The Final State Water Project Delivery Capability Report 2019

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State of California
Natural Resources Agency
Department of Water Resources

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List of Acronyms

ANN (Artificial Neural Network)

BiOps (Biological Opinions)

CEQA (California Environmental Quality Act)

CESA (California Endangered Species Act)

CDFW (California Department of Fish and Wildlife)

CII (Commercial, Industrial, Institutional)

COA (Coordinated Operation Agreement)

CVP (Central Valley Project)

CY (Calendar Year)

D-1641 (State Water Board's Water Right Decision 1641 (D-1641), issued in December 1999 and updated in March 2000)

DO (Dissolved oxygen)

DSM2 (Delta Simulation Model 2)

E/I (Delta Exports to Inflow ratio)

EcoRestore (Governor Brown's Delta habitat restoration plan)

EIR (Environmental Impact Report)

EIS (Environmental Impact Statement)

ESA (Endangered Species Act)

FCWCD (Flood Control and Water Conservation District)

ID (Irrigation District)

ITP (Incidental Take Permit for Long-Term Operation of the State Water Project)

KCWA (Kern County Water Agency)

M&I (Municipal and Industrial)

MWDSC (Metropolitan Water District of Southern California)

NEPA (National Environmental Policy Act)

NMFS (National Marine Fisheries Service)

NOD (Notice of Determination)

NOP (Notice of Preparation)

OAL (The State Office of Administrative Law)

ROC on LTO (Re-initiation of Consultation on the Long-Term Operations of the Central Valley Project and State Water Project)

ROD (Record of Decision)

RPA (Reasonable and Prudent Alternative)

SED (Substitute Environmental Document)

SWP (State Water Project)

SWPAO (State Water Project Analysis Office)

SWRCB (State Water Resources Control Board)

USBR (United States Bureau of Reclamation)

USFWS (United States Fish and Wildlife Service)

UWMP (Urban Water Management Plan)

VA (Voluntary Agreements)

WaterFix (The water transfer component of the Bay Delta Conservation Plan)

WD (Water District)

WSD (Water Storage District)

WSI-DI (Water Supply Index vs. Demand Index Relationship)

WQCP (Water Quality Control Plan for the San Francisco Bay/Sacramento–San Joaquin Delta)

WY (Water Year)

X2 (The distance in kilometers from Golden Gate, where salinity concentration in the Delta is 2 parts per thousand)

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Summary

The California Department of Water Resources (DWR) has authority under state law to construct, operate, and maintain the State Water Project (SWP) to manage, store and deliver water for the benefit of the State. This report is intended to provide information about the key factors affecting the operation of the SWP in California, its long-term capability as a source of water for beneficial use, and an estimate of its current delivery capability. This report meets the requirements of Attachment B to the Monterey Plus Settlement Agreement of May 2003.

Water provided by the SWP is a major source of the water supplies available to many SWP contractors. SWP contractors consist of 29 public entities that include cities, counties, urban water agencies, and agricultural irrigation districts. SWP contractors' local/regional water users have long-term contracts with the California Department of Water Resources (DWR) for all, or a portion of their water supply needs. Thus, the delivery capability of water from the SWP system is an important component in the water supply planning of its recipients, and ultimately affects the amount of water available for beneficial use in California.

The availability of these water supplies may be highly variable. A sequence of relatively wet water years[1] may be followed by a varying sequence of dry or critically dry years. Having good and reliable estimates on how much water each water user under contract with DWR will receive 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 or back up sources of water to meet their needs.

The geography of California and the infrastructure of water transfer from the source areas, located in the Sierra Mountain Range, to areas of demand for water, makes the Sacramento-San Joaquin Delta a key feature of the SWP's ability to deliver water to its agricultural and urban Contractors in the North Bay, the South Bay, California Central Valley, and Southern California. All but five of the 29 SWP Contractors receive water deliveries by diversions from the Delta. These water diversions are pumped by either the Harvey O. Banks or Barker Slough pumping plants.

DWR, and the United States Bureau of Reclamation (USBR), the managing entities of the two statewide systems of water transfer in California, face numerous challenges in the operation of their diversion facilities in the Delta, and are regulated by several state and federal agencies to maintain, and enhance the Delta's long-term sustainability.

Maintaining suitable quality of water flowing in the channels of the Delta for the numerous in-basin beneficial uses, and the protection of endangered and threatened fish species, are important factors of concern for the operators of the Delta export diversion facilities. Ongoing regulatory restrictions, such as those aimed at protecting the estuary's resident and migratory fish species are major challenges to a reliable, and at the same time, sustainable water delivery capability of both, SWP and the Central Valley Project (CVP) systems.

[1] Water years start on October 1 and end on September 30 of the next year.

Complications induced by climate change also pose the threat of increased variability in floods and droughts, and the projected sea level rise, caused by the increase in average temperature, complicate efforts to manage salinity levels in the channels affected by tides. Higher ocean levels could result in more frequent water quality degradation in the Delta channels requiring additional outflow from the Delta to maintain water quality objectives, and reduced delivery capability.

Among the other challenges are continued subsidence of Delta islands, many of which are already below sea level, maintained by relatively unstable levee system, and the related threat of a catastrophic levee failure as water pressure increases on fragile levees.

The analyses in this report factor in all the current regulations governing SWP and CVP operations in the Delta and upstream, and assumptions about water uses upstream in the Sacramento River and San Joaquin River 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.

While many of the same specific assumptions on SWP operations described in the State Water Project Delivery Capability Report 2017 remain the same in this update for 2019, notable changes include the amendment to the Coordinated Operation Agreement (COA), modeling representation of Old and Middle River (OMR) operational criteria, and CVP and SWP operational updates. Hence, the differences between the 2017 and 2019 report can be attributed primarily to inputs on operating assumptions.

SWP Delta exports have decreased since 2005, although the bulk of the change occurred between 2005 and 2009 and in 2019. The former reduction is due to the Delta regulations which constrained exports, culminating in the federal Biological Opinions that went into effect in 2008-2009, restricting operations of the CVP and SWP diversion pumps. The later reduction is primarily due to the amended COA with accompanying project operation changes which reduced SWP exports and increased CVP exports, and to a more conservative operation by the SWP of Lake Oroville.

The most salient findings in this report are as follows:

- Under existing conditions, the average annual delivery of Table A water estimated for this 2019 Report with the 1922-2003 flow record is 2,414 TAF/year, 157 TAF less than the 2,571 TAF/year estimated for the 2017 Report (Table 5-2).

- The likelihood of existing-condition SWP Article 21 deliveries (supplemental deliveries to Table A water) being greater than 20 TAF/year has increased by 27% relative to the likelihood presented in the 2017 Report (Figure 5-7).

Section 1: Reasons to Assess SWP Water Delivery Capability

Two major factors underscore the importance of assessing the SWP's water delivery capability: 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 million. Based on this trend, California's population has been projected to be more than 43 million by 2030. The *California Water Plan 2018* indicates that for year 2060 conditions, based on the California Department of Finance's projections of 2010 U.S. Census data, the population is projected to be nearly 51 million—a 70% increase compared to the 1990 population.

The amount of water available in California 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 enough 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.

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 capability estimates to local and regional water purveyors.

Urban Water Management Planning Act

The Urban Water Management Planning Act was enacted in 1983 (California Water Code, Sections 10610–10656). As amended, this law requires all public urban water purveyors to adopt urban water management plans (UWMPs) every 5 years and submit those plans to DWR. DWR reviews submitted plans to report to the legislature on the status of submitted plans and for the purposes of grant eligibility requirements.

UWMPs must include an estimate of water supply and demand for a 20-year planning horizon and three water-year types, normal, single dry year and a drought lasting 5 consecutive years. SWP Contractors use SWP delivery capability to estimate their long-term water supply needs from other sources available to them. DWR publishes a guidebook to assist water suppliers prepare their urban water management plans.

Further information is available at:

https://water.ca.gov/Programs/Water-Use-And-Efficiency/Urban-Water-Use-Efficiency/Urban-Water-Management-Plans

Water Conservation Act of 2009: SB X7-7

California became the first state to adopt urban water use efficiency targets with the enactment of the Water Conservation Act of 2009 (SB X7-7, Steinberg, 2009). This Act mandated the State achieve a 20% reduction in urban per capita water use by 2020. It directed urban water suppliers to develop individual targets based on a historical per capita baseline, and to report interim progress in their 2015 urban water management plans (UWMPs) and full compliance of their 2020 plans.

In addition, the Act requires agricultural water suppliers serving more than 25,000 irrigated acres (excluding recycled water deliveries) to adopt and submit to DWR an Agricultural Water Management Plan (AWMP). These plans must include reports on the implementation status of specific Efficient Water Management Practices (EWMPs) including the measurement and volumetric pricing of water deliveries. Agricultural water suppliers can submit individual plans or collaborate and submit regional plans, as long as the plans meet the requirements of SB X7-7. Agricultural water suppliers that provide water to between 10,000 and up to 25,000 irrigated acres (excluding recycled water) are not required to prepare or submit AWMPs under SB X7-7, unless state funds are made available to support this.

Water Conservation Legislation of 2018: AB 1668 and SB 606

In 2018, new landmark water conservation legislation was signed into law. Together, AB 1668 (Friedman, 2018) and SB 606 (Hertzberg, 2018), lay out a new long-term water conservation framework for California. This new framework is far-reaching for both the urban and agricultural sectors of California and represents a major shift in focus. Programs and initiatives are organized around four primary goals: (1) use water more wisely, (2) eliminate water waste, (3) strengthen local drought resilience, and (4) improve agricultural water use efficiency and drought planning.

The 2018 legislation defined a process to establish new, standards-based, urban water use objectives (targets) that go beyond the 2020 targets set in the Water Conservation Act of 2009. It also calls for the establishment of performance measures for Commercial, Industrial, Institutional (CII) water use, methods to strengthen local drought resilience including more robust water shortage contingency plans, a new five-year Drought Risk Assessment, and an annual water supply and demand assessment by urban water suppliers. DWR is required to prepare an annual report to the Water Board summarizing the annual assessment results, water shortage conditions, and a regional and statewide analysis of water supply conditions. To improve countywide drought planning, the code requires DWR to conduct a water shortage vulnerability study of rural and small communities and report back to the legislature with recommendations on implementation of drought contingency plans for rural small water systems.

Measures to improve agricultural water use efficiency include strengthened or new agricultural water management planning requirements include annual water budgets, water management objectives, the quantification of agricultural water use efficiency within agricultural water supplier's service area, and new drought planning for periods of limited supply.

To fully plan, develop and implement the new framework, DWR is responsible for numerous studies and investigations over the next three years, the development of standards, guidelines and methodologies, performance measures, web-based tools and calculators, data and data platforms, reports and recommendations to the State Water Resources Control Board (Water Board) for adoption of new regulations.

A detailed outline of the key authorities, requirements, timeline, roles, and responsibilities of State agencies, water suppliers, and other entities during implementation of actions described in the 2018 water conservation legislation, can be found in the summary report "Making Water Conservation a California Way of Life – Primer of 2018 Legislation on Water Conservation and Drought Planning, Senate Bill 606 (Hertzberg) and Assembly Bill 1668 (Friedman)" prepared by DWR and the Water Board.

Additional information on agricultural water use efficiency, water management plans, and supplier compliance can be found in the Agricultural Water Use Efficiency webpage maintained by DWR's Water Use and Efficiency Branch.

Section 2: Regulatory Restrictions on SWP Delta Exports

Multiple needs converge in the Delta: the need 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 fish and wildlife agencies contribute substantially to the challenge of accurately determining the SWP's water delivery capability 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 threatened or endangered are found in the Delta. These protected species' health and the viability of their populations are impacted by various factors, including SWP and CVP operations, nonnative species, predation, Delta salinity, water quality and contaminants, sediment supply, physical alterations to the Delta, land subsidence, pelagic organism decline, methylmercury and selenium, invasive aquatic vegetation, low dissolved oxygen (DO) levels and illegal harvest.

Because of the decline of these species, the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) have issued several Biological Opinions (BiOps) since the 1990s on the effects of coordinated SWP/CVP operations on several listed species. (USFWS Biological Opinion for Delta smelt protection and NMFS Biological Opinion for salmonids, green sturgeon, and Southern Resident killer whales)

These BiOps affect the SWP's water delivery capability for two reasons. Most notably, they include terms that restrict SWP exports in the Delta to specific amounts at certain times under certain conditions. The BiOps also include Delta outflow requirements during certain times of the year thus reducing the available supply for export or storage.

The first BiOp on the effects of SWP (and CVP) operations were issued in February 1993 (NMFS BiOp on effects of project operations on winter-run Chinook salmon) and March 1995 (USFWS BiOp on project effects on delta smelt and splittail). Among other requirements, the BiOps contained requirements for Delta inflow, Delta outflow, and export pumping restrictions in order to protect listed species. These requirements imposed substantial constraints on Delta water supply operations. Many were incorporated into the 1995 *Water Quality Control Plan for the San Francisco Bay/Sacramento–San Joaquin Delta*[2] (1995 WQCP), as described in the "Water Quality Objectives" section, below.

[2] The SWRCB is currently updating the WQCP.

The terms of the USFWS and NMFS BiOps have become increasingly restrictive over the years. In 2004 the USBR sought a new BiOp from USFWS regarding the operation of the CVP and the SWP (collectively, Projects). USFWS issued the opinion in 2005, finding that the proposed coordinated operations of the Projects were not likely to jeopardize the continued existence of the delta smelt or result in the destruction or adverse modification of its critical habitat. After judicial review, the 2005 BiOp was vacated and USFWS was ordered to prepare a new one. USFWS found that the proposed operations of the Project would result in jeopardy to the delta smelt and in December 2008 issued a Jeopardy BiOp which included a Reasonable and Prudent Alternative (RPA) with more protective export restrictions and other actions intended to protect the delta smelt.

Similarly, in 2004 NMFS issued a BiOp on the effects of the coordinated operation of the Projects on salmonids, green sturgeon, and Southern Resident killer whales and found that the proposed operations of the Projects were not likely to jeopardize the continued existence of the listed species or result in the destruction or adverse modification of their critical habitat. After judicial review, the 2004 BiOp was also vacated and NMFS was ordered to prepare a new one. In June 2009, NMFS issued a Jeopardy BiOp covering effects on winter-run and spring-run Chinook salmon, steelhead, green sturgeon, and killer whales. Like the 2008 smelt BiOp, the salmon BiOp included an RPA with more protective export restrictions and other actions intended to protect listed species.

The USFWS BiOp includes requirements on operations in all but 2 months of the year. The BiOp 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 restriction and corresponding effects on export pumping with any great certainty poses a challenge.

The USFWS BiOp 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 BiOp, 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 BiOps were issued shortly before and shortly after Governor Arnold Schwarzenegger 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 BiOp 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 the BiOps to protect delta smelt and other species. CDFW issued consistency determinations under Section 2080.1 of the California Fish and Game Code for these BiOps. The consistency determinations stated that the USFWS and the NMFS BiOps would be consistent with the California Endangered Species Act (CESA). Thus, CDFW 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 USBR to

obtain a separate State-issued permit.[3]

Reinitiation of Consultation for Long-Term Operations (RoC on LTO)

In August 2016, USBR and DWR requested reinitiating consultation with NMFS and USFWS on the Coordinated Long-term Operations of the CVP and SWP due to new information and science on declining listed fish species populations. On October 21, 2019, the U.S. Fish and Wildlife Service and the National Marine Fisheries Service released their Biological Opinions.

Reclamation released a final EIS on the RoC on LTO on December 19, 2019 and approved a Record of Decision that finalized environmental review on February 18, 2020. Reclamation began to operate according to the new operations plan in early 2020.

Incidental Take Permit (ITP)

The 2008 USFWS and 2009 NMFS Biological Opinions were consistent with CESA requirements. As such, further authorizations with respect to species listed under both ESA and CESA were not required. Under section 2081 of the California Fish and Wildlife Code, DWR held an ITP from the CDFW related to Longfin smelt.

But because this ITP expired at the end of December 2019, and because of the decision to pursue a separate state permit to ensure the SWP's compliance with CESA rather than relying on a consistency determination with Federal permits, DWR pursued a new ITP.

The ITP covers species listed under CESA subject to incidental take through long-term operation of the SWP, including Delta smelt, Longfin smelt, winter-run Chinook salmon and spring-run Chinook salmon. An EIR on the new ITP was issued in November 2019, an ITP application was submitted to CDFW in December 2019, and the new ITP was issued on March 31, 2020. DWR began to operate according to the ITP from April 2020 and the ITP operations are included in the CalSim modeling analysis in this document.

Delta Inflows

Delta inflows vary 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

[3] However, CDFW stated in an October 2017 response letter to DWR that according to the evidence, the USFWS memorandum (2017 Memorandum), authorizing a change to the required location of X2 in September and October of Wet Years, would not be consistent with the California Endangered Species Act (CESA) requirements.

rest comes from the three eastside streams (the Mokelumne, Cosumnes, and Calaveras Rivers).

The type of water year is an important factor affecting the volume of Delta inflows. When hydrology is analyzed, water years are designated by DWR as “wet” (W), “above normal” (AN), “below normal” (BN), “dry” (D), or “critical” (C). 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 exports.

Delta inflows will also vary by time of year as 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 regulate this variability by reducing flood flows during the rainy season and storing water to be released later in the year to meet regulatory requirements and water demands.

Water Quality Objectives

Because the Delta is an estuary, salinity is a particular concern. In the 1995 Bay-Delta Water Quality Control Plan (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 USBR. 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, which implemented the 1995 WQCP.

DWR and the USBR must monitor the effects of diversions and SWP and CVP operations to ensure compliance with existing water quality objectives.

Among the objectives established in the 1995 WQCP and D-1641 are the “X2” objectives. X2 is defined as the distance in kilometers from Golden Gate, where salinity concentration in the Delta 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, February through June, 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, which among other factors controls the location of X2 must be at certain specified levels at certain times. This can limit the amount of water the SWP may pump at those times at its Harvey O. Banks Pumping Plant in the Delta.

Because of the relationship between seawater intrusion and interior Delta water quality, meeting the X2 objective can also improve 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 is designed to provide protection for the fish and wildlife beneficial uses in the Bay Delta estuary. 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 March through June and 65% of inflow from July through January. The February E/I ratio can vary from 35% to 45% depending on the January Eight River Index (8RI). The 8RI is the sum of the Sacramento River and San Joaquin River Runoff. This index is used from December through May to set flow objectives as implemented in SWRCB D-1641.

In December 2018 the State Water Board updated the WQCP for the San Joaquin River flows and southern Delta Salinity. The State Water Board is in the process of updating the WQCP for Sacramento/Delta Flows and Cold Water, Delta Outflows, and Interior Delta Flows. (Formally these processes were referred to Phase 1 and Phase 2 respectively). A primary focus of the WQCP update is on additional flows for the beneficial use of fish and wildlife. Based on the environmental documentation that has been produced up to this date by the State Water Board, it is likely that the implementation of these flow requirements will affect SWP contractor deliveries.

The San Joaquin River (SJR) portion of the WQCP update was approved in December 2018 but not implemented. There also needs to be a Decision (like Decision-1641) that amends the water rights license and permits for the SWP and CVP (the Projects collectively) to require the Projects and others to meet the Bay-Delta Plan before the SWP operates to the approved SJR portion of the update. As a result, the DCR 2019 assumes the existing Decision-1641 in its modeling.

2018 Coordinated Operation Agreement (COA) Addendum

Originally negotiated and signed in 1986, the COA establishes the shared responsibility for each of the SWP and CVP to meet water quality and regulatory standards. Between 1986 and 2018, the State Water Resources Control Board imposed additional restrictions, including new Delta outflow requirements, which further restricted Delta exports and affect CVP and SWP operations. In response to these changes, a joint review of the 1986 agreement was conducted by both projects. At the conclusion, DWR and Bureau of Reclamation agreed to the COA Addendum to reflect the current regulatory environment and operations of the projects. The 2018 agreement addendum is included in the CalSim modeling analysis in this document.

Voluntary Agreement (VA)

The California Department of Water Resources and the Department of Fish and Wildlife (DFW) are working to establish the VA with participating water users following adoption by SWRCB of the San Joaquin River/southern Delta salinity WQCP update. The VA involve the development of projects that provide flow augmentation, modified storage releases and non-flow actions such as floodplain inundation to enhance Delta conditions. Both departments are continuing the effort to develop and evaluate proposed voluntary agreements. On March 1, 2019, DWR and DFW submitted documents to the State Water Resources Control Board that reflect progress to flesh-out the previously submitted framework to improve conditions for fish through targeted river flows and a suite of habitat-enhancing projects including floodplain inundation and physical improvement of spawning and rearing areas. Further work and analysis are needed to determine whether the agreements can meet environmental objectives required by law and identified in the State Water Board's update to the Bay-Delta Water Quality Control Plan.

As stated under the Water Quality Objectives background, the WQCP San Joaquin River/southern Delta salinity portion was approved but has not been implemented. The DCR 2019 assumes the existing Decision-1641 as specified in the Technical Addendum modeling assumptions as the implementation of the WQCP is still developing.

Section 3: Ongoing Environmental and Policy Planning Efforts

It is hard to overstate the Delta's importance to California's economy and natural heritage. The Delta supplies a large share of the water used in the state. California would not be the same without that water — hundreds of billions of dollars of economic activity depend upon it. Southern California, with half of the state's population, gets almost a quarter of its average water supply from the Delta; Kern County, which produces about $7 billion annually in grapes, almonds, pistachios, milk, citrus, pistachios and other agricultural produces , depends on the Delta for about a fifth of its irrigation supply; the west side of the San Joaquin Valley also produces billions of dollars' worth of food and depends on the Delta for about three-quarters of its irrigation supply; and the San Francisco Bay Area, including the innovation hub of Silicon Valley, takes about half of its water supply from the Delta and its tributaries.

At the same time, the hundreds of miles of river channels that crisscross the Delta's farmed islands provide a migratory pathway for Chinook salmon, which support an important West Coast fishing industry. Other native fish species depend upon the complex mix of fresh and saltwater in the Delta estuary. Multiple stressors have impaired the ecological functions of the Delta, and concerns have been growing over the ability to balance the many needs of both people and the ecosystem.

In order to respond to these concerns, considerable effort by government agencies and California water community as a whole has been spent during the past several decades to study ways that the problems in the Delta can be addressed, and the more recent attention to the effects of climate change has helped the water community to realize the urgency of addressing these problems. The essential part of all these efforts has been to find a comprehensive solution that brings various, sometimes competing, interests together in a coordinated and concerted set of actions. The Delta Plan and the Delta Conveyance are two large-scale planning efforts that are in development. Once implemented, both efforts, could affect SWP water delivery capability in different ways, and at different scales.

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 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 Council is required to review the Delta Plan at least every five years. The first Delta Plan was adopted by the Council on May 16, 2013. The State Office of Administrative Law (OAL) approved the 14 regulations to implement the Delta Plan, which became effective with legally enforceable regulations on September 1, 2013.

To be responsive to changing circumstances and in accordance with commitments made in the 2013 Plan, the Council amended the Delta Plan twice in 2016. The latest Delta Plan was released last April 2018 and amended January 2019. The Delta Plan contains a set of 14 regulatory policies as well as 95 recommendations, which are non-regulatory but identify actions essential to achieving the coequal goals.

Delta Conveyance Project

On May 2, 2019, Governor Gavin Newsom ended California WaterFix and announced a new approach to modernize Delta Conveyance through a single tunnel alternative. Governor Newsom also released Executive Order 10-19 which directed state agencies to inventory and assess the new planning for the single tunnel project. DWR then withdrew all project approvals and permit applications for California WaterFix, thus, effectively ending the twin tunnels project.

DWR released a notice of preparation (NOP) on January 15, 2020 to start planning for the Delta Conveyance project. The NOP documents the intent to develop an EIR and signals the start of the scoping process. The scoping process establishes the public comment period and public meetings. The NOP describes the proposed project objectives and the project itself.

DWR held an extended 93-day public scoping period that ended in April 2020. DWR released the scoping summary report in July 10, 2020. This report includes all public comments received and the following topics:

- project overview
- the purpose of scoping
- a description of scoping activities, meetings, and notifications
- a summary of public comments received
- copies of all public comments received, including public scoping meeting transcripts

DWR's latest schedule for Delta Conveyance as of August 2020 indicates that a Public Draft EIR/EIS will be available for review mid-2022. The Final EIR/EIS and ROD/NOD expected release will be mid to late 2023. DWR will be ensuring compliance with the federal and state ESA. Around mid-2021, DWR will work on water rights, Delta Plan consistency, and other environmental permits.

For more information, visit https://water.ca.gov/Programs/State-Water-Project/Delta-Conveyance.

EcoRestore

Governor Brown announced the creation of the California EcoRestore program in April 2015, committing to restore more than 30,000 acres of Delta habitat by 2020, which will be implemented on an accelerated timeline independent of the proposed water conveyance facilities. This comprehensive suite of habitat restoration actions under the California EcoRestore program includes specific targets for floodplain, tidal and sub-tidal, managed wetlands, and fish passage improvements to benefit native fish species and a commitment to adaptive management. Current projects under construction include Dutch Slough, McCormack Williamson Tract, and Southport Levee Improvement.

For more information, visit https://water.ca.gov/Programs/All-Programs/EcoRestore.

Section 4: State Water Project Historical Deliveries (2009-2018)

Section 4 and Section 6 present the State Water Project Historical Deliveries from 2009- 2018 (Calendar year). Section 4, this section, focuses on the annual minimum, maximum, and average total contractor combined deliveries during this 10-year (2009- 2018) period. Section 6 of this report includes tables listing annual historical deliveries by various water classifications for each SWP Contractor for 2009–2018.

Contractor deliveries are presented as four different delivery types - Table A delivery, an Article 21 delivery, a carryover delivery, or a turnback delivery. These delivery types are briefly described below.

"Table A" Water is an exhibit to the SWP's water supply contracts. 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.

Article 21 Water (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 is SWP water that is allocated to an SWP contractor and approved for delivery to that contractor each 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.

Table 4-1 lists the maximum annual SWP Table A water delivery amounts for SWP Contractors.

Figure 4-1 shows that the historical deliveries of SWP Table A water including the carryover water deliveries for 2009–2018 range from an annual minimum of 475 TAF to a maximum of 3,100 TAF, with an average of 1,871 TAF. Historical deliveries of SWP Table A water over this 10-year period are less than the maximum of 4,173 TAF/year.

Total historical SWP deliveries, including Table A, Article 21, turnback pool, and carryover water, range from 3,410 to 477 TAF/ year, with an average of 1,963 TAF/year for the period of 2009–2018 (Figure 4-2).

Table 4-1. 2019 Maximum Annual SWP Table A Water Contract 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	**47,756**
Subtotal	**76,781**
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	**45,350**
Empire West Side Irrigation District	**3,000**
Kern County Water Agency	**982,730**
Kings County	**9,305**
Oak Flat Water District	**5,700**
Tulare Lake Basin Water Storage District	**87,471**
Subtotal	**1,133,556**
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	**144,844**
Santa Clarita Valley 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	**85,800**
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	**2,629,544**
TOTAL TABLE A AMOUNTS	**4,172,786**

Source: California State Water Project Bulletin 132-18 Appendix B (Table B-4).

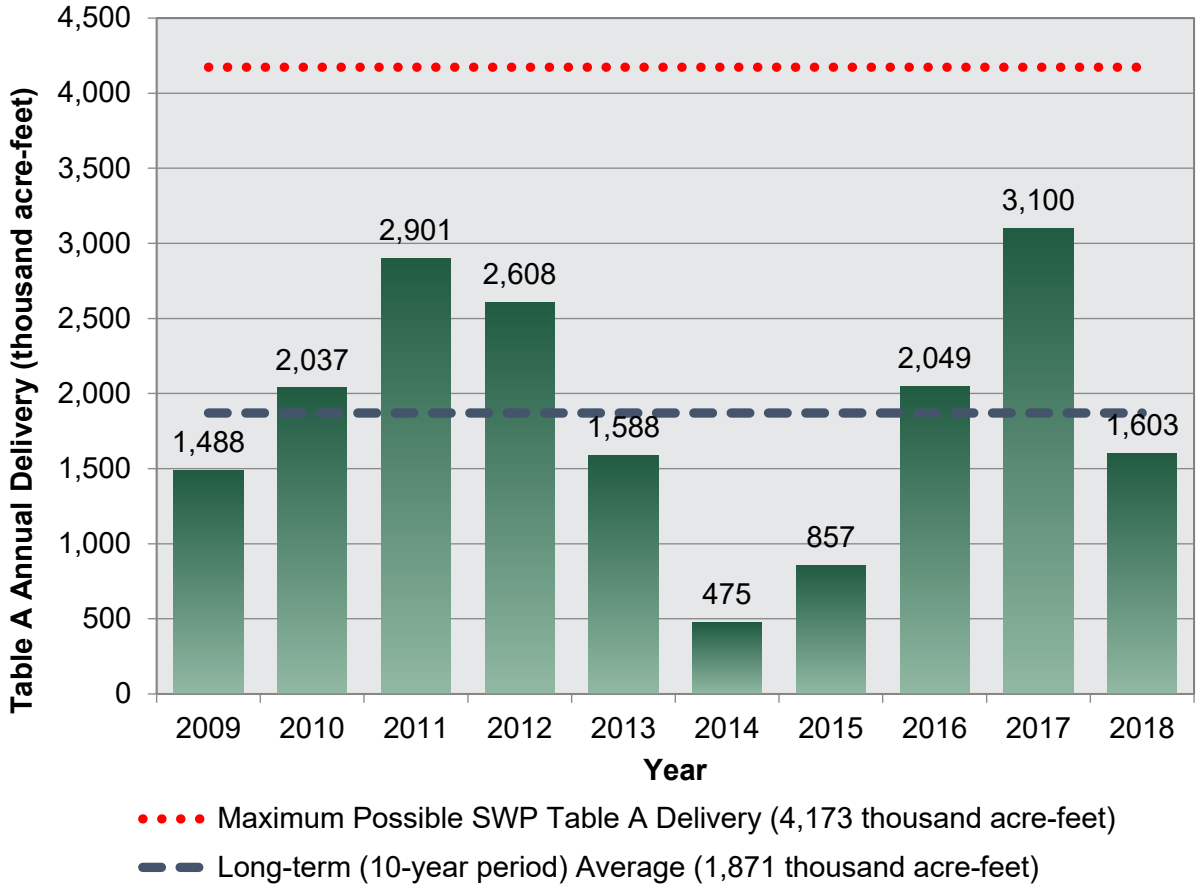
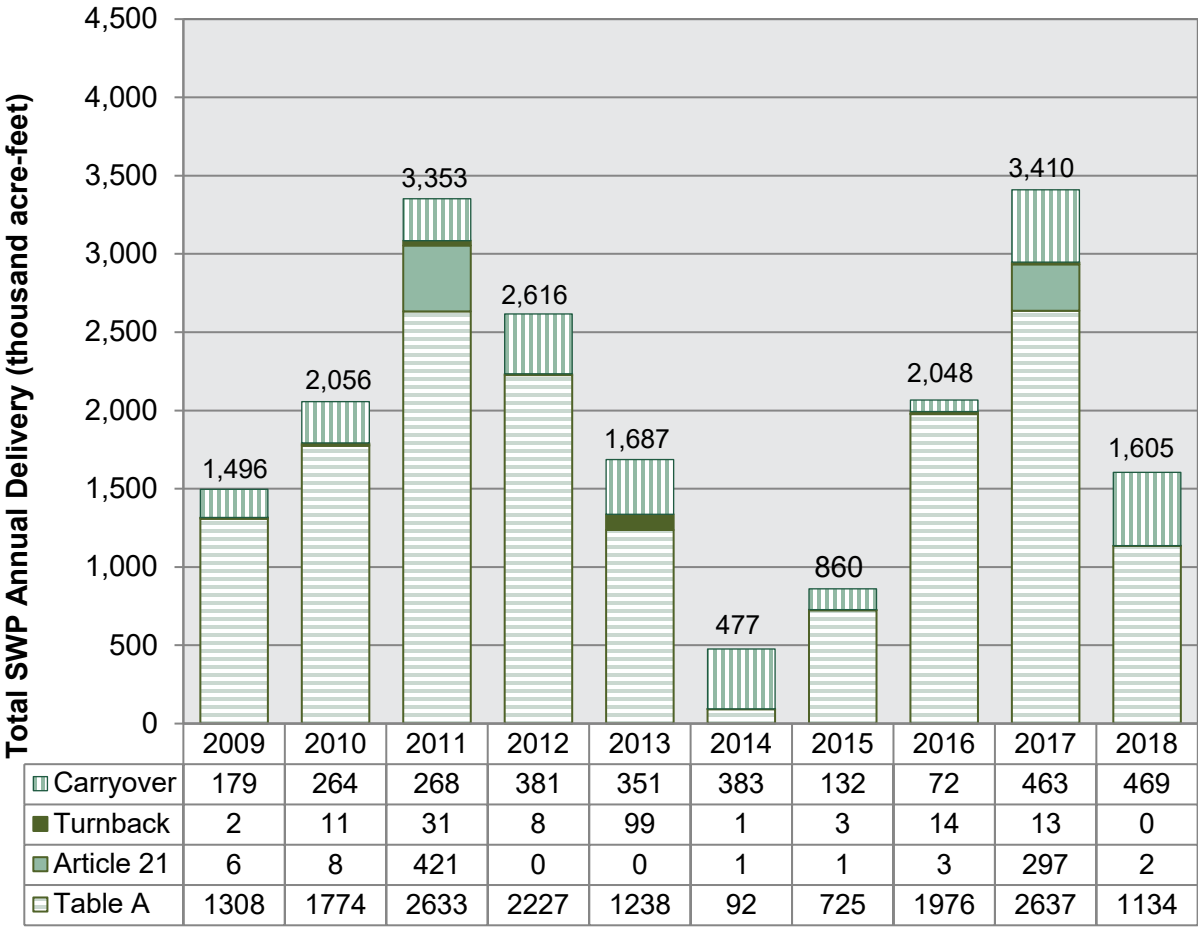


Figure 4-1. Historical Deliveries of SWP Table A and Carryover Water, 2009-2018

Note: The differences in historical deliveries from those reported in the DCR 2017 are due to the State Water Project Analysis Office (SWPAO) reclassification of the various components of water delivered to the SWP Contractors.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Carryover	179	264	268	381	351	383	132	72	463	469
Turnback	2	11	31	8	99	1	3	14	13	0
Article 21	6	8	421	0	0	1	1	3	297	2
Table A	1308	1774	2633	2227	1238	92	725	1976	2637	1134

Figure 4-2. Total Historical SWP Deliveries, 2009–2018 (by Delivery Type)

Note: The differences in historical deliveries from the State Water Project Delivery Capability Report 2017 are due to reclassification of the various components of water delivered to SWP Contractors.

Section 5: Existing SWP Water Delivery Capability (2019)

Model Choice – CalSim II

The modeling analysis included in this report was conducted using the CalSim II model, which is the same model used in prior reports. An improved model, CalSim 3, is under development at DWR and is currently in a beta release. CalSim 3 is an attempt to advance the science of DWR and Reclamation modeling of the SWP, CVP, and the hydraulically connected parts of those joint systems. Efforts have been made to have CalSim 3 ready for use in DCR 2019. Compared to CalSim II, the CalSim 3 model greatly increased its level of spatial detail while also expanding its geographic coverage into the upper watersheds of the Sacramento and San Joaquin River basins. Validating the parts of the model with increased detail and the newly added upper watersheds has taken longer than expected and thus the model is not yet ready. However the refinements being made to these parts of the model are not expected to have a significant impact to the water supply estimates for these areas and thus preliminary modeling does not indicate that the CalSim 3 simulation results for Delta exports and deliveries would be significantly different than what is being reported for CalSim II.

Hydrologic Sequence

SWP delivery amounts are estimated in this 2019 Report for existing conditions using computer modeling[4] that incorporates the historic range of hydrologic conditions (i.e., precipitation and runoff) that occurred from water years 1922 through 2003. This is the period of record used in the CalSim II model. The historic hydrologic conditions are adjusted to account for land-use changes (i.e., the current level of development) and upstream flow regulations as existed in 2019, and current sea levels reflecting sea level rise. 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 the SWP contractors request each year is related to:

- The magnitude (maximum contracted amount),
- The extent of water conservation measures, in place,

[4] CalSim II was used to perform the modeling simulations. https://water.ca.gov/Library/Modeling-and-Analysis/Central-Valley-models-and-tools/CalSim-2

- 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 2019 Report.

SWP Table A and Article 56 Water Demands

The current combined maximum Table A amount is 4,173 TAF/year. See Table 4-1 in Section 4, "State Water Project Historical Delivery Capability (2009-2018). 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 are assumed to be the maximum SWP Table A delivery amount for the 2019 Report (Table 5-1), which is the same as in the 2017 Report.

Table 5-1. Comparison of Estimated Average, Maximum, and Minimum Demands for SWP Table A Water, Excluding Butte County and Yuba City (Existing Conditions, in TAF/year)

Statistics	2017 Report	2019 Report
Average	**4,133**	**4,133**
Maximum	**4,133**	**4,133**
Minimum	**4,133**	**4,133**

The 2019 Report includes updated estimates of the portion of Table A allocated water that is carried over (through Article 56) for some contractors to the next year. These updated demands are based on the average of historical 2014-2019 Table A and Carryover Initial Requests. This update has led to a shift in the proportion of Table A water towards Article 56 water carried over to the following year.

In the 2017 Report, only 5 contractors (Alameda County Zone 7, Coachella Valley, Desert Water Agency, Metropolitan, and San Bernardino Valley) had carryover request inputs to the next contract year. In the 2019 Report, all but 6 contractors (County of Butte, County of Kings, Littlerock Creek, San Gabriel Valley, Tulare Lake Basin, Ventura County) now request Article 56 water in the model. This updated model logic is based on the 2014-2019 Initial Requests.

For more information, please refer to the Technical Addendum, Model Input Data section.

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). SWP Article 21 water demands used in the 2019 Report vary depending on whether it is a Kern wet year. A Kern wet year is defined as a year when the annual Kern River flow is projected to be greater than 1,500 TAF. There are nine Kern wet years in the simulation period of 1922 – 2003 (1941, 1952, 1969, 1978, 1980, 1983, 1986, 1995, and 1998). 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 2019 Report are assumed to be higher during the late fall, winter and spring (November-June) in Kern non-wet years (166-377 TAF/month) than in Kern wet years (6-201 TAF) because in non-wet years most of the irrigation districts in the Kern service area cannot rely as heavily on the Kern River flows to recharge their groundwater basins. Demands are assumed to be lower (6-48 TAF/month) from July through October in both Kern wet and non-wet years.

These demand patterns for SWP Article 21 water have been updated compared to those used in the 2017 Report, for existing conditions. There are two components to the Article 21 demands: monthly and annual maximums.

The monthly demand patterns and annual Article 21 maximums were derived from the maximum 2005-2018 monthly Article 21 deliveries for each contractor. The annual Article 21 maximum delivery caps were based on the maximum Article 21 water deliveries to each contractor during 2005-2018 and maximum requested Article 21 in 2011, 2017, and 2019.

For more information, please refer to the Technical Addendum: Model Input Data section.

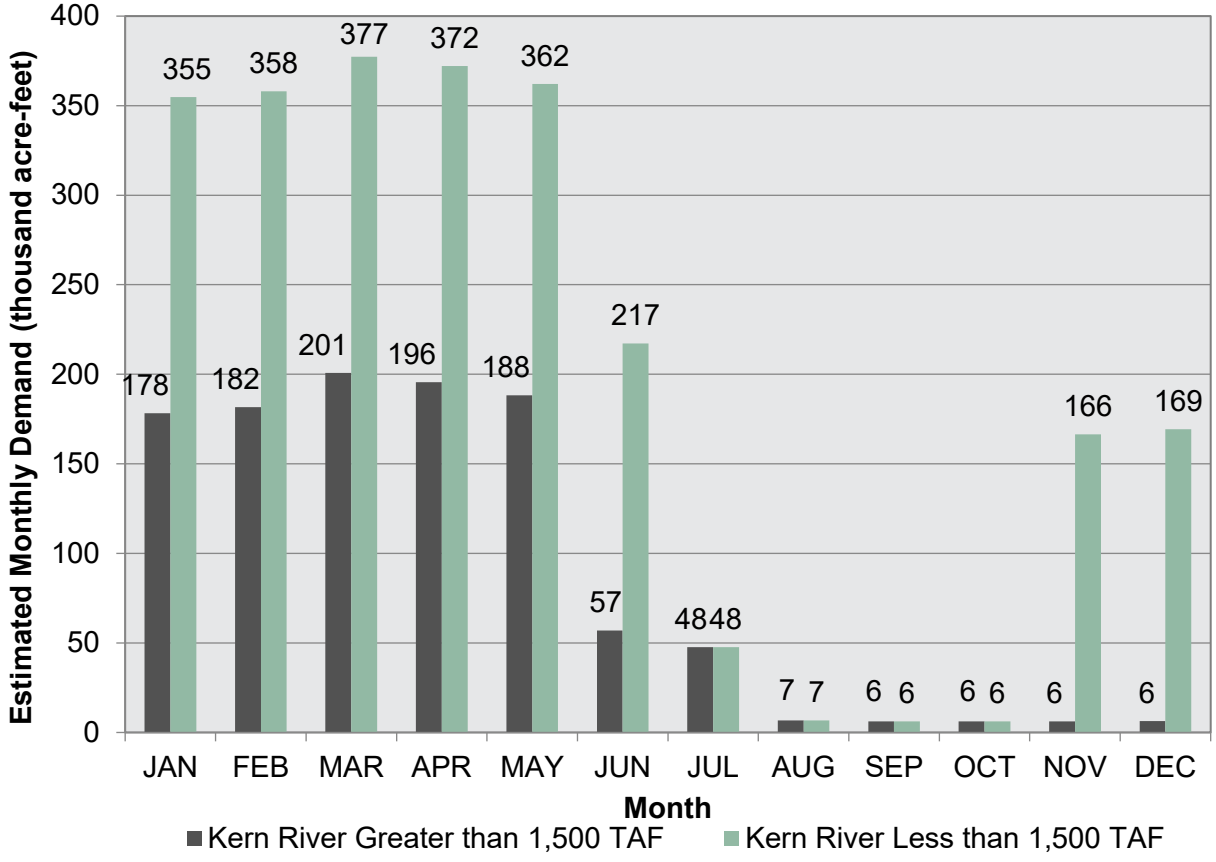


Figure 5-1. SWP Article 21 Demands during Kern Wet Years and Kern Non-Wet Years (Existing Conditions)

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.

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 2017 and 2019 Reports. Average Table A deliveries decreased in the 2019 Report compared to 2017. This was due to several factors, the most significant of which were the 2018 COA Addendum and the increase in the end of September storage target for Lake Oroville from 1.0 to a static (flat) 1.6 million acre-feet (MAF)[5]. Other factors which affected deliveries are the changes in regulations associated with the ITP and the RoC on LTO, a shift from Table A to Article 21 deliveries which occurred due to higher storages in SWP San Luis, and other operational updates to the SWP and CVP.

Table 5-2. Comparison of Estimated Average, Maximum, and Minimum Deliveries of SWP Table A Water, Excluding Butte County and Yuba City (Existing Conditions, in TAF/year)

Statistics	2017 Report	2019 Report
Average	2,571	2,414
Maximum	4,098	4,008
Minimum	336	288

Figure 5-2 shows the average annual SWP exports and Table A deliveries from the 2005 through 2019 Reports. Exports and deliveries decreased from 2005 to 2009 due to Delta regulations which constrained exports, culminating in the 2008-2009 BiOps. Average annual exports and deliveries were then relatively stable through 2017, before decreasing again in this 2019 Report due to the changes discussed above and, in more detail, below.

Table 5-3 shows the approximate impacts on exports of the most significant changes in modeling assumptions since the 2017 Report. These impacts were derived from paired CalSim II model runs whose only difference was the factor noted. The total impact shown in Table 5-3 does not exactly match the decrease in exports shown in Figure 5-2 (-92 TAF), because when combined together these factors may have slightly different effects, and because some more minor model differences are not included, but it does show the most important reasons for the decline in exports. Figure 5-2 also shows that there is a larger decrease in Table A deliveries (-157 TAF) than in exports (-92 TAF). This difference is primarily due to a shift in Table A deliveries to Article 56 and Article 21, and lower Banks transfer water pumping in the 2019 Report, compared to the 2017 Report. The increase in Article 21 deliveries is discussed more in a subsequent section.

[5] The current Oroville target is based on a static 1.6 MAF at the end of September. This methodology differs from the previous studies which used a 1.0 MAF floor and subsequently increased to 1.3 MAF. For more background on the Oroville Carryover Storage Target update, please refer to page 4 in the Technical Addendum.

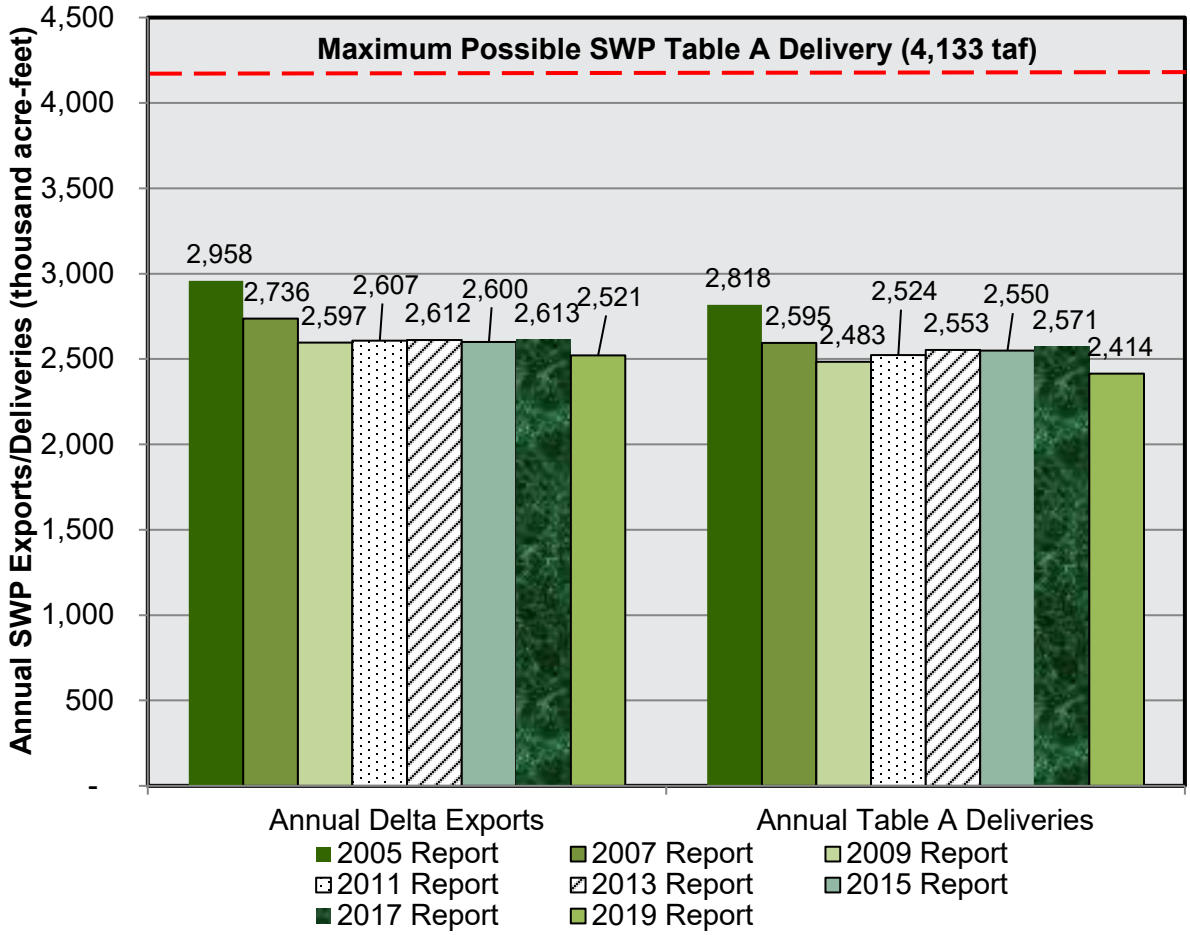


Figure 5-2. Estimated Average Annual Delta Exports and SWP Table A Water Deliveries (Excluding Butte County and Yuba City), for 2005 through 2019 Reports

Table 5-3. Major Differences between DCR 2017 and DCR 2019 CalSim II Models, and Approximate Impact on Banks SWP Exports

Model Difference	Impact on Banks SWP exports
December 2018 COA Addendum	~ -115 TAF
Reclamation model updates in 2018 (primarily CVP operations improvement and refinement of Settlement contractor demands)	~ -25 TAF
Oroville storage target increase from 1.0 to 1.3 MAF	~ -47 TAF
Changes in regulations in ITP/RoC on LTO	~ +40 TAF
Oroville storage target increase from 1.3 to static (flat) 1.6 MAF	~ -14 TAF
Refinement of SWP allocation procedure in DCR 2019 CalSim II model	~ +36 TAF
Total	~ -125 TAF

Figure 5-3 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 2017 and 2019 Reports. This figure shows a 72% likelihood (compared to 77% with the 2017 Report) that more than 2,000 TAF/year of Table A water will be delivered under the current estimates. This distribution of deliveries shown in Figure 5-3 is similar to for the 2019 and 2017 Reports, but the 2019 Report has a decreased probability of deliveries in all categories above 3,000 TAF, and an increased probability of deliveries in all but two of the categories below 3,000 TAF which are about the same with those of the probabilities in the 2017 DCR Report..

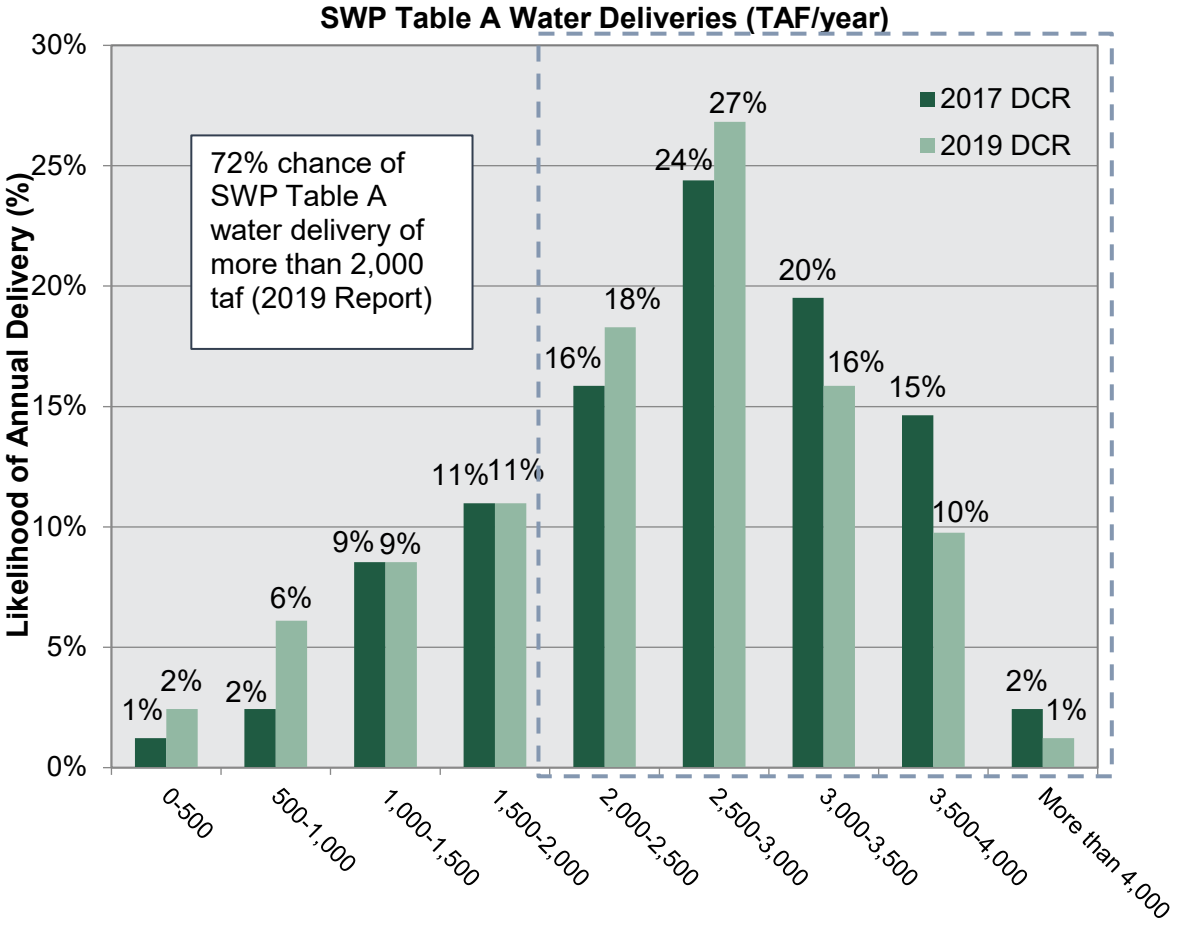


Figure 5-3. Estimated Likelihood of SWP Table A Water Deliveries, by Increments of 500 TAF (Excluding Butte County and Yuba City)

Wet-Year Deliveries of SWP Table A Water

Table 5-5 and Figure 5-4 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 2017 Report. Wet periods for the 2019 Report are analyzed using historical precipitation and runoff patterns from 1922–2003 as a reference, while accounting for existing 2019 conditions (e.g., land use, water infrastructure). For reference, the wettest single year on the 1922-2003 record was 1983. This year had the highest historical value of the Sacramento Valley Index (37.68) and the most annual deliveries in the 2019 Report.

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 4,008 to 2,967 TAF.

The Table A allocation in contract year 1983 was 100%. As such, SOD Table A contractors (including Napa County and Solano County) were to receive the full 4,133 TAF allotment. Of this, 3,470 TAF was delivered in contract year 1983 and 663 TAF was held for delivery as Article 56 in contract year 1984. Table A allocation in contract year 1982 was also 100%. As such, 663 TAF of Article 56 was carried over into contract year 1983 for delivery.

Table 5-4 shows that column 5 in years 1983 and 1984 add up to 663 TAF due to the carryover requests in the previous contract years of 100% allocation, 1982 and 1983 respectively.

However, 125 TAF of the carryover request from 1982 spilled in contract year 1983 in February and March because San Luis reservoir filled up in those months. Therefore, the total contract delivery in 1983 was 3,470 TAF of Table A and 538 TAF of Article 56 for a total of 4,008 TAF. This is 97% of the 4,133 TAF contract supply.

DCR 2017 1983 Table A deliveries were only 99% of the Max Table A amount (Table 5-5). This was also because of carryover spills. However, only 4 TAF spilled in February and March 1983. Therefore, the Table A and Article 56 deliveries in DCR 2017 1983 were 4098 TAF, or 99% of the 4,133 TAF Max Table A amount.

The main difference between the DCR 2017 and 2019 are the Article 56 requests. The 100% Article 56 carryover requests (except Yuba City) increased from 235 TAF in DCR 2017 to 663 TAF in DCR 2019. As a result, the risk of carryover spills is proportional to the carryover requested. For the full Table A and Article 56 requests, please see Table 21 - 2019 DCR Table A Demand and Article 56 Carryover (Existing Conditions) in the Technical Addendum.

Table 5-4. DCR 2019 1982-1983 SWP Allocation, Table A and Article 56 deliveries, and Carryover Spills

	1	2	3	4	5	6	7
Year	SWP Allocation	Delivery w/o Article 56 Carryover (TAF)	Article 56 Carryover (TAF)	Carryover Spill (TAF)	Article 56 request from previous CY before delivery and spills (3 + 4)	Total Table A Delivery (TAF) (2+3)	Percent of Maximum Table A ((6)/4,133)
1982	100%	3469.6	21.8	0.0	21.8	3491.4	85%
1983	100%	3469.7	538.5	124.8	663.3	4008.2	97%
1984	74%	2669.8	434.5	228.7	663.3	3104.4	75%

Table 5-5 and Figure 5-4 show that the 2019 deliveries of SWP Table A water decreased in all wet periods in comparison to the 2017 Report. The reasons for this decrease are the same as described for Table 5-3 and Figure 5-2.

Table 5-5. 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

Year	Long-term Average		Single Wet Year (1983)		Wet Periods							
					2-Year (1982-1983)		4-Year (1980-1983)		6-Year (1978-1983)		10-Year (1978-1987)	
2017 Report	2,571	62%	4,098	99%	3,967	96%	3,569	86%	3,433	83%	3,163	77%
2019 Report	2,414	58%	4,008	97%	3,750	91%	3,330	81%	3,210	78%	2,967	72%

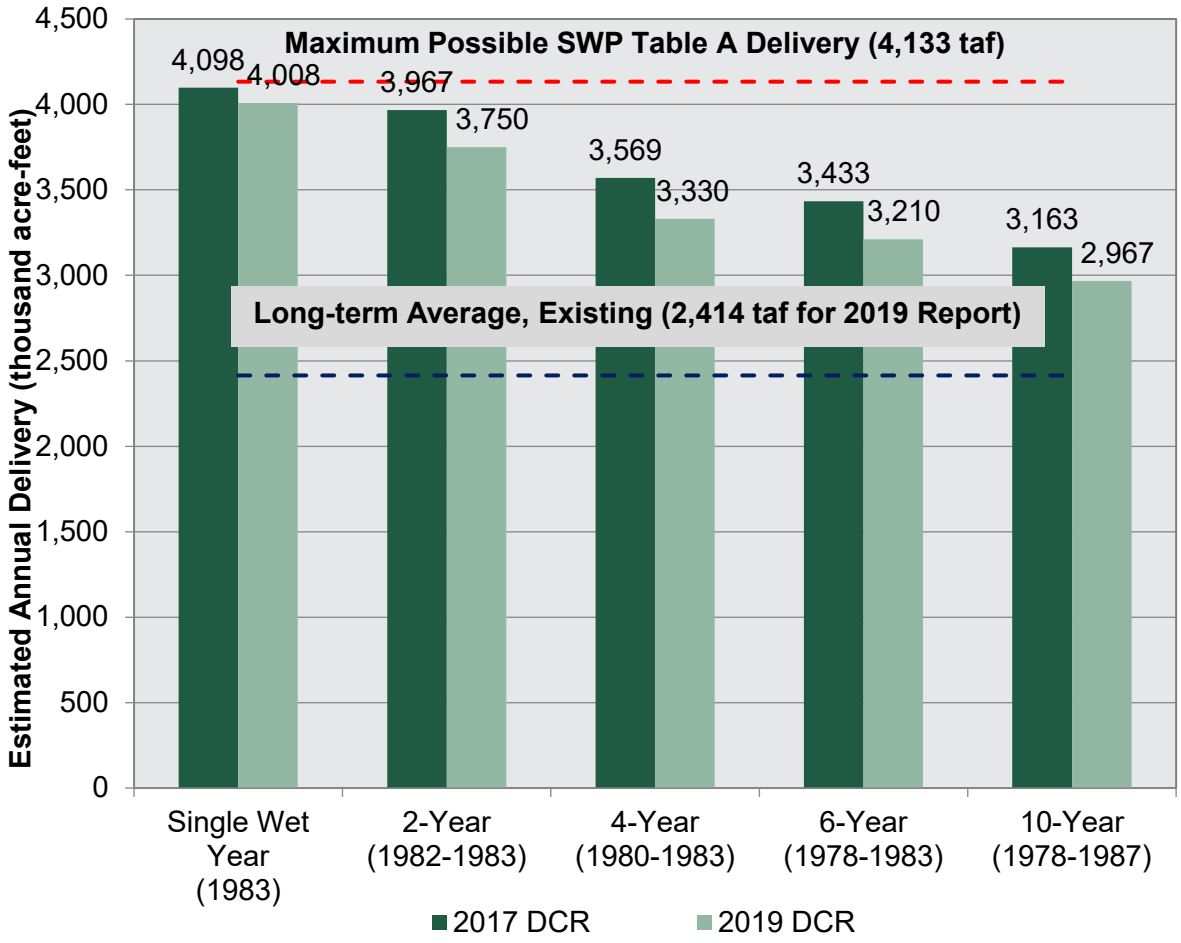


Figure 5-4. Estimated Wet-Period SWP Table A Water Deliveries (Excluding Butte County and Yuba City)

Dry-Year Deliveries of SWP Table A Water

Table 5-6 and Figure 5-5 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 2017 Report. Droughts are analyzed using the historical drought-period precipitation and runoff patterns from 1922 through 2003 as a reference, although existing 2019 conditions (e.g., land use, water infrastructure) are also accounted for in the modeling. For reference, the worst multiyear drought on the 1922-2003 record was the 1929–1934 drought, although the brief drought of 1976–1977 was more intensely dry. The driest single year in terms of deliveries was 1977, which had a Sacramento Valley Index of 3.11.

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 288 and 1,311 TAF. Table 5-6 shows that the 2019 Report deliveries of SWP Table A water decreased in many of the dry periods in comparison to the 2017 Report. The reasons for this decrease are the same as described for Table 5-3 and Figure 5-2. 1976-77 is the exception to this decreasing trend.

The two updates which led to lower Dry-Period SWP exports and deliveries were the 2018 COA Amendment and the increase in the Oroville carryover target from 1.0 to a static 1.6 MAF between the 2017 and 2019 Reports. During export constrained months, CVP's export share increased while SWP's decreased under the COA sharing formula. In addition, less water is available for SWP exports and Table A deliveries because the SWP has to store more water in Oroville to maintain the higher end-of-September carryover target.

For more details, please refer to the Final DCR 2019 Technical Addendum: Dry Year Analysis section.

Table 5-6. Estimated Average and Dry-Period Deliveries of SWP Table A Water, Excluding Butte County and Yuba City (Existing Conditions, in TAF/year) and Percent of Maximum SWP Table A Amount, 4,133 TAF/year

Year	Long-term Average		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)	
2017 Report	2,571	62%	336	8%	1,206	29%	1,397	34%	1,203	29%	1,408	34%
2019 Report	2,414	58%	288	7%	1,311	32%	1,228	30%	1,058	26%	1,158	28%

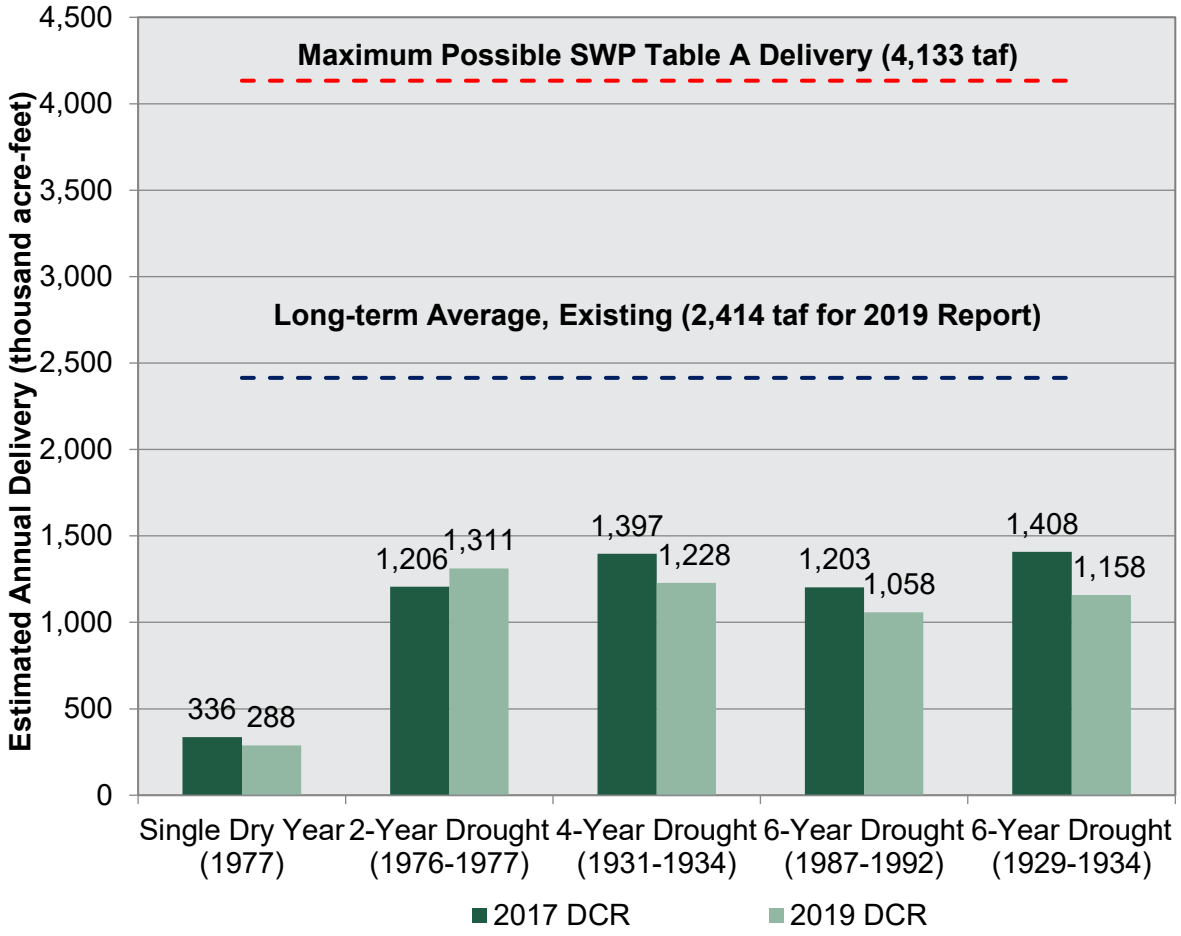


Figure 5-5. Estimated Dry-Period SWP Table A Water Deliveries (Excluding Butte County and Yuba City)

Estimates of SWP Article 21 Water Deliveries

SWP Article 21 water is the third type of SWP delivery considered in the model along with Table A, and Article 56. 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 5-6 (only the maximum and averages have data labels shown as the minimums are zero). In June through November, essentially no Article 21 water is estimated to be delivered on average. In the winter and spring (December through May), maximum monthly deliveries range from 155 to 317 TAF/month.

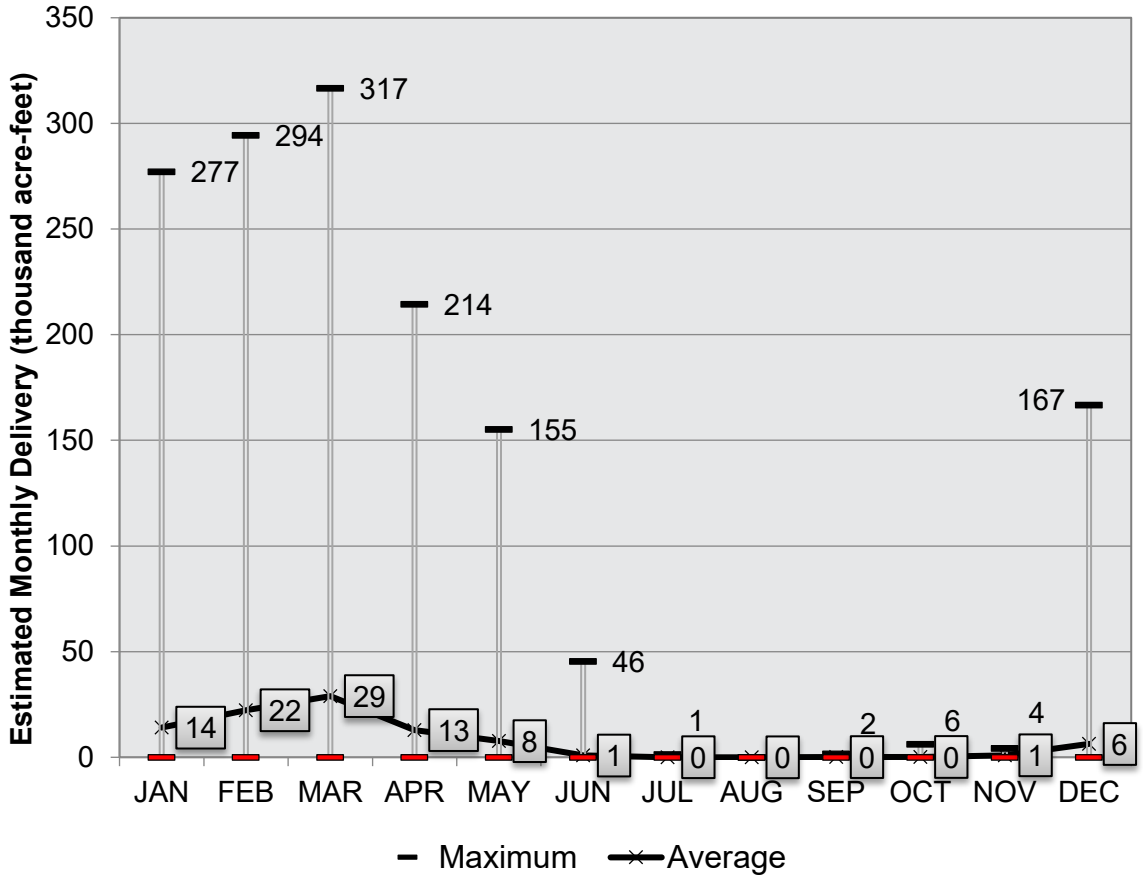


Figure 5-6. Estimated Range of Monthly Deliveries of SWP Article 21 Water (Existing Conditions)

The estimated likelihood that a given amount of SWP Article 21 water will be delivered is presented in Figure 5-7. The 57% chance of delivering 20 TAF or less is less than the 84% chance in the 2017 Report. However, the chance of receiving Article 21 delivery between 20-100 TAF increased by 16% as shown in Figure 5-7. Overall, the likelihood of receiving Article 21 from 20-700 TAF increased by 27%.

The primary reasons for the increase in Article 21 deliveries shown in this section and in subsequent sections is the more conservative allocation procedure adopted starting with CalSim II models that include the ITP regulations, the increased Article 21 demands, and also the updated Article 56 demands used in the 2019 Report which increase the amount of carryover Table A water. Both changes lead to higher storages in SWP San Luis Reservoir, which increase the frequency of Article 21 deliveries due to San Luis being full more often.

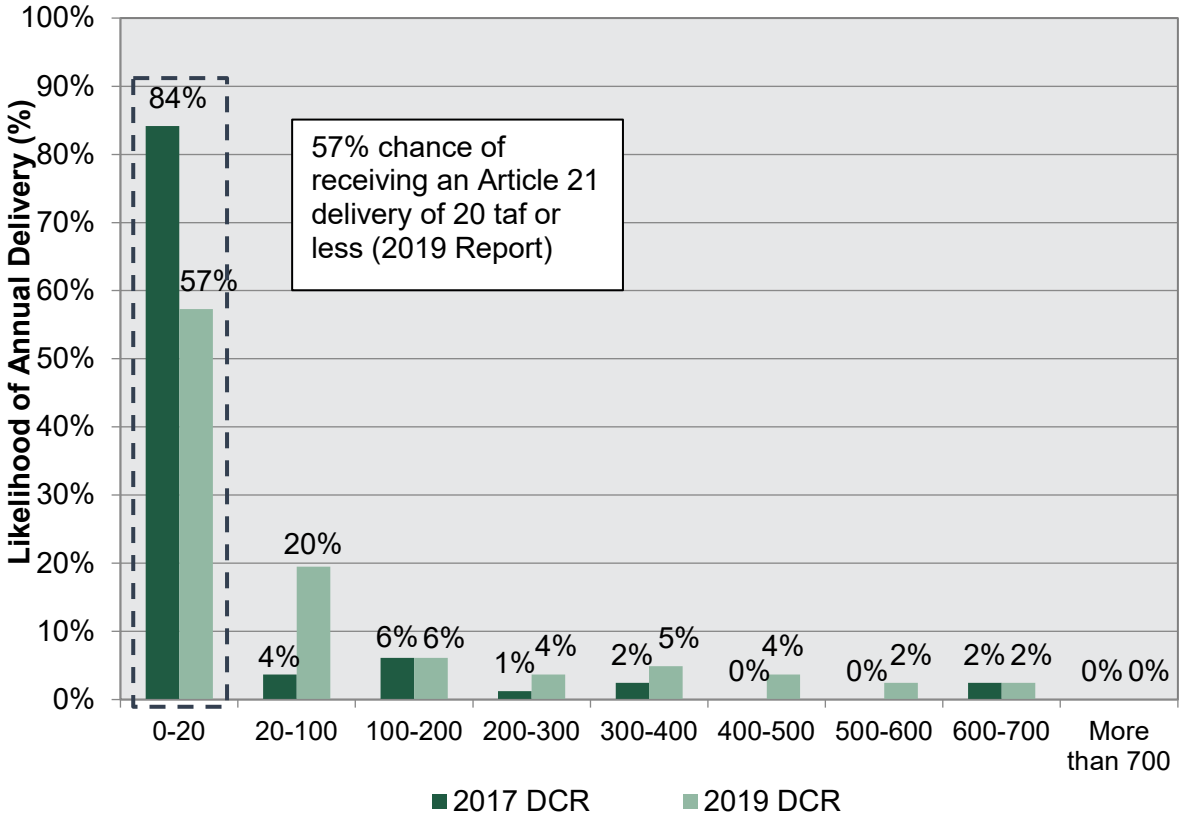


Figure 5-7. Estimated Likelihood of Annual Deliveries of SWP Article 21 Water (Existing Conditions)

Wet-Year Deliveries of SWP Article 21 Water

Table 5-7 shows the estimates of deliveries of SWP Article 21 water during wet periods under existing conditions. Estimated deliveries of SWP Article 21 water in wet years is estimated to range between yearly averages of 156-527 TAF. Wet-period Article 21 deliveries in this 2019 Report are higher than in the 2017 Report for all periods shown and the reasons for this increase were described in the previous section.

Table 5-7. Estimated Average and Wet-Period Deliveries of SWP Article 21 Water (Existing Conditions, in TAF/year)

Year	Long-term Average	Single Wet Year (1983)	Wet Periods			
			2-Year Wet (1982-1983)	4-Year Wet (1980-1983)	6-Year Wet (1978-1983)	10-Year Wet (1978-1987)
2017 Report	50	273	183	123	86	123
2019 Report	94	527	322	225	156	170

Dry-Year Deliveries of SWP Article 21 Water

Table 5-8 shows the estimates of deliveries of SWP Article 21 water during dry periods under existing conditions. Although deliveries of SWP Article 21 water are less 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 much less than in wet periods; however, in the 2019 Report all drought periods can support some level of Article 21 deliveries. Compared to the 2017 Report, Article 21 deliveries in dry periods were similar in the 1976-77 and 1987-92 periods but increased substantially in the 1931-34 and 1929-34 periods.

Table 5-8. Estimated Average and Dry-Period Deliveries of SWP Article 21 Water (Existing Conditions, in TAF/year)

Year	Long-term Average	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)
2017 Report	50	8	14	16	13	15
2019 Report	94	6	10	68	18	50

Section 6: Historical SWP Delivery Tables for 2009-2018

The SWP contracts define several types of SWP water available for delivery to its Contractors under specific circumstances: Table A water, Article 21 water, turnback pool water, and carryover water. 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.

Table 6-1 through Table 6-10 list annual historical deliveries by SWP water type for each Contractor for 2009 through 2018. This data was obtained from SWPAO. Similar delivery tables are presented for years 2007– 2016 in the State Water Project Delivery Capability Report 2017. Any differences in values presented in this 2019 report and those in the 2017 report are due to reclassification of deliveries since the production of the 2017 report.

Table 6-1. Historical SWP 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	11,746	-	14,583	-	26,329
	Alameda County WD	5,911	-	10,494	8	16,413
	Santa Clara Valley WD	9,188	-	23,867	54	33,109
	Subtotal	26,845	-	48,944	62	75,851
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	325,426	-	56,367	544	382,337
	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	379,783	-	65,584	636	446,003
Central Coastal Area	San Luis Obispo County FCWCD	9,723	-	-	-	9,723
	Santa Barbara County FCWCD	4,961	-	4,523	25	9,509
	Subtotal	14,684	-	4,523	25	19,232
Southern California Area	Antelope Valley–East Kern WA	13,499	-	18,408	77	31,984
	Santa Clarita Valley 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		1,308,050	6,032	179,499	2,000	1,495,581

Table 6-2. Historical SWP 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	2,845	90	12,417
	Solano County WA	13,793	5,298	3,661	-	22,752
	Subtotal	21,068	7,505	6,506	90	35,169
South Bay Area	Alameda County FCWCD, Zone 7	28,694	-	13,104	249	42,047
	Alameda County WD	11,668	-	10,889	14	22,571
	Santa Clara Valley WD	37,850	-	22,471	34	60,355
	Subtotal	78,212	-	46,464	297	124,973
San Joaquin Valley Area	Dudley Ridge WD	19,650	-	9,750	156	29,556
	Empire West Side ID	380	-	166	-	546
	Kern County WA	411,821	-	55,419	3,044	470,284
	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	478,192	-	69,511	3,522	551,225
Central Coastal Area	San Luis Obispo County FCWCD	3,480	-	277	-	3,757
	Santa Barbara County FCWCD	8,640	-	8,995	140	17,775
	Subtotal	12,120	-	9,272	140	21,532
Southern California Area	Antelope Valley–East Kern WA	35,312	-	20,813	438	56,563
	Santa Clarita Valley 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	-	67,783	5,922	973,915
	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	-	132,053	7,322	1,320,059
TOTAL SWP DELIVERIES		1,773,657	7,505	263,806	11,371	2,056,339

Table 6-3. Historical SWP 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	-	1,388	-	10,814
	Solano County WA	9,620	14,739	-	-	24,359
	Subtotal	19,046	14,739	1,388	-	35,173
South Bay Area	Alameda County FCWCD, Zone 7	39,066	-	11,675	1,319	52,060
	Alameda County WD	24,813	1,959	9,332	506	36,610
	Santa Clara Valley WD	64,538	970	20,491	-	85,999
	Subtotal	128,417	2,929	41,498	1,825	174,669
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	-	13,770	-	42,902
	Subtotal	32,472	-	14,249	-	46,721
Southern California Area	Antelope Valley–East Kern WA	77,549	7,629	5,888	-	91,066
	Santa Clarita Valley WA	34,067	400	9,332	-	43,799
	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	55,540	8,237	1,532,322
	Mojave WA	4,831	-	268	-	5,099
	Palmdale WD	12,294	-	567	-	12,861
	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	1,607,095	189,639	80,475	10,739	1,887,948
TOTAL SWP DELIVERIES		2,632,985	420,691	268,313	31,061	3,353,050

Table 6-4. Historical SWP 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	5,065	-	4,278	64	9,407
	Solano County WA	11,673	-	9,641	-	21,314
	Subtotal	16,738	-	13,919	64	30,721
South Bay Area	Alameda County FCWCD, Zone 7	32,301	-	20,357	179	52,837
	Alameda County WD	11,951	-	8,787	93	20,831
	Santa Clara Valley WD	34,612	-	11,462	222	46,296
	Subtotal	78,864	-	40,606	494	119,964
San Joaquin Valley Area	Dudley Ridge WD	17,694	-	-	112	17,806
	Empire West Side ID	1,468	-	774	-	2,242
	Kern County WA	560,969	-	32,477	2,180	595,626
	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	641,694	-	67,945	2,510	712,149
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
	Santa Clarita Valley WA	42,707	-	11,350	-	54,057
	Coachella Valley WD	89,928	-	22,663	307	112,898
	Crestline–Lake Arrowhead WA	624	-	-	-	624
	Desert WA	36,238	-	8,461	124	44,823
	Littlerock Creek ID	-	-	-	-	-
	Metropolitan WD of Southern California	1,086,084	-	118,172	4,241	1,208,497
	Mojave WA	4,672	-	6,572	-	11,244
	Palmdale WD	9,959	-	4,736	-	14,695
	San Bernardino Valley MWD	65,102	-	47,870	-	112,972
	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	1,445,049	-	257,634	4,672	1,707,355
TOTAL SWP DELIVERIES		2,226,979	-	380,980	7,740	2,615,699

Table 6-5. Historical SWP Deliveries, Calendar Year 2013

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	9,233	-	-	-	9,233
	Plumas County FCWCD	366	-	-	-	366
	Yuba City	3,360	-	1,490	-	4,850
	Subtotal	12,959	-	1,490	-	14,449
North Bay Area	Napa County FCWCD	2,963	-	9,075	-	12,038
	Solano County WA	5,355	-	17,805	-	23,160
	Subtotal	8,318	-	26,880	-	35,198
South Bay Area	Alameda County FCWCD, Zone 7	14,059	-	21,042	2,596	37,697
	Alameda County WD	4,241	-	15,349	50	19,640
	Santa Clara Valley WD	9,353	-	16,261	10,749	36,363
	Subtotal	27,653	-	52,652	13,395	93,700
San Joaquin Valley Area	Dudley Ridge WD	6,113	-	9,951	5,412	21,476
	Empire West Side ID	1,004	-	482	16	1,502
	Kern County WA	314,466	-	73,303	37,005	424,774
	Kings County	2,851	-	591	1,000	4,442
	Oak Flat WD	583	-	2,200	7	2,790
	Tulare Lake Basin WSD	27,803	-	4,169	8,400	40,372
	Subtotal	352,820	-	90,696	51,840	495,356
Central Coastal Area	San Luis Obispo County FCWCD	1,178	-	2,503	-	3,681
	Santa Barbara County FCWCD	3,252	-	12,233	-	15,485
	Subtotal	4,430	-	14,736	-	19,166
Southern California Area	Antelope Valley–East Kern WA	37,628	-	13,386	-	51,014
	Santa Clarita Valley WA	33,320	-	28,434	-	61,754
	Coachella Valley WD	48,423	-	-	164	48,587
	Crestline–Lake Arrowhead WA	1,368	-	2,000	-	3,368
	Desert WA	19,513	-	-	66	19,579
	Littlerock Creek ID	-	-	-	-	-
	Metropolitan WD of Southern California	619,863	-	106,288	32,267	758,418
	Mojave WA	25,294	-	2,852	-	28,146
	Palmdale WD	4,559	-	3,122	-	7,681
	San Bernardino Valley MWD	26,159	-	4,426	-	30,585
	San Gabriel Valley MWD	10,080	-	-	-	10,080
	San Gorgonio Pass WA	2,339	-	3,729	1,000	7,068
	Ventura County WPD	2,890	-	-	-	2,890
	Subtotal	831,436	-	164,237	33,497	1,029,170
TOTAL SWP DELIVERIES		1,237,616	-	350,691	98,732	1,687,039

Table 6-6. Historical SWP Deliveries, Calendar Year 2014

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	2,596	-	-	-	2,596
	Plumas County FCWCD	251	-	-	-	251
	Yuba City	96	-	4,085	-	4,181
	Subtotal	2,943	-	4,085	-	7,028
North Bay Area	Napa County FCWCD	41	1,444	9,731	-	11,216
	Solano County WA	450	-	9,493	-	9,943
	Subtotal	491	1,444	19,224	-	21,159
South Bay Area	Alameda County FCWCD, Zone 7	1,367	-	17,646	-	19,013
	Alameda County WD	-	-	10,326	-	10,326
	Santa Clara Valley WD	-	-	12,339	79	12,418
	Subtotal	1,367	-	40,311	79	41,757
San Joaquin Valley Area	Dudley Ridge WD	1,783	-	15,783	40	17,606
	Empire West Side ID	104	-	46	303	453
	Kern County WA	1,393	-	25,217	520	27,130
	Kings County	112	-	360	-	472
	Oak Flat WD	-	-	983	-	983
	Tulare Lake Basin WSD	3,942	-	3,181	-	7,123
	Subtotal	7,334	-	45,570	863	53,767
Central Coastal Area	San Luis Obispo County FCWCD	379	-	2,693	-	3,072
	Santa Barbara County FCWCD	289	-	10,533	-	10,822
	Subtotal	668	-	13,226	-	13,894
Southern California Area	Antelope Valley–East Kern WA	2,152	-	12,345	111	14,608
	Santa Clarita Valley WA	451	-	7,743	-	8,194
	Coachella Valley WD	6,918	-	-	-	6,918
	Crestline–Lake Arrowhead WA	83	-	645	-	728
	Desert WA	2,788	-	-	-	2,788
	Littlerock Creek ID	106	-	-	-	106
	Metropolitan WD of Southern California	59,900	-	223,358	-	283,258
	Mojave WA	3,347	-	2,228	-	5,575
	Palmdale WD	1,005	-	3,670	-	4,675
	San Bernardino Valley MWD	-	-	6,320	-	6,320
	San Gabriel Valley MWD	1,434	-	-	-	1,434
	San Gorgonio Pass WA	603	-	4,572	-	5,175
	Ventura County WPD	93	-	-	-	93
	Subtotal	78,880	-	260,881	111	339,872
TOTAL SWP DELIVERIES		91,683	1,444	383,297	1,053	477,477

Table 6-7. Historical SWP Deliveries, Calendar Year 2015

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	3,315	-	-	-	3,315
	Plumas County FCWCD	285	-	-	-	285
	Yuba City	2,400	-	604	-	3,004
	Subtotal	6,000	-	604	-	6,604
North Bay Area	Napa County FCWCD	5,365	690	3,896	35	9,986
	Solano County WA	2,020	-	15,718	-	17,738
	Subtotal	7,385	690	19,614	35	27,724
South Bay Area	Alameda County FCWCD, Zone 7	4,686	-	3,295	97	8,078
	Alameda County WD	-	-	2,233	51	2,284
	Santa Clara Valley WD	-	-	2,858	120	2,978
	Subtotal	4,686	-	8,386	268	13,340
San Joaquin Valley Area	Dudley Ridge WD	7,414	-	1,570	55	9,039
	Empire West Side ID	578	-	46	-	624
	Kern County WA	173,581	-	43,265	707	217,553
	Kings County	698	-	333	11	1,042
	Oak Flat WD	696	-	348	-	1,044
	Tulare Lake Basin WSD	16,359	-	571	105	17,035
	Subtotal	199,326	-	46,133	878	246,337
Central Coastal Area	San Luis Obispo County FCWCD	3,411	-	-	-	3,411
	Santa Barbara County FCWCD	4,973	-	1,089	55	6,117
	Subtotal	8,384	-	1,089	55	9,528
Southern California Area	Antelope Valley–East Kern WA	21,810	-	5,154	174	27,138
	Santa Clarita Valley WA	11,068	-	4,121	-	15,189
	Coachella Valley WD	27,670	-	-	-	27,670
	Crestline–Lake Arrowhead WA	154	-	247	-	401
	Desert WA	11,150	-	-	67	11,217
	Littlerock Creek ID	460	-	-	-	460
	Metropolitan WD of Southern California	379,706	-	35,675	1,374	416,755
	Mojave WA	16,538	-	1,871	-	18,409
	Palmdale WD	2,420	-	-	26	2,446
	San Bernardino Valley MWD	17,737	-	9,012	123	26,872
	San Gabriel Valley MWD	5,759	-	-	-	5,759
	San Gorgonio Pass WA	3,343	-	135	-	3,478
	Ventura County WPD	1,000	-	-	-	1,000
	Subtotal	498,815	-	56,215	1,764	556,794
TOTAL SWP DELIVERIES		724,596	690	132,041	3,000	860,327

Table 6-8. Historical SWP Deliveries, Calendar Year 2016

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	15,634	-	-	-	15,634
	Plumas County FCWCD	387	-	-	-	387
	Yuba City	1,229	-	-	-	1,229
	Subtotal	17,250	-	-	-	17,250
North Bay Area	Napa County FCWCD	13,138	3,319	-	295	16,752
	Solano County WA	12,595	-	4,130	-	16,725
	Subtotal	25,733	3,319	4,130	295	33,477
South Bay Area	Alameda County FCWCD, Zone 7	41,987	-	8,450	819	51,256
	Alameda County WD	14,280	-	8,400	-	22,680
	Santa Clara Valley WD	40,214	-	32,863	-	73,077
	Subtotal	96,481	-	49,713	819	147,013
San Joaquin Valley Area	Dudley Ridge WD	17,372	-	1,656	461	19,489
	Empire West Side ID	1,800	-	22	-	1,822
	Kern County WA	458,825	-	-	3,533	462,358
	Kings County	2,466	-	1,095	95	3,656
	Oak Flat WD	832	-	1,023	-	1,855
	Tulare Lake Basin WSD	41,126	-	1,135	126	42,387
	Subtotal	522,421	-	4,931	4,215	531,567
Central Coastal Area	San Luis Obispo County FCWCD	4,199	-	-	-	4,199
	Santa Barbara County FCWCD	12,003	-	917	-	12,920
	Subtotal	16,202	-	917	-	17,119
Southern California Area	Antelope Valley–East Kern WA	56,148	-	6,054	1,471	63,673
	Santa Clarita Valley WA	31,147	-	2,241	-	33,388
	Coachella Valley WD	52,922	-	-	-	52,922
	Crestline–Lake Arrowhead WA	1,873	-	-	-	1,873
	Desert WA	21,327	-	-	566	21,893
	Littlerock Creek ID	1,380	-	-	-	1,380
	Metropolitan WD of Southern California	1,006,900	-	-	6,871	1,013,771
	Mojave WA	32,045	-	1,170	-	33,215
	Palmdale WD	7,805	-	-	-	7,805
	San Bernardino Valley MWD	57,859	-	2,348	-	60,207
	San Gabriel Valley MWD	17,280	-	-	-	17,280
	San Gorgonio Pass WA	8,683	-	933	-	9,616
	Ventura County WPD	3,000	-	-	-	3,000
	Subtotal	1,298,369	-	12,746	8,908	1,320,023
TOTAL SWP DELIVERIES		1,976,456	3,319	72,437	14,237	2,066,449

Table 6-9. Historical SWP Deliveries, Calendar Year 2017

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	21,636	-	-	-	21,636
	Plumas County FCWCD	363	-	-	-	363
	Yuba City	1,746	-	-	-	1,746
	Subtotal	23,745	-	-	-	23,745
North Bay Area	Napa County FCWCD	974	6,429	822	-	8,225
	Solano County WA	15,190	-	-	-	15,190
	Subtotal	16,164	6,429	822	-	23,415
South Bay Area	Alameda County FCWCD, Zone 7	52,787	-	2,959	712	56,458
	Alameda County WD	27,260	-	1,776	-	29,036
	Santa Clara Valley WD	28,779	-	25,972	582	55,333
	Subtotal	108,826	-	30,707	1,294	140,827
San Joaquin Valley Area	Dudley Ridge WD	27,917	15,722	9,838	400	53,877
	Empire West Side ID	1,698	-	-	-	1,698
	Kern County WA	760,939	114,112	165,613	8,670	1,049,334
	Kings County	5,149	1,414	-	82	6,645
	Oak Flat WD	2,858	-	35	-	2,893
	Tulare Lake Basin WSD	49,119	-	7,336	1,465	57,920
	Subtotal	847,680	131,248	182,822	10,617	1,172,367
Central Coastal Area	San Luis Obispo County FCWCD	2,263	-	582	-	2,845
	Santa Barbara County FCWCD	25,243	4,720	18,150	401	48,514
	Subtotal	27,506	4,720	18,732	401	51,359
Southern California Area	Antelope Valley–East Kern WA	83,343	17,400	15,581	-	116,324
	Santa Clarita Valley WA	38,132	-	33,442	-	71,574
	Coachella Valley WD	47,617	-	30,088	806	78,511
	Crestline–Lake Arrowhead WA	2,897	-	-	-	2,897
	Desert WA	19,188	-	12,123	325	31,636
	Littlerock Creek ID	-	-	-	-	-
	Metropolitan WD of Southern California	1,283,294	123,950	130,511	-	1,537,755
	Mojave WA	29,995	-	820	-	30,815
	Palmdale WD	7,751	-	1,587	-	9,338
	San Bernardino Valley MWD	69,605	-	4,141	-	73,746
	San Gabriel Valley MWD	17,505	3,057	7	-	20,569
	San Gorgonio Pass WA	9,546	-	1,700	-	11,246
	Ventura County WPD	4,250	10,000	-	-	14,250
	Subtotal	1,613,123	154,407	230,000	1,131	1,998,661
TOTAL SWP DELIVERIES		2,637,044	296,804	463,083	13,443	3,410,374

Table 6-10. Historical SWP Deliveries, Calendar Year 2018

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	9,225	-	-	-	9,225
	Plumas County FCWCD	508	-	-	-	508
	Yuba City	-	-	1,715	-	1,715
	Subtotal	9,733	-	1,715	-	11,448
North Bay Area	Napa County FCWCD	10,159	2,180	5,243	-	17,582
	Solano County WA	12,757	-	11,627	-	24,384
	Subtotal	22,916	2,180	16,870	-	41,966
South Bay Area	Alameda County FCWCD, Zone 7	21,170	-	15,739	-	36,909
	Alameda County WD	4,721	-	8,440	-	13,161
	Santa Clara Valley WD	26,297	-	56,221	-	82,518
	Subtotal	52,188	-	80,400	-	132,588
San Joaquin Valley Area	Dudley Ridge WD	13,621	-	7,415	-	21,036
	Empire West Side ID	739	-	852	-	1,591
	Kern County WA	243,956	-	74,382	-	318,338
	Kings County	1,284	-	2,363	-	3,647
	Oak Flat WD	302	-	1,987	-	2,289
	Tulare Lake Basin WSD	10,318	-	23,555	-	33,873
	Subtotal	270,220	-	110,554	-	380,774
Central Coastal Area	San Luis Obispo County FCWCD	2,427	-	-	-	2,427
	Santa Barbara County FCWCD	11,415	-	11,300	-	22,715
	Subtotal	13,842	-	11,300	-	25,142
Southern California Area	Antelope Valley–East Kern WA	40,415	-	26,121	-	66,536
	Santa Clarita Valley WA	12,473	-	24,424	-	36,897
	Coachella Valley WD	48,423	-	69,175	-	117,598
	Crestline–Lake Arrowhead WA	199	-	735	-	934
	Desert WA	19,513	-	27,875	-	47,388
	Littlerock Creek ID	805	-	-	-	805
	Metropolitan WD of Southern California	578,824	-	61,561	-	640,385
	Mojave WA	14,213	-	5,471	-	19,684
	Palmdale WD	7,137	-	4,828	-	11,965
	San Bernardino Valley MWD	23,830	-	17,605	-	41,435
	San Gabriel Valley MWD	10,080	-	6,975	-	17,055
	San Gorgonio Pass WA	2,158	-	3,390	-	5,548
	Ventura County WPD	7,000	-	-	-	7,000
	Subtotal	765,070	-	248,160	-	1,013,230
TOTAL SWP DELIVERIES		1,133,969	2,180	468,999	-	1,605,148

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Appendix: Responses to SWP Contractors' Comments

This section presents SWP contractor comments on the Draft Final DCR 2019 released on July 10, 2020. DWR's responses are also included.

The SWP contractors who provided questions and feedback are as follows:

- Alameda County Water District
- Mojave Water Agency
- Metropolitan Water District of Southern California
- Santa Clarita Valley Water Agency
- Santa Clara Valley Water District

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
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(916) 653-5791

Thomas Niesar
Water Supply and Planning Manager
Alameda County Water District
43885 South Grimmer Boulevard
Fremont, CA 94538

Dear Mr. Niesar,

This letter is in response to your letter dated July 22, 2020 providing Alameda County Water District's (ACWD) comments for the Draft Final 2019 Delivery Capability Report (2019 DCR). DWR's responses to your five comments are attached.

If you or your staff wish to discuss this report further, please contact me at (916) 653-9885 or Tara.Smith@water.ca.gov. For specific questions regarding the analyses used for the report, please contact Erik Reyes erik.reyes@water.ca.gov or Nazrul Islam at Nazrul.Islam@water.ca.gov.

Sincerely,

Tara Smith

Tara Smith, Chief
Modeling Support Branch

Alameda County Water District Comments and DWR Responses

DWR thanks ACWD for providing DCR feedback. These are DWR's responses to the comments received on July 22, 2020 from ACWD.

Note: Based on DWR's Operations staff recommendations, model operations for Oroville carryover storage target have been refined. DWR also refined demand numbers and added minor code fixes. These updates result in differences in values from the Draft Final DCR 2019 shown in Table 1. For more details, please refer to the Code Change documentation included in the Excel Files folder package.

Table 1. Differences in SWP Table A (including Carryover) deliveries excluding Feather contractors and SWP Banks exports from the Draft Final and Final DCR.

Long-term Average (TAF/year)	Draft Final 2019 DCR	Final 2019 DCR	Diff	% Diff
SWP Table A Deliveries, Excluding Butte County and Yuba City	2,385	2,414	29	1.24%
Banks SWP Exports	2,478	2,521	42	1.71%

ACWD comment:

1. *ACWD appreciates how DWR has broken out delivery quantities in the Tech Addendum tables and separated values for "Delivery w/o Article 56 Carryover" and "Article 56 Carryover." This provides the specific input sets that ACWD needs for its integrated resources planning model. ACWD would like to thank DWR for this inclusion and would request that DWR continue to provide this breakdown going forward.*

DWR Response:

Thank you very much. We are glad that DWR reporting format is helping ACWD with their own integrated resources planning modeling.

ACWD comment:

2. *ACWD had previously anticipated that the 2019 DCR would extend beyond the 1922-2003 hydrologic period to cover more recent historical hydrology, particularly the critically dry year of 2014 and the hyper wet year of 2017. While ACWD understands that CalSim 3 is not yet ready, all urban water suppliers are required under the Urban Water Management Planning Act to show how their agencies perform in a single critically dry year. In 2014, all State Water Contractors south of the Delta were subject to a 0% allocation that persisted for 6 months until it was updated to 5%; however, the Existing Conditions modeling results in the 2019 DCR show a minimum dry year allocation of 6% in 1977 (for all contractors collectively as well as for ACWD individually). Given the experience of 2014, should the Existing Conditions worst case year of 1977 be considered an analog for 2014 and be further curtailed with a 6-month 0% allocation? ACWD would like to incorporate DWR's rationale into its upcoming UWMP to avoid potential controversy over insufficient modeling assumptions.*

DWR Response:
CalSim II simulates several dry years and dry periods in 1922-2003 simulation period. Even though single year estimates are provided in the report, caution should be used in planning around these single year estimates. It is important to understand that individual years have a unique hydrology, starting conditions, forecasts, and resulting system operation, all of which affect the outcome of each year. The final DCR 2019 study results indicate that the 1977 percentage of maximum Table A amount delivered is 7% instead of the 6% mentioned in your comment. The historical deliveries are approx. 10% in 2014 shown in main report. The simulated results in 1977 is comparable with historical delivery of 2014. Note that CVP and SWP were operating under Temporary Urgency Change Petition regarding (TUCP) Permits.

Differences between lowest yielding year estimated in the DCR (1977) and the actual 2014 allocation which account for the discrepancies include:

- Hydrology – where the years preceding these years were different. 1977 followed a below normal year while 2014 followed another critical year.
- Requirements assumed – where the 1977 simulation assumed the ROC on LTO and ITP operations which are slightly different than the 2008-2009 BiOps operated to in 2014.
- Modeling artifact: Model represents a specific operation which could be different than that of the real time. For example, the delivery in 1977 depends on the operation of year 1975 and 1976. If the model delivered a lot of water in year 1976 due to higher reservoir storage at the end of year 1975, the model will not have enough water to deliver in 1977 due to lower reservoir storage at the end of 1976.

DCR seeks to represent long-term SWP operation. The DCR does not aim to replicate what happened historically but to best represent the SWP's capability of allocating and delivering water given the available hydrology (1922-2003) and requirements assumptions. For example, modifications to demands such as Article 21 were scaled up from the actual historical maximum so that the model can appropriately determine how much Article 21 could be delivered.

Overall, SWP delivery from the simulated driest year of 1977 is comparable with that of the historical (2014) extreme dry years. Thus, it is appropriate to consider the 1977 as the best available model representation of SWP's operations due to CalSim 3's unavailability for DCR 2019 application.

ACWD comment:

3. *In terms of the Existing Conditions results, ACWD noticed that the maximum year delivery total of 4,011 TAF compared to the total available project deliveries of 4,133 TAF is ~97%, and that the maximum year delivery total of 4,011 TAF compared to the contractual project total of 4,200 TAF is ~95.5%. This contrasts with recent experience during the hyper wet year of 2017, when all reservoirs were essentially full (except for Oroville due to the spillway failure) and Table A allocation was limited to 85%. During conversations with DWR representatives at the annual contractors meeting, DWR indicated that the 2017 allocation was reflective of maximum project delivery under existing operational constraints. ACWD would like further clarification as to what may have changed in the underlying assumptions in the 2019 Existing Conditions modeling runs to show such high maximum allocations in the wettest year, and if these maximums of ~95.5% or ~97% should be considered realistic?*

DWR Response:

Even though single year estimates are provided in the report, caution should be used in planning around these single year estimates. It is important to understand that individual years have a unique hydrology, starting conditions, forecasts, and resulting system operation, all of which affect the outcome of each year.

The comparison provided in the comment is unfortunately an improper comparison for a few reasons. Some of the specific differences between highest yielding year estimated in the DCR (1983) and the actual 2017 allocation which make for an improper comparison include:

- Hydrology – where the years preceding these years were different. 1983 followed a wet year and 2017 followed a below normal year.
- Requirements assumed – where the 1983 simulation assumed the ROC on LTO and ITP operations, which are slightly different than the 2008-2009 BiOps operated to in 2017.
- Demands/deliveries – where the 1983 simulation assumed demand patterns for Table A, Article 56, and Article 21 based on an aggregate of historical initial requests and deliveries, whereas in 2017 delivery of these water types was a result of the contractors managing real-time.
- Facility outages – Along with the emergency response on the Oroville spillway, Clifton Court Intake gates were also out of service for over 30 days. The 1983 simulation assumed an average historical unit outage, but these extreme emergency events were not reflected in the model.

The objective of the DCR is to estimate the average capability of the SWP and in general the model captures this as a baseline operation. The DCR estimates are good for planning purposes, but one should understand that the model is not able to capture some of the unpredictable dynamics that occur in real-time operations.

ACWD comment:

4. *ACWD is aware that CalSim 3 had been intended for use in preparation of the 2019 DCR and that it will be available in the near future to support environmental studies for Delta Conveyance. We feel the DCR would benefit from a summary of why CalSim3 is unavailable for preparation of the 2019 DCR and a qualitative discussion of how upcoming CalSim 3 results might differ from what has been prepared using CalSim 2. Additionally, once Delta Conveyance CEQA analyses begin with the benefit of CalSim 3, can we assume that the future modeling of "without project" conditions will be consistent with the 2019 DCR Future Conditions modeling?*

DWR Response:

We have provided an explanation of why CalSim 3 is unavailable for the DCR into the Main Report (beginning of Section 5, page 20).

ACWD comment:

5. *From our understanding, the State Water Board has adopted unimpaired flow criteria for the Delta through the Bay Delta Water Quality Control Plan (BDWQCP). In the modeling used to develop the Existing Conditions and Future Conditions scenarios in the 2019 DCR, how is BDWQCP included in the modeling and what assumptions are made for the Sacramento and East Delta tributaries outflow requirements? Also, for the Lower San Joaquin unimpaired flow requirements that were adopted but are in negotiations via the Voluntary Agreement process, how were these included in the modeling and model assumptions?*

   Language in the 2019 DCR states the following background, but did not seem to include any related modeling assumptions:

   "In December 2018 the State Water Board updated the WQCP for the San Joaquin River flows and southern Delta Salinity.[4] The State Water Board is in the process of updating the WQCP for Sacramento/Delta Flows and Cold Water, Delta Outflows, and Interior Delta Flows. (Formally these processes were referred to Phase 1 and Phase 2 respectively). A primary focus of the WQCP update is on additional flows for the beneficial use of fish and wildlife. Based on the environmental documentation that has been produced up to this date by the State Water Board, it is likely that the implementation of these flow requirements will affect SWP contractor deliveries."

   and

   "The California Department of Water Resources and the Department of Fish and Wildlife (DFW) are working to establish the VA with participating water users following adoption by SWRCB of the San Joaquin River/southern Delta salinity WQCP update. The VA involve the development of projects that provide flow augmentation, modified storage releases and non-flow actions such as floodplain inundation to enhance Delta conditions. Both departments are continuing the effort to develop and evaluate proposed voluntary agreements. On March 1, 2019, DWR and DFW submitted documents to the State Water Resources Control Board that reflect progress to flesh-out the previously submitted framework to improve

conditions for fish through targeted river flows and a suite of habitat-enhancing projects including floodplain inundation and physical improvement of spawning and rearing areas. Further work and analysis are needed to determine whether the agreements can meet environmental objectives required by law and identified in the State Water Board's update to the Bay-Delta Water Quality Control Plan."

DWR Response:
BDWQCP was updated and adopted for SJR and Southern Delta salinity but it has not yet been implemented. Furthermore, interested stakeholder groups including the California Department of Fish and Wildlife are participating in ongoing negotiations to achieve voluntary agreements to implement the Plan amendments. As the implementation of the BDWQP is still being developed, the Delivery Capability Report 2019 assumes the existing Water Rights Decision 1641 implementation as specified in Table 11 of the Technical Addendum.

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Adnan Anabtawi
Senior Engineer
Mojave Water Agency
13846 Conference Center Drive
Apple Valley, CA 92307-4377

Dear Mr. Anabtawi,

This letter is in response to Mojave Water Agency's (MWA) staff comments dated July 22, 2020 for the Draft Final 2019 Delivery Capability Report (2019 DCR). DWR's response to the nine comments on the CalSim II study, Main Report, and Technical Addendum are attached.

If you or your staff wish to discuss this report further, please contact me at (916) 653-9885 or Tara.Smith@water.ca.gov. For specific questions regarding the analyses used for the report, please contact Erik Reyes erik.reyes@water.ca.gov or Nazrul Islam at Nazrul.Islam@water.ca.gov.

Sincerely,

Tara Smith

Tara Smith, Chief
Modeling Support Branch

Mojave Water Agency Comments and DWR Responses

DWR thanks MWA for sharing their comments on the DCR. Below are DWR's responses to the comments received on July 22, 2020 from MWA.

Note: Based on DWR's Operations staff recommendations, model operations for Oroville carryover storage target have been refined. DWR also refined demand numbers and added minor code fixes. These updates result in differences in values from the Draft Final DCR 2019 shown in Table 1. For more details, please refer to the Code Change documentation included in the Excel Files folder package.

Table 1. Differences in SWP Table A (including Carryover) deliveries excluding Feather contractors and SWP Banks exports from the Draft Final and Final DCR.

Long-term Average (TAF/year)	Draft Final 2019 DCR	Final 2019 DCR	Diff	% Diff
SWP Table A Deliveries, Excluding Butte County and Yuba City	2,385	2,414	29	1.24%
Banks SWP Exports	2,478	2,521	42	1.71%

MWA Comment:

1. ***CalSim II Study.*** *It is unclear whether the COA sharing represented in the modeling is consistent with the December 2018 COA amendment when the projects are operating under different regulatory requirements. For instance, what assumptions are made in the model when OMR flow requirements diverge between the CVP and SWP requirements?*

DWR Response:

Long term operation of ROC on LTO and ITP is modeled in consultation with DWR and BOR. In DCR 2019, OMR[1] target is -5,000 cfs in January through June except for 14 days of -2,000 cfs in January (for the first flush) if it is not triggered in December, or 5 days of -2,000 cfs in January through June for the turbidity bridge, and 6 days of -6,250 cfs when increased pumping due to storm is possible in January and February of AN, BN, and D water years. When salvage occurs in March through May, the target OMR is -3,500 cfs except for 5 days of -2,000 cfs if salvage and turbidity bridge coincide.
When CVP and SWP exports are restricted by OMR constraints, export capacity is shared according to COA Article 10(i) as follows:

- Delta Balanced condition, CVP can pump 65% of the entire exports and SWP can pump 35% of the entire exports.
- Similarly, Delta Excess condition: sharing ratio is 60% for CVP and 40% for SWP.

The difference between OMR flow restrictions in DCR 2019 and ROC_on_LTO[2] is that

1 Combined Flow in Old and Middle River (OMR)
2 Reinitiation of Consultation on the Coordinated Long-Term Operations of the Central Valley Project and State Water Project

OMR target is-5,000 cfs except for 7 days of -6,000 cfs when increased pumping due to storm is possible in January and February of AN, BN, and D water years.
To demonstrate the 2018 COA amendment CVP and SWP exports sharing under OMR flow restrictions, an analysis was conducted.
Table 2 shows the total, SWP and CVP exports restrictions due to OMR regulations. The results indicate that during the simulation period from 1922 to 2003, total and SWP exports are restricted 71 times in January, however, CVP exports are restricted 50 times in the same month.

Table 2. No. of times OMR is controlling exports and export sharing ratio greater than or equal to COA cap share.

	No. of Times OMR Controlling Total Export	No. of Times OMR Share≥ SWP CapShare	No. of Times OMR Share≥ CV CapShare
Jan	71	71	50
Feb	68	67	39
Mar	61	58	30
Apr	9	0	1
May	4	0	2
Jun	56	54	41
Jul	0	0	0
Aug	0	0	0
Sep	0	0	0
Oct	0	0	0
Nov	0	0	0
Dec	23	23	16
TOTAL	292	273	179

Table 3. shows the SWP and CVP exports sharing under OMR flow restrictions in January and February of 1923. In January, although SWP can export 40% of the total exports in excess condition, SWP exported 51% because CVP did not use its sharing capacity. In February, both SWP and CVP exported their full export capacity under OMR restrictions.

Table 3. SWP and CVP shares under OMR flow restrictions in January and February 1923.

Water Year Type	Date	Banks Exports CFS	Jones Exports CFS	Max Export under OMR Restrictions CFS	SWP Export Cap Share	CVP Export Cap Share	SWP Share under OMR	CVP Share under OMR
BN	**1/31/1923**	4711.2	4600	9311.2	0.4	0.6	**0.51**	**0.49**
	2/28/1923	3067.6	4600	7667.6	0.4	0.6	**0.40**	**0.60**

In conclusion, based on the results, CVP and SWP share the export capacity under OMR restriction according to 2018 COA addendum.

MWA Comment:

2. ***CalSim II Study.*** *Does the modeling consider the different contractual capacities of contractors within SWP reaches in determining Table A deliveries by contractor? The expectation is that those contractors who use Article 56 carryover to buffer the variability in the deliveries would average higher deliveries over the period of record than those who do not (due to potential contractual capacity constraints during very wet years when deliveries are limited by aqueduct capacity), but the output tables in the technical addendum do not suggest that.*

DWR Response:

The process of generating the Table A and carryover demand patterns considers the limit on peak deliveries of water.

Monthly max peak formulation in the demand patterns generator tool is as follows:

- Municipal and Industrial (M&I) or Metropolitan Water District diversions arcs: 11% * Max Table A
- For the rest: 18% * Max Table A.

This is consistent with the Water Supply Contracts 12.b limit on Peak Deliveries of Water.

There is a different reason why contractors who request Article 56 did not average higher deliveries over the long-term. This is due to the risk of carryover spills when a contractor requests Article 56.

For example, let's assume that contractor A's Maximum Table A is 150 TAF. In a 100% allocation year like 1983, a contractor requests to carry over 50 TAF to be delivered in 1984 instead (since the model does not consider multi-year carryover). Table A delivery to this contractor A in 1983 was 100 TAF. Overall, the contractor was allocated 100% of the Maximum Table A, 150 TAF where 50 TAF was carryover, and 100 TAF was Table A.

However, there is a risk that not all 50 TAF will be delivered to contractor A in 1984 because some of that carryover can spill due to SWP San Luis being full. In reality, contractors make arrangements with DWR and other agencies to transfer their carryover water before being spilled. This is not the case in CalSim. Thus, instead of receiving the full 50 TAF in 1984 which was requested in 1983, there is a risk of receiving less than 50 TAF due to carryover spills and non-dynamic adaptation of transferring that carryover water to another facility.

Despite this risk, the upside to requesting carryover showed that contractors fare better in dry water year types even though the long term and wet, above normal water years Table A deliveries are lower. These trends were observed after running a sensitivity study in which all Article 56 requests were removed and only Table A requests were made.

MWA Comment:

3. ***Main Report, fig. 4-1, p. 17.*** *It is unclear from the figure and axis title that this figure includes both Table A and Carryover deliveries, we recommend including this in the description. In Figure 4-2, Carryover is identified separately from Table A.*

DWR Response:
Figure 4-1 shows the historical Table A and carryover. We have included additional descriptions to both tables to increase clarity.

MWA Comment:

4. ***Main Report, p. 21.*** *Language in the discussion of Article 21 demands suggests that the simulation period is 1922 – 2015. It is our understanding that this 2019 Draft Final DCR uses CalSim II and a simulation period of 1922 – 2003. Why is there a discrepancy between these?*

DWR Response:
Thanks for pointing this out. It is a typographical error and has been fixed (should be 2003).

MWA Comment:

5. ***Main Report, p. 23.*** *It is noted that average Table A deliveries decreased in the 2019 DCR when compared with the 2017 DCR due in part to the increase in the end of September storage target for Lake Oroville from 1.0 to 1.3 million AF and from 1.3 to 1.6 million AF. It would be helpful to include some background as to why the new operational storage target was chosen.*

DWR Response:
We have documented the reason(s) for changing the Oroville storage target to 1.6 MAF in the Technical Addendum, Overview of Model Assumptions – Oroville Carryover Storage Target (page 4).

MWA Comment:

6. ***Main Report, table 5-3, p. 24.*** *It would be helpful to understand the impacts on Banks exports of the ITP isolated from the RoC on LTO. It would also be helpful to understand the impact on Banks exports due to the ITP for different water year types, as the requirements differ between water year types.*

DWR Response:

Splitting apart the federal and state requirements: The DCR is reporting the latest estimate of the SWP deliveries under the existing SWP regulatory requirements which include among other things, the 2019 BiOps and the 2020 ITP. A "2019 BiOp" scenario is an artificial regulatory construct on which the SWP could not operate to because by itself the 2019 BiOps do not include necessary coverage under CESA. The SWP received a consistency determination (CD) from CDFW on the 2008-2009 BiOps for its CESA coverage, so those items in the aggregate represent a valid regulatory construct on which the SWP did indeed operate to. The 2019 BiOps can only be coupled with the 2020 ITP to form a valid and complete operating structure providing coverage under both ESA and CESA.

Detailed breakdown of impacts: The purpose of the DCR is to provide a reasonable estimate of water deliveries to SWP contractors under existing regulatory requirements. These estimates are based on incorporating the latest thoughts on implementation of actions as well as climate projections. A table (Table 5-3) was provided for informational purposes but diving deeper into the differences is beyond the scope of the DCR.

MWA Comment:

7. ***Main Report, Fig. 5-3, p. 25.*** *There is a substantial increase in likelihood for annual Table A deliveries to be less than 500 thousand acre-feet (TAF) shown in this figure. Can you provide explanation as to why the likelihood of annual deliveries has shifted from a normal distribution in the 2017 DCR to a non-normal distribution in the 2019 DCR? This also deviates substantially from the first draft of the 2019 DCR. This figure also does not seem consistent with the tables in the technical addendum—SOD contractors only show 1 to 2 years in the modeling period with allocations 12% or lower (500 TAF of the 4,133 TAF max is about 12%). It is also not consistent with figure 1 of the technical addendum that shows >95% probability that total deliveries would be >500 TAF.*

DWR Response:

Thank you for pointing this out. The high frequency of Table A deliveries below 500 TAF shown in Figure 5-3 was due to an error in post-processing outputs from the model. This has been corrected and Figure 5-3 now shows a normal distribution. See page 26 for an explanation of the reasons for the changes in Table A deliveries vs the 2017 Report.

MWA Comment:

8. ***Technical Addendum, tables 15-41 & tables 47-73.*** *These tables seem to have errors and inconsistencies between the chronological list of deliveries and the probability curves, for example: (1) Table 16: the Probability curve suggests that 100% of max Table A was delivered to Alameda County WD in 1967, but the left side of the table shows that 85% was delivered in 1967, and 100% was delivered in 1983. (2) Table 17: AVEK receives 100% of their max Table A in the 1999 year, but the probability curve shows the 100% year is 1938. Also, the average percent of maximum Table A should be the same for the two sides of the table (the only difference should be the year ordering). There are many more instances of these errors for different contractor tables.*

DWR Response:
Thanks for pointing this out. The discrepancies noted have been fixed.

MWA Comment:

9. ***Technical Addendum, tables 15-41 & tables 47-73.*** *Many individual contractor tables showing Table A deliveries indicate for existing conditions that there are multiple years for which those contractors would receive 100% of their maximum Table A. Some SOD contractors show as much as 7 or even 9 years in the simulation period that the contractor would receive 100% of their maximum Table A, even if those contractors do not utilize Article 56 carryover (examples are Table 26 Kern M&I and Table 34 San Gabriel Valley MWD). Additionally, even with Article 56 carryover deliveries, it is hard to understand how there would be multiple years in which contractors could receive 100% of their maximum Table A.*

DWR Response:
Model allocates contractors' full maximum Table A entitlement during some wet years (for example, 1938, 1958, 1969, 1982-1983, and so on). However, contractors request the highest Article 56 carryover in the 100% allocation years to be delivered in the following year. If next year is wet or above normal year, San Luis is usually at or near capacity. Under these conditions, contractors may not receive requested carryover water. Since Article 56 carryover deliveries are added to the Table A deliveries of the next calendar year, it is rare to find full Table A deliveries for contractors who request Article 56 water.

Kern M&I and San Gabriel Valley do not request Article 56 carryover water, and since their Table A deliveries are not subject to the San Luis capacity requirement, these contractors receive 100% of their Table A entitlement.

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Deven Upadhyay
Assistant General Manager/Chief Operating Officer
Metropolitan Water District of Southern California
P.O. Box 54153
Los Angeles, CA 90054-0153

Dear Mr. Upadhyay,

This letter is in response to the document titled "*Metropolitan Staff Comments on the Draft Final SWP Delivery Capability Report 2019*" delivered on 22 July 2020. This document provides Metropolitan Water District of Southern California's (MWD) comments for the Draft Final 2019 Delivery Capability Report (2019 DCR). DWR's responses to MWD's comments are attached.

If you or your staff wish to discuss this report further, please contact me at (916) 653-9885 or Tara.Smith@water.ca.gov. For specific questions regarding the analyses used for the report, please contact Erik Reyes erik.reyes@water.ca.gov or Nazrul Islam at Nazrul.Islam@water.ca.gov.

Sincerely,

Tara Smith

Tara Smith, Chief
Modeling Support Branch

Metropolitan Water District of Southern California Comments and DWR Responses

DWR thanks the MWD staff for taking time to provide these comments. Below are the responses to MWD's comments received on 22 July 2020.

Note: Based on DWR's Operations staff recommendations, model operations for Oroville carryover storage target have been refined. DWR also refined demand numbers and added minor code fixes. These updates result in differences in values from the Draft Final DCR 2019 shown in Table 1. For more details, please refer to the Code Change documentation included in the Excel Files folder package.

Table 1. Differences in SWP Table A (including Carryover) deliveries excluding Feather contractors and SWP Banks exports from the Draft Final and Final DCR.

Long-term Average (TAF/year)	Draft Final 2019 DCR	Final 2019 DCR	Diff	% Diff
SWP Table A Deliveries, Excluding Butte County and Yuba City	2,385	2,414	29	1.24%
Banks SWP Exports	2,478	2,521	42	1.71%

MWD comment:

1. ***DCR2019 CSII Study.*** *Review of the model was limited due to time constraints, however, it appears the 2019 draft DCR CalSim II model does not reflect all the requirements and commitments identified in the ITP. Omissions include: dry year Suisun Marsh gate action, the 30 TAF export in Apr-May of W years, allowed exports above 150 TAF outflow in Apr-May of W years, the adaptive management of various outflow blocks, and various daily loss triggers. Also, it is unclear whether the fall X2 implementation results in correct COA sharing.*

DWR Response:

Dry year SMSCG operation: The model implements SMSCG operations in the summer of Dry years following Below Normal years. SMSCG operations in Dry years following Wet and Above Normal are part of the Adaptive Management Program and are dependent on DFW's annual discretion to choose, and the successful carryover of the Wet and Above Normal 100 TAF summer/fall water block. The model reflects the default deployment of this water in the Summer of Wet and Above Normal years and captures the expected effects on SWP deliveries due to this action.

First 30 TAF and the additional exports above 150 TAF in Apr-May of Wet years: is not reflected, but we expect this to result in an insignificant change in deliveries.

Adaptive Management of outflow blocks: The model reflects the default deployment of the water blocks and captures the timing and expected effects on SWP deliveries.

Various daily loss triggers: The daily loss triggers for Winter-run and Spring-run Chinook Salmon are expected to be interim measures until a life cycle models are developed and vetted.

Fall X2 COA sharing: the implementation of Fall X2 has been checked to confirm that responsibility under COA is shared correctly. The formulas used to compute the responsibility of the SWP and CVP for meeting Fall X2 are shown below. A separate spreadsheet is provided in the Excel files package showing the following calculations:

(1) SWP responsibility (decrease in Banks SWP exports and 2/3*North Bay Aqueduct diversions + increase in Oroville storage releases) = 45% * decrease in Unused Water for Export + 20% * increase in In-Basin Use + decrease in Banks exports of Unused Federal Share - decrease in SWP Surplus Delta Outflow

(2) CVP responsibility (decrease in Jones CVP exports + increase in CVP North-of-Delta storage releases) = 55% * decrease in Unused Water for Export + 80% * increase in In-Basin use - decrease in Banks exports of Unused Federal Share - decrease in CVP Surplus Delta Outflow

MWD comment:

2. ***Draft Final DCR.*** *Please document why CalSim II was used.*

DWR Response:
We added an explanation into the Main Report in the beginning of Section 5 (page 20).

MWD comment:

3. ***Draft Final DCR, pp. 1.*** *Second paragraph: "State Water Contractors (SWC)" - should be replaced by "State Water Project contractors…" Recommend not using "SWC" acronym as SWC is an association of 27 of the 29 SWP contractors. The acronym appears p 1 and in the glossary only.*

DWR Response:
We have removed references to SWC and replaced them with "State Water Project contractors."

MWD comment:

4. ***Draft Final DCR, pp. 2-3 & 29.*** *Discrepancy in second bullet discussion of Article 21 delivery likelihood. Figure 5-7 shows that likelihood of less than 20 TAF of Article 21 decreased from 84% to 66%, a decrease of 18% (matches the text). However, the following sentence states the likelihood of between 20 and 100 TAF/year of Article 21 increased 18%. As shown on Figure 5-7 (Draft Final pp. 30), the likelihood only increased from 4% to 10%.*

DWR Response:
Thank you for pointing this out. This text has been adjusted to emphasize the increase in Article 21 deliveries of more than 20 TAF. Note that the numbers in Figure 5-7 have now changed due to updated modeling.

MWD comment:

5. ***Draft Final DCR, pp. 6****. Broken links: If hyperlinking, check that the links point to the correct url from the pdf: (1) https://water.ca.gov/Programs/Water-Use-And-Efficiency/Making-Conservation-a-California-Way-of-Life, (2) https://water.ca.gov/Programs/Water-Use-And-Efficiency/Agricultural-Water-Use-Efficiency*

DWR Response:
We have fixed the broken links in the Main Report.

MWD comment:

6. ***Draft Final DCR, pp. 17.*** *Figure 4-1 needs to include annotation for what the dashed/dotted lines mean for easier comprehension (maximum Table A/average Table A deliveries).*

DWR Response:
We have included the legend for Figure 4-1 for clarity.

MWD comment:

7. ***Draft Final DCR, pp. 19 & 21.*** *Potential discrepancy on simulation period: On pp. 19 the report states that the modeling uses CalSim II with water years 1922-2003. On pp. 21, when explaining the Kern wet year, the report says the simulation period is from 1922- 2015.*

DWR Response:
Thanks for pointing this out. It is a typographical error and has been fixed (should be 2003).

MWD comment:

8. ***Draft Final DCR, p. 21.*** *It may be more appropriate for annual Article 21 deliveries to be capped by annual maximum requests instead of maximum historical deliveries.*

DWR Response:

Thank you for the recommendation. Article 21 demands now consider the annual maximum requests per data from the State Water Project Analysis Office (SWPAO). To make use of the Article 21 deliveries and request data available, the Article 21 limits are now the maximum of either the maximum 2005-2018 annual historical delivery or the maximum of 2011, 2017, and 2019 historical SWPAO Article 21 requests for each contractor.

The annual Article 21 demands are now based on this logic:

$$Article21AnnDem_j = \max\left(\max hist\ del\ 2005-2018, \max hist\ req\ 2011, 2017, 2019\right)$$
$$Article21AnnDemScaled_j = Article21AnnDem_j(ScalingFactor)$$

Where j is the contractor and the scaling factor is 1.2 (20% increase).

The scaling factor was added to not necessarily constrain Article 21 demands by historical data only. For example, if the original annual Article 21 demand determined was 238 TAF, the scaled demand would be 238 TAF * (1.2) = 285.6 TAF. The factor was decided internally but could be updated if needed.

2011, 2017, and 2019 Article 21 request data were provided because these were the most recent Article 21 representative years. Reviewing the request data revealed that there were 9 SWP contractors whose maximum request from 2011, 2017, or 2019 was higher than their maximum annual Article 21 delivery from 2005-2018.

- ANTELOPE VALLEY-EAST KERN WA
- COACHELLA VALLEY WD
- COUNTY OF KINGS
- DESERT WA
- DUDLEY RIDGE WD
- SAN BERNARDINO VALLEY MWD
- SAN GABRIEL VALLEY MWD
- SANTA BARBARA COUNTY FC&WCD
- VENTURA COUNTY WPD

Desert and Coachella Valley did not receive Article 21 deliveries from 2005-2018. Without the Article 21 request data, these contractors would not have contained Article 21 demands in the model.

The Technical Addendum section: Documentation on the Updated CalSim II State Water Project Table A, Carryover, and Article 21 Demands and Demand Patterns has been updated to reflect the latest Article 21 demands, monthly patterns, and annual limits.

MWD comment:

9. ***Draft Final DCR, p. 21; Technical Addendum, p. 4.*** *Discrepancy on the date ranges used for Article 21 annual maximum delivery. p. 21: The annual Article 21 maximum delivery caps were based on the maximum Article 21 water deliveries to each contractor during 2009-2018. p. 4 Tech Add: Article 21 demand and delivery logic were revised to consider the … annual (2008-2018 delivery data) historical ability of SWP contractors to take Article 21 water.*

DWR Response:

Thanks for pointing this out. This was a typographical error on p. 21 of the Main Report. The correct statement should have been 2008-2018 in the Draft Final version. However, the Article 21 annual demands calculation method has been updated. This was explained in the previous comment.

MWD comment:

10. ***Draft Final DCR, pp. 24,*** *Table 5-3. Please consider: (1) Splitting apart "Changes in regulations in ITP/RoC on LTO" into its two components so the impact of each component (ITP vs RoC on LTO) is documented. (2) Documenting within the report the reason(s) for the change in the Oroville storage target. (3) Including a more detailed breakdown of impacts by water year type.*

DWR Response:

Splitting apart the federal and state requirements: The DCR is reporting the latest estimate of the SWP deliveries under the existing SWP regulatory requirements which include among other things, the 2019 BiOps and the 2020 ITP. A "2019 BiOp" scenario is an artificial regulatory construct on which the SWP could not operate to because by itself the 2019 BiOps do not include necessary coverage under CESA. The SWP received a consistency determination (CD) from CDFW on the 2008-2009 BiOps for its CESA coverage, so those items in the aggregate represent a valid regulatory construct on which the SWP did indeed operate to. The 2019 BiOps can only be coupled with the 2020 ITP to form a valid and complete operating structure providing coverage under both ESA and CESA.

Documenting change in Oroville target: We have documented the reason(s) for changing the Oroville storage target to 1.6 MAF in the Technical Addendum, Overview of Model Assumptions – Oroville Carryover Storage Target (page 4).

Detailed breakdown of impacts: The purpose of the DCR is to provide a reasonable estimate of water deliveries to SWP contractors under existing regulatory requirements. These estimates are based on incorporating the latest thoughts on implementation of actions as well as climate projections. A table (Table 5-3) was provided for informational purposes but diving deeper into the differences is beyond the scope of the DCR.

MWD comment:

11. ***Draft Final DCR, p. 25****. The estimated likelihood of SWP Table A water deliveries shows substantial increases in deliveries of 0-500 TAF/year range (from 1% in DCR 2017 to 14% in DCR 2019). It would be helpful to explain why this specific delivery range had a more significant increase.*

DWR Response:

Thank you for pointing this out. The high frequency of Table A deliveries below 500 TAF shown in Figure 5-3 was due to an error in post-processing outputs from the model. This has been corrected and Figure 5-3 now shows a normal distribution. See page 24 for an explanation of the reasons for the changes in Table A deliveries vs the 2017 Report.

MWD comment:

12. ***Draft Final DCR, pp. 27-28.*** *Re Table 5-5, the 2-year period 2014-15 was drier than 1976-77 in terms of SVI, and the 4-year period 2012-15 was drier than 1931-34 in terms of 8-River Index Runoff. Why don't the modeled hydrologic sequences extend to 2015?*

DWR Response:

The hydrologic sequence does not extend to 2015 because CalSim II was used to model the DCR 2019. CalSim 3 is unavailable at this time due to reasons discussed in a new section in the Main Report describing the model choice (beginning of Section 5, page 19).

MWD comment:

13. ***Draft Final DCR, pp. 27.*** *On pp. 27 and Figure 5-5 the 2-year sequence (1976-1977) does not follow the decreasing trend from the 2017 report to the 2019 report. It would be good to have an explanation why, since the single dry year (1977) went down from 8% to 6%.*

DWR Response:

The pattern discussed is still present in updated modeling, and the reason for the shift is the same, although the percent of maximum Table A amount delivered in 1977 decreased from 8% to 7%. The reason for the shift in deliveries from 1977 to 1976 in the 2019 model (compared to 2017), which accounts for why 1976-77 increases but 1977 goes down, is as follows. 1976 has increased deliveries because of the relaxation of the Fall X2 standard in the ITP/ROC LTO regulations in Wet years (this affects both Fall 1974 and 1975). This allows for higher storage in Oroville, which leads to a higher allocation in 1976 (and more carryover deliveries from the prior year). The higher allocation and deliveries in 1976 in turn leads to lower storage in SWP San Luis in December 1976, which leads to lower deliveries in water year 1977. The primary reason for lower deliveries in 1977 is that the intended carryover from 1976 is not delivered because SWP San Luis is so low in December 1976 that the water is not available.

MWD comment:

14. ***Draft Final DCR, p. 31****. It would be helpful to have an explanation for why there were significant Article 21 delivery increases in the (1931-1934) and (1929- 1934) drought periods.*

DWR Response:

The Article 21 delivery increases in these periods have changed slightly with updated modeling, but the numbers are similar. The higher Article 21 deliveries compared to 2017 are due to large Article 21 deliveries in February 1931 and March 1933, when SWP San Luis is full. In both cases the increased Article 21 is due to operational / regulatory differences from the 2017 modeling, but is also generally reflective of the higher Article 21 deliveries overall that occur in the 2019 Report. In February 1931 SWP San Luis is full in the 2019 model when it was not full in the 2017 model. This is due to a lower Table A allocation in the prior year (1930), due to the higher Oroville end of September storage target used in the 2019 modeling. The lower allocation in turn leads to less use of storage in SWP San Luis in 1930 which leads to a fuller SWP San Luis in early 1931. In March 1933 SWP San Luis was full in both the 2017 and 2019 models, but in 2019 the SWP was able to export more Article 21 supplies due to the less restrictive Old and Middle River regulations in drier years in the 2019 modeling.

MWD comment:

15. ***Technical Addendum, pp. 4****. Recommend striking sentence: "However, recent operations in 2017 confirm that Banks pumping plant can sustain continuous monthly pumping at 10,300 cfs." because of 2017 Clifton Court Forebay intake scour damage.*

DWR Response:

We agree with this change and updated the Banks Permitted Pumping Capacity section in the Technical Addendum (page 5).

MWD comment:

16. ***Technical Addendum, pp. 9****. Does "Existing capacity" of the California Aqueduct reflect the reduced capacity due to subsidence?*

DWR Response:

Currently, subsidence has reduced the flow capacity in the aqueduct at locations in San Luis and San Joaquin Field Divisions but has not yet resulted in a reduction in deliveries. However, in order to meet those deliveries, the pumping schedules have to be shifted to non-optimal times and it has decreased the operational flexibility of the system. The shift in pumping schedule and loss of operational flexibility have significantly increased the costs to operate/move water, directly due to the subsidence.

The Future Condition studies that include Climate Change do not include a reduction in delivery due to additional subsidence as assumptions would need to be made on how effective the Sustainable Groundwater Management Act and resulting Groundwater Management Plans will be in reducing subsidence. Assumptions would also need to be made on if repairs to the aqueduct to address subsidence will be in place.

MWD comment:

17. ***Technical Addendum, p. 34, Table 11****. The carryover requests for Desert and Coachella at 100% allocations do not look correct (0 and 37.86 TAF, respectively) in Table 11. Metropolitan schedules delivery of Desert and Coachella SWP supplies and makes exchange deliveries from the Colorado River Aqueduct. Review of Metropolitan's initial schedule submittals show the following requests at 100% allocation levels for the 2014-2019 period:*

Art. 56(c) carryover requests (AF), initial 100% schedules:			
Year	MWD	DWA	CVWD
2014	200,000	0	69,175
2015	200,000	27,875	69,175
2016	200,000	14,361	35,639
2017	200,000	0	0
2018	200,000	27,875	69,175
2019	200,000	15,646	38,832
Average	200,000	14,293	46,999

In 2019, Metropolitan, Desert, and Coachella amended their SWP exchange agreement. Under the amended exchange agreement, Metropolitan will be more fully utilizing Desert and Coachella's Article 56(c) carryover provisions going forward. Modeling of current conditions should reflect 100% initial schedules showing maximized carryover for all 3 agencies: 200 TAF for Metropolitan, 69,175 AF for Coachella, and 27,875 AF for Desert.

DWR Response:

Thank you for this comment. The Article 56 100% requests for Coachella and Desert have been updated to 69,175 AF and 27,875 AF respectively and are reflected in Table 21 - 2019 DCR Table A Demand and Article 56 Carryover (Existing Conditions) in the Technical Addendum (page 45).

MWD comment:

18. ***Tech. Add., p. 37, Table 12 and p. 104,*** *Table 44 It would be helpful to have an explanation for why the driest year is showing an increase in SWP Table A under future conditions (9% from 6% under current conditions). This diverges from the decreasing trend seen in the long-term average (decrease from 58% to 52%).*

DWR Response:

The numbers changed due to the updated Final DCR 2019 study. The Future Conditions percent of maximum Table A amount delivered is still slightly higher at 10% in 1977 (412 TAF/4,133 TAF) while that of the Existing Conditions is 7% (288 TAF/4,133 TAF), 3% less. The long-term average trend reduction is still the same from 58% to 52%.

Understanding why the 1977 SWP SOD (South of Delta) allocation and deliveries behave the way they are requires looking at the precursory conditions like SWP SOD allocation and SWP San Luis (SWP SL) end-of-December (EOD) storage in 1976. The summarized reason as to why the Future Conditions 1977 allocation increased by 3% compared to that of the Existing Conditions is due to the lower 1976 allocation which resulted in SWP SL preserving more storage by the end of December 1976.

For example, the 1976 SWP SOD Allocation in Future Conditions decreased by 28%. This is mainly due to lower water supply estimates from Oroville and SWP SL storage and forecasted Feather River watershed runoff. The reduced 1976 Table A SOD allocation means less drawing down of SWP SL. As a result, the end-of-December 1976 SWP SL storage increased by 166 TAF. Typically, in the driest years, the model relies more upon SWP SL storage (minus deadpool) to make its allocation decisions. Since there is higher storage at the start of the 1977 contract year, this leads to better allocation (3% increase).

Overall, the 1977 conditions are highly dependent on the previous year allocation and end of the year storage. Though the 1977 single dry year trend from Existing to Future Conditions slightly diverges from that of the long-term trend, the 1976-1977 SWP allocation and Table A deliveries better shows the impacts of Future Conditions. The Table A deliveries in those two years decreased from 32% to 23% of the maximum Table A amount which is mainly due to the 28% reduction in 1976 SWP SOD allocation.

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Dirk Marks
Director of Water Resources
Santa Clarita Valley Water Agency
26521 Summit Circle
Santa Clarita, CA 91350-3049

Dear Mr. Marks,

This letter is in response to the document titled "*Santa Clarita Valley Water Agency Comments on the 2019 Draft Final SWP Delivery Capability Report*" delivered on 22 July 2020. This document provides Santa Clarita Valley Water Agency's (SCVWA) comments for the Draft Final 2019 Delivery Capability Report (2019 DCR). DWR's responses to the four comments on the Technical Addendum of the 2019 DCR are attached.

If you or your staff wish to discuss this report further, please contact me at (916) 653-9885 or Tara.Smith@water.ca.gov. For specific questions regarding the analyses used for the report, please contact Erik Reyes erik.reyes@water.ca.gov or Nazrul Islam at Nazrul.Islam@water.ca.gov.

Sincerely,

Tara Smith

Tara Smith, Chief
Modeling Support Branch

Santa Clarita Valley Water Agency Comments and DWR Responses

DWR thanks the SCVWA for taking time to provide these comments. Below are DWR's responses to these comments received on 22 July 2020 from SCVWA.

Note: Based on DWR's Operations staff recommendations, model operations for Oroville carryover storage target have been refined. DWR also refined demand numbers and added minor code fixes. These updates result in differences in values from the Draft Final DCR 2019 shown in Table 1. For more details, please refer to the Code Change documentation included in the Excel Files folder package.

Table 1. Differences in SWP Table A (including Carryover) deliveries excluding Feather contractors and SWP Banks exports from the Draft Final and Final DCR.

Long-term Average (TAF/year)	Draft Final 2019 DCR	Final 2019 DCR	Diff	% Diff
SWP Table A Deliveries, Excluding Butte County and Yuba City	**2,385**	**2,414**	**29**	**1.24%**
Banks SWP Exports	**2,478**	**2,521**	**42**	**1.71%**

SCVWA comment:

1. ***Technical Addendum, general comments****. Several of the tables reference Castaic Lake Water Agency (CLWA) these references should be updated to refer to Santa Clarita Valley Water Agency (SCVWA).*

DWR Response:

Thank you for pointing this out. We have updated all references of Castaic Lake Water Agency (CLWA) to Santa Clarita Valley Water Agency (SCVWA) in the report and CalSim II study.

SCVWA comment:

2. ***Technical Addendum, Table A Amounts and Carryover including Table 11 (pg. 34). A.*** *The description of this topic should be expanded to explain the methodologies used by DWR when preparing Tables 15-41 and 47-73. For example, it appears that generally that for given year only Table A up to the amounts referenced in Table 11 are delivered as Table A and any excess is delivered in the next year as carryover. However, even in relatively dry years such as 1924 water is not delivered as Table A in favor of placing some amounts in carryover. A discussion of the rules used to determine deliveries of Table A and Carryover amounts would significantly improve the transparency of this analysis.*

   B. It appears that the rules employed in this analysis do not work very well for contractors that are not currently taking close to their full Table A. For example, for SCVWA has demands of about 46TAFY and in year 1923 the program delivers all carryover from the previous year regardless of the fact that this brings total deliveries well above its demand for water in that year. This results in an overall delivery of 71 TAF. SCVWA or other contractors in similar circumstances would have carried over all or a portion of such water to supplement supplies in the following year 1924 or another low allocation year. The water supply contracts provide for such management of carryover water. If such adjustments are not feasible within the time frame allowed to finalize the 2019 DCF, contractors should be provided the option of not having carryover incorporated into their tables and handle carryover deliveries through other analyses that they deem appropriate to incorporate into their Urban Water Management Plans.

   C. Table 11 contains information on levels of Table A demands used to determine the quantities of Carryover water and is based on 2019 demand levels. This same table appears to be used for 2040 future conditions. Several agencies including SWCWA anticipate significant growth within our service areas accompanied by higher SWP demand levels. An updated "Table 11 "should be utilized for preparation of Tables 47-73.

DWR Response:

We appreciate your feedback regarding the Table A and carryover process and how we can improve transparency and reporting format. This response is separated in three parts and addresses the comments categorized as follows:

A. Summary and example of CalSim Table A and carryover process

To explain the CalSim Table A and carryover allocation process, we have included an overview and CalSim January 1984 example of Table A and carryover delivery amount calculations in the last part of this letter (**Appendix A: CalSim Determination of Table A and Article 56 deliveries**). We hope that this provides enough detail to clarify the process.

B. Multi-year carryover modeling

Multi-year carryover logic will not be implemented in the 2019 DCR. An additional run using the Draft Final DCR was developed in which all Article 56 requests have been removed; Only Table A demand is modeled and is being delivered. The results showed

that in Wet or Above Normal water year types, Table A deliveries increased by about 80 TAF. Contractors even received 100% of their maximum Table A contract in 1983 which was a 100% allocation year.

However, there was a downside to not setting aside carryover. Table A deliveries during the rest of the drier water types decreased across the board. This was because contractors took all their Table A deliveries in abundant water supply conditions without setting aside carryover for next year in the event of a single or multi-year drought period. Overall, removing all carryover requests improved wet and above normal water year Table A deliveries but impacted the rest of the drier water types and dry periods. Lastly, after discussion with a representative from the SWP contractors, there was a decision that there will be no major changes to the carryover requests except for responding to contractor comments and fixing issues.

C. Future Conditions Table A and carryover demand patterns

After meeting with a representative from the SWP contractors, it was decided that an updated "Table 11" from the technical addendum will not be developed for the Future Conditions final DCR 2019 study.

SCVWA comment:

3. ***Technical Addendum, tables 15-41 & tables 47-73.*** *Given the complications associated with how carryover water is handled in the modeling process (as discussed above) SCVWA strongly recommends that these Tables be expanded. At a minimum, a column showing the SWP Table A allocation before carryover management actions are taken should be added. This would provide greater flexibility for individual contractors to reference these tables and if they chose not utilize the carryover operations contained in the model. It would also have the benefit of allowing contractors that did not have Carryover water in their 2017 DCR tables to directly compare Table A allocation made in the 2017 DCR to those under the 2019 DCR criteria.*

DWR Response:

We have developed two modified Individual Contractor Excel spreadsheets which expands the Table A and carryover deliveries, one workbook each for the Existing and Future Condition. These files are provided separately from the Technical Addendum to not further crowd the document.

The Excel file names are as follows:

- AltSWPReporting_Existing_DCR2019.xlsm
- AltSWPReporting_Future_DCR2019.xlsm

The following columns have been added in the alternate reporting:

- SWP Total Allocation
- Article 56 spills in the next contract year

The existing columns' formulas have been modified:

- Article 56 Carryover (TAF) to Article 56 Carryover (TAF) in Next Contract Year

Values in this column show deliveries in the next contract year. This is because Article 56 requests in the current contract year do not get delivered until the next contract year. Even then, there is no guarantee that a contractor will receive all its request Article 56 due to the risk of spills. As a result, the Article 56 spills in the next contract year column were added to see how the allocated carryover is not always delivered.

We hope that this alternative reporting can help trace the Table A and carryover (and potential spills) from the allocation to delivery.

SCVWA comment:

4. ***Technical Addendum, tables 15-41 & tables 47-73.*** *There appears to be an inconsistency between the total deliveries Total Table A Delivery Column (the fourth column) and the Percent Maximum Table A column (fifth column). For SWCWA, Table 18 in 1922 total deliveries are 45 TAF and 49% Table Max table A. The 49 TAF/95.2 TAF equals 51% not 49%. Similarly, in 1928 the 75 TAF is about 79% not the 82% shown in the table. This appears to be beyond what a simple rounding error would produce. Even when the averages are compared at the bottom of the chart the 51 TAF would yield about 54% vs the 56% shown as the average Percent Maximum Table A amount. Similar anomies seem to appear on other contractor's tables.*

DWR Response:

Thank you for pointing this out. The discrepancies noted have been fixed.

Appendix A: CalSim Determination of Table A and Article 56 deliveries

Summary

The following steps describe the general SWP Table A contractor demand allocation process and distribute SWP allocation to each contractor. The simulation codes are in the model folder: CONV\Run\DeliveryLogic\SwpDeliveryLogic, The steps are

1. Calculate Table A demand allocation target
2. Calculate carryover storage allocation target
3. Subtract current year's allocated carryover storage target from allocated Table A demand

Steps 1-3 constitute SWP Table A contractor delivery target for the current year

4. Calculate remaining Table A delivery target at the beginning of current month
5. Divide by remaining Table A demand to calculate current month's percent delivery allocation

Steps 4-5 make up the SWP Table A contractor allocation for the current month.

The next section goes over an example of how Table A and carryover deliveries were calculated for Santa Clarita Ag and M&I in January 1984. The study used was the Draft Final DCR, however, the logic overall is the same.
The SWP allocation procedure is beyond the scope of this response.

Table A and Article 56 January 1984 Example for SCVWA

Table A1. Santa Clarita Valley Water Agency CalSim delivery arcs

Delivery Arc	Type	Project deliveries
D868	Ag	Table A, Carryover, Article 21
D896	M&I	Table A, Carryover (currently 0)

Step 1. Calculate Table A target using Table A demand profile from swp_3_tablea.table

$$Table\ A\ allocated\ demand\ for\ current\ year = swp_{perdel_{SOD}}(Table\ A\ demand)$$

Table A2. Calculation process for Table A allocated demand

Date	Delivery Arc	swp_perdel_SOD	Table A Max demand (TAF/yr)	Table A demand allocation target (TAF/yr)
31-Jan-84	D868	96.55%	12.7	12.26
31-Jan-84	D896	96.55%	82.5	79.66

- Table A Max demand: found in swp_table_a.table

The SWP Allocation is 96.55%. The current CalSim logic is to assume 100% demand profile if the allocation is 80% or higher. Thus, the rest of the example will be referring to SCVWA's 100% demand profiles located in the following files:

- swp_3_tablea.table
- swp_3pattern_demands.table
- swp_carryover.table

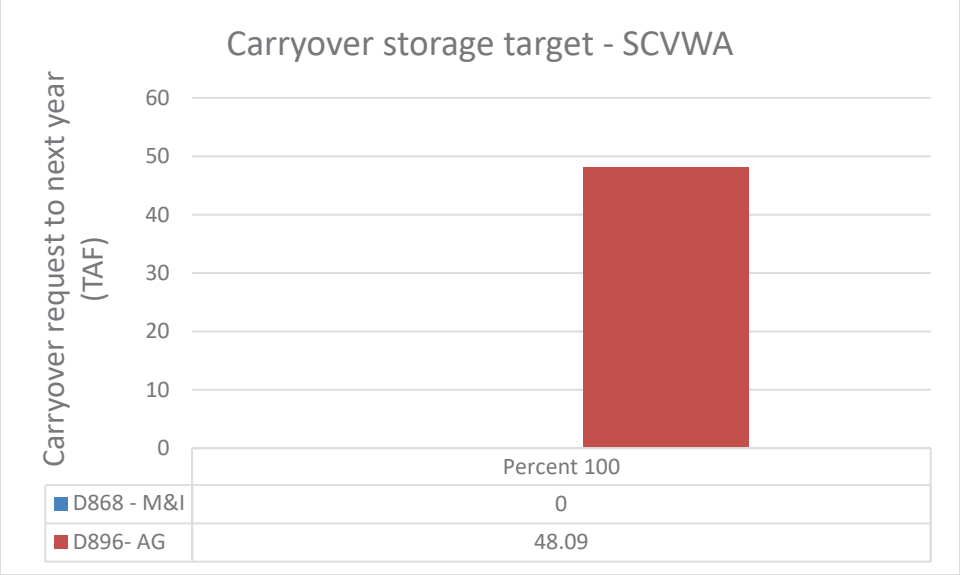
Step 2. Calculate carryover storage allocation target using

$$Carryover\ storage\ allocation\ target = swp\_perdel_{SOD}(Carryover\ storage\ target)$$

Table A3. Calculation process for carryover storage target allocation

Delivery Arc	swp_perdel_SOD	Carryover storage target 100% profile (TAF/yr)	Carryover storage alloc target (TAF/yr)
D868	96.55%	0	0.00
D896	96.55%	48.09	46.43

- Carryover storage target 100% profile: found in swp_carryover.table



Step 3. Find the Table A current year delivery target

$$\begin{aligned} &Table\ A\ delivery\ target\ for\ current\ year \\ &\quad = Allocated\ Table\ A\ demand\ (Step\ 1) \\ &\quad - Current\ year\ alloc\ carryover\ storage\ target (Step\ 2) \end{aligned}$$

Table A4. Calculation process for Table A delivery target

Delivery Arc	Table A demand allocation target - carryover storage alloc tar (TAF/yr)
D868	12.26
D896	33.22

Step 4. Calculate remaining Table A delivery target at the beginning of the current month

$$\begin{aligned} &Remaining\ Table\ A\ delivery\ target\ current\ month \\ &\quad = Table\ A\ delivery\ target\ for\ the\ current\ year\ (Step\ 3) \\ &\quad - \sum_{Jan}^{Previous\ Month} Table\ A\ Deliveries \end{aligned}$$

Table A5. Calculation process for remaining Table A delivery target for the current month

Delivery Arc	Table A delivery target for current year (TAF/yr)	Sum of January-Previous Month Table A deliveries (TAF/yr)	Rem Table A del tar current month (TAF/yr)
D868	12.26	0	12.3
D896	33.22	0	33.2

Step 5. Divide Remaining Table A delivery target by Remaining Table A demand to calculate current month's percent delivery allocation

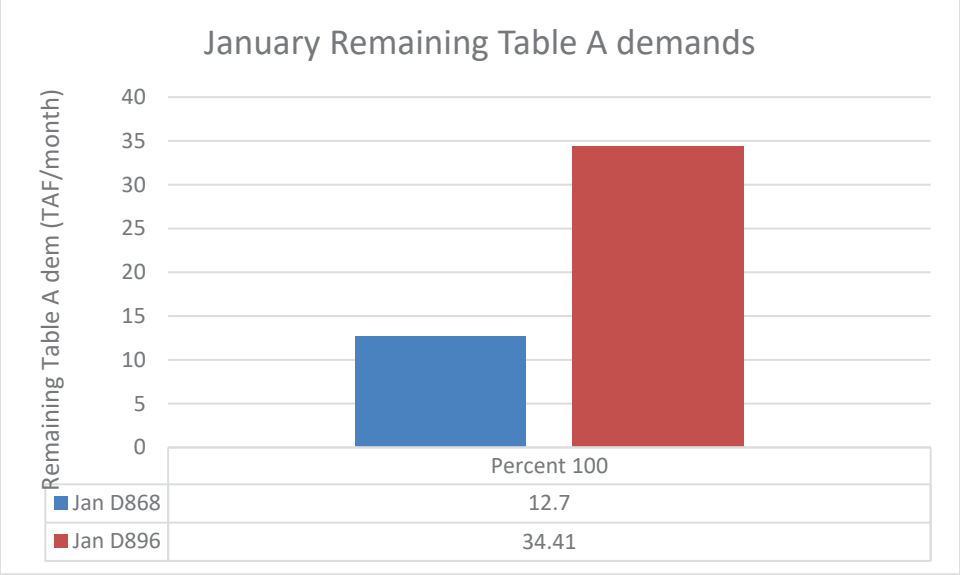
$$Current\ month\ per\ del\ alloc = \frac{Remaining\ Table\ A\ del\ tar\ (Step\ 4)}{Remaining\ Table\ A\ demand_m}$$

Where *m* is the current month, in this case, January.

Table A6. Calculation process for the current month percent delivery allocation

Delivery Arc	Remaining Table A Demand in January	Current month per del Alloc
D868	12.70	96.55%
D896	34.41	96.55%

- Remaining Table A Demand in January: found in swp_3pattern_demands.table



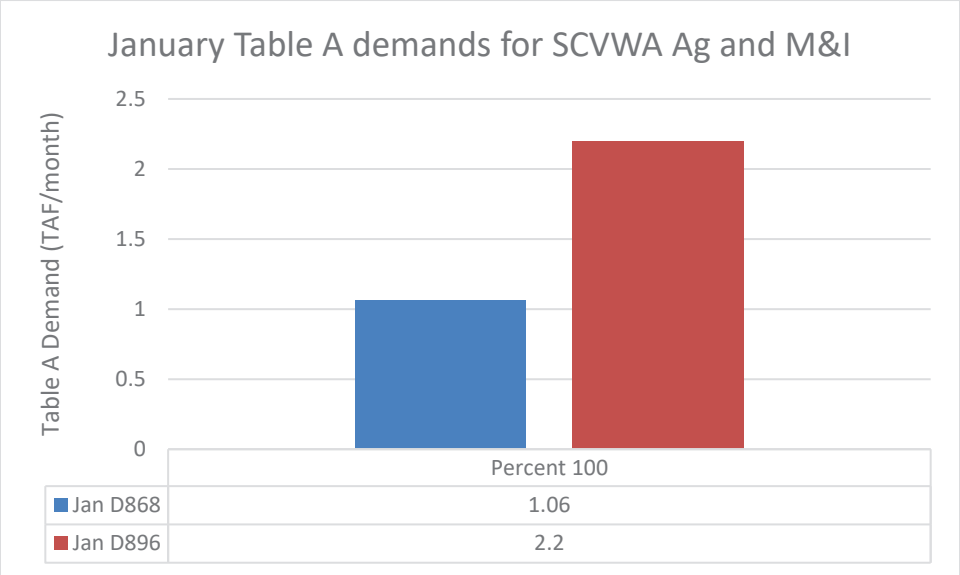
Final Table A delivery in January 1984

$$Current\ month\ Table\ A\ delivery = Current\ month\ per\ del\ alloc\ (Step\ 5) * Table\ A\ demand\ current\ month$$

Table A7. Calculation process for the current month final Table A delivery

Delivery Arc	Current month per del alloc	Table A demand current month (TAF/month)	Table A delivery (TAF/month)	Table A delivery (CFS)
D868	96.55%	1.06	1.02	16.64
D896	96.55%	2.2	2.12	34.55

- Table A demand current month: found in swp_3pattern_demands.table



Final Carryover delivery in January 1984

Table A8. Calculation process for the current month final Carryover delivery

Delivery Arc	Carryover storage at the end of previous year (TAF)	CO Fraction	CO delivery (TAF/month)	CO delivery (CFS)
D868	0	0.45	0	0
D896	48.09	0.45	21.64	351.95

It is important to note that this January 1984 carryover delivery could be made because there were 1983 requests. A contractor is not guaranteed that it will receive all its carryover requests from the previous contract year in the current year. This happens due to SWP San Luis (arc S12) meeting the following criteria:

- Hits dead pool (55 TAF)
- Reaches flood levels (1067 TAF) and Article 21 is delivered
- Has insufficient storage at the beginning of January

For more details on Article 56 logic, see the next section.

Article 56

Article 56 allows SWP Table A contractors to set aside a portion of their Table A allocated water supply in a given contract year and be carried over for delivery in the next contract year. The Article 56 mechanism gives contractors another tool for managing their water portfolios and to increase dry year water supply reliability by carrying over stored water from wetter years.

In CalSim, the Article 56 request of each contractor is dependent on the Table A allocation. All SWP Table A contractors have provided their best estimates of Article 56 requests at allocations of 100%, 60%, 50%, and 30% for input into CalSim. Table A9 provides example inputs for the Metropolitan Water District of Southern California and the Kern County Water Agency (Ag) - the two contractors that make the largest Article 56 requests. Twenty-three out of the thirty SWP contractors have input Article 56 requests greater than zero for at least one or more allocation levels. The remaining seven contractors have listed 0 TAF of Article 56 requests at all allocation levels.

Table A9. Example Article 56 Requests for Metropolitan and Kern County (Ag).

Example Article 56 Requests Given Table A Allocation				
Contractor	Table A Allocation			
	100%	60%	50%	30%
	Article 56 Request (TAF)			
MWDSC	200.00	114.78	100.00	100.00
KCWA	81.40	25.73	13.29	5.05

Modeled Table A allocations vary from 0% to 100%. Article 56 requests are made according to the following logic:

1. If the Table A allocation is less than 35%, use the 30% Article 56 request (e.g., the KCWA Article 56 request would be 5.05 TAF)
2. If the Table A allocation is greater than or equal to 35% but less than 40%, linearly interpolate between the 30% Article 56 request and the 50% Article 56 request (e.g., the KCWA Article 56 request would be 5.05 TAF at a 35% allocation, 13.29 TAF at a 40% allocation, and 9.17 TAF at a 42.5% allocation)
3. If the Table A allocation is greater than or equal to 40% but less than 55%, use the 50% Article 56 request (e.g., the KCWA Article 56 request would be 13.29 TAF)
4. If the Table A allocation is greater than or equal to 55% but less than 65%, use the 60% Article 56 request (e.g., the KCWA Article 56 request would be 25.73 TAF)
5. If the Table A allocation is greater than or equal to 65% but less than 80%, linearly interpolate between the 60% Article 56 request and the 100% Article 56 request (e.g., the KCWA Article 56 request would be 25.73 TAF at a 65% allocation, 81.40 TAF at an 80% allocation, and 52.99 TAF at a 72.5% allocation)
6. Finally, if the Table A allocation is greater than or equal to 80%, use the 100% Article 56 request (e.g. the KCWA Article 56 request would be 81.40 TAF)

Once requested, Article 56 is then carried over into the next contract year for delivery. However, requesting Article 56 carryover does have risks. If SWP San Luis fills and spills (the reservoir fills and Article 21 is delivered), undelivered Article 56 is lost at the rate Article 21 is delivered. Also, if due to operational constraints, the SWP is maintains insufficient carryover storage in San Luis to meet all SOD Article 56 requests, the measured deficit at the beginning of January is considered a loss. Remaining Article 56 after deducting losses is distributed to contractors with Article 56 requests proportional to their full Table A contract supply but not in excess of original Article 56 request. North of Delta Article 56 requests are not subject to San Luis based shortages (spills or deficits).

Let's provide a simple example assuming MWDSC and KCWA are the only contractors making an Article 56 request. MWDSC requests 114.78 TAF of carryover and KCWA requests 25.73 TAF of carryover which aligns with the 60% Article 56 request. Prior to delivery of any Article 56, 30 TAF is lost. It does not matter whether it was spilled or due to insufficient carryover; the remaining Article 56 is distributed to MWDSC and KCWA proportional to their Table A contract supply but not in excess of the initial request. MWDSC Table A contract supply is 1911.5 TAF and the KCWA Ag Table A contract supply is 848.13 TAF.

Total Article 56 request is 114.78 + 25.73 = 140.51 TAF
Total remaining request after loss = 140.51 – 30 = 110.51 TAF
Initial MWD distribution = 110.51*1911.5/(1911.5+848.13) = 76.54 TAF
Initial KCWA distribution = 110.51*848.13/(1911.5+848.13) = 33.96 TAF
However, KCWA's request was only 25.73 TAF. So KCWA gets its full request and experiences no shortage. The remainder of KCWA's initial distribution is then divided between contractors whose initial distribution fell short of their original Article 56 request proportional to Table A contract supply. In this example, only MWD is short, so the distribution of Article 56 to MWD is:
Final MWD distribution = 76.54 + (33.96 -25.73) *1911.5/1911.5 = 84.78 TAF

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Katrina Jessop, P.E., PMP
Senior Engineer
Santa Clara Valley Water District
5750 Almaden Expressway
San Jose CA 95118

Dear Ms. Jessop,

This letter is in response to your letter dated July 22, 2020 providing Santa Clara Valley Water District's (SCVWD) comments for the Draft Final 2019 Delivery Capability Report (2019 DCR). DWR's responses to your two comments on Section 5 of the Main Report are attached.

If you or your staff wish to discuss this report further, please contact me at (916) 653-9885 or Tara.Smith@water.ca.gov. For specific questions regarding the analyses used for the report, please contact Erik Reyes erik.reyes@water.ca.gov or Nazrul Islam at Nazrul.Islam@water.ca.gov.

Sincerely,

Tara Smith

Tara Smith, Chief
Modeling Support Branch

Santa Clara Valley Water District Comments and DWR Responses

DWR appreciates SCVWD for taking the time to provide their comments. The next section consists of DWR's responses to the comments received on July 22, 2020 from SCVWD.

Note: Based on DWR's Operations staff recommendations, model operations for Oroville carryover storage target have been refined. DWR also refined demand numbers and added minor code fixes. These updates result in differences in values from the Draft Final DCR 2019 shown in Table 1. For more details, please refer to the Code Change documentation included in the Excel Files folder package.

Table 1. Differences in SWP Table A (including Carryover) deliveries excluding Feather contractors and SWP Banks exports from the Draft Final and Final DCR.

Long-term Average (TAF/year)	Draft Final 2019 DCR	Final 2019 DCR	Diff	% Diff
SWP Table A Deliveries, Excluding Butte County and Yuba City	2,385	2,414	29	1.24%
Banks SWP Exports	2,478	2,521	42	1.71%

Section 5: Existing SWP Water Delivery Capability (2019), subsection Hydrologic Sequence

SCVWD comment:

1. *Subsections for Article 56 and Article 21 Water Demands indicate different time periods, [2014-2019] and [2005-2018] respectively, were used to develop the corresponding demands and demand patterns in the model. What was the basis for selecting the date ranges of historical information chosen for demand patterns? Recommendation to add a statement in main report to clarify to reader basis for varying time periods (e.g., change in reference regulations).*

DWR Response:

During the initial development of updating the Table A and Article 56 demand patterns, we thought that using data from the last 5-year data was enough. The 2014-2019 period reflected the range of initial requests during some of the driest years (2014-2015) and one of the wettest years (2017). Additionally, the application of multi-year Table A and Article 56 requests was an improvement compared to just using the 2010 Initial Requests which had been used since the 2013 Delivery Reliability Report.

Overall, there was no reason why we could not have used 2005-2018 Initial Requests data like those of used in Article 21 (2005-2018). It just so happened, at the time, that the initial dataset requested was for the last 5 years (2014-2019). These years encompassed the driest and wettest years in California and were deemed appropriate in updating the Table A and Article 56 demands.

SCVWD comment:

2. *Subsection SWP Article 21 Water Demands, second paragraph, 4th sentence: Revise sentence to reflect current model simulation period of 1922 – 2003.*

DWR Response:
The sentence was revised to reflect current model simulation period of 1922-2003.