Warmer temperatures may increase evapotranspiration rates (loss of water from soil by evaporation and plant transpiration) and may extend growing seasons. A larger amount of water may be needed for irrigation of certain crops, urban landscaping, and environmental needs. Warmer temperatures will also increase evaporation from surface reservoirs. Reduced soil moisture and surface flow will disproportionately affect the environment and other water users that rely heavily on annual rainfall such as rain-fed agriculture, livestock grazing on non-irrigated rangeland, and recreation.

Sea Level Rise

During the last century, sea level rose 7 inches along California's coast. Continued increases in sea levels could affect SWP water delivery reliability in several ways (Cayan et al. 2009:Figure 17):

- Most of the land in the Delta is below sea level—by as much as 20 feet—as a consequence of ongoing subsidence (Figure 3-1). Increases in sea level could place more pressure on the Delta's already fragile levee system and, as a consequence, cause levee breaches that could threaten SWP Delta exports.
- As salty water from the Pacific Ocean moves farther upstream into the Delta, DWR could be required to increase the amounts of freshwater releases from Lake Oroville to maintain compliance with Delta water quality standards.
- Sea level rise is expected to cause salt water to flow farther inland. The resulting increase in saltwater intrusion into coastal aquifers would make increasing amounts of groundwater unsuitable for water supply or irrigation (California Climate Change Center 2009b:80–81). The reduced availability of groundwater would likely contribute to further increases in demands for surface water from the SWP, especially by the coastal SWP contractors.



Source: DWR 1995:28

Figure 3-1. Areas of the Delta that Have Subsided to Below Sea Level

Regulatory Restrictions on SWP Delta Exports

Multiple needs converge in the Delta: to protect a fragile ecosystem, to support Delta recreation and farming, and to provide water for agricultural and urban needs throughout much of California. Various regulatory requirements are placed on the SWP's Delta operations to protect special-status species such as delta smelt and spring- and winter-run Chinook salmon. As a result, as described below, restrictions on SWP operations imposed by State and federal agencies contribute substantially to the challenge of accurately determining the SWP's water delivery reliability in any given year.

Biological Opinions on Effects of Coordinated SWP and CVP Operations

Several fish species listed under the federal Endangered Species Act (ESA) as endangered or threatened are found in the Delta. The continued viability of populations of these species in the Delta depends in part on Delta flow levels. For this reason, the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) have issued several BOs since the 1990s on the effects of coordinated SWP/CVP operations on several species. These BOs include terms that affect the SWP's water delivery reliability primarily by restricting SWP pumping levels under certain conditions in the Delta.

The first BOs on the effects of SWP (and CVP) operations were issued in February 1993 (NMFS BO for winter-run Chinook salmon) and March 1995 (USFWS BO for delta smelt and splittail). Among other things, the BOs contained requirements for Delta inflow, Delta outflow, and reduced export pumping to meet specified incidental take limits. (See the definition of "incidental take permit" in the Glossary of this report.) These fish protection requirements imposed substantial constraints on Delta water supply operations. Many BO terms were incorporated into the *1995 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta* (1995 WQCP), as described in the "Water Quality Objectives" section later in this chapter.

The terms of the USFWS and NMFS BOs have become increasingly restrictive in recent years. In December 2008, USFWS issued a new BO covering effects of the SWP and CVP on delta smelt, and in June 2009, NMFS issued a BO covering effects on winter-run and spring-run Chinook salmon, steelhead, green sturgeon, and killer whales. These BOs replaced BOs issued earlier by the federal agencies.

The USFWS BO includes additional requirements in all but 2 months of the year. The BO calls for "adaptively managed" (adjusted as necessary based on the results of monitoring) flow restrictions in the Delta intended to protect delta smelt at various life stages. USFWS determines the required target flow, with the reductions accomplished primarily by reducing SWP and CVP exports. Because this flow restriction is determined based on fish location and decisions by USFWS staff, predicting the flow restrictions and corresponding effects on export pumping with any great certainty poses a challenge. The USFWS BO also includes an additional salinity requirement in the Delta for September and October in wet and above-normal water years, calling for increased releases from SWP and CVP reservoirs to reduce salinity. Among other provisions included in the NMFS BO, limits on total Delta exports have been established for the months of April and May. These limits are mandated for all but extremely wet years.

The 2008 and 2009 BOs were issued shortly before and shortly after the Governor proclaimed a statewide water shortage state of emergency in February 2009, amid the threat of a third consecutive dry year. NMFS calculated that implementing its BO would reduce SWP and CVP Delta exports by a combined 5% to 7%, but DWR's initial estimates showed an impact on exports closer to 10% in average years, combined with the effects of pumping restrictions imposed by BOs to protect delta smelt and other species. Both the 2008 USFWS and 2009 NMFS BOs were challenged in federal court on various grounds, including the failure by USFWS and NMFS to use the best available science in the development of the BOs. U.S. District Judge Oliver Wanger found that both BOs were not legally sufficient and remanded them to the agencies for further review and analysis. However, the operational rules specified in the 2008 and 2009 BOs continue to be legally required and are the rules used in the analyses presented in Chapters 4, 5, and 6 of this report.

The California Department of Fish and Game, now called the California Department of Fish and Wildlife, issued consistency determinations for both BOs under Section 2080.1 of the California Fish and Game Code. The consistency determinations stated that the USFWS BO and the NMFS BO would be consistent with the California Endangered Species Act (CESA). The consistency determination allowed incidental take of species listed under both the federal ESA and CESA to occur during SWP and CVP operations without requiring DWR or the U.S. Bureau of Reclamation to obtain a separate State-issued permit.

Specific restrictions on Delta exports associated with the USFWS and NMFS BOs and their effects on SWP pumping levels are described further in Chapter 4, "SWP Delta Exports," of this report.

Delta Inflows

Delta inflow varies considerably from season to season, and from year to year. For example, in an above-normal year, nearly 85% of the total Delta inflow comes from the Sacramento River, more than 10% comes from the San Joaquin River, and the rest comes from three eastside streams (the Mokelumne, Cosumnes, and Calaveras Rivers) (Figure 3-2).

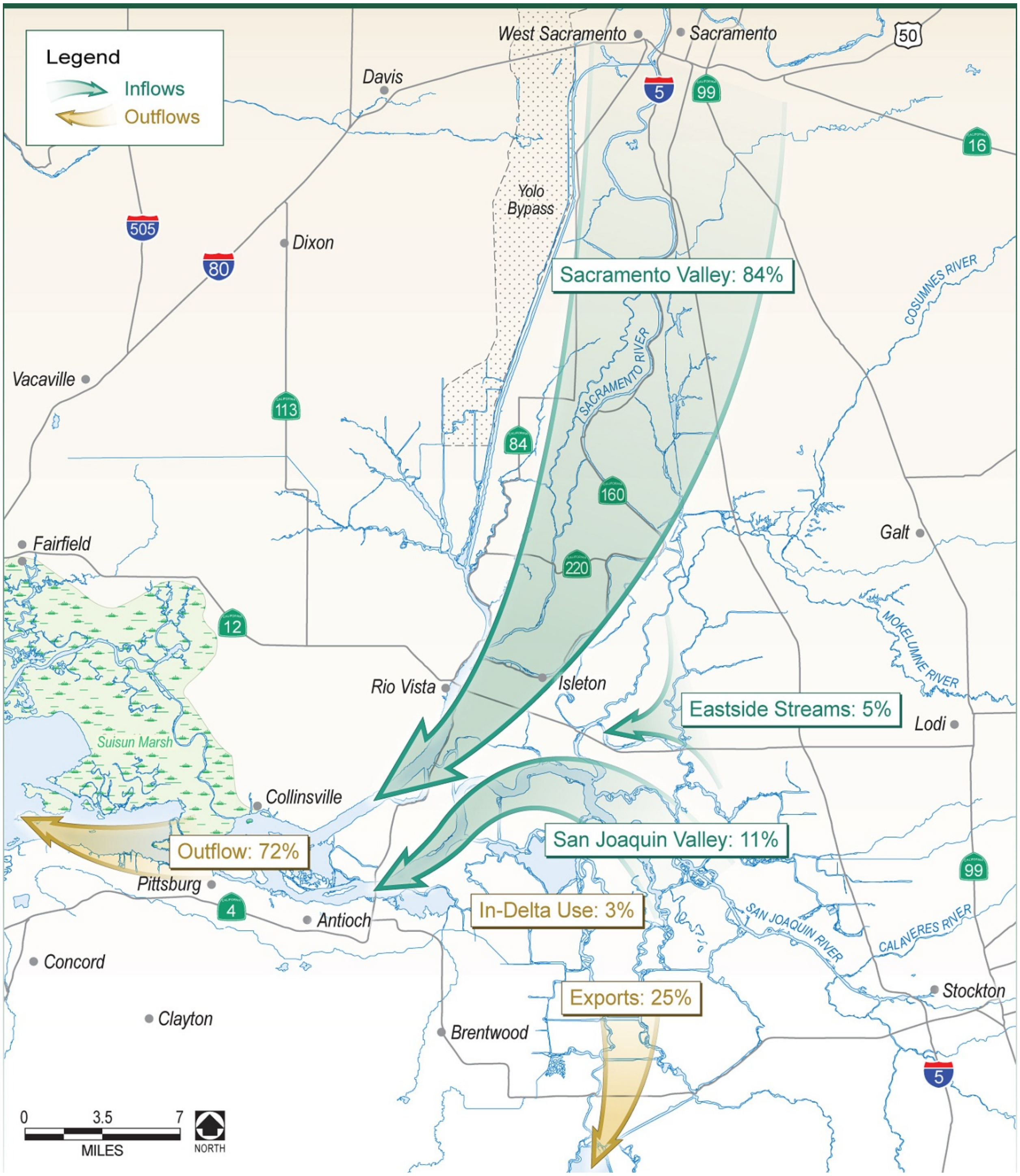
The type of water year is also an important factor affecting the volume of Delta inflows. When hydrology is analyzed, water years are designated by DWR as "wet," "above normal," "below normal," "dry," or "critical." All other factors (such as upstream level of development) being equal, much less water will flow into the Delta during a dry or critical water year (that is, during a drought) than during a wet or above-normal water year. Fluctuations in inflows are a substantial overall concern for the Delta, and a specific concern for the SWP; such fluctuations affect Delta water quality and fish habitat, which in turn trigger regulatory requirements that constrain SWP Delta pumping.

Delta inflows will also vary by time of year because the amount of precipitation varies by season. About 80% of annual precipitation occurs between November and March, and very little rain typically falls from June through September. Upstream reservoirs dampen this variability by reducing flood flows during the rainy season, and storing water to be released later in the year to meet water demands and flow and water quality requirements.

Water Quality Objectives

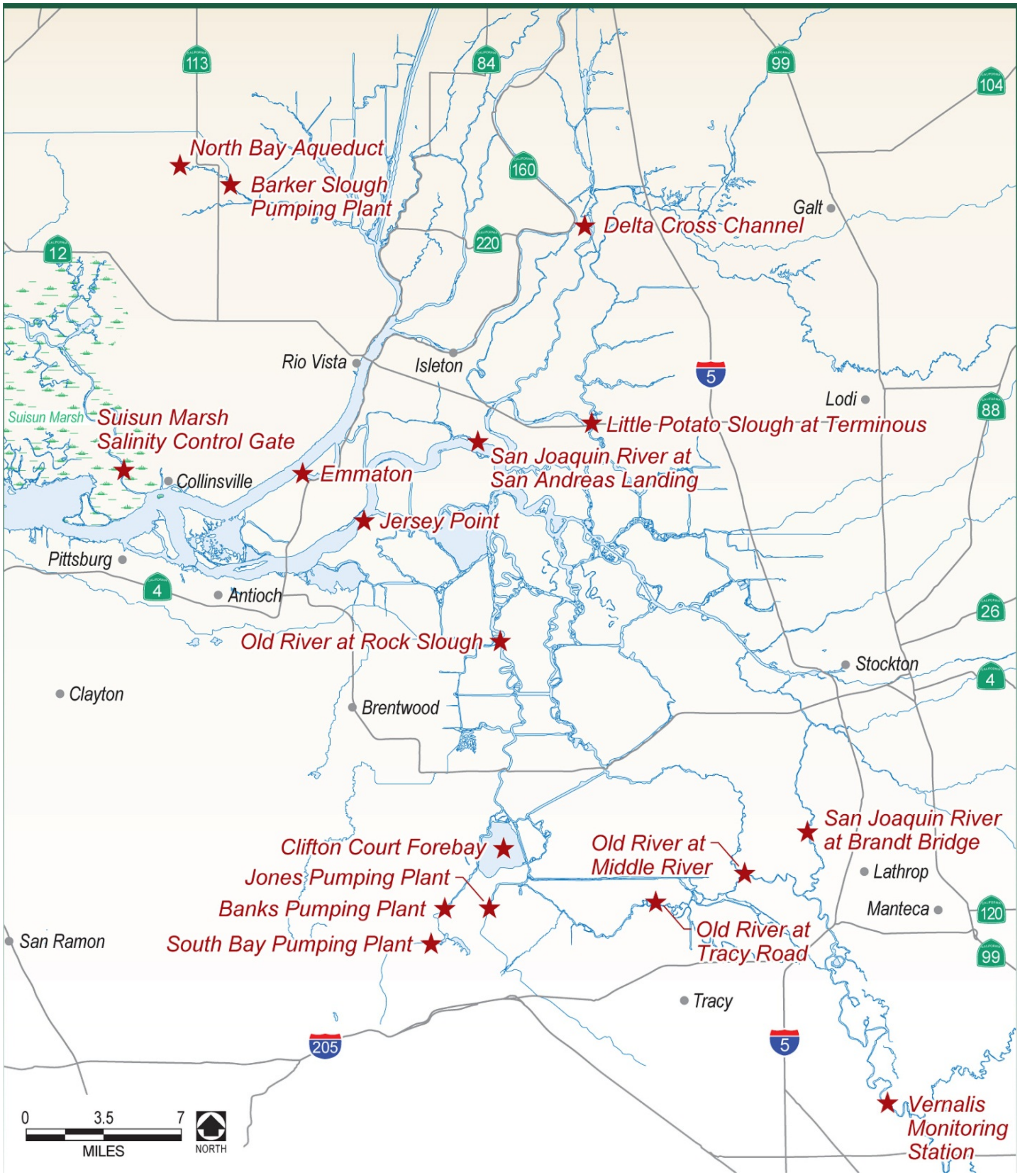
Because the Delta is an estuary, salinity is a particular concern. In the 1995 WQCP, the State Water Board set water quality objectives to protect beneficial uses of water in the Delta and Suisun Bay. The objectives must be met by the SWP (and federal CVP), as specified in the water right permits issued to DWR (and the U.S. Bureau of Reclamation). Those objectives—minimum Delta outflows, limits on SWP and CVP Delta exports, and maximum allowable salinity levels—are enforced through the provisions of the State Water Board's Water Right Decision 1641 (D-1641), issued in December 1999 and updated in March 2000.

DWR and Reclamation must monitor the effects of diversions and SWP and CVP operations to ensure compliance with existing water quality standards. Monitoring stations are shown in Figure 3-3.



Source: DWR 2011a

Figure 3-2. Water Year 2000 (Above-Normal) Delta Water Balance (Percent of Total)



Source: Data provided by DWR in 2011 and 2013

Figure 3-3. Delta Salinity Monitoring Locations of Importance to the SWP

Among the objectives established in the 1995 WQCP and D-1641 are the "X2" objectives. D-1641 mandates the X2 objectives so that the State Water Board can regulate the location of the Delta estuary's salinity gradient during the months of February–June. X2 is the position in the Delta where the electrical conductivity (EC) level, or salinity, of Delta water is 2 parts per thousand. The location of X2 is used as a surrogate measure of Delta ecosystem health.

For the X2 objective to be achieved, the X2 position must remain downstream of Collinsville in the Delta (shown in Figure 3-3) for the entire 5-month period, and downstream of other specific locations in the Delta on a certain number of days each month from February through June. This means that Delta outflow must be at certain specified levels at certain times, which can limit the amount of water the SWP may pump at those times at its Harvey 0. Banks Pumping Plant in the Delta.

Because of the relationship between seawater intrusion and interior Delta water quality, meeting the X2 objective also improves water quality at Delta drinking water intakes; however, meeting the X2 objectives can require a relatively large volume of water for outflow during dry months that follow months with large storms.

The 1995 WQCP and D-1641 also established an export/inflow (E/I) ratio. The E/I ratio, presented in Table 3 of the 1995 WQCP (SWRCB 1995:18-22), is designed to provide protection for the fish and wildlife beneficial uses in the Bay Delta estuary (SWRCB 1995:15). The E/I ratio limits the fraction of Delta inflows that are exported. When other restrictions are not controlling, Delta exports are limited to 35% of total Delta inflow from February through June and 65% of inflow from July through January.

Ongoing Environmental and Policy Planning Efforts

As discussed earlier, the Delta is an essential part of the conveyance system for the SWP. SWP pumping at the Banks Pumping Plant is regulated to protect the many uses of the Delta. However, today's uses in the Delta are not sustainable over the long term under current management practices and regulatory requirements. As discussed below, two large-scale plans for the Delta that are currently being developed could affect SWP water delivery reliability: the Delta Plan and the Bay Delta Conservation Plan (BDCP).

Delta Plan

After years of concern about the Delta amid rising water demand and habitat degradation, the Delta Stewardship Council was created in legislation to achieve State-mandated coequal goals for the Delta. As specified in Section 85054 of the California Water Code:

> "Coequal goals" means the two goals of providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem. The coequal goals shall 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.

The final Delta Plan was adopted by the Delta Stewardship Council on May 16, 2013. The Delta Plan contains a set of 14 regulatory policies that will be enforced by the council through its appellate authority and oversight. The Delta Plan also contains 73 recommendations, which are non-regulatory but call out actions essential to achieving the coequal goals.

The State Office of Administrative Law subsequently approved the 14 regulations to implement the Delta Plan, effective September 1, 2013. Among these are policies that:

- require those who use water from the Delta to certify in their water management plans that they are implementing all feasible efforts to use water efficiently and are developing additional local and regional water supplies;
- reserve six high-priority areas for habitat restoration;
- protect agricultural land by requiring developers to locate new residential, commercial, or industrial development in areas planned for urban use;
- require State and local agencies to locate, when feasible, their water management facilities, ecosystem projects, and flood management infrastructure in ways that would reduce or avoid conflicts with agriculture and other existing planned uses;
- further require those agencies to consider locating their facilities on public land before using private land;
- prohibit encroachment on floodways and floodplains;
- require developers of new residential subdivisions to include a level of flood protection that anticipates sea level rise caused by climate change; and
- set priorities for State investment in Delta flood levees.

The Delta Plan includes recommendations to:

- update statewide water-use efficiency goals and groundwater management plans for areas using Delta water, streamline water transfer procedures, and develop a statewide system for reporting how much water is used;
- have the State Water Board update water quality objectives for the Sacramento and San Joaquin Rivers; control or reduce other Delta stressors such as contaminants and invasive species, expand floodplains and riparian habitats, and locate habitat restoration to accommodate sea level rise;
- encourage agritourism, wildlife-friendly farming practices, and recreational opportunities in the Delta; and
- create a Delta flood risk management district to provide adequate funding for flood control and emergency preparedness.

Bay Delta Conservation Plan

The BDCP is a comprehensive plan being developed by a group of water agencies, environmental and conservation organizations, State and federal agencies, and other interest groups. The plan seeks to address a wide array of challenges in the Delta that California's water community has faced for decades.

The BDCP is being developed in compliance with the federal ESA and the California Natural Communities Conservation Planning Act. When complete, the BDCP will provide the basis for issuing endangered species permits to operate the SWP and CVP. Through the BDCP, project proponents agree to implement a suite of habitat restoration measures, other stressor-reduction activities, and water operations criteria in return for the approval by regulatory agencies of the long-term permits required for projects and water operations ("covered activities") to proceed. The heart of the BDCP is a long-term conservation strategy that sets forth actions needed for a healthy Delta.

The BDCP's approach to addressing Delta challenges departs substantially from previous efforts to manage Delta-specific species and habitats, which used a species-by-species approach. In contrast, the BDCP seeks to improve the health of the ecological system as a whole. Each conservation measure plays a part in an interconnected web of conservation activities designed to improve the health of natural communities and, in so doing, to improve the overall health of the Delta ecosystem. A key component of the BDCP is a new dual conveyance system to create options that would move water through the Delta's interior or around the Delta through an isolated conveyance facility. The BDCP participants are evaluating how these water "operations" could be guided by new rules designed to be helpful for fish, but also to ensure sufficient water flows through the Delta to protect water quality and other habitat. Dual conveyance has the potential for providing the most options to meet the BDCP's planning goals, and also for addressing the threat of levee failure posed by earthquakes and the effects of climate change. These new rules are detailed requirements designed to provide improved habitat conditions for fish, but also help meet other objectives such as reducing fish "entrainment" and minimizing further restrictions at the existing SWP and CVP pumping facilities.

The BDCP will be implemented over a 50-year time frame by several agencies and organizations with specific, prescribed roles and responsibilities. A major part of plan implementation will be monitoring conservation measures to evaluate their effectiveness, and revising actions through the adaptive management decision-making process.

The BDCP has been in development since 2006. A State environmental impact report (EIR) and federal environmental impact statement (EIS) is being prepared to evaluate the BDCP's impacts on the environment, including the human environment, and to identify alternatives and potential mitigation actions. (For more information about the EIR/EIS process, see http://baydeltaconservationplan.com/EnvironmentalReviewProcess/AboutTheEIR.aspx.)

The draft EIR/EIS is planned to be released for public review in late 2013. The report is targeted to be final in mid-2014, after which a decision to proceed with the program would be made.

Delta Levee Failure

The fragile Delta faces a multitude of risks that could affect millions of Californians. Foremost among those risks, as they could affect the SWP's water delivery reliability, are the potential for levee failure and the ensuing flooding and water quality issues.

The Delta is protected by levees built about 150 years ago. The levees are vulnerable to failure because most original levees were simply built with soils dredged from nearby channels, and were never engineered. Most islands in the Delta have flooded at least once over the past 100 years. For example, on June 3, 2004, a huge dry-weather levee failure occurred without warning on Upper Jones Tract in the south Delta, inundating 12,000 acres of farmland with about 160,000 acre-feet of water. Because many Delta islands are below sea level, deep and prolonged flooding could occur during a levee failure event, which could disrupt the quality and use of Delta water.

Many vulnerable Delta levees require installation of rock revetments, riprap, or other engineered structures along eroding banks to reduce erosion and protect levee foundations.

Levee failure can result from the combination of high river inflows, high tide, and high winds; however, levees can also fail in fair weather—even in the absence of a flood or seismic event—in a so-called "sunny day event." Damage caused by rodents, piping (in which a pipe-like opening develops below the base of the levee), or foundation movement could cause sunny-day levee breaches.

A breach of one or more levees and island flooding may affect Delta water quality and SWP operations. Depending on the hydrology and the size and locations of the breaches and flooded islands, a large amount of salt water may be pulled into the interior Delta from Suisun and San Pablo Bays. When islands are flooded, DWR may need to drastically decrease or even cease SWP Delta exports to evaluate the distribution of salinity in the Delta and avoid drawing saltier water toward the pumps.

An earthquake could also put Delta levees, and thus SWP water supplies, at risk. The 2007 Working Group on California Earthquake Probabilities estimated a probability of 63% that a magnitude 6.7 or greater earthquake would strike the San Francisco Bay Area in the next 30 years (WGCEP 2008:6). An earthquake could severely damage Delta levees, causing islands to flood with salty water. The locations most likely to be affected by an earthquake are the west and southwest portions of the Delta because these areas are closer to potential earthquake sources. Flooding of the west and southwest Delta is also more likely to interfere with conveyance of freshwater to export pumps (DWR 2007:17).

Delta levees are prone to failure, increasing risks to State water supplies.

Effects of Emergencies on Water Supplies:

The Delta Risk Management Strategy (DRMS) was initiated in response to Assembly Bill 1200 (2005), which directed DWR to evaluate the potential effects on Delta water supplies associated with continued land subsidence, earthquakes, floods, and climate change. Using information developed by DRMS, the *California Water Plan Update 2009* reported a 40% probability that a major earthquake occurring between 2030 and 2050 would cause 27 or more islands to flood at the same time. If 20 islands were flooded as a result of a major earthquake, the export of freshwater from the Delta could be interrupted by about a year and a half (DWR 2009:5-15). Water supply losses of up to 8 million acre-feet would be incurred by SWP (and CVP) contractors and local water districts.

The Phase 2 report for the DRMS evaluated alternatives to reduce the risk to the Delta and the state from adverse consequences of levee failure (DWR 2011b). Three main categories of "building blocks" were used to formulate alternatives:

- conveyance improvements/flood risk reduction and life safety,
- infrastructure risk reduction, and
- environmental risk mitigation.

The first category is most relevant to the SWP in terms of reducing the risk of disruption of SWP Delta exports, but the environmental risk mitigation category includes reducing water exports from the Delta.

Four risk reduction strategies evaluated by DRMS were as follows:

- *Improved Levees:* Improve the reliability of Delta levees against flood-induced failures by providing up to 100-year flood protection. This strategy would not reduce the risk of potential water export interruptions or change the seismic risk of most levees.

- *Armored Pathway (Through-Delta Conveyance):* Improve the reliability of water conveyance by creating a route through the Delta that has high reliability and the ability to minimize saltwater intrusion into the south Delta. This strategy would reduce the likelihood of levee failures from flood events and earthquakes and would significantly reduce the likelihood of export disruptions.
- *Isolated Conveyance Facility:* Provide high reliability for conveyance of export water by building an isolated conveyance facility on the east side of the Delta. This strategy would not reduce the seismic risk of levee failure on islands that are not part of the isolated conveyance facility.
- *Dual Conveyance:* Improve reliability and flexibility for conveyance of export water by constructing an isolated conveyance facility and a through-Delta conveyance. This strategy would avoid the vulnerability of water exports associated with Delta levee vulnerability and would offer flexibility in water exports from the Delta and/or the isolated conveyance facility. However, seismic risk would not be reduced on islands not part of the export conveyance system or infrastructure pathway.

A promising strategy for resuming water exports after a levee failure would involve placing structural barriers at selected channel locations in the Delta and completing strategic levee repairs to isolate an emergency freshwater conveyance "pathway" (Moffatt and Nichol 2007, cited in DWR 2011a:5-1).

The DRMS study was the first comprehensive risk-based assessment of Delta levee failure and potential consequences to the State. Since the completion of the DRMS report, several projects funded under the Delta Knowledge Improvement Program have been completed to fill the data gaps identified in DRMS. A goal of the Delta Knowledge Improvement Program is to complete bathymetry surveys of the entire Delta. Approximately 15% of the Delta has been surveyed thus far. Potential future projects include compiling in-Delta wind data, conducting wind wave modeling of the Delta, characterizing the soil chemistry of Delta islands to assess levee failures, and supporting hydrology modeling to determine impacts on the Delta from climate change.

Delta Flood Emergency Preparedness, Response, and Recovery Program and Delta Multi-Hazard Coordination Task Force

In the last 5 years, DWR has worked to improve its ability to respond quickly and effectively to simultaneous levee failures on multiple islands within the Delta. *The Delta Emergency Operations Plan Concept Paper* released in April 2007 (DWR 2007) was the initial product of this effort. To enhance the State's ability to prepare for, respond to, and recover from a catastrophic Delta levee failure, DWR subsequently began development of the Delta Flood Emergency Preparedness, Response, and Recovery Program. The goal is to protect lives, property, and critical infrastructure in the Delta while minimizing impacts on the ecosystem. The primary components of the program are:

- develop DWR's Delta Flood Emergency Management Plan,
- facilitate multi-agency coordination with other Delta flood emergency response agencies, and
- design and implement flood emergency response facilities within the Delta.

The Delta Flood Emergency Management Plan, currently in preparation, will describe DWR's policies and actions relating to flood emergency in the Delta, especially relating to potential or actual failure of Delta levees. The plan will describe DWR's concept of operations for Delta flood emergencies, including the roles and responsibilities of the Division of Flood Management, Division of Operations and

Maintenance, Division of Engineering, and Executive Division.

Levee failures and their costly consequences can often be avoided through vigilance, preparedness, and rapid responses to levee emergencies. Local Maintaining Agencies are responsible for maintaining, patrolling, and responding to levee emergencies, but State and federal agencies are often called upon to provide assistance under the State's Standardized Emergency Management System and the federal National Incident Management System, respectively. The intent of the coordination effort is to provide a coordinated and effective multi-agency response during a large-scale Delta flood emergency, with DWR working in concert with other local, State, and federal agencies.

The Delta Flood Emergency Facilities Improvement Project has been proposed to provide DWR with the physical resources to quickly respond to and recover from catastrophic levee failures in the Delta. This would include site acquisition, construction, and material stockpiles. CEQA compliance has been completed and purchase and lease agreements for the proposed facilities at Stockton, Rio Vista, and Brannan Island State Recreation Area are being developed with the property owners, the Central Valley Flood Protection Board, and the California Department of Parks and Recreation, respectively.

The program is also supporting a $5 million Flood Emergency Response Grant Project Solicitation Package to improve local flood emergency response in the Delta region. Under this grant program, DWR will provide financial assistance through a grant agreement with participating agencies to ensure that local agencies have a robust flood emergency plan in place with adequate flood preparedness and response capacity, and will assist counties in the Delta to satisfy a requirement of the Central Valley Flood Protection Act of 2008 by the July 2014 deadline.

Chapter 4
SWP Delta Exports



The purpose of this chapter is to illustrate the effects of factors described in Chapter 3, "Factors that Affect Water Delivery Reliability," on SWP water supplies transferred through the Delta and pumped at the Harvey O. Banks Pumping Plant in the south Delta, i.e., "Delta exports." This chapter also describes how regulatory requirements and climate change have affected or will affect the SWP's Delta water supplies, shows the general pattern of monthly SWP exports from the Delta and focuses on Delta exports associated with the SWP, not on CVP exports through the Banks Pumping Plant via the CVP/SWP joint point of diversion.

The difference between Delta exports and SWP deliveries is explained, and trends in projected average annual exports and SWP Table A water deliveries under various recent existing-conditions scenarios are described. In addition, monthly exports estimated for this 2013 Report are compared with those estimated for the *State Water Project Delivery Reliability Report 2005* (2005 Report) to illustrate the effect of regulatory restrictions.

This chapter also summarizes the primary factors influencing the SWP's Delta export operations and deliveries, presents estimates of exports for the existing-conditions and future-conditions scenarios, and characterizes the likelihood of such exports. Estimated SWP Delta exports by water year type are depicted relative to exports that were estimated for the existing-conditions and future-conditions scenarios in the 2011 Report.

SWP Delta Exports versus SWP Deliveries

SWP Delta exports and SWP deliveries are characterized in separate chapters (this chapter for Delta exports, Chapters 5 and 6 for SWP deliveries) because these two terms are not one and the same.

Water pumped from the Delta is the primary source of SWP supply for 24 of the 29 SWP water contractors listed in Chapter 2, "State Water Project and Water Delivery Contracts." (Occasionally, during very wet periods, flood flows can enter the California Aqueduct and contribute to SWP supply south of the Delta.) As used in this report, "Delta exports" are the water supplies that are transferred ("exported") directly to SWP contractors or to San Luis Reservoir storage via the Banks Pumping Plant.

SWP Delta exports do not include deliveries of SWP water to the two North Bay Area contractors, which receive SWP water pumped by the Barker Slough Pumping Plant and conveyed by the North Bay Aqueduct. (Water conveyed to the SWP's three Feather River Area contractors is not transferred through the Delta and is not the focus of this chapter or of Chapters 5 and 6.)

By contrast, SWP Table A water deliveries from the Delta include both water pumped by the Banks Pumping Plant and conveyed by the California Aqueduct and water pumped by the Barker Slough Pumping Plant and conveyed by the North Bay Aqueduct. Thus, Table A water deliveries, as described in Chapters 5 and 6, also include deliveries to the two North Bay Area contractors, for a total of 26 SWP contractors.

SWP Delta exports include nearly all types of SWP water, not merely Table A water (see the explanation of SWP water types in Chapter 2). As allowed under the SWP's water supply contracts, the amount pumped from the Delta can be exported in the same year as Table A water, or can be exported as Article 21 water if available. A contractor can opt to have exported Table A water held in San Luis Reservoir as carryover water—that is, as part of the contractor's supply for a subsequent year—or made available to another SWP contractor as turnback pool water. Article 21 water must be delivered immediately to SWP contractors when exported and cannot be stored in SWP facilities.

Recent Trends in SWP Delta Exports and Table A Deliveries

SWP Delta exports and Table A deliveries estimated for this 2013 Report are reduced by the operational restrictions imposed on the SWP by the BOs issued by USFWS in December 2008 and NMFS in June 2009. This same scenario occurred in the 2011 Report. By contrast, the *State Water Project Delivery Reliability Report 2007* (2007 Report) incorporated interim, less restrictive operational rules established by U.S. District Judge Oliver Wanger in December 2007 while the USFWS and NMFS BOs were rewritten. The 2005 Report was based on much less restrictive operational rules contained in the BOs that had been issued in late 2004 and 2005.

Overall trends in both SWP Delta exports and Table A deliveries under existing conditions are summarized below. (For further detail on estimated SWP Table A deliveries for the existing-conditions and future-conditions scenarios, respectively, see Chapters 5 and 6.)

Annual Exports and Table A Deliveries—2005–2013 Scenarios

Figure 4-1 illustrates the effect of the operational restrictions imposed by the USFWS and NMFS BOs on estimated average annual Delta exports and Table A water deliveries. The figure depicts the average values estimated for existing conditions in the 2005, 2007, 2009, 2011, and 2013 Reports.

As shown in Figure 4-1, estimated average annual Delta exports and SWP Table A water deliveries have generally decreased since 2005, when rules affecting SWP pumping operations began to become more restrictive. Under existing conditions, estimated average annual Delta exports have decreased since 2005 from 2,958 taf/year to 2,612 taf/year in 2013, a decrease of 346 taf or 11.7%; average annual Table A deliveries have decreased since 2005 from 2,818 taf/year to 2,553 taf/year in 2013, a decrease of 265 taf or 9.4%. The reasons for these decreases are described under "Primary Factors Affecting SWP Delta Export Operations and Table A Water Deliveries" below.

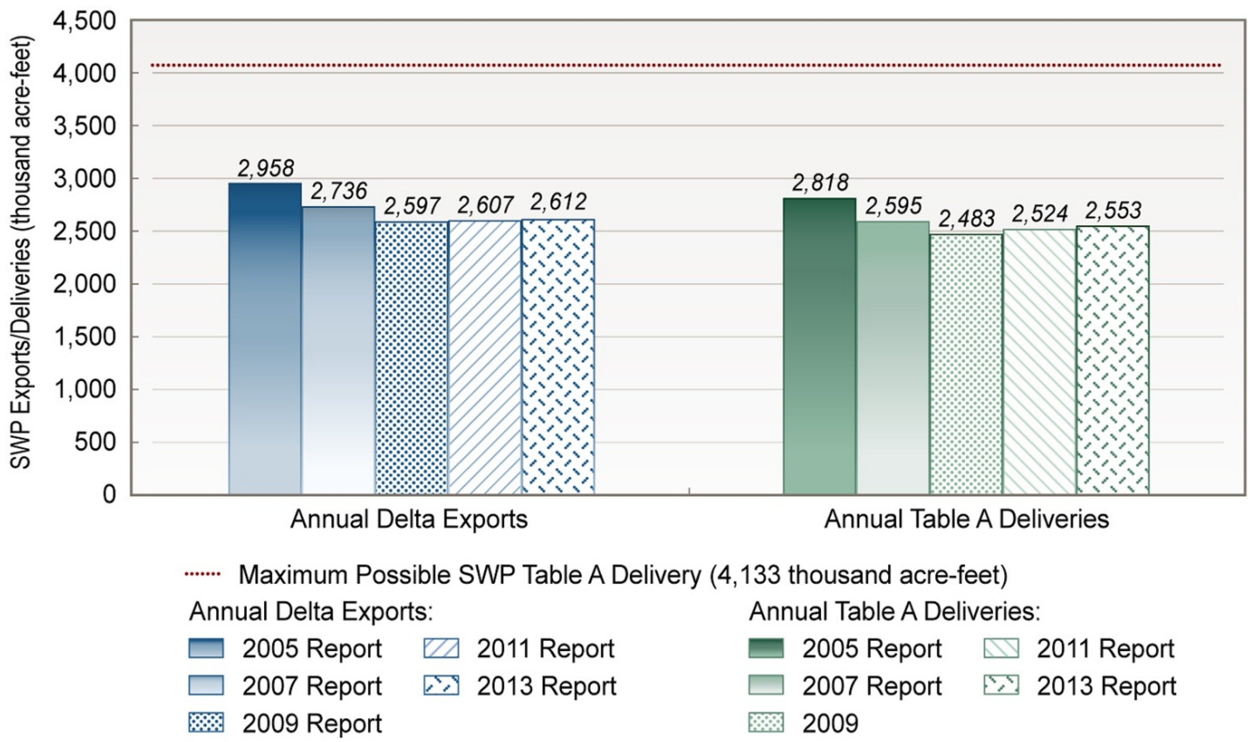


Figure 4-1. Trends in Estimated Average Annual Delta Exports and SWP Table A Water Deliveries (Existing Conditions)

Monthly Delta Exports—2013 Scenario versus 2005 Scenario

Figure 4-2 illustrates the effects of the operational restrictions imposed by the BOs on SWP Delta exports since 2005 by comparing monthly existing-conditions exports estimated for this 2013 Report with those estimated for the 2005 Report. The bar charts show the average exports for each month under each scenario estimated for both reports.

As shown in Figure 4-2, average monthly SWP Delta exports estimated for the 2013 Report are lower than those estimated for the 2005 Report both in the first half of the year and from October through December. The reductions in exports for January through June are substantial, ranging from 21% in June to 55% in April. Exports for July through September as estimated for the 2013 Report exceed those estimated for the 2005 Report, but the increases (45% in July, 18% in August, and 20% in September) are generally smaller than the reductions seen earlier in the year.

Compiling the monthly average values for exports for the entire year under each scenario reveals that, as indicated previously in the description of annual exports, the average annual exports estimated for the 2013 Report are 11.7% less than those estimated for the 2005 Report.

Primary Factors Affecting SWP Delta Export Operations and Table A Water Deliveries

Under current operational constraints on the SWP, maximum exports from the Banks Pumping Plant are generally limited to 6,680 cubic feet per second, except between December 15 and March 15, when exports can be increased by one-third of the San Joaquin River flow at the Vernalis gauge (when the Vernalis flow is greater than 1,000 cubic feet per second). As explained in Chapter 3, regulatory restrictions on the SWP's Delta operations have been among the major factors affecting SWP water delivery reliability. Several of those influence SWP exports from the Banks Pumping Plant and, at times, impose particular

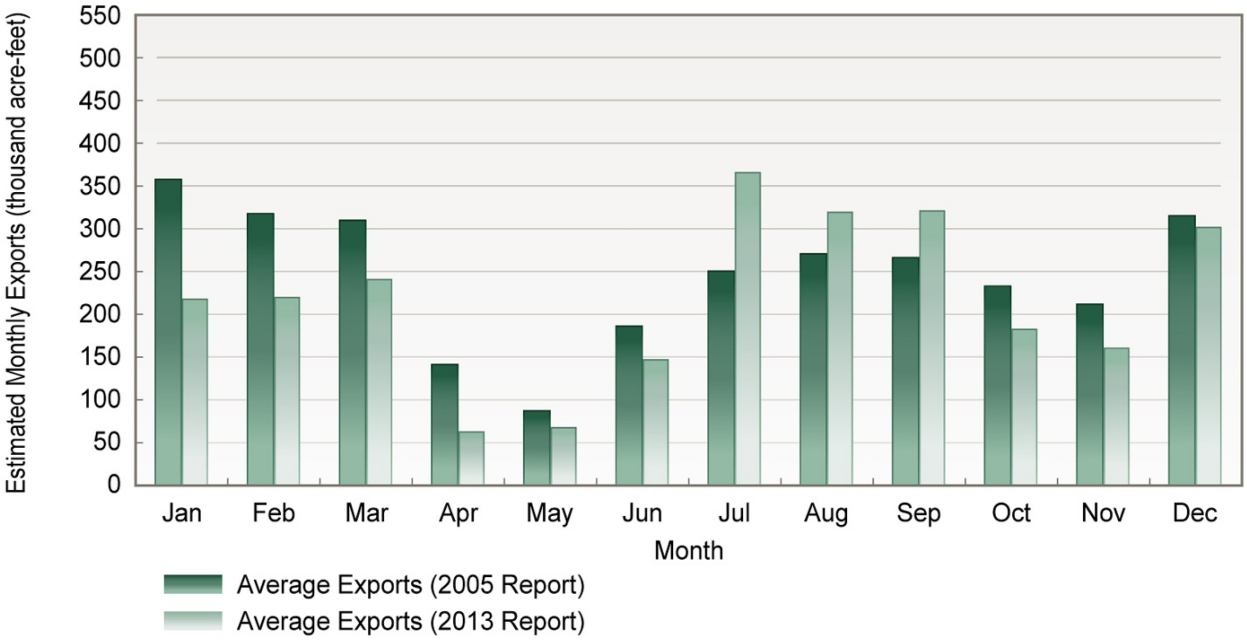


Figure 4-2. Estimated Monthly SWP Delta Exports (Existing Conditions), 2013 Scenario versus 2005 Scenario

limitations on exports. These limits are summarized here to illustrate how they affect the values shown in Figure 4-2:

- *2008 USFWS and 2009 NMFS BOs:* These BOs are much more restrictive than the BOs they replaced. The USFWS BO includes flow restrictions to protect delta smelt, with requirements in all but 2 months of the year. The NMFS BO contains similar limits for January through mid-June, but the greatest restriction imposes limits on total Delta exports in April and May in most years to protect salmon and steelhead.
- *X2:* The "X2" objective mandated by the State Water Board regulates Delta salinity levels in the months of February–June. For the X2 position to be located in the appropriate location to achieve the State Water Board's salinity objective, Delta outflow must be at certain specified levels at certain times between February and June, which can constrain SWP pumping at the Banks Pumping Plant at those times.
- *Fall X2:* USFWS's Reasonable and Prudent Alternative Action 4 sets X2 standards for September through November in wet and above-normal years.
- *Export/Inflow Ratio:* The 1995 WQCP and State Water Board D-1641 limit Delta exports to 35% of total Delta inflow from February through June. Thus, even if substantial runoff occurs during those months (such as during a year with considerable rain-on-snow events, projected to be more likely as the effects of climate change increase), the SWP is limited in its ability to benefit from the availability of that extra water in the Delta by increasing its pumping beyond this limit. Allowable exports increase to 65% of inflow from July through January.
- *Spring Export Limitations:* Spring is an important time in the life cycles of fish protected by the USFWS and NMFS BOs. As a result, requirements for Delta exports exist in several places. D-1641 limits SWP and CVP exports to 100% of the base flow of the San Joaquin River for 31 days during April and May. The NMFS BO limits the combined

exports during all of April and May to a given percentage of the flow: 25% during above-normal and wet years to 100% in critical years. Finally, the previously mentioned flow requirements contained in the USFWS BO to protect delta smelt can also restrict exports during this time.

Figure 4-2 shows reductions in the values estimated for the 2013 Report during January through June and October through December that result from these restrictions. The period of July through September is the time when exports are less restricted. As a result—and to recover some of the water supply lost during the other months—the exports estimated for the 2013 Report for July–September are higher than those estimated for the 2005 Report.

Another factor described in Chapter 3, climate change, is expected to affect the Delta—and SWP exports from the Banks Pumping Plant—under future conditions. The effects of climate change on SWP operations have been factored into DWR's analysis for future conditions.

Estimated SWP Export Amounts—Existing Conditions and Future Conditions

This section provides estimates of average, maximum, and minimum annual Delta exports for both existing (2013) and future (2033) conditions. (The assumptions used to develop both existing and future scenarios for this report are discussed in Chapters 5 and 6, respectively.) This section also summarizes SWP Delta exports by month and by water year type, demonstrating the effects of the USFWS and NMFS BOs and climate change upon SWP Delta exports.

Average, Maximum, and Minimum Annual Delta Exports

Table 4-1 presents the estimated average, maximum, and minimum annual SWP Delta exports (taf/year) for the existing-conditions and future-conditions scenarios, based on the 1922–2003 period of record. The reduction in average exports under future conditions is primarily due to reductions in June through October (Table 4-2). These reductions are caused primarily by climate change conditions. Under climate change, California is expected to see increased precipitation falling as rain instead of snow during the winter, causing the snow to melt earlier in the year and adversely affecting the availability of water for pumping by the SWP during the summer.

Table 4-1. Estimated Average, Maximum, and Minimum Annual SWP Exports

	Existing (2013) (taf/year)	Future (2033) (taf/year)
Average	2,612	2,466
Maximum	4,431	4,119
Minimum	671	760

Table 4-2. Average Estimated SWP Exports by Month (Existing and Future Conditions)

Month	Estimated SWP Exports (taf)		Difference between Future and Existing Conditions	
	Existing	Future	taf	%
January	219	219	0	0
February	220	218	-2	-1
March	241	236	-5	-2
April	63	76	12	18
May	68	71	3	4
June	147	138	-9	-7
July	366	344	-22	-6
August	320	286	-33	-11
September	321	292	-30	-10
October	183	140	-43	-27
November	161	158	-3	-2
December	302	290	-13	-4

Exports by Month

Table 4-2 shows the average estimated SWP exports from the Delta by month under existing and future conditions. As shown, in most months, the average estimated monthly SWP exports for future conditions are lower than the estimated monthly exports for existing conditions. The most notable exceptions are in April and May. Under both existing and future conditions, the values for those months are essentially the same, reflecting the stricter pumping regulations in place during that time of the year.

Figure 4-3 depicts the annual pattern of the monthly values for existing conditions, as well as the maximum and minimum estimated exports for each month. The pattern and ranges of the monthly values under future conditions are similar to those shown in Figure 4-3.

As shown in Figure 4-3 and Table 4-2, estimated SWP exports are highest on average in July, averaging 366 taf under existing conditions. Exports are consistently lowest in April and May, averaging 63 taf in April and 68 taf in May under existing conditions.

Exports by Water Year Type

Tables 4-3 and 4-4 compare SWP exports by water year type under existing conditions and future conditions, as estimated for the 2011 Report and for this 2013 Report. As shown, the SWP exports estimated for this 2013 Report are similar to the existing SWP exports estimated for the 2011 Report for most water year types. For dry and especially critical water year types, however, there is a decrease under both existing and future conditions. This decrease is caused by refinements to the CalSim code in December 2012 in coordination with the U.S. Bureau of Reclamation. These code updates improved the representation of the sharing of water supplies between the CVP and SWP. (For more details, see the technical addendum to this report, which is available online at http://baydeltaoffice.water.ca.gov/.)

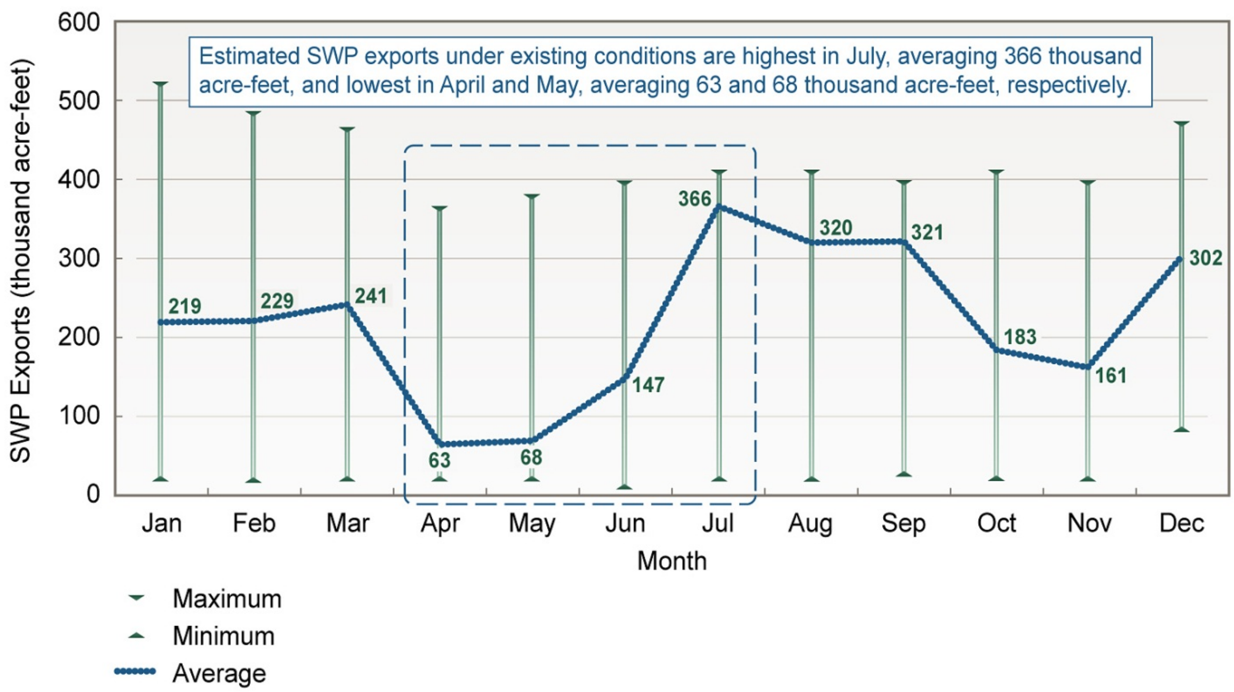


Figure 4-3. Monthly Range of Estimated SWP Exports (Existing Conditions)

Table 4-3. Estimated SWP Exports by Water Year Type (Existing Conditions)		
Water Year Type	2011 Report (taf)	2013 Report (taf)
Wet	3,210	3,338
Above Normal	2,783	2,850
Below Normal	2,642	2,736
Dry	2,320	2,218
Critical	1,512	1,248
Average	*2,607*	*2,612*

Table 4-4. Estimated SWP Exports by Water Year Type (Future Conditions)		
Water Year Type	2011 Report (taf)	2013 Report (taf)
Wet	3,182	3,224
Above Normal	2,754	2,811
Below Normal	2,556	2,609
Dry	2,120	1,943
Critical	1,414	1,093
Average	*2,521*	*2,466*

Likelihood of SWP Exports—Existing and Future Conditions

The estimated likelihood of a given level of SWP exports under existing conditions and under future conditions is presented in Figure 4-4. A total of 4,431 taf in the existing condition scenario is the largest average yearly export amount that was modeled for the 2013 Report.

As shown in Figure 4-4, approximately 71% of simulated cases for existing conditions have estimated SWP exports between 2,000 and 3,500 taf/year.

Likewise, in about 66% of simulated cases for future conditions, estimated SWP exports are between 2,000 and 3,500 taf/year (Figure 4-4).

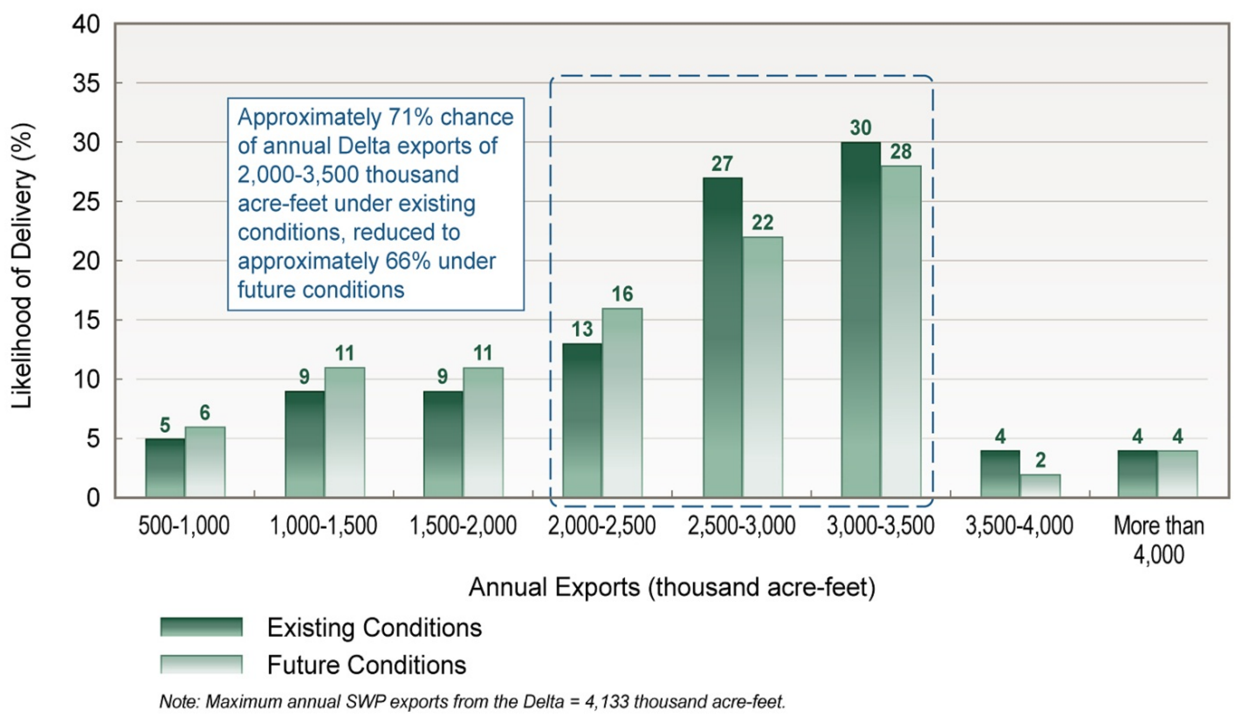


Figure 4-4. Estimated Likelihood of SWP Exports, by Increments of 500 taf (under Existing and Future Conditions)

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Chapter 5

Existing SWP Water Delivery Reliability (2013)

This chapter presents estimates of the SWP's existing (2013) water delivery reliability. The estimates are presented below, alongside the results obtained from the 2011 Report. Like this 2013 Report, the 2011 Report incorporated the requirements of BOs issued by USFWS and NMFS in December 2008 and June 2009, respectively, on the effects of coordinated operations of the SWP and CVP. These BOs are discussed in detail in Chapter 2, "State Water Project and Water Delivery Contracts," and Chapter 3, "Factors that Affect Water Delivery Reliability."

The discussions of SWP water delivery reliability in this chapter and Chapter 6 present the results of DWR's updated modeling of the SWP's water delivery reliability. A tabular summary of the modeling results is presented in the technical addendum to this report, which is available online at http://baydeltaoffice.water.ca.gov/.

The technical addendum also contains annual delivery probability curves (i.e., exceedence plots) to graphically show the estimated percentage of years in which a given annual delivery is equaled or exceeded.

Hydrologic Sequence

SWP delivery amounts are estimated in this 2013 Report for existing conditions using computer modeling that incorporates the historic range of hydrologic conditions (i.e., precipitation and runoff) that occurred from water years 1922 through 2003. The historic hydrologic conditions are adjusted to account for land-use changes (i.e., the current level of development) and upstream flow regulations that characterize 2013. By using this 82-year historical flow record, the delivery estimates modeled for existing conditions reflect a reasonable range of potential hydrologic conditions from wet years to critically dry years.

Existing Demand for Delta Water

Demand levels for the SWP water users in this report are derived from historical data and information from the SWP contractors themselves. The amount of water that SWP contractors request each year (i.e., demand) is related to:

- the magnitude and type of water demands,
- the extent of water conservation measures,
- local weather patterns, and
- water costs.

The existing level of development (i.e., the level of water use in the source areas from which the water supply originates) is based on recent land uses, and is assumed to be representative of existing conditions for the purposes of this 2013 Report.

SWP Table A Water Demands

The current combined maximum Table A amount is 4,172 taf/year. See "'Table A' Water" in Chapter 2, "State Water Project and Water Delivery Contracts," for a full discussion of Table A, which is a table within each water supply contract. Of the combined maximum Table A amount, 4,133 taf/year is the SWP's maximum Table A water available for delivery from the Delta.

The estimated demands by SWP contractors for deliveries of Table A water from the Delta under existing conditions, as determined for the 2013 Report and previously for the 2011 Report, are shown in Table 5-1. The estimated average demand for SWP Table A water is shown, along with maximum and minimum demands. Estimated demands are the result of discussions with staff from DWR's Operations Control Office and the State Water Contractors. The values represent their best estimates of current practices.

Table 5-1. Comparison of Estimated Average, Maximum, and Minimum Demands for SWP Table A Water (Existing Conditions, in taf/year)

	2011 Report	2013 Report
Average	3,722	4,132
Maximum	4,120	4,132
Minimum	3,043	4,132

As estimated for the 2011 Report, demands varied annually depending on local hydrologic patterns and other factors (e.g., demand management and the amount of water storage within the service area). The 2013 Report assumes that the maximum SWP Table A delivery amount is requested (i.e., demanded) each year. The 2011 Report did not assume maximum demand, but because SWP contractors have been requesting the full amount in recent years, the 2013 Report was updated to more accurately reflect the trend in demand. Estimated annual demands for deliveries of SWP Table A water ranged between 3,043 and 4,120 taf/year in the 2011 Report.

SWP Article 21 Water Demands

Under Article 21 of the SWP's long-term water supply contracts, contractors may receive additional water deliveries only under the following specific conditions:

- such deliveries do not interfere with SWP Table A allocations and SWP operations;
- excess water is available in the Delta;
- capacity is not being used for SWP purposes or scheduled SWP deliveries; and
- contractors can use the SWP Article 21 water directly or can store it in their own system (i.e., the water cannot be stored in the SWP system).

The demand for SWP Article 21 water by SWP contractors is assumed to vary depending on the month and weather conditions (i.e., amounts of precipitation and runoff). For the purposes of this discussion of SWP Article 21 water demands, a Kern wet year is defined as a year when the annual Kern River flow is projected to be greater than 1,500 taf. Kern River inflows are important because they are a major component of the local water supply for Kern County Water Agency (KCWA), which is the second largest SWP contractor and possesses significant local groundwater recharge capability. During Kern wet years, KCWA uses more Kern River flows to recharge its groundwater storage and reduce its demand for Article 21 water.

As shown in Figure 5-1, existing demands for SWP Article 21 water estimated for this 2013 Report are assumed to be high during the spring and late fall in non–Kern wet years (214 taf/month) because the contractors cannot rely as heavily on the Kern River flows to recharge their groundwater storage. Demand for Article 21 water is also high during the winter months of December through March in all weather year types (202 taf in Kern wet years and 414 taf in non–Kern wet years). Demands are assumed to be very low (2 taf/month) from April through November of Kern wet years (because high Kern River flows provide groundwater recharge water) and from July through October of Kern dry years.

These demand patterns for SWP Article 21 water are identical to what was presented in the 2011 Report for existing conditions.

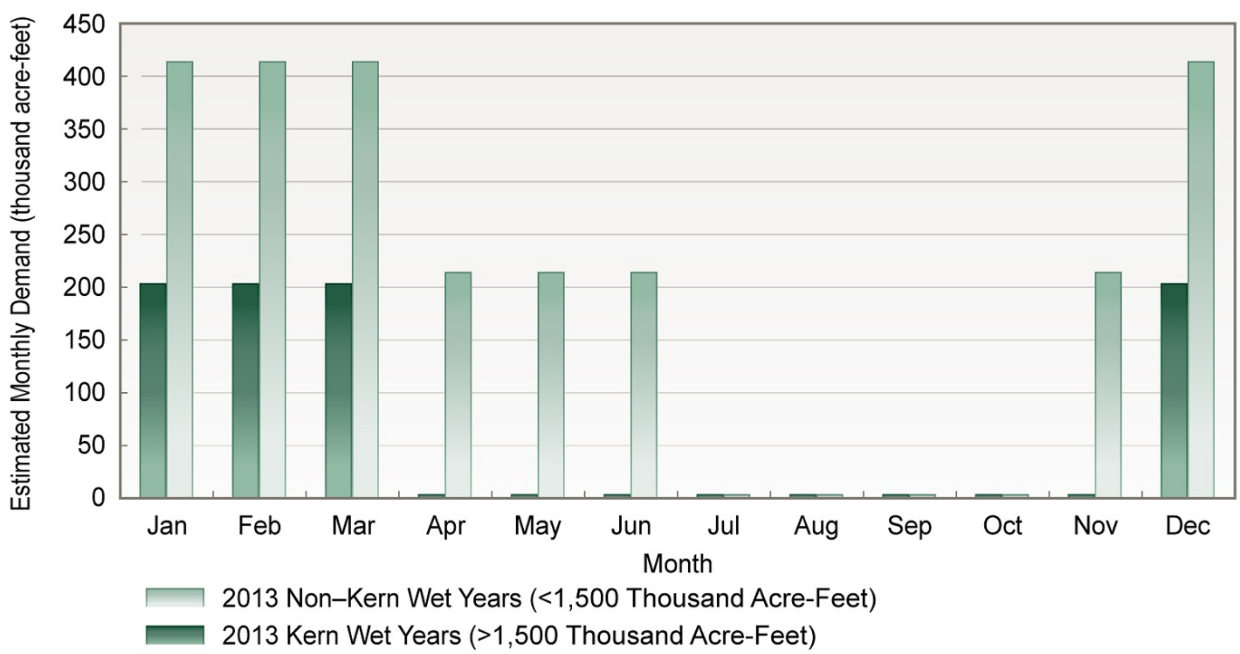
Estimates of SWP Table A Water Deliveries

Table 5-2 presents the annual average, maximum, and minimum estimates of SWP Table A deliveries from the Delta for existing conditions, as calculated for the 2011 and 2013 Reports. The average Table A deliveries are similar between the 2011 and 2013 Reports. The maximum and minimum values are different primarily due to the increased demands assumed in the 2013 Report.

Table 5-2. Comparison of Estimated Average, Maximum, and Minimum Deliveries of SWP Table A Water (Existing Conditions, in taf/year)

	2011 Report	2013 Report
Average	2,524	2,553
Maximum	3,363	3,996
Minimum	377	495

Assumptions about Table A and Article 21 water demands, along with operations for carryover water, have been updated in the model based on discussions with State Water Contractors staff and DWR's Operations and Control Office.



Note: Values shown are the maximum amount that can be delivered monthly. However, the actual capability of SWP water contractors to take this amount of SWP Article 21 water is not the sum of these maximum monthly values.

Figure 5-1. SWP Article 21 Demands during Non–Kern Wet Years and Kern Wet Years (Existing Conditions)

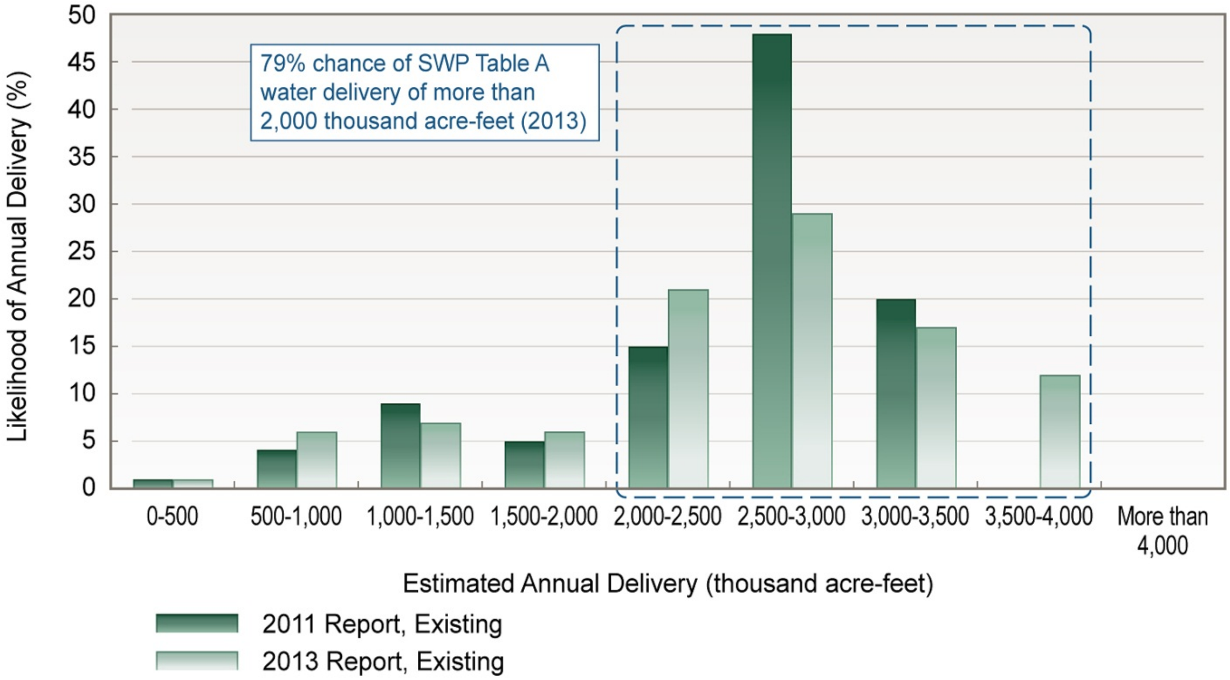


Figure 5-2. Estimated Likelihood of SWP Table A Water Deliveries, by Increments of 500 taf (Existing Conditions)

Figure 5-2 presents the estimated likelihood of delivery of a given amount of SWP Table A water under the existing conditions scenario, as estimated for both the 2011 and 2013 Reports. This figure shows that there is a 79% likelihood (82% with the 2011 Report) that more than 2,000 taf/year of Table A water will be delivered under the current estimates. The distribution of the delivery ranges has also changed since the 2011 Report. For example, Figure 5-2 shows a shift of Table A deliveries from the 2,500–3,000 taf/year range to the 3,500–4,000 taf/year range, because of the increased Table A demand assumed in the 2013 Report (4,133 taf). The 2011 Report assumed variable Table A demands (3,043–4,120 taf) for existing conditions.

Wet-Year Deliveries of SWP Table A Water

Table 5-3 and Figure 5-3 present estimates of SWP Table A water deliveries under existing conditions during possible wet conditions and compares them with corresponding delivery estimates calculated for the 2011 Report. Wet periods for 2013 are analyzed using historical precipitation and runoff patterns from 1922–2003 as a reference, while accounting for existing 2013 conditions (e.g., land use, water infrastructure). For reference, the wettest single year on record was 1983.

The results of modeling existing conditions over historical wet years indicate that SWP Table A water deliveries during wet periods can be estimated to range between yearly averages of 3,086 to 3,996 taf.

Table 5-3 shows that the 2013 deliveries of SWP Table A water increased in wet periods (in comparison to the 2011 Report) because of the assumed higher demand.

Table 5-3. Estimated Average and Wet-Period Deliveries of SWP Table A Water (Existing Conditions, in taf/year) and Percent of Maximum SWP Table A Amount, 4,133 taf/year

	Long-term Average (1921–2003)		Single Wet Year (1983)		Wet Periods							
					2 Years (1982–1983)		4 Years (1980–1983)		6 Years (1978–1983)		10 Years (1978–1987)	
2011 Report	2,524	61%	2,884	70%	2,956	72%	2,871	69%	2,872	69%	2,832	69%
2013 Report	2,553	62%	3,996	97%	3,880	94%	3,501	85%	3,361	81%	3,086	75%

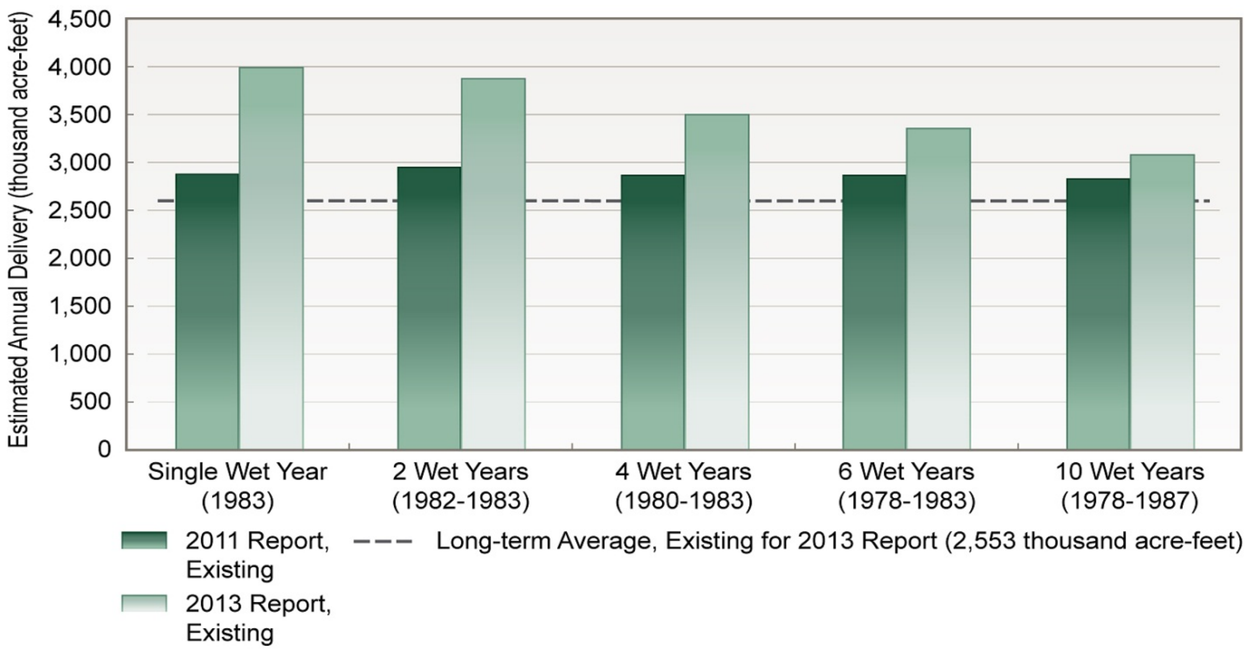


Figure 5-3. Estimated Wet-Period SWP Table A Water Deliveries (Existing Conditions)

Dry-Year Deliveries of SWP Table A Water

Table 5-4 and Figure 5-4 display estimates of existing-conditions deliveries of SWP Table A water during possible drought conditions and compares them with the corresponding delivery estimates calculated for the 2011 Report. Droughts are analyzed using the historical drought-period precipitation and runoff patterns from 1922 through 2003 as a reference, although existing 2013 conditions (e.g., land use, water infrastructure) are also accounted for in the modeling. For reference, the worst multiyear drought on record was the 1929–1934 drought, although the brief drought of 1976–1977 was more intensely dry.

The results of modeling existing conditions under historical drought scenarios indicate that SWP Table A water deliveries during dry years can be estimated to range between yearly averages of 495 and 1,269 taf.

On average, the dry-period deliveries of Table A water are lower in this 2013 Report than in the 2011 Report because of model refinements (discussed in detail in the technical addendum). In the 2011 Report's model, significant CVP north-of-Delta releases were allowed to meet SWP in-basin uses and to support SWP exports. The 2013 Report's model eliminates this artificial support, causing decreases in SWP deliveries during drought periods.

Table 5-4. Estimated Average and Dry-Period Deliveries of SWP Table A Water (Existing Conditions, in taf/year) and Percent of Maximum SWP Table A Amount, 4,133 taf/year

	Long-term Average (1921–2003)		Single Dry Year (1977)		Dry Periods							
					2-Year Drought (1976–1977)		4-Year Drought (1931–1934)		6-Year Drought (1987–1992)		6-Year Drought (1929–1934)	
2011 Report	2,524	61%	377	9%	1,571	38%	1,455	35%	1,461	35%	1,433	35%
2013 Report	2,553	62%	495	12%	1,269	31%	1,263	31%	1,176	28%	1,260	30%

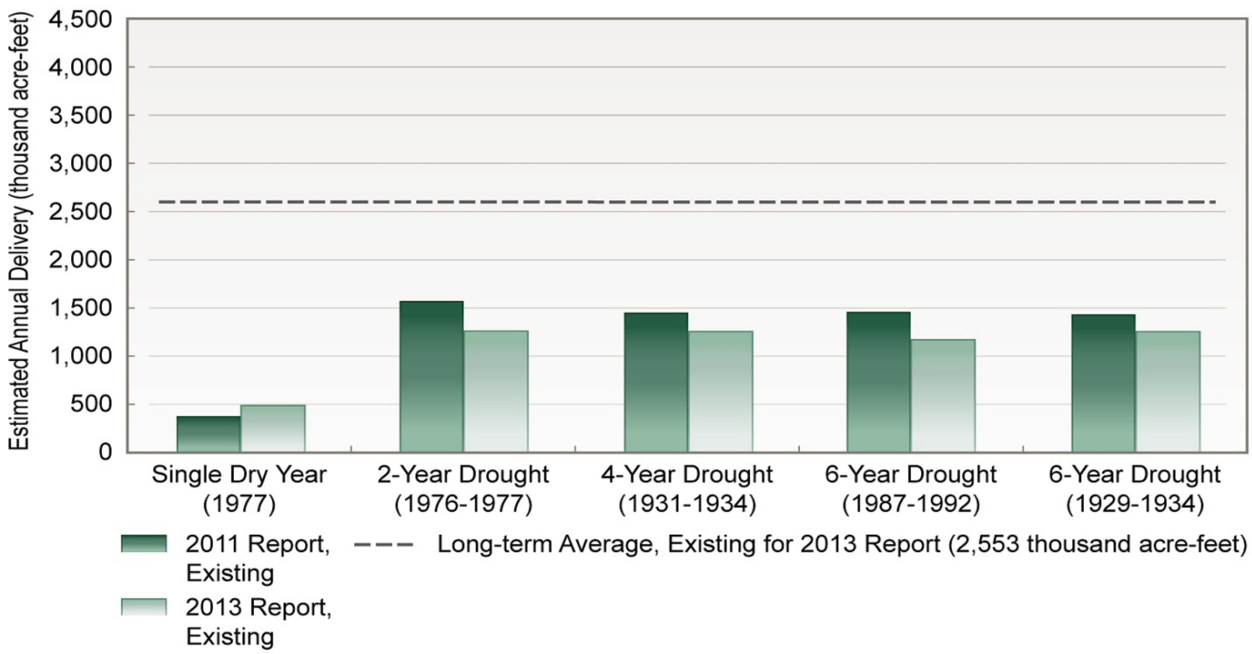


Figure 5-4. Estimated Dry-Period SWP Table A Water Deliveries (Existing Conditions)

Estimates of SWP Article 21 Water Deliveries

SWP water delivery is a combination of deliveries of Table A water and Article 21 water. Some SWP contractors store Article 21 water locally when extra water and capacity are available beyond that needed by normal SWP operations. Deliveries of SWP Article 21 water vary not only by year, but also by month. The estimated range of monthly deliveries of SWP Article 21 water is displayed in Figure 5-5. In May through October, essentially no Article 21 water is estimated to be delivered. In the late fall and winter (November through April), maximum monthly deliveries range from 92 to 245 taf/month.

The estimated likelihood that a given amount of SWP Article 21 water will be delivered is presented in Figure 5-6.

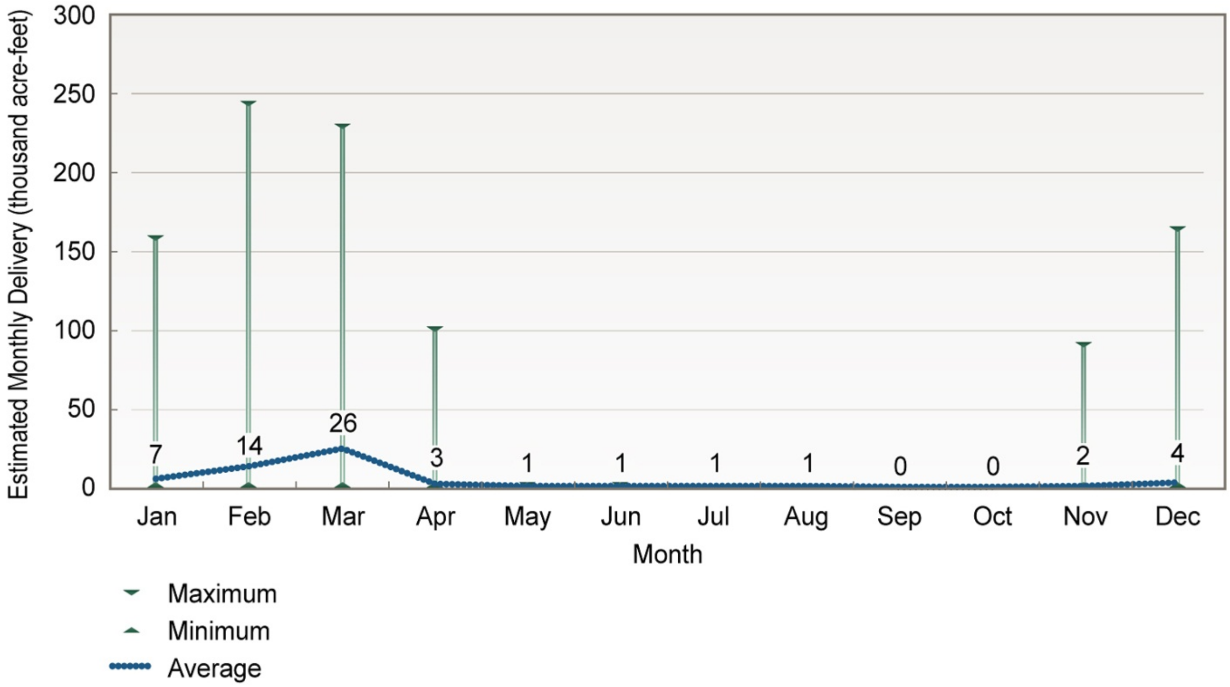


Figure 5-5. Estimated Range of Monthly Deliveries of SWP Article 21 Water (Existing Conditions)

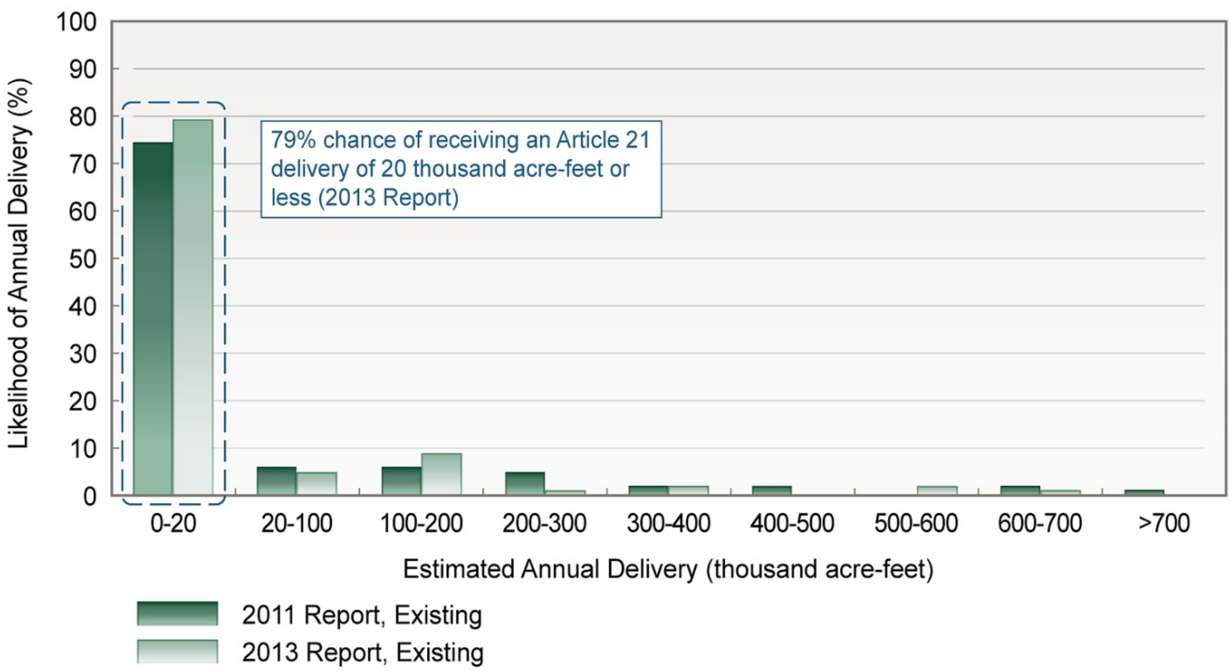


Figure 5-6. Estimated Likelihood of Annual Deliveries of SWP Article 21 Water (Existing Conditions)

Wet-Year Deliveries of SWP Article 21 Water

Table 5-5 shows the estimates of deliveries of SWP Article 21 water during wet periods under existing conditions. Estimated deliveries in wet years are approximately 2.3 to 5.7 times larger than the average existing-conditions delivery of SWP Article 21 water.

In general, the wet-period deliveries in this 2013 Report are lower than in the 2011 Report because of the higher Table A demand assumed in the 2013 Report (the maximum, or 4,133 taf/year). Because Table A demand is higher, the model tries to deliver more water during the year and less is left over to deliver as Article 21 water.

Dry-Year Deliveries of SWP Article 21 Water

Although deliveries of SWP Article 21 water are smaller during dry years than during wet ones, opportunities exist to deliver SWP Article 21 water during multiyear drought periods. As modeled, deliveries in dry years are often small (less than 5 taf); however, longer drought periods can include several years that support Article 21 deliveries. Annual average Article 21 estimates for drought periods of 4 and 6 years vary significantly and can approach the long-term average annual estimate, as shown in Table 5-6.

Table 5-5. Estimated Average and Wet-Period Deliveries of SWP Article 21 Water (Existing Conditions, in taf/year)

	Long-term Average (1921–2003)	Single Wet Year (1983)	Wet Periods			
			2 Years (1982–1983)	4 Years (1980–1983)	6 Years (1978–1983)	10 Years (1978–1987)
2011 Report	76	608	533	306	225	206
2013 Report	58	333	265	196	135	152

Table 5-6. Estimated Average and Dry-Period Deliveries of SWP Article 21 Water (Existing Conditions, in taf/year)

	Long-term Average (1921–2003)	Single Dry Year (1977)	Wet Periods			
			2-Year Drought (1976–1977)	4-Year Drought (1931–1934)	6-Year Drought (1987–1992)	6-Year Drought (1929–1934)
2011 Report	76	3	4	69	9	49
2013 Report	58	10	13	46	11	35

Chapter 6

Future SWP Water Delivery Reliability (2033)

This chapter presents estimates of the SWP's delivery reliability for conditions 20 years in the future (2033). These estimates reflect hydrologic changes that could result from climate change, but they incorporate the same requirements that are assumed under existing conditions, including the USFWS and NMFS BOs.

This chapter also compares these estimates of future conditions with the future-condition results presented in the *State Water Project Delivery Reliability Report 2011* (2011 Report) for the year 2031.

A tabular summary of the modeling results for the future conditions scenario is presented in the technical addendum to this report. The technical addendum also contains annual delivery probability curves (i.e., exceedence plots) to graphically show the estimated percentage of years in which a given annual delivery is equaled or exceeded.

Future Demand for Delta Water

Demand levels for the SWP water users in this report are derived from historical data and information from the SWP contractors themselves. The 2033 level of development (i.e., the level of water use in the source areas from which the water supply originates) is based on the projected assumptions for land use for that year, and is assumed to be representative of future conditions for the purposes of this report.

SWP Table A Water Demands

Future demands for SWP Table A water, as calculated for this 2013 Report, are assumed to be the maximum possible annual amount of 4,133 taf. Therefore, the 2033 future conditions assumptions about SWP Table A water demand are the same as those for the 2013 existing conditions.

The SWP Table A water demands under future conditions as presented in the 2011 Report are also assumed to be the maximum amount of 4,133 taf/year.

SWP Article 21 Water Demands

The assumed future demands for SWP Article 21 water are the same as those assumed for existing conditions (see Chapter 5, "Existing SWP Water Delivery Reliability [2013]").

Estimates of Future SWP Deliveries

When modeling water supply deliveries 20 years in the future, the unknowns are considerable and many assumptions must be made. As was assumed for existing conditions (see Chapter 5), modeling of SWP deliveries for 2033 take into account current Delta water quality regulations and the requirements of the USFWS and NMFS BOs. Climate change as well as changes to water uses in the upstream watersheds (i.e., source watersheds) are also taken into account when modeling water supply deliveries under future conditions. Additional discussion of how the modeling of SWP water delivery reliability is adjusted to account for climate change is provided in Chapter 3, "Factors that Affect Water Delivery Reliability."

One of the most important assumptions when modeling SWP water delivery under future conditions is that the rules and facilities related to Delta conveyance will remain at the status quo. That is, in the future-conditions scenario, no new facilities to convey water through or around the Delta are assumed to be in place because no new programs have been sufficiently developed that can be assumed with certainty.

Future Deliveries of SWP Table A Water

Table 6-1 presents the annual average, maximum, and minimum estimates of SWP Table A water deliveries from the Delta for future conditions, as calculated for the 2011 and 2013 Reports. The SWP Table A water deliveries under future conditions are similar between the 2011 and 2013 Reports. The maximum possible delivery of SWP Table A water, 4,133 taf/year, is not reached under future conditions.

Table 6-1. Comparison of Estimated Average, Maximum, and Minimum Deliveries for SWP Table A Water (Future Conditions, in taf/year)

	2011 Report (Year 2031)	2013 Report (Year 2033)
Average	2,465	2,400
Maximum	4,062	4,068
Minimum	441	453

The estimated likelihood that a given amount of SWP Table A water will be delivered under future conditions is presented in Figure 6-1. Currently, there is a 57% likelihood that 2,000–3,500 taf of SWP Table A water will be delivered under the future-conditions scenario.

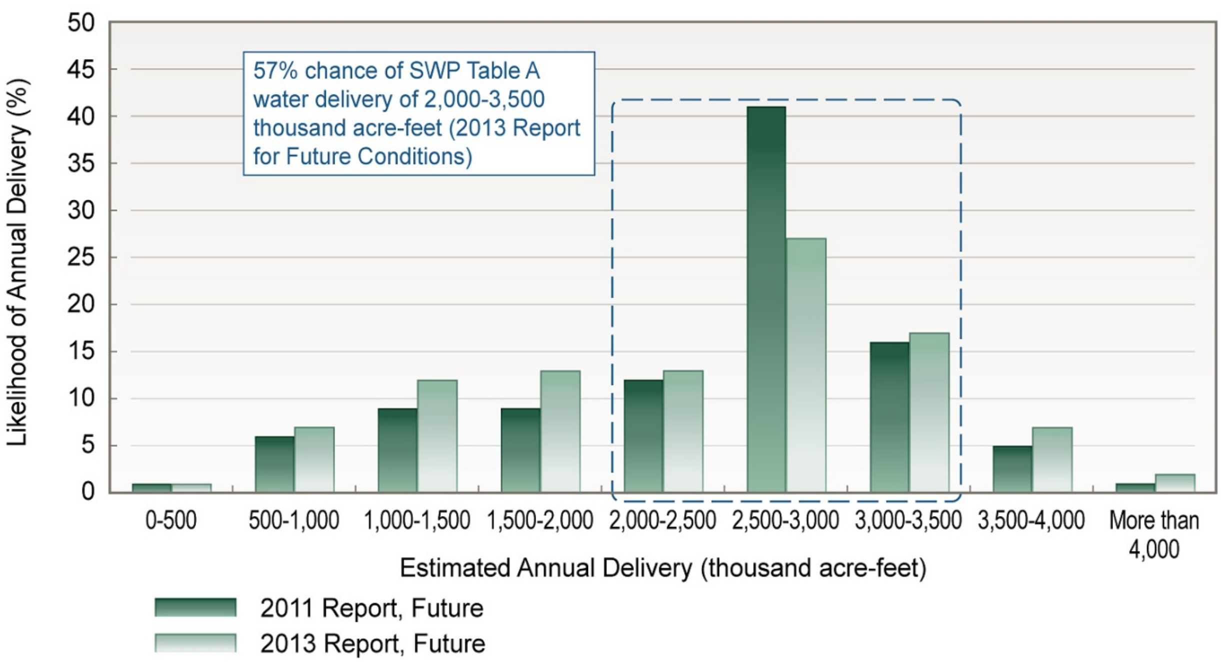


Figure 6-1. Estimated Likelihood of Annual SWP Table A Water Deliveries, by Increments of 500 taf (Future Conditions)

Wet-Year Deliveries of SWP Table A Water under Future Conditions

Table 6-2 and Figure 6-2 present estimates of future SWP Table A water deliveries during a wet period and compare them with the corresponding delivery estimates calculated for the 2011 Report. Wet periods were modeled using historical precipitation and runoff patterns from 1922–2003 as a reference, and accounting for future conditions such as land use and climate change. The results of modeling future conditions over historical wet years indicate that SWP Table A water deliveries during wet periods can be estimated to range between yearly averages of 2,900 to 4,068 taf.

Table 6-2. Estimated Average and Wet-Period Deliveries of SWP Table A Water (Future Conditions, in taf/year) and Percent of Maximum SWP Table A Amount, 4,133 taf/year

	Long-term Average (1921–2003)		Single Wet Year (1983)		Wet Periods							
					2 Years (1982–1983)		4 Years (1980–1983)		6 Years (1978–1983)		10 Years (1978–1987)	
2011 Report	2,465	60%	4,062	98%	3,909	95%	3,396	82%	3,248	79%	2,972	72%
2013 Report	2,400	58%	4,068	98%	3,945	95%	3,333	81%	3,191	77%	2,900	70%

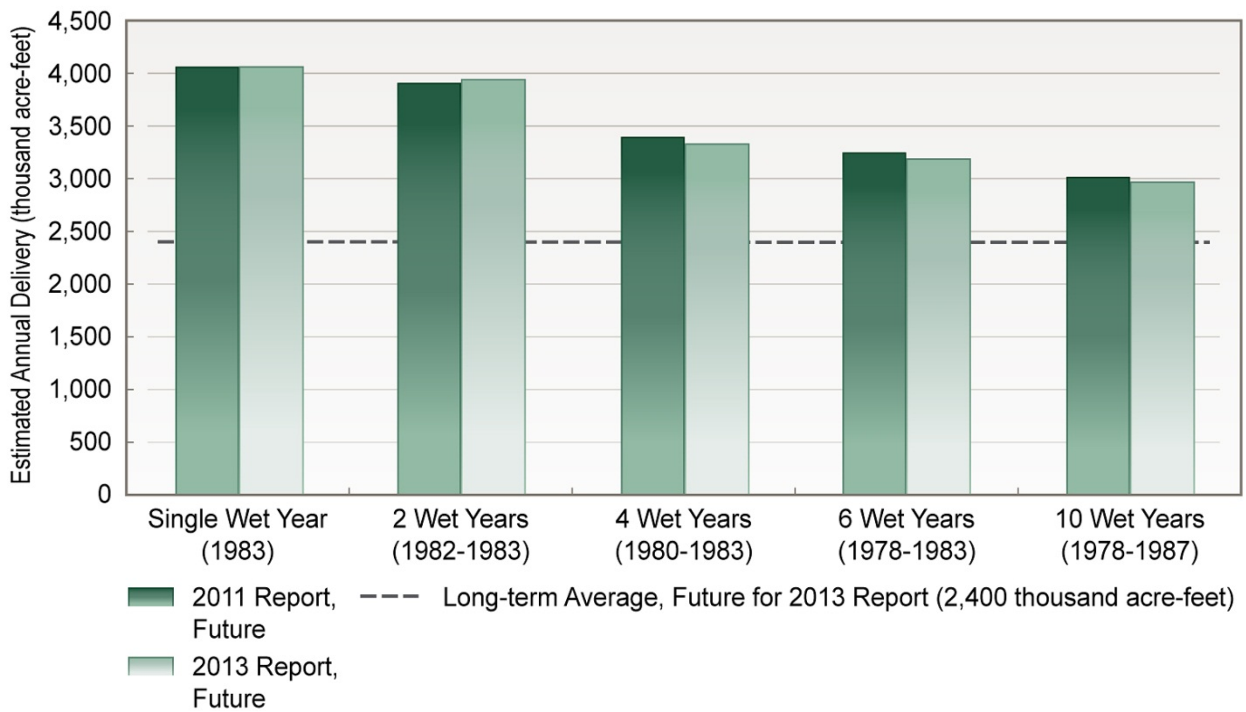


Figure 6-2. Estimated Wet-Period SWP Table A Water Deliveries (Future Conditions)

Dry-Year Deliveries of SWP Table A Water under Future Conditions

Table 6-3 and Figure 6-3 present estimates of future SWP Table A water deliveries during possible drought conditions and compare these estimates with the corresponding delivery estimates calculated for the 2011 Report. Drought scenarios for future conditions are analyzed using the historical drought-period precipitation and runoff patterns from 1922–2003 as a reference, while accounting for future conditions (e.g., land use, climate change).

The results of modeling future conditions under potential drought-year scenarios provide an estimated range of Table A deliveries that can be expected during drought periods.

The 2-year drought period (1976–1977) shows significantly lower Table A deliveries in the 2013 Report than in the 2011 Report (see Figure 6-3), because of modeling refinements (see the technical addendum at http://baydeltaoffice.water.ca.gov/) and reclassification of 1975 into a wet year rather than an above-normal year, as was used in the 2011 Report (due to the change in the assumed climate change model). Because 1975 is now considered a wet year in this 2013 Report's model, there are higher fall X2 requirements to meet and more Delta outflow is required in September. This leads to lower reservoir levels at the start of the new water year and smaller deliveries during the upcoming 2-year dry period.

Table 6-3. Estimated Average and Dry-Period Deliveries of SWP Table A Water (Future Conditions, in taf/year) and Percent of Maximum SWP Table A Amount, 4,133 taf/year

	Long-term Average (1921–2003)		Single Dry Year (1977)		Dry Periods							
					2-Year Drought (1976–1977)		4-Year Drought (1931–1934)		6-Year Drought (1987–1992)		6-Year Drought (1929–1934)	
2011 Report	2,465	60%	441	11%	1,457	35%	1,401	34%	1,226	30%	1,365	33%
2013 Report	2,400	58%	453	11%	978	24%	1,263	31%	1,055	26%	1,251	30%

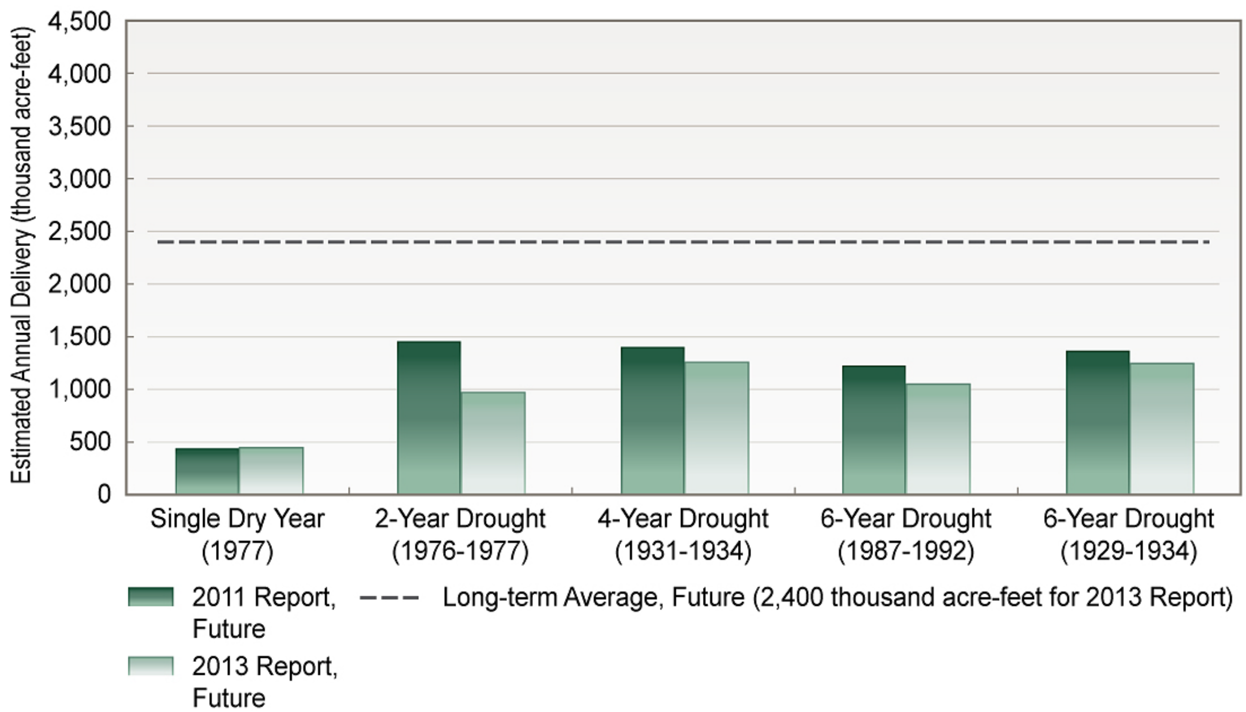


Figure 6-3. Estimated Dry-Period SWP Table A Water Deliveries (Future Conditions)

SWP Article 21 Water Deliveries under Future Conditions

The estimated range of monthly deliveries of SWP Article 21 water is displayed in Figure 6-4. Estimated deliveries of SWP Article 21 water under future conditions vary not only by year, depending on the precipitation and runoff, but also by month. In the spring, summer, and early fall months (May through October), deliveries of SWP Article 21 water under future conditions are estimated to be low, with a maximum of approximately 18 taf/month and a minimum of 0 taf/month. From November through April, maximum estimated future deliveries of SWP Article 21 water can be as high as 256 taf and as low as 41 taf in a given month; however, the average deliveries range between 1 and 25 taf.

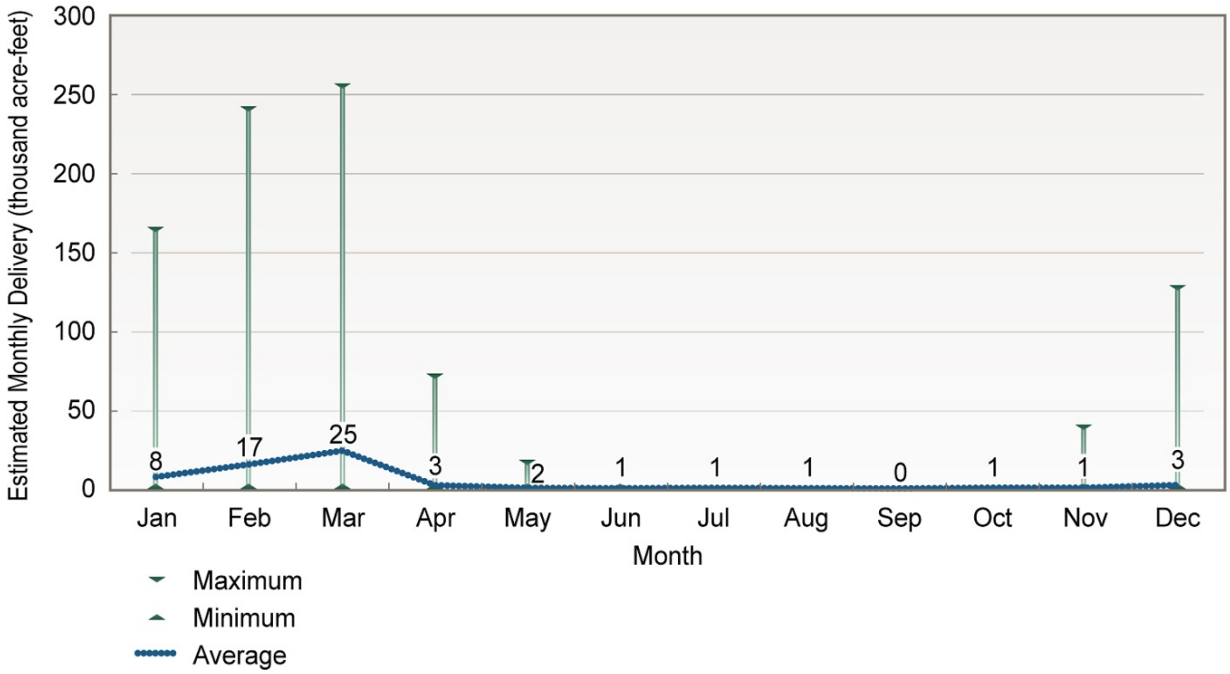


Figure 6-4. Estimated Range of Monthly Deliveries of SWP Article 21 Water (2033 Future Conditions)

The estimated likelihood that a given amount of SWP Article 21 water will be delivered under future conditions is presented in Figure 6-5. There is a 23% likelihood that more than 20 taf/year of SWP Article 21 water will be delivered under future conditions.

In the 2011 Report, there is a 22% likelihood that estimated deliveries of SWP Article 21 water under future conditions are more than 20 taf/year.

Wet-Year Deliveries of SWP Article 21 Water under Future Conditions

Table 6-4 shows the estimates of deliveries of SWP Article 21 water during wet periods under future conditions. The results of modeling future conditions over historical wet years indicate that wet-period deliveries of SWP Article 21 water can be estimated to range between yearly averages of 126–227 taf.

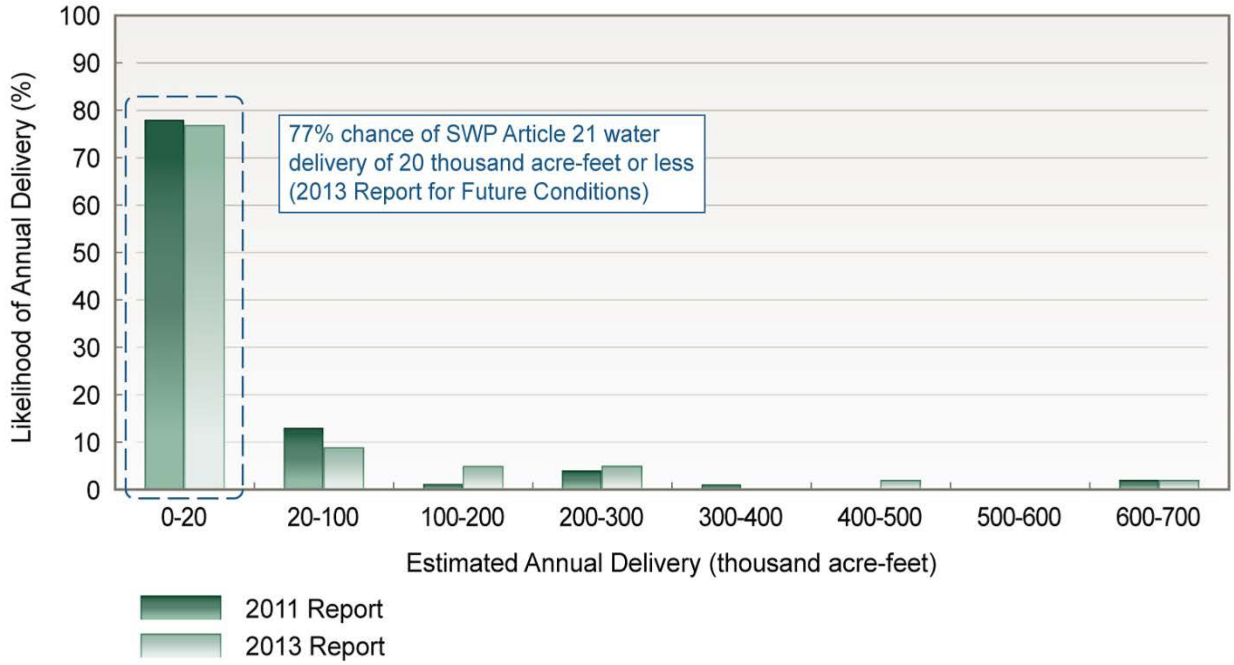


Figure 6-5. Estimated Likelihood of Annual Deliveries of SWP Article 21 Water (Future Conditions)

Table 6-4. Estimated Average and Wet-Period Deliveries of SWP Article 21 Water (Future Conditions, in taf/year)

	Long-term Average (1921–2003)	Single Wet Year (1983)	Wet Periods			
			2 Years (1982–1983)	4 Years (1980–1983)	6 Years (1978–1983)	10 Years (1978–1987)
2011 Report	50	291	190	120	83	121
2013 Report	62	227	211	183	126	146

Dry-Year Deliveries of SWP Article 21 Water under Future Conditions

Table 6-5 shows the estimates of future deliveries of SWP Article 21 water during dry periods. The results of modeling future conditions under historical drought scenarios indicate that deliveries of SWP Article 21 water during dry periods can be estimated to range between yearly averages of 9-41 taf. Although drought-period deliveries are typically less than deliveries in average years, Table 6-4 shows that opportunities to deliver SWP Article 21 water exist during multiyear drought periods.

Table 6-5. Estimated Average and Dry-Period Deliveries of SWP Article 21 Water (Future Conditions, in taf/year)

	Long-term Average (1921–2003)	Single Dry Year (1977)	Dry Periods			
			2-Year Drought (1976–1977)	4-Year Drought (1931–1934)	6-Year Drought (1987–1992)	6-Year Drought (1929–1934)
2011 Report	50	4	7	50	10	37
2013 Report	62	9	13	41	13	32

Glossary

acre-foot The volume of water (about 325,900 gallons) that would cover an area of 1 acre to a depth of 1 foot. This is enough water to meet the annual needs of one to two households.

agricultural water supplier As defined by the California Water Code, a public or private supplier that provides water to 2,000 or more irrigated acres per year for agricultural purposes or serves 2,000 or more acres of agricultural land. This can be a water district that directly supplies water to farmers or a contractor that sells water to the water district.

annual Delta exports The total amount of water transferred ("exported") to areas south of the Delta through the Harvey O. Banks Pumping Plant (SWP) and the C. W. "Bill" Jones Pumping Plant (CVP) in 1 year.

appropriative water rights Rights allowing a user to divert surface water for beneficial use. The user must first have obtained a permit from the State Water Resources Control Board, unless the appropriative water right predates 1914.

Article 21 water Water that a contractor can receive in addition to its allocated Table A water. This water is only available if several conditions are met: (1) excess water is flowing through the Delta; (2) the contractor can use the surplus water or store it in the contractor's own system; and (3) delivering this water will not interfere with Table A allocations, other SWP deliveries, or SWP operations.

Bay Delta Conservation Plan (BDCP) A plan for the Delta being developed by a group of local water agencies, environmental and conservation organizations, State and federal agencies, and other interest groups. The plan seeks to address challenges in the Delta that California's water community has faced for decades. When complete, the BDCP will provide the basis for issuing endangered species permits to operate the SWP and CVP. The heart of the BDCP is a long-term conservation strategy that sets forth actions needed for a healthy Delta.

biological opinion A determination by the U.S. Fish and Wildlife Service or National Marine Fisheries Service on whether a proposed federal action is likely to jeopardize the continued existence of a threatened or endangered species or result in the destruction or adverse modification of designated "critical habitat." If jeopardy is determined, certain actions are required to be taken to protect the species of concern.

CalSim-II A computer model, jointly developed by DWR and the U.S. Bureau of Reclamation, that simulates existing and future operations of the SWP and CVP. The hydrology used by this model was developed by adjusting the historical flow record (1922–2003) to account for the influence of changes in land uses and regulation of upstream flows.

carryover deliveries See "carryover water."

carryover water A water supply "savings account" for SWP water that is allocated to an SWP contractor in a given year, but not used by the end of the year. Carryover water is stored in the SWP's share of San Luis Reservoir, when space is available, for the contractor to use in the following year.

Central Valley Project (CVP) Operated by the U.S. Bureau of Reclamation, the CVP is a water storage and delivery system consisting of 20 dams and reservoirs (including Shasta, Folsom, and New Melones Reservoirs), 11 power plants, and 500 miles of major canals. CVP facilities reach some 400 miles from Redding to Bakersfield and deliver about 7 million acre-feet of water for agricultural, urban, and wildlife use.

cubic feet per second (cfs) A measure of the rate at which a river of stream is flowing. The flow is 1 cfs if a cubic foot (about 7.48 gallons) of water passes a specific point in 1 second. A flow of 1 cubic foot per second for a day is approximately 2 acre-feet.

Among the SWP's facilities are more than 700 miles of canals that distribute water to urban and agricultural water suppliers in Northern California, the San Francisco Bay Area, the San Joaquin Valley, the Central Coast, and Southern California.

Delta exports Water transferred ("exported") to areas south of the Delta through the Harvey O. Banks Pumping Plant (SWP) and the C. W. "Bill" Jones Pumping Plant (CVP). The SWP's Delta exports are the primary component of total SWP deliveries.

Delta inflow The combined total of water flowing into the Delta from the Sacramento River, San Joaquin River, and other rivers and waterways.

exceedence plot For the SWP, a curve showing SWP delivery probability (especially for Table A water)—specifically, the likelihood that SWP contractors will receive a certain volume of water under current or future conditions.

existing-conditions scenario For the SWP delivery reliability reports, the results of modeling for SWP Delta exports or deliveries for the year the report was written.

future-conditions scenario For the SWP delivery reliability reports, the results of modeling for SWP Delta exports or SWP deliveries for 20 years into the future.

incidental take permit A permit issued by the U.S. Fish and Wildlife Service or National Marine Fisheries Service, under Section 10 of the federal Endangered Species Act, to private nonfederal entities undertaking otherwise lawful projects that might result in the "take" of an endangered or threatened species. In California, an additional permit is required and take may be authorized under Section 2081 of the California Fish and Game Code through issuance of either an incidental take permit or a consistency determination. The California Department of Fish and Wildlife is authorized to accept a federal biological opinion as the take authorization for a State-listed species when a species is listed under both the federal and California Endangered Species Acts.

riparian water rights Water rights that apply to lands traversed by or bordering on a natural watercourse. No permit is required to use this water, which must be used on riparian (adjacent) land and cannot be stored for later use.

State Water Project (SWP) Operated by DWR, a water storage and delivery system of 33 storage facilities, about 700 miles of open canals and pipelines, four pumping-generating plants, five hydroelectric power plants, and 20 pumping plants that extends for more than 600 miles in California. Its main purpose is to store and distribute water to 29 urban and agricultural water suppliers in Northern California, the San Francisco Bay Area, the San Joaquin Valley, the Central Coast, and Southern California. The SWP provides supplemental water to 25 million Californians (almost two-thirds of California's population) and about 750,000 acres of irrigated farmland. Water deliveries have ranged from 1.4 million acre-feet in a dry year to more than 4.0 million acre-feet in a wet year.

SWP contractors Twenty-nine entities that receive water for agricultural or municipal and industrial uses through the SWP. Each contractor has executed a long-term water supply contract with DWR. Also sometimes referred to as "State Water Contractors."

Table A water (Table A amounts) The maximum amount of SWP water that the State agreed to make available to an SWP contractor for delivery during the year. Table A amounts determine the maximum water a contractor may request each year from DWR. The State and SWP contractors also use Table A amounts to serve as a basis for allocation of some SWP costs among the contractors.

turnback pool water Allocated water that individual SWP contractors may offer early in the year for other SWP contractors to buy later at a set price.

urban water supplier As defined by the California Water Code, a public or private supplier that provides water for municipal use directly or indirectly to more than 3,000 customers or supplies more than 3,000 acre-feet of water in a year. This can be a water district that provides the water to local residents for use at home or work, or a contractor that distributes or sells water to that water district.

Water Rights Decision 1641 (D-1641) A regulatory decision issued by the State Water Resources Control Board in 1999 (updated in 2000) to implement the 1995 *Water Quality Control Plan for the San Francisco Bay/Sacramento–San Joaquin Delta*. D-1641 assigned primary responsibility for meeting many of the Delta's water quality objectives to the SWP and CVP, thus placing certain limits on SWP and CVP operations.

water year In reports on surface water supply, the period extending from October 1 through September 30 of the following calendar year. The water year refers to the September year. For example, October 1, 2010, through September 30, 2011 is the 2011 water year.

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SWRCB. *See* State Water Resources Control Board.

WGCEP. *See* 2007 Working Group on California Earthquake Probabilities.

Appendix A

Historical SWP Delivery Tables for 2003–2012

The State Water Project (SWP) contracts define several types of SWP water available for delivery to contractors under specific circumstances: Table A water, Article 21 water, turnback pool water, and carryover water. (See the glossary for definitions of these terms; Chapter 2 describes each type of SWP water in greater detail.) Many SWP contractors frequently use Article 21, turnback pool, and carryover water to increase or decrease the amount of water available to them under SWP Table A.

The Sacramento River Index, previously referred to as the "4 River Index" or "4 Basin Index," is the sum of the unimpaired runoff of four rivers: the Sacramento River above Bend Bridge near Red Bluff, Feather River inflow to Lake Oroville Reservoir, Yuba River at Smartville, and American River inflow to Folsom Lake. The five water year types used in the Sacramento River Index are as follows:

Sacramento River Index	Water Year Type
1	Wet
2	Above Normal
3	Below Normal
4	Dry
5	Critical

Tables A-1 through A-10 list annual historical deliveries by SWP water type for each contractor for 2003 through 2012. The Sacramento River Index and water year type are presented along with the delivery results for each year. Similar delivery tables are presented for years 2001–2010 in the *State Water Project Delivery Reliability Report 2011.* Any differences in values presented in this 2013 report and those in the 2011 report are due to reclassification of deliveries since the production of the 2011 report.

SWP contractors are listed in Tables A-1 through A-10 by location, as follows:

- *Feather River Area:* Butte County, Plumas County Flood Control and Water Conservation District (FCWCD), and Yuba City
- *North Bay Area:* Napa County FCWCD and Solano County Water Agency (WA)
- *South Bay Area:* Alameda County FCWCD, Zone 7; Alameda County Water District (WD); and Santa Clara Valley WD
- *San Joaquin Valley Area:* Dudley Ridge WD, Empire West Side Irrigation District (ID), Kern County WA, Kings County, Oak Flat WD, and Tulare Lake Basin Water Storage District (WSD)
- *Central Coastal Area:* San Luis Obispo County FCWCD and Santa Barbara County FCWCD
- *Southern California Area:* Antelope Valley–East Kern WA, Castaic Lake WA, Coachella Valley WD, Crestline–Lake Arrowhead WA, Desert WA, Littlerock Creek ID, Metropolitan WD of Southern California, Mojave WA, Palmdale WD, San Bernardino Valley Municipal Water District (MWD), San Gabriel Valley MWD, San Gorgonio Pass WA, and Ventura County Watershed Protection District (WPD)

Table A–1. Historical State Water Project Deliveries, Calendar Year 2003						
Contractor Location	SWP Contractor	SWP Water Type Delivered (acre–feet)				Total SWP Deliveries (acre–feet)
		Table A	Article 21	Carryover	Turnback	
Feather River Area	Butte County	551	–	–	–	551
	Plumas County FCWCD	–	–	–	–	–
	Yuba City	1,324	–	–	–	1,324
	Subtotal	**1,875**	–	–	–	**1,875**
North Bay Area	Napa County FCWCD	6,026	376	1,055	180	7,637
	Solano County WA	25,135	2,280	1,918	–	29,333
	Subtotal	**31,161**	**2,656**	**2,973**	**180**	**36,970**
South Bay Area	Alameda County FCWCD, Zone 7	31,695	–	13,099	656	45,450
	Alameda County WD	31,086	–	5,150	354	36,590
	Santa Clara Valley WD	90,000	936	14,104	841	105,881
	Subtotal	**152,781**	**936**	**32,353**	**1,851**	**187,921**
San Joaquin Valley Area	Dudley Ridge WD	49,425	1,928	1,451	482	53,286
	Empire West Side ID	1,074	175	187	–	1,436
	Kern County WA	860,735	27,891	22,379	8,419	919,424
	Kings County	3,600	58	–	34	3,692
	Oak Flat WD	4,059	19	140	48	4,266
	Tulare Lake Basin WSD	94,376	6,243	4,284	938	105,841
	Subtotal	**1,013,269**	**36,314**	**28,441**	**9,921**	**1,087,945**
Central Coastal Area	San Luis Obispo County FCWCD	4,417	36	–	–	4,453
	Santa Barbara County FCWCD	24,312	339	2,274	43	26,968
	Subtotal	**28,729**	**375**	**2,274**	**43**	**31,421**
Southern California Area	Antelope Valley–East Kern WA	52,730	–	7,049	250	60,029
	Castaic Lake WA	49,895	991	4,760	90	55,736
	Coachella Valley WD	14,045	204	–	194	14,443
	Crestline–Lake Arrowhead WA	1,563	–	–	–	1,563
	Desert WA	23,168	330	–	321	23,819
	Littlerock Creek ID	–	–	–	–	–
	Metropolitan WD of Southern California	1,480,252	17,622	204,949	16,920	1,719,743
	Mojave WA	10,907	–	3,528	–	14,435
	Palmdale WD	9,701	–	1,846	–	11,547
	San Bernardino Valley MWD	24,069	200	1,844	–	26,113
	San Gabriel Valley MWD	13,034	200	–	–	13,234
	San Gorgonio Pass WA	116	–	–	–	116
	Ventura County WPD	5,000	–	–	–	5,000
	Subtotal	**1,684,480**	**19,547**	**223,976**	**17,775**	**1,945,778**
TOTAL SWP DELIVERIES		**2,912,295**	**59,828**	**290,017**	**29,770**	**3,291,910**

Table A-2. Historical State Water Project Deliveries, Calendar Year 2004

Contractor Location	SWP Contractor	SWP Water Type Delivered (acre-feet)				Total SWP Deliveries (acre-feet)
		Table A	Article 21	Carryover	Turnback	
Feather River Area	Butte County	1,440	–	–	–	1,440
	Plumas County FCWCD	–	–	–	–	–
	Yuba City	1,434	–	–	–	1,434
	Subtotal	**2,874**	**–**	**–**	**–**	**2,874**
North Bay Area	Napa County FCWCD	5,030	1,450	1,602	52	8,134
	Solano County WA	17,991	7,787	47	–	25,825
	Subtotal	**23,021**	**9,237**	**1,649**	**52**	**33,959**
South Bay Area	Alameda County FCWCD, Zone 7	40,898	–	11,466	–	52,364
	Alameda County WD	20,956	–	6,714	214	27,884
	Santa Clara Valley WD	52,867	2,983	–	508	56,358
	Subtotal	**114,721**	**2,983**	**18,180**	**722**	**136,606**
San Joaquin Valley Area	Dudley Ridge WD	36,378	7,393	2,184	291	46,246
	Empire West Side ID	1,310	626	1,626	–	3,562
	Kern County WA	640,190	86,513	40,120	5,075	771,898
	Kings County	5,850	3,157	–	46	9,053
	Oak Flat WD	4,324	–	276	29	4,629
	Tulare Lake Basin WSD	58,575	15,299	5,638	489	80,001
	Subtotal	**746,627**	**112,988**	**49,844**	**5,930**	**915,389**
Central Coastal Area	San Luis Obispo County FCWCD	4,096	69	–	–	4,165
	Santa Barbara County FCWCD	29,358	–	208	122	29,688
	Subtotal	**33,454**	**69**	**208**	**122**	**33,853**
Southern California Area	Antelope Valley-East Kern WA	50,532	–	9,199	–	59,731
	Castaic Lake WA	46,358	1,618	35,785	–	83,761
	Coachella Valley WD	8,631	–	6,745	89	15,465
	Crestline-Lake Arrowhead WA	2,006	–	–	–	2,006
	Desert WA	9,966	–	11,122	102	21,190
	Littlerock Creek ID	–	–	–	–	–
	Metropolitan WD of Southern California	1,195,807	91,601	215,000	10,223	1,512,631
	Mojave WA	11,176	–	–	–	11,176
	Palmdale WD	10,549	–	1,613	–	12,162
	San Bernardino Valley MWD	35,555	–	20,631	–	56,186
	San Gabriel Valley MWD	15,600	–	–	–	15,600
	San Gorgonio Pass WA	841	–	–	–	841
	Ventura County WPD	5,250	–	–	–	5,250
	Subtotal	**1,392,271**	**93,219**	**300,095**	**10,414**	**1,795,999**
TOTAL SWP DELIVERIES		**2,312,968**	**218,496**	**369,976**	**17,240**	**2,918,680**

Table A–3. Historical State Water Project Deliveries, Calendar Year 2005						
Contractor Location	SWP Contractor	SWP Water Type Delivered (acre–feet)				Total SWP Deliveries (acre–feet)
		Table A	Article 21	Carryover	Turnback	
Feather River Area	Butte County	527	–	–	–	527
	Plumas County FCWCD	–	–	–	–	–
	Yuba City	1,894	–	–	–	1,894
	Subtotal	**2,421**	**–**	**–**	**–**	**2,421**
North Bay Area	Napa County FCWCD	5,322	606	1,741	–	7,669
	Solano County WA	24,515	10,421	83	–	35,019
	Subtotal	**29,837**	**11,027**	**1,824**	**–**	**42,688**
South Bay Area	Alameda County FCWCD, Zone 7	39,388	–	7,849	275	47,512
	Alameda County WD	36,469	846	6,341	943	44,599
	Santa Clara Valley WD	89,476	6,298	12,133	342	108,249
	Subtotal	**165,333**	**7,144**	**26,323**	**1,560**	**200,360**
San Joaquin Valley Area	Dudley Ridge WD	51,609	28,197	821	1,286	81,913
	Empire West Side ID	1,448	1,799	587	–	3,834
	Kern County WA	893,439	453,078	8,985	22,397	1,377,899
	Kings County	8,100	11,504	–	202	19,806
	Oak Flat WD	4,067	–	–	127	4,194
	Tulare Lake Basin WSD	86,604	47,267	3,973	2,158	140,002
	Subtotal	**1,045,267**	**541,845**	**14,366**	**26,170**	**1,627,648**
Central Coastal Area	San Luis Obispo County FCWCD	4,006	245	–	–	4,251
	Santa Barbara County FCWCD	22,981	–	–	155	23,136
	Subtotal	**26,987**	**245**	**–**	**155**	**27,387**
Southern California Area	Antelope Valley–East Kern WA	57,205	–	2,626	–	59,831
	Castaic Lake WA	54,303	2,451	2,702	–	59,456
	Coachella Valley WD	26,984	–	12,819	2,716	42,519
	Crestline–Lake Arrowhead WA	807	–	–	–	807
	Desert WA	33,168	–	14,799	1,122	49,089
	Littlerock Creek ID	–	–	–	–	–
	Metropolitan WD of Southern California	1,247,183	168,300	128,140	6,530	1,550,153
	Mojave WA	10,360	–	1,201	–	11,561
	Palmdale WD	10,174	–	1,538	–	11,712
	San Bernardino Valley MWD	31,205	56	282	–	31,543
	San Gabriel Valley MWD	10,500	–	–	–	10,500
	San Gorgonio Pass WA	655	15	–	22	692
	Ventura County WPD	1,665	–	–	–	1,665
	Subtotal	**1,484,209**	**170,822**	**164,107**	**10,390**	**1,829,528**
TOTAL SWP DELIVERIES		**2,754,054**	**731,083**	**206,620**	**38,275**	**3,730,032**

Table A–4. Historical State Water Project Deliveries, Calendar Year 2006							
Contractor Location	SWP Contractor	SWP Water Type Delivered (acre–feet)				Total SWP Deliveries (acre–feet)
		Table A	Article 21	Carryover	Turnback	
Feather River Area	Butte County	468	–	–	–	468
	Plumas County FCWCD	–	–	–	–	–
	Yuba City	4,148	1,194	–	–	5,342
	Subtotal	**4,616**	**1,194**	**–**	**–**	**5,810**
North Bay Area	Napa County FCWCD	7,317	300	172	–	7,789
	Solano County WA	12,070	18,195	390	–	30,655
	Subtotal	**19,387**	**18,495**	**562**	**–**	**38,444**
South Bay Area	Alameda County FCWCD, Zone 7	51,784	–	2,252	491	54,527
	Alameda County WD	39,570	1,922	1,331	256	43,079
	Santa Clara Valley WD	47,344	26,769	524	–	74,637
	Subtotal	**138,698**	**28,691**	**4,107**	**747**	**172,243**
San Joaquin Valley Area	Dudley Ridge WD	55,343	18,429	–	1,068	74,840
	Empire West Side ID	1,500	1,124	658	–	3,282
	Kern County WA	970,689	247,914	5,418	18,610	1,242,631
	Kings County	8,991	366	–	173	9,530
	Oak Flat WD	4,118	–	17	107	4,242
	Tulare Lake Basin WSD	48,361	58,059	–	1,787	108,207
	Subtotal	**1,089,002**	**325,892**	**6,093**	**21,745**	**1,442,732**
Central Coastal Area	San Luis Obispo County FCWCD	3,382	827	–	–	4,209
	Santa Barbara County FCWCD	19,255	4,020	–	–	23,275
	Subtotal	**22,637**	**4,847**	**–**	**–**	**27,484**
Southern California Area	Antelope Valley–East Kern WA	76,623	–	3,761	–	80,384
	Castaic Lake WA	56,758	2,089	3,905	–	62,752
	Coachella Valley WD	121,100	–	–	–	121,100
	Crestline–Lake Arrowhead WA	641	–	–	–	641
	Desert WA	50,000	–	–	–	50,000
	Littlerock Creek ID	–	–	–	–	–
	Metropolitan WD of Southern California	1,103,538	238,478	136,424	11,638	1,490,078
	Mojave WA	32,496	–	1,518	–	34,014
	Palmdale WD	10,374	1,653	335	130	12,492
	San Bernardino Valley MWD	31,902	–	3,427	–	35,329
	San Gabriel Valley MWD	13,524	–	–	–	13,524
	San Gorgonio Pass WA	4,278	–	–	–	4,278
	Ventura County WPD	1,850	–	–	–	1,850
	Subtotal	**1,503,084**	**242,220**	**149,370**	**11,768**	**1,906,442**
	TOTAL SWP DELIVERIES	**2,777,424**	**621,339**	**160,132**	**34,260**	**3,593,155**

Table A–5. Historical State Water Project Deliveries, Calendar Year 2007						
Contractor Location	SWP Contractor	SWP Water Type Delivered (acre–feet)				Total SWP Deliveries (acre–feet)
		Table A	Article 21	Carryover	Turnback	
Feather River Area	Butte County	956	–	–	–	956
	Plumas County FCWCD	–	–	–	–	–
	Yuba City	2,327	–	–	–	2,327
	Subtotal	**3,283**	**–**	**–**	**–**	**3,283**
North Bay Area	Napa County FCWCD	6,362	3,597	998	–	10,957
	Solano County WA	14,892	8,217	1,822	–	24,931
	Subtotal	**21,254**	**11,814**	**2,820**	**–**	**35,888**
South Bay Area	Alameda County FCWCD, Zone 7	35,972	912	2,895	378	40,157
	Alameda County WD	16,541	550	2,103	197	19,391
	Santa Clara Valley WD	38,812	4,840	8,161	469	52,282
	Subtotal	**91,325**	**6,302**	**13,159**	**1,044**	**111,830**
San Joaquin Valley Area	Dudley Ridge WD	28,457	8,953	2,000	269	39,679
	Empire West Side ID	397	1,172	515	–	2,084
	Kern County WA	592,423	99,861	19,645	4,683	716,612
	Kings County	4,924	474	305	43	5,746
	Oak Flat WD	3,430	41	69	27	3,567
	Tulare Lake Basin WSD	57,272	12,902	16,459	450	87,083
	Subtotal	**686,903**	**123,403**	**38,993**	**5,472**	**854,771**
Central Coastal Area	San Luis Obispo County FCWCD	3,752	24	–	–	3,776
	Santa Barbara County FCWCD	24,760	1,070	1,390	–	27,220
	Subtotal	**28,512**	**1,094**	**1,390**	**–**	**30,996**
Southern California Area	Antelope Valley–East Kern WA	74,459	–	4,364	–	78,823
	Castaic Lake WA	44,974	–	4,216	–	49,190
	Coachella Valley WD	72,660	–	–	568	73,228
	Crestline–Lake Arrowhead WA	1,768	–	–	–	1,768
	Desert WA	30,000	–	–	234	30,234
	Littlerock Creek ID	1,380	–	–	–	1,380
	Metropolitan WD of Southern California	1,146,900	166,517	28,098	8,962	1,350,477
	Mojave WA	45,372	–	737	–	46,109
	Palmdale WD	12,780	843	985	100	14,708
	San Bernardino Valley MWD	57,116	–	–	–	57,116
	San Gabriel Valley MWD	10,000	–	–	–	10,000
	San Gorgonio Pass WA	3,935	–	–	–	3,935
	Ventura County WPD	3,000	–	–	–	3,000
	Subtotal	**1,504,344**	**167,360**	**38,400**	**9,864**	**1,719,968**
TOTAL SWP DELIVERIES		**2,335,621**	**309,973**	**94,762**	**16,380**	**2,756,736**

Table A–6. Historical State Water Project Deliveries, Calendar Year 2008

Contractor Location	SWP Contractor	SWP Water Type Delivered (acre–feet)				Total SWP Deliveries (acre–feet)
		Table A	Article 21	Carryover	Turnback	
Feather River Area	Butte County	9,436	–	–	–	9,436
	Plumas County FCWCD	243	–	–	–	243
	Yuba City	1,923	–	–	–	1,923
	Subtotal	**11,602**	**–**	**–**	**–**	**11,602**
North Bay Area	Napa County FCWCD	3,636	1,219	7,363	21	12,239
	Solano County WA	10,436	1,510	12,389	–	24,335
	Subtotal	**14,072**	**2,729**	**19,752**	**21**	**36,574**
South Bay Area	Alameda County FCWCD, Zone 7	17,913	–	15,400	–	33,313
	Alameda County WD	4,206	–	8,659	37	12,902
	Santa Clara Valley WD	11,133	–	21,188	88	32,409
	Subtotal	**33,252**	**–**	**45,247**	**125**	**78,624**
San Joaquin Valley Area	Dudley Ridge WD	12,260	–	5,949	51	18,260
	Empire West Side ID	–	–	915	–	915
	Kern County WA	271,636	–	6,815	883	279,334
	Kings County	3,187	–	541	8	3,736
	Oak Flat WD	1,929	–	–	5	1,934
	Tulare Lake Basin WSD	32,302	–	281	85	32,668
	Subtotal	**321,314**	**–**	**14,501**	**1,032**	**336,847**
Central Coastal Area	San Luis Obispo County FCWCD	8,512	–	–	–	8,512
	Santa Barbara County FCWCD	11,311	–	2,532	40	13,883
	Subtotal	**19,823**	**–**	**2,532**	**40**	**22,395**
Southern California Area	Antelope Valley–East Kern WA	31,082	–	10,381	125	41,588
	Castaic Lake WA	18,710	–	12,146	–	30,856
	Coachella Valley WD	42,385	–	–	107	42,492
	Crestline–Lake Arrowhead WA	1,159	–	689	–	1,848
	Desert WA	17,500	–	–	44	17,544
	Littlerock Creek ID	805	–	–	–	805
	Metropolitan WD of Southern California	658,304	–	–	1,689	659,993
	Mojave WA	26,288	–	108	–	26,396
	Palmdale WD	4,226	–	–	19	4,245
	San Bernardino Valley MWD	26,562	–	4,444	–	31,006
	San Gabriel Valley MWD	10,080	–	–	–	10,080
	San Gorgonio Pass WA	5,419	–	300	–	5,719
	Ventura County WPD	3,798	–	–	–	3,798
	Subtotal	**846,318**	**–**	**28,068**	**1,984**	**876,370**
	TOTAL SWP DELIVERIES	**1,246,381**	**2,729**	**110,100**	**3,202**	**1,362,412**

Table A–7. Historical State Water Project Deliveries, Calendar Year 2009						
Contractor Location	SWP Contractor	SWP Water Type Delivered (acre–feet)				Total SWP Deliveries (acre–feet)
		Table A	Article 21	Carryover	Turnback	
Feather River Area	Butte County	10,206	–	–	–	10,206
	Plumas County FCWCD	200	–	–	–	200
	Yuba City	2,114	–	–	–	2,114
	Subtotal	**12,520**	**–**	**–**	**–**	**12,520**
North Bay Area	Napa County FCWCD	2,723	1,588	4,475	13	8,799
	Solano County WA	7,118	4,444	3,123	–	14,685
	Subtotal	**9,841**	**6,032**	**7,598**	**13**	**23,484**
South Bay Area	Alameda County FCWCD, Zone 7	16,245	–	14,932	–	31,177
	Alameda County WD	5,911	–	10,883	8	16,802
	Santa Clara Valley WD	9,188	–	29,679	54	38,921
	Subtotal	**31,344**	**–**	**55,494**	**62**	**86,900**
San Joaquin Valley Area	Dudley Ridge WD	13,185	–	7,810	32	21,027
	Empire West Side ID	1,034	–	–	–	1,034
	Kern County WA	323,426	–	56,367	544	380,337
	Kings County	3,153	–	70	5	3,228
	Oak Flat WD	1,825	–	66	3	1,894
	Tulare Lake Basin WSD	35,160	–	1,271	52	36,483
	Subtotal	**377,783**	**–**	**65,584**	**636**	**444,003**
Central Coastal Area	San Luis Obispo County FCWCD	9,723	–	–	–	9,723
	Santa Barbara County FCWCD	4,961	–	6,384	25	11,370
	Subtotal	**14,684**	**–**	**6,384**	**25**	**21,093**
Southern California Area	Antelope Valley–East Kern WA	13,499	–	18,408	77	31,984
	Castaic Lake WA	14,858	–	9,529	52	24,439
	Coachella Valley WD	40,845	–	–	66	40,911
	Crestline–Lake Arrowhead WA	1,000	–	893	–	1,893
	Desert WA	16,865	–	–	27	16,892
	Littlerock Creek ID	920	–	–	–	920
	Metropolitan WD of Southern California	696,817	–	10,721	1,042	708,580
	Mojave WA	30,300	–	242	–	30,542
	Palmdale WD	2,470	–	3,229	–	5,699
	San Bernardino Valley MWD	26,085	–	9,348	–	35,433
	San Gabriel Valley MWD	11,516	–	–	–	11,516
	San Gorgonio Pass WA	5,312	–	480	–	5,792
	Ventura County WPD	3,890	–	–	–	3,890
	Subtotal	**864,377**	**–**	**52,850**	**1,264**	**918,491**
TOTAL SWP DELIVERIES		**1,310,549**	**6,032**	**187,910**	**2,000**	**1,506,491**

Table A–8. Historical State Water Project Deliveries, Calendar Year 2010

Contractor Location	SWP Contractor	SWP Water Type Delivered (acre–feet)				Total SWP Deliveries (acre–feet)
		Table A	Article 21	Carryover	Turnback	
Feather River Area	Butte County	807	–	–	–	807
	Plumas County FCWCD	243	–	–	–	243
	Yuba City	2,331	–	–	–	2,331
	Subtotal	**3,381**	**–**	**–**	**–**	**3,381**
North Bay Area	Napa County FCWCD	7,275	2,207	3,044	90	12,616
	Solano County WA	13,793	5,298	3,661	–	22,752
	Subtotal	**21,068**	**7,505**	**6,705**	**90**	**35,368**
South Bay Area	Alameda County FCWCD, Zone 7	28,694	–	16,356	249	45,299
	Alameda County WD	11,668	–	14,359	14	26,041
	Santa Clara Valley WD	37,850	–	28,809	34	66,693
	Subtotal	**78,212**	**–**	**59,524**	**297**	**138,033**
San Joaquin Valley Area	Dudley Ridge WD	19,650	–	9,750	156	29,556
	Empire West Side ID	380	–	166	–	546
	Kern County WA	410,856	–	55,419	3,044	469,319
	Kings County	4,094	–	522	29	4,645
	Oak Flat WD	2,412	–	455	18	2,885
	Tulare Lake Basin WSD	39,835	–	3,199	275	43,309
	Subtotal	**477,227**	**–**	**69,511**	**3,522**	**550,260**
Central Coastal Area	San Luis Obispo County FCWCD	3,480	–	277	–	3,757
	Santa Barbara County FCWCD	8,640	–	9,865	140	18,645
	Subtotal	**12,120**	**–**	**10,142**	**140**	**22,402**
Southern California Area	Antelope Valley–East Kern WA	35,312	–	20,813	438	56,563
	Castaic Lake WA	37,054	–	14,501	295	51,850
	Coachella Valley WD	69,175	–	7,595	429	77,199
	Crestline–Lake Arrowhead WA	1,357	–	–	–	1,357
	Desert WA	27,875	–	3,135	173	31,183
	Littlerock Creek ID	1,150	–	–	–	1,150
	Metropolitan WD of Southern California	900,210	–	123,323	5,922	1,029,455
	Mojave WA	41,132	–	20	–	41,152
	Palmdale WD	5,585	–	5,325	59	10,969
	San Bernardino Valley MWD	38,133	–	11,273	–	49,406
	San Gabriel Valley MWD	14,400	–	–	–	14,400
	San Gorgonio Pass WA	5,226	–	1,608	6	6,840
	Ventura County WPD	4,075	–	–	–	4,075
	Subtotal	**1,180,684**	**–**	**187,593**	**7,322**	**1,375,599**
TOTAL SWP DELIVERIES		**1,772,692**	**7,505**	**333,475**	**11,371**	**2,125,043**

Table A–9. Historical State Water Project Deliveries, Calendar Year 2011						
Contractor Location	SWP Contractor	SWP Water Type Delivered (acre–feet)				Total SWP Deliveries (acre–feet)
		Table A	Article 21	Carryover	Turnback	
Feather River Area	Butte County	1,092	–	–	–	1,092
	Plumas County FCWCD	98	–	–	–	98
	Yuba City	2,297	–	–	–	2,297
	Subtotal	**3,487**	**–**	**–**	**–**	**3,487**
North Bay Area	Napa County FCWCD	9,426	–	1,189	–	10,615
	Solano County WA	9,620	15,000	–	–	24,620
	Subtotal	**19,046**	**15,000**	**1,189**	**–**	**35,235**
South Bay Area	Alameda County FCWCD, Zone 7	39,066	–	11,975	1,319	52,360
	Alameda County WD	24,813	1,959	7,840	506	35,118
	Santa Clara Valley WD	64,538	970	19,803	–	85,311
	Subtotal	**128,417**	**2,929**	**39,618**	**1,825**	**172,789**
San Joaquin Valley Area	Dudley Ridge WD	40,141	11,666	5,524	823	58,154
	Empire West Side ID	1,626	138	151	–	1,915
	Kern County WA	753,707	194,119	119,773	16,068	1,083,667
	Kings County	5,294	552	558	152	6,556
	Oak Flat WD	2,644	–	71	–	2,715
	Tulare Lake Basin WSD	39,056	6,909	4,626	1,454	52,045
	Subtotal	**842,468**	**213,384**	**130,703**	**18,497**	**1,205,052**
Central Coastal Area	San Luis Obispo County FCWCD	3,340	–	479	–	3,819
	Santa Barbara County FCWCD	29,132	–	6,587	–	35,719
	Subtotal	**32,472**	**–**	**7,066**	**–**	**39,538**
Southern California Area	Antelope Valley–East Kern WA	77,549	7,629	5,888	–	91,066
	Castaic Lake WA	34,509	400	9,332	–	44,241
	Coachella Valley WD	88,017	–	–	2,262	90,279
	Crestline–Lake Arrowhead WA	423	–	51	–	474
	Desert WA	36,139	–	–	240	36,379
	Littlerock Creek ID	–	–	–	–	–
	Metropolitan WD of Southern California	1,286,935	181,610	42,688	8,237	1,519,470
	Mojave WA	4,831	–	268	–	5,099
	Palmdale WD	12,294	–	5,019	–	17,313
	San Bernardino Valley MWD	30,916	–	7,210	–	38,126
	San Gabriel Valley MWD	23,040	–	–	–	23,040
	San Gorgonio Pass WA	8,884	–	1,619	–	10,503
	Ventura County WPD	4,000	–	–	–	4,000
	Subtotal	**1,607,537**	**189,639**	**72,075**	**10,739**	**1,879,990**
TOTAL SWP DELIVERIES		**2,633,427**	**420,952**	**250,651**	**31,061**	**3,336,091**

Table A–10. Historical State Water Project Deliveries, Calendar Year 2012						
Contractor Location	SWP Contractor	SWP Water Type Delivered (acre–feet)				Total SWP Deliveries (acre–feet)
		Table A	Article 21	Carryover	Turnback	
Feather River Area	Butte County	17,875	–	–	–	17,875
	Plumas County FCWCD	79	–	–	–	79
	Yuba City	2,695	–	–	–	2,695
	Subtotal	**20,649**	**–**	**–**	**–**	**20,649**
North Bay Area	Napa County FCWCD	5,062	–	4,278	64	9,404
	Solano County WA	3,428	1,027	22,096	–	26,551
	Subtotal	**8,490**	**1,027**	**26,374**	**64**	**35,955**
South Bay Area	Alameda County FCWCD, Zone 7	32,301	–	18,457	179	50,937
	Alameda County WD	11,951	–	6,420	93	18,464
	Santa Clara Valley WD	34,612	–	14,330	222	49,164
	Subtotal	**78,864**	**–**	**39,207**	**494**	**118,565**
San Joaquin Valley Area	Dudley Ridge WD	17,694	–	–	112	17,806
	Empire West Side ID	1,468	–	774	–	2,242
	Kern County WA	549,932	–	32,477	2,180	584,589
	Kings County	5,337	–	2,001	21	7,359
	Oak Flat WD	2,596	–	612	–	3,208
	Tulare Lake Basin WSD	53,630	–	32,081	197	85,908
	Subtotal	**630,657**	**–**	**67,945**	**2,510**	**701,112**
Central Coastal Area	San Luis Obispo County FCWCD	3,111	–	833	–	3,944
	Santa Barbara County FCWCD	20,874	–	43	–	20,917
	Subtotal	**23,985**	**–**	**876**	**–**	**24,861**
Southern California Area	Antelope Valley–East Kern WA	80,694	–	32,854	–	113,548
	Castaic Lake WA	43,226	–	11,496	–	54,722
	Coachella Valley WD	89,928	–	22,663	307	112,898
	Crestline–Lake Arrowhead WA	483	–	–	–	483
	Desert WA	36,238	–	8,461	124	44,823
	Littlerock Creek ID	–	–	–	–	–
	Metropolitan WD of Southern California	1,084,623	–	75,484	4,241	1,164,348
	Mojave WA	4,672	–	6,572	–	11,244
	Palmdale WD	9,959	–	4,736	–	14,695
	San Bernardino Valley MWD	65,102	–	47,900	–	113,002
	San Gabriel Valley MWD	18,720	–	–	–	18,720
	San Gorgonio Pass WA	5,968	–	4,956	–	10,924
	Ventura County WPD	4,353	–	–	–	4,353
	Subtotal	**1,443,966**	**–**	**215,122**	**4,672**	**1,663,760**
TOTAL SWP DELIVERIES		**2,206,611**	**1,027**	**349,524**	**7,740**	**2,564,902**