Hazen and Sawyer
90 New Montgomery St. Suite 333
San Francisco, CA 94105

2020 Agricultural Water Management Plan

to be considered for adoption on February 18, 2025

Prepared for the
Byron-Bethany Irrigation District

Prepared in Compliance with
the Water Code Section §10826

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Abbreviation	Definition
AF	Acre-Feet
AFY	Acre-Feet per Year
AW	Applied Water
AWHC	Available Water Holding Capacity
AWMP	Agricultural Water Management Plan
BBIC	Byron-Bethany Irrigation Company
BBID	Byron-Bethany Irrigation District
Bethany SA	Bethany Service Area (aka Bethany Division)
Board	Byron-Bethany Irrigation District Board of Directors
Br	Bromine
Byron SA	Byron Service Area (aka Byron Division)
CCWD	Contra Costa Water District
CDEC	California Data Exchange Center
CFS	Cubic Feet per Second
CIMIS	California Irrigation Management Information System
CIP	Capital Improvement Plan
Cl	Chlorine
CUP+	Consumptive Use Program Plus
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CWC	California Water Code
Delta	Sacramento-San Joaquin River Delta
District	Byron-Bethany Irrigation District
DMC	Delta-Mendota Canal
DWR	California Department of Water Resources
ECC	East Contra Costa
ET	Evapotranspiration
ET_{AW}	Evapotranspiration of Applied Water
ET_C	Crop Evapotranspiration
EWMP	Efficient Water Management Practice
GM	Byron-Bethany Irrigation District General Manager
GSA	Groundwater Sustainability Agency

Abbreviation	Definition
GSP	Groundwater Sustainability Plan
JPA	Joint Powers Authority
MCL	Maximum Contaminant Level
MHCSD	Mountain House Community Services District
M&I	Municipal and Industrial
Mountain House SA	Mountain House Service Area (aka RWSA 1)
NO_3	Nitrate
NPDES	National Pollutant Discharge Elimination System
O_2	Oxygen
PVSA	Plain View Service Area (aka CVP Service Area)
PVWD	Plain View Water District
RWSA	Raw Water Service Area
SB X7-7	Senate Bill X7-7, the Water Conservation Act of 2009
RF	Recoverable Flows
SA	Service Area
SCADA	Supervisory Control and Data Acquisition
SGMA	Sustainable Groundwater Management Act
SLDMWA	San Luis and Delta-Mendota Water Authority
SMCL	Secondary Maximum Contaminant Level
SO_4	Sulfate
SWP	State Water Project
SWRCB	California State Water Resources Control Board
TAF	Thousand Acre-Feet
TDS	Total Dissolved Solids
Tracy Hills SA	Tracy Hills Service Area (aka RWSA 2)
USBR	United States Bureau of Reclamation
UWMP	Urban Water Management Plan
WC	California Water Code
WMF	Water Management Fraction
WRCC	Western Regional Climate Center
West Side SA	West Side Service Area
WIIN Act	Water Infrastructure Improvements for the Nation Act
WSID	The West Side Irrigation District

1. Introduction

The Water Conservation Act of 2009 (Senate Bill [SB] X7-7) stipulated that agricultural water suppliers who provide water to 10,000 or more irrigated acres, excluding recycled water, must produce an Agricultural Water Management Plan (AWMP) on or before December 2012 and every five years thereafter. Legislation enacted since 2009 modified the threshold acreage, as well as other AWMP components:

- Senate Bill 1330 (2011): Modified the law to require only those agricultural water suppliers supplying water to over 25,000 irrigated acres (excluding recycled water) to generate AWMPs. Suppliers providing water to 10,000 to 25,000 irrigated acres could forgo Water Code Parts 2.55 (sustainable water use and demand reduction) and 2.8 (agricultural water management planning), unless sufficient funding the State provides sufficient funding.
- Executive Order B-37-16 (2016): Acknowledged the multi-year drought and permanently required the completion of AWMPs by water suppliers providing water to over 10,000 irrigated acres of water.
- Assembly Bill 1668 and Senate Bill 606 (2018): Required preparation of annual water budgets, quantification of water use efficiency from California Department of Water Resources' (DWR) 2012 Report to the Legislature, and a "drought plan" for periods of limited water supplies that describes actions for drought preparedness (i.e., resilience planning) and management and allocations of water supply during drought conditions (i.e., response planning).

The Byron-Bethany Irrigation District ("BBID" or the "District") supplies water to 12,600 irrigable acres in its Byron and Bethany Service Areas and to 3,450 irrigable acres in its Plain View Service Area. The District annexed the West Side Irrigation District in October 2020, and this new West Side Service Area will be incorporated into the 2025 AWMP. The District has produced an AWMP because its irrigable (potential irrigated) acreage exceeds 10,000 acres. This AWMP follows the guidelines from DWR's *Guidebook to Assist Agricultural Water Suppliers to Prepare a 2020 Agricultural Water Management Plan*. An AWMP checklist is included in Appendix A of this AWMP, providing the components of this AWMP and those component's applicable statutory authority under the California Water Code (WC). This Plan also reports on the implementation status of specific Efficient Water Management Practices (EWMPs) required under the SB X7-7.

SB X7-7 also mandates that urban water suppliers serving more than 3,000 AF of raw water annually for municipal and industrial (M&I) purposes adopt an Urban Water Management Plan (UWMP). In 2020, BBID supplied over 4,600 AF to M&I users, in addition to the agricultural water previously discussed. BBID has chosen to adopt by resolution UWMPs for its M&I customers (Mountain House Community Services District (MHCSD, now the city of Mountain House which incorporated as a General Law City in 2024) and the city of Tracy. Copies of the BBID resolutions are included in Appendix G.

1.1 Description of Previous Water Management Activities

BBID has historically recognized water management and planning as essential to continuing to provide its customers with a reliable water supply. The *Byron-Bethany Irrigation District Feasibility Report in Support of P.L. 984 Loan Application for Proposed Improvements to Irrigation System* (Clair A. Hill and Associates, 1964) included a summary of the District's history, geography, general geology, water quality, groundwater and drainage issues, system evaluations, and water requirements. It also described a general plan for improvements, including designs and cost estimates.

Historically, BBID updated water demand projections every 5-10 years. In 1996 the District participated in the *East County Water Supply Management Study* (East County Water Management Association, 1996), which included projections of agricultural and M&I demands within its service area for the following planning periods: 2000, 2010, 2020, 2030, and 2040. The District then updated these projections in 1999 when planning for the annexation of the Tracy Hills Development. In 2002, BBID again updated its water supply and demand evaluation as part of the certification of the East Altamont Energy Center. In 2010, the District further updated the supply and demand evaluation to support its water supply and exchange agreement between BBID and the United States Bureau of Reclamation (USBR) for the Tracy Hills Development located in Tracy. The District adopted an AWMP in 2017, which was submitted to DWR. The District did not adopt an AWMP in 2020 due to ongoing consolidation efforts with the former West Side Irrigation District, which took several years to conclude. This 2020 AWMP updates the 2017 AWMP with data for the Byron, Bethany, and Plain View service areas. Data for the West Side Service Area (formerly the West Side Irrigation District) will be incorporated into the 2025 AWMP.

1.2 Coordination Activities

This section discusses the notification and involvement of customers in the AWMP process.

1.2.1 Notification of Agricultural Water Management Plan Preparation

Per WC section 10841 BBID notified the cities and counties to which it supplies water that it is preparing an AWMP. These entities include Alameda, Contra Costa, and San Joaquin Counties, and the cities of Tracy and Mountain House.

1.2.2 Public Participation

Table 1-1 summarizes public participation activities BBID performed for this AWMP. Appendix B includes documentation on the public noticing of the AWMP preparation and adoption.

Table 1-1: Public Participation Activities

Potential Interested Parties	Notified of AWMP Preparation	Notified of Public Meetings	Attended Public Meetings (Optional)	Copy of Adopted AWMP/ Amendment Sent
County of Alameda	01/24/2025			
County of Contra Costa	01/24/2025			
County of San Joaquin	01/24/2025			
City of Tracy	01/24/2025			
City of Mountain House	01/24/2025			
DWR	01/24/2025			
Local Newspaper	01/24/2025			
California State Library	01/24/2025			
BBID Website	01/24/2025			

1.3 AWMP Adoption and Submittal

This section reviews the adoption and submittal process of the District's 2020 AWMP to DWR.

1.3.1 AWMP Adoption

BBID's Board of Directors (Board) adopted the updated AWMP through Resolution No. 25 during the January Board meeting. This meeting comports with the hearing requirements under WC section 10841. A copy of Resolution No. 25 is included in Appendix C.

1.3.2 AWMP Submittal

Within 30 days of adoption, BBID will submit electronically to DWR and to the California State Library the final AWMP.

1.3.3 AWMP Availability

Prior to the adoption hearing, BBID made the draft AWMP available for public review on January 24, 2025. BBID provided notice that the public was able to submit written comments on the proposed AWMP by February 17, 2025, as well as oral comments at the adoption hearing. Within 30 days following adoption, BBID made available the final version of the AWMP on the BBID website. It also provided electronic copies the Counties of Alameda, Contra Costa, and San Joaquin, as well as the cities of Tracy and Mountain House.

1.4 AWMP Implementation Schedule

California Code of Regulations, Title 23, §597.1 defines the applicability of efficient water management practice (EWMP) implementation (the two critical are water measurement and volumetric pricing of water deliveries) to agricultural water suppliers. An agricultural water supplier providing water to between 10,000 and 25,000 irrigated acres must not implement EWMPs unless sufficient funding is provided specifically for that purpose, as stated under Water Code §10853.

The District provides water to more than 10,000 irrigable acres and is completing the AWMP as required. Additionally, the District serves less than 25,000 irrigable acres and does not receive State funding for EWMP implementation and is not required to measure or volumetrically price water. However, BBID previously implemented 2 critical EWMPs (water measurement and volumetric pricing) and has recently implemented most of the 14 conditional EWMPs. discussed in Section 7 of this AWMP and the 2017 AWMP. BBID plans to continue to implement feasible EWMPs over the next twenty years.

2. Description of the Agricultural Water Supplier and Service Area

This section provides a description of the BBID service area, including physical and operational characteristics. BBID's service area has remained unchanged since publication of the 2017 AWMP. However, effective 2020 through consolidation with the WSID, BBID's service area increased to include the lands within the former WSID.

2.1 Physical Characteristics

2.1.1 Service Area Description

BBID is a multi-county special district serving 36,000 acres across parts of Alameda, Contra Costa, and San Joaquin Counties. The District serves more than 215 agricultural customers and more than 40,000 M&I customers. BBID utilizes three different surface water sources (described below) to supply water to the following six service areas (SA), as shown in Figure 2-1 :

- Byron Division (Byron SA);
- Bethany Division (Bethany SA);
- Raw Water SA 1, (Mountain House SA);
- Raw Water SA 2, (Tracy Hills SA);
- Central Vally Project SA (Plain View SA); and
- West Side SA.

BBID does not rely on or use groundwater as a primary water supply due to its poor quality and permeability of the soils in the Delta upland area. During severe historical droughts, some private landowners within BBID will use groundwater available to them on their properties to keep high value crops alive, but typically must blend with limited surface water availability due to the high salinity levels and other salts found in Delta upland geographic vicinity. In some years, BBID may convey and/or purchase small amounts of groundwater to provide to other growers, adhering to the county ordinances regarding groundwater use.

Pre-1914 Water Rights

In 1919, BBID formed and succeeded to all the works of the old Byron-Bethany Irrigation Company (BBIC), including the pre-1914 appropriative right to 40,000 miner inches of water from Old River, as described in BBIC's Notice of Appropriation. In 1963, the California Department of Water Resources (DWR) completed construction of the new State Water Project intake from the south Delta, and under an agreement between BBID and DWR, BBID's historic point of diversion for their pre-1914 water right was relocated from Italian Slough to the state's intake channel connecting the State Water Project's (SWP) Clifton Court Forebay and Harvey O. Banks Pumping Plant (Intake Channel). A 2003 Agreement between BBID and DWR updated the 1963 agreement, which recognizes BBID's prior pre-1914 water right. BBID provides water service to four service areas through its pre-1914 water right: Byron SA, Bethany SA, Mountain House SA, and Tracy Hills SA, with the Byron SA and the Bethany SA comprising approximately 24,000 acres.

BBID provides the Mountain House SA with up to 9,813 AFY of M&I water under a Water Services Agreement executed in 1996 by both BBID and the city of Mountain House, which was subsequently amended in 2008.

The Tracy Hills SA, which includes the Tracy Hills development, was created in 2013. BBID provides 4,500 AFY of M&I water under a wholesale water agreement between BBID and Tracy. BBID began providing water for M&I uses to the Tracy Hills SA in 2021.

As shown in Figure 2-1, BBID's pump stations in the Intake Channel divert the District's water into canals that convey raw water north to the Byron SA, south to the Bethany SA, and a turnout to the Delta-Mendota Canal (DMC) or conveyance to the Tracy Hills SA. The Mountain House SA is served from a pump station and pipeline that originates at Pump Station 1S (Pump Station 1 South).

USBR Central Valley Project Water

In 2004, Plain View Water District (PVWD) consolidated with BBID, dissolving PVWD and reorganizing PVWD's territory into BBID's Plain View Service Area (PVSA). The PVSA is served through the combination of (1) Central Valley Project (CVP) contract water with USBR; and (2) Warren Act (non CVP project water) comprised of BBID's pre 1914 water subject to contract conditions. The CVP contract entitles BBID to receive up to 20,600 AF of surface water made available at a specific locations along the DMC within the PVSA, as depicted in Figure 2-1. The place of use for the water provided under this contract is limited to a specific area, comprising 6,300 acres, of which approximately 3,450 are currently irrigable.

The availability of water to which BBID is entitled to receive under the CVP contract is constrained by USBR's allocation analysis, which considers hydrology, soil moisture conditions, reservoir carryover storage, regulations, and overall total system capacity. This means that even though BBID has a contractual entitlement to receive up to 20,600 AF, if the hydrologic conditions do not support allocating to BBID 100% of its entitlement, USBR will allocate a lesser percentage, which since 1992 and the commencement of modern day environmental regulations like the Central Valley Project Improvement Act (CVPIA), USBR's CVP annual water supply allocations average approximately forty percent (40%). In 2020, BBID converted its CVP water service contract with USBR to a "repayment contract," under the Water Infrastructure Improvements for the Nation (WIIN) Act (Pub. L. 114-322, 130 Stat. 1628). This

conversion changed the timing by which BBID repays the CVP-related construction costs and ongoing share of operation and maintenance. The maximum water entitlement under the repayment contract, as well as all other material conditions, remained unchanged through the conversion.

BBID holds Warren Act contracts with USBR entitling BBID, subject to certain conditions, to convey and store non-CVP water in federal facilities when excess capacity exists. Non-CVP water is water BBID diverts under its pre-1914 water right. Through these Warren Act contracts BBID may store non-CVP water in the following CVP facilities, including the DMC, O'Neill Forebay, and San Luis Reservoir. BBID uses the San Luis Reservoir as a water storage banking facility for its Plain View SA.

Post-1914 Water Rights

As discussed in the preceding section, WSID consolidated with BBID in 2021, thereby increasing BBID's service area to create the West Side SA, comprising 6,589 acres of unincorporated land around the city of Tracy. The consolidation of WSID resulted in BBID acquiring its post-1914 appropriative water right. Under this water right, BBID is entitled to divert up to 27,000 AFY of water between on or about April 1 and October 31 from the Old River for irrigation, domestic, and M&I uses. The consolidation also resulted in BBID receiving WSID's CVP water service contract. That contract was originally for 7,500 AFY, but WSID sold 5,000 AFY to the city of Tracy, entitling BBID to receive up to 2,500 AFY of CVP water for use within the West Side SA.

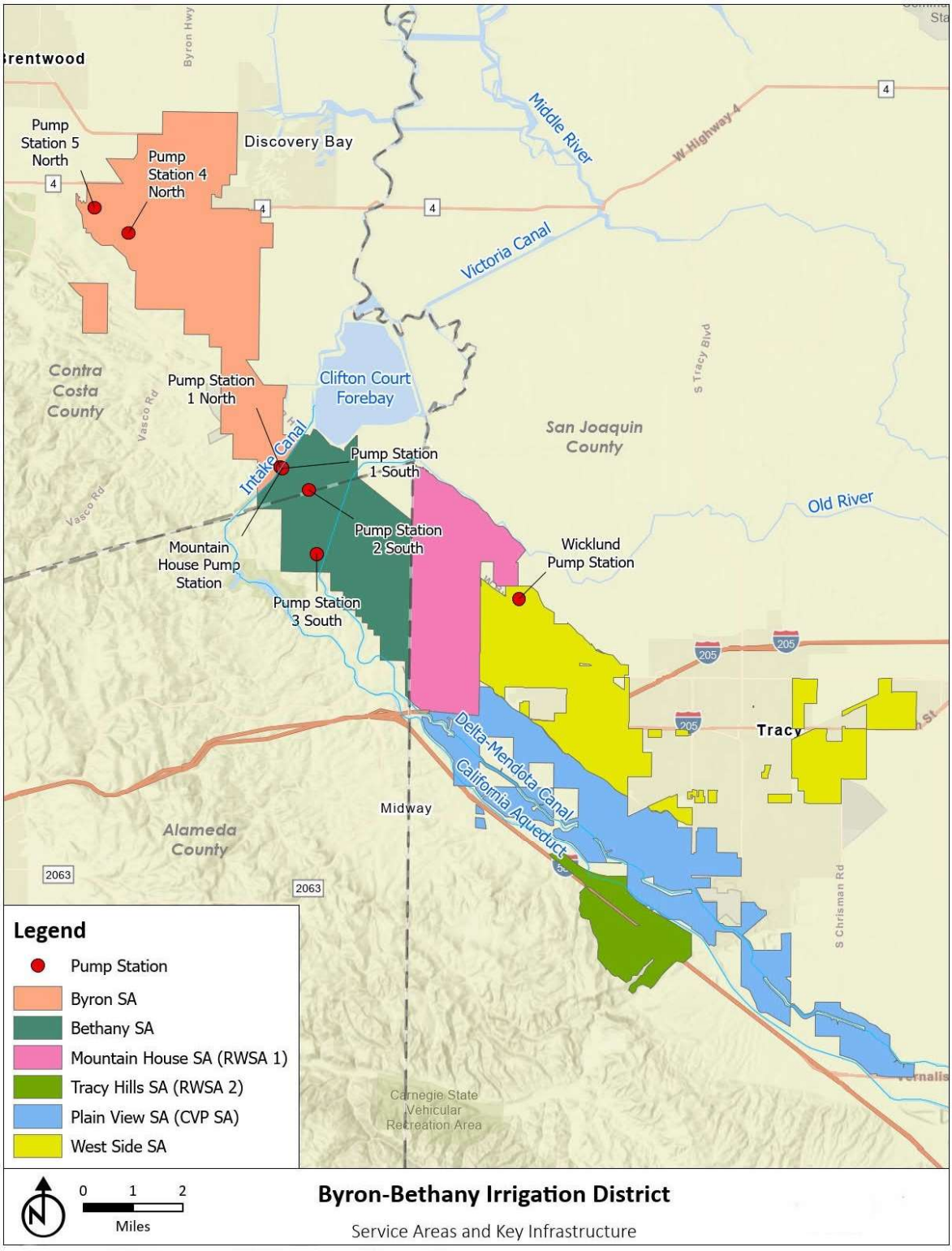


Figure 2-1: BBID Service Area & Infrastructure Map

2.1.2 Terrain and soils

The terrain and soils in BBID offer excellent conditions for agriculture. The western part of the District that is not irrigated, has rolling hills with slopes up to a 40% grade.

The soils in the BBID service area are primarily clay and clay loam textured soils. These soils are generally well and moderately well drained and do not have restrictive subsoils. The fine textured soils found in BBID are well suited to irrigation because they have a slow infiltration rate when wet. Areas of the Bethany SA near Clifton Court Forebay are composed of poorly drained loam and sandy loam. However, these soil characteristics are not impactful to agricultural because most water users in this area use water for M&I, rather than agricultural purposes. Table 2-1 depicts the majority terrain and soil type in each service area and the percentage of the area the soil type covers. Figure 2-2 depicts a detailed soil map of the service areas.

Table 2-1: BBID Terrain and Soil Type

Service Area	Majority Soil Type & Description	Percent of Area
Pre-1914		
Byron	CbA: Capay clay, wet, 0 percent slopes, MLRA 17	19.9%
Bethany	RdA: Rincon clay loam, 0 to 3 percent slopes	50.1%
Mountain House	252: Stomar clay loam, 0 to 2 percent slopes	47.6%
Tracy Hills	123: Carbona clay loam, 2 to 8 percent slopes	60.8%
CVP		
Plain View	118: Capay clay, 0 to 2 percent slopes, MLRA 17	57.2%
Post-1914		
West Side	118: Capay clay, 0 to 2 percent slopes, MLRA 17	56.8%

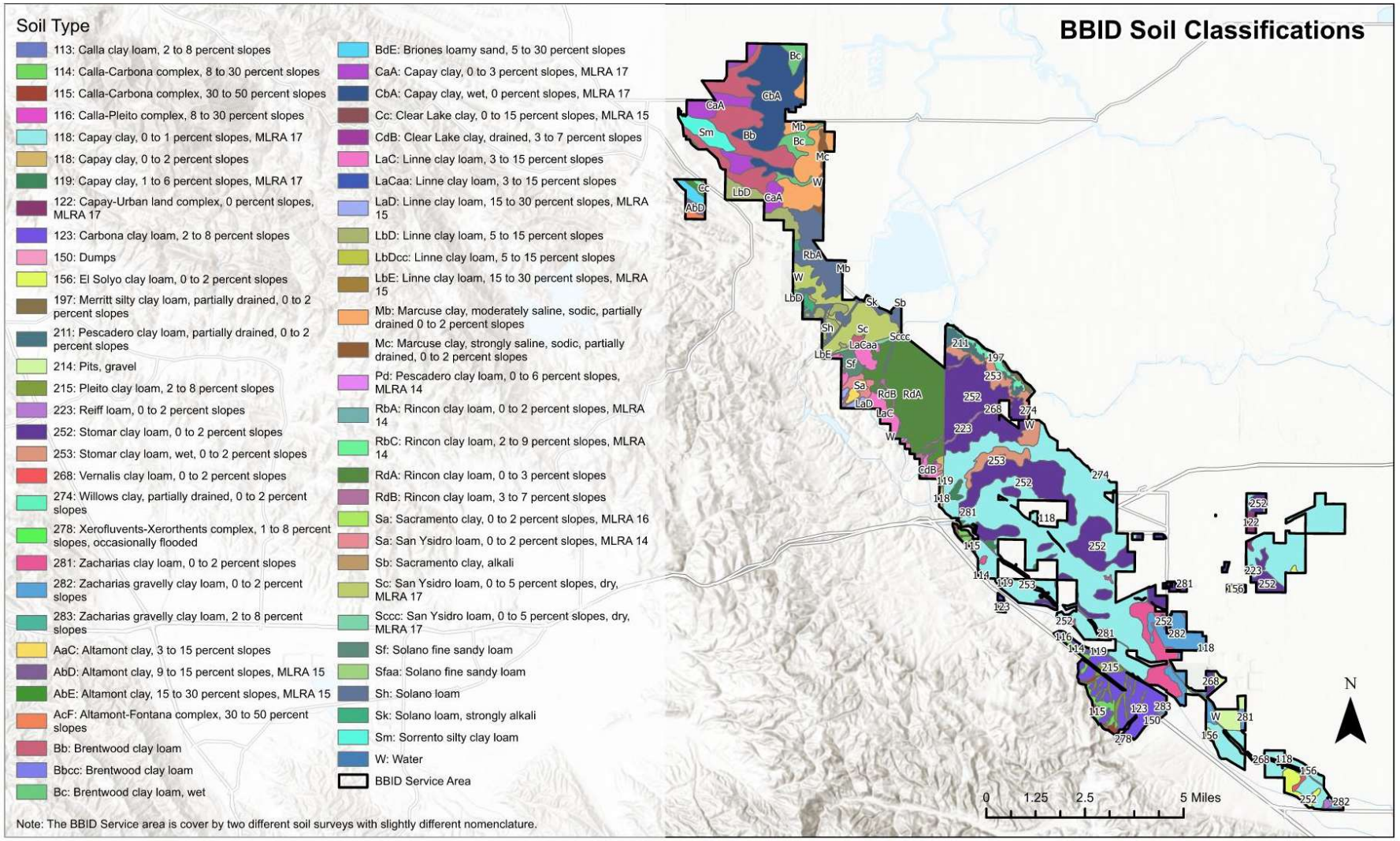


Figure 2-2: Soils Map

2.1.3 Climate

The climate across BBID is uniform, with minimal effects of microclimates. The District sees hot, dry summers and cool, moist winters. Most precipitation falls from November to March, and most evapotranspiration demand occurs from May to August. Table 2-2 shows monthly and annual average temperature, precipitation, and evapotranspiration from 2016 to 2020. The data was sourced from California Irrigation Management Information System (CIMIS) station 47 near Brentwood, California, which is 2 miles northwest of the BBID northern boundary.

Table 2-2: Monthly and Yearly Average Climate

Month	Average Max Temperature (°F)	Average Min Temperature (°F)	Average Temperature (°F)	Average Precipitation (in)	Average ET (in)
January	60.8	43.5	51.3	3.0	1.3
February	66.1	43.0	54.0	1.6	2.7
March	67.2	45.2	56.0	2.0	3.6
April	74.8	49.2	61.9	1.1	5.5
May	80.7	51.8	66.1	0.4	7.1
June	90.0	55.7	73.1	0.4	8.5
July	94.0	57.1	75.4	0.4	8.7
August	93.7	57.3	75.0	0.4	7.7
September	89.2	55.5	72.1	0.3	6.1
October	81.2	49.7	64.9	0.3	4.6
November	69.3	42.9	55.1	0.6	2.3
December	61.8	40.0	49.4	1.2	1.8
Yearly Average/ Total	77.4	49.3	62.9	11.7	59.9
Yearly Minimum	60.8 (January)	40.0 (December)	49.4 (December)	0.3 (September-October)	1.3 (January)
Yearly Maximum	94.0 (July)	57.3 (August)	74.7 (July)	3.0 (January)	8.7 (July)

2.2 Operational Characteristics

2.2.1 Operating Rules and Regulations

This section discusses BBID's operating rules and regulations. The complete document of *Rules and Regulations of the Byron-Bethany Irrigation District – Governing the Distribution of Water* (Rules and Regulations) is included in Appendix D.

2.2.1.1 Water Use and Availability

The irrigation season is generally from mid-March through mid-November. BBID makes water available to growers during the irrigation season, provided there is sufficient supply under the applicable right or contract under which BBID provides that grower water. Water must be used continuously by irrigators

throughout the period of the run. If water is inefficiently or improperly used, the General Manager (GM) is entitled to refuse delivery of water until the cause of waste or inefficient or improper use is removed.

2.2.1.2 Lead Time for Water Orders and Water Shut-Off

In the Byron SA, the Bethany SA and the West Side SA, customers must provide the Water Conservation/Schedule Coordinator with at least 24 hours notice for all water deliveries, delivery changes, and shut-off of deliveries.

In the Plain View SA, customers must provide 24 notice for water delivery and shut-off. BBID encourages flexible shut-off times, to the extent they can be accommodated by the CVP's DMC water operators.

2.2.1.3 Policies for Return Flows and/or Drainage Leaving the Service Area

BBID identified specific policies associated with agricultural return flows to District facilities. Return flow policies differ based on service area and are summarized below and explained in more detail in the Rules and Regulations.

Byron SA, Bethany SA, and West Side SA

All water introduced into District facilities (e.g., return flow, tail water, and seepage water) is considered District water and is subject to re-diversion and use by BBID. All such water intercepted and used by customers requires payment to BBID at the rate established by BBID. All return flows from water provided by BBID become the property of the District again when such flows enter a District lateral or surface drainage system, leaves the boundaries of a customer's property, or percolates into the District's sub-surface drainage system or other District facilities.

All customers who drain their surface run-off into District facilities must install sumps, in accordance with the District's Sump Standards and Requirements. No water, including tailwater, can be placed into the District's irrigation or drainage system without prior approval of the GM.

Adequate safeguards are established to prevent entry of trash, silt, herbicides, pesticides, fertilizers, etc., into the District's system. For example, the District requires the use of polyacrylamide to stabilize soil against erosion for furrow irrigation. Any damage, injury or legal action which may result from poor quality tailwater, including injury to third parties, is the responsibility of the discharger. The District may require reasonable periodic testing of tailwater discharged into the District's system at the expense of the discharger.

Plain View SA

If applicable, control and disposition of tailwater drainage flow from all CVP water deliveries is the customer's responsibility. There is no permitted recirculation of water within the Plain View SA.

Mountain House SA and Tracy Hills SA

There are no return flow polices for the Mountain House SA and the Tracy Hills SA because water delivered to these service areas is for M&I uses only, and no return flows occur.

2.2.1.4 Restrictions on Deliveries

When the demand for water deliveries exceeds the ability of the District's system or the available water supply for a specific service are, the GM may prorate water according to the limits of the system. The GM establishes crop priorities, which are then subject to revision or approval of the Board. These cropping priorities are established in the manner most likely to minimize overall detriment to crops that may result from the District's inability to serve water in the order requested. Additional information regarding the District's response during times of water shortage can be found in the drought response plan below in Section 2.2.4.1.2

During periods of critical supply, the District may not be able to provide water delivery on time. If the customer has not received water within five days of the date requested and reasonably expects permanent damage may result to the crop from such a delay in delivery of water, the customer shall file a written factual statement with the GM. The GM will immediately review this statement with a committee of three Directors from the Board, who will collectively determine (in their complete and sole discretion) if crop priorities should and can be modified. It is understood that the capacity of the District's system is limited by demands or outages, which may result in delays up to, or exceeding, five days.

2.2.2 Water delivery measurements or calculations

BBID is committed to the accurate measurement of all customer deliveries as a basis for sound water management and appropriate billing to its customers. Per the BBID Rules and Regulations, the District uses the units of cubic feet per second (cfs) to measure delivery flow rates and AF in volumetric measurement for charging their customers.

BBID purchases, installs, and maintains meters for each of its 315 customer turnouts, which serve 110 agricultural customers and 12 M&I customers within the Byron SA, the Bethany SA, and the Plain View SA. For these service areas, BBID uses McCrometer strap-on electronic meters and in-line propeller meters and inspects the meters annually. BBID sends meters to the McCrometer factory for calibration on a regular rotating basis. Factory specifications for the most common meter model used in the service area (McCrometer Strap-On Electronic Low-Pressure Meter) are included in Appendix E, along with the most recent certification for factory inspection and calibration.

Not every turnout in the West Side SA is currently equipped with a flowmeter, and most of the meters in the West Side SA are privately owned. Manual water measurement is performed for those turnouts that are not equipped with meters. The District is planning to conduct an assessment of all West Side SA turnouts to determine the feasibility of meter installation, or an alternative compliance measure.

2.2.3 Water rate schedules and billing

The Board establishes water rates annually prior to the start of the irrigation season. Water rates vary depending upon service area, but are levied on a per acre-foot basis. All payments for delivered water are due 30 days after completion of the irrigation event.

In 2016, the District commissioned a rate study, which informed a subsequent increase in water rates. The 2017 Water Rate Charge Resolution is included in Appendix F. Current water rates by service area are presented in Table 2-3 below and comport with the limitations of the 2016 rate study.

Table 2-3: BBID Current Water Rates

Rate Type	Service Area	Conditions	Rate
Agricultural Water Rate	Byron Bethany	Minimum charge of one acre-foot per turn on	$65.00 per acre-foot
Industrial Raw Water Rate	Byron	For sand-mining purposes and wetlands mitigation	$95.00 per acre-foot
Annual Flat Rate Water Service Charge (Interruptible)	Byron Bethany	Based on 2 acres or less	$120.00 per year
Construction Water	District Wide		$15.00 per unit (3500 gallons)
Water Availability / Stand-by Charge	Byron Bethany		$8.00 per acre
Category 1 O&M Charge	Plain View		$5.15 per acre
Category 2 O&M Charge	Plain View		$66.00 per acre
Category 3 O&M Charge	Plain View		$145.00 per acre
Applicable Rates & Charges of the USBR and San Luis & Delta-Mendota Water Authority	Plain View	Including the Authority membership assessment	Per acre-foot water charge

The District recently conducted a cost-of-service evaluation for the city of Tracy and the city of Mountain House in March 2023 to understand the cost and associated fees for delivering raw water to the customers. The District routinely updates its water rates based on cost-of-service evaluations, which includes industrial water users, such as the Mariposa Energy Project, which is a M&I user in Bethany SA.

2.2.4 Drought Plan and Water Shortage Allocation Policies

BBID recognizes that there may be times when the available water supplies are insufficient to meet the demands of its customers, especially given that the rights supporting those supplies are not the same in terms of reliability. Despite this, BBID is committed to providing reliable water supply and water-related services in an environmentally sound and cost-effective manner. In support of these commitments, the District is working to diversify its water supply portfolio through developing access to surface water storage facilities, conjunctive use opportunities, and identifying potential water transfer partners, as well as through the development of a Drought Plan and water shortage allocation policies in compliance with updated AWMP requirements.

Per the BBID Rules and Regulations, the District can initiate water rationing under conditions where the anticipated demand for water deliveries either exceeds the ability of the District's system, or the supply of water available under the applicable water right. Under these conditions, the GM has the authority and discretion to prorate water within the supply limitations of the system. Prior to prorating water deliveries, the GM will work directly with customers to determine the minimum water demand needed to keep their crops alive, which includes setting the general cropping preference (with approval of the Board) in the manner most likely to minimize overall detriment that may result from a water shortage.

2.2.4.1.1 Drought Resilience Planning

1) Determination of water supply availability and drought severity

Monitoring is a core aspect of BBID's Drought Plan. BBID regularly monitors water supply availability data to inform operational decisions. These data include hydrologic conditions of the Sacramento-San Joaquin Delta (Delta), CVP allocations, and any state regulatory actions which may impact allocations or water rights.

2) Potential vulnerability to drought

BBID has historically had access to sufficient water supplies due to their water rights and physical location in the Delta. Despite this, the District's potential vulnerability to drought may be impacted by a variety of factors, including future hydrologic conditions, outflow requirements from the Delta, availability of CVP allocations, and other potential regulatory actions by the State Water Resources Control Board (SWRCB). Potential vulnerabilities for each of the District's surface water supply sources, based on right, are summarized below.

Pre-1914 Water Rights

BBID's pre-1914 water right is the most senior water right held by the District, and as such, is a reliable surface water right. This right, under very specific circumstances, may be subject to curtailment by the SWRCB.

WIIN Act Contract with USBR

As detailed previously, BBID acquired PVWD's CVP water service contract in 2004, and, in 2020, converted this water service contract to a WIIN Act Repayment Contract. Under the terms of the Repayment Contract, BBID is entitled to receive up to 20,600 AFY of CVP water. Of this contractual entitlement, 19,800 AFY is south of Delta agricultural water and 800 AFY is south of Delta M&I water.

The actual availability of CVP water depends on the hydrological conditions, and allocations vary interannually (Figure 2-3). Since 2001, CVP agricultural allocations have averaged 49% and have been as low as 0%, while M&I allocations have averaged 79% and have been as low as 25%.

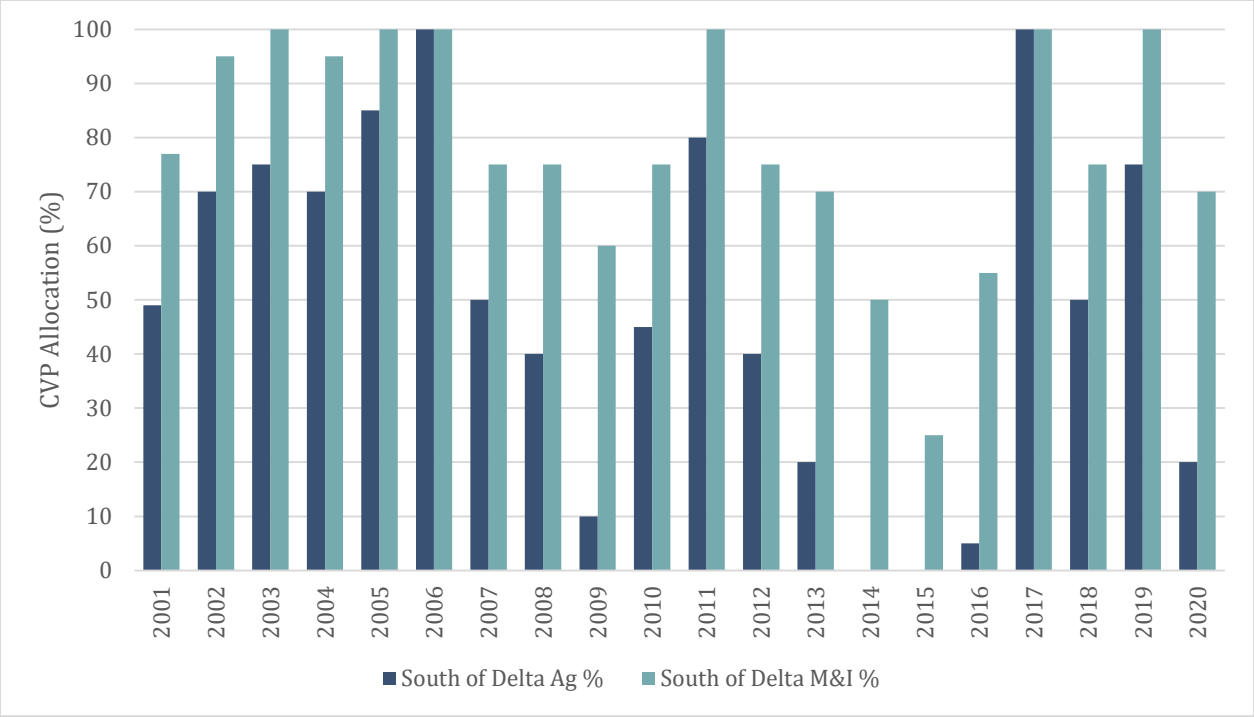


Figure 2-3: Historical Annual Maximum CVP Allocation for South of Delta

Post-1914 Water Rights

The District holds the former WSID post-1914 appropriative right in the form of a water right license. This right entitles BBID to divert up to 27,000 AFY from Old River. This post-1914 license, like all post-1914 water rights, may be subject to curtailment by the SWRCB.

Groundwater

The District does not rely on groundwater as a source of water supply due primarily to its poor water quality, but also to poor production from wells. However, landowners can choose to rely on privately owned groundwater wells in times of low allocations. This pumping depends upon the conditions of the groundwater basin, including groundwater quality issues, making this source the least reliable source of water and is generally only used to supplement surface water supplies when needed.

3) Drought resilience planning opportunities and constraints

BBID prioritized drought resilience planning opportunities, including implementing new technology, acquiring additional water sources, and other actions to improve resilience in times of drought. The District works with its customers, agricultural and M&I alike, as well as regional partners to foster the beneficial use of its water supplies in a responsible manner.

(A) The availability of new technology or information.

Incorporating new technology is a priority for BBID, as utilizing these resources results in minimized spills, better service provided to customers, and more efficient use of diverted water. BBID implemented

infrastructure upgrades, including the installation of a Supervisory Control and Data Acquisition (SCADA) system and control structure automation projects, resulting in more efficient operation of the system. The District supported customers to convert flood irrigation to drip irrigation systems, resulting in water conservation. About 62% of customers in the Byron SA and the Bethany SA use micro-irrigation as of 2023. About 80% of the irrigated lands in the Plain View SA had micro-irrigation in 2023. In the West Side SA, about 40% of agricultural customers utilize micro-irrigation. These conversions have mostly been done in the years since 2000 and accelerated after 2015.

The District is in the process of evaluating installation of flowmeters for the West Side SA, as only about 75% of agricultural customers in the West Side SA have flowmeters, and most are privately owned. The remaining 25% of agricultural customers' usage is manually measured based on measurements of gate openings and head loss through the gates. BBID plans to inventory all customer meters and determine the existence and condition of the meters.

(B) The ability of the agricultural water supplier to obtain or use additional water supplies during drought conditions.

BBID is planning several new projects to enhance system flexibility and further diversify it water supply portfolio. The District has proposed a construction and operation agreement for an intertie between the Byron SA Canal 45 and the Contra Costa Water District (CCWD) Old River pipeline to facilitate water transfers with CCWD and/or storage of BBID'spre-1914 water in the Los Vaqueros Reservoir. Such stored water can then later be withdrawn and used in the northern portion of the Byron SA. The District was also participating with CCWD in the now recently ended Los Vaqueros Reservoir Expansion Project. The additional storage would have increased water supply reliability for the "partners" to the project and facilitate development of supplies for environmental water management and improve water quality in the Delta. As a partner in the Los Vaqueros Expansion Joint Powers Authority (JPA), BBID was evaluating reserving 10 TAF of storage capacity. BBID is also participating through the San Luis & Delta-Mendota Water Authority (SLDMWA) and its partners to increase San Luis Reservoir storage by 130,000 AF, with BBID reserving 1,000 AF of storage for its customers. Lastly, the District continues engaging with regional water agencies regarding possible water transfers and regional water supply agreements. Most of the agreements with regional agencies are short-term agreements.

(C) A description of other actions planned for implementation to improve drought resilience.

Other actions BBID has taken to improve drought resiliency include participation in groundwater sustainability activities. As a GSA, BBID works cooperatively with two groundwater subbasins: (1) Tracy Subbasin; and (2) East Contra Costa Subbasin. BBID participates through the GSAs and other project partners to investigate conjunctive use opportunities and aquifer storage recharge groundwater wells to increase water supply reliability for BBID and its partners.

2.2.4.1.2 Drought Response Planning

1) Water shortage declaration, water shortage allocations, and response actions implementation

After reviewing supply availability and anticipated demand, BBID will make a water shortage declaration if the demand exceeds the available supply. To do this, the District meets with the agricultural customers

to understand the minimum water quantities needed before initiating water rationing per the BBID Rules and Regulations. During the 2015 drought, BBID's drought response actions taken during consisted of four main criteria: supply augmentation, demand reduction, operational actions, and others. Each is discussed below in greater detail.

Supply augmentation actions are important during drought periods to supplement water supply and minimize the effect of the drought on the District's customers. Supply augmentation in 2015 consisted of the following actions:

- Purchasing privately pumped water from growers;
- Actively pursuing short-term water transfers to keep high value crops alive;
- Collaboratively working with SLDMWA and other CVP contractors on the DMC Pump Back Projects to deliver water stored in the San Luis Reservoir to users upstream of the reservoir on the DMC;
- Utilizing the A&E groundwater well (a private well) to supplement supply in the Plain View SA; and

Demand reduction is another important aspect of drought response planning. Ensuring water is used efficiently and not wastefully is always a priority of the District that is heightened during drought. As the holder of the District's water rights, BBID is also bound by the Constitutional prohibition of waste and unreasonable use of water. Accordingly, during the 2015 drought, BBID took the following demand reduction actions: (1) reduce agricultural and M&I water deliveries to minimum levels; (2) reduce "construction water" deliveries; and (3) monitor wasteful run-off from agricultural fields to minimize any wasteful runoff.

Operational actions, similar to demand reduction, are important to reevaluate during times of drought, to ensure that water is not wasted. Like demand reduction, while operational actions are always a priority, they are particularly important when there is less water available. During the 2015 drought, BBID optimized the system operations by rapidly implementing additional technology, such as gate control through its SCADA/Telemetry system, improving District and grower communication, and assisting growers rapidly migrate toward drip irrigation to facilitate reduced water usage (i.e., less drop per crop) and reduce system spills.

Other actions taken by the District in response to the 2015 drought were as follows:

- Holding additional public outreach meetings for growers and the general public regarding the severity of conditions and promoting water conservation;
- Holding educational meetings to provide tips to growers regarding farming with reduced supplies;
- Developing and disseminating informational newsletters and/or website content regarding drought conditions and the District's response.

All of the aforementioned response actions BBID took during the 2015 drought achieved satisfactory outcomes to mitigate the negative impacts resulting from drought, while also creating foundation for the District to build on and improve practices to overcome future drought obstacles.

2) Methods and procedures for triggering and enforcing shortage response actions

BBID publishes its Rules and Regulations on its website, and they include information about the District's shortage response actions. BBID also provides a copy of the Rules and Regulations to all irrigation customers. During drought, BBID engages in the following activities to ensure the water resources of the District are distributed and used efficiently and equitably:

- Bulletin release to public to inform about drought conditions;
- Reminder letters to irrigation customers about rules and regulations regarding irrigation water distribution;
- Increased enforcement of water regulations to prevent unauthorized use;
- Investigation of all unauthorized uses of water;
- Investigation of all unauthorized encroachments;
- Increased water theft penalties;
- Implementation of several extraordinary operational measures to manage limited water supplies and augmented water supply.

3) Monitoring and evaluation of the effectiveness of the drought plan

BBID prioritizes continuous monitoring to understand and evaluate the effectiveness of their drought plan. While monitoring is always a priority, it is especially necessary during times of drought for effective water management. The District continuously monitors hydrological conditions, water supply, deliveries, and operational efficiency. Additionally, BBID plans to conduct retrospective timeline analysis of past drought declarations and actions implemented, to learn from past decisions and droughts. Staff input on the performance of past implemented actions is also considered.

4) Communication protocols and procedures

BBID is proactive in communicating with its customers regarding water supply. The District understands that communication, both internally and externally, is a necessary and important step in drought resilience protocol. Internal communication with growers and the general public within the District includes the following actions:

- Hold additional public outreach meetings for growers and the general public;
- Hold educational meetings to help growers work with reduced supplies;
- Develop informational newsletters or website content regarding drought conditions and the District's response;

- Inform the public about the severity of conditions and promote water conservation.

External communication consists of outreach with neighboring cities and counties, and state, federal, and other government entities. The external groups BBID would coordinate with, and the goals of coordination are as follows:

- City of Tracy for Tracy Hills Service Area M&I delivery and recycled water reuse;
- City of Mountain House: Mountain House SA M&I delivery;
- SLDMWA: water transfer;
- CCWD: water transfer;
- Delta Watermaster: Delta water operations and diversion;
- USBR: CVP allocation;
- SWRCB: potential state regulatory action.

5) Potential financial impacts of drought and proposed district management measures

Drought conditions could impact District finance. BBID may need additional labor during drought to fine tune district operations, including internal and external coordination with growers and public agency partners. The District also faces increased costs due to higher priced water in the form of water transfers, as well as increased energy costs and associated maintenance costs. Water sale revenue may also decline due to water conservation efforts. To overcome these impacts, BBID may consider the following actions:

- Impose a water surcharge for the extra cost induced from the transferred water to the growers. The water transfer contract will be negotiated, and there will be coordination and agreement with the growers.
- Utilize funds from reallocated deferred capital improvements and/or planned financial reserves to support District operations.
- Defer the implementation of capital improvement plan (CIP) projects until after drought when the hydrologic and financial conditions have sufficiently recovered.

3. Description of Quantity of Water Uses

Section 3 describes the quantity of water used for agricultural, environmental, recreational, M&I and groundwater recharge use. BBID primarily supplies water to agricultural users in addition to a handful of M&I users. Currently, BBID does not supply water for environmental purposes, recreational use, or groundwater recharge.

Water uses and demands are reported on a calendar year basis for 2016 to 2020 to include a complete irrigation season. The same time period was used to calculate the water budget in Section 5. According to the CDEC, the years 2016 to 2020 cover a wide range of water year types ranging from wet to dry.

3.1 Agricultural Water Use

The total agricultural water demand is estimated by crop evapotranspiration (ET_C) which combines water evaporation from the soil surface and transpiration through the crops. The ET_C used in this water budget analysis was quantified using the CUP+ Model for each crop.

The Consumptive Use Program Plus (CUP+) model was used to support BBID water budget calculations and was developed by DWR to help water suppliers quantify the efficiency of agricultural water use. CUP+ is an Excel application that estimates soil water balance to estimate ET_C, effective precipitation (E_r), and evapotranspiration of applied water (ET_{AW}) for crops. ET_{AW} is a seasonal estimate of the irrigation water requirement for evapotranspiration of a crop minus any water supplied by effective rainfall and effective seepage (DWR, 2012).

The CUP+ model requires the users to input information, including weather data, crop type, irrigation starting and end date, available water holding capacity (AWHC), maximum soil depth, maximum root depth, and allowable depletion of plant available water in the effective root zone, to generate output. The weather data for this analysis was retrieved from CIMIS Station 71, which is located near Modesto, California, and it includes daily solar radiation, maximum and minimum temperature, dew point temperature, and wind speed. Irrigation starting and ending dates are set to reflect the farmer's irrigation period for their crops. The AWHC is determined based on the soil texture of the irrigated land. As discussed in Section 2.1.2, BBID soil is primarily made of clay and clay loam. The maximum soil depth is assumed to be approximately 4 feet (PSSAC, 2022). The maximum root depth and allowable depletion is referenced from the crop information found from the Division of Agriculture and Natural Resources, University of California.

3.1.1 Pre-1914 Water Rights

Agricultural demand within the BBID area served by pre-1914 water rights is attributed to the Byron SA and the Bethany SA, in which over 5,000 out of the 12,600 potentially irrigable acres are actively irrigated. Most irrigated acreage (approximately 70% of total) is allocated to tree nuts, corn, row crops, and fruits shown in Table 3-1. Table 3-1 shows that almonds and orchard trees have expanded their acreage from 2016 to 2020. The District summarizes crop types and acreage from the growers' annual water applications. The District approximated the crop acreage for 2016 using the 2017 crop data. Changes to the cropping and weather patterns cause the calculated water demand to vary each year.

Table 3-1: Pre-1914 Water Rights Agricultural Crop and Water Demand Data, 2016 to 2020

Crop Type	2016		2017		2018		2019		2020	
	Acres	ET_c Demand (AF)	Acres	ET_c Demand (AF)	Acres	ET_c Demand (AF)	Acres	ET_c Demand (AF)	Acres	ET_c Demand (AF)
Alfalfa	765	2,383	765	2,383	392	1,221	301	936	393	1,223
Almonds	944	3,410	944	3,410	1,485	5,364	1,384	5,001	1,198	4,326
Apples	10	33	10	33	10	33	16	53	16	53
Beans	29	31	29	31	37	39	158	167	157	166
Corn	768	1,273	768	1,273	1,074	1,781	642	1,064	1,177	1,951
Garlic	0	0	0	0	0	0	50	83	45	75
Grapes	719	1,785	719	1,785	451	1,118	588	1,458	561	1,392
Oats	230	480	230	480	0	0	27	56	0	0
Olives	0	0	0	0	188	432	0	0	0	0
Orchard	438	1,581	438	1,581	445	1,608	548	1,978	556	2,007
Pasture	381	777	381	777	101	207	67	136	73	149
Peaches	59	199	59	199	59	199	59	199	59	198
Peppers	70	114	70	114	15	24	28	46	15	24
Strawberries	3	4	3	4	3	4	3	4	3	4
Tomatoes	540	1,171	540	1,171	784	1,701	993	2,154	786	1,705
Walnuts	329	1,124	329	1,124	294	1,006	276	944	276	942
Wheat	0	0	0	0	0	0	11	27	0	0
Total	**5,283**	**14,363**	**5,283**	**14,363**	**5,337**	**14,736**	**5,149**	**14,307**	**5,313**	**14,215**

As the crops have transitioned from annual crops to more high value permanent crops (i.e., almonds and orchards), the service areas' water demand has hardened.

Actual water deliveries to the Byron SA and the Bethany SA differ from the estimated values in Table 3-1 but show a similar pattern (highest deliveries in 2020). Table 3-2 shows the surface water and groundwater deliveries within the two service areas from 2016 to 2020.

Table 3-2: Pre-1914 Water Rights Agricultural Water Use, 2016 to 2020

Source	2016 (AF)	2017 (AF)	2018 (AF)	2019 (AF)	2020 (AF)
Surface Water (Pre-1914 Right)	13,988	11,828	12,415	11,849	18,516
BBID Groundwater	8	0	0	16	21
Private Pumping Estimate	2,012	4,173	4,261	3,980	0
Total	**16,008**	**16,001**	**16,406**	**15,845**	**18,537**

Private groundwater pumping in the pre-1914 service area is estimated and assumed to bring the total agricultural use (pre-1914 diversion minus M&I uses) to 16,000 AFY, the level of agricultural use during 2015.

The surface water deliveries in Table 3-1 do not follow the same pattern as the estimated ETc due to effective precipitation. The high ETc of 14,736 AFY in 2018 required a delivery of 14,642 AF, while the

14,215 ETc in 2020 required 13,055 AF of supply. Effective precipitation was 2,422 AF in 2018 but only 1,535 AF in 2020.

BBID relies primarily on its pre-1914 right from Old River to meet agricultural and M&I water demand in the Byron SA and the Bethany SA. During years when BBID cannot meet all demand using surface water, BBID has purchased groundwater from growers as a supplemental water source, albeit groundwater quality is poor and must be blended to meet crop water demands without jeopardizing the health of the crop. 2020 is classified as a dry year per the San Joaquin index, and the total 2020 water uses exceeds those of the prior years with a higher reliance on groundwater.

BBID typically delivers water to agricultural customers from March to November, but the water delivery schedule might vary depending on the hydrological conditions of that year.

3.1.2 Central Valley Project Water

Within the Plain View SA, approximately 1,500 out of 3,450 irrigable acres are actively irrigated. Table 3-3 summarizes the crop acreage and estimated evapotranspiration within the Plain View SA, as obtained from the growers' water application by the District (2016 data is approximated by 2017 use). The primary crops grown include almonds, grapes, and orchards. Almonds have also expanded their acreage significantly from 2016 to 2020 and hardened the water demand.

Table 3-3: Plain View SA Agricultural Crop and Water Demand Data, 2016 to 2020

Crop Type	2016		2017		2018		2019		2020	
	Acres	ET_c Demand (AF)	Acres	ET_c Demand (AF)	Acres	ET_c Demand (AF)	Acres	ET_c Demand (AF)	Acres	ET_c Demand (AF)
Almonds	816	2,948	816	2,948	879	3,177	1,265	4,572	1,265	4,571
Grapes	114	282	114	282	114	282	114	282	114	281
Orchard	119	432	119	432	119	432	119	432	119	431
Wheat	0	0	0	0	20	49	20	49	20	49
Total	**1,049**	**3,661**	**1,049**	**3,661**	**1,132**	**3,939**	**1,518**	**5,334**	**1,518**	**5,332**

Table 3-4 shows that the actual agricultural water use within the Plain View SA from 2016 to 2020 reflects the pattern in calculated crop use. The District relies on CVP supplies, while private pumpers augment surface water with groundwater. As the District does not keep records of the quantity of privately pumped water, the values in the table are estimates.

Table 3-4: Plain View SA Agricultural Water Use, 2016 to 2020

Source	2016 (AF)	2017 (AF)	2018 (AF)	2019 (AF)	2020 (AF)
Surface Water	2,869	2,217	4,804	4,094	5,074
Private Pumping Estimate	2,100	2,800	200	900	0
Total	**4,969**	**5,017**	**5,004**	**4,994**	**5,074**

For the Plain View SA, the high ETc is observed in 2019 at 5,334 AF although the highest water supply occurs in 2020. The effective precipitation for 2019 was 982 AF and in 2020 the effective precipitation dropped to 774 AF, necessitating higher deliveries.

3.1.3 Post-1914 Water Rights

The District started to record agricultural water use and crop data for the West Side SA in 2021 after the consolidation of WSID with BBID. Since the reporting years of this AWMP are 2016 to 2020, the agricultural water use and crop data for the West Side SA is not included in this AWMP. According to the BBID and WSID Municipal Service Review and Sphere of Influence (BBID and WSID, 2018), the historical annual average water use was approximately 19,000 AFY.

3.2 Environmental Water Use

BBID does not provide water for environmental uses.

3.3 Recreational Water Use

BBID does not provide water for recreational water uses.

3.4 Municipal and Industrial Use

3.4.1 Pre-1914 Water Rights

M&I demands served by the District's pre-1914 water rights include several users in the Byron SA and the Bethany SA, as well as the cities of Mountain House and Tracy.

The Byron SA and the Bethany SA listed in Table 3-5 serve Mariposa Energy LLC, among other industrial customers, and construction sites.

The city of Mountain House in the Mountain House SA has a right up to 9,813 AFY but used over 5,000 AFY in 2020.

The Tracy Hills development is not listed as a water user in Table 3-5, since BBID did not begin to provide municipal service to the Tracy Hills SA until 2021.

Table 3-5: Byron SA and Mountain House SA M&I Water Uses, 2016 to 2020

M&I Entity	2016 (AF)	2017 (AF)	2018 (AF)	2019 (AF)	2020 (AF)
Mariposa Energy, LLC	43	23	20	15	17
City of Mountain House (RWSA1)	2,689	3,355	4,258	4,733	5,188
G3 Enterprises	0	0	185	218	78
Construction	10	102	29	26	40
Total	**2,743**	**3,480**	**4,491**	**4,993**	**5,323**

As depicted in Table 3-5, M&I water uses within the pre-1914 water rights region of BBID increased in recent years due to the rapid development of area served by the city of Mountain House, which is expected to continue as rapid urbanization continues in the Tracy and Mountain House area.

3.4.2 Central Valley Project Water

The Plain View SA served seven M&I and construction customers from 2016 to 2020 as listed in Table 3-6. The primary M&I water users include Musco Family Olive, and Patterson Pass Business Park.

Table 3-6: Plain View SA Municipal and Industrial Water Uses, 2016 to 2020

M&I Entity	2016 (AF)	2017 (AF)	2018 (AF)	2019 (AF)	2020 (AF)
AltaGas San Joaquin Energy	0	15	15	0	0
Baselite Concrete	12	6	8	11	12
GWF Energy	19	0	0	0	0
MRP San Joaquin Energy	0	0	0	30	37
Musco Family Olive	439	478	492	639	685
Patterson Pass Business Park	478	356	674	698	313
Stephen & Jamie Wesely	0	0	46	16	18
Construction	0	63	103	0	0
Total	**948**	**918**	**1,338**	**1,393**	**1,066**

3.4.3 Post-1914 Water Rights

The West Side SA does not provide water to M&I customers.

3.5 Groundwater Recharge Use

BBID does not provide water for direct groundwater recharge uses, but is working through various partner agencies examining south of Delta conjunctive use projects.

3.6 Transfers and Exchange Use

BBID made and one transfer out of the District in 2020. BBID growers have installed more groundwater wells and increasingly rely on groundwater (or allow BBID to purchase groundwater instead of transfers) when surface water is not available.

4. Quantity and Quality of Water Resources

This section describes the sources of water available to BBID.

4.1 Water Supply Quantity

BBID primarily relies on surface water, though has witnessed groundwater pumping in dry years. The District has some transfers and currently uses occasional recycled water from the city of Tracy.

4.1.1 Surface Water Supply

BBID surface water rights include pre-1914 Water Rights to the Delta, two separate CVP allocations (20,600 AFY from the 2004 consolidation of PVWD and 2,500 AFY from the 2021 consolidation of WSID), and post-1914 rights to Old River (also acquired from the WSID consolidation in 2021.) The 2016 to 2020 total water supply for both agricultural and M&I BBID service areas are shown in Table 4-1.

Table 4-1: BBID Surface Water Diversions

	2016 (AF)	2017 (AF)	2018 (AF)	2019 (AF)	2020 (AF)
Pre-1914 Right	16,731	15,308	16,636	16,842	23,839
CVP Supply	3,817	3,135	6,142	5,487	5,833

BBID's diversions under the pre-1914 Right are higher than the deliveries shown in Table 3-2 and Table 3-5 due to the reported losses in the pre-1914 canal system, which is discussed in Section 5.3.

Diversions from the CVP have historically reached a maximum of just over 6,000 AFY, below the 20,600 AFY allocation obtained from the former PVWD. This difference reflects that large areas have been fallowed, converted to urban uses served by the city of Tracy, or now depend on groundwater pumping.

4.1.2 Groundwater Supply

BBID can augment the shortage in surface water supplies throughout the growing season by paying growers to pump groundwater into the canals to supply water to customers downstream. Due to the poor groundwater quality in the area, groundwater must be blended to ensure no crop damage during irrigation. The quantity of the water pumped depends on the hydrological conditions and the crop water demand. Table 4-2 summarizes the groundwater pumped for BBID for 2016 to 2020 and does not include private pumping.

Table 4-2: BBID Groundwater Supplies, 2016 to 2020

	2017 (AF)	2017 (AF)	2018 (AF)	2019 (AF)	2020 (AF)
Pre-1914 Water Rights Area	8	0	0	16	21
Plain View SA	0	0	0	0	0

Groundwater pumping in the BBID service area is supplied from either the ECC Subbasin or the Tracy Subbasin. In March 2017, the Board voted to become GSA for a portion of the Tracy Subbasin to comply with the Sustainable Groundwater Management Act (SGMA). BBID worked jointly with the other GSAs to prepare a GSP for the Tracy Subbasin. The Tracy Subbasin GSP was adopted in November 2021.

In May 2017, BBID became a GSA for the ECC Subbasin and worked collaboratively with seven other agencies within the subbasin to prepare a GSP. The ECC Subbasin GSP was adopted in October 2021.

The goal of these two GSPs is to sustainably manage the groundwater basins and avoid undesired results in the future; BBID currently predicts no limit to groundwater sources in either basin, other than water quality constraints.

4.1.3 Other Water Supplies

BBID did not make any water transfers into the District from 2016 to 2020. BBID did not utilize recycled water.

4.2 Water Supply Quality

Historically BBID's water purchases have been reliably high-quality supplies. This section summarizes the recent water quality parameters for BBID's water supply.

4.2.1 Surface Water Supply

Pre-1914 Water Rights

BBID diverts pre-1914 water from the Delta from the Harvey O. Banks Pumping Plant intake channel. The CDEC hosts publicly available data for water quality at the Banks pumping plant; data from two adjacent stations were assumed to represent water quality at the BBID intake. Table 4-3 shows the average, minimum and maximum from 2016 to 2020.

Table 4-3: Banks Pumping Plant Water Quality

Characteristic	Units	Average	Minimum	Maximum
Electric Conductivity	uS/cm	359	61	764
pH	pH	8.0	7.0	9.9
Turbidity	NTU	7.3	1.7	65.5

USBR CVP Water Rights

BBID diverts water for the Plain View SA from the DMC near the C.W. Bill Jones Pumping Plant. CDEC data at the Jones plant (station TRP) is assumed to be similar to the BBID CVP diversion and is shown in Table 4-4.

Table 4-4: Jones Pumping Plant Water Quality

Characteristic	Units	Average	Minimum	Maximum
Electric Conductivity	uS/cm	461	235	799
pH	pH	7.6	6.9	8.2
Turbidity	NTU	9.32	0.02	285.9
Dissolved Br	mg/L	0.2	0.01	57.5
Dissolved Cl	mg/L	70.9	0.03	193.4
Dissolved NO_3	mg/L	2.8	0.02	146.1
Dissolved SO_4	mg/L	36.8	0.01	198.1

Post-1914 Rights

BBID diverts water from the CVP as well as Old River to supply the West Side SA. CDEC station ORM (Old River Upstream of Mountain House Creek) was used to report water quality in Table 4-5. Station ORM is northwest of Tracy, just upstream of the BBID intake on Old River.

Table 4-5: Old River Water Quality

Characteristic	Units	Average	Minimum	Maximum
Electric Conductivity	uS/cm	583	117	1,271
pH	pH	7.8	7.0	9.1
Turbidity	NTU	3.5	0.9	2,803
Dissolved O_2	uS/cm	8.0	2.8	15.2

The water quality is worse (higher EC) in Old River than downstream at the Jones Pumping Plant. This is consistent with sampling sites further upstream on Old River (for example, TWA) having higher EC values that flows coming out of the Delta (ORI). Point-source agricultural and wastewater discharges, as well as groundwater effluence along the Old River may lead to higher EC values than found in the high water volumes of the Delta.

4.2.2 Groundwater Supply

Groundwater within BBID has historically been of poor quality, which explains why surface water is and has been the primary water supply for agricultural irrigation, and now M&I due to rapid urbanization in the area.

BBID groundwater quality is monitored under the ECC Subbasin GSP and the Tracy Subbasin GSP. Table 4-6 shows the water quality for the key constituents measured for the ECC Subbasin. It indicates that the total dissolved solids (TDS) and chloride concentrations in ECC Subbasin groundwater exceed or are near the recommended Secondary Maximum Contaminant Level (SMCL) of 500 mg/L and 250 mg/L, respectively, in most wells. Nitrate is observed in some shallow zones of the subbasin (i.e., Brentwood) with concentration exceeding the Maximum Contaminant Level (MCL) of 10 mg/L that may be linked to historical agricultural influences in the area. Arsenic concentrations are generally lower than the MCL of 10 ug/L subbasin wide.

Table 4-6: ECC Subbasin Groundwater Quality for Key Constituents

Constituents	Units	Date Range	Concentration		
			Average	Minimum	Maximum
TDS	mg/L	1957-2019	1,098	86	20,400
Chloride	mg/L	1957-2019	231	11	4,900
Nitrate	mg/L	1957-2019	4.7	ND[a]	1,400
Arsenic	ug/L	1957-2019	8	ND	750

[a] ND – indicates analytical result has not been detected at or above the reporting limit.

Table 4-7 provides a list of key constituents monitored for the Tracy Subbasin, and it includes the date range the analyzes being measured, the minimum and maximum concentrations, the reporting MCL or Notification Level (NL), and the number of wells exceeding the MCL or NL. Overall, a high portion of wells exceeds or is near the recommended SMCL for TDS and chloride. Boron is present in the non-Delta areas and in the northern portion of the Delta area.

Table 4-7: Tracy Subbasin Groundwater Quality for Key Constituents

Constituents	Units	Date Range	MCL or NL	Number of Wells Analyzed	Number of Wells Exceeded MCL or NL	Concentration	
						Minimum	Maximum
Arsenic	ug/L	1959-2020	10	195	32	<2.0[c]	54
Boron	mg/L	1945-2019	1[a]	584	227	<0.1	10
Chloride	mg/L	1945-2020	250[b]	664	210	1.1	2,400
Iron	ug/L	1953-2020	300	206	34	<0.03	25,700
Manganese	ug/L	1950-2020	50	190	67	<0.01	17,600
Nitrate as Nitrogen	mg/L	1947-2020	10	537	21	<0.02	81
TDS	mg/L	1944-2020	500[b]	376	269	82	4,500
Sulfate	mg/L	1944-2020	250[b]	465	122	0.2	1,420
1,2,3TCP	ug/L	1984-2020	0.005	126	25	<0.001	0.500

[a] It indicates the analyze does not have an established MCL but has a NL.

[b] The recommended SMCL is provided in the table.

[c] < indicates analytical result has not been detected at or above the reporting limit.

4.2.3 Other Water Supplies

BBID had no other water supplies available to it during this reporting period.

4.2.4 Source Water Quality Monitoring Practices

Due to rapid aquatic weed growth during peak summer months in BBID's canals, BBID applies aquatic herbicides under permit requirements and under strict conditions to ensure meters, gates, and weir structures are operational and free of aquatic vegetation. The District complies with all permit conditions to include monitoring of surface water quality in conjunction with an aquatic pesticide monitoring program, which typically occurs from April to September. BBID controls its application of herbicides (i.e., acrolein and endothall) under the Statewide General National Pollutant Discharge Elimination System (NPDES) Permit for aquatic pesticides. Before the application of weed control herbicide into the supply canal, the District collects samples from the canal to determine the source water quality. After herbicide application, the District also samples water from the canals to ensure complete dispersion of the herbicide.

5. Water Budget

5.1 Overview

BBID supplies and demands have already been introduced but are paired with incidental rainfall and losses in this section to describe the annual water for 2016 to 2020. The water budget results are presented in calendar years to reflect BBID irrigation practices and operation. BBID's agricultural water deliveries typically occur from mid-March to mid-November but is adjusted based on hydrologic conditions and grower demands.

Since the post-1914 rights area is not supplied by the date required to be reported on this AWMP, the water budget is broken down into two separate accounting centers: the pre-1914 rights and the CVP rights.

Figure 5-1 provides a schematic of the water budget structure that summarizes the inflows and outflows in each accounting center.

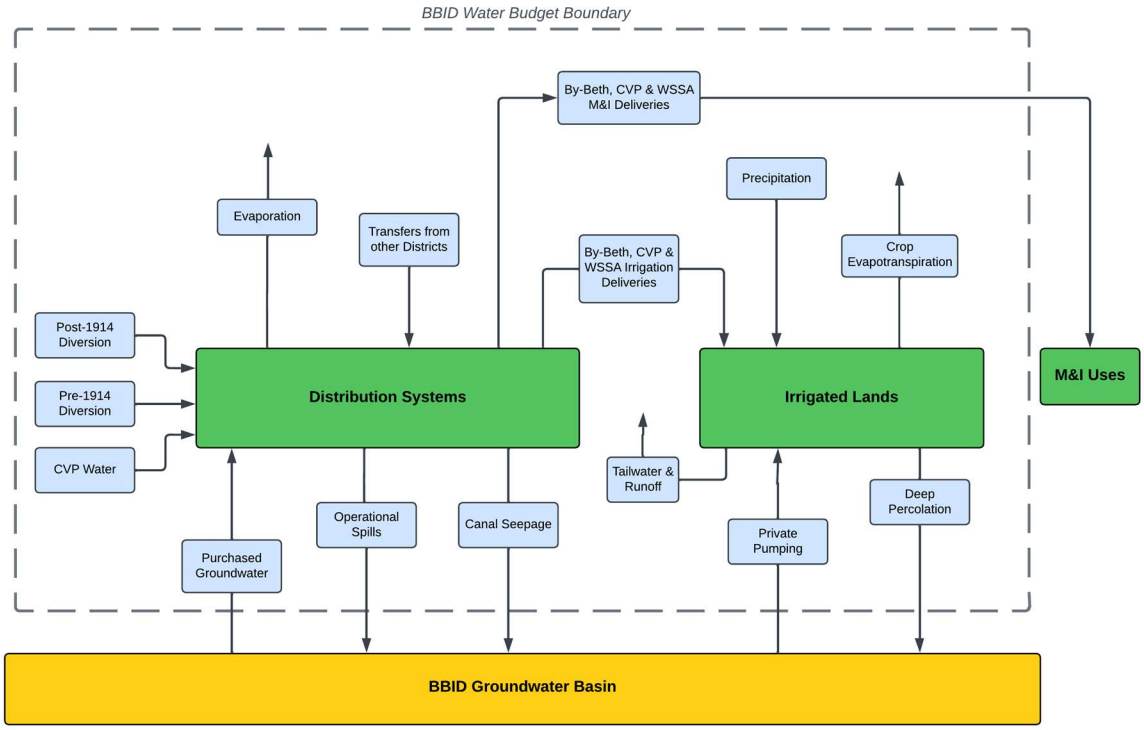


Figure 5-1: BBID Water Balance Model Schematic

5.2 Water Supply Quantity (Inflows)

Surface and groundwater inflows to the District are described by service area in Section 4.

This section adds effective precipitation to the mass balance. Effective precipitation is the function of the total precipitation on the irrigated land during a specific period that is available for crops to consume. The quantity of precipitation that could be stored in the root zone depends on the crop characteristics, such as root depth and allowable depletion. The effective precipitation estimated for this analysis was computed using the CUP+ Model for each crop and depicted for the appropriate BBID service area in Tables 5-1 and 5-2.

5.2.1 Pre-1914 Water Rights

The Byron SA and the Bethany SA divert surface water from Old River to provide water to their agricultural and M&I customers. The Old River water diversions vary annually depending on hydrologic conditions and demands. A limited amount of groundwater is also used to satisfy a portion of irrigation needs within BBID during drought conditions.

Table 5-1 summarizes the surface water diversions, groundwater pumping, transfers and exchange, and effective precipitation from 2016 to 2020.

Table 5-1: Pre-1914 Area Water Supply Quantities, 2016 to 2020

Source	2016 (AF)	2017 (AF)	2018 (AF)	2019 (AF)	2020 (AF)
Pre-1914 Right	16,731	15,308	16,636	16,842	23,839
Effective Precipitation	1,643	2,888	2,422	2,541	1,535
BBID Groundwater	8	0	0	16	21
Groundwater (Private Pumping Estimate)	2,012	4,173	4,261	3,980	0
Transfers & Exchange	0	0	0	0	(1,862)
Total	**20,394**	**22,369**	**23,319**	**23,379**	**23,533**

5.2.2 Central Valley Project Water

Table 5-2 summarizes the annual CVP water deliveries, estimated groundwater pumping quantity, and effective precipitation that occurred within the Plain View SA, which is described in more details in Section 2.1.1. from 2016 to 2020. The Plain View SA supplies CVP surface water to their agricultural and M&I customers. The CVP surface water delivery also varies from year to year depending on the hydrological condition, demands, and availability of CVP water supply. During drought conditions, groundwater is used as a supplemental source to meet irrigation needs. Some landowners within the Plain View SA installed deep wells within their property that they operate as needed to meet crop demands, depending on the CVP water allocation. Groundwater conditions in the Plain View SA are generally more favorable than conditions found in the Byron or Bethany Sas. BBID did not keep track of the privately pumped groundwater, thus the private pumping quantity provided in Table 5-2 is just an estimate of how much groundwater is needed to meet the demand.

Table 5-2: CVP Service Area Water Supply Quantities, 2016 to 2020

Source	2017 (AF)	2017 (AF)	2018 (AF)	2019 (AF)	2020 (AF)
CVP Supply	3,817	3,135	6,142	5,487	5,833
Effective Precipitation	484	783	709	982	774
BBID Groundwater	0	0	0	0	0
Groundwater (Private Pumping Estimate)	2,100	2,800	200	900	0
Transfers & Exchange	0	0	0	0	0
Total	**6,401**	**6,718**	**7,051**	**7,369**	**6,607**

5.2.3 Post-1914 Water Rights

The West Side SA diverts surface water from the Old River to supply water to their agricultural customers. The water diversion from Old River fluctuates every year based on the growers' water demand and the hydrologic conditions. As previously identified, the West Side SA consolidated into BBID in 2021.

5.3 Water Uses (Outflows)

In addition to agricultural and M&I deliveries, water outflows in the BBID service area include evaporation, seepage, operational losses, deep percolation, tailwater. Due to modernization of the irrigation district and on farm, operational losses are minimal from the irrigation district conveyance system and on farm tailwater runoff is nearly non-existent due to the conversion to micro irrigation. Old tiles drains exist in significant portions of the Byron and Bethany SAs to lower the shallow groundwater table below the crop root zone. Tile drain flows ultimately spill to the delta via private drainage ditches in the area.

Evaporation

The Western Regional Climate Center (WRCC) provides the monthly average pan evaporation data at the Tracy Pumping Plant is shown in Table 5-3 below. The averages reflect a 1955 to 2005 period of record; the annual average is 97.48 inches.

Table 5-3: WRCC Evaporation Data, Tracy Pumping Plant

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Evaporation (in)	1.53	2.47	5.30	8.20	12.01	14.88	16.92	14.55	10.64	6.57	2.93	1.48

BBID uses their irrigation canal system from mid-March to mid-November. The evaporation in these months sums to 87.89 inches.

A pan evaporation correction coefficient from Evaporation Atlas for the Contiguous 48 United States (NOAA, 1982) is used to adjust for local free water surface conditions. For the BBID service area, the correction coefficient is approximately 0.72 as show in Figure 5-2.

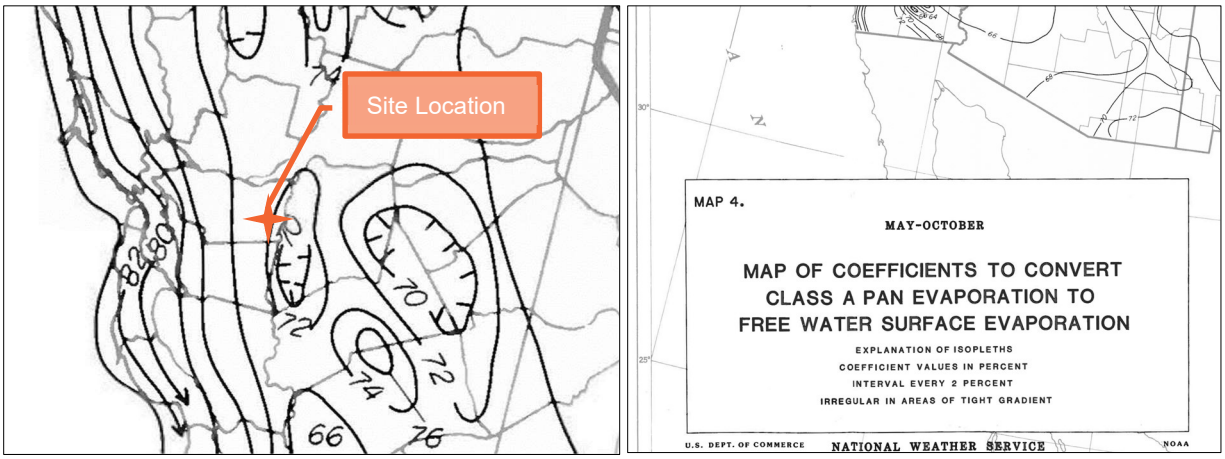


Figure 5-2: Map of Pan Evaporation Coefficients

Equation (1) gives the calculation for evaporation, Where E_p is irrigation season pan evaporation, C_E is the pan evaporation correction coefficient and A is the surface area of the canals.

$$\boldsymbol{Evaporation = E_p * C_E * A} \quad (1)$$

ArcMap and arial imagery were used to calculate the surface area of BBID canals. The estimated average evaporation is approximately 231 AF/year for the canals within the combined Byron SA, Bethany SA (pre-1914) and the Plain View SA.

Seepage

The District is continually maintaining the existing canal lining and installing lining on the unlined canals to conserve water. The lining projects have significantly reduced seepage loss. The seepage rate was assumed to be approximately 5% of water diverted from Old River. The water loss from seepage passively recharges the groundwater basin; therefore, this term was considered as recoverable flows in the later calculation of agricultural water use efficiency.

Operational Losses

The District does not measure operational spills, but the loss is assumed to be relatively small since the District operates the system very efficiently and is set to zero for the outflow calculations.

Deep Percolation

Deep percolation is the water lost from the soil when infiltrated water exceeds the storage capacity of the soil during irrigation. The deep percolation water could infiltrate into the aquifer to recharge the groundwater basin or become interflow into rivers or streams. The applied irrigation that becomes deep percolation may become recoverable and reused by the water users. Deep percolation is estimated as the closure term for the service areas.

Tailwater

Tailwater is the irrigation water running off the lower end of the field and is often associated with surface irrigation. Tailwater is considered an outflow from the irrigated lands. Since most of the crops were irrigated by drip irrigation method within BBID's service area, tailwater is assumed to be zero for this analysis.

5.3.1 Pre-1914 Water Rights

Table 5-4 summarizes the outflow amount of water used for agricultural and M&I delivery within the Byron SA and the Bethany SA from 2016 to 2020. The irrigation delivery is considered as outflow in the distribution system accounting center and is considered as the inflow into the irrigated lands accounting center as Figure 5-1 depicted.

Table 5-4: Byron SA and Bethany SA Water Use Quantity, 2016 to 2020

Water Use	2016 (AF)	2017 (AF)	2018 (AF)	2019 (AF)	2020 (AF)
Agricultural Use (ETc)	14,363	14,363	14,736	14,307	14,215
Total M&I	2,743	3,480	4,491	4,993	5,323
Evaporation	188	188	188	188	188
Seepage	837	765	802	565	1,185
Operational Spills	0	0	0	0	0
Deep Percolation	2,263	3,573	3,102	3,326	2,622
Tailwater/Runoff	0	0	0	0	0
Total	**20,394**	**22,369**	**23,319**	**23,379**	**23,533**

5.3.2 Central Valley Project Water

Table 5-5 summarizes the amount of water used for agricultural and M&I delivery within the Plain View SA from 2016 to 2020. The irrigation delivery is considered as outflow in the distribution system accounting center but is considered as inflow into the irrigated lands accounting center as Figure 5-1 depicted.

Table 5-5: Plain View SA Water Use Quantity, 2016 to 2020

Water Use	2016 (AF)	2017 (AF)	2018 (AF)	2019 (AF)	2020 (AF)
Agricultural Use (ETc)	3,661	3,661	3,939	5,334	5,332
Total M&I	948	918	1,338	1,393	1,066
Evaporation	43	43	43	43	43
Seepage	191	157	307	274	292
Operational Spills	0	0	0	0	0
Deep Percolation - CVP	1,558	1,939	1,424	325	(126)[1]
Tailwater/Runoff	0	0	0	0	0
Total	**6,401**	**6,718**	**7,051**	**7,369**	**6,607**

[1]The negative deep percolation number is likely due to inherent inaccuracies in methods for estimating ET and/or or inaccuracies in water meter(s) on deliveries from the DMC.

5.4 Annual Water Budget

Table 5-6 and Table 5-7 provide the water budget results for each of the two areas, including the data source for each flow component, and uncertainty of each component result for the distribution system and irrigated land, respectively, for 2016 to 2020.

Table 5-6: Service Area Suppled by Pre-1914 Water Rights Water Budget Analysis

Flow Type	Flow Component	Data Source	AWMP Location Supporting Calculation	Uncertainty (Percent)	Required?	2016 (AF)	2017 (AF)	2018 (AF)	2019 (AF)	2020 (AF)
Inflows	Pre-1914 Right	Measured	5.2.10	<5%	X	16,731	15,308	16,636	16,842	23,839
	Effective Precipitation	Measured	5.2.10	<5%	X	1,643	2,888	2,422	2,541	1,535
	BBID Groundwater	Measured	5.2.10	<5%	X	8	0	0	16	21
	Groundwater (Private Pumping Estimate)	Estimated	5.2.10	<5%	X	2,012	4,173	4,261	3,980	0
	Transfers & Exchange	Measured	5.2.10	<5%	X	0	0	0	0	(1,862)
Outflows	ETc	Measured	5.3.1	<5%	X	14,363	14,363	14,736	14,307	14,215
	M&I Delivery	Measured	5.3.1	<5%	X	2,743	3,480	4,491	4,993	5,323
	Evaporation	Estimated	5.3.1	20%		188	188	188	188	188
	Seepage	Estimated	5.3.1	20%		837	765	802	565	1,185
	Operational Spills	Estimated	5.3.1	30%		0	0	0	0	0
	Deep Percolation	Closure term	5.3.1	30%	X	2,263	3,573	3,102	3,326	2,622
	Tailwater/Runoff	Estimated	5.3.1	30%		0	0	0	0	0

Table 5-7: CVP Service Area Water Budget Analysis

Flow Type	Flow Component	Data Source	AWMP Location Supporting Calculation	Uncertainty (Percent)	Required?	2016 (AF)	2017 (AF)	2018 (AF)	2019 (AF)	2020 (AF)
Inflows	CVP Supply	Measured	5.2.2	<5%	X	3,817	3,135	6,142	5,487	5,833
	Effective Precipitation	Measured	5.2.2	<5%	X	484	783	709	982	774
	BBID Groundwater	Measured	5.2.2	<5%	X	0	0	0	0	0
	Groundwater (Private Pumping Estimate)	Estimated	5.2.2	30%	X	2,100	2,800	200	900	0
	Transfers & Exchange	Measured	5.2.2	20%	X	0	0	0	0	0
Outflows	ETc	Modeled	5.3.2	20%	X	3,661	3,661	3,939	5,334	5,332
	M&I Delivery	Measured	5.3.2	30%	X	948	918	1,338	1,393	1,066
	Evaporation	Estimated	5.3.2	30%		43	43	43	43	43
	Seepage	Estimated	5.3.2	5%		191	157	307	274	292
	Operational Spills	Estimated	5.3.2	5%		0	0	0	0	0
	Deep Percolation	Closure term	5.3.2	5%	X	1,558	1,939	1,424	325	(126)
	Tailwater/Runoff	Estimated	5.3.2	5%		0	0	0	0	0

5.5 Water Management Objectives

Since the formation of the District, BBID has been committed to providing reliable water supply and water-related services in an environmentally sound and cost-effective manner while responsibly managing local water resources and ensuring customer satisfaction. BBID aspires to promote water management practices that align with the District's vision, mission, and values. The District strives to undertake the following:

- Protect, preserve, and enhance the District's historically acquired pre-1914 appropriative water rights together with managing the District's groundwater resources basin-wide, in cooperation with other water agencies.
- Provide District consumers and landowners with an efficient raw water distribution system.
- Encourage conservation and prudent management of water resources.
- Provide a safe working environment for all District employees and associated personnel.
- Foster a positive working relationship with all agricultural, municipal and industrial consumers, landowners, and other agencies.

To achieve these objectives, BBID has implemented the following water supply planning initatives:

1. **System Modernization Improvement.** As described in Section 2.2.4, the District has undertaken numerous CIPs to improve physical infrastructure and will continue to be an ongoing effort in the future. As part of this initiative, BBID has implemented a SCADA system to monitor and control the water diversion structures at the Byron SA and the Bethany SA. BBID aims to phase modernization of its system by extending a system-wide SCADA system to operate and control critical gates and structures, automate meter reading, and install variable frequency pumps. Automation of the system has led to increased water order flexibility and a reduction in lead time for water orders. Additionally, BBID intends to evaluate the conditions of the currently installed flowmeters and upgrade them to meet industry standards as necessary in the West Side SA. These upgrades will enable the District to improve its water management capabilities and provide efficient and reliable services to its customers.
2. **System Efficiency Improvement.** As described in Section 2.2.4 and Section 7.1, the District has implemented a number of canal lining projects and will continue its effort to install lining to the unlined canals to reduce water loss during conveyance. As shown in Table 6-1, the District completed some CIP projects to upgrade their control structures and pump stations to improve system efficiency. Also, the District is continually seeking any opportunity to operate the system more efficiently and minimize operational spills.
3. **Water Supply Reliability.** One of the District's goals is to provide reliable water service to their customers by diversifying its water supply portfolio. The District has several water sources including the pre-1914 and post-1914 water rights from Old River, CVP water, and the agreement with growers to purchase their privately pumped groundwater. In addition, the District seeks to secure additional water transfer agreement with other agencies to mitigate the potential water

shortfall during drought periods. As described in Section 2.2.4, the District is also participating in the Los Vaqueros Reservoir expansion project to gain a share of the reservoir's storage, along with the Sisk Dam raise project increasing San Luis Reservoir storage by 130,000 AF, which will provide 1,000 AF to BBID, both of which would provide additional reliability to the District.

4. **Water Conservation.** Promoting mindful and efficient water use among growers is crucial to reducing water demand. The District conducts public outreach meetings to encourage water conservation and provide support to its customers. Additionally, the District encourages growers to upgrade their on-farm irrigation systems and support transition from flood irrigation to micro-irrigation systems. By doing so, growers can reduce their water consumption and increase the efficiency of their water use. BBID also works with its public relations department to develop documentaries and short films to demonstrate the value and benefits of on farm and conveyance system improvements. BBID maintains all of this information on its website and via its social media links. BBID's efforts to promote water conservation and support grower's adoption of more efficient irrigation systems will contribute to the overall sustainability of the District's water resources.

5.6 Efficiency of Agricultural Water Use

Quantifying the efficiency of agricultural water use allows the water suppliers to understand the performance of their water system and informs where improvements can be made. DWR developed four methods to help water suppliers calculate water use efficiency. The method of water management fraction (WMF) is most applicable to BBID. The WMF represents the sum of applied water evaporation (ET_{AW}) and recoverable flows (RF) divided by the total applied water use (AW) as shown in Equation (2).

$$\boldsymbol{WMF = \frac{ET_{AW}+RF}{AW}} \quad (2)$$

ET_{AW} represents the applied water component of evapotranspiration by subtracting the effective precipitation from the total crop evapotranspiration.

RF is assumed to be a function of applied water only. BBID's distribution system and irrigated lands have interconnection with the groundwater basin. The operational spill, canal seepage and deep percolation will return back to the District's system and/or infiltrate into the aquifer as the growers also pump groundwater to irrigate their crops. The recoverable flows include the agricultural apportion of operational spill and seepage and deep percolation from irrigation.

The AW flows include the surface water and groundwater supply that is used within the District service area.

The numerator in Equation 2 increase the applied water directly used for crop growth by the additional applied water that can be reused. When divided by the total applied water, the WMF represents the total water used for growth; a larger number is better.

Table 5-8 shows the calculated WMF for 2016 to 2020 for the pre-1914 area, and Table 5-8 shows the WMF for the Plain View SA.

Table 5-8: Water Use Efficiency Fraction Pre-1914 Area

	2016	2017	2018	2019	2020
ETc	14,363	14,363	14,736	14,307	14,215
Effective Precipitation	1,643	2,888	2,422	2,541	1,535
Evapotranspiration of Applied Water, ET_{AW} (AF)	12,720	11,475	12,314	11,766	12,680
Seepage	837	765	802	565	1,185
Deep Percolation	2,263	3,573	3,102	3,326	2,622
Operational Losses	0	0	0	0	0
Recoverable Flow, RF (AF)	3,100	4,338	3,904	3,891	3,807
Total Surface Water Applied	13,988	11,828	12,145	11,849	18,516
Total Groundwater Applied	2,020	4,173	4,261	3,996	21
Total Supply Water, AW (AF)	16,008	16,001	16,406	15,845	18,537
Water Management Fraction, WMF (AF)	98.8%	98.8%	98.9%	98.8%	88.9%

Table 5-9: Water Use Efficiency Fraction CVP Area

	2016	2017	2018	2019	2020
ETc	3,661	3,661	3,939	5,334	5,332
Effective Precipitation	484	783	709	982	774
Evapotranspiration of Applied Water, ET_{AW} (AF)	3,177	2,878	3,230	4,352	4,558
Seepage	191	157	307	274	292
Deep Percolation	1,558	1,939	1,424	325	(126)
Operational Losses	0	0	0	0	0
Recoverable Flow, RF (AF)	1,749	2,096	1,731	599	166
Total Surface Water Applied	2,869	2,217	4,804	4,094	5,074
Total Groundwater Applied	2,100	2,800	200	900	0
Total Supply Water, AW (AF)	4,969	5,017	5,004	4,994	5,074
Water Management Fraction, WMF (AF)	**99.1%**	**99.1%**	**99.1%**	**99.1%**	**93.1%**

The high WMF implies that BBID's water system and irrigation method is highly efficient in ultizing the District's water supplies to meet irrigation demand. The only irrecoverable flow in the water budget flow path is the evaporation loss from the distribution system.

6. Climate Change

The District recognizes that climate change could impact the timing and volume of water availability to their customers, and is committed to increasing the resilience of water supplies. This section discusses the potential impact of climate change to BBID's water supply and demand, and identifies actions to help mitigate the impacts.

6.1 Effects of Climate Change on Water Supply

The local climate change snapshot tool and projected annual average charts available at Cal-Adapt were used to understand the projected changes in temperature, precipitation and wildfire within the BBID service area (Cal-Adapt, 2022a; Cal-Adapt, 2022b). The BBID service are is expected to experience an increase in the overall temperature, more severe weather conditions (i.e., more intense storms and droughts), and increased risks to wildfires. Additionally, sea level rise in the Bay Delta could affect the water quality and the ability to divert water.

6.1.1 Changes as a Result of Temperature and Precipitation Fluctuation

Snowpack in the Sierra Nevada is an important high quality water source for water users across California. Snowpack acts as a natural storage reservoir that lessens the need for reservoir capacity; during spring and summer, the snowpack gradually melts and releases water to Delta tributaries. Snowmelt in the Sierra Nevada has declined due to increasing temperature over the last century, with more precipitation falling as rain into surface water bodies instead of snow being stored as snowpack. Studies show that the Sierra Nevada snowpack is expected to continue to shrink due to global warming (Reich et al., 2018). As precipitation shifts to rain instead of snow, high runoff volumes will occur earlier in the year, prior to the summer irrigation season. BBID does not currently have surface water storage to capture early season runoff and store it for peak use, nor do many opportunities exist in the western delta upland area. The delta as a waterbody provides storage, which BBID relies upon. Additionally, runoff from precipitation falling as rain instead of snow can flush local contaminants into the surface water bodies (Fecht, 2019), potentially damaging BBID source water quality.

Although the current projection shows little change in average total annual precipitation in California during the next century, dry years are expected to become more frequent and precipitation is expected to be delivered in more intense storms and within a shorter wet season (Cal-Adapt, 2022a). The more intense storms may result in flooding and degradation of future water supply as fast-moving floodwaters erode and carry sediment downstream. The drier years increase the risk of drought and can reduce the available water supply.

6.1.2 Changes as a Result of Sea-level Rise

Another significant impact of global warming is sea-level rise which will increase high salinity seawater in the Sacramento-San Joaquin Delta (DWR, 2022). Increased seawater intrusion will require more surface water inflows to be directed to the ocean to repel the poorer quality water moving eastward from the shoreline into the Delta (DWR, 2022), allowing lower diversion volumes to downstream contractors.

Sea-level rise could cause flooding of the low-lying areas due to excessive stress on the Delta levees. BBID service area is within the boundaries of the Sacramento-San Joaquin Delta, therefore it could be affected by future sea-level rise.

6.2 Effects of Climate Change on Water Demand

The rising temperature and changing precipitation patterns may impact agricultural and M&I water demand.

6.2.1 Changes as a Result of Weather and Temperature Fluctuation

Increased temperature will increase ETc and change irrigation demand within BBID. Irrigation demand is highest during the hot summer season during peak ETc (and low rainfall). An increase in summer temperatures will lead to an increase in ETc requiring higher water deliveries. Also, a longer period of high heat will force a longer irrigation season.

Additionally, if source water quality degrades due to factors discussed in Section 6.1, more irrigation water may be needed to leach out salt from the crop root zones to maintain crop viability.

6.2.2 Changes as a Result of Crop Changes

Increases to average temperature cause both summers and winters to increase in temperature. Winter chill is important for fruit and nut crops that require a certain number of hours below a crop-specific chilling temperature to promote leaf growth or flowering. The chilling period ensures that the crops do not flower early, and flower after winter conditions to optimize crop yields (California Environmental Protection Agency [CalEPA] – Office of Environmental Health Hazard Assessment [OEHHA], 2018). BBID customers grow several types of fruit and nut crops and a potential decrease to winter chill may affect these crops.

Climate change impacts could potentially lead growers to change their crop types to more heat and drought-resilient crops.

6.3 Potential Actions and Responses to Changes

BBID is committed to continuously monitoring the key indicators of climate change and proactively developing solutions to mitigate the impacts on water supply availability. As discussed in Section 7, BBID's ongoing CIP highlights two efforts to limit water loss:

- Increase maintenance and construction of canal lining projects and canal-to-pipeline connections; and
- Upgrade the SCADA system to optimize the water conveyance system and minimize waste and reduce diversions while maintaining agricultural production.

Relevant CIP projects are shown in Table 6-1.

Table 6-1: BBID CIP Projects

Project	Status
Canal 45 North of Armstrong Road Canal Lining Project	Completed
Green A-Line and Green B-Line Pipe Replacement	Completed
Kellogg Creek-Canal 45 Radial Gate Replacement and Canal Lining	Completed
Pump Station 4 Replacement	Completed
Pump Station 2 Pipeline Replacement	Completed
R-Line Pipeline Replacement	In progress: design phase
Wicklund Cut Pump Station Rehabilitation	Design and funding phase
Byron and Bethany water control gate automation	Planning and funding phase
Canal Lining and Lining Rehabilitation Projects	Future planned
Pipeline Replacement Projects	Future planned
Smith Pumps Upgrade and Automation Project	In progress
SCADA/Telemetry Upgrade and Extension	In progress
Pump Station 1 North Upgrade (VFDs and new MCC)	Preliminary design; future funding phase

As part of adaptive management measures for climate change, BBID will continue to provide support and initiatives to their growers to improve irrigation efficiency and on-farm technologies.

7. Water Use Efficiency Information

This section describes BBID's efforts to improve Water Use Efficiency through the application of efficient water management practices (EWMPs.)

7.1 EWMP Implementation and Reporting

WC §10608.48 requires two types of critical EWMPs for all agricultural water suppliers:

1) Measure the volume of water delivered to customers with sufficient accuracy; and

2) Adopt a pricing structure for water customers based at least in part on quantity delivered.

The CWC also lists 14 conditional EWMPs that are required only if they are locally cost-effective and technically feasible.

BBID will continue implementing critical and conditional EWMPs as described in Table 7-1.

Table 7-1: Report of EWMPs Implemented/Planned

EWMP No.	EWMP	Implementation Status	Description
Critical EWMP - Water Code §10608.48.b			
1	Measure water deliveries with sufficient accuracy	Implemented in the Pre-1914 Byron SA, the Bethany SA and the Plain View SA, ongoing in the West Side SA	For decades, the District has measured deliveries at each farm turnout with flowmeters. BBID measures flow at the intake diversions with Water Specialty brand propeller type meters for all pump discharge except the pump to Mountain House SA, which is measured by a Magmeter flowmeter. The turnout flowmeters are inspected on an annual basis as well as factory tested on a rotational schedule. All meters have an accuracy of ±2% certified on an annual basis. BBID maintains a database of customer turnout delivery data and aggregates by service area. BBID complies with the terms of its 2003 Agreement with DWR regarding the diversion of water from the Delta by providing daily records of diversions from the intake channel to DWR. Some turnouts within the newly consolidated West Side SA lack electronic flowmeters and manual water measurements are required. The District will conduct an assessment of existing condition of turnouts in the West Side SA.
2	Adopt a pricing structure for water customers based at least in part on quantity delivered	Implemented	The District has used volumetric pricing for agricultural water use since 1965. For all parcels greater than 2 acres, the District charges on a per AF basis. For parcels of 2 acres or less, there is an interruptible annual flat rate water service charge and there is no volumetric pricing. Parcels of 2 acres or less constitute less than 2% of all parcels served.
Conditional EWMP - Water Code §10608.48.c			

EWMP No.	EWMP	Implementation Status	Description
3	Facilitate Alternate Land Use	Implemented/Ongoing	According to CWC §10608.48 (c)(1), this EWMP is the facilitation of alternative land use for lands with exceptionally high-water duties or whose irrigation contributes to drainage and other signification problems. As discussed in Section 2.1.2, the majority of the District is prime farmland and is used for agricultural purposes though some farmland has been developed for municipal uses (MHCSD) due to external drivers in the last 20 years. BBID addressed this change of land use within its Bethany SA and provides raw water to the Mountain House SA and the Tracy Hills SA (MHCSD; see Appendix G for the resolution regarding MHCSD and city of Tracy UWMP).
4	Facilitate Use of Recycled Water	Conceptual planning ongoing	In 2001, the District conducted a system-wide recycled water feasibility study to analyze the integration of recycled water supplies into BBID water resources. In 2009, a recycled water pipeline feasibility study was conducted to provide supply to the Mariposa Energy Project, though it was deemed economically infeasible. Through these efforts, the District has sought out the possibility of using recycled water and most internal opportunities were deemed to be economically infeasible. However, the District continues to pursue recycled water use with regional partners and will continue to do so. Currently, the District is engaged in preliminary studies with the city of Tracy to potentially receive recycled water from the city of Tracy in the West Side SA to diversify its water supply portfolio.
5	Facilitate Financing of On-Farm Irrigation Systems	Not implemented	BBID's priority is to provide water to its customers at the lowest cost. The District does not have the resources to finance on-farm irrigation system capital improvements though landowners continue to make on-farm irrigation efficiency improvements to increase yields.
6	Incentive Pricing Structure	Implemented	The District uses volumetric pricing for water deliveries. No tiered pricing is planned since current growers have near maximum efficiencies, and tiered pricing is not expected to yield greater water efficiency. Growers in the District are very efficient with their water: over 90% of the row crops are irrigated with drip irrigation. The majority of all farms in the District are on drip or micro-spray irrigation.
7	Conveyance and Storage Infrastructure	Implemented/Ongoing	According to CWC §10608.48 (c)(1), this EWMP includes expanding lined or pipe distribution systems, decreasing maintenance, and reducing seepage. The District's CIP includes several projects that will decrease maintenance and reduce seepage. The District is continually

EWMP No.	EWMP	Implementation Status	Description
			maintaining existing canal lining and installing new lining. Table 6-1 shows some of the completed, in progress, and future projects that will decrease maintenance and reduce seepage. The District is currently developing CIP for the newly consolidated West Side SA to improve their agricultural water use efficiency.
8	Water Ordering Flexibility	Implemented/Ongoing	The District is using its CIP to increase order flexibility and decrease lead time for water orders. The District has SCADA system monitoring and control north and south of the Intake Channel (Byron SA and Bethany SA), using a mobile SCADA platform that allows canal operators more flexibility with water orders from any location in the SA by making real-time changes to canal flows. The District is currently reviewing the feasibility of developing a SCADA telemetry system that will allow them to expand their SCADA capabilities further north in the Byron SA, further south in the Bethany SA, and the West Side SA.
9	Spill and Tail-Water Recovery	Implemented	The District has approximately 7 miles of subsurface drains. As discussed in this AWMP, growers in the District have high efficiencies and runoff is minimal. The District's operational outflows are kept to a minimum in the Byron SA and the Bethany SA. In the Plain View SA, runoff is practically zero. The District continues to seek any opportunity to minimize operational spills and efficiently manage water deliveries throughout the District. In the West Side SA, tailwater and runoff is recaptured to convey into Wicklund Cut. .
10	Conjunctive Use of Groundwater	Ongoing	Opportunities for groundwater use and development are limited in the District. Historically, BBID has fully relied on surface water supplies with groundwater as a supplement in drought or restricted supply years. The District is a GSA for the Tracy Subbasin and the ECC Subbasin. As a GSA, BBID is working cooperatively with surrounding agencies, cities, and counties to manage groundwater resources in a responsible, sustainable manner. BBID will also continue to look for opportunities for future conjunctive use.
11	Automation	Implemented/Ongoing	The District is reviewing the feasibility of extending its SCADA system automation for the Byron SA and the Bethany SA. BBID has SCADA control and monitoring at Pumping Plant 1 North and at all major facilities in the Bethany SA and the Mountain House SA. A SCADA telemetry plan is being reviewed for feasibility for extending further north into the Byron SA and further south into the Bethany SA to enable more

EWMP No.	EWMP	Implementation Status	Description
			automation of canal control structures and pump stations. Also, as part of this effort, Pumping Station 5 was automated and a radial gate on Canal 45 was automated in 2018.
12	Facilitate Customer Pump Testing	Not Implemented	Because BBID has historically relied on surface water in nearly all years with very limited groundwater for water supply, providing groundwater pump testing for its customers has not been necessary. Customers rely on their power supplier (Pacific Gas & Electric) for pump testing service.
13	Water Conservation Coordinator	Implemented	The District has designated Nader Shareghi as the Water Conservation/Schedule Coordinator; contact information is shown below. **Nader Shareghi, P.E. DM, NSPE-CA** **Assistant General Manager** **Byron-Bethany Irrigation District** **7995 Burns Road** **Byron CA 94514** **(209)835-0375** **n.shareghi@bbid.org** **Website: bbid.org**
14	Technical Assistance	Implemented/Ongoing	BBID coordinates irrigation delivery scheduling with all growers and encourages efficient use of water. Additionally, BBID provides intake channel flow data and water quality data to growers upon request. ET rates are available to growers from CIMIS in the vicinity of the District (Station 47 Brentwood and Station 71 Modesto). ET data can be used by growers for irrigation scheduling and maximization of irrigation efficiency.
15	Evaluate Policies	Ongoing	The District believes that there are three basic components to a water delivery service: equity, reliability, and flexibility. When considering modifications to District policies and facilities, BBID is aware of the significance of optimizing these components. The District believes it is also important to recognize the evolving demands of the water users, based on improved water management practices, and to incorporate the means to meet the demands by updating and enhancing District policies as necessary.
16	Water Supplier Pump Efficiency	Ongoing	Since 1964, BBID has been testing pumps of its water supply conveyance system for efficiency and maintaining the pumps to increase the efficiency. As part of the CIP, BBID has replaced, rebuilt, or has

EWMP No.	EWMP	Implementation Status	Description
			plans to replace all of the major pumping stations in the District within the next 10 years. A new VFD type pump was installed on Pumping Station 1S, and Pumping Stations 3, 4 and 5 have been replaced. Pumping Stations 1N, 2 and Smith are planned for replacement with VFDs.

7.2 EWMPs Efficiency Improvements

Quantification of the improvements in water use efficiency is challenging due to the complexity of the system, variable water supply, limited implementation periods, and incomplete data for evaluation. However, a qualitative assessment based on completed and proposed projects and policies is a feasible approach to gauge the level of efficiency improvements. Table 7-2 provides an estimate of the water use efficiency improvements for each EWMP since the 2017 AWMP and the anticipated improvements to occur in five and ten years. The improvements are qualitatively estimated as denoted ranging from None, Limited, Moderate, and Significant.

Table 7-2: Report of EWMPs Efficiency Improvements

EWMP No.	EWMP	Estimate of Water Use Efficiency Improvements That Occurred Since Last Report	Estimated Water Use Efficiency Improvements 5 and 10 years in future
Critical EWMP - Water Code §10608.48.b			
1	Measure water deliveries with sufficient accuracy	**Limited** The installed flowmeters in the Byron SA, the Bethany SA, and the Plain View SA help the District measure water deliveries to monitor the water use. The flowmeters are inspected regularly to ensure accuracy. Minor improvement has been made since the last report because the existing flowmeters were already installed with proven accuracy.	**Moderate** The District is conducting an assessment of the turnout flow measurements that are currently made in the West Side SA and the feasibility of equipping every turnout with a flowmeter there or continuing headgate measurements if sufficiently accurate. Moderate water efficiency improvement may be made over the next 5 to 10 years to comply with water measurements provision of Water Code §10608.48(b).
2	Adopt a pricing structure for water customers based at least in part on quantity delivered	**Moderate** The District adopted volumetric pricing for agricultural water use since 1965. The volumetric water pricing varies across different service areas to reflect the cost of water for different water sources. The District conducted a study in 2016 to examine the cost of service for delivering agricultural water. The District's Board adopted an increase to the water rates in 2017 but with the consideration of softening the blow to the growers. Moderate improvement has been made.	**Moderate** The District will continue to implement the established volumetric pricing structure at a uniform water rate, which is different across the six service areas, for all agricultural water deliveries. Moderate improvement is anticipated to be made.
Conditional EWMP - Water Code §10608.48.c			
3	Facilitate Alternate Land Use	**Significant** As discussed in Table 7-1, some farmland within the Bethany SA has been developed for municipal uses and became part of the MHCSD due to external drivers in the past decades. To accommodate this change of land use, the District had an agreement with the MHCSD District to provide raw M&I water to the Mountain House SA. Significant improvement has been made.	**Moderate** The MHCSD, now the city of Mountain House, continues to expand to meet the growing demand for more development, with all new construction meeting new efficient building and water use standards. BBID will continue to provide raw water service to the growing water demand in the Mountain House SA in the future. Significant improvement in efficiency is anticipated to be made.

EWMP No.	EWMP	Estimate of Water Use Efficiency Improvements That Occurred Since Last Report	Estimated Water Use Efficiency Improvements 5 and 10 years in future
4	Facilitate Use of Recycled Water	**Limited** The District has been actively seeking the possibility of using recycled water in the last decade. The District has been working closely with the neighboring city to look into the potential opportunities to facilitate the use of recycled water between agencies. The facilitation with the city of Tracy was still at conceptual planning phase since the last AWMP report, so limited improvement in efficiency has been made.	**Moderate** The District is currently engaged in preliminary studies with the city of Tracy to potentially receive recycled water from the city of Tracy to diversify its water supply portfolio. The District will continue to pursue recycled water use opportunities with regional partners. Moderate improvement is anticipated to be made.
5	Facilitate Financing of On-Farm Irrigation Systems	**None** Although the District does not have the resources to finance on-farm irrigation system capital improvement, the District has been supporting growers to shift from flood to drip irrigation.	**None** The District will continue to support growers to convert from flood to drip irrigation.
6	Incentive Pricing Structure	**Limited** Although no tiered pricing is implemented or planned because most growers are using water near their maximum efficiencies, the current volumetric pricing structure also encourages growers to use water wisely and efficiently.	**Limited** The District will continue to implement the volumetric pricing structure for agricultural water deliveries.
7	Conveyance and Storage Infrastructure	**Significant** The District completed a number of CIP projects on pump stations upgrade and canal lining as shown in Table 6-1. The completed projects have made significant improvements to the water distribution and conveyance system.	**Significant** The District will continue to investigate the feasibility and invest in CIP projects to increase the water system's efficiency. Also, the District is currently developing a CIP for the newly consolidated West Side SA to improve their agricultural water use efficiency.
8	Water Ordering Flexibility	**Moderate** With the installation of the SCADA system for the Byron SA and the Bethany SA, the District increases water order flexibility and decreases lead time for water orders. Moderate improvement in efficiency.	**Moderate** The District continues to seek opportunities to increase water ordering flexibility. The District is currently reviewing the feasibility of expanding the SCADA telemetry system will allow them to expand their SCADA capabilities in the Byron SA, the Bethany SA, and the West Side SA.
9	Spill and Tail-Water Recovery	**Moderate** The District believes that the runoff is relatively minimal in the Byron SA, the Bethany SA, and the	**Moderate** The District continues to seek any opportunity to minimize operational spills and efficiently

EWMP No.	EWMP	Estimate of Water Use Efficiency Improvements That Occurred Since Last Report	Estimated Water Use Efficiency Improvements 5 and 10 years in future
		Plain View SA because the growers are mostly on drip irrigation. Also, the installation of the SCADA system allows the operators to monitor data in real-time in order to make the necessary adjustment on operation to minimize spills. Moderate improvement has been made.	manage water deliveries throughout the District. The SCADA system installation projects that are being reviewed will help the operators to further reduce operational spills. Moderate improvement is anticipated to be made.
10	Conjunctive Use of Groundwater	**None** Opportunities for groundwater use and development are limited in the District. However, as a GSA, the District is working cooperatively with surrounding agencies, cities, and counties to manage the basins in a responsible, sustainable manner.	**Limited** The District will continue to be a responsible GSA to work closely with the other agencies to manage the Tracy Subbasin and the ECC Subbasin. The District will also continue to look for opportunities for future conjunctive use.
11	Automation	**Significant** As discussed previously, the District completed several CIP projects to install the SCADA system to automate controls at canals and pump stations within the Bethany SA. The installed SCADA system significantly improved water efficiency through allowing the operator to make real-time operational decisions and monitor data in real time.	**Significant** The District is currently reviewing the feasibility of expanding the SCADA telemetry system in the Byron SA, the Bethany SA, and West Side SA. Significant improvement is anticipated to be made.
12	Facilitate Customer Pump Testing	**None** As emphasized in Table 7-1, this EWMP is not implemented.	**None** The District doesn't have plans to implement this EWMP in the next 5 to 10 years.
13	Water Conservation Coordinator	**Limited** A new Water Coordinator was appointed since the last AWMP report. As described in the Drought Plan, several water conservation measures will be made to address the issues of reduced water supply during drought conditions.	**Limited** The new Water Conservation Coordinator will continue to contribute effort to promote water conservation to the growers.
14	Technical Assistance	**Limited** The District coordinates with growers on irrigation delivery scheduling and makes intake channel flow data, water quality data, hydrological data available to the growers upon request. Very limited improvement has been made.	**Limited** The District will continue to provide current assistance to the growers to help them maximize their efficiency.
15	Evaluate Policies	**Limited**	**Limited** The District will continue to do the same in the future.

EWMP No.	EWMP	Estimate of Water Use Efficiency Improvements That Occurred Since Last Report	Estimated Water Use Efficiency Improvements 5 and 10 years in future
		Whether a policy can improve the District's water use efficiency has been one of the important elements when evaluating them.	
16	Water Supplier Pump Efficiency	**Moderate** The District has been testing pumps to evaluate their efficiency and maintaining them to increase efficiency. As shown in Table 6-1, the District completed the Pump Station 4 Replacement project since the last report and made some moderate improvement on efficiency.	**Significant** As part of the CIP, the District has been planning to replace all of the major pump stations in the future. The new/upgraded pump stations will significantly improve the pump efficiency therefore increasing the water use efficiency.

7.3 Schedule and Budget Allotment to Implement EWMPs

Table 7-3 summarizes the schedule and budget allotment for implementing the EWMPs. The budget allotments provided in Table 7-3 may not be particularly assigned to a specific EWMP and may be allocated across multiple EWMPs, therefore they are not additive. The amounts presented have been rounded to the nearest $100 and are applicable only to the 2023 budget year.

Table 7-3: Schedule and Budget Allotment to Implement EWMPs

EWMP No.	EWMP	Implementation Schedule	Finance Plan	Budget Allotment
Critical EWMP - Water Code §10608.48.b				
1	Measure water deliveries with sufficient accuracy	Implemented in the Byron SA, the Bethany SA, and the Plain View SA, and ongoing in the West Side SA	BBID Proposed 2023 Budget	$300,000
2	Adopt a pricing structure for water customers based at least in part on quantity delivered	Implemented	BBID Proposed 2023 Budget	N/A
Conditional EWMP - Water Code §10608.48.c				
3	Facilitate Alternate Land Use	Implemented/Ongoing	BBID Proposed 2023 Budget	N/A
4	Facilitate Use of Recycled Water	Conceptual planning ongoing	BBID Proposed 2023 Budget	$50,000
5	Facilitate Financing of On-Farm Irrigation Systems	Not implemented	BBID Proposed 2023 Budget	N/A
6	Incentive Pricing Structure	Implemented	BBID Proposed 2023 Budget	
7	Conveyance and Storage Infrastructure	Implemented/Ongoing	BBID Proposed 2023 Budget	$2,000,000 (Total CIP Budget)
8	Water Ordering Flexibility	Implemented/Ongoing	BBID Proposed 2023 Budget	$100,000
9	Spill and Tail-Water Recovery	Implemented	BBID Proposed 2023 Budget	$92,000
10	Conjunctive Use of Groundwater	Ongoing	BBID Proposed 2023 Budget	$50,000
11	Automation	Implemented/Ongoing	BBID Proposed 2023 Budget	$250,000
12	Facilitate Customer Pump Testing	Not Implemented	BBID Proposed 2023 Budget	N/A
13	Water Conservation Coordinator	Implemented	BBID Proposed 2023 Budget	$182,600
14	Technical Assistance	Implemented/Ongoing	BBID Proposed 2023 Budget	
15	Evaluate Policies	Ongoing	BBID Proposed 2023 Budget	
16	Water Supplier Pump Efficiency	Ongoing	BBID Proposed 2023 Budget	$1,000,000 (Total CIP Budget)

7.4 Documentation for Non-Implemented EWMPs

Table 7-4 documents the EWMPs that are not-technically feasible and/or not locally cost-effective to the District. However, the District may re-evaluate these EWMPs if they become more viable to the District to improve water use efficiency in the future.

Table 7-4: Non-Implemented EWMPs Documentations

EWMP No.	EWMP	Technically Infeasible	Not Locally Cost-effective	Justification/Documentation
5	Facilitate Financing of On-Farm Irrigation Systems		X	The District does not have the resources to finance on-farm irrigation system capital improvements though landowners continue to make on-farm irrigation efficiency improvements to increase yields.
12	Facilitate Customer Pump Testing		X	Because BBID has historically relied on surface water in nearly all years with very limited groundwater for water supply, providing groundwater pump testing for its customers has not been necessary. Customers rely on their power supplier (Pacific Gas & Electric) for pump testing service.

8. Supporting Documentation

8.1 Agricultural Water Measurement Regulation Documentation

The District supplies water to less than 25,000 acres and is not required to complete this section.

8.2 Delta Plan Consistency

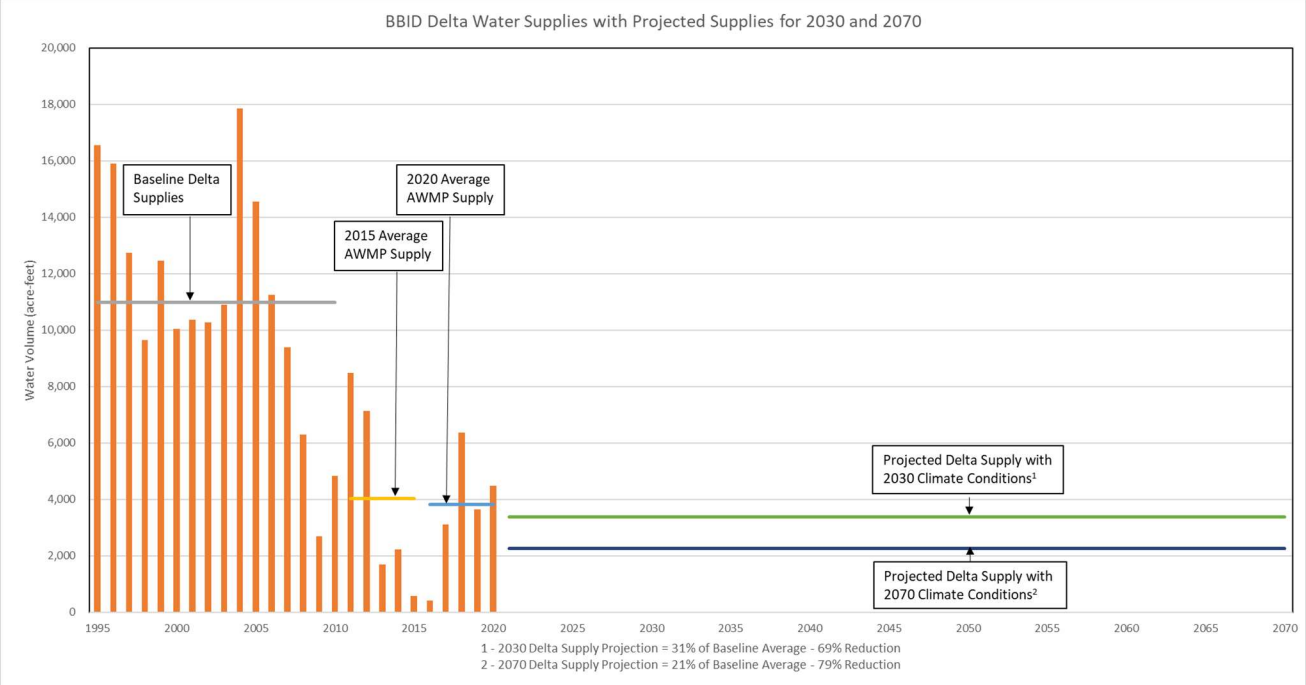
To provide "the expected outcome for measurable reduction in Delta reliance", baseline historic Delta supplies delivered to BBID were compared to supplies delivered over the past decade. Additionally, Delta supply reduction projections were made for comparison and future planning. For the purposes of comparison, the historic baseline period selected begins in 1995 and ends in 2010 because it is consistent with the typical historic water budget reporting period included in the recently completed Groundwater Sustainability Plans. This period provides a reasonable time frame for assessing average current conditions and to demonstrate consistency with reduced Delta reliance after enactment of the Delta Reform Act (2009). The table below shows projected water supplies from the Delta. The California Water Commission CALSIM 2030 and 2070 climate change scenarios were used to project future water supplies under 2030 and 2070 climate change scenarios. The table and figure below demonstrate reduced Delta reliance. Over the 2015 AWMP period, a 63% reduction in Delta water supplies was observed when compared to the baseline condition discussed above. Over the past decade (combined 2015 and 2020

AWMP period), a 65% reduction was observed. Due to increasing environmental commitments and restrictions on Delta Flows, landowners in the District will continue to experience reductions in Delta supply, likely exceeding the 2030 and 2070 projections.

Table 8-1: Historic Average Annual Delta Supplies vs. Projected Average Annual Delta Supplies

Value	Baseline Delta Supplies (1995-2010)	2015 Conditions Delta Supplies	2020 Conditions Delta Supplies	2030 Climate Conditions Delta Supplies	2070 Climate Conditions Delta Supplies
Average Annual Supplies (AF)	10,985	4,027	3,815	3,380	2,265
Percent of Baseline Supply	n/a	37%	35%	31%	21%
Percent Reduction in Supplies	n/a	63%	65%	69%	79%

Figure 8-1: Historic, 2015 and 2020 AWMP and Projected Delta Supplies



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Appendix A: Agricultural Water Management Plan Checklist

AWMP* Location	Guidebook Location	Description	Water Code Section (or as identified)
1	1.4	AWMP Required?	10820, 10608.12
N/A	1.4	At least 25,000 irrigated acres	10853
N/A	1.4	10,000 to 25,000 acres and funding provided	10853
1.3.1	1.4	April 1, 2021 update	10820 (a)
1.3.2	1.4 A.2	Added to the Water Code: AWMP submitted to DWR no later than 30 days after adoption; AWMP submitted electronically	New to the Water Code: 10820(a)(2)(B)
1	1.4 B	5-year cycle update	10820 (a)
N/A	1.4 B	New agricultural water supplier after December 31, 2012 - AWMP prepared and adopted within 1 year	10820 (b)
N/A	1.6, 5	USBR water management/conservation plan:	10828(a)
N/A	1.6, 5.1	Adopted and submitted to USBR within the previous four years, AND	10828(a)(1)
N/A	1.6, 5.1	The USBR has accepted the water management/conservation plan as adequate	10828(a)(2)
3.4	1.4.B	UWMP or participation in area wide, regional, watershed, or basin wide water management planning: does the plan meet requirements of SB X7-7 2.8	10829
1.1	3.1 A	Description of previous water management activities	10826(d)
1.2.2	3.1 B.1	Was each city or county within which supplier provides water supplies notified that the agricultural water supplier will be preparing or amending a plan?	10821(a)
1.2.2	3.2 B.2	Was the proposed plan available for public inspection prior to plan adoption?	10841
1.2.2	3.1 B.2	Publicly-owned supplier: Prior to the hearing, was the notice of the time and place of hearing published within the jurisdiction of the publicly owned agricultural water supplier in accordance with Government Code 6066?	10841
1.2.2	3.1 B.2	14 days notification for public hearing	GC 6066
1.2.2	3.1 B.2	Two publications in newspaper within those 14 days	GC 6066
1.2.2	3.1 B.2	At least 5 days between publications? (not including publication date)	GC 6066
1.2.2	3.1 B.2	Privately-owned supplier: was equivalent notice within its service area and reasonably equivalent opportunity that would otherwise be afforded through a public hearing process provided?	10841
1.2.2	3.1 C.1	After hearing/equivalent notice, was the plan adopted as prepared or as modified during or after the hearing?	10841
1.2.2	3.1 C.2	Was a copy of the AWMP, amendments, or changes, submitted to the entities below, no later than 30 days after the adoption?	10843(a)

AWMP* Location	Guidebook Location	Description	Water Code Section (or as identified)
	3.1 C.2	The department.	10843(b)(1)
1.2.2	3.1 C.2	Any city, county, or city and county within which the agricultural water supplier provides water supplies.	10843(b)(2)
1.2.2	3.1 C.2	Any groundwater management entity within which jurisdiction the agricultural water supplier extracts or provides water supplies.	10843(b)(3)
1.3.3	3.1 C.3	Adopted AWMP availability	10844
1.3.3	3.1 C.3	Was the AWMP available for public review on the agricultural water supplier's Internet Web site within 30 days of adoption?	10844(a)
1.3.3	3.1 C.3	If no Internet Web site, was an electronic copy of the AWMP submitted to DWR within 30 days of adoption?	10844(b)
1.4	3.1 D.1	Implement the AWMP in accordance with the schedule set forth in its plan, as determined by the governing body of the agricultural water supplier.	10842
2	3.3	Description of the agricultural water supplier and service area including:	10826(a)
2.1.1	3.3 A.1	Size of the service area.	10826(a)(1)
2.1.1	3.3 A.2	Location of the service area and its water management facilities.	10826(a)(2)
2.1.2	3.3 A.3	Terrain and soils.	10826(a)(3)
2.1.3	3.3 A.4	Climate.	10826(a)(4)
2.2	3.3 B.1	Operating rules and regulations.	10826(a)(5)
2.2.2	3.3 B.2	Water delivery measurements or calculations.	10826(a)(6)
2.2.3	3.3 B.3	Water rate schedules and billing.	10826(a)(7)
2.2.4	3.3 B.4	Water shortage allocation policies and detailed drought plan	10826(a)(8) 10826.2
3	3.4	Water uses within the service area, including all of the following:	10826(b)(5)
3.1	3.4 A	Agricultural.	10826(b)(5)(A)
3.2	3.4 B	Environmental.	10826(b)(5)(B)
3.3	3.4 C	Recreational.	10826(b)(5)(C)
3.4	3.4 D	Municipal and industrial.	10826(b)(5)(D)
3.5	3.4 E	Groundwater recharge, including estimated flows from deep percolation from irrigation and seepage	10826(b)(5)(E)
4	3.5 A	Description of the quantity of agricultural water supplier's supplies as:	10826(b)
4.1.1	3.5 A.1	Surface water supply.	10826(b)(1)
0	3.5 A.2	Groundwater supply.	10826(b)(2)
4.1.3	3.5 A.3	Other water supplies, including recycled water	10826(b)(3)
4.1.3	3.5 A.4	Drainage from the water supplier's service area.	10826(b)(6)
4.2	3.5 B	Description of the quality of agricultural waters suppliers supplies as:	10826(b)
4.2.1	3.5 B.1	Surface water supply.	10826(b)(1)
0	3.5 B.2	Groundwater supply.	10826(b)(2)

AWMP* Location	Guidebook Location	Description	Water Code Section (or as identified)
4.2.3	3.5 B.3	Other water supplies.	10826(b)(3)
4.2.4	3.5 C	Source water quality monitoring practices.	10826(b)(4)
5, 5.1,5.2,5.3,0	3.6	Added to Water Code: Annual water budget based on the quantification of all inflow and outflow components for the service area.	Added to Water Code 10826(c)
5.5	3.7 C	Added to Water Code: Identify water management objectives based on water budget to improve water system efficiency	Added to Water Code 10826(f)
5.6	3.8 D	Added to Water Code: Quantify the efficiency of agricultural water use	Added to Water Code 10826(h)
0	3.9	Analysis of climate change effect on future water supplies analysis	10826(d)
7	4	Water use efficiency information required pursuant to § 10608.48.	10826(e)
7.1	4.1	Implement efficient water management practices (EWMPs)	10608.48(a)
7.1	4.1 A	Implement Critical EWMP: Measure the volume of water delivered to customers with sufficient accuracy to comply with subdivision (a) of §531.10 and to implement paragraph (2).	10608.48(b)
7.1	4.1 A	Implement Critical EWMP: Adopt a pricing structure for water customers based at least in part on quantity delivered.	10608.48(b)
7.1	4.1 B	Implement additional locally cost-effective and technically feasible EWMPs	10608.48(c)
7.1	4.1 C	If applicable, document (in the report) the determination that EWMPs are not locally cost-effective or technically feasible	10608.48(d)
7.1	4.1 C	Include a report on which EWMPs have been implemented and planned to be implemented	10608.48(d)
7.1	4.1 C	Include (in the report) an estimate of the water use efficiency improvements that have occurred since the last report, and an estimate of the water use efficiency improvements estimated to occur five and 10 years in the future.	10608.48(d)
N/A	5	USBR water management/conservation plan may meet requirements for EWMPs	10608.48(f)
N/A	6 A	Lack of legal access certification (if water measuring not at farm gate or delivery point)	CCR, title 13, §597.3(b)(2)(A)
N/A	6 B	Lack of technical feasibility (if water measuring not at farm gate or delivery point)	CCR, title 13, §597.3(b)(1)(B), §597.3(b)(2)(B)
N/A	6 A, 6 B	Delivery apportioning methodology (if water measuring not at farm gate or delivery point)	CCR, title 13, §597.3.b(2)(C),
N/A	6 C	Description of water measurement BPP	CCR, title 13, §597.4(e)(2)
N/A	6 D	Conversion to measurement to volume	CCR, title 13, §597.4(e)(3)
N/A	6 E	Existing water measurement device corrective action plan? (if applicable, including schedule, budget and finance plan)	CCR, title 13, §597.4(e)(4))

Appendix B: Coordination Activities: Public Notification of Agricultural Water Management Plan Preparation

Appendix C: Agricultural Water Management Plan Update Resolution

Appendix D: BBID Rules and Regulations

Appendix E: Meters Inspection & Calibration Certification

Appendix F: 2017 Water Rate Charge Resolution

Appendix G: Urban Water Management Plan Resolution