Appendix M:
Water Supply Assessment

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SOLANO IRRIGATION DISTRICT & SUISUN-SOLANO WATER AUTHORITY

Water Supply Assessment – Logistics Center and Highway 12 Logistics Center Projects

October 2022

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	I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my knowledge and on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. Neal T. Colwell 10/3/2022 My license renewal date is 03/31/21

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Section 1

Introduction & Project Description

1.1 INTRODUCTION

The Suisun Logistics Center Project (SLC Project) and Highway 12 Logistics Center Project (Highway 12 Project) includes the annexation and pre-zoning of approximately 167 acres located southeast and approximately 472 acres southwest of the City of Suisun City limits, respectively. The SLC project is bounded on the west by Walters Road, State Route 12 on the south, and Peterson Road on the north, and open land on the east, and the Highway 12 Project is bounded on the State Route 12 to the north and Pennsylvania Avenue to the east. Both projects are located adjacent to the Suisun-Solano Water Authority (SSWA) Service Area. The City of Suisun City made a request to SSWA for preparation of a Water Supply Assessment pursuant to Water Code §10910. The Water Supply Assessment is a required component of the environmental review process under the California Environmental Quality Act. The City of Suisun City published a Notice of Preparation for preparation of a Draft Environmental Impact Report (DEIR) on January 6, 2021 for the SLC Project and May 14, 2021 for the Highway 12 Project. This assessment will provide information for the DEIR evaluating the Project's effects on water supply.

The most recently SSWA adopted 2015 Urban Water Conservation Plan did not account for the additional water demand from the proposed projects. Therefore, in accordance with Water Code §10910 (c)(3) *"… the water assessment for the project shall include a discussion with regard to whether the public water system's total projected water supplies available during normal, single dry, and multiple dry water years during a 20-year projection will meet the projected water demand associated with the proposed project, in addition to the public water system's existing and planned future uses, including agricultural and manufacturing uses."*

1.2 PROJECT DESCRIPTION

The following is a general description of the proposed projects for annexation. All development would plan to receive domestic water service from SSWA. As required by SSWA, the developer would fund construction of all new water distribution facilities required to serve the project. Water distribution pipelines and individual services would be constructed per improvement plans conforming to SSWA standards. Figure 1 shows the ultimate service area of development for SSWA. Table 1 details the proposed projects land use and net acreage.

Table 1
Land Use and Acreage for Proposed Project Developments

Proposed Project Development	Land Use	Net Acres[1]
Suisun Logistics Center	Industrial and Warehouse	120
	Natural Resource/Open Space	47
	Total	**167**
Highway 12 Logistics Center		
	Industrial and Warehouse	93
	Natural Resource/Open Space	379
	Total	**472**

1. Acreage values rounded to nearest integer. Source: City of Suisun 2022

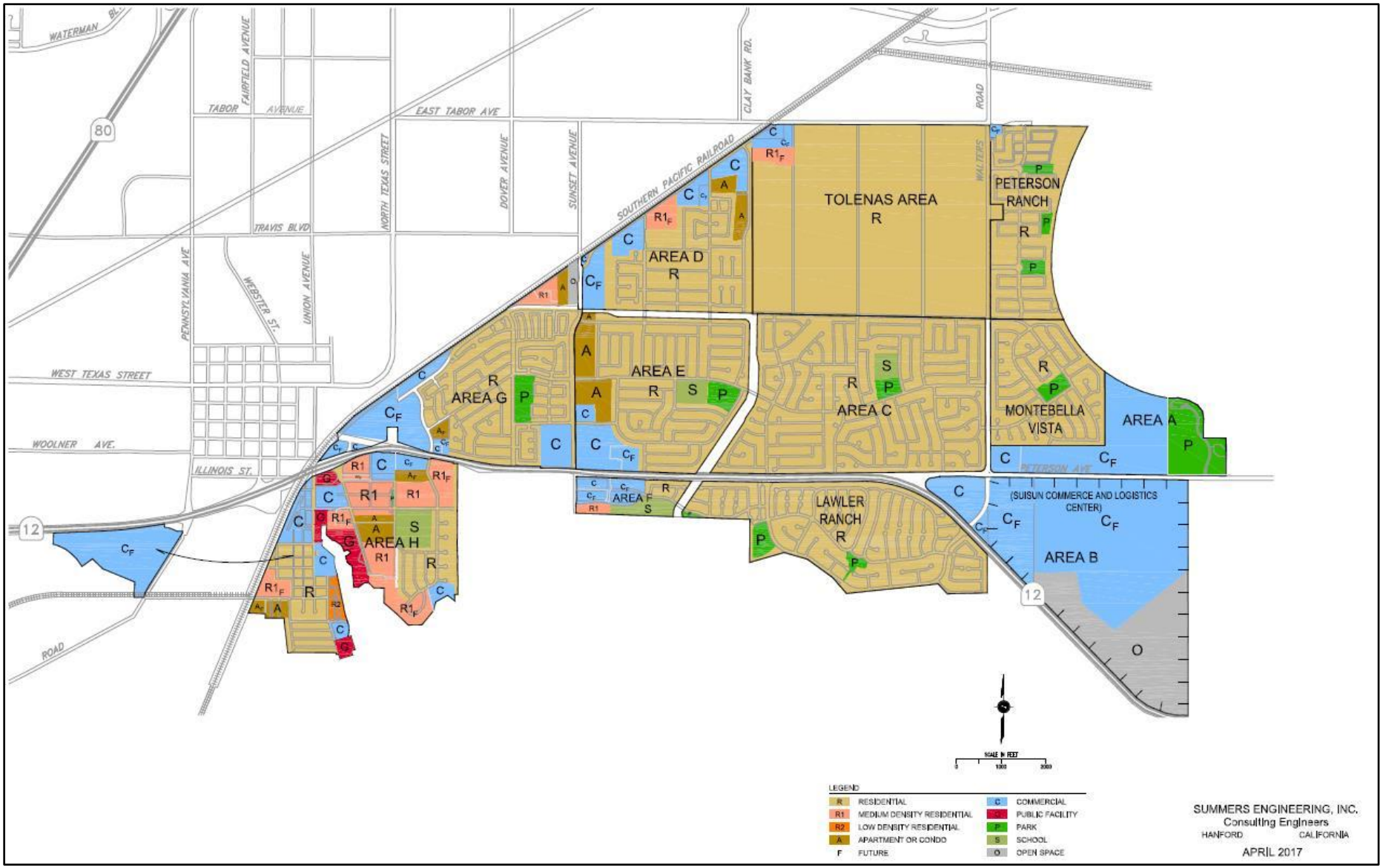

Figure 1
SSWA Ultimate Serve Area Development

1.2.1. SLC PROJECT

The proposed SLC Project is an Industrial and Warehouse and Open Space land use designation per the Suisun Logistics Center Notice of Preparation. Figure 2 shows the preliminary Planning Zones of CSF has a net acreage of 119.7 acres and a Natural Resource/Open Space of 47 acres adjacent to Highway 12 which is not planned for development. The net acreage of the project is approximately 166.7 acres with proposed project development as listed in Table 1. The Natural Resource/Open Space includes 47 acres adjacent to Highway 12 not planned for development.

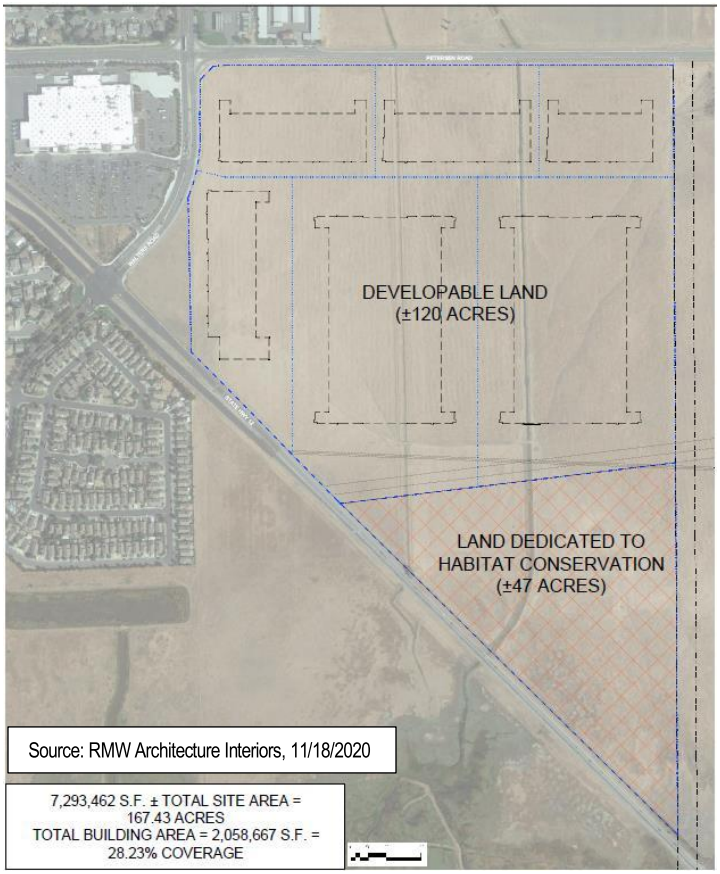

Figure 2
Suisun Logistics Center Proposed Project Site

1.2.2. HIGHWAY 12 PROJECT

The proposed Highway 12 Project is both industrial high cube warehouse space, Commercial Service and Fabricating, and Open Space land use designation per the planning application form. The preliminary Planning Zones of CSF has a net acreage of 93 acres and a Natural Resource/Open Space of 379 acres adjacent to Highway 12 which is not planned for development (Figure 3). The net acreage of the project is approximately 485 acres with proposed project development as listed in Table 1. Similar to the SLC Project, the Natural Resource/Open Space land use includes 392 acres that is not planned for development.

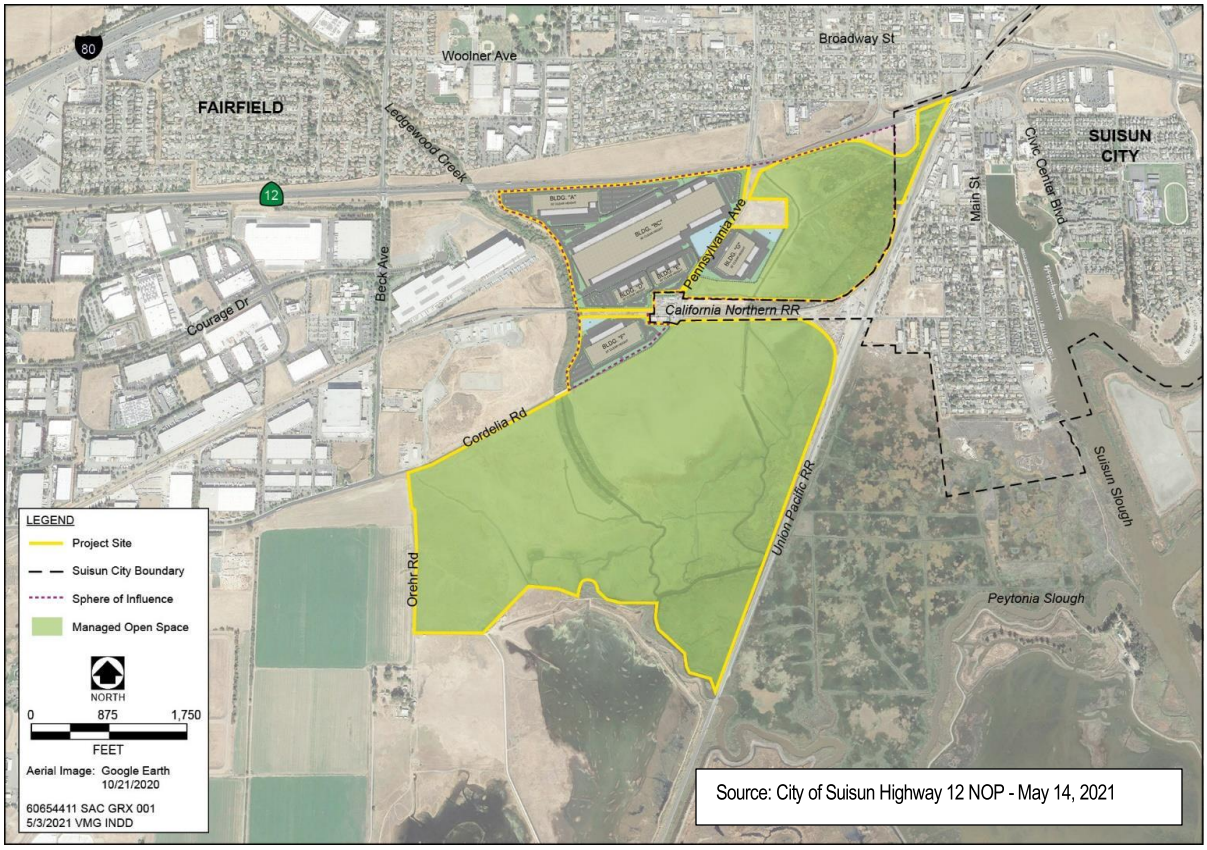

Figure 3
Highway 12 Logistics Center Proposed Project Site

Section 2

Requirements for Water Supply Assessment

The Project is subject to CEQA and is defined as a "project" per Water Code §10912(a)(2) & (3) since proposed development includes construction of warehouses and industrial manufacturing facilities with more than 500,000 square feet of floor space and employing more than 1,000 persons. Since SSWA is the water supplier providing water supplies to the area, it is required to prepare a Water Supply Assessment (WSA) in accordance with SB 610.

Section 3

Water Supply and Water Rights

SSWA is a joint powers authority between the City of Suisun City and the Solano Irrigation District under an Implementation Agreement entered into in 1990. Both the City of Suisun City and Solano Irrigation District have contracts with the Solano County Water Agency for water supplies from the federal Solano Project. The Solano County Water Agency is the contracting agency with the United States Bureau of Reclamation (USBR) for water supplies from the Solano Project. SSWA currently has a water treatment facility that receives surface water from the Solano Project, and following treatment delivers it to the service area. Table 2 summarizes the annual entitlements City of Suisun City and the Solano Irrigation District have provided to SSWA from Solano Project water supplies. The City of Suisun City also has an annual entitlement from the State Water Project's North Bay Aqueduct. Their State Water Project entitlement increased to 1,300 acre-feet per year in 2015.

At present, due to a lack of a connection to the SSWA water treatment plant, City of Suisun City is unable to directly utilize their State Water Project entitlement, in meeting their future water supplies. However, the Second Amendment to the Implementation/Lease Agreement between the City of Suisun City and Solano Irrigation District, effective August 16, 2022, provides for a path forward to implement a point of transfer for the State Water Project water transfer. Solano Irrigation District, under their Implementation Agreement with SSWA, currently delivers from its Solano Project entitlement additional water needed to provide treated water service to the SSWA service area. Table 3 summarizes the quantity of water received by SSWA under the existing water supply entitlements of City of Suisun City and Solano Irrigation District for the 2000 – 2020 period.

Table 2
Suisun-Solano Water Authority Annual Water Entitlements

Solano Project	
Agency	**Annual Entitlement (Acre Feet)**
City of Suisun City	1,600
Solano Irrigation District (Ag & M&I)	141,000

State Water Project				
Agency/Year	**Annual Entitlement (Acre Feet)[1]**			
	2010	2015	2020	2025
City of Suisun City	1,050	1,300	1,300	1,300

[1] In 2015 City of Suisun City reached its maximum Table A Entitlement

Table 3
Historic Cement Hill Water Treatment Plant Production and Delivery Summary of Solano Project Water Supplies to SSWA

Year	Total Annual Plant Production (Million Gallons)	Daily Average Production (Million Gallons)	Annual Delivery (Acre Feet)	City of Suisun City [1] (Acre Feet)	SID-Suisun [2] (Acre Feet)
2000	1,421.99	3.90	4,364	1,600	2,764
2001	1,467.08	4.02	4,503	1,600	2,903
2002	1,549.48	4.25	4,756	1,600	3,156
2003	1,555.60	4.26	4,774	1,600	3,174
2004	1,636.76	4.48	5,023	1,600	3,423
2005	1,642.54	4.50	5,041	1,600	3,441
2006	1,520.30	4.17	4,666	1,600	3,066
2007	1,537.80	4.21	4,720	1,600	3,120
2008	1,540.22	4.22	4,727	1,600	3,127
2009	1,441.89	3.95	4,425	1,600	2,825
2010	1,340.60	3.67	4,114	1,600	2,514
2011	1,300.80	3.56	3,992	1,600	2,392
2012	1,317.90	3.61	4,045	1,600	2,445
2013	1,395.40	3.82	4,283	1,600	2,683
2014	1,205.70	3.30	3,700	1,600	2,100
2015	1,058.40	2.90	3,248	1,600	1,648
2016	1,020.80	2.80	3,133	1,600	1,533
2017	1,084.97	2.97	3,330	1,600	1,730
2018	1,097.93	3.01	3,369	1,600	1,769
2019	1,113.27	3.05	3,417	1,600	1,817
2020	1,173.51	3.22	3,601	1,600	2,001

[1] Represents the water supplies delivered to SSWA by City of Suisun City under their Solano Project entitlement.
[2] Represents the water supplies delivered to SSWA by Solano Irrigation District under their Solano Project entitlement.

3.1 SERVICE AREA BOUNDARY

Figure 4 and Figure 5 show the current boundaries of SID and an overview of the SSWA service area as presented in the Draft 2020 UWMP. The Suisun Valley service area component of SSWA is to the north and east of the City of Suisun.

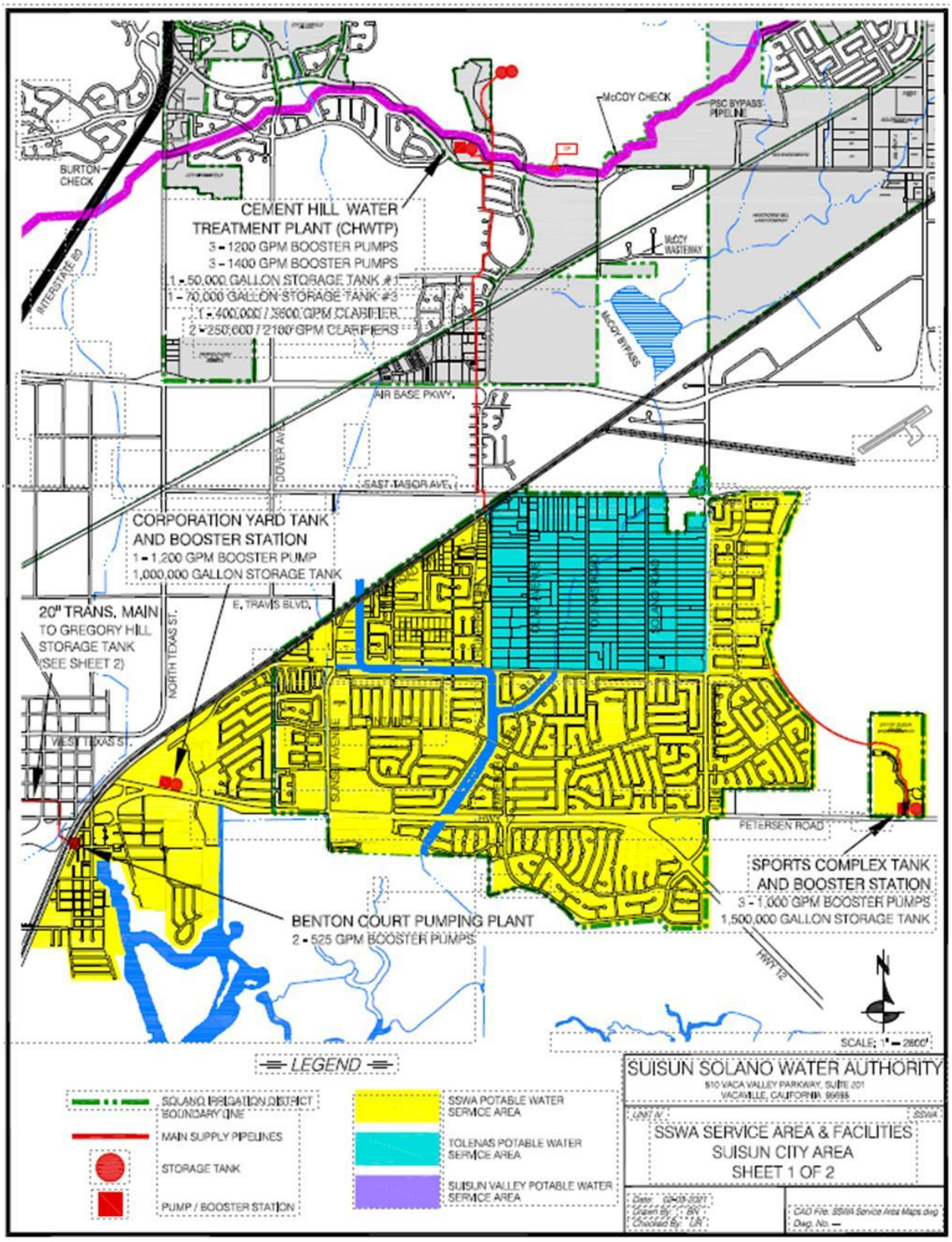

Figure 4
SSWA Current Eastern Service Area for Detailing Service Area

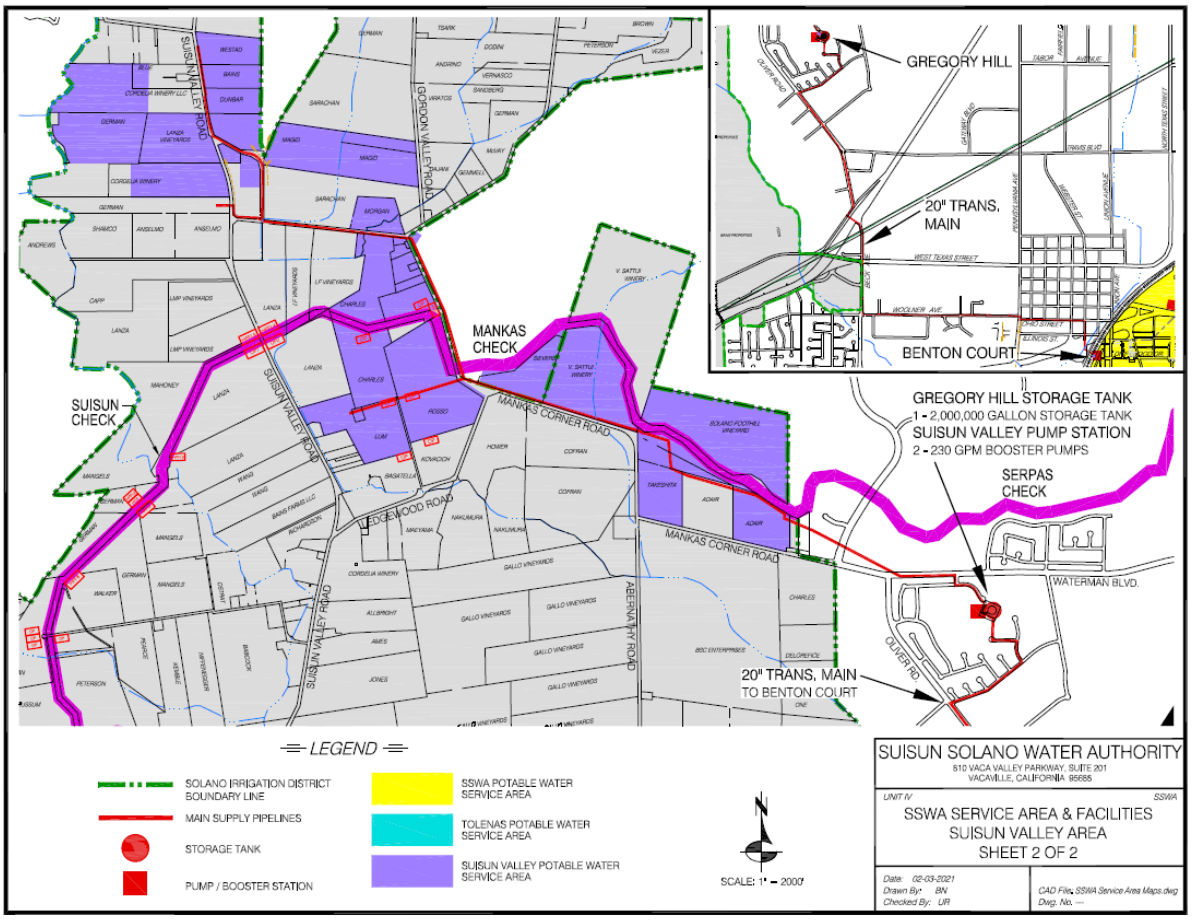

Figure 5
SSWA Suisun Valley Service Area

Section 4

Funding and Delivery of Water Supply

4.1 CAPITAL OUTLAY PROGRAM

The formation of SSWA authorized financing of any future required expansion and/or rehabilitation of water service facilities through the issuance of revenue bonds. A financial plan is in place addressing the ongoing costs for operation and maintenance of water treatment and delivery facilities. The plan establishes residential and commercial water rates and connection fees which are imposed on new development to fund the ongoing operation, maintenance, and capital costs for certain water treatment and delivery facilities. SSWA requires development projects to construct water delivery facilities needed to supply and distribute water supplies to new development. Depending on the type and size of a development, specific terms and conditions for additional needed water supply facilities may be set forth in development agreements between the developers and City of Suisun City on behalf of SSWA.

4.2 PERMITS FOR CONSTRUCTION

Water production facilities are exempt from local building and zoning ordinances per Government Code §53091 (c) and (d). (Nonetheless, SSWA obtains permits for them from City of Suisun City and Solano County for record purposes at no charge.)

4.3 REQUIRED REGULATROY APPROVALS FOR CONVEYANCE

One SSWA regulatory requirement for water service, as outlined in the Second Amendment to the Implementation Agreement, is that "new land is to be "…annexed into the Joint Service Area before water can be made available." Since SSWA supplies water in accordance with the Water Code, no further regulatory approvals are required for service within the service area. However, this does not include construction of conveyance facilities located outside the City limits for new raw water capacity.

Section 5

SSWA Demand Analysis

Water Code §10910 (c) (3) requires an analysis of the projected water demand of the Project. In December 2012 a report was prepared for SWWA titled *Water System Design Review*. This report provided a 2012 update to the anticipated ultimate growth and development of the service area and a revised estimate for the ultimate maximum day water demand. A hydraulic model for the distribution system was updated and a system operations review performed to confirm the existing water distribution system and pipelines could adequately meet the maximum day water requirements. The estimated Ultimate Water Demand at Buildout, from the above report with the addition of water demands for the new proposed City of Suisun City Commerce and Logistics Center project and a few development changes within the SSWA service area have modified the water demand. Another factor affecting the demand analysis is the severe California drought ending in 2017 which caused the Governor and State Water Resources Control Board (the Agency formed in 1967 by the Legislature with a goal to balance, where possible, all uses of California's water resources - agricultural, municipal, industrial and environmental) to recognize and encourage all Californians to practice and implement water use efficiency to sustain the long term availability of water supplies in California.

Reductions have occurred in SSWA water use, as evident in Table 3 summarizing the last 20 years of water use. A review of the recent and improved SSWA water use efficiencies, and the changing household population densities both in homes and apartments (the US Census Bureau in 2010 listed the City of Suisun City household density at 3.15 persons/household, increased in 2015 to 3.28 persons/household, and decrease in 2020 to 3.16 persons/household), together with younger age groups living in apartments versus owning their own homes, and with the understanding future SSWA requirements will require reduced water use, it was decided the water use factors utilized in the 2012 report should be reviewed and revised as appropriate and a new estimate for Ultimate Water Demand at Buildout of City of Suisun City developed.

With the March 2015 development of Super Wal-Mart, a large commercial development in City of Suisun City, its water use was reviewed since start up to determine and then revise the water use factor for all commercial developments. Reviewing water use over the five prior drought years based on the estimated population and the water supplies treated, delivered, and used in SSWA, new reasonable estimates for water use factors for residential homes and apartments and the new proposed development project were developed. For the new proposed project development, a future Ultimate Water Demand at Buildout for SSWA is required to make sure SSWA has the ability to provide the needed annual water supplies in the future.

Appendix A provides an updated *Estimated Ultimate Water Demand at Buildout* for SSWA. Appendix A notes demand associated with the areas demarcated in the Ultimate Service Area Development map for SSWA's primary Service Area, Figure 1 . SSWA also serves a small rural service area in upper Suisun Valley which is shown in Figure 5 . Figure 1 indicates the current and proposed residential and commercial development "Areas" within SSWA. The different "Areas" are labeled "A" through "G" or the common name of prior development projects specific within SSWA. This development information was used to develop the peak estimated SSWA water demand. The proposed SLC Project development is shown as future in "Area B" east of Walters Road, south of

Peterson Road, and north of Highway 12 and the proposed Highway 12 Project is shown as a future in Area H south of Highway 12 on the westernmost side of the SSWA service area shown in Figure 1.

Section 6

Projected Development Rates, Water Demand and Available Supplies

Development within the City of Suisun City continues and includes new construction. Population growth within the City of Suisun City is summarized in Table 4. Estimated ultimate buildout of the existing and proposed expansion to the City of Suisun City and SSWA service area was projected to be completed beyond 2045 based on projections detailed in Table 4. Table 4 incorporates the 2020 US Census data person per household rate of 3.16 and assumes linear population growth until year 2045. Estimated ultimate buildout is considered for the water demand projections included in Appendix A.

Table 4
Existing and Projected Population Growth within the City of Suisun City

Year	Population	Estimated Households
2010	28,111[1]	8,924[2]
2015	29,492[3]	8,991[3]
2020	29,518[4]	9,293[4]
2025	30,447[5]	9,635[5]
2030	31,151[5]	9,858[5]
2035	31,854[5]	10,080[5]
2040	32,558[5]	10,303[5]
2045	33,261[5]	10,526[5]
Est'd Ultimate Buildout	34,052	10,931

[1] 2010 U.S Census Data, City of Suisun City

[2] Calculated from persons per household rate (2010 Census) of 3.15.

[3] 2015 U.S. Census Data with estimated person per household rate of 3.28.

[4] 2020 U.S. Census Data with estimated person per household rate of 3.16 (2016-2020).

[5] Assumes linear population growth and estimated No. of households from 2020-2045.

The population density factors listed in Appendix A, estimate the ultimate City of Suisun City population at 34,052 persons. This estimated population is greater than the estimated 2015 Suisun-Solano Water Authority Urban Water Management Plan 2040 projected population at 33,722 or the 2020 Draft Suisun-Solano Water Authority Urban Water Management Plan 2045 projected population of 33,200. As stated, the U.S. Census data provided an estimate of 3.28 persons per household in 2015 for the City of Suisun City. Fluctuating population density between 2015 and 2020 in the City of Suisun City is the basis of using estimated ultimate buildout population in Appendix A. Table 4 summarizes the current and projected City of Suisun City population growth with buildout population estimated to occur after the year 2045.

Therefore, if the proposed SLC project and Highway 12 project are completed, along with the remaining future developable housing and commercial/industrial projects within the City of Suisun City service area to buildout beyond 20 years, the estimated annual water supplies SSWA needed to meet the projected water demand are approximately 4,685 acre feet, as summarized Appendix A,. Water supply necessary for the SLC and Highway 12 proposed projects that are currently located outside the existing SID boundary is approximately 240 acre feet.

Section 7

Water Supply Reliability

In accordance with Water Code §10910 (c)(3) *"… the water assessment for the project shall include a discussion with regard to whether the public water system's total projected water supplies available during normal, single dry, and multiple dry water years during a 20-year projection will meet the projected water demand associated with the proposed project, in addition to the public water system's existing and planned future uses, including agricultural and manufacturing uses."*

7.1 SOLANO COUNTY WATER AGENCY

In 1955, the Solano County Flood Control and Water Conservation District, now the Solano County Water Agency (SCWA), entered into a contract with the United States of America acting through the U.S. Bureau of Reclamation for a water supply from the Solano Project. The Solano Project is SID's primary water supply and this supply is based on Water Rights originally filed with the State Water Resources Control Board at the time of the project. The Solano Project facilities, Monticello Dam, Lake Berryessa, the Putah Diversion Dam and the Putah South Canal throughout their 56 year operational history have provided a reliable water supply to its water users. The watershed includes 576 square miles above Monticello Dam, and the Lake Berryessa reservoir provides a storage capacity of 1,602,000 acre-feet. Flow measurements have been kept on Putah Creek since 1906. The average annual inflow is estimated at 360,000 acre-feet. The inflow over the period of record has varied from a maximum of 1,140,000 acre-feet in 1983 to a minimum of 26,100 acre-feet in 1976-77. The Lake Berryessa storage capacity allows Solano Project water users the ability to store and carryover 440% of the project's average annual yield. A primary reason for construction of the large reservoir was to increase the annual safe yield. With a 1,602,000 acre-foot reservoir, a pre-project operation study estimated the safe annual yield at 262,000 acre-feet. The annual contractual entitlements of Solano Project water users are 207,350 acre-feet. The remaining inflow covers the reservoir evaporation losses and downstream flow requirements.

7.2 STATE WATER PROJECT (SWP) RELIABILITY AND SOLANO PROJECT RELIABILTY

In April 2016 Kennedy/Jenks Consultants prepared for SCWA a Technical Memorandum providing technical support for Solano County Participating Agencies to address water supply reliability for their 2015 Urban Water Management Plans. Attached in Appendix B is a copy of the Technical Memorandum. Table 3c in this report summarizes the SWP Supply Reliability for the City of Suisun City, and Table 5 lists the Solano Project Supply Reliability for both the City of Suisun and Solano Irrigation District water supplies. These are summarized below.

7.2.1. STATE WATER PROJECT RELIABILITY

Suisun City has a right to a maximum of 1,300 acre feet per year of the SWP's Maximum North Bay Aqueduct Table A supplies (47,567 Acre Feet per year). Therefore, The City of Suisun City has a proportionate right or allocation of 2.722% (1,300 Solano Project Reliability AF/47,567 AF) of the total available North Bay Aqueduct supplies each year. Table 3c lists the following water supply reliability for:

- **Average Water Year plus North Delta Allocation (NDA)**
  (based on average SWP deliveries over the historic hydrologic period of 1922-2003.)
  = 73% Table A & 10% NDA = 1,044AF (for period 2020 – 2050)

- **Single Dry Year plus NDA**
  (based on repeat of historic single dry year 1977.)
  = 22% Table A & 0% NDA = 282 AF (for period 2020 – 2050)

- **Multi-Dry Year plus NDA**
  (Annual averages based on a repeat of historic four year dry period 1931-34.)
  = 24% Table A & 3% NDA = 323AF (for period 2020 – 2050)

The above bullets summarize the City of Suisun City water supply reliability for SWP North Bay Aqueduct supplies. This is based on the DWR analyses presented in its "2015 State Water Project Delivery Capability Report (2015 DCR)". However, the worst case actual SWP allocation for the City of Suisun City occurred in 2014 when they would only have received a 5% Table A allocation (65 AF). The extremely dry period from the beginning of January 2013 through the end of 2014 was one of the driest two-year periods in the historic record.

7.2.2. SOLANO PROJECT RELIABILITY

City of Suisun City has a right to a maximum of 1,600 acre feet of Solano Project Water Supplies, and Solano Irrigation District to a right of 141,000 acre feet. The maximum Solano Project Allocation is 207,350 acre feet. With the large storage capacity in Lake Berryessa, the impacts of a single or four year drought reduction can be minimized. Table 5 in the Technical Memorandum summarizes Solano Project Reliability as follows:

- **Single Dry Year -** (Based on the average percent allocation (including canal losses) during Single Dry Years over the study's historic hydrologic period of 1906 through 2007, rounded to the nearest whole percent, the project supply reliability between 2015 through 2050 would be 98%.)

  City of Suisun City = 1,568 AF and Solano Irrigation District = 138,100 AF

- **Multi-Dry Year -** (Based on the average percent allocation (including canal losses) over four consecutive dry years, and assuming a repeat of the historic four-year dry period with low inflow to Lake Berryessa of 1990-1994, rounded to the nearest whole percent, the project supply reliability would be 89%.)

  City of Suisun City = 1,424 AF and Solano Irrigation District = 125,490 AF

Since construction of the Solano Project, the 1987 –1992 California Drought has had the greatest impact on Solano Project water supplies. The cumulative Putah Creek runoff into Lake Berryessa during the six year 1987-92 period was approximately 800,000 acre feet. However, due to the large storage capacity in Lake Berryessa, mandatory curtailments in contractual entitlements did not begin until 1992, the sixth year of the drought. Table 3, summarizing the historic water deliveries to SSWA does not show the City of Suisun City water entitlement was reduced over the last 17 years but it was reduced in 1992, with a 21.5% reduction. The SID-Suisun water supplies are provided to SSWA from the Solano Irrigation District contractual entitlement and are delivered to SSWA under

their Implementation Agreement. During SSWA's nearly 40 year history, Solano Irrigation District has been able to provide additional supplies when needed during periods of drought.

The historic deliveries that occurred during the 1987-92 drought show although there were reductions in the available Solano Project supplies, the SSWA Implementation Agreement allowed the City of Suisun City and Solano Irrigation District to work together to meet SSWA water requirements. A factor which may affect this ability is summarized in the following section. The future projected SSWA water demand, listed in Appendix A, is now estimated at 4,685 acre-feet per year.

7.3 SOLANO IRRIGATION DISTRICT WATER SUPPLY AVAILABILITY AND PROJECTED WATER DEMANDS

SID has an allocated surface water supply from the Solano Project for 141,000 acre feet per year. With the addition of groundwater supplies SID has available an average annual water supply of approximately 146,000 acre feet.

The Solano Irrigation District's primary water demand is the agricultural water needed to produce the crops grown within the SID service area. In addition to this demand SID also provides municipal and industrial (M&I) and non-potable water supplies to some rural developments within its service area. With land use changes and increased urbanization occurring, M&I water demand within Solano County has increased over the years for nearby urban areas. When water supplies were available, SID has entered into agreements with cities (Benicia, Fairfield, Suisun, and Vacaville) to augment the cities' respective water supplies. The agreements provide for water transfers from SID to said cities. Depending upon the agreement, water may be held in trust for the city and available upon demand, or on an entitlement basis. If on an entitlement basis, the city is able to utilize said entitlement water as carryover storage if it is not used in the year allotted.

SID engaged a consultant reevaluate its water supply and water demands. In June 2015, Davids Engineering, Inc. submitted to SID a report titled "Water Supply Shortage Risk Assessment" for abbreviation WSSRA will be used (See Appendix C). The Executive Summary for the WSSRA summarizes its purpose as follows:

> *Prompted primarily by obvious, rapidly changing cropping patterns and irrigation practices in its service area, particularly the rapid expansion of almonds and walnuts, Solano Irrigation District initiated a 2-phase analysis to assess the adequacy of its water supplies. The initial phase was simply to quantify historical agricultural water demands. The second phase involved development of a district water balance as a means of characterizing on-farm and SID distribution system efficiencies, developing projections of future agricultural water demands, and comparing SID's available water supplies to the sum of SID's projected future agricultural water demands and urban water supply obligations. The period of analysis is 2015 through 2059.*

The SID administrative staff indicate this report provided the basis for SID establishing a future water allocation policy in 2016 (Policy 8200). The WSSRA mentions there is difficulty in projecting future agricultural water demands with certainty because those demands depend on a variety of assumptions and factors which are difficult to reliably predict. This uncertainty was addressed by preparing future water demand scenarios for several different scenarios which represent "… a unique combination of possible future policy, behavioral and

climatological conditions. … The scenarios were developed according to assumptions made to describe possible future SID cropping patterns, on-farm and SID distribution system efficiencies, permanent crop water use intensity, climate change and urban water supply obligations."

The essence of this analysis is that under all future water demand scenarios, SID's agricultural and urban water demand was shown to exceed its Solano Project entitlement with shortages ranging from 7,000 AF to 27,000 AF per year. Concern is also impacted by the reality SID has future water supply contract commitments to urban areas in Solano County scheduled to increase from 18,976 to 34,929 AF in 2024. Of particular note are some of the conclusions and recommendations in the last section of the report which state, "Under the most challenging future conditions when urban supply obligations increase, SID agricultural customers are forecast to experience water supply shortages 96 percent of the time, with maximum shortages of up to 60,000 AF, or 28 percent of total demand (agricultural and urban), in any given year.", and the final recommendation which states, "SID should not increase its urban water supply obligations without first defining a regime of sustainable conjunctive water management. The outcome of this effort could be that SID cannot assign more water to urban entities without unacceptably jeopardizing the reliability of its agricultural water supplies, or that provisions should be incorporated into urban water supply agreements that give priority to agricultural water supply under certain conditions."

The review of projected agricultural water demands needs to consider ongoing improvements which have been occurring within SID to further improve water delivery efficiency. Water management improvements continue to be reviewed and implemented to further improve water efficiency in the SID distribution system, and the reduction of water delivery losses and operational spills of landowners. All of these factors affect the required quantity of SID water deliveries. SID continues to have a rehabilitation and betterment program which annually improves facilities and infrastructure to reduce losses. This includes installing concrete lining in canals not originally lined to reduce seepage losses, installation of automatic control gates, and Supervisory Control and Data Acquisition (SCADA) systems to better monitor operational spills and reduce unnecessary water supply losses. All potential, cost effective control measures to further reduce water losses and improve the efficiency of surface water deliveries are investigated.

Section 8

Solano Project Water Shortage Allocation

Water management planning is still needed to help mitigate drought water supply impacts. Solano Project water users entered into a Drought Measures and Water Allocation Agreement in 1999 which provides a phased response and planning process to address future drought situations. The agreement calls for mandatory curtailment of Solano Project water use when drought conditions on December 1 reduce storage in Lake Berryessa below 800,000 acre-feet. When this occurs all parties are to begin developing drought contingency plans with specific water conservation measures to further reduce demand. When April 1 storage is between 550,000 and 800,000 acre-feet, each party agrees to reduce their delivery by at least 5% of their annual entitlement, and the curtailed water is carried over in Solano Project storage for use in future dry years. When April 1 storage drops below 400,000 acre-feet, the Agreement provides that Solano Irrigation District will begin implementing a voluntary agricultural water marketing program for growers willing to sell their water allocations to cities for M&I use the following March. A copy of the Drought Measures and Water Allocation Agreement is included in Appendix D.

Section 9

Summary SSWA Water Demand and Supply

In accordance with the Implementation Agreement, dated January 1, 1990, the City of Suisun City Solano Project water supplies are to be first used within the City Service Area, Area G and Area H of Figure 1, with remaining supplies used within the Joint Service Area. Demands within the Joint Service not met by the City's Solano Project supplies are backfilled by Solano Irrigation District. A summary of ultimate SSWA water demands based on Appendix A and the available water supplies are listed in Table 5 below. The ultimate water demand in the area outside the City of Suisun City, SID boundary and the proposed SLC and Highway 12 Projects is currently estimated at approximately 115 acre feet. The Outside Areas presented in Table 5 are excluded from total demand. The 240 acre feet estimated for the proposed SLC and Highway 12 Projects is made available to the proposed development by SID through the Second Amendment to the Suisun/Solano Implementation Agreement and Lease Agreement (Appendix E).

Table 5
Summary of Water Supply and Demand by Service Areas

Service Areas	Demand (AF)	Supply the City of Suisun City (AF)	Supply by SID (AF)
Current City Service Area	1,385	1,600	
Current Joint Service Area	2,935	(1,600 - 1,385) = 215	2,720
Proposed SLC and Hwy 12	240		240[a]
Outside Areas[b]	115		
Total	4,560		
Tolenas	105		105
Suisun Valley	20		20
SSWA Total	4,685	1,600	3,085

a. 240 AFY has been made available to the proposed development by SID through the Second Amendment to the Suisun/Solano Implementation Agreement and Lease Agreement.
b. Estimated values for ultimate water demand (excluded proposed SLC and Hwy12 Projests) in the area outside the City of Suisun City and the SID boundary. Area A.3 and Area B.2 in Appendix A. Excluded from total.

Section 10

Steps Required to Develop Reliable Source of Water for SSWA

Prior delivery of water supplies for SSWA, listed in Table 3, were provided from City of Suisun and SID Solano Project water supplies. Future delivery of water supplies will likely continue to be provided from Solano Project water supplies, and some exchange or transfer agreements for the use of City of Suisun State Water Project North Bay Aqueduct supplies. Per Appendix A the ultimate buildout water demand for SSWA is estimated to be approximately 4,685 acre-feet per year. As specified, the City of Suisun City has a right in a normal year to a supply of 1,600 acre-feet of Solano Project water supplies, and SID has provided in the past 20 years up to a maximum of 3,441 acre-feet of their Solano Project water supplies to meet the demand.

The current available water supplies, with expectation of increased SID irrigation demands, together with the severe multiple year (2012-2016) drought, and uncertainty regarding reliability of NBA water supplies during severe droughts, highlighted a need to review and evaluate SSWA water supply options. As cited, a requirement of a Water Supply Assessment (Water Code §10910 (c)(3)) is *"… the water assessment for the project shall include a discussion with regard to whether the public water systems total projected water supplies available during normal, single dry, and multiple dry water yeas during a 20-year projection will meet the projected water demand associated with the proposed project, in addition to the public water system's existing and planned future uses, including agricultural and manufacturing uses."*

Since preparation of the SID Water Supply Shortage Risk Assessment report, SID was not able to confirm it would have surplus water available to meet a water supply for lands located outside its boundaries in a 2017 Water Supply Assessment; however, the demand resulting from the proposed SLC and Highway 12 Projects, 240 AF, have now been made available through the Second Amendment to the Suisun/Solano Implementation Agreement and Lease Agreement

Section 11

Regulatory Agency Approvals Necessary for Projects to Move Forward

- **SSWA**
    - Issuance of a will serve letter confirming water supplies will be available to serve project development over next 20 years.
- **City of Suisun City**
    - Lead Agency for EIR
    - Implement Second Amendment of the Implementation/Lease Agreement
- **Solano Irrigation District**
    - Implement Second Amendment of the Implementation/Lease Agreement
- **Local Agency Formation Committee**
    - Annexation of development property to City of Suisun City and SID

Section 12

References

1. United States Department of the Interior, Water and Power Resources Service (USBR), Project Data, 1981.

2. Suisun-Solano Water Authority, Implementation Agreement and Lease Agreement, January 1, 1990.

3. Solano Project Members' *Agreement as To Drought Measures And Water Allocation*, January 25, 1999.

4. Summers Engineering, Inc., *Suisun-Solano Water Authority, Water System Design Review*, December 2012.

5. Davids Engineering, Inc., Solano Irrigation District – Water Supply Shortage Risk Assessment, June 2015.

6. Kennedy/Jenks Consultants, *Technical Memorandum – Water Supply Reliability*, April 14, 2016.

7. City of Suisun, *Notice of Preparation - Draft Environmental Impact Report for the Suisun Commerce and Logistics Center Project*, July 15, 2016.

8. Maddaus Water Management, Inc. *Suisun-Solano Water Authority – Urban Water Management Plan*, August 8, 2016.

9. Maddaus Water Management, Inc. *DARFT Suisun-Solano Water Authority – Urban Water Management Plan*, June 30, 2021.

APPENDICES

Appendix A

ESTIMATED ULTIMATE WATER DEMAND AT BUILDOUT

Appendix A

SUISUN - SOLANO WATER AUTHORITY

Estimated Ultimate Water Demand At Buildout

RESIDENTIAL			**SCHOOL & PUBLIC FACILITIES USAGE**		
Low Density (LD) Units/Acre		5.5 units/acre	AAWC	1.1	gpm/acre
Medium Density (MD) Units/Acre		10.5 units/acre	**PARK & SPORT COMPLEX USAGE**		
Multi-Family (MF) Units/Acre		15 units/acre	AAWC	1.3	gpm/acre
Persons/Unit		3.28 persons/unit	**COMMERCIAL USAGE**		
Annual Aver. Water Consumption (AAWC)		100 gpcd	AAWC	0.85	gpm/acre
APARTMENT USAGE	AAWC	70 gpcd	**WAREHOUSE**		
High Density (HD) Units/Acre		22 units/acre	AAWC	0.7	gpm/acre
Res Units in Cf on 2nd floor or higher		2.0 persons/unit	**MANUFACTURING & HEAVY COMMERCIAL**		
Res Units in Cf on 2nd floor or higher	AAWC	55 gpcd	AAWC	1	gpm/acre
TOLENAS AREA USAGE	AAWC	140 gpcd			
SUISUN VALLEY AREA USAGE	AAWC	190 gpcd			

				ANNUAL AVERAGE	**MAXIMUM MONTH**	**MAXIMUM DAY**	**MAXIMUM HOUR**
				Factor 1	1.58	1.92	3.4
Area Name or Number	ACREAGE (acres)	UNITS (lots)	POPULATION	ANNUAL AVERAGE (gpm)	MAXIMUM MONTH (gpm)	MAXIMUM DAY (gpm)	MAXIMUM HOUR (gpm)
Montebella Vista							
1 Existing Residential		685	2,247	156.0	246.5	299.6	530.5
2 Existing Park	5.87			7.6	12.1	14.7	25.9
Area A - East and South of Montebella Vista							
1 Existing Commercial	9.2			7.8	12.4	15.0	26.6
2 Existing Sports Complex	40			52.0	82.2	99.8	176.8
3 Future Commercial (Outside Serivice Area)	81.9			69.6	110.0	133.7	236.7
Area B - South of Peterson Road and North of Hwy 12							
1 Super Walmart - West Side Walters Rd	20.8			17.7	27.9	33.9	60.1
2 Future Commercial (Outside Service Area)	3.08			2.6	4.1	5.0	8.9
3 Suisun Commerce & Logistics Ctr - Future							
a. Warehouse	**120**			84.0	132.7	161.3	285.6
b. Open/Natural Area	**47**						
Lawler Ranch							
1 Existing Residential		1199	3,933	273.1	431.5	524.4	928.6
2 Existing Park	14			18.2	28.8	34.9	61.9
Peterson Ranch							
1 Existing Residential		640	2,099	145.8	230.3	279.9	495.6
2 Existing Park	10.5			13.7	21.6	26.2	46.4
3 Existing Commercial	1.3			1.1	1.7	2.1	3.8
NW Tolenas Area							
1 Existing Commercial	3.9			3.3	5.2	6.4	11.3
2 Future Residential		80	262	18.2	28.7	34.9	61.9
3 Future Commercial	4.5			3.8	6.0	7.3	13.0
Area C - South of Bella Vista Drive, West of Walters Road, East of Drainage Channel & North of Hwy 12							
1 Existing Residential		1973	6,471	449.4	710.0	862.8	1,527.9
2 Existing School	6.6			7.3	11.5	13.9	24.7
3 Existing Park	5			6.5	10.3	12.5	22.1
Area D - North of Bella Vista Drive Alignment, South of Southern Pacific Railroad & West of Storm Drain Channel near Humphrey Drive							
1 Existing Residential		576	1,889	131.2	207.3	251.9	446.0
2 Existing Apartments		153	502	24.4	38.6	46.9	83.0
3 Existing Commercial	28.5			24.2	38.3	46.5	82.4
4 Future Residential (MD)	9.5	100	328	22.8	36.0	43.7	77.4
5 Future Commercial	14			11.9	18.8	22.8	40.5
Area E - South of Bella Vista Drive Alignment, South of Drainage Channel, North of Hwy 12 & East of Sunset Avenue							
1 Existing Residential		1085	3,559	247.2	390.5	474.5	840.3
2 Existing Apartments		475	1,558	75.7	119.7	145.4	257.5
3 Existing Commercial Area	24.8			21.1	33.3	40.5	71.7
4 Existing Suisun Elementary School	7.4			8.1	12.9	15.6	27.7
5 Existing Park near School	9.8			12.7	20.1	24.5	43.3
6 Future Commercial	4			3.4	5.4	6.5	11.6

RESIDENTIAL			**SCHOOL & PUBLIC FACILITIES USAGE**			
Low Density (LD) Units/Acre		5.5 units/acre	AAWC	1.1	gpm/acre	
Medium Density (MD) Units/Acre		10.5 units/acre	**PARK & SPORT COMPLEX USAGE**			
Multi-Family (MF) Units/Acre		15 units/acre	AAWC	1.3	gpm/acre	
Persons/Unit		3.28 persons/unit	**COMMERCIAL USAGE**			
Annual Aver. Water Consumption (AAWC)		100 gpcd	AAWC	0.85	gpm/acre	
APARTMENT USAGE	AAWC	70 gpcd	**WAREHOUSE**			
High Density (HD) Units/Acre		22 units/acre	AAWC	0.7	gpm/acre	
Res Units in Cf on 2nd floor or higher		2.0 persons/unit	**MANUFACTURING & HEAVY COMMERCIAL**			
Res Units in Cf on 2nd floor or higher	AAWC	55 gpcd	AAWC	1	gpm/acre	
TOLENAS AREA USAGE	AAWC	140 gpcd				
SUISUN VALLEY AREA USAGE	AAWC	190 gpcd				

				ANNUAL AVERAGE	**MAXIMUM MONTH**	**MAXIMUM DAY**	**MAXIMUM HOUR**
			Factor	1	1.58	1.92	3.4
Area Name or Number	ACREAGE (acres)	UNITS (lots)	POPULATION	ANNUAL AVERAGE (gpm)	MAXIMUM MONTH (gpm)	MAXIMUM DAY (gpm)	MAXIMUM HOUR (gpm)
Area F - South of Hwy 12, West of Drainage Channel & East of Grizzly Island Road							
1 Existing Residential		61	200	13.9	21.9	26.7	47.2
2 Existing Residential (MD)	4.3	45	148	10.3	16.2	19.7	34.9
3 Existing Commercial	6			5.1	8.1	9.8	17.3
4 Existing School	10.8			11.9	18.8	22.8	40.4
5 Future Commercial	16.2			13.8	21.8	26.4	46.8
Area G - North of Hwy 12, West of Sunset Avenue & South of Southern Pacific Railroad							
1 Existing Residential		1188.0	3897.0	270.6	427.6	519.6	920.1
2 Existing Residential (MD)		69.0	226.0	15.7	24.8	30.1	53.4
3 Existing Apartment	4.6	101.0	331.0	16.1	25.4	30.9	54.7
4 Existing Commercial	25.1			21.4	33.7	41.0	72.6
5 Existing Park	10.0			13.0	20.6	25.0	44.2
6 Future Apartments	3.2	70.0	230.0	16.0	25.2	30.7	54.3
7 Future Commercial	39.0			33.2	52.4	63.6	112.7
8 Open Space	4.1						
Area H - Old Town Suisun Area							
1 Existing Residential		509.0	1670.0	116.0	183.2	222.7	394.3
2 Existing Apartments		312.0	1023.0	49.7	78.6	95.5	169.1
3 Existing Residential (MD)		202.0	663.0	46.0	72.7	88.4	156.5
4 Existing Residential (LD)		120.0	394.0	27.4	43.2	52.5	93.0
5 Existing Commercial	55.6			47.3	74.7	90.7	160.7
6 Existing Schools & Public Facilities	31.7			34.9	55.1	67.0	118.6
6.1 New Homes on "G" Site		51.0	167.0 w		18.3	22.3	39.4
7 Existing Park	0.5			0.7	1.0	1.2	2.2
8 Future Apartments		170.0	558.0	27.1	42.9	52.1	92.2
9 Future Residential (MD)		248.0	813.0	56.5	89.2	108.4	192.0
10 Future Commercial	5.6			4.8	7.5	9.1	16.2
10.1 W/Est res units on 2nd flr or higher		442.0	884.0	61.4	97.0	117.9	208.7
11 Future Commercial (Gateway Gentry)	**93.0**			65.1	124.9	151.8	268.8
TOTAL FOR SUISUN CITY		10,554	34,052	2,898	4,619	5,613	9,940
Tolenas Area		200	656	63.8	100.8	122.5	216.8
Suisun Valley Area		26	85	11.2	17.7	21.5	38.1
TOTAL FOR SUISUN - SOLANO WATER AUTHORITY (SSWA)		10,780	34,793	2,973	4,738	5,757	10,195

ESTIMATED ANNUAL AVERAGE FLOW = 2,973 **Ave Ann gpm** = 4,795 **AF Annual Demand**

SAY REQUIRED ANNUAL DEMAND = 4795 AF

Appendix B

SOLANO PROJECT & STATE WATER PROJECT – TECHNICAL MEMORANDUM – WATER SUPPLY RELIABILITY

14 April 2016

Technical Memorandum

To: Thomas Pate, Solano County Water Agency

From: Jennifer Lau, Kennedy/Jenks Consultants

CC: Sachi Itagaki and Mary Lou Cotton, Kennedy/Jenks Consultants

Subject: SCWA Water Supply Reliability
K/J 1568025*00

Introduction

This Technical Memorandum is part of Task 3A of the Solano County Water Agency (SCWA) Strategic Plan Update to provide technical support for the SCWA Participating Agencies to address water supply reliability for their 2015 Urban Water Management Plans. This Technical Memorandum provides:

- A review of 2015 California Department of Water Resources (DWR) State Water Project (SWP) Delivery Capability Report (DCR) for applicable delivery reliability assumptions, particularly for SCWA.

- A review and summary of Solano Project Reliability.

SCWA supplies untreated water from the Solano Project and the State Water Project for agriculture, and municipal and industrial uses. SCWA Participating Agencies that are also urban water suppliers include:

- City of Benicia
- City of Dixon
- City of Fairfield
- City of Rio Vista
- Suisun City
- City of Vacaville
- City of Vallejo

State Water Project Supply

SCWA has a long-term water master water supply contract with DWR for water supply from the State Water Project that currently expires in 2035 but is renewable. SCWA is a North of Delta SWP Contractor and receives SWP water via the North Bay Aqueduct, which is owned and operated by DWR to deliver wholesale water supply for municipal and industrial uses from the Barker Slough Pumping Plant in the Sacramento-San Joaquin Delta to Napa and Solano Counties. SCWA's contract with DWR includes a maximum allocation of 47,756 acre-feet per

year (AFY), known as Table A water. Supplemental SWP water, "Advanced Table A" (ATA), under specific conditions, is available to SCWA under specific conditions. Additional supplemental water, Settlement Water (SW), is also available from year to year with some restrictions.

State Water Project Capability Report

DWR prepares a biennial report to assist SWP contractors assess the availability of supplies from the SWP. The most recent update, the 2015 DWR State Water Project DCR was finalized in July 2015. In this 2015 update, DWR provides SWP supply estimates for SWP contractors to use in their planning efforts, including for use in their 2015 UWMPs. The 2015 DCR includes DWR's estimates of SWP water supply availability under both current and future conditions. Further details on modeling assumptions can be found in the DCR and its appendices.

Terms and Definitions

Table A Water (Table A Amounts)

Each SWP contractor's State Water Supply Contract (SWP Contract) contains a "Table A," which lists the maximum amount of annual allocated water supply, or "Table A water," an agency may request each year throughout the life of the contract. The Table A Amounts in each contractor's SWP Contract ramped up over time, based on projections at the time the contracts were signed of future increases in population and water demand, until they reached a maximum Table A Amount. SCWA's Table A reached its maximum allotment in 2015. Table A Amounts are used in determining each contractor's proportionate share, or "allocation," of the total SWP water supply DWR determines to be available each year. Table 1 below shows SCWA's active Participating Agencies' allocation of 100% Table A. Vacaville and Fairfield numbers include 5,756 AF (50-50 split) Kern County Water Agency permanent Table A transfer purchased in 2001.

TABLE 1
SCWA PARTICIPATING AGENCY MAXIMUM SWP TABLE A AMOUNTS (AF)

SCWA Participating Agency	Maximum Table A Amounts (AF)
City of Benicia	17,200
City of Fairfield	14,678
Suisun City	1,300
City of Vacaville	8,978
City of Vallejo	5,600
TOTAL	**47,756**

The cities of Dixon and Rio Vista have a right to obtain a specified portion of SCWA Table A supply (1,500 AF each) in the future with a 5-year notice. However, they currently do not have a means to deliver the water into their service areas but may call upon their water with a 5-year notice. This allocation is currently being utilized by Benicia (1,125 AF), Fairfield (750 AF), and Vallejo (1,125 AF).

SWP Allocation

The amount of water that is allocated and delivered by the SWP to each contractor during a year under SWP contract is determined annually by DWR. Table A Amounts determine the maximum amount of water a contractor may request in any year from DWR. SWP allocations are based on CALSIM modeling runs that take into consideration SWP storage in Oroville and San Luis reservoirs, "South of Delta" (SOD) Contractor demand, hydrology, operational requirements and regulatory constraints. The allocation is typically reported as a percentage of maximum Table A amounts and is finalized by May 1 of the current year.

North of Delta Allocation

As a result of the North of Delta Settlement (December 31, 2013), DWR issues a separate SWP annual allocation for SCWA, Napa, and Yuba City ("the North of Delta (NOD) Contractors"), defined as the NOD Allocation. The NOD Allocation cannot exceed the Annual Table A Amounts. The NOD Allocation amounts to an additional increment of annual allocation above the current SWP Allocation described above. The other SOD contractors receive the baseline SWP allocation.

The concept of the NOD is to not penalize the NBA for conveyance restriction exclusive to the SOD pumping plants. Currently, DWR's D1461 CALSIM model run is used as a surrogate for determining the NOD Allocation. All regulatory requirements under D1641 are met before allocations are met, so all contractors share in the responsibility to meet those regulatory requirements. D1641 was what the SWP operated to prior to the new ESA regulations, the 2008 and 2009 Biological Opinions. The Old-Middle River restrictions (OMR) part of the ESA regulations greatly impact the SOD pumping plant, but do not impact NOD diversions. However, the NOD allocation does provide an equitable share of any additional Delta outflow and water quality requirements, such as Fall X2.. If Delta regulations change in the future, the NOD Allocation may be affected commensurately.

Analysis performed by DWR estimated that SCWA could receive an additional 11 TAF approximately 50% of the years compared to existing Table A deliveries.[1] The actual differential varies each year being less in drier years. Since the implementation of the NOD Allocation in 2014, SCWA has received an additional increment of: 0% (2014), 5% (2015), and 15% (2016 as of April 1).

[1] California Department of Water Resources State Water Project Analysis Office, *Initial Study/Proposed Negative Declaration State Water Project Supply Allocation Settlement Agreement*. Prepared by AECOM. July 2013.

Memorandum

Carryover Water

Carryover is unused Table A water "stored" in SWP reservoirs, when storage capacity is available, for use in the following years. SCWA Carryover is accounted for in San Luis Reservoir and may be partially or completely lost when San Luis "spills" meaning that carryover is displaced by higher priority new State Water Project water pumped into storage. The amount of Table A that can be converted and added to storage at the end of each year as new Carryover is governed by Article 56 of the SWP Contract. The amount of new Carryover allowed each year by Article 56 ranges from 25% to 50%, with interpolation in between, depending on the SWP Allocation for that year. There is no limit to the amount of accumulated carryover that can be stored.

Advanced Table A (ATA)

Another component of the North of Delta Settlement (December 31, 2013), Advanced Table A (ATA), is supplemental SWP water that can be used to make up shortfalls of the NOD Allocation in a given year under specific conditions. The annual NOD Allocation plus Advanced Table A requested cannot exceed SCWA contract amount of 47,756 acre-feet per year. ATA is limited to a maximum of 15,000 acre feet per year and a cumulative balance of 60,000 acre feet. ATA is only accessible when the SWP Allocation is greater than 20% and all available SCWA Table A and Carryover is used. Computer simulations show that a 20% or lower allocation would occur only once in the 82 years of record. In these years, the cumulative ATA limit is temporarily increased by 16,800 acre feet (or the current Advanced Table A balance, whichever is lessor) for use in future years. The ATA limit and cumulative balance resets when Oroville Reservoir spills and has limited pay-back provisions after 5 years. All active SCWA Participating Agencies have access to proportional allocation of ATA, at a minimum, when available.

Article 21 Water

Water identified in Article 21 of SWP Contract is additional unregulated water above the annual NOD Allocation available for diversion at the NBA when the Delta is in "excess" conditions. Solano, as a North Bay contractor, can access this water when DWR and the US Bureau of Reclamation mutually agree and declare that the Delta is in "excess" conditions which typically occur in winter and spring with storm runoff. The Delta is considered in "excess" conditions when the SWP and Central Valley Project are pumping the maximum amount allowed, all Delta standards are met, and there is still water available for export. "Balanced" conditions in the Delta occur when the SWP and CVP are releasing stored water into the Delta to meet their obligations and there is no extra water available in the system.

Settlement Water

Settlement Water (SW) is additional non-project water provided by a settlement agreement (executed May 19, 2003) among DWR, SCWA, and the cities of Fairfield, Vacaville, and Benicia. The agreement provides for delivery of up to 31,620 AFY of SW to SCWA for delivery through the NBA to the three cities to help meet their current and future municipal and industrial water needs. SW is not available when the Standard Water Right Term 91 is in effect. The Settlement expires December 31, 2035 with the option to renew. [2]

Standard Water Right Term 91 (Term 91)

Term 91 is declared by the State Water Resources Control Board when it is determined that the SWP and CVP are releasing stored water into the Delta in excess of natural flow ("natural" flow is the flow that would have been present if the dams did not exist) to meet inDelta demands and Delta water standards.

2014 SWP Water Supply Allocation

The extremely dry sequence from the beginning of January 2013 through the end of 2014 was one of the driest two-year periods in the historical record. Water year 2013 was a year with two hydrologic extremes.[3] October through December 2012 was one of the wettest fall periods on record, but was followed by the driest consecutive 12 months on record. Accordingly, the 2013 State Water Project (SWP) supply allocation was a low 35% of SWP Table A Amounts. The 2013 hydrology ended up being even drier than DWR's conservative hydrologic forecast, so the SWP began 2014 with reservoir storage lower than targeted levels and less stored water available for 2014 supplies. Compounding this low storage situation, 2014 also was an extremely dry year, with runoff for water year 2014 the fourth driest on record. Due to extraordinarily dry conditions in 2013 and 2014, the 2014 SWP water supply allocation was a historically low 5% of Table A Amounts. The dry hydrologic conditions that led to the low 2014 SWP water supply allocation were extremely unusual, and to date have not been included in the SWP delivery estimates presented in DWR's 2015 Delivery Capability Report.[4] It is anticipated that the hydrologic record used in the DWR model will be extended to include the period through 2014 during the next update of the model, which is expected to be completed prior to issuance of the next update to the biennial SWP Delivery Capability Report. For the reasons stated above, the SCWA UWMP uses a conservative assumption that a 5% allocation of SWP Table A Amounts represents the "worst case" scenario.

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[2] California Department of Water Resources (DWR). 2014. *Management of the California State Water Project: Bulletin 132-14*. <http://www.water.ca.gov/swpao/bulletin_home.cfm>

[3] A water year begins in October and runs through September. For example, water year 2013 is October 2012 through September 2013.

[4] SWP delivery estimates from DWR's 2015 SWP Delivery Capability Report are from computer model studies which use 82 years of historical hydrologic inflows from 1922 through 2003.

Memorandum

Thomas Pate, Solano County Water Agency
14 April 2016
1568025*00

SCWA SWP Reliability

For long term planning purposes, the Early Long Term (ELT) scenario of the DWR SWP CalSim model found in Appendix C of the DCR (excerpted and attached) was agreed upon by the SWP Contractors as the most appropriate scenario to use to estimate future supply availability. Therefore, future SWP supply availability presented in Table 2 is based on the ELT study included in the 2015 DCR.

TABLE 2
SWP SCWA TABLE A SUPPLY RELIABILITY (AF)[a][b]

DWR (SWP) Table A Supply	% of Table A Amount[c]	2015	2020	2025	2030	2035-2050
Average Water Year[d]	73%	34,869	34,869	34,869	34,869	34,869
North of Delta Allocation[e]	+10%	3,487	3,487	3,487	3,487	3,487
Single Dry Year[f]	22%	10,351	10,351	10,351	10,351	10,351
North of Delta Allocation [e]	+0%	0	0	0	0	0
Multiple-Dry Year[g]	24%	11,542	11,542	11,542	11,542	11,542
North of Delta Allocation [e]	+3%	346	346	346	346	346
2014 Table A Supply[h]	5%	2,388	2,388	2,388	2,388	2,388
North of Delta Allocation [e]	+0%	0	0	0	0	0

Notes:
(a) Supplies to SCWA are based on DWR analyses presented in its "*2015 State Water Project Delivery Capability Report" (2015 DCR),* assuming existing SWP facilities and current regulatory and operational constraints (except as otherwise indicated in Note (h)).
(b) Table A supplies include supplies allocated in one year that are carried over for delivery the following year.
(c) Supply as a percentage of SCWA's Table A Amount of 47,756 AF (DWR Bulletin 132-15, Appendix B, Data and Computations Used to Determine 2016 Water Charges, page B-36, Table B-4).
(d) Based on average deliveries over a repeat of the study's historic hydrologic period of 1922 through 2003.
(e) North of Delta Allocation as an additional percentage of SCWA's Table A Allocation, estimated based on actual amounts received since the implementation of the North of Delta Settlement in 2014. Because of the limited historical data, this estimate is preliminary and will be adjusted for subsequent UWMP updates as additional data becomes available.
(f) Based on a repeat of the worst case historic single dry year of 1977 (from 2015 DCR).
(g) Supplies shown are annual averages over four consecutive dry years, based on a repeat of the historic four-year dry period of 1931-1934.
(h) Based on the worst-case actual allocation of 2014.
(i) Advanced Table A allocations are not quantified in this table but this supplemental SWP water can be used to make up shortfalls in the North of Delta Allocation in a given year under specific conditions.

SCWA has subsequent long term water service contracts for SWP water supply deliveries with Participating Agencies. The SWP Table A Supply Reliability values in Table 2 can be applied directly to SCWA supply reliability and need to be adjusted to reflect individual SCWA Participating Agencies contract terms with SCWA. The following tables show the SCWA

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Participating Agency SWP allocations based on Table 2 and Participating Agency maximum SCWA contract allocations in Table 1:

TABLE 3a
SWP SCWA PARTICIPATING AGENCY SUPPLY RELIABILITY (AF)[(a)(b)]
CITY OF BENICIA

DWR (SWP) Table A Supply	% of Table A Amount[(c)]	2015	2020	2025	2030	2035-2050
Average Water Year[(d)]	73%	12,559	12,559	12,559	12,559	12,559
North of Delta Allocation [(e)]	+10%	1,256	1,256	1,256	1,256	1,256
Single Dry Year[(f)]	22%	3,728	3,728	3,728	3,728	3,728
North of Delta Allocation [(e)]	+0%	0	0	0	0	0
Multiple-Dry Year[(g)]	24%	4,157	4,157	4,157	4,157	4,157
North of Delta Allocation [(e)]	+3%	125	125	125	125	125
2014 Table A Supply[(h)]	5%	860	860	860	860	860
North of Delta Allocation [(e)]	+0%	0	0	0	0	0

Notes:
(a) Supplies to SCWA are based on DWR analyses presented in its "*2015 State Water Project Delivery Capability Report" (2015 DCR),* assuming existing SWP facilities and current regulatory and operational constraints (except as otherwise indicated in Note (h)).
(b) Table A supplies include supplies allocated in one year that are carried over for delivery the following year.
(c) Based on average SWP deliveries over a repeat of the study's historic hydrologic period of 1922 through 2003.
(d) Supply as a percentage of City of Benicia's SCWA Table A contract amount for SWP supply of 17,200 AF, not including Advanced Table A or Settlement Water.
(e) North of Delta Allocation as an additional percentage of SCWA's Table A Allocation, estimated based on actual amounts received since the implementation of the North of Delta Settlement in 2014. Because of the limited historical data, this estimate is preliminary and will be adjusted for subsequent UWMP updates as additional data becomes available.
(f) Based on a repeat of the worst case historic single dry year of 1977 (from 2015 DCR).
(g) Supplies shown are annual averages over four consecutive dry years, based on a repeat of the historic four-year dry period of 1931-1934.
(h) Based on the worst-case actual SWP allocation of 2014.
(i) Advanced Table A allocations are not quantified in this table but this supplemental SWP water can be used to make up shortfalls in the North of Delta Allocation in a given year under specific conditions.

In addition to SWP supplies, the City of Benicia has access to 10,500 AFY of Settlement Water delivered through the North Bay Aqueduct when available.

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TABLE 3b
SWP SCWA PARTICIPATING AGENCY SUPPLY RELIABILITY (AF)[(a)(b)]
CITY OF FAIRFIELD

DWR (SWP) Table A Supply	% of Table A Amount[(c)]	2015	2020	2025	2030	2035-2050
Average Water Year[(d)]	73%	10,717	10,717	10,717	10,717	10,717
North of Delta Allocation [(e)]	+10%	1,072	1,072	1,072	1,072	1,072
Single Dry Year[(f)]	22%	3,181	3,181	3,181	3,181	3,181
North of Delta Allocation [(e)]	+0%	0	0	0	0	0
Multiple-Dry Year[(g)]	24%	3,547	3,547	3,547	3,547	3,547
North of Delta Allocation [(e)]	+3%	106	106	106	106	106
2014 Table A Supply[(h)]	5%	734	734	734	734	734
North of Delta Allocation [(e)]	+0%	0	0	0	0	0

Notes:
(a) Supplies to SCWA are based on DWR analyses presented in its "*2015 State Water Project Delivery Capability Report" (2015 DCR),* assuming existing SWP facilities and current regulatory and operational constraints (except as otherwise indicated in Note (h)).
(b) Table A supplies include supplies allocated in one year that are carried over for delivery the following year.
(c) Based on average SWP deliveries over a repeat of the study's historic hydrologic period of 1922 through 2003.
(d) Supply as a percentage of City of Fairfield's SCWA contract amount for SWP supply of 14,678 AF, not including Advanced Table A or Settlement Water.
(e) North of Delta Allocation as an additional percentage of SCWA's Table A Allocation, estimated based on actual amounts received since the implementation of the North of Delta Settlement in 2014. Because of the limited historical data, this estimate is preliminary and will be adjusted for subsequent UWMP updates as additional data becomes available.
(f) Based on a repeat of the worst case historic single dry year of 1977 (from 2015 DCR).
(g) Supplies shown are annual averages over four consecutive dry years, based on a repeat of the historic four-year dry period of 1931-1934.
(h) Based on the worst-case actual SWP allocation of 2014.
(i) Advanced Table A allocations are not quantified in this table but this supplemental SWP water can be used to make up shortfalls in the North of Delta Allocation in a given year under specific conditions.

In addition to SWP supplies, the City of Fairfield has access to 11,800 AFY of Settlement Water Settlement Water, delivered through the North Bay Aqueduct when available.

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TABLE 3c
SWP SCWA PACTICIPATING AGENCY SUPPLY RELIABILITY (AF)[a][b]
CITY OF SUISUN CITY

DWR (SWP) Table A Supply	% of Table A Amount[c]	2015	2020	2025	2030	2035-2050
Average Water Year[d]	73%	949	949	949	949	949
North of Delta Allocation [e]	+10%	95	95	95	95	95
Single Dry Year[f]	22%	282	282	282	282	282
North of Delta Allocation [e]	+0%	0	0	0	0	0
Multiple-Dry Year[g]	24%	314	314	314	314	314
North of Delta Allocation [e]	+3%	9	9	9	9	9
2014 Table A Supply[h]	5%	65	65	65	65	65
North of Delta Allocation [e]	+0%	0	0	0	0	0

Notes:
(a) Supplies to SCWA are based on DWR analyses presented in its "*2015 State Water Project Delivery Capability Report" (2015 DCR),* assuming existing SWP facilities and current regulatory and operational constraints (except as otherwise indicated in Note (h)).
(b) Table A supplies include supplies allocated in one year that are carried over for delivery the following year.
(c) Based on average SWP deliveries over a repeat of the study's historic hydrologic period of 1922 through 2003.
(d) Supply as a percentage of City of Suisun City's SCWA contract amount for SWP supply of 1,300 AF.
(e) North of Delta Allocation as an additional percentage of SCWA's Table A Allocation, estimated based on actual amounts received since the implementation of the North of Delta Settlement in 2014. Because of the limited historical data, this estimate is preliminary and will be adjusted for subsequent UWMP updates as additional data becomes available.
(f) Based on a repeat of the worst case historic single dry year of 1977 (from 2015 DCR).
(g) Supplies shown are annual averages over four consecutive dry years, based on a repeat of the historic four-year dry period of 1931-1934.
(h) Based on the worst-case actual SWP allocation of 2014.
(i) Advanced Table A allocations are not quantified in this table but this supplemental SWP water can be used to make up shortfalls in the North of Delta Allocation in a given year under specific conditions.

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TABLE 3d
SWP SCWA PARTICIPATING AGENCY SUPPLY RELIABILITY (AF)[(a)(b)]
CITY OF VACAVILLE

DWR (SWP) Table A Supply	% of Table A Amount[(c)]	2015	2020	2025	2030	2035-2050
Average Water Year[(d)]	73%	6,555	6,555	6,555	6,555	6,555
North of Delta Allocation [(e)]	+10%	656	656	656	656	656
Single Dry Year[(f)]	22%	1,946	1,946	1,946	1,946	1,946
North of Delta Allocation [(e)]	+0%	0	0	0	0	0
Multiple-Dry Year[(g)]	24%	2,170	2,170	2,170	2,170	2,170
North of Delta Allocation [(e)]	+3%	65	65	65	65	65
2014 Table A Supply[(h)]	5%	449	449	449	449	449
North of Delta Allocation [(e)]	+0%	0	0	0	0	0

Notes:
(a) Supplies to SCWA are based on DWR analyses presented in its "*2015 State Water Project Delivery Capability Report" (2015 DCR),* assuming existing SWP facilities and current regulatory and operational constraints (except as otherwise indicated in Note (h)).
(b) Table A supplies include supplies allocated in one year that are carried over for delivery the following year.
(c) Based on average SWP deliveries over a repeat of the study's historic hydrologic period of 1922 through 2003.
(d) Supply as a percentage of City of Vacaville's SCWA contract amount for SWP supply of 8,978 AF, not including Advanced Table A or Settlement Water.
(e) North of Delta Allocation as an additional percentage of SCWA's Table A Allocation, estimated based on actual amounts received since the implementation of the North of Delta Settlement in 2014. Because of the limited historical data, this estimate is preliminary and will be adjusted for subsequent UWMP updates as additional data becomes available.
(f) Based on a repeat of the worst case historic single dry year of 1977 (from 2015 DCR).
(g) Supplies shown are annual averages over four consecutive dry years, based on a repeat of the historic four-year dry period of 1931-1934.
(h) Based on the worst-case actual SWP allocation of 2014.
(i) Advanced Table A allocations are not quantified in this table but this supplemental SWP water can be used to make up shortfalls in the North of Delta Allocation in a given year under specific conditions.

In addition to SWP supplies, the City of Vacaville has access to 9,320 AFY of Settlement Water delivered through the North Bay Aqueduct when available.

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Thomas Pate, Solano County Water Agency
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TABLE 3e
SWP SCWA PARTICIPATING AGENCY SUPPLY RELIABILITY (AF)[(a)(b)]
CITY OF VALLEJO

DWR (SWP) Table A Supply	% of Table A Amount[(c)]	2015	2020	2025	2030	2035-2050
Average Water Year[(d)]	73%	4,089	4,089	4,089	4,089	4,089
North of Delta Allocation [(e)]	+10%	409	409	409	409	409
Single Dry Year[(f)]	22%	1,214	1,214	1,214	1,214	1,214
North of Delta Allocation [(e)]	+0%	0	0	0	0	0
Multiple-Dry Year[(g)]	24%	1,353	1,353	1,353	1,353	1,353
North of Delta Allocation [(e)]	+3%	41	41	41	41	41
2014 Table A Supply[(h)]	5%	280	280	280	280	280
North of Delta Allocation [(e)]	+0%	0	0	0	0	0

Notes:
(a) Supplies to SCWA are based on DWR analyses presented in its "*2015 State Water Project Delivery Capability Report" (2015 DCR),* assuming existing SWP facilities and current regulatory and operational constraints (except as otherwise indicated in Note (h)).
(b) Table A supplies include supplies allocated in one year that are carried over for delivery the following year.
(c) Based on average SWP deliveries over a repeat of the study's historic hydrologic period of 1922 through 2003.
(d) Supply as a percentage of City of Vallejo's SCWA contract amount for SWP supply of 5,600 AF
(e) North of Delta Allocation as an additional percentage of SCWA's Table A Allocation, estimated based on actual amounts received since the implementation of the North of Delta Settlement in 2014. Because of the limited historical data, this estimate is preliminary and will be adjusted for subsequent UWMP updates as additional data becomes available.
(f) Based on a repeat of the worst case historic single dry year of 1977 (from 2015 DCR).
(g) Supplies shown are annual averages over four consecutive dry years, based on a repeat of the historic four-year dry period of 1931-1934.
(h) Based on the worst-case actual SWP allocation of 2014.
(i) Advanced Table A allocations are not quantified in this table but this supplemental SWP water can be used to make up shortfalls in the North of Delta Allocation in a given year under specific conditions.

Solano Project

The Solano Project is a federal facility owned by the Bureau of Reclamation (USBR) that stores water in Lake Berryessa for delivery to agriculture and municipal and industrial users throughout the Solano County. SCWA has a long-term master water supply agreement with USBR that currently expires in 2025 but is renewable. The Solano Project first delivered water in 1959. The major facilities are:

- Monticello Dam, which captures water from Putah Creek in Lake Berryessa;
- Putah Diversion Dam, which diverts water out of Lower Putah Creek just downstream of Monticello Dam; and

- Putah South Canal, which delivers water to local agencies. The Putah South Canal is 33 miles long, concrete lined and has a maximum capacity of 956 cubic feet per second.

The annual firm yield of the Solano Project is 207,350 AFY. Solano Project water is designated for Agricultural (AG) and Municipal and Industrial (M&I) uses allocated to Participating Agencies as follows in Table 4:

TABLE 4
SCWA PARTICIPATING AGENCY MAXIMUM SOLANO PROJECT ALLOCATION (AF)

Participating Agency	Maximum Allocation (AFY)	Use
City of Fairfield	9,200	M&I
City of Suisun	1,600	M&I
City of Vacaville	5,750	M&I
City of Vallejo	14,600	M&I
Solano Irrigation District	141,000	AG+M&I
Maine Prairie Water District	15,000	AG
University of California- Davis	4,000	AG
California State Prison- Solano	1,200	AG+M&I
SCWA	15,000	Operating Loss
TOTAL	**207,350**	

Reliability estimates for the Solano Project were last updated for the 2010 UWMP and were developed based on historic hydrology from 1906-2003, Lake Berryessa inflows, and the Sacramento Valley Index (SVI) for hydrologic year types (wet, above normal, below normal, dry, critically dry). The SVI was further categorized into Average Year (above normal, below normal), Single Dry Year, and Multi-Dry Year. As noted in the August 10, 2010 SCWA memorandum presenting the 2010 SCWA water supply reliability, the update of the Solano Project reliability analysis from 2005 to 2009 resulted in minimal change. This is assumed to remain true for 2015; therefore, it is recommended that the 2015 Solano Project Reliability estimates use the Solano Project reliability estimates from the 2010 SCWA UWMP. The recommended 2015 Solano Project Reliability estimates are presented in Table 5 below.

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TABLE 5
SOLANO PROJECT SUPPLY RELIABILITY (AF)

Solano Project Supply[(a)]	2015	2020	2025	2030	2035-2050
Average Water Year[(b)]	205,825	205,825	205,825	205,825	205,825
% of Contract Amount[(b)]	99%	99%	99%	99%	99%
Single Dry Year[(c)]	204,051	204,051	204,051	204,051	204,051
% of Contract Amount[(c)]	98%	98%	98%	98%	98%
Multi-Dry Year[(d)]	184,887	184,887	184,887	184,887	184,887
% of Contract Amount[(d)]	89%	89%	89%	89%	89%

Notes:
(a) SCWA's Total Participating Agency Contract Amounts equal 207,350 AF and includes 15,000 AF of canal losses.
(b) Based on average percent allocation (including canal losses) during Average Years over the study's historic hydrologic period of 1906 through 2007, rounded to the nearest whole percent.
(c) Based on the average percent allocation (including canal losses) during Single Dry Years over the study's historic hydrologic period of 1906 through 2007, rounded to the nearest whole percent.
(d) Supplies shown are average percent allocation (including canal losses) over four consecutive dry years, based on a repeat of the historic four-year dry period with low inflow to Lake Berryessa of 1990-1994, rounded to the nearest whole percent.

SCWA has subsequent long term water service contracts for Solano Project water supply deliveries with Participating Agencies. Similar to the SWP Table A Supply Reliability, Solano Project Reliability shown in Table 5 are for SCWA and need to be adjusted to reflect individual Participating Agencies contract terms. The following tables show the SCWA Participating Agency Solano Project allocations based on Table 5 and Participating Agency maximum contract allocations in Table 4:

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TABLE 6a
CITY OF FAIRFIELD SOLANO PROJECT SUPPLY RELIABILITY (AF)

Solano Project Supply[a]	2015	2020	2025	2030	2035-2050
Average Water Year[b]	9,132	9,132	9,132	9,132	9,132
% of Contract Amount[b]	99%	99%	99%	99%	99%
Single Dry Year[c]	9,054	9,054	9,054	9,054	9,054
% of Contract Amount[c]	98%	98%	98%	98%	98%
Multi-Dry Year[d]	8,203	8,203	8,203	8,203	8,203
% of Contract Amount[d]	89%	89%	89%	89%	89%

(a) City of Fairfield's Solano Project Contract Amount is 9,200 AF, not including canal losses.
(b) Based on average percent allocation (including canal losses) during Average Years over the study's historic hydrologic period of 1906 through 2007, rounded to the nearest whole percent.
(c) Based on the average percent allocation (including canal losses) during Single Dry Years over the study's historic hydrologic period of 1906 through 2007, rounded to the nearest whole percent.
(d) Supplies shown are average percent allocation (including canal losses) over four consecutive dry years, based on a repeat of the historic four-year dry period with low inflow to Lake Berryessa of 1990-1994, rounded to the nearest whole percent.
(e) The City of Fairfield may have additional water supply agreements in place with other agencies. See the City of Fairfield's most recently adopted UWMP for descriptions of their water supply portfolio.

TABLE 6b
CITY OF SUISUN CITY SOLANO PROJECT SUPPLY RELIABILITY (AF)

Solano Project Supply[a]	2015	2020	2025	2030	2035-2050
Average Water Year[b]	1,588	1,588	1,588	1,588	1,588
% of Contract Amount[b]	99%	99%	99%	99%	99%
Single Dry Year[c]	1,575	1,575	1,575	1,575	1,575
% of Contract Amount[c]	98%	98%	98%	98%	98%
Multi-Dry Year[d]	1,427	1,427	1,427	1,427	1,427
% of Contract Amount[d]	89%	89%	89%	89%	89%

(a) City of Suisun City's Solano Project Contract Amount is 1,600 AF, not including canal losses.
(b) Based on average percent allocation (including canal losses) during Average Years over the study's historic hydrologic period of 1906 through 2007, rounded to the nearest whole percent.
(c) Based on the average percent allocation (including canal losses) during Single Dry Years over the study's historic hydrologic period of 1906 through 2007, rounded to the nearest whole percent.
(d) Supplies shown are average percent allocation (including canal losses) over four consecutive dry years, based on a repeat of the historic four-year dry period with low inflow to Lake Berryessa of 1990-1994, rounded to the nearest whole percent.
(e) Suisun City may have additional water supply agreements in place with other agencies. See the Suisun Solano Water Authority's most recently adopted UWMP for descriptions of their water supply portfolio.

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TABLE 6c
CITY OF VACAVILLE SOLANO PROJECT SUPPLY RELIABILITY (AF)

Solano Project Supply[a]	2015	2020	2025	2030	2035-2050
Average Water Year[b]	5,708	5,708	5,708	5,708	5,708
% of Contract Amount[b]	99%	99%	99%	99%	99%
Single Dry Year[c]	5,659	5,659	5,659	5,659	5,659
% of Contract Amount[c]	98%	98%	98%	98%	98%
Multi-Dry Year[d]	5,127	5,127	5,127	5,127	5,127
% of Contract Amount[d]	89%	89%	89%	89%	89%

(a) City of Vacaville's Solano Project Contract Amount is 5,750 AF, not including canal losses.
(b) Based on average percent allocation (including canal losses) during Average Years over the study's historic hydrologic period of 1906 through 2007, rounded to the nearest whole percent.
(c) Based on the average percent allocation (including canal losses) during Single Dry Years over the study's historic hydrologic period of 1906 through 2007, rounded to the nearest whole percent.
(d) Supplies shown are average percent allocation (including canal losses) over four consecutive dry years, based on a repeat of the historic four-year dry period with low inflow to Lake Berryessa of 1990-1994, rounded to the nearest whole percent.
(e) City of Vacaville may have additional water supply agreements in place with other agencies. See the City of Vacaville's most recently adopted UWMP for descriptions of their water supply portfolio.

TABLE 6d
CITY OF VALLEJO SOLANO PROJECT SUPPLY RELIABILITY (AF)

Solano Project Supply[a]	2015	2020	2025	2030	2035-2050
Average Water Year[b]	14,493	14,493	14,493	14,493	14,493
% of Contract Amount[b]	99%	99%	99%	99%	99%
Single Dry Year[c]	14,368	14,368	14,368	14,368	14,368
% of Contract Amount[c]	98%	98%	98%	98%	98%
Multi-Dry Year[d]	13,018	13,018	13,018	13,018	13,018
% of Contract Amount[d]	89%	89%	89%	89%	89%

(a) City of Vallejo's Solano Project Contract Amount is 14,600 AF, not including canal losses.
(b) Based on average percent allocation (including canal losses) during Average Years over the study's historic hydrologic period of 1906 through 2007, rounded to the nearest whole percent.
(c) Based on the average percent allocation (including canal losses) during Single Dry Years over the study's historic hydrologic period of 1906 through 2007, rounded to the nearest whole percent.
(d) Supplies shown are average percent allocation (including canal losses) over four consecutive dry years, based on a repeat of the historic four-year dry period with low inflow to Lake Berryessa of 1990-1994, rounded to the nearest whole percent.
(e) City of Vallejo may have additional water supply agreements in place with other agencies. See the City of Vallejo's most recently adopted UWMP for descriptions of their water supply portfolio.

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TABLE 6e
CALIFORNIA STATE PRISON SOLANO PROJECT SUPPLY RELIABILITY (AF)

Solano Project Supply[a]	2015	2020	2025	2030	2035-2050
Average Water Year[b]	1,191	1,191	1,191	1,191	1,191
% of Contract Amount[b]	99%	99%	99%	99%	99%
Single Dry Year[c]	1,181	1,181	1,181	1,181	1,181
% of Contract Amount[c]	98%	98%	98%	98%	98%
Multi-Dry Year[d]	1,070	1,070	1,070	1,070	1,070
% of Contract Amount[d]	89%	89%	89%	89%	89%

(a) California State Prison's Solano Project Contract Amount is 1,200 AF, not including canal losses.
(b) Based on average percent allocation (including canal losses) during Average Years over the study's historic hydrologic period of 1906 through 2007, rounded to the nearest whole percent.
(c) Based on the average percent allocation (including canal losses) during Single Dry Years over the study's historic hydrologic period of 1906 through 2007, rounded to the nearest whole percent.
(d) Supplies shown are average percent allocation (including canal losses) over four consecutive dry years, based on a repeat of the historic four-year dry period with low inflow to Lake Berryessa of 1990-1994, rounded to the nearest whole percent.

TABLE 6f
MAINE PRAIRIE WATER DISTRICT SOLANO PROJECT SUPPLY RELIABILITY (AF)

Solano Project Supply[a]	2015	2020	2025	2030	2035-2050
Average Water Year[b]	14,890	14,890	14,890	14,890	14,890
% of Contract Amount[b]	99%	99%	99%	99%	99%
Single Dry Year[c]	14,761	14,761	14,761	14,761	14,761
% of Contract Amount[c]	98%	98%	98%	98%	98%
Multi-Dry Year[d]	13,375	13,375	13,375	13,375	13,375
% of Contract Amount[d]	89%	89%	89%	89%	89%

(a) Maine Prairie Water District's Solano Project Contract Amount is 15,000 AF, not including canal losses.
(b) Based on average percent allocation (including canal losses) during Average Years over the study's historic hydrologic period of 1906 through 2007, rounded to the nearest whole percent.
(c) Based on the average percent allocation (including canal losses) during Single Dry Years over the study's historic hydrologic period of 1906 through 2007, rounded to the nearest whole percent.
(d) Supplies shown are average percent allocation (including canal losses) over four consecutive dry years, based on a repeat of the historic four-year dry period with low inflow to Lake Berryessa of 1990-1994, rounded to the nearest whole percent.
(e) Maine Prairie Water District may have additional water supply agreements in place with other agencies, which are not shown in this table.

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TABLE 6g
SOLANO IRRIGATION DISTRICT SOLANO PROJECT SUPPLY RELIABILITY (AF)

Solano Project Supply[a]	2015	2020	2025	2030	2035-2050
Average Water Year[b]	139,963	139,963	139,963	139,963	139,963
% of Contract Amount[b]	99%	99%	99%	99%	99%
Single Dry Year[c]	138,757	138,757	138,757	138,757	138,757
% of Contract Amount[c]	98%	98%	98%	98%	98%
Multi-Dry Year[d]	125,725	125,725	125,725	125,725	125,725
% of Contract Amount[d]	89%	89%	89%	89%	89%

(a) Solano Irrigation District's Solano Project Contract Amount is 141,000 AF, not including canal losses.
(b) Based on average percent allocation (including canal losses) during Average Years over the study's historic hydrologic period of 1906 through 2007, rounded to the nearest whole percent.
(c) Based on the average percent allocation (including canal losses) during Single Dry Years over the study's historic hydrologic period of 1906 through 2007, rounded to the nearest whole percent.
(d) Supplies shown are average percent allocation (including canal losses) over four consecutive dry years, based on a repeat of the historic four-year dry period with low inflow to Lake Berryessa of 1990-1994, rounded to the nearest whole percent.
(e) Solano Irrigation District may have additional water supply agreements in place with other agencies, which are not shown in this table.

TABLE 6h
UNIVERSITY OF CALIFORNIA, DAVIS SOLANO PROJECT SUPPLY RELIABILITY (AF)

Solano Project Supply[a]	2015	2020	2025	2030	2035-2050
Average Water Year[b]	3,971	3,971	3,971	3,971	3,971
% of Contract Amount[b]	99%	99%	99%	99%	99%
Single Dry Year[c]	3,936	3,936	3,936	3,936	3,936
% of Contract Amount[c]	98%	98%	98%	98%	98%
Multi-Dry Year[d]	3,567	3,567	3,567	3,567	3,567
% of Contract Amount[d]	89%	89%	89%	89%	89%

(a) University of California, Davis's Solano Project Contract Amount is 4,000 AF, not including canal losses.
(b) Based on average percent allocation (including canal losses) during Average Years over the study's historic hydrologic period of 1906 through 2007, rounded to the nearest whole percent.
(c) Based on the average percent allocation (including canal losses) during Single Dry Years over the study's historic hydrologic period of 1906 through 2007, rounded to the nearest whole percent.
(d) Supplies shown are average percent allocation (including canal losses) over four consecutive dry years, based on a repeat of the historic four-year dry period with low inflow to Lake Berryessa of 1990-1994, rounded to the nearest whole percent.

Enclosure(s) (2)

1. 2015 SWP Delivery Capability Report Excerpt of Appendix C
2. Memorandum, Subject: UWMP Reliability Data (Revised for SWP-prior memo is dated 6/10/10 - Solano Project data unchanged)

Table C.29. Solano County WA: 2015 DCR ELT

SWP Table A Deliveries for 2015 Study					Probability Curve			
Year	Delivery w/o Article 56 Carryover (TAF)	Article 56 Carryover (TAF)	Total Table A Delivery (TAF)	Percent of Maximum Table A	Year	Total Table A Delivery (TAF)	Exceedence Frequency (%)	Percent of Maximum Table A
1922	48	0	48	100%	1938	48	0%	100%
1923	40	0	40	84%	1938	48	1%	100%
1924	12	0	12	25%	1938	48	2%	100%
1925	23	0	23	48%	1938	48	4%	100%
1926	23	0	23	48%	1938	48	5%	100%
1927	44	0	44	93%	1938	48	6%	100%
1928	44	0	44	93%	1922	48	7%	100%
1929	12	0	12	25%	1922	48	9%	100%
1930	23	0	23	48%	1922	48	10%	100%
1931	12	0	12	25%	1922	48	11%	100%
1932	12	0	12	25%	1963	48	12%	100%
1933	12	0	12	25%	1963	48	14%	100%
1934	10	0	10	22%	1963	48	15%	100%
1935	23	0	23	48%	1963	48	16%	100%
1936	40	0	40	84%	1942	48	17%	100%
1937	23	0	23	48%	1942	48	19%	100%
1938	48	0	48	100%	1942	48	20%	100%
1939	40	0	40	84%	1942	48	21%	100%
1940	44	0	44	93%	1942	48	22%	100%
1941	48	0	48	100%	1942	48	23%	100%
1942	48	0	48	100%	1942	48	25%	100%
1943	48	0	48	100%	1942	48	26%	100%
1944	23	0	23	48%	1942	48	27%	100%
1945	40	0	40	84%	1942	48	28%	100%
1946	44	0	44	93%	1942	48	30%	100%
1947	23	0	23	48%	1942	48	31%	100%
1948	40	0	40	84%	1927	44	32%	93%
1949	23	0	23	48%	1927	44	33%	93%
1950	23	0	23	48%	1927	44	35%	93%
1951	44	0	44	93%	1927	44	36%	93%
1952	48	0	48	100%	1927	44	37%	93%
1953	48	0	48	100%	1927	44	38%	93%
1954	44	0	44	93%	1927	44	40%	93%
1955	23	0	23	48%	1927	44	41%	93%
1956	48	0	48	100%	1927	44	42%	93%
1957	44	0	44	93%	1940	44	43%	93%
1958	48	0	48	100%	1940	44	44%	93%
1959	40	0	40	84%	1940	44	46%	93%
1960	23	0	23	48%	2003	43	47%	91%
1961	23	0	23	48%	1923	40	48%	84%
1962	40	0	40	84%	1923	40	49%	84%
1963	48	0	48	100%	1923	40	51%	84%
1964	23	0	23	48%	1923	40	52%	84%

SWP Table A Deliveries for 2015 Study					Probability Curve			
Year	Delivery w/o Article 56 Carryover (TAF)	Article 56 Carryover (TAF)	Total Table A Delivery (TAF)	Percent of Maximum Table A	Year	Total Table A Delivery (TAF)	Exceedence Frequency (%)	Percent of Maximum Table A
1965	48	0	48	100%	1923	40	53%	84%
1966	40	0	40	84%	1923	40	54%	84%
1967	48	0	48	100%	1923	40	56%	84%
1968	40	0	40	84%	1923	40	57%	84%
1969	48	0	48	100%	1923	40	58%	84%
1970	48	0	48	100%	1923	40	59%	84%
1971	48	0	48	100%	1923	40	60%	84%
1972	40	0	40	84%	1947	23	62%	48%
1973	44	0	44	93%	2002	23	63%	48%
1974	48	0	48	100%	1925	23	64%	48%
1975	48	0	48	100%	1925	23	65%	48%
1976	23	0	23	48%	1925	23	67%	48%
1977	12	0	12	25%	1925	23	68%	48%
1978	44	0	44	93%	1925	23	69%	48%
1979	23	0	23	48%	1925	23	70%	48%
1980	44	0	44	93%	1925	23	72%	48%
1981	23	0	23	48%	1925	23	73%	48%
1982	48	0	48	100%	1925	23	74%	48%
1983	48	0	48	100%	1925	23	75%	48%
1984	48	0	48	100%	1925	23	77%	48%
1985	40	0	40	84%	1925	23	78%	48%
1986	48	0	48	100%	1925	23	79%	48%
1987	23	0	23	48%	1925	23	80%	48%
1988	12	0	12	25%	1925	23	81%	48%
1989	23	0	23	48%	1925	23	83%	48%
1990	12	0	12	25%	1937	23	84%	48%
1991	12	0	12	25%	1937	23	85%	48%
1992	12	0	12	25%	1924	12	86%	25%
1993	44	0	44	93%	1924	12	88%	25%
1994	12	0	12	25%	1924	12	89%	25%
1995	48	0	48	100%	1931	12	90%	25%
1996	48	0	48	100%	1931	12	91%	25%
1997	48	0	48	100%	1931	12	93%	25%
1998	48	0	48	100%	1931	12	94%	25%
1999	48	0	48	100%	1931	12	95%	25%
2000	44	0	44	93%	1931	12	96%	25%
2001	23	0	23	48%	1931	12	98%	25%
2002	23	0	23	48%	1931	12	99%	25%
2003	43	0	43	91%	1934	10	100%	22%
Average	**35**	**0**	**35**	**73%**		**35**		**73%**
Maximum	**48**	**0**	**48**	**100%**		**48**		**100%**
Minimum	**10**	**0**	**10**	**22%**		**10**		**22%**

Appendix C Solano Project Reliability

Ultimate level of development-of Lake Berryessa watershed @ 30,000 AF/yr - 2009 Study

Lake Berryessa Index

Value	Year Type
W	Wet
N	Below Normal
N	Above Normal
D	Dry
D	Critically Dry

Year	Index Value	% Full Alloc	% Full Alloc for Normal Year (N)	% Full Alloc for Single Dry Year (D) *	% Full Alloc for Multiple Dry Years (3 or more Dry years)
1906	W	100%			
1907	W	100%			
1908	D	100%		100%	
1909	W	100%			
1910	N	100%	100%		
1911	W	100%			
1912	D	100%		100%	
1913	D	100%			
1914	W	100%			
1915	W	100%			
1916	W	100%			
1917	N	100%	100%		
1918	D	100%		100%	
1919	N	100%	100%		
1920	D	100%		100%	
1921	N	100%	100%		
1922	N	100%	100%		
1923	N	100%	100%		
1924	D	95%		95%	
1925	N	95%	95%		
1926	N	95%	95%		
1927	W	95%			
1928	N	100%	100%		
1929	D	95%		95%	
1930	N	95%	95%		
1931	D	100%		100%	100%
1932	D	100%			100%
1933	D	45%			45%
1934	D	45%			45%
1935	N	100%	100%		
1936	N	100%	100%		
1937	N	100%	100%		
1938	W	100%			
1939	D	95%		95%	

1940	W	100%			
1941	W	100%			
1942	W	100%			
1943	N	100%	100%		
1944	D	100%		100%	
1945	N	100%	100%		
1946	N	100%	100%		
1947	D	100%		100%	100%
1948	D	95%			95%
1949	D	95%			95%
1950	D	95%			95%
1951	N	95%	95%		
1952	W	100%			
1953	N	100%	100%		
1954	N	100%	100%		
1955	D	95%		95%	
1956	W	100%			
1957	D	100%		100%	
1958	W	100%			
1959	D	100%		100%	
1960	N	100%	100%		
1961	D	100%		100%	
1962	N	100%	100%		
1963	W	100%			
1964	D	100%		100%	
1965	W	100%			
1966	N	100%	100%		
1967	W	100%			
1968	N	100%	100%		
1969	W	100%			
1970	W	100%			
1971	N	100%	100%		
1972	D	100%		100%	
1973	W	100%			
1974	W	100%			
1975	N	100%	100%		
1976	D	100%		100%	
1977	D	100%			
1978	W	100%			
1979	N	100%	100%		
1980	W	100%			
1981	D	100%		100%	
1982	W	100%			
1983	W	100%			
1984	N	100%	100%		
1985	D	100%		100%	
1986	W	100%			
1987	D	100%		100%	100%
1988	D	100%			100%
1989	D	100%			100%
1990	D	95%			95%
1991	N	95%	95%		

1992	D	90%		90%	
1993	W	95%			
1994	D	95%		95%	
1995	W	100%			
1996	W	100%			
1997	W	100%			
1998	W	100%			
1999	N	100%	100%		
2000	N	100%	100%		
2001	D	100%		100%	
2002	N	100%	100%		
2003	N	100%	100%		
2003	W	100%			
2004	N	100%	100%		
2005	N	100%	100%		
2006	W	100%			
2007		100%			
	Average	98%	99%	98%	89%

*Includes first year of consecutive dry years

Appendix C

SOLANO IRRIGATION DISTRICT – WATER SHORTAGE RISK ASSESSMENT

Solano Irrigation District
Water Supply Shortage Risk Assessment

Prepared for

Solano Irrigation District

DAVIDS ENGINEERING, INC
www.davidsengineering.com

June 2015

Solano Irrigation District
Water Supply Shortage Risk Assessment

Davids Engineering, Inc.
June 2015

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Executive Summary

Prompted primarily by obvious, rapidly changing cropping patterns and irrigation practices in its service area, particularly the rapid expansion of almonds and walnuts, Solano Irrigation District initiated a 2-phase analysis to assess the adequacy of its water supplies. The initial phase was simply to quantify historical agricultural water demands. The second phase involved development of a district water balance as a means of characterizing on-farm and SID distribution system efficiencies, developing projections of future agricultural water demands, and comparing SID's available water supplies to the sum of SID's projected future agricultural water demands and urban water supply obligations. The period of analysis is 2015 through 2059.

Projecting SID's future agricultural water demands is inherently uncertain because those demands depend on a variety of policy, behavioral (economic) and climatological factors that are impossible to predict reliably. This uncertainty was addressed by developing future water demands for seven different scenarios, each representing a unique combination of possible future policy, behavioral and climatological conditions. Specifically, the scenarios were developed according to assumptions made to describe possible future SID cropping patterns, on-farm and SID distribution system efficiencies, permanent crop water use intensity, climate change and urban water supply obligations as summarized Table ES-1. Table ES-1 does not include information for Scenarios 5 and 6 that are described in the body of this report. These two scenarios are identical to Scenario 4 except that they include slightly increased water demands associated with possible future climate change. The increases attributable to possible future climate change are small relative to other factors affecting water demands and they are highly uncertain, so they are not presented in this Executive Summary.

Table ES-1. Future Water Demand Scenario Assumptions Summary

Scenario	Assumed Conditions				
	Cropping Pattern	Efficiency		Actual ET_{aw} Of Permanent Crops, inches	Climate Change
		On-Farm	System		
1	Current	70%	87%	23.2 (Historical Average)	No
2	Current	70%	92%	23.2 (Historical Average)	No
3	Increased	78%	87%	27.2 (Historical 75th Percentile)	No
4	Increased	78%	92%	27.2 (Historical 75th Percentile)	No
4 (2024)[1]	Increased	78%	92%	27.2 (Historical 75th Percentile)	No

[1]Scenario 4 (2024) has Urban Demand increased from existing quantities to the quantities provided for beginning in 2024 according to existing contracts.

The assessment reveals that under all future water demand scenarios, SID's water demands (agricultural and urban) significantly exceed its 141,000 acre-foot (AF) contractual entitlement. Even if groundwater is used at recent historical levels, significant surface water shortages are forecast to occur. The results of the

analysis are summarized in Table ES-2 (which also does not include Scenarios 5 and 6 for the reasons explained above), which shows that projected future average annual shortages will range between approximately 7,000 AF and 27,000 AF depending on the demand scenario. The exception is Scenario 2 for which supplies and demands are estimated to be more or less in balance, on average. However, Scenario 2 is regarded as an unlikely future demand scenario.

The frequencies and related magnitudes of shortages projected to occur under the seven scenarios are presented in Figure ES-1. The frequencies (or probability, or risk) and associated magnitudes of projected future water supply shortages are illustrated in Figure ES-1. The figure indicates that under Scenario 1 (essentially representing a continuation of existing conditions) water shortages will occur in about 50 percent of years and be as large as 30,000 AF, or about 17 percent of the total agricultural and urban water demand. The average annual shortage for Scenario 1 is about 7,000 AF. Scenario 2 represents a possible future condition where SID demands do not increase but SID implements conservation measures to reduce spills by 9,000 AF per year, essentially increasing available supplies by that amount. Consequently, Scenario 2 shortages are estimated to be infrequent and modest; however, as noted above, Scenario 2 is regarded as an unlikely future demand scenario. For all other scenarios, projected shortages significantly exceed those for Scenario 2, with shortages occurring between 53 percent (Scenario 4) and 96 percent (Scenario 4 (2024)) of the years and with maximum annual shortage volumes ranging between approximately 37,000 AF and 60,000 AF. (Note that Figure ES-1 also does not include Scenarios 5 and 6 for the reasons explained above.)

The results of this analysis may not be immediately intuitive because SID has never experienced a surface water shortage in its 56 years of operation. This apparent discrepancy is explained primarily by the assumption that the future conditions used to describe the various scenarios presently exist. In reality, SID is evolving toward these future conditions. Thus, while future shortages are likely to occur, exactly when they will begin is uncertain depending on SID actions, the rate at which on-farm practices and climate change occur and on weather conditions. Avoiding the projected shortages will require that additional water supplies including groundwater be developed, or that water demands be reduced, or some combination of the two. Whether sufficient additional groundwater could be developed sustainably remains a question.

Recommendations stemming from this analysis are as follows:

1) SID should develop and implement a policy for allocating available surface water supplies. A wide variety of options exist for doing this.

2) SID should not wait until water shortages occur to implement conservation measures, but should at a minimum identify the most cost-effective conservation projects and pursue grant and other funding to implement those projects.

3) There is some degree of uncertainty associated with the SID water balance results due primarily to data limitations. SID should assess the sources of uncertainty and identify measurement and recordkeeping improvements that could be implemented to improve data quality and the associated reliability of the water balance. In particular, SID should take measures to more accurately quantify groundwater pumping in the district

Table ES-2. Summary of Average Annual Water Shortage Assessment Results for 2015 through 2059

Future Water Demands Scenario	Ag Demand (at heads of SID laterals)	Surface Water Supply (Reclamation Contract)	Surface Water Supply Minus Ag Demand	Urban Demand	Surface Water Supply Minus Ag and Urban Demand	Groundwater Supply (Total Avg. District + Private)	Total Water Supplies Minus Total Demands (Negatives Equal Unmet Demand)
Scenario 1	138,333	141,000	2,667	18,976	-16,310	9,000	-7,310
Scenario 2	130,815	141,000	10,185	18,976	-8,792	9,000	208
Scenario 3	150,497	141,000	-9,497	18,976	-28,474	9,000	-19,474
Scenario 4	142,318	141,000	-1,318	18,976	-20,294	9,000	-11,294
Scenario 4 (2024 Urban)	142,318	141,000	-1,318	34,929	-36,247	9,000	-27,247

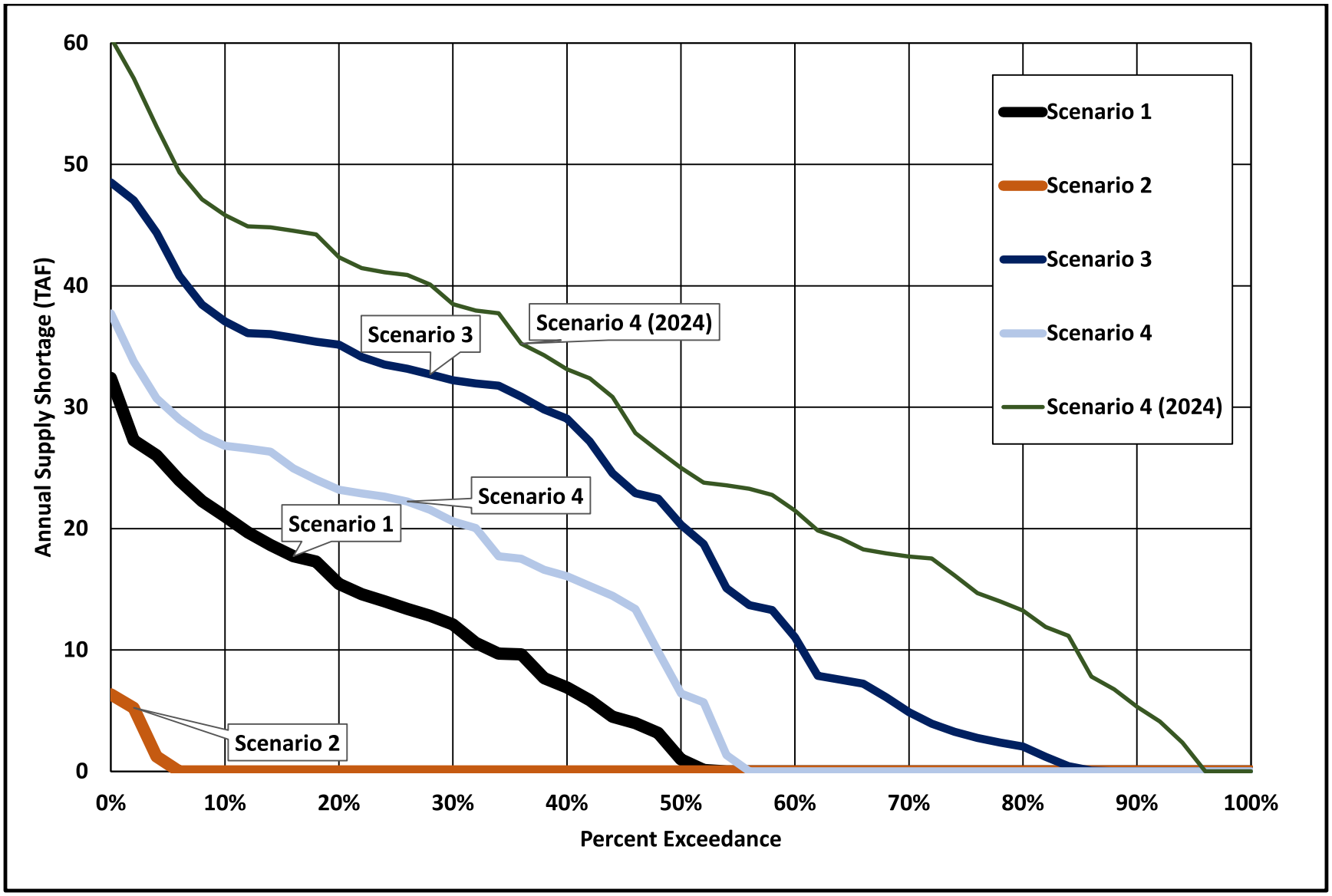

Figure ES-1. Frequency of Projected Future Annual Shortage Equaling or Exceeding the Volumes Indicated

4) SID's surface water allocation and pricing policies have direct implication to groundwater use and management. Particularly in view of the recently enacted Sustainable Groundwater Management Act, SID should undertake investigations to define the limits of sustainable groundwater management in SID and in the Solano Subbasin as a whole (working in collaboration with neighboring local agencies). Such investigations would provide the basis for a comprehensive conjunctive water use program that ensures a high level of water supply reliability and long-term sustainability.

5) The factors posing the greatest uncertainty to SID's future agricultural water supply are associated with cropping and management decisions made by its growers. Therefore, SID should track changes in on-farm conditions to provide a basis for anticipating changes in water demands (as well as in customer service preferences). By comparison, the potential effects of climate change on future agricultural demands appear to be modest.

6) SID should not increase its urban water supply obligations without first defining a regime of sustainable conjunctive water management. The outcome of this effort could be that SID cannot assign more water to urban entities without unacceptably jeopardizing the reliability of its agricultural water supplies, or that provisions should be incorporated into urban water supply agreements that give priority to agricultural water supply under certain conditions.

Introduction

Solano Irrigation District (SID or District) has a fixed contractual entitlement of 141,000 acre-feet (AF) per year of surface water from the federal Solano Project operated by the United States Bureau of Reclamation (Reclamation). Most of the entitlement is used to meet irrigation water demands within the District and some has been dedicated to nearby cities. Over time, municipal water demands have increased as cities have grown. Some of this urban growth has occurred within SID resulting in a reduction of irrigated area and agricultural water demands. Given the general trends of increasing urban water demands and declining agricultural demands, SID has tended to accommodate requests by the cities for additional water without rigorous technical analysis.

However, within SID, permanent tree crops, notably almonds and walnuts, increasingly have been displacing annual crops and pastures. This trend is not unique to SID, but is occurring throughout California's Central Valley. In fact, statewide, almond acreage has increased 65% over the past 10 years, from 620,000 acres to 1,020,000 acres (National Agricultural Statistics Service, 2005 and 2015). Because of the ongoing expansion of tree crops within SID, and because almonds and walnuts are relatively high water use crops, the District felt the need to establish a technical basis to guide its water allocation policy in order to ensure that the District reserves sufficient supplies to meet future agricultural water demands.

An important underlying policy principle is that SID's current and future agricultural water demands should be met with sufficient reliability to ensure that groundwater supplies within the district are managed sustainably. As of January 1, 2015, the Sustainable Groundwater Management Act (SGMA) requires that certain groundwater basins in California be managed sustainably, generally meaning (among other conditions) that groundwater levels cannot decline over the long term (although they are expected to fluctuate over wet and dry hydrologic cycles). SID overlies the Solano Groundwater Basin, which is subject to SGMA, underscoring the importance of SID having a well-founded surface water allocation policy.

SID undertook its water allocation policy analysis in phases. The initial phase was simply to quantify historical agricultural water demands, involving characterizing historical cropping within the district, estimating the total amount of water used by each crop and the portion of use satisfied by irrigation, and summing water demands across crops to estimate district-wide crop water requirements. The results of the Phase 1 analysis were presented to the SID Board of Directors on March 18, 2014 at which time the Board authorized staff to proceed with a second phase of the analysis. The second phase involved development of a district water balance as a means of characterizing on-farm and SID distribution system efficiencies, developing projections of future agricultural water demands under a range of different development scenarios, and comparing SID's available water supplies to the sum of SID's projected future water demands and urban water supply obligations. The Phase 2 analysis is described in this report and is generally referred to as the Shortage Risk Assessment (Assessment).

Objectives

The primary objective of the Assessment is to establish a technical basis for the District's water allocation policy. Secondary objectives of the water balance prepared for the Assessment are to provide essential information for completing the District's System Optimization Review and to support a wide range of SID water management initiatives.

Methodology

The reliability of SID's agricultural water supplies was assessed by comparing projected future water demands to available supplies on an annual basis. The assumption was made that SID's future water supplies, particularly its 141,000 AF per year contractual entitlement from Reclamation, will not change in the future. Consequently, the Assessment focused primarily on estimating future water demands (although the reliability of SID's contractual entitlement could be evaluated as part of refining this analysis). Estimating future demands involved developing an historical district water balance to characterize on-farm and system performance, developing a range of future water demand scenarios and assessing the reliability of future water supplies through a water shortage analysis. The methodologies used for each of the elements are described below.

Water Balance

Recognizing that agricultural water demands depend not just on crop types and weather conditions, but also on the efficiency of on-farm water application and SID's distribution system, a district water balance was developed for recent historical conditions to determine these characteristics on a district-wide, aggregate basis. The water balance was also used to quantify groundwater recharge within SID and as a basis for estimating potential on-farm and district water conservation.

A water balance accounts for all water entering and leaving a 3-dimensional volume over a defined period of time. For a water balance to yield meaningful results, its spatial and temporal boundaries must be clearly and strategically defined, and all flows across the defined boundaries and any changes in water storage within the boundaries must be accounted for during the selected period of analysis. This generally includes surface water, groundwater, rainfall, and exchanges with the underlying groundwater system via pumping and deep percolation.

The water balance structure developed for SID is shown in Figure 1. It includes three accounting centers and associated flow paths. The water balance was completed for 1991 through 2014, on an annual time step for 1991 through 2003 and on a monthly time step for 2004 through 2014. This period was selected because it includes a range of wet to dry hydrologic conditions and because SID's cropping and operational records are sufficiently reliable. The water balance was not developed for earlier years because operational records are less reliable and on-farm and system conditions prior to 1991 are less representative of current conditions. The water balance was completed for the full year (as opposed to for the crop growing season only) in order to account for winter precipitation stored in the root zone and used by crops or percolating beyond the root zone to become groundwater recharge. Natural flows into SID from adjoining watersheds were not included in the balance because those flows generally do not contribute to SID's agricultural water supplies and they are difficult to estimate.

As presented in the Results section, the water balance was used to characterize on-farm and SID distribution system efficiency, to quantify groundwater recharge within SID and to quantify potential future water conservation. Development of the water balance, including discussion of available data and the techniques used for calculating and estimating each flow path are described in a separate report: Solano Irrigation District Water Balance Description and Results (2015).

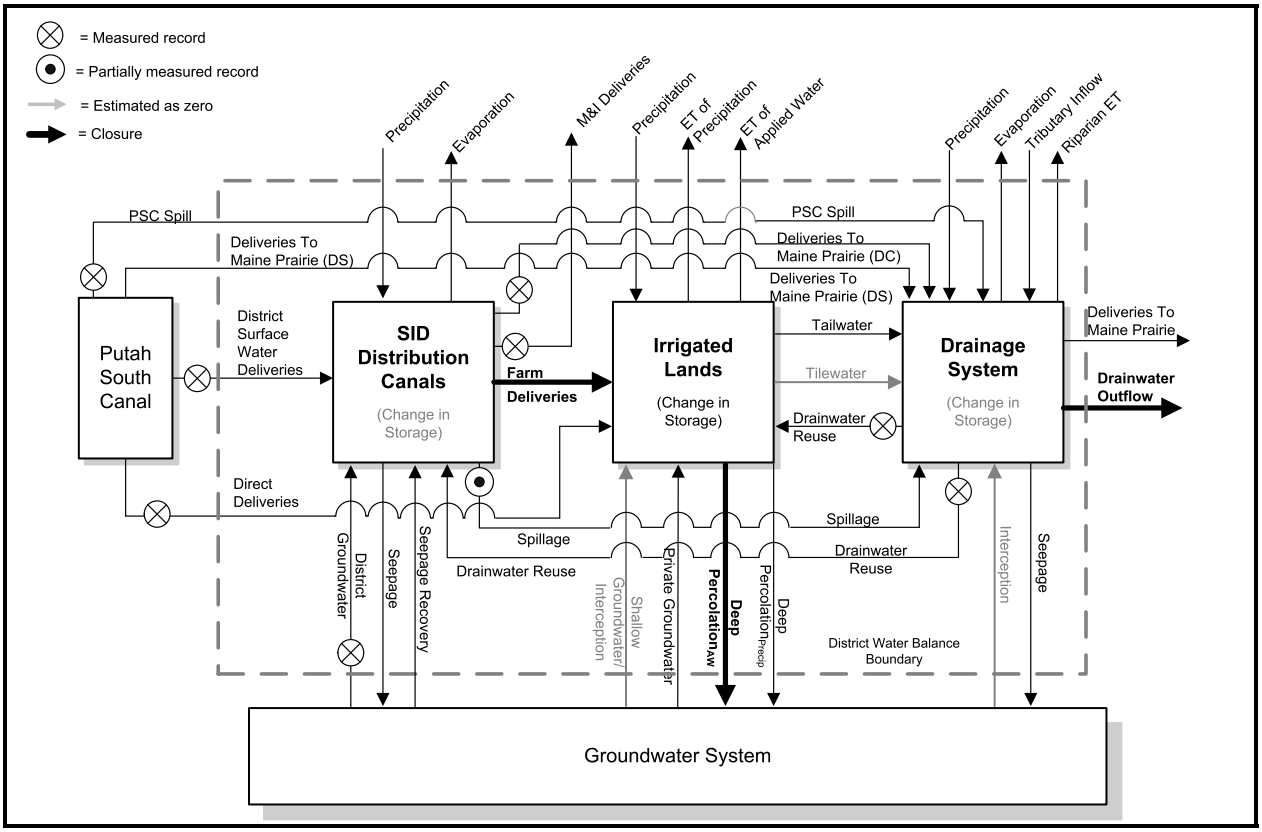

Figure 1. SID Water Balance Structure

Future Water Demand Scenarios

Projecting SID's future agricultural water demands is inherently uncertain because those demands depend on a variety of policy, behavioral (economic) and climatological factors that are impossible to predict reliably. This uncertainty was addressed by developing future water demands for seven different scenarios, each representing a unique combination of possible future policy, behavioral and climatological conditions. Specifically, the scenarios were developed according to assumptions made to describe possible future SID cropping patterns, on-farm and SID distribution system efficiencies, permanent crop water use intensity, climate change and urban water supply obligations. The seven scenarios and associated assumptions are described in the Results section.

Shortage Analysis

For each scenario, its projected water demands were compared to assumed future water supplies, including SID's contractual surface water entitlement and groundwater. The analysis was made for a 45-year period from 2015 through to 2059, on an annual time step. For each year, the sum of projected agricultural water demands and SID's contractual urban water supply obligations are subtracted from the available supplies. If supplies equal or exceed demands, then no shortage occurs and any surplus is carried over to become part of the next year's available supplies. This approach is consistent with SID's contract with Reclamation, which allows unused water in any year to be carried over to the subsequent year (or years), except that any SID carryover is zeroed out if Lake Berryessa spills[1]. Alternatively, if demands exceed supplies, this represents a water shortage that in reality would have to be made up by reducing water demands (temporary fallowing, for example) or increasing water supplies, or some combination of the two.

As noted above, it was assumed that SID's 141,000 AF per year contractual entitlement from Reclamation remains available into the future. Further, it was assumed that future groundwater use would be similar to recent historical use determined from the water balance, although the supply-demand spreadsheet model allows the user to specify any quantity of groundwater use desired.

Results

Results for the water balance (as they pertain to this analysis), the future water demand scenarios and the shortage analysis are presented in the following sections.

Water Balance

The SID water balance analysis provides a platform for comprehensive assessment of historical water use in the district and for identifying water management improvement opportunities. For the Water Shortage Assessment, the water balance was used to assess historical on-farm and distribution system efficiencies, to assess the potential to conserve water and to quantify groundwater recharge. Each of these factors is described in the following sections.

[1] Lake Berryessa operations were not simulated for this analysis, so any loss of SID carryover due to the reservoir spilling is not represented. However, Lake Berryessa rarely spills, so this limitation is not considered to have a significant effect on estimated water supplies or the results of the Assessment.

On-farm and Distribution System Efficiencies

A Consumptive Use Fraction (CUF) was calculated for the Irrigated Lands accounting center as the ratio of evapotranspiration of applied water (ET_{aw}) to the sum of farm deliveries, direct deliveries, private pumping and drainwater reuse. The CUF essentially represents the efficiency of on-farm water application. The CUF varied from 59 to 77 percent, and averaged 69 percent from 2004 through 2014. This period within the full 1991 through 2014 water balance period is regarded as being most the most reliable indicator of existing on-farm efficiency. For purposes of the Assessment, existing on-farm efficiency was assumed to be 70 percent.

For the SID Distribution Canals, delivery efficiency was computed as the ratio of the Farm Deliveries to the sum of District Surface Water Deliveries from the Putah South Canal (into SID lateral headings), District Groundwater, Drainwater Reuse and Seepage Recovery. This performance indicator varied from 82 percent to 91 percent and averaged 87 percent over the 1991 through 2014 period for the months representing the irrigation season. The average value was used to represent existing system efficiency.

Conservation Assessment

Based on the water balance results, the potential to conserve water through improvements to the District distribution system should focus on spillage reduction rather than seepage reduction. This is because spillage flows into drains that flow out of SID whereas seepage contributes to groundwater recharge within SID and may be recovered by pumping. Additionally, most of the distribution system is either lined or pipelined and the areas that remain unlined are areas where seepage has been observed to be relatively low. Average annual spillage of about 10,500 AF has been reduced to about 9,500 AF in recent years due to the installation and availability of SCADA. Based on professional judgment, it was estimated that strategic, system-wide application of SCADA, possibly in conjunction with regulating reservoirs, would allow SID to reduce spillage to 1,000 AF annually.

On-farm conservation potential was expressed in terms of increased on-farm application efficiency relative to existing conditions. Based on professional judgment, it was assumed that on-farm efficiency could be increased from the existing district-wide average of 70 percent to 78 percent. This increase is generally associated with the ongoing rapid conversion from surface irrigation to pressurized irrigation, particularly the adoption of drip and micro-sprinkler systems for permanent crop irrigation. This trend is expected to continue as more permanent crops are planted within SID.

Net Groundwater Recharge

SID overlies the Solano Subbasin (Subbasin 5-21.66) of the Sacramento Valley Groundwater Basin as defined by the Department of Water Resources (DWR, 2003). In the context of supply reliability, understanding net recharge to the subbasin resulting from SID and landowner activities is important because it helps to assess the extent to which forecast surface water supply shortages might be offset by increased groundwater pumping on a sustainable basis.

Losses from SID, primarily deep percolation of applied surface water and seepage from District canals, serve as primary sources of recharge to the subbasin, which is considered to have generally stable groundwater levels in the long-term (SCWA, 2014). Groundwater elevation contours indicate that groundwater flows generally eastward toward the Sacramento River. During the irrigation season, the District recharges an average of about 51,000 AF, including 25,000 AF from deep percolation of precipitation (annually), 15,500 AF from deep percolation of applied water and 10,200 AF of seepage

from the distribution and drainage systems. The District and private landowners pumped an average of 15,800 AF from 1991 through 2014, averaging about 9,000 AF annually over the last 11 years. Thus, historically, annual net groundwater recharge due to SID and landowners operations is about 35,500 AF each year. During the study period, net recharge varied from a low of 9,100 AF in 1992 (a dry year) to a high of about 63,600 acre-feet in 1998 (a wet year) (Figure 2). The majority of the variation in net recharge is associated with variability in precipitation from year to year.

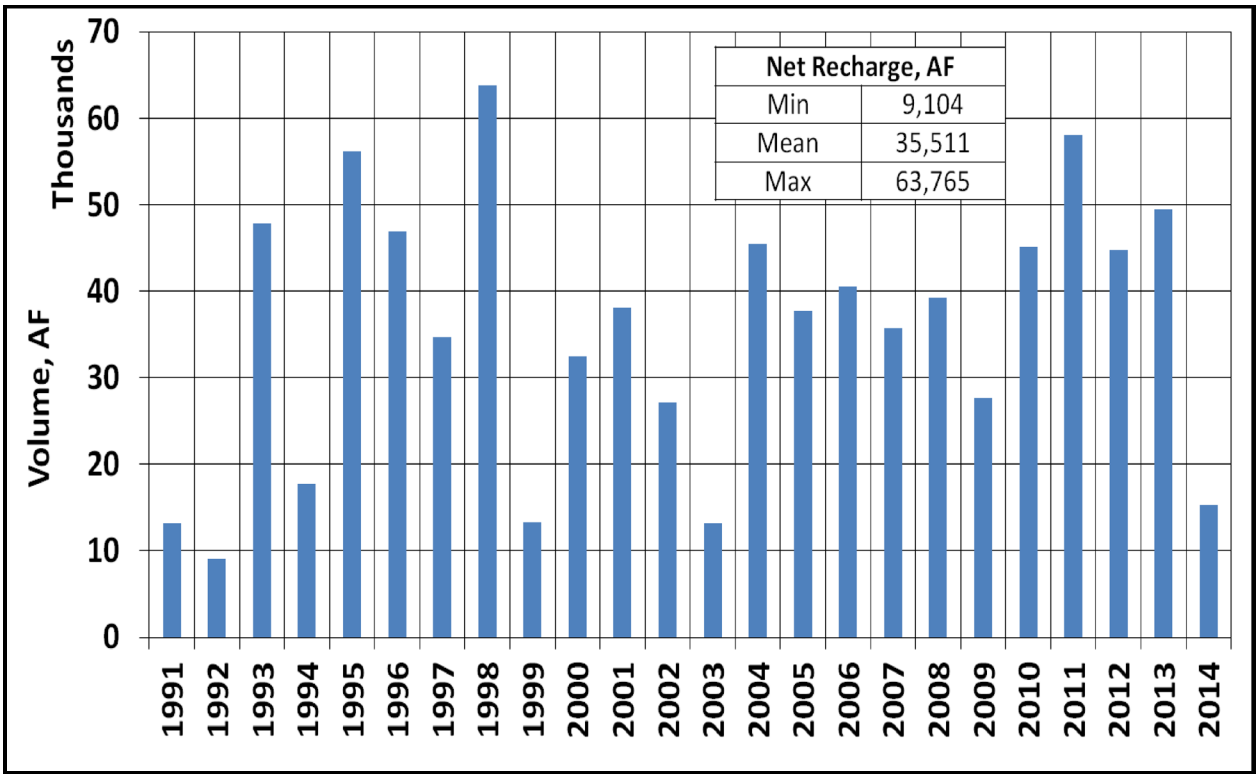

Figure 2. Net Groundwater Recharge

Future Demand Scenarios

As previously described, seven scenarios were developed to represent a range in future water demands to be used in evaluating future water supply shortages. Each scenario is formed by a unique combination of assumptions regarding future cropping patterns, on-farm and system efficiency and different possible future cropping patterns, on-farm and SID distribution system efficiencies, permanent crop water use intensity, climate change and urban water supply obligations. The seven scenarios are described in the following sections. The different sets of assumptions defining the scenarios are summarized in Table 1.

All scenarios assume that SID's future urban water supply obligations will remain as they presently are under existing water supply contracts, except that Scenario 4 is also evaluated assuming that urban demands increase in 2024 to the quantities provided for in existing contracts.

Table 1. Future Water Demand Scenario Assumptions Summary

Scenario	Assumed Conditions				
	Cropping Pattern	Efficiency		Actual ET_{aw} Of Permanent Crops, inches	Climate Change
		On-Farm	System		
1	Current	70%	87%	23.2 (Historical Average)	No
2	Current	70%	92%	23.2 (Historical Average)	No
3	Increased	78%	87%	27.2 (Historical 75th Percentile)	No
4	Increased	78%	92%	27.2 (Historical 75th Percentile)	No
5	Increased	78%	92%	27.2 (Historical 75th Percentile)	Low
6	Increased	78%	92%	27.2 (Historical 75th Percentile)	High
4 (2024)[1]	Increased	78%	92%	27.2 (Historical 75th Percentile)	No

[1]Scenario 4 (2024) has Urban Demand increased from existing quantities to the quantities provided for beginning in 2024 according to existing contracts.

The demand projections for all scenarios are based on historical weather conditions for 1970 through 2014, reflecting the global assumption that future climate conditions will be like recent historical conditions. The exception is that under Scenarios 5 and 6, demands are factored up according to published information to reflect the effects of climate change on crop ET. Minimum, average and maximum reference evapotranspiration (ET_o) and precipitation for the analysis period are presented in Table 2, illustrating that the period includes a wide range of weather conditions.

Table 2. Reference ET (ET_o) and Precipitation during the 1970 through 2014 Period of Analysis

Statistic	ET_o (in)	Precipitation (in)
Minimum	47.8	4.7
Average	56.7	18.1
Maximum	63.0	37.4

Scenario 1

Scenario 1 essentially represents no change from existing conditions. The "Current" cropping pattern represents existing conditions in SID with approximately 42,000 acres under irrigation. This is based on SID's 2014 cropping records plus new orchards that have been identified by SID staff. Additionally, on-farm and system efficiencies remain at existing levels as determined by the water balance, the intensity of permanent crop water use (ET_{aw}) remains the same as it has been in recent years, and climate does not change. In view of easily observable trends of increasing permanent crops and associated adoption of pressurized on-farm irrigation systems, Scenario 1 is probably not a realistic depiction of future conditions. Nevertheless, it provides a useful point of reference.

Scenario 2

Scenario 2 is different from Scenario 1 only with respect to distribution system efficiency, which is assumed to increase from the existing average of 87 percent to an average of 92 percent. The increased efficiency results in a demand reduction of 7,518 AF annually. Scenario 2 represents a condition where SID implements system conservation measures but demands otherwise remain essentially as they are today.

Scenario 3

Under Scenario 3, it is assumed that cropping patterns in SID change, resulting in an increased proportion of permanent crops (consistent with ongoing trends) and a net increase in irrigated area from the existing 42,000 acres to 46,000 acres. Specifically, it is assumed that tree/vine crops will comprise 63 percent[2] of the crop mix, with the acreages of other crops reduced proportionally to accommodate the increase in tree/vine acreage. The crops comprising the Current and Increased cropping conditions are illustrated in Figure 3, along with actual cropping patterns for the averages of 1991 through 2014 and 2001 through 2014 and the individual years of 2014 and 2015, for purposes of comparison. Relative to 2015, the "Increased" cropping pattern appears to be reasonable and may even under-estimate SID's future irrigated area.

Additionally, on-farm irrigation efficiency is assumed to increase from the existing 70 percent to 78 percent and the average intensity of permanent crop ET_{aw} is assumed to increase. The increased future permanent crop ET_{aw} is equal to the 75th percentile ET_{aw} for permanent crops in SID as determined by remote sensing energy balance analyses for 2007 and 2009. The effect of this assumption is that tree/vine ET_{aw} increases by an average of 4.1 inches per year over the period of analysis as shown in Table 3.

Under Scenario 3, it is assumed that despite the assumed increases in farm delivery requirements SID does not implement system conservation projects and the system efficiency remains at existing levels. No climate change is also assumed.

[2] Estimate based on representative soil textures and areas assumed suitable for high production almond cultivation.

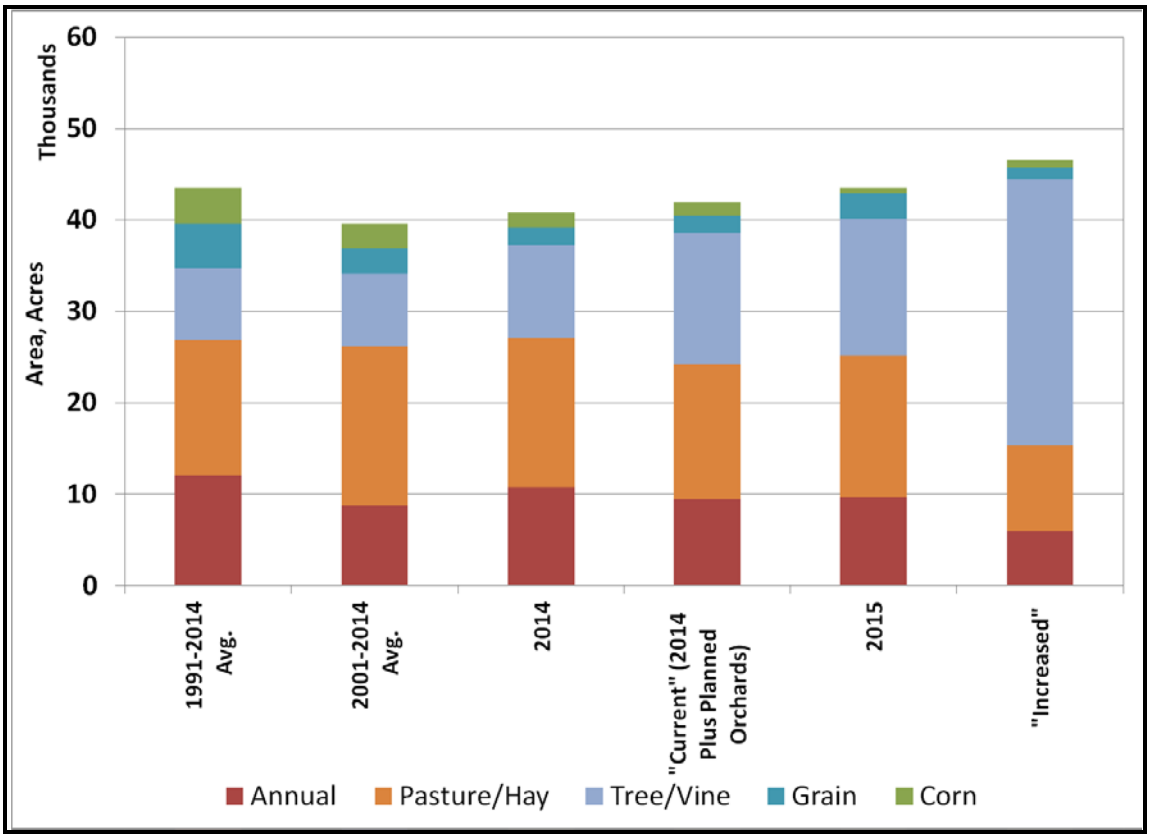

Figure 3. SID Recent Historical Cropping Compared to Cropping Assumed for Shortage Scenarios

Table 3. Increased Average Actual ET_{aw} for Trees/Vines Crop Group (Scenarios 3, 4 and 4 (2024))

IDC Model Results (1970-2014)	ET_{aw}, inches			Difference (75 Percent – Avg.)		
	Min.	Max.	Avg.	Min.	Max.	Avg.
ET_{aw} (Avg2007and2009 SEBAL)	15.9	29.0	23.2	2.1	6.2	4.1
ET_{aw} (Avg2007and2009 75 Percentile SEBAL)	19.1	33.7	27.2			

Scenario 4

Scenario 4 is identical to Scenario 3, except that system efficiency is assumed to increase from 87 to 92 percent, as described under Scenario 2. The increased efficiency results in a demand reduction of 8,180 AF annually. Scenario 4 is regarded as the "most likely" representation of future conditions. A variation of Scenario 4 with future urban demands increased to the levels allowed by existing contracts beginning in 2024 is also analyzed (representing the seventh demand scenario analyzed).

Scenarios 5 and 6

Scenarios 5 and 6 are identical to Scenario 4 except that agricultural demands are increased to reflect the possible effects of climate change. A reconnaissance-level assessment of the effects of climate change was completed through review of information developed by others. Reclamation's West-Wide Climate

Risk Assessment: Irrigation Demand and Reservoir Evaporation Projections (Reclamation, 2015), the primary resource, utilizes future climate projections from global climate models (GCMs) to simulate crop evapotranspiration and resulting net irrigation requirements.

Impact models used the projected temperature and precipitation results to develop projected ET. Increases in ET are projected to range from 1.5 to 3.4 percent during the 2020's period, 3.0 to 5.6 percent during the 2050's period, and 4.6 to 7.5 percent during the 2080's period. For this study, two plausible climate change scenarios were selected:

- Low Increase: 1.5 percent increase in ET_{aw} and no change for precipitation, and
- High Increase: 3.4 percent increase in ET_{aw} and no change for precipitation.

The Low Increase resulted in a demand increase of 2,135 AF to Scenario 4 and was used for Scenario 5. The High Increase resulted in a demand increase of 4,839 AF to Scenario 4 and was used for Scenario 6.

Shortage Analysis

The results of the shortage analysis are summarized in Table 4. Average annual agricultural water demands are projected to range between approximately 131,000 AF (Scenario 2) and 150,000 AF (Scenario 3). SID's annual surface water entitlement of 141,000 is roughly adequate for meeting projected agricultural demands across all scenarios (except for Scenario 2, which shows supply surplus) but is not adequate for meeting projected future agricultural and urban demands combined. Neglecting groundwater as a supply source, average annual surface water supply shortages range between approximately 9,000 AF and 36,000 AF. When the assumed 9,000 AF per year of groundwater is added to the supply, shortages are reduced commensurately but still occur for all scenarios except Scenario 2.

The frequencies (or probability, or risk) and associated magnitudes of projected future water supply shortages are illustrated in Figures 4 and 5. The two figures are based on identical data, but in Figure 4 the magnitude of the annual supply shortage is presented as a volume while in Figure 5 the shortage is expressed as a percentage of the total water demand in the year of shortage. Figure 4 indicates that under Scenario 1 (essentially representing a continuation of existing conditions) water shortages will occur in about 50 percent of years and be as large as 30,000 AF, or about 17 percent of the total agricultural and urban water demand (Figure 5). As indicated in Table 4, the average annual shortage for Scenario 1 is about 7,000 AF.

As described above, Scenario 2 represents a possible future condition where SID demands do not increase but SID implements conservation measures to reduce spills by 9,000 AF per year, essentially increasing available supplies by that amount. Consequently, Scenario 2 shortages are estimated to be infrequent and modest; however, Scenario 2 is regarded as an unlikely future demand scenario.

For all other scenarios, projected shortages significantly exceed those for Scenario 2, with shortages occurring between 53 percent (Scenario 4) and 96 percent (Scenario 4 (2024)) of the years and with maximum annual shortage volumes ranging between approximately 37,000 AF and 60,000 AF (Figure 4).

Expressed as a percentage of the annual total (agricultural and urban) demand, maximum shortages would range between about 20 percent and 28 percent (Figure 5).

Table 4. Summary of Average Annual Water Shortage Assessment Results for 2015 through 2059

Future Water Demands Scenario	Ag Demand (at heads of SID laterals)	Surface Water Supply (Reclamation Contract)	Surface Water Supply Minus Ag Demand	Urban Demand	Surface Water Supply Minus Ag and Urban Demand	Groundwater Supply (Total Avg. District + Private)	Total Water Supplies Minus Total Demands (Negatives Equal Unmet Demand)
Scenario 1	138,333	141,000	2,667	18,976	-16,310	9,000	-7,310
Scenario 2	130,815	141,000	10,185	18,976	-8,792	9,000	208
Scenario 3	150,497	141,000	-9,497	18,976	-28,474	9,000	-19,474
Scenario 4	142,318	141,000	-1,318	18,976	-20,294	9,000	-11,294
Scenario 4 (2024 Urban)	142,318	141,000	-1,318	34,929	-36,247	9,000	-27,247
Scenario 5	144,453	141,000	-3,453	18,976	-22,429	9,000	-13,429
Scenario 6	147,157	141,000	-6,157	18,976	-25,133	9,000	-16,133

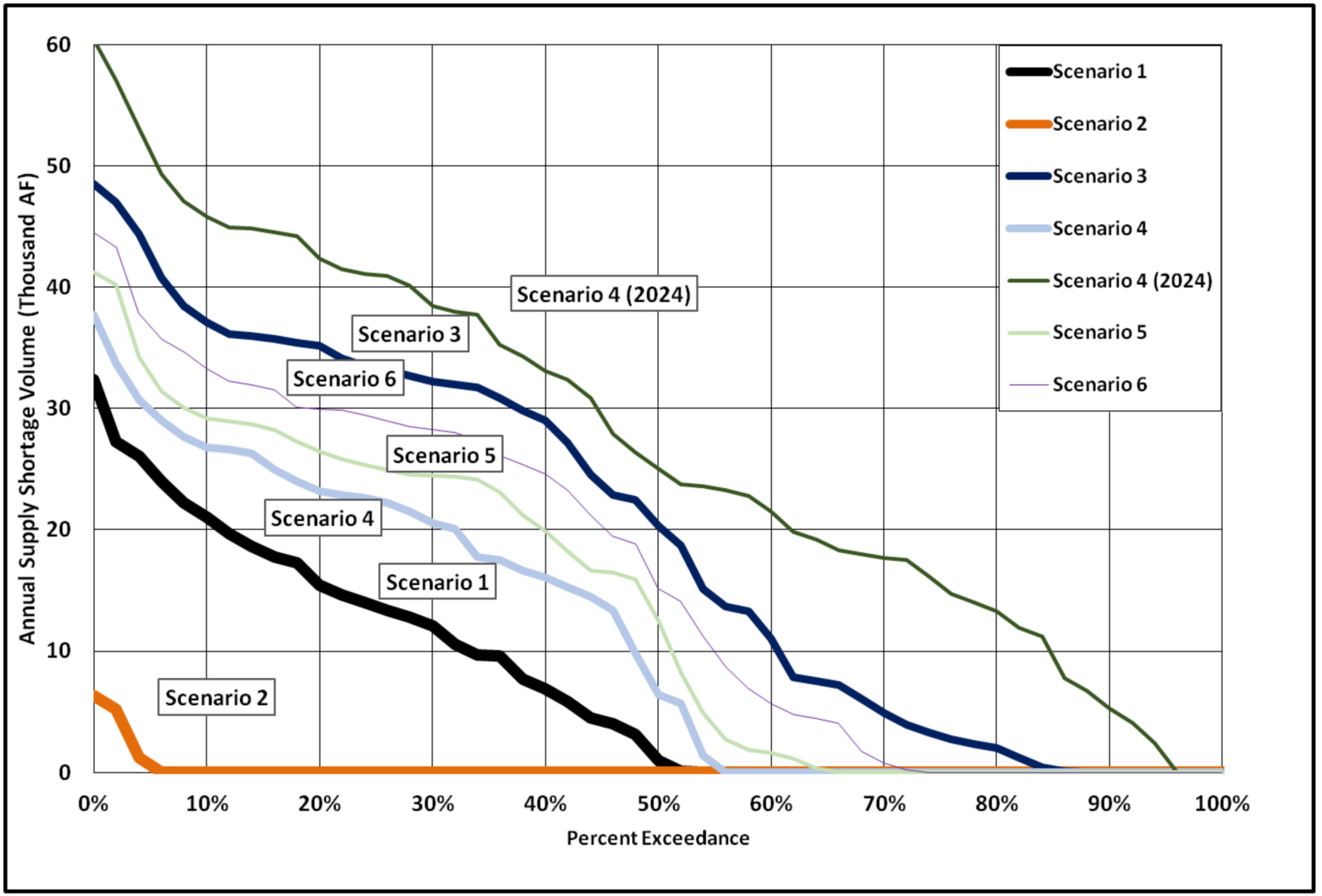

Figure 4. Frequency of Projected Future Annual Shortage Equaling or Exceeding the Volumes Indicated

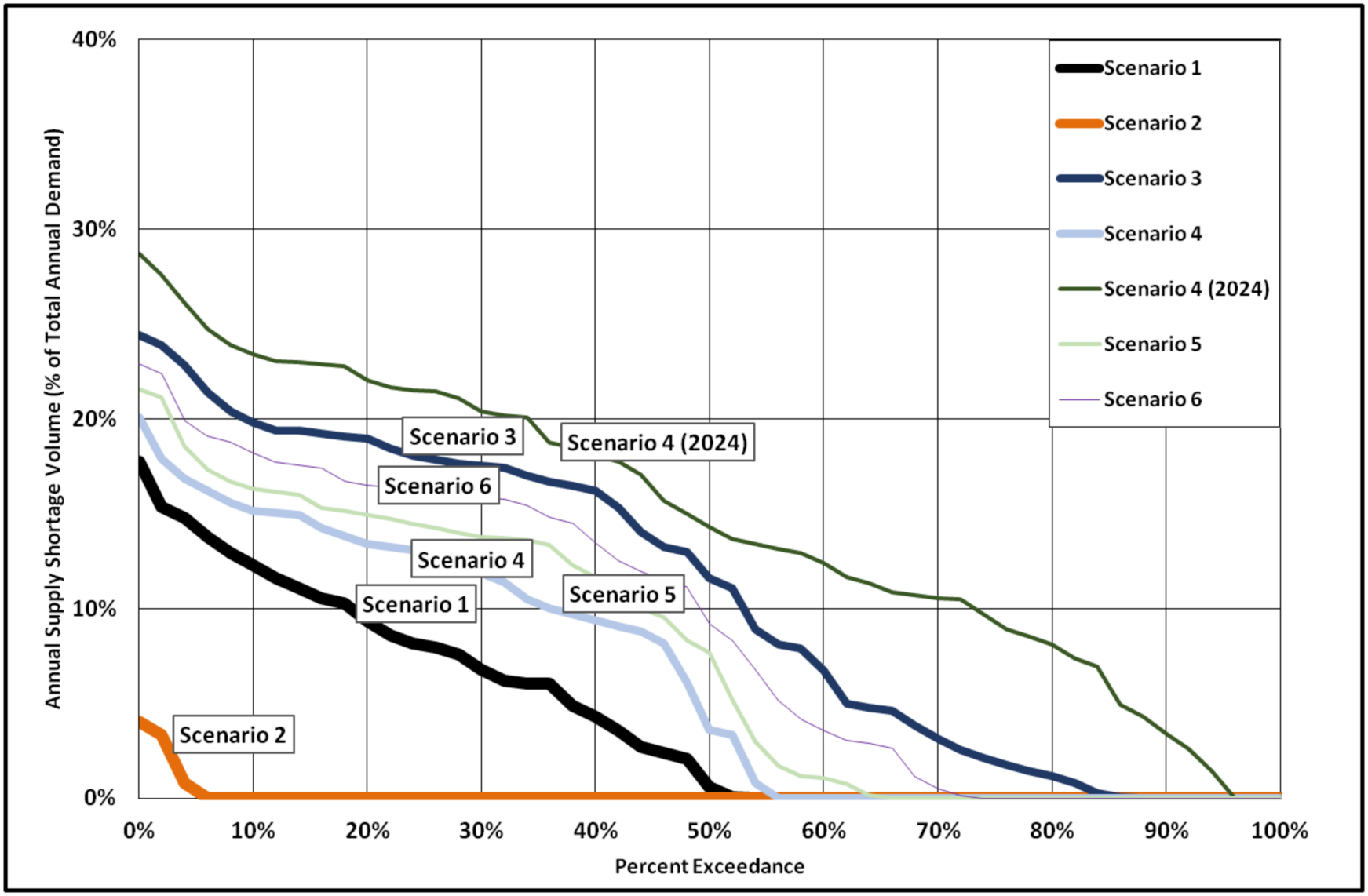

Figure 5. Frequency of Projected Future Annual Shortage Equaling or Exceeding the Percentages of Total Demand Indicated

Table 5 lists the maximum Lake Berryessa carryover and maximum shortage projected to occur over the 45-year period of analysis (2015-2059). Consistent with the foregoing results, the largest carryover and smallest maximum shortage are associated with Scenario 2 and the smallest carryover and largest maximum shortage are associated with Scenario 4 (2024).

Tables 6 and 7 present the shortage results in additional, different forms to allow further comparison among the supply and demand scenarios. For each scenario, Table 6 presents the percentage of years in the 45-year period of analysis that shortages would exceed zero, 5,000 AF and 20,000 AF. Table 7 presents the percentage of annual agricultural demand that would be unmet 10, 25 and 50 percent of the time.

Table 5. Maximum Carryover and Shortages by Scenario

Scenario	Maximum Carryover (AF)	Maximum Shortage (AF)
Scenario 1	48,030	32,416
Scenario 2	103,807	6,347
Scenario 3	23,138	48,532
Scenario 4	36,057	37,727
Scenario 4 (2024 urban)	11,123	60,429
Scenario 5	28,695	41,269
Scenario 6	25,560	44,518

Table 6. Percentage of Years in the 45-Year Period of Analysis with Shortages Exceeding Zero, 5,000 AF and 20,000 AF

Scenario	Percent Years with Shortage > 0 AF	Percent Years with Shortage > 5,000 AF	Percent Years with Shortage > 20,000 AF
Scenario 1	53	43	12
Scenario 2	6	2	0
Scenario 3	86	70	50
Scenario 4	55	53	32
Scenario 4 (2024 urban)	96	90	62
Scenario 5	66	54	40
Scenario 6	72	62	46

Table 7. Percentage of Annual Agricultural Demand Not Met in 10, 25 and 50 Percent of the Years in the 45-Year Period of Analysis

Scenario	Percent Demand Unmet 10% of the Time	Percent Demands Unmet 25% of the Time	Percent Demands Unmet 50% of the Time
Scenario 1	12	8	1
Scenario 2	0	0	0
Scenario 3	20	18	12
Scenario 4	15	13	4
Scenario 4 (2024 urban)	23	22	14
Scenario 5	16	14	8
Scenario 6	18	16	9

Conclusions and Recommendations

The future demand scenarios developed for this analysis represent a plausible range of possible future SID conditions, reflecting possible changes in irrigated area and cropping patterns, intensity of permanent crop water use, on-farm and system efficiency and climate. For all scenarios except Scenario 2, which is considered to be an unlikely future condition, frequent and appreciable shortages of SID surface water are forecast to occur given SID's current urban water supply obligations. Per existing contracts, these obligations increase in 2024 and will result in commensurate increases in future water supply shortages. Under the most challenging future conditions when urban supply obligations increase (Scenario 4 (2024)), SID agricultural customers are forecast to experience water supply shortages 96 percent of the time, with maximum shortages of up to 60,000 AF, or 28 percent of total demand (agricultural and urban), in any given year.

These results are based on the assumption that SID and its landowners will continue to pump groundwater at recent historical levels (approximately 9,000 AF per year). Actual shortages would be less to the extent that SID and/or landowners pump additional groundwater or water demands are reduced, or some combination of the two. Whether sufficient additional groundwater could be developed sustainably remains a question.

The results of this analysis may not be immediately intuitive because SID has never experienced a water shortage in its 56 years of operation. This apparent discrepancy is explained primarily by the assumption that the future conditions used to describe the various scenarios presently exist. In reality, SID is evolving toward these future conditions. Thus, while future shortages are likely to occur, exactly when they will begin is uncertain depending on SID actions and the rate at which on-farm practices and climate occur.

The potential effects of climate change on future agricultural water consumption and demands are small relative to the potential effects of changing cropping patterns and increased ET_{aw} due to improved farming practices.

Recommendations stemming from this assessment are as follows:

1) SID should develop and implement a policy for allocating available surface water supplies. A wide variety of options exist for doing this.

2) SID should not wait until water shortages occur to implement conservation measures, but should at a minimum identify the most cost-effective conservation projects and pursue grant and other funding to implement those projects.

3) There is some degree of uncertainty associated with the SID water balance results due primarily to data limitations. SID should assess the sources of uncertainty and identify measurement and recordkeeping improvements that could be implemented to improve data quality and the associated reliability of the water balance. In particular, SID should take measures to more accurately quantify groundwater pumping in the district.

4) SID's surface water allocation and pricing policies have direct implication to groundwater use and management. Particularly in view of the recently enacted Sustainable Groundwater Management Act, SID should undertake investigations to define the limits of sustainable groundwater management in SID and in the Solano Subbasin as a whole (working in collaboration with neighboring local agencies). Such investigation would provide the basis for a comprehensive conjunctive water use program that ensures a high level of water supply reliability and long-term sustainability.

5) The factors posing the greatest uncertainty to SID's future agricultural water supply are associated with cropping and management decisions made by its growers. Therefore, SID should track changes in on-farm conditions to provide a basis for anticipating changes in water demands (as well as in customer service preferences). By comparison, the potential effects of climate change on future agricultural demands appear to be modest.

6) SID should not increase its urban water supply obligations without first defining a regime of sustainable conjunctive water management. The outcome of this effort could be that SID cannot assign more water to urban entities without unacceptably jeopardizing the reliability of its agricultural water supplies, or that provisions should be incorporated into urban water supply agreements that give priority to agricultural water supply under certain conditions.

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Appendix D

DROUGHT MEASURES AND WATER ALLOCATION AGREEMENT

SOLANO PROJECT MEMBERS'
AGREEMENT AS TO DROUGHT MEASURES
AND WATER ALLOCATION

THIS AGREEMENT, dated as of March 1, 1999, by and among the Solano Irrigation District, a California Irrigation District (hereinafter referred to as "SID"), Maine Prairie Water District, (hereinafter referred to as "MPWD"), the City of Fairfield, a California municipal corporation (hereinafter referred to as "Fairfield"), the City of Vacaville, a California municipal corporation (hereinafter referred to as "Vacaville"), the City of Suisun City (hereinafter referred to as "Suisun"), and the City of Vallejo, a California municipal corporation (hereinafter referred to as "Vallejo"), individually referred to or collectively referred to in this Agreement as "Party" or "Parties," respectively, is made and entered into and the Parties do, for full and adequate consideration, receipt of which is hereby acknowledged, agree as follows:

Section 1.0: Background Facts

1.1 The Parties are all, through contracts with the Solano County Water Agency ("SCWA"), Participating Agencies of the Solano Project, entitled to annual deliveries of water from the Solano Project in the following amounts:

Name of Party	Annual Entitlement (Acre-Feet ("AF")/Water Year)
Solano Irrigation District	141,000
Fairfield	9,200
Vacaville	5,600
Suisun City	1,600
Maine Prairie	15,000
Vallejo	14,750
Total:	187,150

The present contract between the United States and SCWA for Solano Project water supply ("Solano Project Master Contract") expires in 1999, and negotiations between the United States and SCWA for Solano Project Master Contract renewal and extension are underway, and the Member Unit Parties' contracts with SCWA for the annual entitlements will be extended or renewed.

1.2 The Parties wish to provide for this Agreement as to the measures to be used in regard to the accounting of water not used from a Party's annual entitlement from the Solano Project in a year after renewal, and also to provide for contractually agreed-to and enforceable curtailments in the amounts of water taken under the respective Parties' annual entitlements during certain drought conditions. This Agreement provides for the accounting of and preservation of the rights of the Parties to those waters which are voluntarily or mandatorily curtailed.

1.3 The Parties wish to further provide in this Agreement for special measures which SID will implement should the drought conditions deepen and become more severe, resulting in reduction of storage in Lake Berryessa to certain levels despite all reasonable efforts of the Parties.

1.4 The Parties agree that each of the Background Facts in Section 1.0 *et seq.* is true and correct, and a portion of the consideration for this Agreement.

Section 2.0: Definitions.

2.1 The phrase "Storage in Lake Berryessa" shall mean the amount of water stored on the date specified in this Agreement within Lake Berryessa (i) excluding any amounts of water in dead storage which may not be physically released or diverted from Lake Berryessa for any reason, (ii) excluding any amounts of water held on that date in Voluntary Carryover Accounts by the Parties to this Agreement, but (iii) including any amounts of water held in Restricted Carryover Accounts by the Parties on that date. The Storage in Lake Berryessa shall be calculated utilizing the most current elevation capacity curve for Lake Berryessa approved by the United States.

2.2 The phrase "annual entitlements" shall mean the amount of water a Party is entitled to delivery each water year in the amounts set forth in Paragraph 1.1 above, where each "water year" begins on March 1, and ends on the last day of the following February, as set forth in the present contracts.

Section 3.0: Renewal Contracts of Parties

3.1. The Parties agree that the Parties shall each be entitled to renewal of their

Contract with SCWA for the purchase of water from the Solano Project annually on the basis of the annual amounts set forth in Paragraph 1.1 above.

3.2 It shall be a precondition to the enforceability of this Agreement that each of the Parties shall have received and accepted a renewal contract for Solano Project Water in the above amounts from SCWA ("Renewal Participating Agency Contract") and that the terms of those agreements have been accepted by each Party and approved by the United States Department of Interior, Bureau of Reclamation, if such approval is required by the Solano Project Master Contract, and the Renewal Participating Agency Contracts have each been validated in accordance with the provisions of California Code of Civil Procedure section 860, *et seq.* It shall be a further precondition of the enforceability of this Agreement that no material change has been made in the terms and provisions of each Renewal Participating Agency Contract including, without excluding other material changes, that:

3.2.1 The term of all of the Renewal Participating Agency Contracts shall be equivalent to the term of the renewed Solano Project Master Contract; and

3.2.2 The proportions of payment amounts per AF of water available under the Renewal Participating Agency Contracts shall be the same as the existing Contracts of $15.00 per AF for municipal and industrial ("M&I") water use and $2.65 per AF for irrigation use or a ratio of 5.66 to 1, depending on the respective purpose of use; and

3.2.3 There shall be included within all Renewal Participating Agency Contracts provisions permitting each Party to voluntarily retain carryover storage in Lake Berryessa for any unutilized portion of that Party's annual water entitlement under its Renewal Participating Agency Contract under the following conditions:

(a) The amount so voluntarily unutilized on the last day of February shall be added on that date to a carryover account ("Voluntary Carryover Account") for the Party that did not order delivery of the amount of water, but the Party shall pay SCWA for the undelivered water as if the water was delivered to the Party in that year in accordance with the Renewal Participating Agency Contract terms. No additional payment will be required for subsequent use of that water if there is no change in type of use.

(b) Any water in a Party's Voluntary Carryover Account may be utilized by that Party, in addition to all portions of their annual entitlement, in any water year subsequent to the water year in which it is added to the Party's Voluntary Carryover Account, or may be assigned, with approval by SCWA, to another Party to this Agreement, for use by the other Party in the year of non-diversion before its addition to a Party's Voluntary Carryover Account or for use in a subsequent water year from that assignee's Voluntary Carryover Account.

(c) Any water in a Party's Voluntary Carryover Account at the time that Lake Berryessa spills, or at a time in which emergency releases are made from Lake Berryessa for any other reason which releases are not delivered by the Solano Project to SCWA, may be lost as follows: The spill or emergency release shall be charged proportionately to each Party having a Voluntary Carryover Account and subtracted from the Parties' Voluntary Carryover Accounts then having a balance in their accounts to the extent of the spill or emergency release.

Example: Party A has 20,000 AF in its Voluntary Carryover Account, Party Y has 10,000 AF in its Voluntary Carryover Account, and Party X has 2,000 AF in its Voluntary Carryover Account, as these accounts exist at the time the spill condition commences, and these are the only carryover amounts presently in Lake Berryessa. A spill condition occurs in which water is not diverted into the Putah South Canal for beneficial use, or is not credited to a release requirement of the Solano Project in Putah Creek, including carriage losses upstream of Putah Diversion Dam. Each net acre foot spilling shall be charged proportionately to each Party's Voluntary Carryover Account. In the example, the percentages are: Party A, 62.5%; Party Y, 31.25%; Party X, 6.25%. If the net spill was of 16,000 AF, the Voluntary Carryover Accounts of all Parties would be reduced by 50%. If the net spill exceeded 32,000 AF, each Party's Voluntary Carryover Account would have a zero balance.

(d) No monies shall be reimbursable from SCWA to the Parties for the amounts paid for the Voluntary Carryover Account water to SCWA which is spilled.

(e) No evaporation, measurement or carriage loss will be charged upon any Party's Voluntary Carryover Account balance. No Party shall be charged a storage charge upon its Voluntary Carryover Account balances.

Section 4.0: Preparation of Drought Contingency Plans:

4.1 When Storage in Lake Berryessa falls below 800,000 AF as measured on December 1, the Parties will participate with SCWA staff in preparation of a Drought Contingency Plan which shall include reasonable water conservation measures, investigation of potential emergency supplies which could be imported without construction of new conveyance facilities, and other reasonable measures which could reduce the depletion of Storage in Lake Berryessa. Implementation of any of these measures by the Parties and SCWA will only be with the consent of the individual Parties electing to participate, and SCWA will not suspend or supersede provisions of the Participating Agency Renewal Contracts with SCWA. The Drought Contingency Plan shall also address terms and conditions for water sales pursuant to Paragraph 5.6(b). If Storage in Lake Berryessa exceeds 1.1 million AF on the following April 1, development of the Drought Contingency Plan shall be suspended.

Section 5.0 Mandatory Additions to Storage and Carryover Accounts by Parties ("Restricted Carryover Account"):

5.1 When Storage in Lake Berryessa is between 550,000 AF and 800,000 AF as measured on April 1 of any water year, then each of the Parties agrees to forego taking delivery of at least 5% of the Party's annual entitlement. If the Storage in Lake Berryessa is between 450,000 AF and 550,000 AF as measured on April 1, the Parties agree that they will forego taking delivery of at least 10% of their annual entitlements. On the first day of the next water year, a 5% (if Storage in Lake Berryessa had been between 550,000 AF and 800,000 AF the previous April 1) or 10% (if Storage in Lake Berryessa had been between 450,000 AF and 550,000 AF the previous April 1) portion of each Party's annual entitlement shall be credited to what will be called the Party's "Restricted Carryover Account."

5.2 Restricted Carryover shall be classified as either irrigation or M&I. For a Party that delivers only one class of water, 100% of its Restricted Carryover shall be designated of that class. For a Party that delivers both irrigation water and M&I water, the Restricted Carryover shall be segregated into irrigation ("irrigation Restricted Carryover") and M&I ("M&I Restricted Carryover") classes based on the amounts of each class of water acquired by that Party from SCWA during the water year in which the Restricted Carryover was generated.

Example: The Storage in Lake Berryessa is between 550,000 AF and 750,000 AF on April 1. Party A delivers both M&I and irrigation water, and in the current water year acquires 20% M&I and 80% irrigation from SCWA. The 5% of annual entitlement foregone amount deposited in Party A's Restricted Carryover Account the following water year would be classified as 1% M&I Restricted Carryover and 4% irrigation Restricted Carryover.

5.3 Notwithstanding the mandatory foregoance of a portion of its annual entitlement, a Party having a Voluntary Carryover Account balance from voluntary curtailment of use may take any portion of the Voluntary Carryover Account balance from that account in a water year.

5.4 A Party shall not withdraw water from its Restricted Carryover Account until either (a) the Storage in Lake Berryessa on a subsequent April 1 exceeds 800,000 AF, or (b) the Storage in Lake Berryessa on a subsequent April 1 falls below 450,000 AF. If the April 1 Storage in Lake Berryessa exceeds 800,000 AF, the Restricted Carryover Accounts shall convert to or combine with Voluntary Carryover Accounts of the respective Parties. If the April 1 Storage in Lake Berryessa falls below 450,000 AF, the water in Restricted Carryover Accounts will become available to the Member unit Parties as specified in Section 5.6 below.

Example: Party A serves only M&I water and has a Voluntary Carryover Account balance of 2,000 AF on April 1 and no Restricted Carryover Account balance. The April 1 Storage in Lake Berryessa is less than 800,000 AF but more than 550,000 AF. Party A will forego taking delivery of at least 5% of its annual entitlement in the current water year ending on the last day of February. Party A may, up to the last day of February, order and receive 95% of its annual entitlement and an additional 2,000 AF from its Voluntary Carryover Account, bringing its Voluntary Carryover Account to zero on the last day of the water year. The following water year, the Restricted Carryover Account of Party A will have the foregone amount of 5% in it, classified as 100% M&I Restricted Carryover. If the Storage in Lake Berryessa on April 1 of that year exceeds 800,000 AF, Party A's Restricted Carryover Account will convert to a Voluntary Carryover Account, and Party A is entitled to use the water at any time. If the Storage in Lake Berryessa falls below 450,000 AF on April 1 of that year, the water in Restricted Carryover Accounts will become available to the Parties as specified in Section 5.6

below. If the April 1 Storage in Lake Berryessa is any other amount (between 450,000 AF and 800,000 AF), the foregone amount remains in Party A's Restricted Carryover Account and is not available for use.

5.5 After successive water years in which Storage in Lake Berryessa is between 450,000 AF and 800,000 AF on April 1, water will tend to accumulate in the Restricted Carryover Accounts. The above provisions notwithstanding, however, accumulated water in a Party's Restricted Carryover Account (combined M&I and irrigation Restricted Carryover) shall not exceed 50% of that Party's annual entitlement.

Example: Same as last example (Section 5.4) except Party A starts with a Restricted Carryover Account balance of 48% of its annual entitlement. Party A would be required to deposit only 2% of its annual entitlement into its Restricted Carryover Account to bring the Restricted Carryover Account up to the maximum 50% of annual entitlement. Party A may take delivery and use up to 98% of its annual entitlement that water year, excluding any Voluntary Carryover.

5.6 When Storage in Lake Berryessa falls to less than 450,000 AF on April 1, the Parties will not be required to deposit additional water into Restricted Carryover attributable to that water year and water from the Restricted Carryover Accounts will be released to the Parties as follows:

a. The Parties shall have access to their M&I Restricted Carryover Account balances for M&I uses; and

b. The Parties shall have access to their irrigation Restricted Carryover balances for voluntary sale to other Parties for M&I uses based on terms and conditions established through the drought contingency planning process of Section 4.0.

Example: In 2006, Storage in Lake Berryessa is between 550,000 AF and 800,000 AF on April 1 after being above 800,000 AF the previous year. A 5% Restricted Carryover amount is required of all Parties for that water year. Since water orders are submitted to SCWA prior to March 1, the order for that year will be amended to reflect the reduction in available water supply for each of the Parties and the foregone amount will be credited to the Restricted Carryover Accounts on March 1, 2007. On April 1 in each of years 2007 and 2008,

Storage in Lake Berryessa is between 450,000 AF and 550,000 AF. On March 1, 2009, each Party will have 25% of its annual entitlement in its Restricted Carryover Account. On April 1, 2009, Storage in Lake Berryessa falls below 450,000 AF. The Parties will not be required to deposit further water into their Restricted Carryover Accounts that year, and each Party may use any M&I Restricted Carryover in its Restricted Carryover Account for M&I uses that year. Furthermore, Parties with irrigation Restricted Carryover may sell all or any part of that water to other Parties for M&I use pursuant to the drought contingency plan of Section 4.0 above. Any water not sold will remain irrigation Restricted Carryover in the selling Party's Restricted Carryover Account, and such water's disposition will be determined by the April 1 Storage in Lake Berryessa in subsequent years.

5.7 Any amounts of water which are mandatorily foregone and placed into the Restricted Carryover Accounts by the Parties pursuant to Paragraph 5.1 shall be subject to payment of the water charge to SCWA for the foregone amount. No additional payment will be required for subsequent use of that water if there is no change in the type of use.

5.8 In addition to the provisions above, when Storage in Lake Berryessa is less than 400,000 AF on April 1, SID will prepare to implement a voluntary agricultural water marketing program in order to sign up growers who are willing to sell their water allocations for the next water year beginning March 1 of the following year. The water obtained by this voluntary process will be marketed by SID to the Parties to meet M&I water needs of those Parties. The process, methods of determining cost, and conditions governing the marketing to Participating Agencies shall be reasonable and are generally outlined as to form in Exhibit "A" entitled "Solano Irrigation District Drought Impact Reduction Program" (referred to herein as "Program"). The SID Board of Directors may alter and modify the conditions, charges and terms of the Program from time to time, but the purposes of the Program of providing for voluntary relinquishment of agricultural water, while avoiding permanent adverse economic, environmental and social or organizational damage to the agricultural community and to the Parties' M&I users, and retaining the viability of SID, shall be reasonably retained in the Program adopted and implemented by SID. Parties desiring to obtain water from SID for M&I purposes will be provided a reasonable opportunity to comment on any proposed Program changes in advance of their implementation by SID.

5.9 If the Solano Irrigation District Drought Impact Reduction Program shall have been implemented for two or more successive years in the previous three years, and a total of more than 35,000 AF of water are subscribed during the three years to meet M&I water needs of Parties, and on the following April 1 Storage in Lake Berryessa is less than 400,000 AF, the amounts of water to be made available under the Program in that year shall be reduced by SID to a maximum of 5,000 AF.

Example A: Same as last example (Section 5.6), with the additional facts that Storage in Lake Berryessa drops below 400,000 AF on April 1 in years 2010 through 2012, and in year 2009 and 2010, the Program provides for the subscription of 20,000 AF annually for M&I use. Because in the successive years 2009 and 2010 the Program is utilized to provide 35,000 AF or more to M&I users, each Party would have the additional right to participate in the Program in year 2011, but only to the extent of the Party's share of a total Program amount not to exceed 5,000 AF. In year 2012, because more than 35,000 AF were subscribed to under the Program over the past three years and the program was in effect in at least two successive years within the previous three years, the Program shall be reduced again to a maximum of 5,000 AF. If Storage in Lake Berryessa continues below 400,000 AF on April 1, 2013, the 5,000 AF restriction would not be in effect because the Program did not provide 35,000 AF or more to M&I users over the past three years.

Example B: Same as last example, except Storage in Lake Berryessa is above 400,000 AF on April 1, 2010, and therefore the Program is not in effect that year. In year 2011 the program provides for the subscription of 20,000 AF for M&I use. In year 2012, the 5,000 AF restriction would not be in effect because, although the Program provided over 35,000 AF to M&I users over the past three years, the Program was not in effect in at least two successive years during that period. If Storage in Lake Berryessa continues below 400,000 AF on April 1, 2013, the 5,000 AF restriction would be in effect if the 2012 subscription was 15,000 AF or more (so that the combined 2011 and 2012 subscription was 35,000 AF or more).

5.10 Except as provided otherwise by this Section, Restricted Carryover will be treated the same as Voluntary Carryover.

Section 6.0: No Assignments

6.1 This Agreement, and the rights, duties and benefits given in it, may not be assigned by a Party to a non-Party without the advance written consent of all other Parties, and any attempted direct or indirect assignment without such consent is void. The amounts of water in a Party's Voluntary or Restricted Carryover Accounts may not be assigned directly or indirectly for the benefit of non-Parties and SCWA must consent to any such assignments between Parties. Approval of assignment of portions of a Party's annual entitlement to water under its Renewal Participating Agency Contract by SCWA shall carry with it the obligation to provide the Restricted Carryover Account amounts attributable to that entitlement.

Section 7.0: Counterparts

7.1 This Agreement may be executed in several duplicate counterparts, each of which shall be an original.

Section 8.0: SCWA Consent

8.1 The Solano County Water Agency executes this Agreement for the purposes of consenting to the terms hereof. Each Party shall have the right to enforce the terms of this Agreement against any or all other Parties.

SOLANO IRRIGATION DISTRICT

Dated: By: _____
President, Board of Directors

[SEAL] Attest:

_____
Secretary, Board of Directors

Approved as to form:

_____
District Counsel, Solano Irrigation District

EXHIBIT "A"

SOLANO IRRIGATION DISTRICT
DROUGHT IMPACT REDUCTION PROGRAM ELEMENTS

The Program will include the following elements:

1.0 The District's Contract with the Parties requesting Municipal and Industrial Water:

1.1 Proportions in Program: On or about April 1 when it is determined that the amount of water in Storage in Lake Berryessa is less than 400,000 AF, excluding water which is in dead storage and water which is in the voluntary carryover accounts of the Parties to the Agreement, the Parties, including SID, delivering municipal and industrial water in proportion to the average annual amounts of municipal and industrial water ordered and paid for from the Solano Project by those Parties during the preceding five (5) full water years, shall be entitled to participate in the SID Drought Impact Reduction Program ("The Program").

1.2 No Assignment of Proportion of Program Water: All Parties seeking water under the Program for municipal and industrial use shall be entitled to their proportional share of the water made available by the Program. If a Party desires less than their proportional share of the Drought Impact Reduction Program water, they may not assign their relinquished portion of the Program water to any other Party, and the relinquished portion of the water will be divided in accordance with the percentage of the Program water requested by Parties, if any Party requests less than their proportional share.

1.3 District Target Price: On or before May 1, SID will establish and announce a target price per AF for the amount of water which will be deemed relinquished by a Landowner and/or Tenant within SID for the Program in the following water year.

1.4 Additional Costs: In addition to the target price payable to the Landowner and/or Tenant for each acre foot, SID shall establish the additional amounts payable to SID for its operation and maintenance costs, lost water revenues and other reasonable costs to be incurred in implementing the Program. SID will establish the amounts of water which will be allocated to each acre of land under the rules and regulations in the following water year in which the Program is to be implemented and to which the target price and charges of SID would apply if the Landowner and/or Tenant elect to participate in the Program.

1.5 Contract with District: Upon establishing the economic terms of the Program, ninety (90) days notice shall be provided to the Parties serving Municipal and Industrial water of their right to subscribe and contract to the terms of the Program and their right to purchase upon those terms their proportionate share of the Program water in the following water year. The Program water to be made available to the Parties providing for municipal and industrial water service, including SID, shall not exceed twenty thousand (20,000) AF in a water year, or the water allocation from 7,500 acres of SID land, whichever sum is less. A Party declining to or omitting to subscribe to its proportionate share of the Program water may subscribe to a lesser amount of water, or if no election to subscribe is made, their proportionate share shall be divided among the other participants in proportion to requests of the remaining Parties limited by those Parties' proportions established under Paragraph 1.1 above (five years' historic ordering of M & I water from Solano Project). All subscription requests shall be submitted in writing.

1.6 Solicitation Period: Because the terms will be announced and the subscriptions sought approximately 9 months before the relinquishment would commence to take effect, a period of at least 45 days beginning on or before August 1 will be provided for Landowners and Tenants within the boundaries of SID to offer in writing the amounts of water specified and committed to be purchased by the Parties for municipal and industrial purposes in the following water year under the Program.

1.7 Solicitation Complete - Finalization of Contract Amounts: If sufficient Landowner and/or Tenant participants are received within the initial 45-day period by SID, a final binding contract for these amounts shall be delivered by the Parties to SID for the purchases, and SID will submit contracts to the participating SID landowners and/or tenants for the relinquishment to take effect in the following water year.

1.8 Insufficient or Excessive Landowner Offers: If insufficient lands subscribe to the SID Program in the solicitation, and insufficient amounts of water are obtained to meet the total demand of the requesting Parties, which demand shall not exceed 20,000 AF or water from 7,500 acres, whichever is less in any water year, the Parties shall nevertheless be bound to purchase those amounts tendered by landowners and/or tenants from SID.

If the participating landowners and/or tenants offer amounts of water in excess of subscriptions of the Parties, the amounts tendered by each participant will be reduced by a factor representing the excess amount as a percent of the subscribed amount.

Final contracts with participants and the subscribing Parties shall be delivered to SID for approval on or before October 15.

1.9 Payment to District: The monies due to SID from the Parties shall be paid on or before October 15, and shall be obtained by SID and distributed by SID in accordance with its contractual terms with the Landowners and Tenants. Interest earned upon the payments prior to disbursement shall be credited to the Parties participating in the Program. The participating Parties shall pay to SCWA the municipal and industrial rate for the water so assigned by SID to the Parties prior to the Parties participating in the Program ordering and delivery of the water in the following water year.

1.10 No Upset Price: The provisions of the Parties' agreement with SID and the Landowner/Tenant agreement with SID will not provide for an upset price, and thus if the following water year is a plentiful water year, nevertheless the water to be transferred by SID to the Parties will be transferred on the first day of the subsequent water year and will be added to the account of the participating Parties in the Program on that day. Participating Parties should recognize that it is possible that spills of Lake Berryessa may occur after March 1, and thus it is theoretically possible to obtain water pursuant to the Program and to lose it forthwith without the ability to use it or hold it in a carryover account. Water transferred by SID to participating Parties will be treated as voluntarily added to the Party's carryover account if not utilized in the water year.

1.11 No Waiver or Transfer of Water Outside Solano Project Service Areas: As a condition of participating in the Program, no Party participating in the receipt of water from the Program shall directly or indirectly in the water year that deliveries are made under the Program (i) waive the ability to receive water from other sources available to it, or (ii) transfer directly or indirectly the amounts held by the Party in their Solano Project account or held by them pursuant to their State Water Project contracts or held as other water rights to any non-Party, or (iii) allow amounts to be received by the Party pursuant to the Solano Irrigation District Drought

Impact Reduction Program to be used for the benefit of a non-Party or for use outside the service area of the Solano Project.

1.12 Solano County Water Agency will be paid for the water transferred by SID at the municipal industrial rate by the purchaser in accordance with the schedule for payments by the Party to SCWA under the Renewal Member Unit Contract.

2.0 SIDs' Contract with Landowners/Tenants: The Program will be implemented with voluntarily participating landowners and tenants by SID determining an amount of water to be allocated by SID in the ensuing water year for each acre of participating land, and a price per acre divided by the number of AF to be allocated yielding a per AF price for water tendered by landowner and tenant to SID. Landowners will be required to allocate full measurable fields or tracts to the Program. Parcels of 20 acres or less in size will not be eligible. Water from land with permanent crops such as trees and vines will not be eligible for transfer. Participants in this relinquishment program shall not supplement their allocation with ground water at levels which exceed the historical average over the previous four (4) years. No more than 7,500 acres of SID lands will be removed from production in a water year under the Program. Specific guidelines and contract forms will be developed by SID prior to the beginning of the landowner solicitation period and that information will be provided in a notice to owners of eligible lands.

Appendix E

SUISUN/SOLANO IMPLEMENTATION AGREEMENT AND LEASE AGREEMENT

SECOND AMENDMENT TO THE SUISUN/SOLANO IMPLEMENTATION AGREEMENT AND LEASE AGREEMENT

THIS SECOND AMENDMENT TO THE SUISUN/SOLANO IMPLEMENTATION AGREEMENT AND LEASE AGREEMENT is dated as of August 16, 2022 (the "**Effective Date**") and entered into by and among the CITY OF SUISUN CITY, a California municipal corporation and general law city organized and existing under the laws of the State of California (hereinafter "**City**"), the SOLANO IRRIGATION DISTRICT, an irrigation district organized and existing under the laws of the State of California (hereinafter "**District**" or "**SID**"), and the SUISUN/SOLANO WATER AUTHORITY, a joint powers authority organized and existing under the laws of the State of California (hereinafter "**Authority**" or "**SSWA**"), (collectively, the "Parties").

RECITALS

WHEREAS, in 1988, SID, the cities of Fairfield, Vacaville, Suisun City, Maine Prairie Water District, Vallejo, Benicia, and the-then Solano County Water Agency formed the "Solano Water Authority, Project Agreement No. 2, Noonan Reservoir" ("**SWA**2"). The purpose of the agreement was to purchase lands and perform engineering studies to construct a "point of transfer" facility and pipeline between the State Water Project's North Bay Aqueduct and SID's agricultural irrigation canal system. Such a pipeline connection would enable the SWA members to exchange North Bay Aqueduct ("**NBA"**) water for Solano Project water during times of surplus, thereby increasing all participating agencies' water reliability of supply; and,

WHEREAS, based on the progress of the SWA2 "point of transfer" facility (the "**PT Facility**") progress, SID and the City entered into the 1990 Implementation Agreement and Lease Agreement (the "**Implementation Agreement**") which explains how the lands within SSWA receive water. For example, the City's annual Solano Project of 1,600 Acre Feet ("**AF**") shall first be applied to the City Service Area. Second, any remainder shall be applied to the Joint Service Area. By 1990, the City's Solano Project water was already fully utilized for the City Service Area and the existing Joint Service Area; and,

WHEREAS, between 1990 and the present, SID advanced water to City to meet its growth goals, with the expectation of recovering said water through an exchange of water through the SWA2 PT Facility. However, in or around 2012, the SWA2 PT Facility became infeasible. For example, the City of Fairfield that was a member and holding about half the property for the SWA2 PT Facility, re-dedicated the land for permanent habitat conservation instead; and,

WHEREAS, in 2015 SID adopted a study entitled "Solano Irrigation District, Water Supply Shortage Risk Assessment" which essentially concluded that SID did not have surplus water which could be allocated to properties seeking to annex into SID. In accordance with the Implementation Agreement, City properties seeking to annex into the City and develop would need to have a water supply other than City or SID's Solano Project supply; and,

WHEREAS, since the failed SWA2 PT Facility in 2012, and SID's Water Supply Shortage Risk Assessment in 2015, City and SID have been working to identify a feasible alternative to the SWA2 PT Facility and also to identify a source of water for current City growth, and;

WHEREAS, the Implementation Agreement requires the City to provide all entitlement to Solano Project water not used within the City Service Area, to any annexed lands within the Joint Service Area after 1990; and,

WHEREAS, SID is required to provide water to backfill the needs of the Joint Service Area; however, SID is not required to serve new lands desiring to annex to the City and not already located in SID's boundary (the "**Growth Service Area**" or "**GSA**"); and,

WHEREAS, the Implementation Agreement requires new land to be annexed into the Joint Service Area before water can be made available. The City's Solano Project must be used for the GSA until it is exhausted, and then the City's NBA water would be exchanged for SID's Solano Project ("**SP**") water, until that source is exhausted; and,

WHEREAS, the exchange of NBA water for SP water would be accomplished once the PT Facility was constructed but, to present date, the PT Facility has not been constructed by any party; and,

WHEREAS, the City has received an application to develop two parcels within its Sphere of Influence that are comprised of a 93-acre lot within the western side of the City (the "**West Parcel**") and a 119.7-acre lot on the eastern edge of the City (the "**East Parcel**") (collectively, the "**Project**"). The Project is outside of the SSWA Joint Service Area and considered to be within the GSA. Both lots are proposed to be zoned Commercial Services and Fabricating (See, depiction in Attachment 1); and,

WHEREAS, a Water Supply Assessment was conducted to analyze the water needs of the project and concluded that the Project will have a 240 AF annual demand; and,

WHEREAS, the Implementation Agreement was once amended on September 6, 2016 to extend the term of the Agreement (the "**First Amendment**"); and,

WHEREAS, the Parties wish to allow the City to annex the Project into the GSA and SID, under the terms and conditions set forth in this Amendment, deferring discussing of the City's NBA water revenues if a PT Facility is not constructed, to some point in the future.

NOW, THEREFORE, in recognition of the backgroundset forth above, the Parties agree as follows:

1. **Recitals.** The above recitals are true and correct and incorporated as though fully set forth herein**.**

2. **Annexation by LAFCO.** The rights and obligations set forth in this Amendment are conditional upon the successful annexation of the West Parcel, East Parcel or the entire Project into the City, SSWA, and into the boundaries of SID by the Local Agency Formation Commission ("**LAFCO**"). If, for any reason, neither the East Parcel nor West Parcel are annexed into the City, SSWA, and SID within twenty four (24) months of the Effective Date, this Amendment shall be null and void and have no further effect. If the Amendment is terminated or voided, the provisions of the 1990 Implementation Agreement will control. Any raw water rate increases shall be forward looking and only imposed following compliance with applicable laws.

3. **Amendments.** Any language conflicting with Section 3 and Section 4 of the Implementation Agreement shall be stricken and superseded with the following:

3.1 Additional Water to Growth Service Area. Provided the annexation to SSWA, SID, and City is approved, SID agrees to advance up to 240 AF of water annually for the buildout of any portion of the Project. As a condition precedent to receiving water, the City must pay $1.5 million to SSWA, and in compliance with the terms and conditions set forth in this Amendment.

3.2 Point of Transfer Facility. The Parties agree to work cooperatively to facilitate the construction of the PT Facility and/or the means of implementation of the Exchange by doing the following:

a. Each Party shall use its best efforts to actively advocate that the Solano County Water Agency ("**SCWA**") complete the feasibility study for the PT Facility (either at the formerly designated sites or at additional sites) to accomplish the purpose of the Exchanges, in the reasonable determination of SID.

b. Each Party shall use its best efforts to research, apply for, and/or secure grant funding for the environmental analysis, design, property acquisition, and construction of the PT Facility.

c. SSWA will create an earmarked account called the "**PT Fund**", which shall be restricted so that any money placed in this fund is only used to offset costs to advance the PT Facility. In accordance with Section 3.1 and Section 3.4(b)(i), the City's $1.5 million payment to SSWA and Table A revenues shall be remitted into the PT Facility Fund (collectively, the "**PT Fund Proceeds**"). Beyond the City's $1.5 million payment, neither the City nor SID have any independent obligation to expend City or SID funds on the PT Facility. Approvals for PT Fund expenditures (e.g., consultants, studies, construction) shall not be unreasonably withheld by the SSWA Board.

i. PT Fund Closure. The PT Fund will be created when SSWA receives the $1.5 million payment from the City, and will close when the PT Facility is constructed and operational, or when this Amendment is terminated, or ten (10) years after the Effective Date, unless extended by mutual agreement of the parties (the "**PT Fund Closure**").

(1) If the PT Facility is not constructed and the PT Fund Closure occurs, all PT Fund Proceeds through the date of the closure shall revert to SID to be expended for water enhancement projects, as determined by SID.

(2) If the PT Fund Closure occurs, the Parties shall work cooperatively to determine how to expend further revenues collected from Table A water, and in accordance with Section 3.4.

3.3 Exchange Ratio. As long as the PT Facility is constructed and operational, the City shall exchange its NBA water with SID for its SP water as provided below. All water received by SSWA as a result of the Exchange between City and SID shall be used to serve the Joint Service Area (which includes the GSA once it is annexed into SSWA), in order to reduce the volume of water SSWA needs to purchase from SID, and as set forth in Section 3.5. In any year when SSWA's Exchanged water exceeds its Joint Service Area water demand, provided any expenses of carryover are paid by City, said excess may be carried over into the next water year to the extent carryover is available for the NBA waters, made subject to Exchange. The carrying over of water must at all times comply with SCWA policies.

a. During the years when the NBA has Table A water to allocate, the City's allocation shall be exchanged with SID in a 1:1 ratio. Table A water shall mean the maximum amount of water each State Water Project ("**SWP**") contractor can receive

each year, excluding certain interruptible deliveries (the "**Exchange**"). Table A amounts are used by the Department of Water Resources for allocating NBA water and costs among the water contractors.

b. In years where the Delta is in surplus, as declared by the State and upon written notice to SCWA, SID may make beneficial use of said surplus water as set forth by the State's surplus declaration otherwise available under City's SWP supply agreement during the timeframe during which the surplus exists. Under such conditions, the exchange ratio shall be 2:1 NBA water for SP water. These amounts shall be in addition to Table A water.

3.4 City's NBA Water.

a. Provided that the PT Facility is constructed and placed into operation by any entity (e.g., SID, SSWA, SCWA, DWR, or other), the City shall allow SID to manage City's annual NBA water; provided, however, the City shall continue to maintain all underlying water rights.

b. Up until the PT Fund Closure, as set forth in Section 3.3(c), the City will allow SID to actively manage and market City's surplus Table A water; provided, however, the City will continue to retain all of the underlying water rights.

i. Though City shall retain all water rights, SID shall be allowed to market the City's Table A allocation to other SWP users in accordance with existing SCWA policies for the purpose of selling the Table A surplus water. Proceeds of such sale shall go to the PT Fund to offset planning, feasibility, financing, and operation, maintenance, capital improvement, and construction costs.

3.5 Water Rate. Provided that the Project, or a portion thereof, is annexed into SSWA and SID and approved by the City, the raw water rate charged by SID to SSWA shall be increased from $15 per AF to the market price on July 1, 2023. The estimated market rate is $155 per AF, as may be increased from time to time, but in no event more than once a year, pursuant to the Consumer Price Index (CPI-U, San Francisco-Oakland, Hayward) utilizing that index on July 1 as the base (the "**market water rate**"). The market water rate may be passed through to SSWA rate-payers in accordance with applicable laws, including Proposition 218. Starting on July 1, 2023 and for as long as the market water rate is not adopted through the Proposition 218 process and passed through to rate payers, and provided that SSWA's revenues maintain appropriate reserves as required by its bylaws and bond indebtedness obligations, SID shall draw on SSWA funds for the difference between the $15 per AF and the market water rate.

4. Other Terms. Except as expressly set forth herein, all terms and conditions of the

Implementation Agreement and First Amendment remain in full force and effect. In the event of a conflict between this Amendment and the Implementation Agreement or First Amendment, the terms of this Amendment shall control.

5. **No Third Party Beneficiaries.** Nothing in this Second Amendment, express or implied, is intended to confer on any person other than the Parties hereto and the respective successors and assigns, any rights or remedies under by reason of this agreement.

6. **Counterparts.** This document may be executed in multiple counterparts, each of which shall be deemed an original, and all of which shall constitute one original, by each of the parties hereto on the dates respectively indicated in their signatures below, notwithstanding that all parties are not signatories to the original or the same counterpart.

IN WITNESS WHEREOF, the City has caused this Second Amendment to the Implementation Agreement and Lease Agreement to be executed and attested in its corporate name by its duly authorized officers and sealed with its corporate seal, the District has caused this Second Amendment to the Implementation Agreement and Lease Agreement to be executed and attested in its corporate name by its duly authorized officers and sealed with its corporate seal, and the Authority has caused this Second Amendment to the Implementation Agreement and Lease Agreement to be executed and attested in its corporate name by its duly authorized officers and sealed with its corporate seal, all as of the date hereinabove stated.

[Signatures on the Following Two Pages.]

CITY OF SUISUN CITY:

By: _____
Alma Hernandez, Vice Mayor

Attest:

_____
City Clerk

Approved as to Form:

By: _____
Elena Gerli, City Attorney

SOLANO IRRIGATION DISTRICT:

By: _____
John D. Kluge, President
Board of Directors

Attest:

_____
Cary Keaten, Secretary
Board of Directors

Approved as to Form:

By: _____
Paul R. Minasian, District Counsel

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Alma Hernandez, Vice Mayor

Attest:

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Cary Keaten, Secretary
Board of Directors

Approved as to Form:

By: _____
Paul R. Minasian, District Counsel

SUISUN/SOLANO WATER AUTHORITY:

By: _____
John D. Kluge, President
Board of Directors

Attest:

_____
Authority Secretary

Approved as to Form:

By: _____
Mona Ebrahimi, Authority Counsel

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M.2 - RBI, Inc. Water Supply Environmental Effects Analysis

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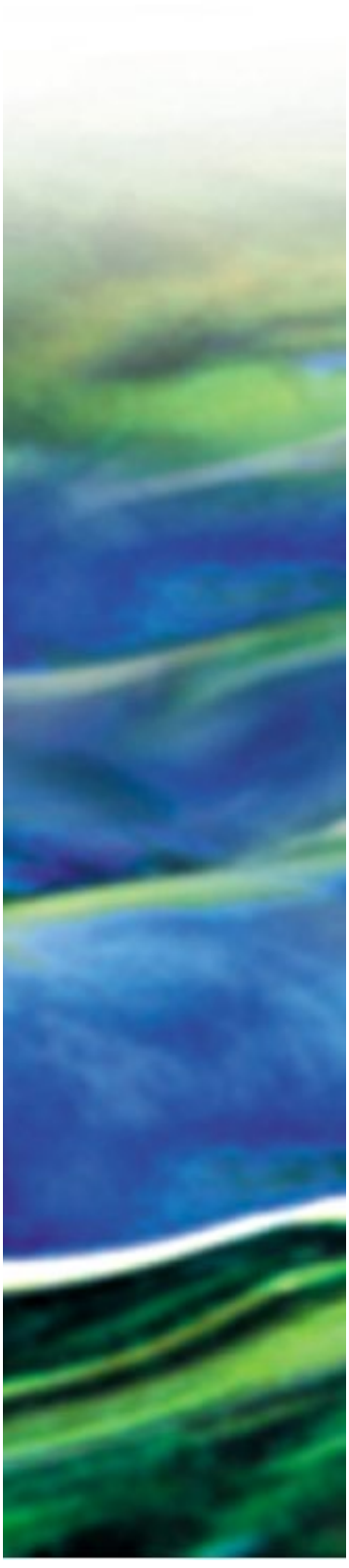
WATER SUPPLY ENVIRONMENTAL EFFECTS ANALYSIS FOR THE SUISUN LOGISTICS CENTER



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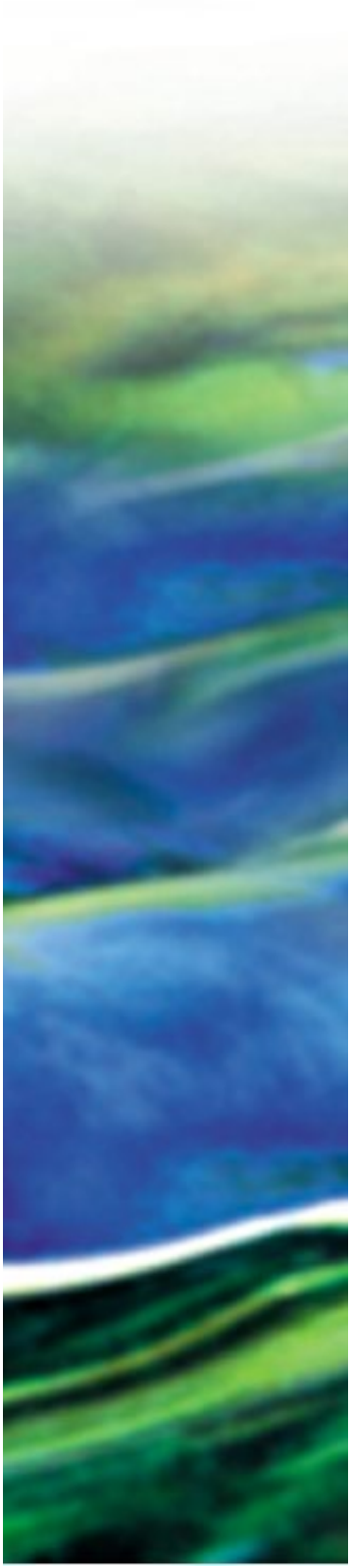
October 2023



WATER SUPPLY ENVIRONMENTAL EFFECTS ANALYSIS FOR THE SUISUN LOGISTICS CENTER

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ACRONYMS AND ABBREVIATIONS

CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CVP	Central Valley Project
D-1641	Decision 1641 by the State Water Resources Control Board
Delta	Sacramento-San Joaquin Delta
DWR	California Department of Water Resources
EPA	U.S. Environmental Protection Agency
HCP	Habitat Conservation Plan
Project	Suisun Logistics Center Project
Reclamation	U.S. Bureau of Reclamation
RWQCB	Regional Water Quality Control Board
SSWA	Suisun-Solano Water Authority
SWRCB	State Water Resources Control Board
SWP	State Water Project
WQCP	Water Quality Control Plan

1 INTRODUCTION

The proposed Suisun Logistics Center Project (project), if approved, would consist of 2.1 million square feet of warehouse uses on approximately 120 acres in unincorporated Solano County, California, within the existing Suisun City Sphere of Influence. The site, along with an additional 47 acres designated for open space, is proposed to be annexed into the Suisun City limits. The project would be served with 120 acre-feet of treated municipal water supply from Suisun-Solano Water Authority (SSWA).

This report evaluates the potential direct, indirect, and cumulative environmental effects of providing 120 acre-feet of SSWA water to the project.

2 WATER SUPPLY AND WATER RIGHTS

SSWA is a joint powers authority between Suisun City and Solano Irrigation District established under an implementation agreement in 1990. SSWA provides water to customers within Suisun City limits and unincorporated areas of Solano County.

Both Suisun City and Solano Irrigation District have contracts with Solano County Water Agency for water supplies from the Solano Project, a federal water project owned by the U.S. Bureau of Reclamation (Reclamation) located in the Putah Creek watershed. Solano County Water Agency is the contracting agency with Reclamation for Solano Project water. SSWA's Cement Hill Water Treatment Plant treats Solano Project water and delivers it to the service area.

Suisun City also has entitlement to 1,300 acre-feet of water from the North Bay Aqueduct, a State Water Project (SWP) facility. Due to lack of connection to the Cement Hill Water Treatment Plant, however, Suisun City is unable to directly use this water. In August 2022, Suisun City and Solano Irrigation District entered into an agreement that allows Suisun City to transfer its SWP entitlement to Solano Irrigation District in exchange for additional Solano Project water deliveries to the SSWA service area.

Based on the current SSWA conveyance and distribution facilities and implementation agreements, the 120 acre-feet of water supply needed for the project would originate from the Solano Project. As a result, and to meet customer demands, the Solano Irrigation District could, in turn, withdraw 120 acre-feet of SWP water from the North Bay Aqueduct, which receives water from Barker Slough in the Sacramento-San Joaquin Delta (Delta).

3 RESOURCES POTENTIALLY AFFECTED BY DELIVERY OF WATER TO PROJECT

In accordance with the California Environmental Quality Act (CEQA) and the State CEQA Guidelines, the discussion of potential effects of delivery of the project's water supply on the physical environment is focused on those impacts that may be potentially significant. CEQA requires a lead agency, in preparing an environmental impact report (EIR), to focus its analysis "on those potential effects on the environment … which the lead agency has determined are or may be significant." (Public Resources Code Section 21100(b)(1); see also California Code of Regulations, Title 14, Sections 15126.2[a] ["[a]n EIR shall identify and focus on the significant effects of the proposed project on the environment"].) CEQA requires that the discussion of any

significant effect on the environment be limited to substantial, or potentially substantial, adverse changes in physical conditions that exist within the affected area, as defined in Public Resources Code Section 21060.5 (statutory definition of "environment").

State CEQA Guidelines Appendix G, Environmental Checklist, identifies resource categories to be evaluated for project impacts on the environment. Of the resource categories listed in the Environmental Checklist, this water supply environmental effects analysis evaluates impacts to the following resource categories, which are the water resource-related categories in the checklist.

- Hydrology and Water Quality
- Biological Resources (Aquatic)

Delivery of water to the project would not impact the remaining resource categories because: (1) they are not present in the vicinity of the water delivery facilities associated with the project; or (2) the resources may be present in these areas, but impacts are not anticipated to occur (a) because no impact mechanism link exists between hydrologic changes associated with the project water supply and the resource, or (b) because the potential impacts would be negligible or speculative. Therefore, the environmental resources listed below are not discussed further in this water supply environmental effects analysis.

- Aesthetics
- Agriculture and Forestry Resources
- Air Quality
- Biological Resources (Terrestrial)
- Cultural Resources
- Energy
- Geology and Soils
- Greenhouse Gas Emissions
- Hazards and Hazardous Materials
- Land Use and Planning
- Mineral Resources
- Noise
- Population and Housing
- Public Services
- Recreation
- Transportation
- Tribal Cultural Resources
- Utilities/Service Systems
- Wildfire

4 STUDY AREA

Water supply for the project would originate from the Solano Project. Therefore, potentially affected environmental resources are the waterbodies within the Putah Creek watershed associated with the Solano Project, which are Lake Berryessa and Putah Creek (**Figure 1**). Because the delivery of Solano Project water to the project may result in diversion of additional SWP water from Barker Slough into the North Bay Aqueduct by Solano Irrigation District, this waterbody is also discussed.

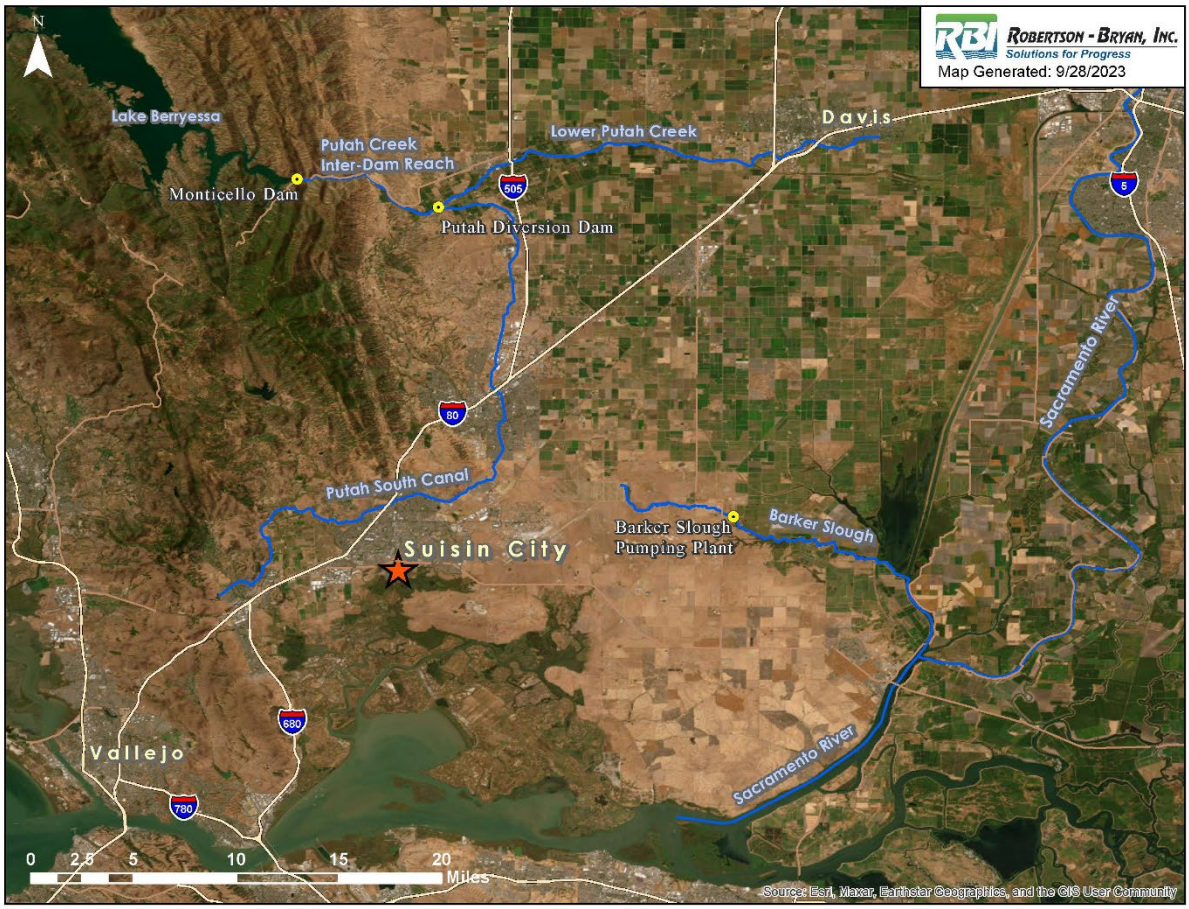

Figure 1. Regional map of Lake Berryessa, Putah Creek, and Solano Project features.

Barker Slough Pumping Plant, which pumps water into the North Bay Aqueduct, is located at the northern end of Barker Slough (Figure 1). Because of its location at the northern end of Barker Slough and the slough's location relative to other Delta channels, Barker Slough Pumping Plant diversions into the North Bay Aqueduct have relatively little influence on the hydrodynamics of the nearest waterbodies. This is because the tributary inflows from Ulatis Creek, Hass Slough, Sacramento Deep Water Ship Channel, and Sacramento River, coupled with substantial tidal effects, dictate the hydrodynamics in this area of the Delta. Therefore, other downstream waterbodies (i.e., Sacramento River, Miner Slough, Sutter Slough, and Steamboat Slough) are not addressed further in this assessment.

Other components of the SWP also are not addressed in this assessment because Solano Irrigation District's diversion of 120 acre-feet of SWP water from Barker Slough would have little to no effect on upstream SWP facilities. SWP water originates in Lake Oroville, which has a capacity of 3.5 million acre-feet and average end-of-September storage volume of approximately 2.0 million acre-feet (California Department of Water Resources 2022:5-24). The project's total water supply of 120 acre-feet annually would comprise 0.006% of the average

end-of-September volume in Lake Oroville. The average monthly water supply of 10 acre-feet (i.e., 120 acre-feet divided by 12 months) would comprise 0.0005% of Lake Oroville's average end-of-September volume. Thus, the project would have an immeasurable effect on Lake Oroville storage and operations, and downstream Feather River flows. Therefore, Lake Oroville, the Feather River, and Sacramento River below the Feather River confluence are not addressed further in this assessment.

Similarly, the magnitude of monthly and annual Delta inflows and outflows are such that the diversion of 120 acre-feet annually of additional SWP water at Barker Slough Pumping Plant would have an immeasurable effect on Delta hydrodynamics. The Sacramento River is the primary contributor to Delta inflows, contributing about 16.1 million acre-feet per year (Delta Stewardship Council 2018:84). Outflows to San Francisco Bay are about 15.8 million acre-feet per year (Delta Stewardship Council 2018:84). The project's annual water supply would be about 0.00075% of the average annual Delta inflows and outflows. Therefore, the additional diversion would have an immeasurable effect on SWP operations to meet Delta outflow and other regulatory requirements, and also would not affect the coordinated operations of the SWP with the federal Central Valley Project. As such, upstream Central Valley Project (CVP) reservoirs, the Sacramento River downstream of Shasta Dam, and Delta are not addressed further in this assessment.

5 ENVIRONMENTAL SETTING

The sections below provide the geographic, hydrologic, and aquatic biological resources setting of study area waterbodies: Putah Creek, Lake Berryessa, and Barker Slough. Aquatic biological resources of these waterbodies are also described.

5.1 PUTAH CREEK

The Putah Creek watershed lies on the eastern slope of the Coast Range, south of the Cache Creek drainage and north of Napa Valley. The drainage encompasses southern Lake County, the northern half of Napa County, and small portions of Yolo and Solano counties. Putah Creek originates from the northwestern corner of the drainage in Lake County and flows southeastward into the Yolo Bypass near Davis. The primary feature in the Putah Creek watershed is Lake Berryessa, an impoundment created by Monticello Dam. Putah Creek below Monticello Dam consists of two primary reaches: (1) inter-dam reach; and (2) Lower Putah Creek.

5.1.1 Inter-Dam Reach

The inter-dam reach of Putah Creek is comprised of the approximately 5-mile segment downstream of Monticello Dam to the Putah Diversion Dam. This reach includes Lake Solano, a 750 acre-feet impoundment formed by Putah Diversion Dam. The instream habitat within the inter-dam reach of Putah Creek near Monticello Dam is like that of many Central Valley tailwater streams. This relatively high gradient reach is comprised of a relatively even distribution of pools, riffles, and runs with abundant overhead cover. These conditions coupled with the cold water released from Lake Berryessa provide habitat favorable for salmonids (Solano County Water Agency 2005).

The fish assemblage of Putah Creek in the inter-dam reach is comprised primarily of native species and introduced recreational game fish. This reach is actively managed by California Department of Fish and Wildlife (CDFW) as a put-and-take (stocked) coldwater fishery for hatchery-reared native rainbow trout (*Onchorhynchus mykiss*), along with non-native brown trout (*Salmo trutta*) and brook trout (*Salvelinus fontinalis*). Non-game fish residing in the inter-dam reach include native Sacramento sucker (*Catostomus occidentalis*), Sacramento pikeminnow (*Ptychocheilus grandis*), California roach (*Hesperoleucus symmetricus*), hitch (*Lavinia exilicauda*), threespine stickleback (*Gasterosteus aculeatus*), riffle sculpin (*Cottus gulosus*), and non-native goldfish (*Carassius auratus*). These non-game fish are generally most abundant downstream near Lake Solano (Solano County Water Agency 2005).

5.1.2 Lower Putah Creek

Lower Putah Creek is the 23-mile segment between the Putah Diversion Dam and the creek's confluence with the Yolo Bypass. Lower Putah Creek's instream aquatic habitat conditions are similar to those of many Central Valley foothill streams. Shaded riverine aquatic cover, measured as the percentage of stream covered by overhead canopy, generally decreases in a downstream direction (Solano County Water Agency 2005). Water temperatures are largely driven by releases from Lake Berryessa (Jacinto et al. 2023). Putah Creek is undergoing various restoration initiatives, including rechanneling at various points, uncovering of previously silted spawning gravels, addition of new gravel habitats, and improvements within the surrounding riparian landscape (Willmes et al. 2021).

Putah Creek's hydrologic regime is highly regulated via a seasonal instream flow and release patterns adopted in the Putah Creek Accord, an agreement between the Solano County Water Agency and Putah Creek Council intended to balance the competing uses for water and create as natural a flow regime as feasible from the Putah Diversion Dam to Lower Putah Creek. The accord established maintenance of minimum flows in the creek (**Table 1**), increased flows in the fall and spring to support spawning and rearing, respectively, of native and anadromous fish, and a pulse flow in the fall to attract salmon (Jacinto et al. 2023).

Table 1. Minimum daily flow rates for Lower Putah Creek.

Location	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Putah Diversion Dam – Mean Daily Release (cfs)	20	25	25	25	16	26	46	43	43	43	34	20
Interstate 80 – Mean Daily Flows (cfs)	5	10	10	15	15	25	30	20	15	15	10	5
Source: Solano County Water Agency 2023 cfs = cubic feet per second												

Fish assemblage data spanning the pre- and post-Putah Creek Accord years indicates that, overall, the creek flows dedicated by the accord coupled with other restoration effort have improved conditions for native fishes (Jacinto et al. 2023). There has been 35 fish species observed in Lower Putah Creek (Jacinto et al. 2023). The fish species assemblage is comprised of 11 native species and 24 nonnative species. The number of native fish species (i.e., species richness) is higher than the number of nonnative fish species within the first ten miles downstream of the Putah Diversion Dam, while number of nonnative fish species is greater

beginning 12 miles downstream of the Putah Diversion Dam. Native fish species include California roach, Chinook salmon, Pacific lamprey, prickly sculpin, rainbow trout, Sacramento blackfish, Sacramento perch, Sacramento pikeminnow, Sacramento sucker, Sacramento tule perch, and three-spine stickleback. Adult numbers of Chinook salmon were documented to increase from <10 per year prior to 2014 to over 500 in each of the following three years (Willmes et al. 2021). California Central Valley Distinct Population Segment steelhead, a federally threatened species, historically spawned in Putah Creek (Willmes et al. 2021), but no confirmed observations of steelhead have been made in recent years (Jacinto et al. 2023). Nonnative fish species include bluegill, green sunfish, largemouth bass, western mosquitofish, inland silverside, and smallmouth bass (Jacinto et al. 2023).

5.2 LAKE BERRYESSA

Lake Berryessa, the impoundment formed by Monticello Dam, is a key feature in the Putah Creek watershed and water supply component of the Solano Project. Lake Berryessa capacity is 1.55 million acre-feet. **Table 2** presents monthly average end-of-month storage for Lake Berryessa, which averages approximately 1.2 million acre-feet. **Table 3** presents outflow rates at Monticello Dam. Highest outflow rates are during the spring and summer months, corresponding with the irrigation season.

Table 2. Lake Berryessa end-of-month storage for the period January 1985 through August 2023.

Location	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average (MAF)	1.2	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.1	1.1	1.1	1.2
Minimum (MAF)	0.5	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.5
Maximum (MAF)	1.7	1.7	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.4	1.5	1.6
Source: California Data Exchange Center 2023 MAF = million acre-feet												

Table 3. Lake Berryessa monthly average outflow rates at Monticello Dam for the period October 1993 through August 2023.

Location	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average (cfs)	198	84	82	203	509	612	555	487	583	649	521	385
Minimum (cfs)	134	49	41	15	48	36	89	247	453	491	408	292
Maximum (cfs)	285	138	120	2,357	5,868	3,087	3,250	862	718	1,580	616	464
Source: California Data Exchange Center 2023 cfs = cubic feet per second												

Fish reported as being present in Lake Berryessa include crappie, bluegill, red-reared sunfish, green sunfish, rainbow trout, brown trout, brook trout, largemouth bass, smallmouth bass, spotted bass, catfish species, carp, Sacramento pikeminnow, golden shiner, and threadfin shad (U.S. Bureau of Reclamation 2023).

5.3 BARKER SLOUGH

Barker Slough is a tidally influenced channel within the Delta. Barker Slough Pumping Plant is located at the north end of the slough to pump water into the North Bay Aqueduct, a SWP facility. The intake is approximately 10 miles from the mainstem Sacramento River (California

Department of Water Resources 2022:6-14). Barker Slough water quality is influenced more by runoff contributions from the local watershed than Delta conditions (State Water Contractors 2022:ES-5). The current maximum pumping rate is 140 cubic feet per second (cfs) because an additional pump is required to be installed to reach 175 cfs (California Department of Water Resources 2022:6-14). **Table 4** presents the monthly diversion rates at the Barker Slough Pumping Plant for April 2008 through August 2023.

Special status fish species identified as potentially occurring in the Delta are delta smelt, California Central Valley steelhead, Central Valley spring-run Chinook salmon, Central Valley winter-run Chinook salmon, Sacramento splittail, and green sturgeon (National Marine Fisheries Services 2019, U.S. Fish and Wildlife Service 2019). Longfin smelt also has been granted protection by the incidental take permit issued by CDFW for SWP facilities (California Department of Fish and Wildlife 2020).

Per the CDFW 2020 SWP Incidental Take Permit and the U.S. Fish and Wildlife Service (USFWS) 2019 Biological Opinion (for delta smelt) for the SWP and CVP, Barker Slough Pumping Plant rates are to be reduced when longfin smelt or delta smelt larvae are present in the vicinity to minimize entrainment into the North Bay Aqueduct (California Department of Fish and Wildlife 2020; U.S. Fish and Wildlife Service 2019). The intake is equipped with a positive barrier fish screen to prevent fish at least 25 millimeters in size from being entrained. CDFW found low levels of entrainment of larval delta smelt less than 20 mm at Barker Slough during the mid-1990s to mid-2000s. More recent entrainment monitoring in the pump bays behind the fish screens in 2014–2016 only collected one delta smelt (Yip et al. 2019:29–30, as cited in California Department of Water Resources 2022:12-17).

Table 4. Barker Slough Pumping Plant monthly average diversion rates for the period April 2008 through August 2023.

Location	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average (cfs)	71	68	41	28	28	10	36	72	85	85	88	83
Minimum (cfs)	23	20	14	5	5	0	6	33	55	42	54	30
Maximum (cfs)	96	92	71	61	69	26	82	108	118	115	114	109
Source: California Data Exchange Center 2023 cfs = cubic feet per second												

6 REGULATORY SETTING

The following federal, state, and local regulations, plans, and policies are relevant to the water supply environmental effects analysis.

6.1 FEDERAL REGULATIONS, PLANS, AND POLICIES

- **Clean Water Act.** The Clean Water Act (33 United States Code § 1251 *et seq*.) establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters and gave the U.S. Environmental Protection Agency (EPA) the authority to implement control programs. The Clean Water Act authorizes the EPA to delegate many permitting, administrative, and enforcement aspects of the act to state governments, with the EPA retaining oversight responsibilities. The EPA has delegated various authorities for establishing water quality

standards and regulating controllable factors affecting water quality to the State of California. California's State Water Resources Control Board (SWRCB) and nine Regional Water Quality Control Boards (RWQCBs) implement the state's water quality management responsibilities.

- **Section 7 of the Endangered Species Act.** Section 7 of the federal Endangered Species Act requires federal agencies to engage in formal consultation with USFWS and/or National Marine Fisheries Service for any proposed actions that are likely to adversely affect listed species. A biological opinion containing terms and conditions is issued at the completion of formal consultation. In 2019, the USFWS issued a biological opinion for the coordinated operations of the CVP and SWP, which includes terms and conditions related to the operation of the SWP's Barker Slough Pumping Plant.

6.2 STATE REGULATIONS, PLANS, AND POLICIES

- **Porter-Cologne Water Quality Control Act.** The Porter-Cologne Water Quality Control Act is California's statutory authority for the protection of water quality. Under this act, California must adopt water quality policies, plans, and objectives that ensure beneficial uses of the state are reasonably protected. The Porter-Cologne Water Quality Control Act requires California's nine RWQCBs to adopt water quality control plans (WQCP) and establish water quality objectives.

- ***Water Quality Control Plan for the San Francisco Bay/Sacramento–San Joaquin Delta Estuary*.** The Bay-Delta WQCP identifies beneficial uses of water in the Delta to be protected, water quality objectives for the reasonable protection of beneficial uses, and an implementation program to achieve the water quality objectives (State Water Resources Control Board 2018). Key elements of the Bay-Delta WQCP include salinity-related objectives. In Decision 1641 (D-1641), the SWRCB amended the water right license and permits for the SWP and CVP to meet certain objectives in the Bay-Delta WQCP. Specifically, D-1641 places responsibility on DWR and Reclamation for measures to ensure that specified water quality objectives are met.

- ***Water Quality Control Plan (Basin Plan) for the Sacramento and San Joaquin River Basins.*** The Central Valley RWQCB's Basin Plan defines beneficial uses of water resources, water quality objectives, and implementation programs for surface waters in the Central Valley. The Basin Plan contains specific numeric water quality objectives for surface waters for dissolved oxygen, pH, pesticides, electrical conductivity, temperature, turbidity, and some priority toxic pollutants (i.e., some trace metal and organic compounds), as well as narrative water quality objectives for several constituents. Lake Berryessa, Putah Creek, Barker Slough, and the Delta are within the jurisdiction of the Central Valley RWQCB Basin Plan.

- **California Endangered Species Act (Fish and Game Code Section 2081(b).** As provided by Section 2081(b) of California's Fish and Game Code, CDFW may authorize take under the California Endangered Species Act that is otherwise prohibited by Section 2080 with an incidental take permit. The requirements of an application for incidental

take are described in Section 2081 of the Fish and Game Code. Incidental take of endangered, threatened, or candidate species may be authorized if an applicant demonstrates, among other things, that the effects of the proposed take will be minimized and fully mitigated (Fish and Game Code Section 2081(b)(2)). In March 2020, DWR secured an incidental take permit from CDFW for the long-term operation of the SWP. As described in Section 5.3, the incidental take permit includes terms and conditions regarding operation of the SWP's Barker Slough Pumping Plant.

6.3 LOCAL REGULATIONS, PLANS, AND POLICIES

- **Putah Creek Accord.** The Putah Creek Accord establishes seasonal flow releases from Putah Diversion Dam. The court-mediated accord stemmed from a lawsuit (Putah Creek Council vs. Solano Irrigation District and Solano County Water Agency, Sacramento Superior Court Number 515766) that was filed to seek a more natural flow regime in Putah Creek under Section 5937 of the California Fish and Game Code, which requires that fish populations below dams be kept in "good condition." The purpose of the accord was to create as natural a flow regime as feasible, as well as to provide for the protection and enhancement of native resident and anadromous fish populations and maintenance of riparian vegetation.

- **Solano Multispecies Habitat Conservation Plan.** The Solano Habitat Conservation Plan (HCP), when finalized, will establish a framework for complying with state and federal endangered species regulations while accommodating future urban growth, development of infrastructure, and ongoing operations and maintenance activities associated with flood control, irrigation facilities, and other public infrastructure undertaken by or under the permitting authority/control of the plan participants within Solano County over the next 30 years. These covered activities are associated: (1) with urban development within urban growth boundaries of the cities of Dixon. Fairfield, Rio Vista, Suisun City, Vacaville, and Vallejo; (2) secondary support development such as communication service facilities, flood control facilities, roads, and recreation facilities outside of urban growth boundaries, and operations and maintenance of these facilities; (3) habitat management, enhancement, restoration, and monitoring, and relocation of covered species. The HCP was required as part of Solano County Water Agency renewing its Solano Project water supply contract in 1999. Development of the HCP is ongoing.

7 ENVIRONMENTAL IMPACTS

Sections below describe impacts to hydrology and water quality, and aquatic biological resources that could occur as a result of delivering 120 acre-feet of Solano Project water to the project annually.

7.1 HYDROLOGY AND WATER QUALITY

7.1.1 Thresholds of Significance

Criteria for determining significant impacts on hydrology and water quality are based upon questions found in Appendix G of the State CEQA Guidelines and professional judgment. In the evaluation that follows, a potential impact to water quality would be significant if the implementation of the project would do any of the following.

- Violate any water quality standards.
- Otherwise substantially degrade water quality.

The following hydrology and water quality impact indicators in the State CEQA Guidelines Appendix G Environmental Checklist are not relevant to this evaluation and, thus, are not included as significance criteria.

- Violate any waste discharge requirements.
- Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin.
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:
    - result in a substantial erosion or siltation on- or off-site;
    - substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or offsite;
    - create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or
    - impede or redirect flood flows.
- In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation.
- Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan.

However, the hydrologic effects to study area waterbodies from delivering water to the project are discussed in the next section to provide information necessary to characterize potential effects on water quality and aquatic biological resources.

7.1.2 Impacts on Hydrology and Water Quality

7.1.2.1 Lake Berryessa

Water quality within Lake Berryessa is affected, in part, by the quality and quantity of tributary inflows, which in turn are affected, in part, by precipitation and upstream watershed land use activities. The project would not affect annual precipitation or watershed land uses, thus would not affect inflow quality or quantity. Therefore, external source contributions of constituents to Lake Berryessa under the project would not differ from existing conditions.

Water quality within Lake Berryessa also can be affected by the amount of water present seasonally within the reservoir (i.e., end-of-month storage volume). Reservoir storage volume can affect the dilution of tributary inflows, which in turn can affect reservoir constituent concentrations. Reservoir storage volume also can affect internal physical processes, such as temperature gradients from the water surface to the sediment, which in turn can affect other water quality parameters, such as nutrient cycling and dissolved oxygen conditions.

Because Lake Berryessa is a relatively large reservoir (1.55 million acre-feet), storage changes that could occur as a result of delivering water to the project would be minimal. Monthly storage in Lake Berryessa from January 1985 to August 2023 ranges from a low of about 0.4 million acre-feet to a high of about 1.6 million acre-feet and averages about 1.2 million acre-feet. The volume of water for the project, 120 acre-feet, would comprise 0.03% of the lowest lake volume, 0.01% of the highest lake volume, and 0.01% of the average lake volume. A storage reduction of this amount would be immeasurable and would not cause substantial, if any, changes to the lake's seasonal end-of-month storage levels, thermal profiles, biochemical processes, or dilution capacity.

Therefore, delivery of water to the project would not cause violation of any water quality standards or otherwise substantially degrade water quality in Lake Berryessa and, therefore, would have a **less-than-significant impact** on Lake Berryessa water quality.

7.1.2.2 Putah Creek

Water quality within Putah Creek is affected, in part, by the quality and quantity of tributary inflows and nonpoint discharges, which in turn are affected, in part, by upstream watershed land use activities. The project would not affect watershed land uses and thus would not affect seasonal tributary inflow quality or quantity of nonpoint source discharges. Thus, external source contributions of constituents to Putah Creek under the project would not differ from existing conditions.

Water quality within Putah Creek also can be affected by the amount of water present seasonally (i.e., creek flow rates). Creek flow rates can affect the dilution of tributary inflows and nonpoint source discharges. Creek flow rates also can affect physical processes, such as temperature gradients, erosion processes that drive suspended sediment and turbidity levels, and turbulence that affect reaeration processes.

With the project, Solano County Water Agency would continue to operate the Putah Diversion Dam to meet Putah Creek Accord flow requirements. Furthermore, any changes in releases of

Lake Berryessa water to supply project water would be to support additional diversions at the Putah Diversion Dam. Therefore, release of water to the inter-dam reach of Putah Creek to provide water for the project would not affect Putah Creek flows below the Putah Diversion Dam. Assuming a constant delivery of water to the project, a 120 acre-feet annual supply is equal to 0.33 acre-feet per day or 0.17 cfs. This flow rate is 0.2% of the minimum monthly average flow below Monticello Dam (82 cfs; Table 3) and 1% of the minimum daily flow rate required to be released at Putah Diversion Dam to Lower Putah Creek (16 cfs; see Table 1). Such minor changes in releases of Lake Berryessa water into Putah Creek would not cause substantial, if even measurable, changes to Putah Creek daily flows. Such negligible flow changes would not cause alteration of water quality conditions within Putah Creek.

Therefore, delivery of water to the project would not cause violation of any water quality standards or otherwise substantially degrade water quality in Putah Creek and, therefore, would have a **less-than-significant impact** on Putah Creek water quality.

7.1.2.3 Barker Slough

As described in Section 2, Water Supply and Water Rights, providing water to the project could result in Solano Irrigation District diverting up to an additional 120 acre-feet of SWP water, annually, at the Barker Slough Pumping Plant. Assuming Solano Irrigation District diverts this water primarily during a five-month period within the peak irrigation season, the associated diversion rate would be 0.40 cfs, which is 0.3% of the Barker Slough Pumping Plant capacity and approximately 0.5% of the historical average summer diversion rate (Table 4). Such minor additional pumping and diversion of water from Barker Slough would not result in substantial adverse effects, if any effects, to wetted habitat or water quality conditions in Barker Slough, nor would it substantially affect the quality of the water for municipal and industrial uses of SWP contractors that receive water from the North Bay Aqueduct.

Therefore, delivery of water to the project would not cause violation of any water quality standards or otherwise substantially degrade water quality in Barker Slough and, therefore, would have a **less-than-significant impact** on Barker Slough water quality.

7.2 AQUATIC BIOLOGICAL RESOURCES

7.2.1 Thresholds of Significance

Criteria for determining significant impacts on aquatic biological resources are based upon the language found in State CEQA Guidelines section 15065 and in questions found in State CEQA Guidelines Appendix G Environmental Checklist. In the evaluation that follows, a potential impact to aquatic biological resources would be significant if the implementation of the project would do any of the following.

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the CDFW or USFWS.

- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the CDFW or USFWS.
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.
- Substantially reduce the habitat of a fish species.
- Cause a fish population to drop below self-sustaining levels.
- Substantially reduce the number or restrict the range of an endangered, rare or threatened aquatic species.

The following biological resources impact indicators in the State CEQA Guidelines Appendix G Environmental Checklist are not relevant to this evaluation and, thus, are not included as significance criteria.

- Have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means.
- Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.
- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.

7.2.2 Impacts on Aquatic Biological Resources

7.2.2.1 Lake Berryessa

As described in Section 6.1.2, *Impacts on Hydrology and Water Quality*, supplying water to the project would have an immeasurable effect on Lake Berryessa storage and would not affect the lake's thermal profile, water quality, or available habitat. The minor effects on Lake Berryessa storage that could result from the project would not result in substantial adverse effects to phytoplankton, zooplankton, benthic macroinvertebrate, or emergent and submerged macrophyte communities, or any of the lake's other aquatic biological resources. Likewise, any small effect of the project on Lake Berryessa storage would have no effect on coldwater or warmwater fish habitat within the lake because the small effect on storage would not affect available habitat or the thermal profile of the lake. As described in Section 5, *Environmental Setting*, Lake Berryessa does not support special status aquatic biological species.

Based on the projected negligible changes in storage and lack of adverse effects on water quality and habitat, delivery of water to the project would not affect Lake Berryessa aquatic biological resources as follows.

- Would not have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the CDFW or USFWS.
- Would not have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the CDFW or USFWS.
- Would not interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.
- Would not substantially reduce the habitat of a fish species.
- Would not cause a fish population to drop below self-sustaining levels.
- Would not substantially reduce the number or restrict the range of an endangered, rare or threatened aquatic species.

Therefore, delivery of water to the project would have a **less-than-significant impact** on Lake Berryessa aquatic biological resources.

7.2.2.2 Putah Creek

As described in Section 6.1.2, *Impacts on Hydrology and Water Quality*, the project could result in a small increase in flows in the inter-dam reach associated with the delivery of project's water supply. The project would not affect flows in Putah Creek below the Putah Diversion Dam, which would continue to be subject to the Putah Creek Accord. Therefore, the delivery of water to the project would not affect Putah Creek aquatic biological resources as follows because the small effect on flows would not affect aquatic habitat quantity or quality, including the seasonal thermal regime of the creek.

- Would not have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the CDFW or USFWS.
- Would not have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the CDFW or USFWS.
- Would not interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.
- Would not substantially reduce the habitat of a fish species.
- Would not cause a fish population to drop below self-sustaining levels.
- Would not substantially reduce the number or restrict the range of an endangered, rare or threatened aquatic species.

Therefore, delivery of water to the project would have a **less-than-significant impact** on Putah Creek aquatic biological resources.

7.2.2.3 Barker Slough

As described in Section 6.1.2, *Impacts on Hydrology and Water Quality*, supplying water to the project would have an immeasurable effect on the diversion rate at Barker Slough Pumping Plant and would not affect Barker Slough's water quality or quantity and quality of aquatic habitat. Furthermore, as described in Section 5, *Environmental Setting*, operation of the Barker Slough Pumping Plant is subject to requirements in the current CDFW incidental take permit and USFWS biological opinion for protection of Delta special status species, including delta smelt. Therefore, delivery of water to the project would not affect Barker Slough aquatic biological resources as follows.

- Would not have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the CDFW or USFWS.
- Would not have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the CDFW or USFWS.
- Would not interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.
- Would not substantially reduce the habitat of a fish species.
- Would not cause a fish population to drop below self-sustaining levels.
- Would not substantially reduce the number or restrict the range of an endangered, rare or threatened aquatic species.

Therefore, delivery of water to the project would have a **less-than-significant impact** on Barker Slough aquatic biological resources.

7.3 CUMULATIVE ANALYSIS

The State CEQA Guidelines Section 15130 requires that an environmental impact report discuss cumulative impacts of a project when the project's incremental effect is "cumulatively considerable." According to Section 15065(a)(3), "cumulatively considerable" means the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects. Pursuant to Section 15130(b) of the CEQA Guidelines, "(t)he discussion of cumulative impacts shall reflect the severity of the impacts and their likelihood of occurrence, but the discussion need not provide as great detail as is provided for the effects attributable to the project alone. The discussion should be guided by the standards of practicality and reasonableness, and

should focus on the cumulative impacts to which the identified other projects contribute rather than the attributes of other projects which do not contribute to the cumulative impact."

If the future cumulative condition is determined not to be significant (i.e., the environmental condition resulting from impacts of all past, present and reasonably foreseeable projects including the proposed project is not adverse relative to existing conditions), then no further assessment to determine whether the project's contribution is cumulatively considerable is needed because the project would not have effects that are individually minor but collectively significant. Conversely, if the future cumulative condition is determined to be significantly adverse relative to existing conditions, then further assessment is conducted to determine whether the project's individual contributions to the significant cumulative condition are "cumulatively considerable" and thus significant.

State CEQA Guidelines Section 15130, subdivision (b)(3), states that "[l]ead agencies should define the geographic scope of the area affected by the cumulative effect and provide a reasonable explanation for the geographic limitation used." The geographic scope of this cumulative analysis is the Putah Creek watershed, including Lake Berryessa, and Barker Slough. This is a large area, but is considered here because water quality issues are typically limited by watersheds and because the aquatic fauna of concern could be affected by water quality and water volumes in the watershed.

7.3.1 Hydrology and Water Quality

7.3.1.1 Lake Berryessa and Putah Creek

Future cumulative hydrologic and water quality conditions in Lake Berryessa and Putah Creek are expected to be influenced by climate change effects on precipitation patterns and ambient air temperatures, which could affect seasonal lake volumes, creek flow rates, and contribute to higher lake and creek temperatures. Cumulative water quality conditions in Lake Berryessa and Putah Creek would also be affected by new development within the watershed. New development would be subject to federal, state, and local regulations, plans, and policies for the protection of water and biological resources. These regulations, plans, and policies should be sufficient to protect Lake Berryessa and Putah Creek from water quality degradation compared with existing conditions. In addition, the Putah Creek Accord was designed to protect the aquatic resources of the creek in balance with water supply interests and remains protective with the passage of time. For these reasons, **the future cumulative hydrologic and water quality condition for Lake Berryessa and Putah Creek is determined to be less than significant.**

7.3.1.2 Barker Slough

Cumulative hydrologic conditions in Barker Slough are expected to be influenced by climate change effects on watershed hydrology and sea level rise. Cumulative water quality conditions in Barker Slough are expected to be influenced by future population growth and associated urban development, salinity intrusion resulting from sea level rise, habitat restoration projects, and water quality regulations, plans and policies to improve conditions for beneficial uses. The effects of these influences on water quality will vary, with some having the potential to contribute to degradation of water quality, whereas others will improve water quality. Because of anticipated increases in salinity associated with climate change, **the cumulative hydrologic and**

water quality condition for Barker Slough is determined to be significant relative to existing conditions.

The small additional diversions that could occur at the Barker Slough Pumping Plant due to the proposed project would contribute very minimally to alterations of Barker Slough hydrodynamics and water quality. Furthermore, the SWP would have to be operated to satisfy various biological and water quality regulatory requirements with the additional diversion associated with the project, including the CDFW incidental take permit (current and future), USFWS biological opinion for coordinated operation of the SWP and CVP (current and future), SWRCB D-1641 (and any successor water rights decisions) requiring the SWP to be operated to meet Bay-Delta WQCP water quality objectives. **Consequently, the project's individual contribution to the significant cumulative condition for hydrology and water quality in Barker Slough would not be cumulatively considerable.**

7.3.2 Aquatic Biological Resources

7.3.2.1 Lake Berryessa and Putah Creek

Future cumulative conditions for aquatic biological resources in Lake Berryessa and Putah Creek (resulting from cumulative impacts from all past, present, and reasonably foreseeable projects including the proposed project) are expected to be similar to existing conditions. Although climate change may have some thermal effects on Lake Berryessa and Putah Creek, such effects are not expected to be at levels that would cause adverse thermal impacts to the aquatic biological resources of the lake or creek. Coldwater released from Lake Berryessa into Putah Creek will continue to occur in the future. This is because Lake Berryessa will continue to thermally stratify seasonally. In addition, seasonal water surface elevations will not change substantially and, therefore, seasonal release temperatures will remain similar to existing conditions during the summer and fall months. Climate change will have similar magnitude, or possibly lesser effects, on Lake Berryessa water temperatures, and thus temperatures of water released into Putah Creek, during winter and spring months of the year. Climate change is expected to have minor, if any, effects on other water quality parameters in these water bodies. Moreover, the Solano Project operates to maintain sufficient flows to maintain fish and aquatic species habitat in Putah Creek. Project operations support a healthy recreational fishery below Monticello Dam in the inter-dam reach and releases from Lake Berryessa and diversions at the Putah Diversion Dam are controlled to maintain prescribed flows in the reaches below the Putah Diversion Dam. It is expected that future Lake Berryessa and Putah Diversion Dam operations would continue in a manner that sustains a healthy recreational fishery in the inter-dam reach and maintains spawning and rearing flows downstream of the Putah Diversion Dam. In consideration of the past and present activities affecting aquatic biological resources in Lake Berryessa and Putah Creek, the planned future implementation of the project in combination with other projects, such as future creek restoration projects and future Solano Multispecies Habitat Conservation Plan, **the cumulative condition for the aquatic biological resources of Lake Berryessa and Putah Creek is determined to be less than significant.**

7.3.2.2 Barker Slough

Barker Slough is located within the Delta, which is experiencing a decline of the open-water (pelagic) fishes (e.g., delta smelt, longfin smelt) and some prey species, commonly referred to as "pelagic organism decline." The causes of pelagic organism decline remain uncertain and likely involve many factors, including changes to hydrologic patterns and entrainment losses associated with Delta water export operations, loss of habitat, prior-year abundance of each species, food and prey relationships, water quality parameters (e.g., turbidity, contaminants), and non-native species predation and competition. Decline in habitat suitability for delta smelt is associated with high water temperatures in summer and salinity mixing zone intrusion in fall months.

Uncertain hydrologic and hydraulic conditions, along with increased temperatures resulting from climate change and sea level rise, as well as implementation of reasonably foreseeable actions in the Delta, including DWR's Delta Conveyance Project, DWR's EcoRestore program, and continued implementation of the federal biological opinions on the long-term operation of the CVP and SWP make prediction of the cumulative conditions for delta smelt, salmonids, and other aquatic species of concern in the Delta difficult. In consideration of the past, present, and future activities affecting aquatic biological resources in the Delta, along with anticipated increases in water temperatures driven by climate change, existing adverse conditions for special status species and species of concern present in the Delta (delta smelt, longfin smelt, winter-run and spring-run Chinook salmon, and steelhead) are expected to become more adverse. Habitat restoration and adaptive management associated with CVP and SWP operations are not expected to completely offset the adverse effects. **Therefore, the cumulative condition for aquatic biological resources in Barker Slough is determined to be significant.**

The project could result in additional diversion of water from Barker Slough, which would have minor, if any, measurable hydrologic effects on Barker Slough. Average monthly increases in diversion rates at the Barker Slough Pumping Plant could be 0.40 cfs (0.5% of the historical summer diversion rate). Such small diversion rates would not contribute to measurable changes in Delta outflow, Delta water temperatures, or the seasonal location of the low salinity zone. As such, the project's incremental diversion would not adversely affect aquatic habitat quantity or quality in Barker Slough. Moreover, the project's incremental effect on diversions at this location would not contribute considerably to entrainment as another stressor to Delta smelt under the cumulative condition, because fish entrainment is expected to remain at levels similar to existing conditions. Also, operation of the Barker Slough Pumping Plant is subject to requirements in the current CDFW incidental take permit and USFWS biological opinion for protection of special status species, including delta smelt. Based on these factors, **the project's individual contribution to the significant cumulative condition for aquatic biological resources in Barker Slough would not be cumulatively considerable.**

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