Section V: Water Accounting and Water Supply Reliability

A. Quantifying the Water Supplier's Water Supplies

1. Agricultural Water Supplier Water Quantities

Table 46.1-46.5 illustrates the District's water. The District routinely transfers and/or exchanges water to and from various entities as part of its normal operations.

Table 46.1 Surface and Other Water Supplies for 2020

Source	Supply	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
CVP Class 1 Contracts	0													0
Pre-1914 Rights	0													0
SWP water contract	23,822													23,822
Other Surface Water	15743													15,743
Banked water recovery	10547													10,547
Carryover	33669													33,669
Recycled Water	0													0
Other	0													0
Total Supply														83,781
Monthly Deliveries		**438**	**3172**	**3012**	**4036**	**9922**	**15208**	**17313**	**15369**	**8940**	**5474**	**760**	**137**	**83,781**

Notes:
The District doesn't track monthly deliveries by individual water type. The Agency does.
Carryover balance is water from 2019

Table 46.2 Surface and Other Water Supplies for 2019

Source	Supply	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
CVP Class 1 Contracts	0													0
Pre-1914 Rights	0													0
SWP water contract	89,333													89,333
Other Surface Water	2,728													2,728
Banked water recovery	19,704													19,704
Carryover	17,078													17,078
Recycled Water	0													0
Other	0													0
Total Supply														89,435
Monthly Deliveries		**624**	**2804**	**2395**	**6108**	**10213**	**15851**	**17997**	**16190**	**9473**	**6731**	**942**	**107**	**89,435**

Table 46.3 Surface and Other Water Supplies for 2018														
Source	Supply	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
CVP Class 1 Contracts	0													0
Pre-1914 Rights	0													0
SWP water contract	41,689													41,689
Other Surface Water	27550													27550
Banked water recovery	6333													6333
Carryover	10351													10351
Recycled Water	0													0
Other	0													0
Total Supply														85,923
Monthly Deliveries		**695**	**3,783**	**3,986**	**5,502**	**10,010**	**15,123**	**16,786**	**14,875**	**9,486**	**4,641**	**703**	**333**	**85,923**

Table 46.4 Surface and Other Water Supplies for 2017														
Source	**Supply**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
CVP Class 1 Contracts	0													0
Pre-1914 Rights	0													0
SWP water contract	101,244													101,244
Other Surface Water	27,467													27,080
Banked water recovery	-63546													-63546
Carryover	24457													24457
Recycled Water	0													0
Other	0													0
Total Supply	89622													89,235
Monthly Deliveries		**2396**	**3588**	**3967**	**5783**	**9636**	**15628**	**16457**	**14364**	**10062**	**5957**	**853**	**544**	**89,235**

Table 46.5 Surface and Other Water Supplies for 2016														
Source	Supply	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
CVP Class 1 Contracts	0													0
Pre-1914 Rights	0													0
SWP water contract	71,466													71,466
Other Surface Water	-12,815													-12,815
Banked water recovery	13,763													13,763
Carryover	10,544													10,544
Recycled Water	0													0
Other	0													
Total Supply														82,958
Monthly Deliveries		**534**	**1658**	**4055**	**5685**	**8922**	**14509**	**16885**	**15632**	**9490**	**4759**	**724**	**105**	**82,958**

Table 47 shows water pumped in the District. Groundwater in the District is typically brackish and unusable without being treated. The primary method of treatment for pumped groundwater in LHWD is to blend the groundwater with delivered SWP before use. The district only has groundwater pumped quantities for 2020, because it was historically so minimal (due to low water quality) that the data was not collected. With the onset of SGMA, pumped groundwater quantities will be collected annually.

Table 47. Groundwater Supplies Summary for 2020 (AF)							
Month	**Pumped by the Water Supplier**			**Pumped within Service Area by Customers**			**TOTAL**
	Basin 1	**Basin 2**	**Basin 3**	**Basin 1**	**Basin 2**	**Basin 3**	
TOTAL	0	0	0	Unknown	Unknown	Unknown	8160

2. Other Water Sources Quantities

Effective precipitation is accounted for as a water source within the cropped irrigated area Table 48.

Table 48. Effective Precipitation Summary (AF)

Month	2020		2019		2018		2017		2016	
	Gross (in)	Effective (AF)*	Gross (in)	Effective (AF)*	Gross (in)	Effective (AF)*	Gross (in)	Effective (AF)*	Gross (in)	Effective (AF)*
January	0.15	178	1.78	2263	1.83	2327	2.09	2581	2.27	2467
February	0	0	1	2543	0.19	483	1.6	3951	0.04	87
March	1.91	4591	1.45	3687	1.55	3941	0.53	1309	0.77	1673
April	2.43	5840	0.21	534	0.08	203	0	0	0.81	1760
May	0.01	24	0.71	1805	0.02	51	0	0	0.02	43
June	0	0	0	0	0.02	51	0	0	0	0
July	0	0	0	0	0	0	0	0	0	0
August	0.04	96	0	0	0	0	0	0	0.23	500
September	0	0	0	0	0	0	0.75	1852	0	0
October	0	0	0	0	0	0	0.14	346	0	0
November	0.38	913	1.03	2619	1	2543	0.06	148	0.04	87
December	0.34	403	1.33	1691	0.29	369	0.18	222	1.16	1261
Total	5.26	12046	8	15142	5	9967	5	10409	5	7878

Note:
*Assumes an effectiveness coefficient of 50% for the months of December and January and 100% for the remaining months. Volumes in AF result from multiplying the effective precipitation depth in a given year and the irrigated acreage.

B. Quantification of Water Uses

Applied water Table 49 is approximately equivalent to agricultural water use Table 50.

Table 49. Applied Water (AF)

	2020	2019	2018	2017	2016
Applied Water (fromTable 46)	92,196	89,435	85,923	89,235	82,958

The water use for each of the different concepts is described in Table 50. The different concepts are specified in the indicated tables.

Table 50. Quantify Water Use (AF)					
Water Use	**2020**	**2019**	**2018**	**2017**	**2016**
Crop Water Use (from Table 25)					
1. Crop Evapotranspiration*	95763	92454	98976	103288	93813
2. Leaching*	5899	5777	6190	6336	7287
3. Cultural practices	0	0	0	0	0
Conveyance & Storage System					
4. Conveyance seepage	0	0	0	0	0
5. Conveyance evaporation	0	0	0	0	0
6. Conveyance operational spills	0	0	0	0	0
7. Reservoir evaporation	0	0	0	0	0
8. Reservoir seepage	0	0	0	0	0
Environmental Use (consumptive)					
9. Environmental use – wetlands (from Table 27)	0	0	0	0	0
10. Environmental use – Other (from Table 27)	0	0	0	0	0
11. Riparian vegetation (from Table 27)	0	0	0	0	0
12. Recreational use (from Table 29)	0	0	0	0	0
Municipal and Industrial					
13. Municipal (from Table 30)	30	47	40	46	42
14. Industrial (from Table 30)	1344	1385	1312	1224	1256
Outside the District					
15. Transfers or Exchanges out of the service area (not included)	0	0	0	0	0
Conjunctive Use					
16. In-District Groundwater recharge (from Table 31)*	0	0	0	0	0
Other (from Table 32)	0	0	0	0	0
Subtotal	**103,036**	**99,663**	**106,518**	**110,894**	**102,398**
Note:					
* Recharge outside District boundary is not accounted here.					

There is no water leaving the District Table 51 and no irrecoverable water losses Table 52.

Table 51. Quantify Water Leaving the District (AF)					
	2020	**2019**	**2018**	**2017**	**2016**
1. Surface drain water leaving the service area	0	0	0	0	0
2. Subsurface drain water leaving the service area	0	0	0	0	0
Subtotal	0	0	0	0	0

Table 52. Irrecoverable Water Losses (Optional) (AF)					
	2020	**2019**	**2018**	**2017**	**2016**
Flows to saline sink	0	0	0	0	0
Flows to perched water table	0	0	0	0	0
Subtotal	0	0	0	0	0

C. Overall Water Budget

Table 53 and Table 54 summarize the water supplies and the water budget in the District.

Table 53. Quantify Water Supplies (AF)					
Water Supplies	2020	2019	2018	2017	2016
1. Surface Water (summary total from Table 46)	83,781	89,435	85,923	89,235	82,958
2. Groundwater (summary total from Table 47)	8,160	0	0	0	0
3. Annual Effective Precipitation (summary total from Table 48)	12046	15142	9967	10409	7878
4. Water purchases	0	0	0	0	0
Subtotal	**106,007**	**106,596**	**97,908**	**101,661**	**92,852**

Table 54. Budget Summary (AF)					
Water Accounting	**2020**	**2019**	**2018**	**2017**	**2016**
1. Subtotal of Water Supplies (Table 53)	106,007	106,596	97,908	101,661	92,852
2. Subtotal of Water Uses (Table 50)	103,036	99,663	106,518	110,894	102,398
3. Drain Water Leaving Service Area (Table 51)	-	-	-	-	-
Excess Deep Percolation* **(Deficit Irrigation)**	2,971	6,933	-8,610	-9,233	-9,546
Note:					
*Calculated from lines 2 and 3 subtracted from line 1					

The District as a whole appears to be very efficient with its water supply. Data from Table 54 for year 2020 suggests a Total Water Use Efficiency (TWUE) for the District of approximately 117% under the assumptions used in the calculations (see 25 for details). Excess deep percolation and TWUE values vary accordingly with the year type. Crop water use estimates may be too high, particularly for pomegranates. These results are due to uncertainties in the crop coefficients (might be high) values to estimate crop evapotranspiration and the salt tolerance threshold values to estimate the leaching requirements. These results suggest that growers are performing deficit irrigation in response to a limited, unreliable, and expensive water supply. These results also collaborate mobile lab results which indicate distribution uniformities (DU) for District Water Users ranged between 85% and 95% from 2016 to 2020.

In addition, it is probable that the growers are deficit irrigating in response to multiple years of insufficient water supplies.

D. Water Supply Reliability

The water supply reliability for the District is parallel to that of the SWP and is best described by DWR in the following excerpts from "The State Water Project Final Delivery Reliability Report 2011", dated June 2012.

"The 2011 Report shows that the SWP continues to be subject to reductions in deliveries similar to those contained in the State Water Project Delivery Reliability Report 2009 (2009 Report), caused by the operational restrictions of biological opinions (BOs) issued in December 2008 and June 2009 by the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) to govern SWP and Central Valley Project operations. Federal court decisions have remanded the BOs to USFWS and NMFS for further review and analysis. We expect that the current BOs will be replaced sometime in the future. The operational rules defined in the 2008 and 2009 BOs, however, continue to be legally required and are the rules used for the analyses supporting the 2011 Report."

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 agencies contribute substantially to the challenge of accurately determining the SWP's water delivery reliability in any given year."*

Biological Opinions on Effects of Coordinated SWP and CVP Operations

"*Several fish species listed under the federal Endangered Species Act (ESA) as endangered or threatened are found in the Delta. The continued viability of populations of these species in the Delta depends in part on Delta flow levels. For this reason, the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) have issued several BOs since the 1990s on the effects of coordinated SWP/CVP operations on several species.*

These BOs affect the SWP's water delivery reliability for two reasons. Most obviously, they include terms that specifically restrict SWP pumping levels in the Delta at certain times under certain conditions. In addition, the BOs' requirements are based on physical and biological phenomena that occur daily while DWR's water supply models are based on monthly data.

The first BOs on the effects of SWP (and CVP) operations were issued in February 1993 (NMFS BO on effects of project operations on winter-run Chinook salmon) and March 1995 (USFWS BO on project effects on delta smelt and splittail). Among other things, the BOs contained requirements for Delta inflow, Delta outflow, and reduced export pumping to meet specified incidental take limits. These fish protection 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 (1995 WQCP), as described in the "Water Quality Objectives" section later in this chapter.

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

The USFWS BO includes additional requirements in all but 2 months of the year. The BO calls for "adaptively managed" (adjusted as necessary based on the results of monitoring) flow restrictions in the Delta intended to protect delta smelt at various life stages. USFWS determines the required target flow, with the reductions accomplished primarily by reducing SWP and CVP exports. Because this flow restriction is determined based on fish location and decisions by USFWS staff, predicting the flow restriction and corresponding effects on export pumping with any great certainty poses a challenge. The

USFWS BO also includes an additional salinity requirement in the Delta for September and October in wet and above-normal water years, calling for increased releases from SWP and CVP reservoirs to reduce salinity. Among other provisions included in the NMFS BO, limits on total Delta exports have been established for the months of April and May. These limits are mandated for all but extremely wet years.

The 2008 and 2009 BOs were issued shortly before and shortly after the Governor proclaimed a statewide water shortage state of emergency in February 2009, amid the threat of a third consecutive dry year. NMFS calculated that implementing its BO would reduce SWP and CVP Delta exports by a combined 5% to 7%, but DWR's initial estimates showed an impact on exports closer to 10% in average years, combined with the effects of pumping restrictions imposed by BOs to protect delta smelt and other species. The 2008 USFWS and 2009 NMFS BOs have been subject to considerable litigation. Recent decisions by U.S. District Judge Oliver Wanger changed specific operational rules for the fall/ winter of 2011–2012, and both the USFWS BO and NMFS BO have been remanded to the agencies for further review and analysis. However, the operational rules specified in the 2008 and 2009 BOs continue to be legally required and are the rules used in the analyses presented in Chapters 5, 6, and 7 of this report. Chapter 5 presents a comparison of monthly Delta exports as estimated for this 2011 Report with those estimated for the 2005 Report, illustrating how the 2008 and 2009 BOs have affected export levels from the Delta.

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

Specific restrictions on Delta exports associated with the USFWS and NMFS BOs and their effects on SWP pumping levels are described further in Chapter 5, "SWP Delta Exports," of this report."

Water Quality Objectives

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