



*Cawelo Water District*

# 2025 AGRICULTURAL WATER MANAGEMENT PLAN

April 2026

Prepared by:

Cawelo Water District





# **CAWELO WATER DISTRICT**

## **AGRICULTURAL WATER MANAGEMENT PLAN**

*PREPARED BY:*  
**CAWELO WATER DISTRICT**  
**17207 Industrial Farm Road**  
**Bakersfield, CA 93308**

*SUBMITTED TO THE*  
**CALIFORNIA DEPARTMENT OF WATER RESOURCES**  
*IN ACCORDANCE WITH THE*  
**WATER CONSERVATION ACT OF 2009**  
**(SB x7-7)**  
*AND THE*  
**WATER CONSERVATION BILL OF 2018**  
**(AB 1668 and SB 606)**

**April 2026**

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## List of Acronyms

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|                 |   |
|-----------------|---|
| AF              | Acre-Feet   |
| AW              | Applied Water   |
| AWMC            | Agricultural Water Management Council                 |
| AWCP            | Agricultural Water Conservation Plan                  |
| AWMP            | Agricultural Water Management Plan                    |
| CASGEM          | California Statewide Groundwater Elevation Monitoring |
| CAWSSC          | California Water Science Center                       |
| CCUF            | Crop consumptive use fraction                         |
| cfs             | Cubic Feet Per Second                                 |
| CIMIS           | California Irrigation Management Information System   |
| CVC             | Cross Valley Canal                                    |
| CVP             | Central Valley Project                                |
| CVRWQCB         | Central Valley Regional Water Quality Control Board   |
| CWD             | Cawelo Water District                                 |
| DCP             | Drought Contingency Plan                              |
| DSC             | Delta Stewardship Council                             |
| DWR             | Department of Water Resources                         |
| EPA             | U.S. Environmental Protection Agency                  |
| ET              | Evapotranspiration                                    |
| ET <sub>c</sub> | Crop Evapotranspiration                               |
| ET <sub>o</sub> | Reference Evapotranspiration                          |
| ETAW            | Evapotranspiration of Applied Water                   |
| EWMP            | Efficient Water Management Practice                   |
| FKC             | Friant-Kern Canal                                     |
| Ft              | Feet  |
| GHG             | Greenhouse gas  |
| ID              | Irrigation District                                   |
| in              | Inch  |
| ILRP            | Irrigated Lands Regulatory Program                    |
| ITRC            | Irrigation Training & Research Center (Cal Poly)      |
| IRWM            | Integrated Regional Water Management                  |
| GSA             | Groundwater Sustainability Agency                     |
| GSP             | Groundwater Sustainability Plan                       |
| GW              | Groundwater   |
| GWMP            | Groundwater Management Plan                           |
| KCWA            | Kern County Water Agency                              |
| KGA             | Kern Groundwater Authority                            |
| KRWCA           | Kern River Watershed Coalition Authority              |

|         |  |
|---------|--|
| M&I     | Municipal and Industrial                               |
| MOU     | Memorandum of Understanding                            |
| NPDES   | National Pollutant Discharge Elimination System (EPA)  |
| NWKRCDD | North West Kern Resource Conservation District         |
| OCAP    | Operations Criteria and Plan for CVP Deliveries (USBR) |
| ppm     | Parts per Million                                      |
| RWMSG   | Regional Water Management Group                        |
| USACE   | U.S. Army Corps of Engineers                           |
| USBR    | U.S. Bureau of Reclamation                             |
| USGS    | United States Geological Survey                        |
| SBx7-7  | Water Conservation Act of 2009                         |
| SCADA   | Supervisory Control and Data Acquisition               |
| SGMA    | Sustainable Groundwater Management Act                 |
| SSJMUD  | San Joaquin Municipal Utilities District               |
| SWP     | State Water Project                                    |
| SWRCB   | State Water Resources Control Board                    |
| TDS     | Total Dissolved Solids                                 |
| TOC     | Total Organic Carbon                                   |
| WD      | Water District   |
| WDR     | Waste Discharge Reports                                |
| WSD     | Water Storage District                                 |
| WY      | Water Year   |

## Glossary of Terms

---

|                                     |   |
|-------------------------------------|---|
| <b>Acre-Foot</b> .....              | The volume of water required to cover one acre of land one foot deep. Equal to 325,900 gallons.   |
| <b>Assessed Acres</b> .....         | Total acres, as determined by the county assessor’s office, for parcels that receive irrigation water. This acreage includes developed (non-irrigated) portions of parcels such as roads, buildings and ditches.  |
| <b>Conjunctive Use</b> .....        | Using a combination of surface water and groundwater supplies to meet water demands.  |
| <b>Conjunctive Management</b> ..... | Coordinating operation and monitoring of surface water and groundwater supplies to meet defined objectives.   |
| <b>Evapotranspiration</b> .....     | The loss of water, to the atmosphere, by the combined processes of evaporation (from soil and plant surfaces) and transpiration (from plant tissues).   |
| <b>Gross Acres</b> .....            | All lands within the irrigation service boundary such as cities, agricultural lands, roads and lake acreage.  |
| <b>Irrigable Acres</b> .....        | All lands that could be irrigated within the district boundary. This designation includes both lands that are currently irrigated and lands that are not currently being irrigated but have access to irrigation water through an active irrigation service connection.   |
| <b>Irrigated Acres</b> .....        | An estimate of the actual amount of land surface to which irrigation water is being applied.  |
| <b>Private Pumping</b> .....        | Groundwater pumping by growers using privately-owned wells. Private pumping is often used to supplement irrigation water supplied by CWD.   |
| <b>Kern Subbasin</b> .....          | DWR Bulletin 118 Subbasin No. 5-022.14) is the largest groundwater subbasin in California, located at the southern end of the San Joaquin Valley. It underlies much of Kern County and is bounded by the Tulare Lake Subbasin to the north, the Sierra Nevada foothills to the east, the Coast Ranges to the west, and the Tehachapi Mountains to the south.. |

# 1. AWMP Preparation and Adoption

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The Agricultural Water Management Plan (AWMP) involves the planning, the implementation of the plan, and the operations required to provide an adequate, reliable and acceptable agricultural water supply for the landowners of the Cawelo Water District (Cawelo, District, or CWD). The District's water supplies are defined as water which is delivered to Cawelo's water management facilities for the purposes of agricultural, groundwater recharge, transfer and exchange, or irrigation water uses. Agricultural water supply, primarily for crop irrigation, includes the volume of water delivered to the District's service area from both surface water and groundwater sources. Figure 1 is a map showing the location of the District's service area within Kern County.

This document conforms to the framework presented in *A Guidebook to Assist Agricultural Water Suppliers to Prepare a 2025 Agricultural Water Management Plan* (Guidebook) that was issued by the California Department of Water Resources (DWR) in July 2025 to aid water suppliers in preparing AWMPs in accordance with the requirements of AB 1668 and SB 606, which updated the previous requirement of SBx7-7. In addition, the 2020 AWMP complies with Executive Order B-29-15 which was issued April 1<sup>st</sup>, 2015 in response to the 2013-15 drought conditions and provides more details on Drought Plan requirements.

Much of the District's information developed for the AWMP is based on the 2025 Kern County Subbasin Groundwater Sustainability Plan (GSP) (Kern County Subbasin Groundwater Sustainability Plan, 2025), which was submitted to the California Department of Water Resources (DWR) pursuant to the Sustainable Groundwater Management Act (SGMA). The purpose of the GSP is to assess water resources and land use conditions within Cawelo's Groundwater Sustainability Agency (GSA) to implement long-term groundwater sustainability. The GSP also contains a detailed Annual Water Budget.

The requirements in SBx7-7 are intended to encourage agricultural water suppliers to assess current efficient water management practices, to evaluate additional practices that may conserve water, and to measure water with a certain level of accuracy. The requirements of AB 1668 include discussion of annual water budget and identification of water use management during drought periods.

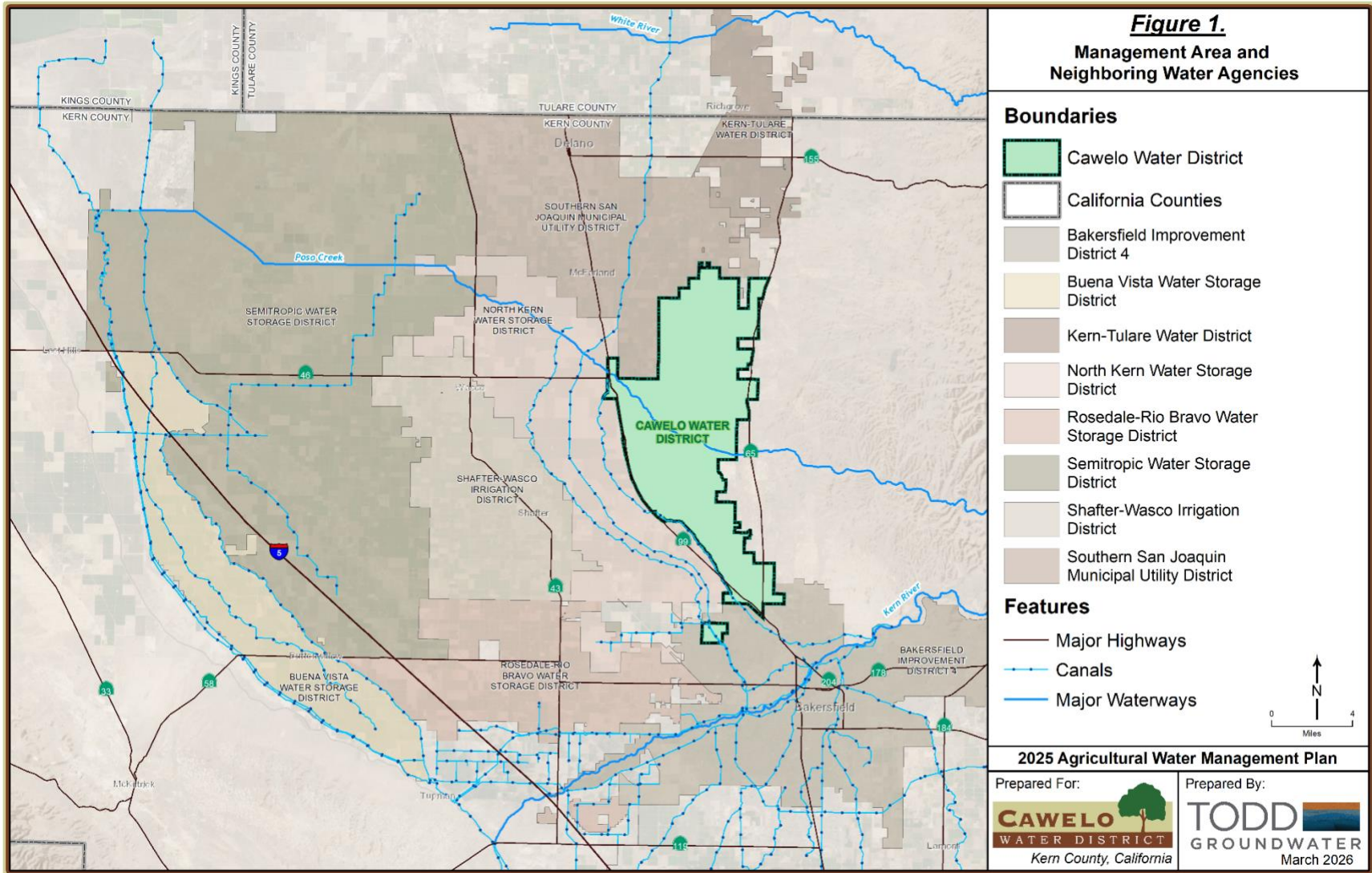


Figure 1. Management Area and Neighboring Water Agencies

One of the requirements of AB 1668 for AMWPs is to discuss the District’s annual water budget and identify its water use management practices during drought periods. Included in *Section 5* of this plan is a description of water use management objectives and efficiency quantifications. Water management actions planned and implemented were developed to address drought conditions. The quantification of water efficiency was determined through calculations of one or more water use efficiency methods for crop water use, agronomic water use, environmental water use, and recoverable surface flows. Additionally, the section includes a summary table identifying the inflow and outflow components of the District for the last five (5) water years.

In addition, one of the requirements introduced by SBx7-7 for AWMPs is to document the existing water management activities of the District and describe proposed programs and activities. The AWMP is used to document implemented, or proposed, monitoring and management programs designed to improve water use efficiency. Included in *Section 7* of this plan is a description of the efficient water management practices implemented or planned to be implemented, estimates of water use efficiency improvements that have been implemented since the District completed their last AWMP, and estimates of water use efficiency improvements expected to occur five and ten years in the future.

### **1.1. Description of Previous Water Management Activities**

Cawelo Water District implements a suite of projects and management actions that promote efficient water use, support sustainable groundwater management, and align with both Efficient Water Management Practices (EWMPs) and the Groundwater Sustainability Plan (GSP) Projects and Management Actions (PMAs). A summary of the suite of water management activities and how they tie to the district GSP are shown below in Table 1.

### **1.2. Coordination Activities**

#### ***1.2.1. Notification of AWMP Preparation and Public Participation***

SBx7-7 does not specify how much advance notice is required to cities and counties regarding plan preparation, does not require notification to any other agency(s), and does not require that comments from any city, county or other agency must be solicited and considered. In complying with these provisions, Cawelo notified entities of the AWMP preparation and for public participation through the March 12<sup>th</sup>, 2026, Board of Directors meeting agenda.

### **1.3. Plan Adoption and Submittal**

The 2025 AWMP was considered for adoption by the District following a public hearing scheduled on May 14<sup>th</sup> 2026. During the Public Hearing, the public and District landowners were provided with

an opportunity to provide comments on the AWMP. The District will submit a copy of the plan electronically to the DWR within 30 days of adoption. The resolution of adoption is included in the appendices.

**Table 1. Summary of Water Management Activities**

| <b>EWMP Category</b>              | <b>Cawelo District Actions</b>   | <b>Aligned GSP PMAs</b>  |
|-----------------------------------|--|--|
| Irrigation System Efficiency      | Promote on-farm efficiency via mobile irrigation laboratory evaluations; support irrigation improvements; provide water allocation projections | Reduces groundwater pumping demand; supports sustainable use           |
| Measurement & Accounting          | Encourage private well meters; monitor District water delivered to landowner turnouts; CASGEM reporting and well data consolidation            | Monitoring & Assessment PMA; supports sustainable groundwater tracking |
| Water Loss Reduction              | Maintain and upgrade distribution infrastructure; deliver surface water in lieu of groundwater pumping   | Conjunctive use PMA; reduces overdraft risk                            |
| Water Recycling & Reuse           | Deliver treated oilfield recycled produced water (RPW); facilitate regional water transfers  | Augmentation PMA; reduces groundwater reliance                         |
| Recharge & Groundwater Management | Operate Famoso and other spreading basins; Direct and In-Lieu Water Banking Programs; coordinate regional recharge projects                    | Recharge & Banking PMAs; supports sustainable basin management         |
| Water Transfers                   | Facilitate water exchanges and surface water banking; support neighboring agency imports   | Regional coordination PMA; enhances conjunctive use                    |
| Land Use Planning                 | Monitor crop types and acreage; track permanent crop water demand  | Links water demand to sustainable management PMAs                      |
| Monitoring & Assessment           | Track groundwater levels, quality, subsidence; record surface water deliveries, pumping, and banking recoveries; adapt practices as needed     | Monitoring, Assessment, and Adaptive Management PMAs                   |

## **2. Description of the Cawelo Water District and Service Area**

### **2.1. Physical Characteristics**

#### *2.1.1. Size of the service Area*

The District was formed in 1965 under the provisions of Division 13 of the Water Code of the State of California for the purpose of obtaining a “supplemental or partial water supply” for irrigation. In other words, the District was formed for the purpose of obtaining water supplies to supplement the pumping of groundwater for irrigation. Prior to formation of the District, water for irrigation was obtained almost exclusively from groundwater sources, resulting in a decline in groundwater levels averaging about ten feet per year. At the time the District was formed, approximately 38,200 acres within the District were under full irrigation. Although the total number of irrigated acres has decreased over time, the District currently encompasses a total area of 45,724 gross acres within its boundaries.

The District is governed by a five-member, at-large Board of Directors. The District provided a public entity for entering a contract for the importation of supplemental surface water from the State Water Project (SWP) through the Kern County Water Agency (KCWA or Agency). The KCWA was formed to contract with the State of California for SWP water to be delivered through the California Aqueduct. The District began surface water deliveries in February of 1976. In addition to SWP supplies, other District water sources include the Kern River water, the Friant Division of the Central Valley Project (CVP) water, Poso Creek, and RPW. These sources of supply have been used to conjunctively manage groundwater pumped in the District.

Cawelo has based its irrigation distribution system on conjunctive management of its surface water and groundwater resources. The District’s distribution system and service areas are shown on Figure 2. The District relies on conjunctive management to ensure the long-term sustainability of its water resources. In addition, the District coordinates its activities with neighboring districts and continually reviews and modifies its management practices to preserve and enhance the groundwater resources for the benefit of its landowners. Table 2 provides an overview of the District history and size.

**Table 2 Water Supplier History and Size**

|   |                   |
|---|-------------------|
| <b>Date of Formation</b>                                    | February 16, 1965 |
| <b>Source(s) of Water</b>                                   |                   |
| Federally Regulated Water <sup>(1)</sup>                    | X                 |
| State (SWP) Regulated Water                                 | X                 |
| Local Surface Water <sup>(2)</sup>                          | X                 |
| Local Groundwater   | X                 |
| <b>Gross Acreage at Time of Formation (within Boundary)</b> | 44,700            |
| <b>Gross Acreage in 2024 (within) Service Area</b>          | 33,618            |
| <b>Current Irrigated Acreage (2024)<sup>(3)</sup></b>       | 34,201            |

<sup>1</sup>Occasional water supplies from CVP.

<sup>2</sup>Primarily Kern River water supplies delivered to District, however, Poso Creek is also an infrequent source of local surface water.

<sup>3</sup>Includes irrigated acreage outside of District's "service area" but within the District's boundary. This area is primarily reliant on groundwater resources but does occasionally receive surface water in particularly "wet" years.

### ***2.1.2. Location of the service area and Water Management Facilities***

Cawelo is located in the north-central portion of Kern County, between U.S. Highway 99 on the west and State Highway 65 on the east, Oildale on the south and the community of McFarland on the north. Figure 1 illustrates the District location within the Kern County. Neighboring irrigation districts include North Kern Water Storage District (North Kern WSD) to the west and Kern-Tulare Water District (Kern-Tulare WD) to the north, with the Southern San Joaquin Municipal Utilities District (SSJMUD) to the north-northwest. Poso Creek traverses Cawelo about midway between the District's northern and southern boundaries.

Combined with the topographic characteristics of the service area, this distance has resulted in little to no pressure for conversion of agricultural lands to urban uses. Limited urbanization is occurring along the southern boundary of the District; however, urban expansion throughout Kern County has affected other water districts to a much greater extent.

The current irrigated land area within the District is expected to remain relatively stable for the foreseeable future (see Table 3). Nevertheless, there is potential for minor increases in irrigated acreage, as some undeveloped or currently non-irrigated lands within the District could be converted to agricultural production.

**Table 3. Expected Changes to the Service Area**

| <b>Change to Service Area</b> | <b>Estimate of Magnitude</b> | <b>Cause of Change</b> | <b>Effect on Water Supplier</b> |
|-------------------------------|------------------------------|------------------------|---------------------------------|
| Reduction (Service Area)      | Negligible                   | Urbanization           | No substantive impact.          |
| Increase (Service Area)       | Negligible                   |                        | None                            |
| Reduction (Irrigated Area)    | Negligible                   | Urbanization           | No substantive impact           |

The District has constructed extensive facilities for the purpose of conveyance and distribution of imported surface water supplies within the District. These project facilities include canals, pipelines, pumping plants, and reservoirs. To round out the District’s conjunctive-use program, groundwater recharge facilities and deep wells have also been constructed. In addition to District-owned facilities, the District has participated in the construction or expansion of certain joint-use facilities with the neighboring North Kern WSD. These joint-use facilities include the Beardsley Canal, portions of the Lerdo and Calloway Canals, the Calloway-to-Lerdo Intertie, and the Cross Valley Canal-to-Calloway Canal Intertie. The District was a participant, along with several other agencies, in the construction of the Cross Valley Canal (CVC) and is currently constructing additional pipelines, a new turnout off the Friant-Kern Canal and a new pump station . The District’s irrigation distribution system is shown in Figure 2, and these facilities are listed below:

**Pump Stations and Discharge Pipelines**

- Pump Station “A” and Conduit “A” [165.0 cfs] - *CVC Extension to Beardsley Canal*
- Pump Station “B” and Conduit “B” [250.0 cfs] - *Lerdo Canal to Reservoir “B”*
- Pump Station “C” and Conduit “C” [120.0 cfs] - *North Service Area*
- Pump Station “D” and Conduit “D” [130.0 cfs] – *8-23 Canal to Pump Station “E” and “F”*
- Pump Station “E” and Conduit “E” [80.0 cfs] - *Western Service Area*
- Pump Station “F” and Conduit “F” [30.0 cfs] - *Famoso Service Area*

Irrigation distribution system comprises of 6.5 miles of lined canals [250 cfs capacity], and about 55 miles of main and lateral pipelines of various sizes and capacities.

Five reservoirs, which are used to manage mismatches between supply and demand; for short- term storage; and for recharge.

**Reservoirs**

- Reservoir “B” [140 AF]
- Robertson Reservoir [120 AF]
- Poso Reservoir [400 AF]
- Reservoir “C” [125 AF]

- Reservoir “E” [49 AF]

**Recharge Basins**

- Famoso Groundwater Banking Project Basins [370 Acres]
- Poso Creek Streambed [≈180 Acres]
- Poso Creek Basin [130 Acres]

The current distribution system is capable of delivering 250 cfs to landowners within the primary service area. Table 4 provides a summary of these existing irrigation distribution facilities located within Cawelo. Note that there are lands within the District but outside the surface water (primary) service area; these lands (“groundwater-only”) depend exclusively on pumped groundwater for their irrigation supply. On occasion, typically in particularly wet years, the District can deliver surplus surface water supplies to these areas.

**Table 4. Water Conveyance and Delivery Systems**

| <b>System Used</b> | <b>Length (mi)</b> |
|--------------------|--------------------|
| Lined Canals       | 6.5                |
| Pipelines          | 55                 |

Pump Station “A”, Conduit “A” and the enlargement of Beardsley and Lerdo Canals were necessary to transport the District’s water supplies from the CVC Extension and/or the Kern River to the District. The remaining facilities were constructed within the District for distribution of the supplemental water supplies to lands within the District’s Service Area.

Delivery of water within the District’s distribution system, during the period of peak summer irrigation demand (June through August), has been limited by the pumping capacity of Pump Station “B”. The District added storage capacity along the distribution system to mitigate this limitation and regulate water supplies. The additional storage also increases the total quantity of water which can be delivered and adds flexibility to the District’s operations.

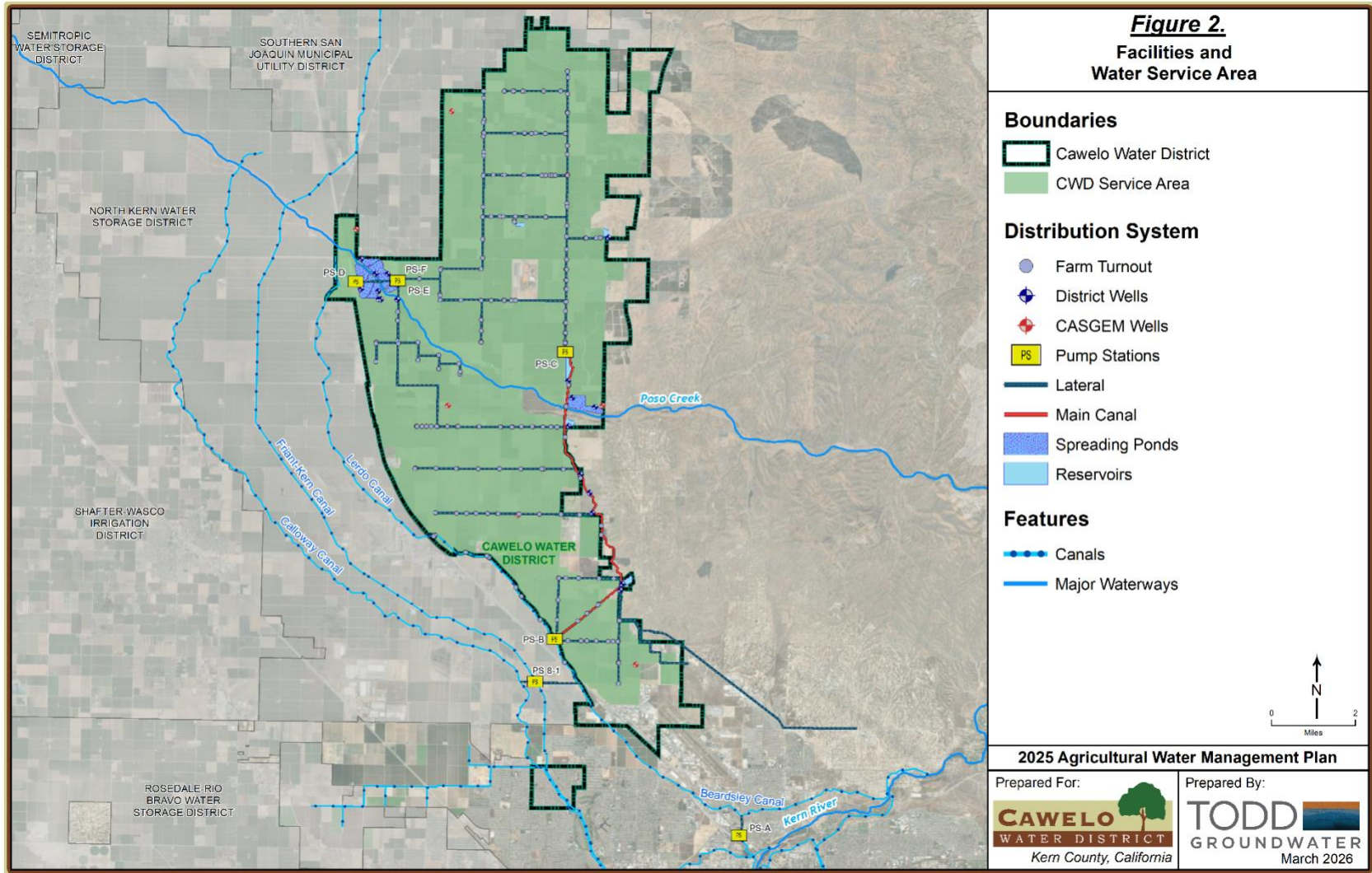


Figure 2. Facilities and Water Supply Area

The District receives SWP water at the California Aqueduct, transports the water through the CVC to the District's Pump Station "A" for discharge to the Beardsley Canal. The CVC is approximately 16.8 miles in length with seven pump lifts and varies in original capacity from 736 cfs to 646 cfs depending upon the reach. Since 1975, CWD has had a right to 135 cfs of the flow capacity within each reach of the CVC and 165 cfs of the flow capacity in the so-called CVC Extension. With the CVC expansion in 2012, the District now has a capacity in the CVC of up to 173 cfs. SWP water, as well as Kern River water, is wheeled through the Beardsley and Lerdo Canals, under an agreement with the North Kern WSD, to the District's Pump Station "B", where it is then pumped to Reservoir "B" and delivered to the users through the District's distribution system. Figures 3A and 3B are photographs of the District's Pump Stations "A" and "B".



**Figure 3A and 3B. District Pump Station "A" and "B"**

Cawelo has agreements with local oil producers including:

- Chevron USA Inc. (Chevron)
- California Resources Corporation (CRC)
- TRIO Petroleum (TRIO)

Cawelo receives treated RPW in conformance with the Central Valley Regional Water Quality Control Board's (CVRWQCB) waste discharge requirements. Oil producers typically pump the treated RPW to the District's Reservoir "B" through a series of pipelines. All treated RPW is blended with water from other sources in Reservoir "B" and subsequently delivered to the District's water users. The District's Reservoir "B" is shown on Figure 4.



**Figure 4. District Reservoir “B”**

Cawelo relies on the storage and recovery of groundwater for the year-to-year regulation which is required to manage variations in the District’s surface water supplies. The District does not have access to storage in a large external reservoir (such as Lake Isabella) to regulate seasonal or year-to-year water supplies. Cawelo does, however, have small volumes of operational storage available in mid-system reservoirs within its service area as listed above.

The Poso Creek Recharge and Regulation Reservoir, with a capacity of 400 acre-feet, was added to the system during the Fall of 1980. Although this reservoir fulfills a minor groundwater recharge function, its primary purpose is to provide operational flexibility and surface water regulation. During peak irrigation demand periods (usually Monday through Friday during June, July and August), three pumping units with capacities of 5, 10 and 15 cfs can deliver as much as 30 cfs from the reservoir into

the northern portion of the distribution system; thus, a prorated additional quantity of water can be retained in the southern part of the system for distribution. The reservoir is refilled during off-peak demand periods. The reservoir’s operation reduces variations in flow through Pump Station “C” and also provides operational flexibility during contingencies such as a pipeline lateral break.

The Robertson Reservoir, located south of Poso Creek near the end of the Distribution Canal, was constructed by CWD in 1984 and was enlarged early in 1990 to increase its capacity to approximately 150 acre-feet. The storage of the separate Regulating Reservoir “B” was increased from an original capacity of 29 acre-feet to 100 acre-feet in 1992. Since these reservoirs are all used exclusively for canal regulation, their capacity is not included as part of the water ‘supply’ reservoirs as seen in Table 5.

**Table 5. Water Supplier Reservoirs**

| Reservoir                                 | Capacity (AF) | Storage Rights (AF) |
|---|---------------|---------------------|
| Cawelo District Reservoirs <sup>(1)</sup> | N/A           | N/A                 |

<sup>1</sup>District regulating reservoirs have a cumulative capacity of about 834 acre-feet, however, since these are conveyance regulating reservoirs, their capacity is not a factor in assessing the District’s water supply.

Most of the land within the District’s service area is well drained. The need for on-farm surface drainage is non-existent, especially with low-volume irrigation application methods. Table 6 summarizes the existence of tailwater/operational outflow recovery systems. Currently, Cawelo has no District-operated recovery systems.

**Table 6. Tailwater/Operational Outflow Recovery System**

| System                                | Yes/No |
|---------------------------------------|--------|
| District Operated Tailwater Recovery  | No     |
| Landowner Operated Tailwater Recovery | No     |

Following is a list of ongoing water management improvements and programs, enacted by the Board of Directors, for Cawelo. This list supplements the description of previous water management activities presented in Section 1 and the description of specific EWMP implementation and reporting, included in Section 9 (Table 49).

- Expansion of the District’s conjunctive use program, including addition of groundwater recovery wells throughout the District. This includes the addition of approximately 400 acres of groundwater recharge basins and 17 District-owned recovery wells, allowing the District to bank more water in “wet” years and deliver more water to landowners in “dry” years.
- Establishment of a Water Purchase Reserve Fund to obtain additional water from available sources in “wet” and “above normal” years.
- Exploration of additional water supplies from the City of Bakersfield

- Expansion of additional facilities for the blending of treated RPW with other water supplies, and increased capacity for receiving treated RPW, to allow delivery of increased water supplies to land owners for irrigation.
- Establishment of a Drought Year Reserve Fund to partially mediate the very large cost increases associated with drought year operations. Dry years may occur in succession and therefore a large enough reserve funds needs to be created to cover such costs for at least two consecutive years.
- Establishment of a Capital Facility Reserve Fund to ensure that the District can quickly repair or replace a major capital feature of the District’s system upon failure. This fund is also used to replace or repair facilities that are beyond their service life.
- Administration of new State mandated programs; in particular, SGMA, CASGEM and Irrigated Lands Regulatory Program (ILRP) programs.

All of these programs were proposed by the District to maintain the goal of providing an annual supplemental surface water supply of 1.8 to 2.0 AF/acre to the landowners within the primary service area, and thereby extend the utility of the groundwater underlying the District. Due to the extensive permanent plantings within the District, on-farm distribution systems have been converted to sprinkler, drip and fan-jet systems, which provide highly efficient irrigation operations. The District also provides funds annually to the North West Kern Resource Conservation District (NWKRC), which supports the evaluation of the efficiency of on-farm irrigation systems.

A specific example of district facility improvement is the recently completed Calloway Canal-to-Lerdo Canal Intertie Project. The 400 cfs intertie connects the Calloway, Friant-Kern, and Lerdo canals allowing conveyance of CVP-Friant supply to Cawelo’s recharge facilities. The intertie was completed under a cost sharing agreement with North Kern WSD and received \$5M in federal funding that was matched with local funds. In addition, the District cost-shared the construction of the CVC-to-Calloway Canal Intertie, in 2014, and Calloway Canal Lining, in 2015. The districts may line additional phases of the Calloway Canal to allow SWP water to be delivered more efficiently into the districts through use of the canals that route the water through the North Kern WSD, as seen in Figure 5. Several conveyance improvements are partially funded through the DWR’s IRWMP and Water Use Efficiency programs and Reclamation programs including the Famoso intertie pipeline and pump station from the FKC to the Famoso Spreading Grounds. Benefits of the improved conveyance system include conserved water (through increased utilization of local spreading grounds); and decreased pumping costs (to the extent that use of Pump Station “A” can be avoided)

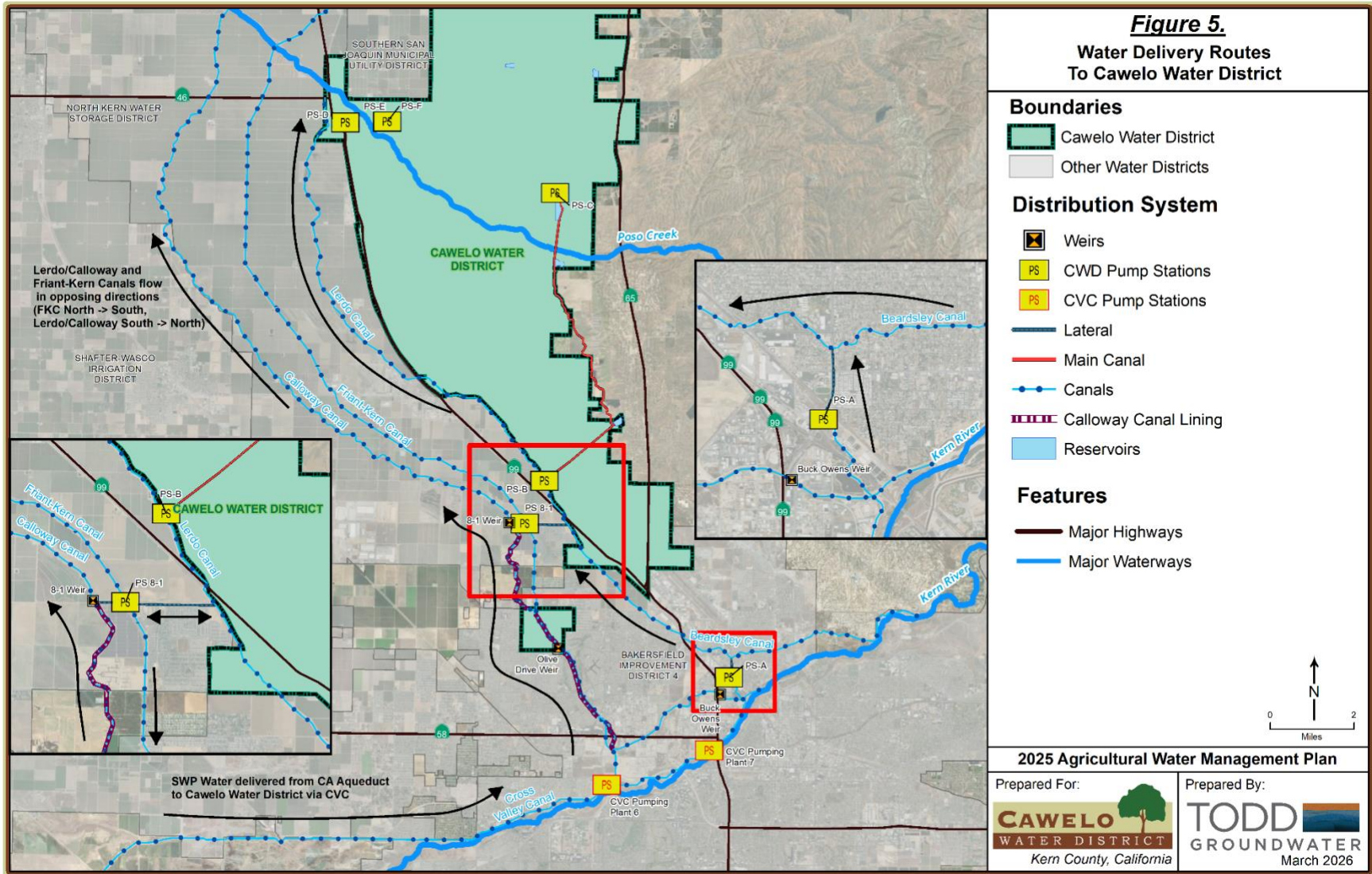


Figure 5. Water Delivery Routes To Cawelo Water District

### 2.1.3. Terrain and Soils

The District is located on the valley floor of the southeastern portion of the San Joaquin Valley. The San Joaquin Valley comprises the southerly two-thirds of the Central Valley from the Sacramento-San Joaquin River Delta on the north to the Tehachapi Mountains on the south. The valley floor is characterized by low alluvial plains and fans, overflow lands, and old lakebeds.

Unconsolidated deposits on the east side of the San Joaquin Valley consist of materials derived from the Sierra Nevada and are divided into three stratigraphic units: continental deposits, older alluvium, and younger alluvium. These unconsolidated deposits serve to transmit and store most of the groundwater pumped in the area.

The formations underlying the District consist of continental deposits of poorly bedded, loosely consolidated sands, gravels, silts and clays. Very deep deposits of old alluvium were deposited by several small intermittent streams that flowed in a westerly direction from the foothills. More recent alluvium is found along Poso Creek which is the largest of the streams in this area. The terminus for these flows in the geologic past was Tulare Lake, located to the north of Kern County on the west side of the San Joaquin Valley. Now, the Tulare Lake bed is separated from the San Joaquin River drainage by a low divide approximately 120 miles north of the southern end of the valley. The permeable alluvial deposits which underlie the District form an aquifer system which is naturally replenished by the flow of groundwater originating from precipitation in the Greenhorn Mountains to the East of the District.

The topography in the District consists of flat and rolling land sloping in a westerly direction. Elevations range from 375 feet above mean sea level in the west and southwest portion of the District to 600 feet above mean sea level in the east portion. The topographic features within the District do not have any identifiable impacts upon the District's water operations and management, as noted in Table 7.

**Table 7. Landscape Characteristics**

| <b>Topography Characteristic</b> | <b>% of the District</b> | <b>Effect on Water Operations and Drainage</b>               |
|----------------------------------|--------------------------|--|
| Flat Land                        | 35%                      | Land is adaptable to sprinkler and micro irrigation systems. |
| Rolling Land                     | 65%                      | Land is adaptable to sprinkler and micro irrigation systems. |

The soil types in Kern County vary in structure, texture, and chemistry with geographical location. Valley floor soils within Cawelo are derived mostly from mixed granitic and sedimentary rocks and are characterized as saline-alkaline. The generalized soils map units or soil associations underlying the

area are described in the published “*Soil Survey, The Wasco Area, California, 1936*” and were prepared by the U.S. Natural Resources Conservation Service under the SSURGO (Soil Survey Geographic Database) Program. A general soil texture map summarizing the SSURGO data is displayed in Figure 6. Soils within the District do not have any identifiable impacts upon water operations and management in the service area.

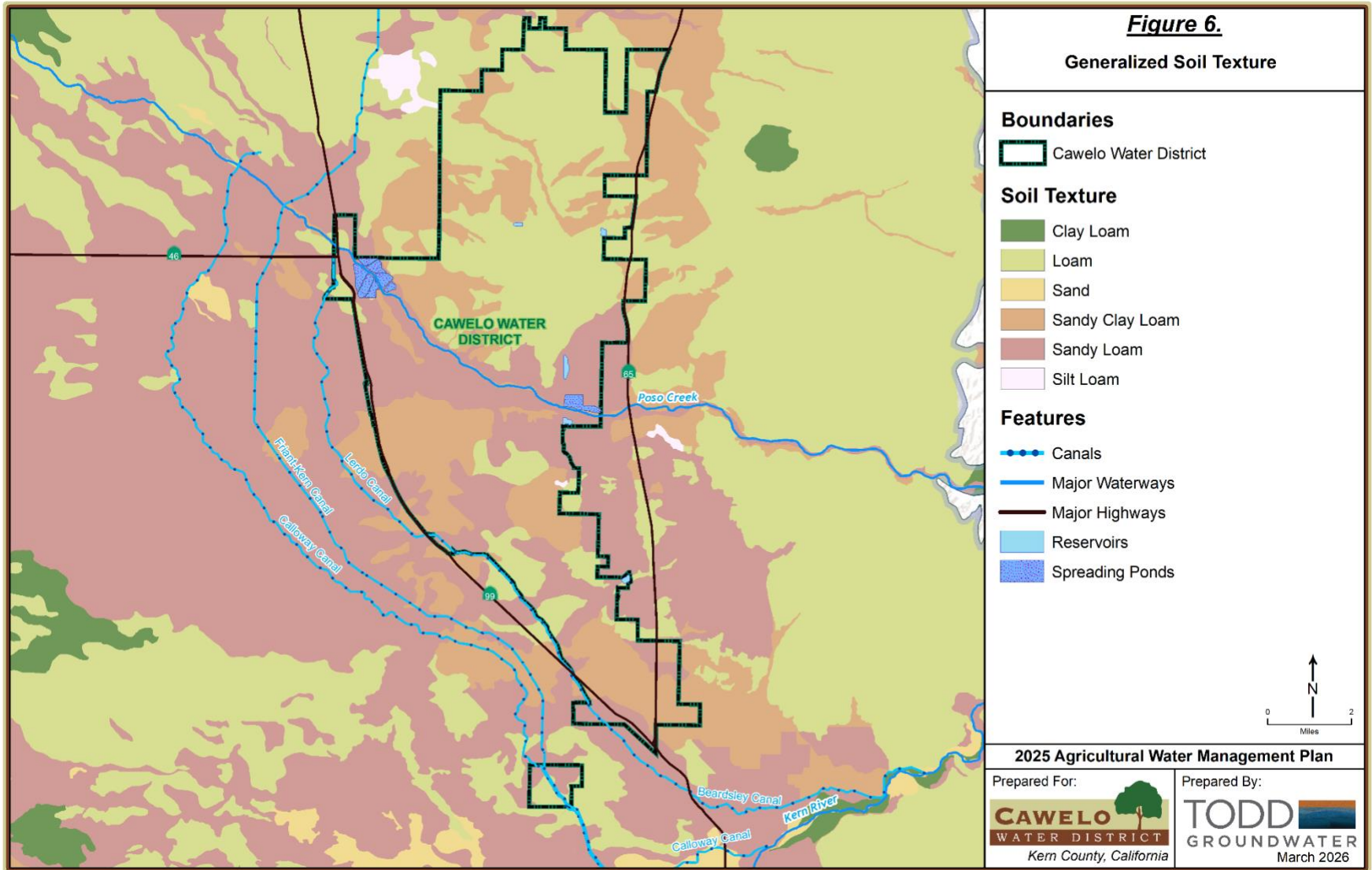


Figure 6. Generalized Soil Texture Map

### **2.1.4. Climate**

The District is located at the southern end of the San Joaquin Valley, a region partially enclosed by surrounding mountain ranges. The Sierra Nevada to the east exerts a strong influence on regional hydrology by capturing winter precipitation as snowpack, which contributes runoff to local surface water systems, including the Kern River, during the dry summer months. The surrounding topography also limits winter intrusion of continental cold air masses and contributes to the Valley's characteristic temperature inversion conditions.

The southern San Joaquin Valley climate is characterized by hot, dry summers and cool winters. Winter conditions frequently include nighttime tule fog and low cloud cover associated with temperature inversions, when cool, moist air is trapped near the valley floor beneath high-pressure systems. These inversion layers are generally confined to elevations below approximately 3,000 feet above ground surface, while adjacent foothill and mountain areas often experience clearer and milder conditions. Precipitation occurs predominantly during the winter months, with little to no rainfall during the summer, resulting in a strong seasonal hydrologic regime.

Climate inputs used for planning and water budget development are derived from long-term District rain gauge and temperature records and Spatial CIMIS reference evapotranspiration (ET<sub>o</sub>) datasets, consistent with methodologies applied in the Kern Subbasin groundwater modeling framework.

Table 8 and 9 summarizes mean annual and seasonal climate characteristics for the District service area. Mean annual precipitation is approximately 7.35 inches, with approximately 5.98 inches occurring during the wet season (November–March) and 1.37 inches during the dry season (April–October). Annual precipitation typically ranges between five and nine inches.

Average summer (July/August) maximum and minimum temperatures are 98.6°F and 69.3°F, respectively. Average winter (December) maximum and minimum temperatures are 58.0°F and 38.9°F, respectively. Summers are generally characterized by daytime temperatures in the upper 90s, while winter temperatures typically range from the low to mid-40s.

Mean annual reference evapotranspiration (ET<sub>o</sub>) is approximately 58.23 inches. Monthly ET<sub>o</sub> ranges from a minimum of 1.35 inches in December to a maximum of 8.72 inches in July, reflecting substantial seasonal atmospheric demand. These climate parameters serve as primary drivers for estimating crop water requirements, irrigation demand, recharge, and other components of the District's annual water budget.

**Table 8. Average Annual Climate Characteristics**

| Parameter  | Climate Characteristic   | Average Value |
|--|--|---------------|
| Precipitation (Inches) <sup>1</sup>                                  | Average Annual Precipitation                                       | 7.35 in       |
|  | Average Dry Season Precipitation (April-October)                   | 1.37 in       |
|  | Average Wet Season Precipitation (November-May)                    | 5.98 in       |
| Temperature (°F) <sup>2</sup>  | Summer Average Maximum and Minimum Temperature (July/August)       | 98.6/69.3 °F  |
|  | Winter Average Maximum and Minimum Temperature (December/December) | 58.0/38.9 °F  |
| Reference Evapotranspiration (ET <sub>o</sub> , Inches) <sup>3</sup> | Average Annual ET <sub>o</sub>                                     | 58.23 in      |
|  | Average Minimum Monthly ET <sub>o</sub> (December)                 | 1.35 in       |
|  | Average Maximum Monthly ET <sub>o</sub> (July)                     | 8.72 in       |

<sup>1</sup>Obtained from Cawelo Water District Rain Gauge data for the period March 1982 to December 2024

<sup>2</sup>Obtained from Cawelo's Temperature data for the period February 1996 to December 2024

<sup>3</sup>Obtained from Spatial CIMIS data for CWD area from January 1993 to December 2024

**Table 9. Average Monthly Climate Characteristics**

| Month/Time                 | Season | Average Precipitation <sup>1</sup> | Average Reference ET <sub>o</sub> <sup>2</sup> | Avg Max Temp <sup>3</sup> | Avg Min Temp <sup>3</sup> |
|----------------------------|--------|------------------------------------|--|---------------------------|---------------------------|
| January                    | "Wet"  | 1.38                               | 1.47   | 58.4                      | 39.4                      |
| February                   |        | 1.33                               | 2.22   | 64.5                      | 42.2                      |
| March                      |        | 1.34                               | 3.84   | 69.9                      | 46.2                      |
| April                      | "Dry"  | 0.57                               | 5.39   | 76.6                      | 50.2                      |
| May                        |        | 0.26                               | 7.27   | 84.5                      | 57.2                      |
| June                       |        | 0.10                               | 8.22   | 92.6                      | 64.4                      |
| July                       |        | 0.01                               | 8.72   | 98.6                      | 70.6                      |
| August                     |        | 0.04                               | 7.82   | 97.2                      | 69.3                      |
| September                  |        | 0.09                               | 5.95   | 91.2                      | 64.4                      |
| October                    |        | 0.31                               | 3.92   | 80.5                      | 54.8                      |
| November                   | "Wet"  | 0.67                               | 2.05   | 67.0                      | 44.7                      |
| December                   |        | 1.26                               | 1.35   | 58.0                      | 38.9                      |
| "Wet" Season Total/Average |        | 5.98                               | 10.94  | 63.6                      | 42.3                      |
| "Dry" Season Total/Average |        | 1.37                               | 47.28  | 88.7                      | 61.5                      |
| Annual Total/Average       |        | 7.35                               | 58.23  | 78.3                      | 53.5                      |

<sup>1</sup>Obtained from Cawelo Water District Rain Gauge data for the period March 1982 to December 2024

<sup>2</sup>Obtained from Spatial CIMIS data for CWD area from January 1993 to December 2024

<sup>3</sup>Obtained from Cawelo's Temperature data for the period February 1996 to December 2024

## 2.2. Operational Characteristics

As stated previously, Cawelo Water District manages its irrigation system using a conjunctive use strategy that integrates surface water deliveries with groundwater pumping to optimize the efficiency and reliability of water supply. The District is divided into two operational zones:

- **Groundwater-Only Service Area** – Lands located outside the District’s surface water delivery network (Service Area) rely almost entirely on privately pumped groundwater for irrigation except in wet years when the District provides supplemental surface water supplies.
- **Service Area** – Lands within the surface water delivery network receive imported surface water, with groundwater used as a supplemental source when surface water deliveries are limited or seasonal.

This division allows the District to prioritize surface water use where available while maintaining groundwater as a flexible supply, thereby supporting efficient irrigation management and contributing to long-term groundwater sustainability within the Subbasin.

### ***2.2.1. Operational Rules and Regulations***

The District Cawelo Water District (CWD) relies on conjunctive management of surface water and groundwater to support long-term sustainability of its water resources. The District coordinates operations with neighboring districts and continuously reviews and modifies management practices to preserve and enhance groundwater conditions for the benefit of its landowners. Over the years, CWD has implemented measures to promote direct and in-lieu recharge, enhance groundwater levels, and mitigate impacts of water supply deficiencies from the State Water Project (SWP).

District operations are governed by the *Rules and Regulations for Distribution of Water*, which establish procedures for the orderly, efficient, and equitable delivery of irrigation water. Under these guidelines:

- Water “turn on” orders are requested at least 48 hours prior to delivery; water is typically delivered continuously until the scheduled amount is reached.
- Immediate delivery requests may be accommodated through special arrangements.
- “Turn off” orders are submitted concurrently with “turn on” orders to facilitate proper scheduling of District activities and facilities.
- Landowners are generally responsible for operating their delivery gates according to the scheduled deliveries, with adjustments made as necessary in consultation with the District.

- The District may reschedule deliveries when capacity limitations or system shutdowns occur.

The District’s delivery system is 100% arranged demand as summarized in Table 10.

**Table 10. Supplier Delivery System**

| System          | Yes/No | % of System | Description             |
|-----------------|--------|-------------|-------------------------|
| On Demand       | No     |             |                         |
| Arranged Demand | Yes    | 100%        | Minimum 48-hour notice. |
| Rotation        | No     |             |                         |
| Other           | No     |             |                         |

CWD’s **Board of Directors** annually establishes the allocation of water and associated costs for landowners. Allocations are determined based on:

- Area of land in service
- Hydrologic year type (“wet” or “dry”), which influences both supply and demand
- Seasonal information provided by the California Department of Water Resources (DWR)

Water allocations are finalized after the DWR seasonal data is available. Table 11 summarizes the factors used to determine allocations.

**Table 11. Water Allocation System**

| Basis of Water Allocation | Yes/No |        |                   | Allocation             |                 |
|---------------------------|--------|--------|-------------------|------------------------|-----------------|
|                           | Flow   | Volume | Seas. Allocations | Normal Year            | % of Deliveries |
| Land in Service Area      | No     | Yes    | Yes               | 1.8 AF/AC <sup>1</sup> | 100%            |
| Water Year Type           | No     | Yes    | Yes               |                        |                 |

<sup>1</sup>Allocation for WY2024 is 1.9 AF/AC, all other years from 2017-2023 are 1.8 AF/AC

During periods of peak irrigation demand, system capacity constraints may necessitate a 24-hour daily operation to ensure users receive adequate water. The District evaluates operational adjustments based on system capacity, costs, and demand.

In emergency situations, water users may turn off their turnout but must immediately notify the District office by telephone or in person. Lead times for the arranged-demand program are summarized in Table 12.

**Table 12. Actual Lead Times**

| <b>Operations</b> | <b>Hours/Days</b>  |
|-------------------|--|
| Water Orders      | 48 hours   |
| Water Shut-Off    | Water Shut-Off orders are given at same time as Water Orders |

### ***2.2.2. Water Delivery Measurements or Calculations***

All deliveries of surface water and groundwater to farm delivery points, or “turnouts,” are owned and metered by the District. Turnout meter readings are taken daily whenever the turnout is in operation and also at the end of each month by District staff. The District employs propeller meters equipped with totalizers, which are periodically checked and calibrated as part of the maintenance program to ensure measurement accuracy.

When properly calibrated, these meters provide a highly accurate method of measuring both the flow rate and the volume of water delivered at each turnout. Because all propeller meters are equipped with totalizers, the District can equate the calibrated flow rate accuracy with volumetric accuracy. According to the SBx7-7 Flow Rate Measurement Compliance for Agricultural Irrigation Districts (Irrigation Training & Research Center, California Polytechnic State University, San Luis Obispo), devices with totalizers provide sufficiently precise measurements to assume that flow rate accuracy is equivalent to calibrated volumetric accuracy when monitoring flow duration.

As a result, the District’s measurement system allows for reliable computation of delivered water volumes at each turnout. Figure 7 illustrates a typical farm turnout.



**Figure 7. Typical Farm Turnout**

Table 13 provides District flow meter information in tabular form, along with the typical levels of accuracy for typical types of measurement devices.

**Table 13. Water Delivery Measurements**

| Type of Measurement | Freq. of Measurement (Days) | Freq. of Calibration (Months) | Freq. of Maintenance (Months) | Est. Level of Accuracy (%) |
|---------------------|-----------------------------|-------------------------------|-------------------------------|----------------------------|
| Propeller Meters    | Daily                       | Infrequently                  | As Needed                     | ± 5%                       |

District staff routinely monitor each meter for abnormalities. Policy dictates that any meter exhibiting uncorrectable abnormal readings in the field is replaced.

Section 8 of this plan describes the District’s ongoing and planned efforts to maintain compliance with SBx7-7 water measurement requirements, including regular verification of meter accuracy and maintenance of metering devices to ensure reliable, precise delivery measurements.

### ***2.2.3. Water Rate Schedules and Billing***

The Cawelo Water District Board of Directors annually establishes a Special Assessment applied on a per-acre basis to fund operations. The District operates on a calendar-year basis for budgeting and accounting. Charges to landowners are structured to cover costs associated with water supply, operations, maintenance, administration, and debt service, and are composed of three elements:

- Special Assessment – fixed per-acre assessment for general District operations.
- “Dry” Standby Charge – fixed per acre assessment for the availability of water service from District facilities.
- Water Toll – variable charges based on the delivery of supplemental surface water.

Annual water tolls are calculated based on the variable transportation and pumping costs for delivering supplemental surface water to different areas within the District. Separate tolls are applied for deliveries to:

- Lerdo Service Area (1,647 acres)
- South Service Area (14,014 acres)
- North Service Area (12,323 acres)
- Western Service Area (5,062 acres)
- Famoso Service Area (5,295 acres)

Water tolls are based on the volume of water delivered, as measured by District flow meters indicated in Table 14.

**Table 14. Water Rate Basis**

| Type of Billing           | Yes/No | % of Water Delivery | Description  |
|---------------------------|--------|---------------------|--|
| Volume of Water Delivered | Yes    | 100%                | Water billings are based on volume of water delivered. |
| Area (acres)              | No     |                     |  |
| Crop                      | No     |                     |  |
| Land Assessment           | No     |                     |  |

As of December 2024, the water toll for the growing season range from \$61 to \$126 per acre-foot, depending on the delivery areas. Table 15 identifies the District’s adopted rate structure.

**Table 15. Rate Structure**

| Type of Billing       | Yes/No | Description  |
|-----------------------|--------|--|
| Declining Block Rate  | No     |  |
| Uniform               | Yes    | Varies from year-to-year based on availability of water. |
| Increasing Block Rate | Yes    | Supplemental water when available.                       |

Cawelo generally bills irrigation water users at the beginning of each calendar year, covering all water allocated for the year. The frequency of billing is shown in Table 16.

**Table 16. Frequency of Billing**

| <b>Frequency</b> | <b>Yes/No</b> |
|------------------|---------------|
| Weekly           | No            |
| Monthly          | No            |
| Seasonally       | No            |
| Annually         | Yes           |

### ***2.2.4. Water Shortage Allocation Policies***

The Board of Directors of the Cawelo Water District has established and maintained the Rules and Regulations for Distribution of Water pursuant to Section 35423 of the California Water Code. From the District’s inception, it has not been intended that all lands within the District boundaries receive District water. To provide cost-effective service, the Board has designated a Service Area, which has:

- First priority for water delivery, and
- First priority for use of District delivery capacity.

Water users are notified of their final annual allocation by April 30 of each year.

Surface water is delivered to lands within the Service Area according to the District’s water allocation plan. Water allocations satisfy Water User applications and are billed at the Service Area water toll rate. Lands outside the Service Area may receive water after all Service Area demands have been met, billed at the applicable toll rate where the farm turnout is located. Supplemental Water refers to any water available for delivery beyond the annual allocations provided under the District’s contractual water supply agreements.

A water shortage, as defined in the Rules and Regulations, occurs when total Water User applications within the Service Area, submitted by March 1, exceed the sum of water supplies expected from the District’s contractual sources. In such cases:

- The District seeks to obtain Supplemental Water to meet unfulfilled demands.
- Allocation priorities for receiving District water are identified in Section IV of the Rules and Regulations, with Service Area lands receiving precedence.

Water supply planning accounts for year-to-year variability, including:

- State Water Project (SWP) allocations from the California Aqueduct, which are subject to hydrologic conditions (“dry” vs. “wet”) and legal or regulatory constraints on Delta pumping.
- Kern River supplies, which fluctuate based on Sierra Nevada watershed precipitation and snowmelt runoff.

During years of limited surface water availability, the District supplements supply with groundwater from District-owned wells to meet irrigation needs. Measures implemented for responding to water shortages shown below in Table 17.

**Table 17. Decreased Water Supply Allocations**

| <b>Measure</b>                 | <b>Description</b>   |
|--------------------------------|--|
| Supplemental Water Acquisition | Purchase or transfer of additional water to meet unmet demand          |
| Groundwater Pumping            | Operation of District wells to supplement surface water supplies       |
| Allocation Adjustments         | Pro-rata reductions to Water User allocations in Service Area          |
| Delivery Rescheduling          | Rescheduling water deliveries to manage system capacity                |
| Communication                  | Notification to Water Users regarding shortages and allocation changes |

The District enforces allocation policies to prevent wasteful water use (Table 18). Water will not be delivered to any farm with delinquent Water Charges or Special Assessments. Service may be resumed once outstanding charges are remedied. Enforcement methods include:

**Table 18. Enforcement Methods of Allocation Policies**

| <b>Enforcement Method</b>  | <b>Yes/No</b> |
|----------------------------|---------------|
| Shut-off of Water Supplies | Yes           |
| Refuse Service             | No            |
| Fines/Penalties            | No            |

### ***2.2.5. Drought Management Plan***

#### ***Regional Drought Planning***

Cawelo Water District participates in regional drought planning through the Poso Creek Regional Water Management Group (RWMG). The Poso Creek region developed a regional Drought Contingency Plan that evaluates drought vulnerabilities, identifies mitigation actions to improve long-term water supply reliability, and establishes response actions that may be implemented during drought conditions.

The Drought Contingency Plan builds upon existing regional water management efforts, including the Poso Creek Integrated Regional Water Management (IRWM) Plan, Groundwater Sustainability Plans (GSPs) developed under the Sustainable Groundwater Management Act (SGMA), Urban Water Management Plans, and Agricultural Water Management Plans prepared by participating agencies. These planning efforts provide a coordinated framework for managing water supplies during periods of hydrologic variability.

The regional drought planning approach focuses on improving operational flexibility, increasing groundwater recharge and storage capacity, and enhancing coordination among regional water agencies to better manage water supplies during both wet and dry periods.

### ***Drought Vulnerability Assessment***

The Poso Creek regional drought vulnerability assessment evaluates risks to water supply reliability and water management systems within the region. Because the region relies heavily on imported water supplies, the primary drought vulnerabilities are associated with reductions in surface water allocations during dry hydrologic conditions.

Key drought vulnerabilities identified for the region include:

- Variability in Kern River water supplies regulated through Lake Isabella Reservoir
- Reduced storage in Lake Isabella Reservoir during dry conditions
- Reduced conveyance capacity in the Friant-Kern Canal due to subsidence and infrastructure limitations
- Reduced allocations from the State Water Project (SWP) and Central Valley Project (CVP)
- Increased groundwater pumping costs associated with declining groundwater elevations
- Municipal water systems that rely exclusively on groundwater supplies
- Constraints associated with meeting groundwater sustainability requirements under SGMA

Because imported surface water supplies originate outside the region, drought conditions elsewhere in California may significantly influence water supply availability within the Poso Creek region.

### ***Regional Water Supply Resources***

Water supplies within the Poso Creek region are derived from several sources, including imported surface water, local surface water, and groundwater resources.

Imported water supplies are delivered through the State Water Project and the Central Valley Project. These supplies provide an important component of regional water supply reliability, particularly during wet and average water years.

Local surface water supplies are derived from the Kern River watershed and are regulated through Lake Isabella Reservoir. Water from the Kern River is delivered to local water districts when hydrologic conditions allow.

Groundwater resources within the Kern Subbasin also play a significant role in regional water supply reliability. Groundwater supplies consist of both native groundwater and groundwater that has been recharged or banked during wetter years. During dry or drought periods, groundwater pumping typically increases to offset reductions in surface water deliveries.

During wetter years, districts within the region attempt to maximize the use of available surface water supplies by reducing groundwater pumping and increasing groundwater recharge through spreading basins, in-lieu recharge programs, and groundwater banking operations. This conjunctive management strategy improves long-term water supply reliability by storing water during wet periods for later use during drought conditions.

### ***Water Quality Considerations***

Surface water quality from imported sources such as the State Water Project and Central Valley Project is regularly monitored by state and federal agencies. Water quality data indicates that surface water delivered to the region generally meets recommended agricultural water quality thresholds.

Although salinity levels may increase slightly during drought conditions, concentrations generally remain within acceptable agricultural and drinking water standards.

Groundwater quality within the region varies depending on aquifer depth and local hydrogeologic conditions. Constituents of concern in some areas include total dissolved solids (TDS), nitrate, arsenic, chloride, and sodium. However, groundwater quality studies conducted within the region indicate that groundwater quality does not significantly degrade during drought conditions. As a result, water quality is not considered a primary vulnerability associated with drought in the Poso Creek region.

### ***Climate Change Considerations***

Climate projections indicate that long-term changes in precipitation patterns and snowpack in the Sierra Nevada watershed may influence the reliability of water supplies delivered to the Poso Creek region. Modeling studies conducted as part of the regional IRWM Plan and Groundwater

Sustainability Plans indicate that future surface water allocations from the State Water Project and Central Valley Project may decrease due to hydrologic variability and regulatory constraints. Cawelo’s State Water Project allocations between 2009 and 2024 are shown in Figure 8.

Long-term planning assumptions indicate that future water supply allocations from imported sources may average approximately 60 percent of contracted amounts. Historical State Climate change may also alter the timing and magnitude of runoff from the Sierra Nevada, potentially reducing the availability of water for delivery to the region.

These projected changes increase the importance of groundwater recharge, groundwater banking, and regional water management strategies that improve the ability to capture and store water during wet periods.

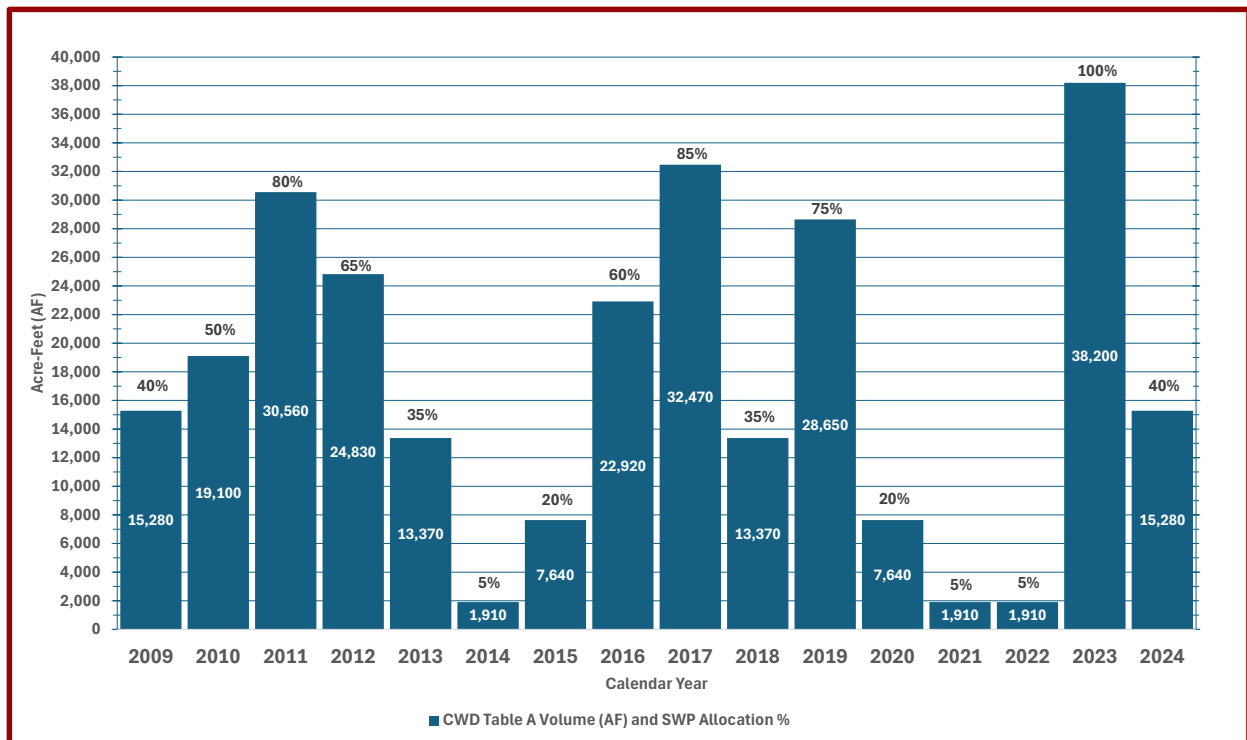


Figure 8. Annual State Water Project Allocations in Percent for 2009 to 2024

### *Drought Mitigation Actions*

The regional Drought Contingency Plan identifies a range of mitigation actions intended to improve long-term drought resiliency within the Poso Creek region. Mitigation actions are designed to enhance the region’s ability to capture, convey, store, and manage water supplies during wet years in order to reduce the impacts of future droughts.

Mitigation actions generally fall into four primary categories.

### **Conveyance Improvements**

Several projects are intended to improve water conveyance capacity within the region. These projects include canal lining, pipeline construction, intertie projects between districts, and improvements to pumping and control systems. These improvements increase the ability to move water throughout the region and improve operational flexibility.

### **Groundwater Recharge and Banking**

Many mitigation projects focus on expanding groundwater recharge capacity and increasing groundwater banking opportunities. These projects include construction of spreading basins, on-farm recharge programs, and expansion of groundwater banking partnerships. By increasing groundwater recharge capacity during wet years, the region can store water that can later be recovered during drought conditions.

### **Supplemental Water Supplies**

Additional mitigation actions focus on developing supplemental water supplies to improve water supply reliability. These actions may include acquiring new water supply contracts, expanding groundwater banking partnerships, utilizing recycled water supplies, and developing water treatment facilities to allow the use of RPW for irrigation.

### **Demand Management Programs**

Demand management programs are also used to improve drought resilience. These programs include irrigation efficiency programs, evapotranspiration monitoring tools, groundwater pumping management programs, and voluntary land conversion programs designed to reduce overall water demand.

### ***District Mitigation Actions***

Cawelo Water District has identified several mitigation projects intended to improve water supply reliability and reduce vulnerability to drought conditions. These actions include development of additional groundwater recharge capacity, acquisition of supplemental water supplies, expansion of groundwater banking partnerships, development of water treatment facilities to utilize additional RPW supplies, and construction of surface water storage and conveyance improvements.

These projects are intended to improve the District's ability to capture and store water during wet years and increase operational flexibility during drought conditions.

### ***Drought Response Actions***

Response actions are implemented when drought conditions reach defined thresholds based on reductions in surface water allocations or declining groundwater levels. These actions are intended to manage limited water supplies and reduce the severity of drought impacts.

Response actions may include:

- Public education and outreach regarding water conservation
- Proration of water deliveries based on available supplies
- Participation in water transfer programs
- Recovery of previously banked groundwater supplies
- Groundwater pumping from district-owned wells
- Groundwater pumping by landowners when surface water supplies are limited

During severe drought conditions, water districts may also request state or federal disaster assistance to address impacts associated with prolonged water shortages.

During wet years, the regional response focuses on maximizing groundwater recharge and water banking activities in order to increase available water supplies for future drought conditions.

### ***Plan Monitoring and Updates***

The regional Drought Contingency Plan is updated periodically to reflect changing water supply conditions, infrastructure improvements, and updated planning information. The plan may be updated following significant drought events or as new information becomes available.

The Poso Creek Regional Water Management Group will evaluate the effectiveness of the drought planning framework through both ongoing monitoring and post-drought evaluations. Plan elements are expected to be reviewed and updated at least every five years.

Updates to the plan will also be coordinated with updates to regional water management planning documents including Groundwater Sustainability Plans, Integrated Regional Water Management Plans, and Agricultural Water Management Plans.

### 2.3. Basis for Reporting Water Quantities

Cawelo’s primary surface water supplies come from an annual allocation of SWP water and historically from the Kern River. As previously noted, year-to-year variability in those supplies is to be expected. In “dry” years, surface water supplies are generally not sufficient to meet water demands, thus pumping from District-owned wells is significant. In “wet” years, surface water supplies are sufficient to satisfy irrigation water allocations (and thereby avoid the use of District-owned deep wells) and are adequate to make significant deliveries to spreading ponds for direct groundwater recharge.

In compliance with AB 1668 and SB 606, the water uses and operations for the years of 2020 through 2024 are included in this report. Hydrologically these years were “wet” to “critically dry” years and represent operations in extreme conditions. The water year types and SWP allocations for all five years included in this Plan are summarized in Table 19.

**Table 19. Representative Year**

| <b>Water Year</b>         | <b>2020</b> | <b>2021</b>    | <b>2022</b>    | <b>2023</b> | <b>2024</b>  |
|---------------------------|-------------|----------------|----------------|-------------|--------------|
| Water Year Index Type     | Dry         | Critically Dry | Critically Dry | Wet         | Above Normal |
| SWP Allocation Percentage | 20%         | 5%             | 5%             | 100%        | 40%          |

### 3. Description of Quantity of Water Uses of the Agricultural

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#### Water Supplier

The following section describes the quantity of water uses in the District, which are predominantly agricultural. Water uses are calculated on a calendar years basis, consistent with District accounting and landowner billing practices. The water budget details are consistent with the District’s GSP.

Water uses and water supplies within these AWMP sections are summarized on a calendar year basis to include a complete irrigation season, thus better describing irrigation practices and Cawelo’s operations that support those practices. The typical irrigation season in Cawelo extends into October and occasionally November, straddling two DWR-defined water years (October 1 to September 30).

#### 3.1. Agricultural Water Use

Permanent crops—primarily citrus, nut trees, and vineyards—comprise approximately 98 percent of the Cawelo Water District’s irrigated lands, reflecting the long-term conversion from annual to high-value perennial crops. This transition has “hardened” the District’s water demand, providing more predictable irrigation requirements. Crop acreage data are derived from the California Natural Resource Agency Statewide Crop Mapping<sup>1</sup>. The total water deliveries to farm turnouts per year are displayed in Table 20.

**Table 20. Agricultural Water Use (AF)**

| Water Source                  | Water Deliveries, per Year (AF) |        |        |        |        |
|-------------------------------|---------------------------------|--------|--------|--------|--------|
|                               | 2020                            | 2021   | 2022   | 2023   | 2024   |
| Water Delivered to Landowners | 62,758                          | 49,233 | 46,573 | 69,945 | 66,549 |
| <b>Total</b>                  | 62,758                          | 49,233 | 46,573 | 69,945 | 66,549 |

Actual crop evapotranspiration (ETa) is estimated using remote sensing models developed by ITRC for 2020-2023 and Land IQ for 2024, providing a reliable measure of water use by crop type over time. ETa values, combined with a uniform 10 percent leaching requirement applied across all crops, inform calculations of total crop water requirements. Between 2020 and 2024, the District’s average total crop water requirement has been approximately 100,100 acre-feet, equivalent to roughly 3.0 acre-feet per irrigated acre (Tables 21-24).

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<sup>1</sup><https://data.cnra.ca.gov/dataset/statewide-crop-mapping>

The integration of ETa and crop mapping data supports the District's water planning, including surface water allocations, operational decisions, and drought management strategies under conjunctive use operations. This approach also provides critical input for SGMA-compliant water budgets and long-term resource planning.

**Table 21. Agricultural Crop Data For 2020**

| Crop                       | Total Acres   | % of Total  | Estimated ET <sub>a</sub> (In) <sup>2</sup> | Crop Water Requirement (AF) | Estimated Leaching Requirement (AF) <sup>1</sup> | Total Crop Water Requirement (AF) |
|----------------------------|---------------|-------------|---|-----------------------------|--|-----------------------------------|
| Citrus & Subtropical       | 5,617         | 17%         | 38.3  | 17,938                      | 1,794  | 19,732                            |
| Almonds                    | 4,843         | 15%         | 45.2  | 18,255                      | 1,826  | 20,081                            |
| Young Pistachios           | 4,448         | 14%         | 15.7  | 5,811                       | 581  | 6,392                             |
| Vineyards                  | 4,193         | 13%         | 40.6  | 14,204                      | 1,420  | 15,624                            |
| Pistachios                 | 4,186         | 13%         | 40.0  | 13,947                      | 1,395  | 15,341                            |
| Young Citrus & Subtropical | 3,560         | 11%         | 19.6  | 5,827                       | 583  | 6,410                             |
| Young Other Deciduous      | 2,033         | 6%          | 8.2   | 1,393                       | 139  | 1,533                             |
| Young Vineyards            | 1,641         | 5%          | 21.3  | 2,914                       | 291  | 3,205                             |
| Young Almonds              | 1,345         | 4%          | 21.4  | 2,395                       | 240  | 2,635                             |
| Unknown                    | 335           | 1%          | 12.6  | 351                         | 35   | 386                               |
| Other Truck                | 217           | 1%          | 24.0  | 435                         | 43   | 478                               |
| Cherries                   | 76            | 0%          | 34.9  | 221                         | 22   | 243                               |
| Young Cherries             | 48            | 0%          | 28.1  | 113                         | 11   | 124                               |
| Grain                      | 11            | 0%          | 28.1  | 26                          | 3  | 29                                |
| Pasture                    | 8             | 0%          | 14.7  | 9                           | 1  | 10                                |
| Double Cropped             | 3             | 0%          | 12.4  | 3                           | 0  | 3                                 |
| Alfalfa                    | 0             | 0%          | 0.0   | 0                           | 0  | 0                                 |
| Young Peaches              | 0             | 0%          | 0.0   | 0                           | 0  | 0                                 |
| <b>Total</b>               | <b>32,563</b> | <b>100%</b> | <b>--</b>                                   | <b>83,843</b>               | <b>8,384</b>                                     | <b>92,227</b>                     |

<sup>1</sup>For the purposes of this table, a leaching requirement of 10 percent of the crop water requirement was assigned District-wide.

<sup>2</sup>Based on remotely sensed data from Irrigation and Training Center (ITRC) for 2020-2023 and LandIQ for 2024

**Table 22. Agricultural Crop Data For 2021**

| Crop                       | Total Acres   | % of Total  | Estimated ET <sub>a</sub> (In) <sup>2</sup> | Crop Water Requirement (AF) | Estimated Leaching Requirement (AF) <sup>1</sup> | Total Crop Water Requirement (AF) |
|----------------------------|---------------|-------------|---|-----------------------------|--|-----------------------------------|
| Citrus & Subtropical       | 5,986         | 18%         | 43.8  | 21,836                      | 2,184  | 24,019                            |
| Pistachios                 | 4,756         | 15%         | 41.3  | 16,358                      | 1,636  | 17,993                            |
| Young Pistachios           | 4,748         | 15%         | 16.1  | 6,365                       | 637  | 7,002                             |
| Almonds                    | 4,705         | 14%         | 49.4  | 19,368                      | 1,937  | 21,305                            |
| Vineyards                  | 4,131         | 13%         | 41.9  | 14,421                      | 1,442  | 15,863                            |
| Young Citrus & Subtropical | 3,249         | 10%         | 19.0  | 5,154                       | 515  | 5,669                             |
| Young Other Deciduous      | 1,984         | 6%          | 7.4   | 1,220                       | 122  | 1,342                             |
| Young Almonds              | 1,258         | 4%          | 19.2  | 2,017                       | 202  | 2,219                             |
| Young Vineyards            | 1,095         | 3%          | 20.6  | 1,876                       | 188  | 2,063                             |
| Unknown                    | 418           | 1%          | 15.7  | 547                         | 55   | 602                               |
| Other Truck                | 198           | 1%          | 24.2  | 399                         | 40   | 439                               |
| Cherries                   | 76            | 0%          | 41.7  | 263                         | 26   | 290                               |
| Young Cherries             | 40            | 0%          | 17.2  | 58                          | 6  | 64                                |
| Pasture                    | 32            | 0%          | 14.9  | 39                          | 4  | 43                                |
| Grain                      | 22            | 0%          | 10.2  | 18                          | 2  | 20                                |
| Double Cropped             | 8             | 0%          | 28.7  | 19                          | 2  | 21                                |
| <b>Total</b>               | <b>32,705</b> | <b>100%</b> | <b>--</b>                                   | <b>89,959</b>               | <b>8,996</b>                                     | <b>98,955</b>                     |

<sup>1</sup>For the purposes of this table, a leaching requirement of 10 percent of the crop water requirement was assigned District-wide.

<sup>2</sup>Based on remotely sensed data from Irrigation and Training Center (ITRC) for 2020-2023 and LandIQ for 2024

**Table 23. Agricultural Crop Data For 2022**

| Crop                       | Total Acres   | % of Total  | Estimated ET <sub>a</sub> (In) <sup>2</sup> | Crop Water Requirement (AF) | Estimated Leaching Requirement (AF) <sup>1</sup> | Total Crop Water Requirement (AF) |
|----------------------------|---------------|-------------|---|-----------------------------|--|-----------------------------------|
| Citrus & Subtropical       | 5,865         | 18%         | 40.7  | 19,898                      | 1,990  | 21,887                            |
| Pistachios                 | 5,591         | 17%         | 40.0  | 18,619                      | 1,862  | 20,481                            |
| Young Pistachios           | 5,368         | 16%         | 13.2  | 5,895                       | 590  | 6,485                             |
| Almonds                    | 4,691         | 14%         | 48.0  | 18,757                      | 1,876  | 20,633                            |
| Vineyards                  | 4,127         | 12%         | 42.3  | 14,558                      | 1,456  | 16,014                            |
| Young Citrus & Subtropical | 3,623         | 11%         | 19.6  | 5,918                       | 592  | 6,510                             |
| Young Almonds              | 1,313         | 4%          | 14.1  | 1,540                       | 154  | 1,694                             |
| Young Other Deciduous      | 1,183         | 4%          | 7.6   | 752                         | 75   | 827                               |
| Young Vineyards            | 982           | 3%          | 22.6  | 1,846                       | 185  | 2,031                             |
| Other Truck                | 207           | 1%          | 24.1  | 417                         | 42   | 459                               |
| Grain                      | 85            | 0%          | 25.7  | 183                         | 18   | 201                               |
| Cherries                   | 76            | 0%          | 47.9  | 303                         | 30   | 333                               |
| Pasture                    | 27            | 0%          | 14.3  | 32                          | 3  | 35                                |
| Young Cherries             | 13            | 0%          | 22.1  | 24                          | 2  | 27                                |
| Alfalfa                    | 8             | 0%          | 14.0  | 9                           | 1  | 10                                |
| <b>Total</b>               | <b>33,158</b> | <b>100%</b> | <b>--</b>                                   | <b>88,752</b>               | <b>8,875</b>                                     | <b>97,627</b>                     |

<sup>1</sup>For the purposes of this table, a leaching requirement of 10 percent of the crop water requirement was assigned District-wide.

<sup>2</sup>Based on remotely sensed data from Irrigation and Training Center (ITRC) for 2020-2023 and LandIQ for 2024

**Table 24. Agricultural Crop Data For 2023**

| Crop                       | Total Acres   | % of Total  | Estimated ET <sub>a</sub> (In) <sup>2</sup> | Crop Water Requirement (AF) | Estimated Leaching Requirement (AF) <sup>1</sup> | Total Crop Water Requirement (AF) |
|----------------------------|---------------|-------------|---|-----------------------------|--|-----------------------------------|
| Pistachios                 | 7,596         | 23%         | 39.3  | 24,847                      | 2,485  | 27,332                            |
| Citrus & Subtropical       | 5,920         | 18%         | 38.5  | 19,008                      | 1,901  | 20,909                            |
| Almonds                    | 4,753         | 14%         | 42.0  | 16,652                      | 1,665  | 18,318                            |
| Vineyards                  | 4,209         | 13%         | 39.5  | 13,850                      | 1,385  | 15,235                            |
| Young Pistachios           | 3,866         | 12%         | 18.9  | 6,092                       | 609  | 6,701                             |
| Young Citrus & Subtropical | 3,781         | 11%         | 18.2  | 5,748                       | 575  | 6,323                             |
| Young Almonds              | 1,078         | 3%          | 20.0  | 1,799                       | 180  | 1,979                             |
| Young Vineyards            | 592           | 2%          | 23.5  | 1,161                       | 116  | 1,277                             |
| Young Other Deciduous      | 518           | 2%          | 15.4  | 666                         | 67   | 733                               |
| Other Truck                | 265           | 1%          | 15.6  | 345                         | 34   | 379                               |
| Grain                      | 234           | 1%          | 13.2  | 257                         | 26   | 283                               |
| Unknown                    | 158           | 0%          | 14.1  | 186                         | 19   | 205                               |
| Cherries                   | 77            | 0%          | 42.5  | 272                         | 27   | 299                               |
| Alfalfa                    | 32            | 0%          | 20.9  | 56                          | 6  | 61                                |
| Pasture                    | 3             | 0%          | 38.4  | 10                          | 1  | 11                                |
| <b>Total</b>               | <b>33,083</b> | <b>100%</b> | <b>--</b>                                   | <b>90,494</b>               | <b>9,095</b>                                     | <b>100,044</b>                    |

<sup>1</sup>For the purposes of this table, a leaching requirement of 10 percent of the crop water requirement was assigned District-wide.

<sup>2</sup>Based on remotely sensed data from Irrigation and Training Center (ITRC) for 2020-2023 and LandIQ for 2024

**Table 25. Agricultural Crop Data For 2024**

| Crop                       | Total Acres   | % of Total  | Estimated ET <sub>a</sub> (In) <sup>2</sup> | Crop Water Requirement (AF) | Estimated Leaching Requirement (AF) <sup>1</sup> | Total Crop Water Requirement (AF) |
|----------------------------|---------------|-------------|---|-----------------------------|--|-----------------------------------|
| Pistachios                 | 8,378         | 24%         | 44.9  | 31,314                      | 3,131  | 34,446                            |
| Young Citrus & Subtropical | 7,025         | 21%         | 28.7  | 16,810                      | 1,681  | 18,491                            |
| Almonds                    | 4,752         | 14%         | 46.8  | 18,537                      | 1,854  | 20,390                            |
| Vineyards                  | 4,024         | 12%         | 40.6  | 13,615                      | 1,362  | 14,977                            |
| Young Pistachios           | 3,988         | 12%         | 17.5  | 5,831                       | 583  | 6,414                             |
| Citrus & Subtropical       | 3,348         | 10%         | 37.3  | 10,416                      | 1,042  | 11,457                            |
| Young Almonds              | 720           | 2%          | 22.3  | 1,337                       | 134  | 1,471                             |
| Grain                      | 693           | 2%          | 15.1  | 872                         | 87   | 959                               |
| Unknown                    | 633           | 2%          | 26.9  | 1,422                       | 142  | 1,564                             |
| Other Truck                | 366           | 1%          | 23.2  | 707                         | 71   | 778                               |
| Young Vineyards            | 128           | 0%          | 26.6  | 284                         | 28   | 312                               |
| Cherries                   | 80            | 0%          | 45.4  | 301                         | 30   | 331                               |
| Alfalfa                    | 36            | 0%          | 21.0  | 63                          | 6  | 70                                |
| Young Other Deciduous      | 28            | 0%          | 10.4  | 24                          | 2  | 27                                |
| Pasture                    | 1             | 0%          | 30.1  | 2                           | 0  | 2                                 |
| <b>Total</b>               | <b>34,201</b> | <b>100%</b> | <b>--</b>                                   | <b>101,536</b>              | <b>10,154</b>                                    | <b>111,690</b>                    |

<sup>1</sup>For the purposes of this table, a leaching requirement of 10 percent of the crop water requirement was assigned District-wide.

<sup>2</sup>Based on remotely sensed data from Irrigation and Training Center (ITRC) for 2020-2023 and LandIQ for 2024

Table 26 shows the District’s gross service areas and acreage irrigated from surface water and groundwater sources. The service area acreage has changed little over time, while the irrigated acreage has varied due to many factors.

**Table 26. District Irrigated Acreage**

| Irrigated Acreage                            | Acres  |        |        |        |        |
|--|--------|--------|--------|--------|--------|
|  | 2020   | 2021   | 2022   | 2023   | 2024   |
| Service Area                                 | 33,618 | 33,618 | 33,618 | 33,618 | 33,618 |
| Surface Water and Groundwater Irrigated Area | 32,563 | 32,705 | 33,158 | 33,083 | 34,201 |

Inter-cropping and double-cropping practices are minimal within the District, and most irrigation is managed for single, permanent crops as shown in Table 27.

**Table 27. Multiple Crop Information**

| Cropping Pattern | Acres      |            |            |            |            |
|------------------|------------|------------|------------|------------|------------|
|                  | 2020       | 2021       | 2022       | 2023       | 2024       |
| Cropped          | 32,563     | 32,705     | 33,158     | 33,083     | 34,201     |
| Inter-Cropping   | Negligible | Negligible | Negligible | Negligible | Negligible |
| Double           | 3          | 8          | Negligible | Negligible | Negligible |

### 3.2. Environmental Water Use

Cawelo does not make deliveries of water specifically for environmental purposes, however there may be environmental benefits incidental to the District’s operations.

These potential sources do not qualify as consumptive environmental water uses applicable to the AWMP water balance, and Table 28 has been completed accordingly.

**Table 28. Environmental Water Uses (AF)**

| <b>Environmental Resources</b> | <b>2020</b> | <b>2021</b> | <b>2022</b> | <b>2023</b> | <b>2024</b> |
|--------------------------------|-------------|-------------|-------------|-------------|-------------|
| In-Stream Flow Releases        | 0           | 0           | 0           | 0           | 0           |
| Streams                        | 0           | 0           | 0           | 0           | 0           |
| Lakes or Reservoirs            | 0           | 0           | 0           | 0           | 0           |
| Riparian Vegetation            | 0           | 0           | 0           | 0           | 0           |
| <b>Totals</b>                  | 0           | 0           | 0           | 0           | 0           |

### 3.3. Recreational Water Use

Cawelo does not supply water to recreational facilities within the service area, which is noted in Table 29.

**Table 29. Recreational Water Uses**

| <b>Recreational Facility</b> | <b>Volume (AF)</b> |
|------------------------------|--------------------|
| 2020-2024                    | 0                  |
| <b>Totals</b>                | 0                  |

### 3.4. Municipal and Industrial Water Use

All municipal and industrial water use within the Cawelo Water District service area is supplied exclusively through groundwater pumping. Rural residences and businesses obtain their domestic and commercial water directly from wells drawing from the underlying aquifer.

When surface water supplies are available, the District supports replenishment of the underlying aquifer through recharge operations conducted at District spreading ponds. These recharge activities primarily support irrigation water demands within the District; however, the same groundwater system also serves municipal and industrial users.

The District does not directly supply water for municipal or industrial use, as summarized in Table 30.

**Table 30. Municipal/Industrial Water Uses**

| Entity              | Volume (AF) |
|---------------------|-------------|
| Municipal Entities  | 0           |
| Industrial Entities | 0           |
| <b>Totals</b>       | 0           |

### 3.5. Groundwater Recharge Use

Indirect recharge occurs to the extent that the District delivers surface water in-lieu of pumped groundwater to satisfy irrigation water requirements that include leaching. In addition, Surface water supplies which are surplus to immediate irrigation requirements are available for direct groundwater recharge. In this regard, the District makes use of over 500 acres of spreading ponds which consist of several ponds or cells within a given spreading site, which are created and separated by contour dikes. The largest spreading site encompasses about 370 acres and is referred to as the Famoso Project Basins (reference Figure 2). Table 31 shows the volume of water recharged in the representative years, which is relatively modest. However, during particularly wet years, recharge using spreading ponds is significant.

**Table 31. Groundwater Recharge Uses**

| Groundwater Basin/Location | Method of Recharge         | Volume (AF) <sup>1</sup> |       |       |        |       |
|----------------------------|----------------------------|--------------------------|-------|-------|--------|-------|
|                            |                            | 2020                     | 2021  | 2022  | 2023   | 2024  |
| Famoso Basin Ponds         | Spreading of Surface Water | 4,987                    | 3,267 | 2,059 | 22,284 | 2,790 |
| Poso Creek Streambed       | Spreading of Surface Water | 0                        | 0     | 0     | 0      | 947   |
| Poso Creek Basin           | Spreading of Surface Water | 404                      | 1,307 | 1,599 | 6,637  | 2,662 |
|                            | <b>Totals</b>              | 5,391                    | 4,574 | 3,658 | 28,921 | 6,399 |

<sup>1</sup>Values have not been reduced by evaporation, thus represent gross estimates

The District operates a long-term “Water Banking Program” that allows “banking partners” to store “surplus” water, in the District and to recover their water when needed. Water banking involves the regulation of surplus surface water supplies, by placing the water into groundwater storage for subsequent recovery. The storage is achieved through either indirect or direct recharge. Indirect recharge is based on the delivery of surface water in-lieu of pumping groundwater (“in-lieu recharge”). Direct recharge is based on the surface spreading and percolation of water supplies in basins or ponds (such as the District’s Famoso Project Basins).

Banking partners include the Zone 7 Water Agency (located in the Livermore area) and the Dudley Ridge Water District (located in Western Kings County). The following agreements govern the banking arrangements with these agencies.

- “Agreement Between Alameda County Flood Control and Water Conservation District, Zone 7 and Cawelo Water District for a Water Banking and Exchange Program”, which became effective in 2006.
- “Amended and restated Agreement for Water Regulation Program between Cawelo Water District and Dudley Ridge Water District”, which became effective in 2002.

The Water Banking Program provides up to 120,000 acre-feet of groundwater storage capacity for a banking partner(s) with an annual recharge and recovery capacity of approximately 1,500 to 5,500 acre-feet per year.

### **3.6. Projected Water Use**

Cawelo Water District’s surface water supplies are primarily derived from its State Water Project (SWP) allocation through the Kern County Water Agency, supplemented historically by the Kern River and Poso Creek. Projected surface water availability in the District is expected to be reduced in the future, although the precise magnitude and timing of these reductions remain uncertain. The reliability of these supplies is influenced by several factors:

- SWP supply constraints: Although the District has a contractual entitlement of 38,200 acre-feet per year, long-term analysis indicates that a reliable yield under normal hydrologic and regulatory conditions is approximately 22,150 AF per year (roughly 58% of contract). Reductions are largely due to ongoing regulatory restrictions on pumping from the Sacramento–San Joaquin Delta, incomplete conservation facilities within the SWP system, and the variable nature of annual SWP allocations, which are often not finalized until mid-to-late in the irrigation season. This creates uncertainty for growers, who must make planting and irrigation decisions before final allocations are known.
- Kern River supply: Use of Kern River water by the City of Bakersfield is expected to reduce the District’s access to this source. Historically variable, Kern River deliveries are currently limited and unreliable as a long-term source.
- Other surface supplies: Additional surface water sources, such as Central Valley Project (CVP) and Article 21 water, have historically been infrequent and represent a relatively small portion of the District’s supply. Future availability of these supplies is expected to decline due to regulatory constraints, including those associated with implementation of the San Joaquin River Restoration Program. Surface water from Poso Creek is also expected to remain a minor component of Cawelo Water District’s overall supply portfolio, averaging approximately 4,000 acre-feet per year.

Permanent crops, including citrus, almonds, pistachios, and vineyards, dominate Cawelo’s irrigated lands, and most rely on low-volume irrigation methods. These crops create a “hard” annual water demand that must be met to maintain crop health and yield. Because surface water supplies are variable and projected reductions are likely, the District’s growers increasingly rely on groundwater pumping to meet irrigation needs during “dry” periods. Historical trends indicate that groundwater levels were declining prior to the District’s importation of surface water, and future reductions in surface water availability could exacerbate long-term declines in groundwater levels, highlighting the importance of conjunctive management and careful planning to sustain the District’s water resources.

## **4. Description of Quantity and Quality of the Water Resources of the Agricultural Water Supplier**

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### **4.1. Surface Water Supply**

The following section describes the quantity and quality of water available to the District to meet irrigation demands, including leaching requirements and groundwater recharge. Water supplies are presented on a calendar-year basis, consistent with District accounting and landowner billing practices. The water budget details are consistent with those developed for the District’s Groundwater Sustainability Plan (GSP). Differences between the values presented in this AWMP and those reported in the GSP primarily reflect the use of calendar-year reporting in this document versus water-year reporting (October–September) in the GSP, as well as minor classification differences and slight spatial variations resulting from model element boundaries. In addition, minor refinements to the underlying data were incorporated in this report following completion of the GSP. Leaching was not evaluated as a separate component in the GSP, as it is included within the total water supply.

As noted previously, the Cawelo Water District began importing surface water in February 1976. The District’s primary source of surface water is State Water Project (SWP) water delivered through the California Aqueduct and the Cross Valley Canal (CVC). In addition to SWP supplies, the District supplements deliveries with water from other sources, including the Kern River, Central Valley Project (CVP) supplies conveyed through the Friant–Kern Canal (FKC), and treated recycled produced water (RPW).

#### **4.1.1. State Water Project**

Cawelo imports SWP water under a contract with the KCWA for 38,200 acre-feet per year. The contract with the KCWA was signed in 1972, simultaneously with the construction and operation agreements for the Cross Valley Canal. Shortages in SWP supplies are occurring more frequently and

are larger than originally envisioned, mainly due to the regulatory restrictions on exports from the Sacramento-San Joaquin River Delta.

From time to time, surplus SWP supplies, referred to as “Article 21” water, are made available. Historically, Cawelo has seen an annual Article 21 allocation of approximately 6,800 acre-feet; however, due to the restrictions on pumping water from the Delta, Article 21 water is becoming less available to Cawelo and other districts over time.

Over the 30-year historical period from 1995 through 2024, total State Water Project (SWP) deliveries to Cawelo have averaged approximately 25,300 acre-feet per year. During the more recent 2020–2024 period, deliveries have declined significantly, averaging approximately 15,500 acre-feet annually.

Looking ahead, the long-term average yield of Cawelo’s 38,200 acre-foot Table A contract amount is projected to be approximately 58 percent, or about 22,150 acre-feet per year, based on the 2019 SWP Water Supply Reliability Report. However, recent delivery trends indicate increased variability and a greater frequency of shortages relative to historical expectations.

In addition, Article 21 (surplus) water is not assumed to provide a reliable future supply and is not incorporated as a projected yield in forward-looking water supply estimates.

#### **4.1.2. Kern River**

The District’s other major contractual source of surface water is Kern River water purchased from the City of Bakersfield and from the KCWA.

The District has an agreement with the City of Bakersfield that provides for the purchase, on average, approximately 27,000 acre-feet per year through the Basic Term of the agreement. The Basic Term of the agreement expired in 2011, and the agreement is now operating under the Extension Term. The Extension Term provides the ability for the District to purchase water on a year-to-year basis when supplies are available. Therefore, this supply is no longer considered reliable. Under the agreement, the City sold an average of 21,400 acre-feet per year from 1995 through 2024, and 5,400 acre-feet per year from 2020 through 2024. The District is currently in discussions with the City of Bakersfield to establish a new agreement for Kern River water purchases.

The District has an agreement with the KCWA that provides for the purchase, when available, of high flow water on the Kern River. Due to the water in the agreement being high flow water (e.g., flood water), this supply is not considered reliable. Under the agreement the District purchased on average approximately 9,380 acre-feet per year from 2020 through 2024 under the agreement with KCWA. The quantity of deliveries in 2023 – nearly 46,900 acre-feet – significantly influences the 2020 – 2024 average, reflecting one of the wettest years on record for the region.

### **4.1.3. Central Valley Project**

While Cawelo is not a CVP contractor, the U.S. Bureau of Reclamation has historically made annual contracts available to non-CVP contractors for the purchase and diversion of “Section 215” water, which is generally characterized as un-storable and unmanaged flood flows of short duration. The availability of CVP Section 215 water depends on the hydrologic conditions of the San Joaquin River and diversions are made from the FKC. Given completion of the Calloway-to-Lerdo Intertie in 2021, Cawelo is now capable of receiving CVP Section 215 deliveries when available. In addition, Cawelo is increasing their capacity to receive CVP Section 215 deliveries by adding the Famoso Pipeline and pump station. Historically, Cawelo has received Section 215 deliveries only once, in 2011, totaling 1,666 acre-feet. In addition, the District has periodically participated in water exchanges and transfers that have made CVP water available.

### **4.1.4. Treated Oilfield Recycled Produced Water (RPW)**

Cawelo receives treated RPW in accordance with the Central Valley Regional Water Quality Control Board (CVRWQCB) waste discharge requirements. The District has agreements with local oil well operators, including:

- Chevron USA Inc. (Chevron/Texaco) – 23,900 acre-feet per year (average for 2020–2024)
- California Resources Corporation (CRC) – 5,400 acre-feet per year (average for 2020–2024)
- TRIO Petroleum (TRIO) – Approx. 3,400 acre-feet per year anticipated (starting in 2026)

The treated RPW is blended with other District water supplies and delivered to users through the main distribution system (see Section 2.1). Total deliveries of treated RPW averaged approximately 29,300 acre-feet per year during the 2020–2024 period.

### **4.1.5. Poso Creek**

In 1982, Cawelo constructed a streamflow gaging station on Poso Creek near State Highway 65, approximately one mile upstream of the District’s eastern boundary. The 30-year average annual flow at this gaging station (1995–2024) has been approximately 17,450 acre-feet, with the recent 2020–2024 average at about 15,350 acre-feet. It should be noted that a few very wet years contribute disproportionately to the annual average, and flows are generally infrequent. Some District landowners do exercise riparian rights and divert water from Poso Creek on occasion.

In 2000, the District was issued a Permit to divert water from Poso Creek for beneficial use at a maximum rate of approximately 110 cfs, with an annual volume limit of 30,000 acre-feet between November 1 and June 14 of the following year. An agreement between Cawelo Water District,

North Kern Water Storage District, and Semitropic Water Storage District allocated the first 135 cfs of Poso Creek flow—as measured at the State Highway 65 gaging station—to Cawelo.

Table 32 summarizes Cawelo’s diversions from surface water sources for 2020 through 2024, including estimated landowner riparian diversions from Poso Creek.

**Table 32. Surface Water Supplies (AF)**

| Calendar Year | State Water Project (SWP) | Kern River | Central Valley Project (CVP) | Recycled Produced Water (Oil Fields) | Other <sup>1</sup> | Total District Surface Water Supply | Riparian Diversions from Poso Creek |
|---------------|---------------------------|------------|------------------------------|--------------------------------------|--------------------|-------------------------------------|-------------------------------------|
| 2020          | 11,300                    | 5,000      | 0                            | 30,400                               | 3,000              | 49,700                              | 400                                 |
| 2021          | 1,100                     | 1,500      | 0                            | 29,600                               | 0                  | 32,200                              | 0                                   |
| 2022          | 500                       | 0          | 0                            | 29,400                               | 1,700              | 31,600                              | 0                                   |
| 2023          | 28,600                    | 73,700     | 0                            | 28,900                               | 0                  | 131,200                             | 2,100                               |
| 2024          | 36,100                    | 0          | 0                            | 28,300                               | 0                  | 64,400                              | 0                                   |
| Avg 2020-2024 | 15,500                    | 16,000     | 0                            | 29,300                               | 900                | 61,800                              | 500                                 |
| Avg 1995-2024 | 25,300                    | 21,400     | 55                           | 25,600                               | 4,500              | 76,800                              | 600                                 |

<sup>1</sup>Miscellaneous transfers including Annual Water Purchases, Banked Groundwater Recovery Pumping via CVC, and Friant-Kern Canal Exchanges excluding Section 215 water

Table 33 lists restrictions or imposed limitations on sources of Cawelo’s surface water supply; in particular, the District’s supply of SWP water via the California Aqueduct. Restrictions on this supply generally result from Court Orders and regulatory actions of wildlife agencies related to endangered species actions and actions of the State Water Resources Control Board (SWRCB) that restrict the pumping operations managed by the DWR. Pumping restrictions have adversely affected the reliability of this source of supply.

The use of treated RPW is governed by the waste discharge requirements of the CVRWQCB and the specific agreements between the District and the treated RPW producers. All transfers of treated RPW into the District for irrigation purposes are authorized by the EPA Waste Discharge Reports (WDR) permit program within the State of California. The quality of treated RPW is measured monthly, as explained in Section 4.5 and 4.6 with the imposed limitations shown in Table 33.

**Table 33. Restrictions on Water Sources**

| Source                          | Restrictions or Imposed Limitations             | Name of Agency Imposing | Operational Constraints  |
|---------------------------------|---|-------------------------|--|
| State Water Project (SWP)       | Delivery Schedule and Volume                    | DWR                     | Reduced reliability of SWP deliveries south of the Sacramento-San Joaquin River Delta due to court-ordered constraints on pumping. |
| Treated oilfield Produced Water | Water Quality Monitoring/Water- Use Limitations | CVRWQCB                 | Limitations on water quality of treated oilfield produced water for use in irrigated agriculture (i.e. District operations).       |

## 4.2. Groundwater Supply

A significant portion of the District overlies a usable groundwater basin, specifically the Kern County Subbasin of the Tulare Lake Basin, which is part of the broader Central Valley aquifer system. The subbasin is identified in DWR Bulletin 118 (2003 Update) as No. 5-22.14. Figure 9 illustrates the Kern County Subbasin in relation to the District’s service area, and Table 34 presents the basin’s size as described in the Kern Subbasin 2025 GSP.

**Table 34. Groundwater Basins**

| Basin Name                       | Size (Sq. Mi.)                  | Est. Capacity (AF)             | Safe Yield (AFY)                                  |
|----------------------------------|---------------------------------|--------------------------------|---|
| Kern County Groundwater Subbasin | ~2,834 sq mi<br>(≈1.78 M acres) | Basin storage ~90–<br>260 M AF | ~1.31 MAFY<br>(sustainable yield per<br>2025 GSP) |

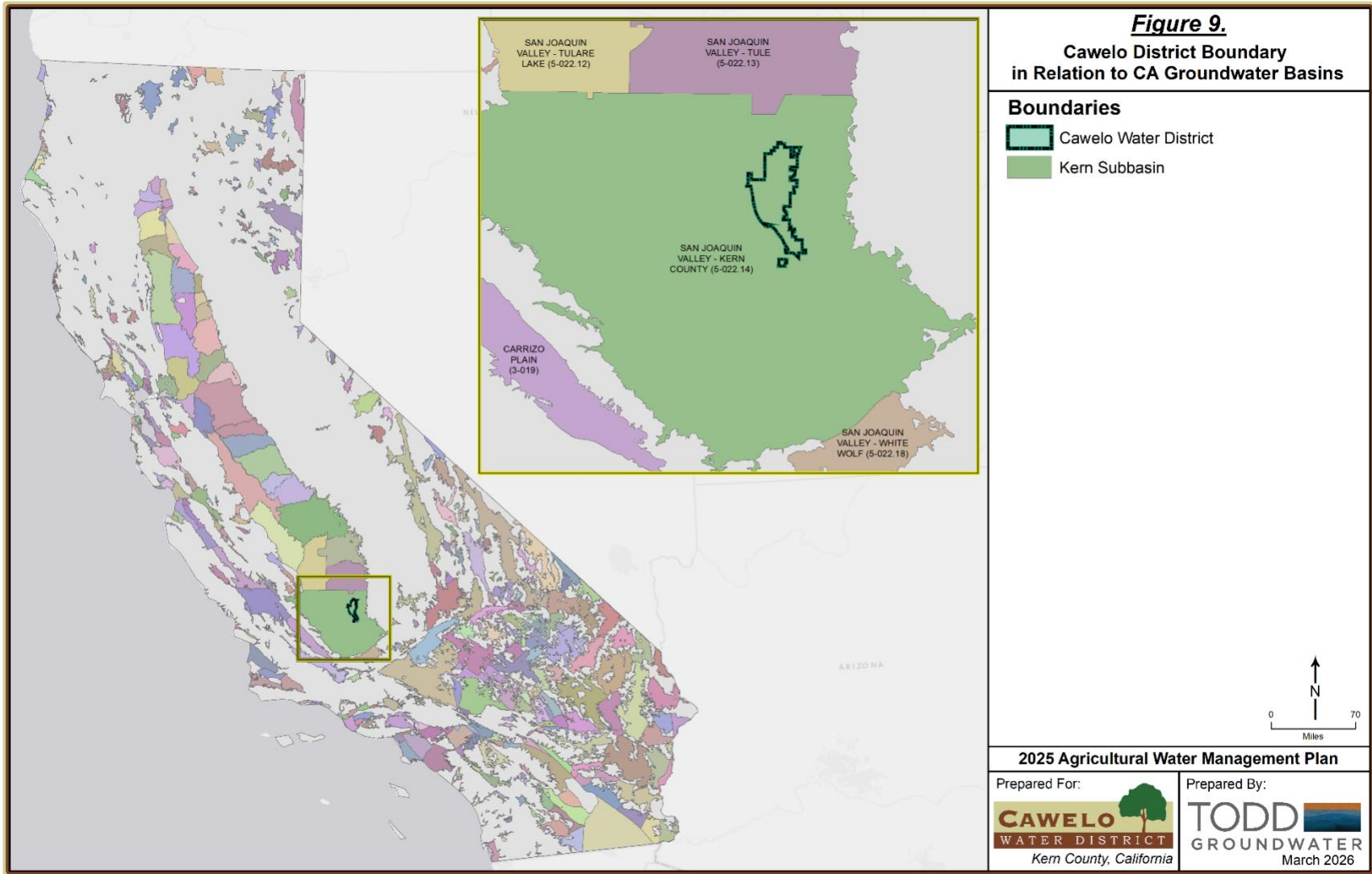


Figure 9. Map of District In Relation To Groundwater Basins(s)

As mentioned in Section 2.1 underlying the District service area are deposits of the Kern River formation consisting of poorly bedded, loosely consolidated sands, gravels, silts, and clays. The permeable alluvial deposits form an aquifer system that is naturally replenished by the flow of underground water originating from precipitation in the hills and mountains to the east of the District. In addition, the use of imported surface water and treated RPW, coupled with the District’s groundwater recharge and water banking programs, help to replenish the underlying groundwater system, and mitigate the effects of groundwater pumping.

The District commenced a Groundwater Monitoring Program in the fall of 1979 and currently measures groundwater levels in approximately 250 wells on a semi-annual basis.

More information on groundwater management in the District, as well as the geology of the aquifer underlying the District’s service area, is presented in the Kern Subbasin 2025 GSP. Table 35 indicates the date of the Plan and lists the firm responsible for its preparation.

**Table 35. Cawelo GSA Groundwater Sustainability Plan**

|                              |                                 |
|------------------------------|---------------------------------|
| <b>Prepared By</b>           | Multiple Authors <sup>1</sup>   |
| <b>Year</b>                  | 2025                            |
| <b>Is Appendix Attached?</b> | See Appendix B for link to plan |

<sup>1</sup> The Kern County Subbasin Groundwater Sustainability Plan (2025) was developed collaboratively by the Kern County Subbasin Groundwater Sustainability Agencies with technical support from multiple consulting firms.

The District maintains and operates 17 deep wells to supplement deliveries of surface water as needed (reference Figure 2 for the locations of these wells). Typical District-constructed wells vary from 1,200 to 1,500 feet in depth, with perforated intervals around 500 feet to the bottom, in a 30-inch (minimum) diameter bore hole. Pumping lifts vary with hydrology and location; however, the average lift has been approximately 500-700 feet in recent years. A typical District-owned deep well is shown in Figure 10.



**Figure 10. Typical Cawelo District-Owned Groundwater Well**

Table 36 shows groundwater pumped by District wells for the years 2020 through 2024 in acre-feet per year.

**Table 36. Groundwater Supplies (AF)**

| Calendar Year | District Groundwater Pumping |
|---------------|------------------------------|
| 2020          | 25,500                       |
| 2021          | 29,700                       |
| 2022          | 34,800                       |
| 2023          | 4,900                        |
| 2024          | 12,800                       |
| Avg 2020-2024 | 21,500                       |
| Avg 1995-2024 | 11,600                       |

District landowners rely on groundwater to meet crop demands beyond the volume of District delivered surface water. Private pumped groundwater estimates for lands within the District boundary are shown in Table 37. Private groundwater pumping is an output of the Kern Subbasin Groundwater model. Pumping from privately-owned wells within the District are not reported to the District unless

the water is pumped into the District’s system for conveyance and delivery. This volume includes all private pumping from lands within the district boundary including lands within and outside the districts service area. Although infrequent, water pumped from certain private wells is used for District purposes through an agreement with the private well owner. This privately pumped water is included in the total private pumping volumes displayed in Table 37.

**Table 37. Private Pumping (AF)**

| Calendar Year | Private Pumping |
|---------------|-----------------|
| 2020          | 20,600          |
| 2021          | 43,000          |
| 2022          | 45,600          |
| 2023          | 12,400          |
| 2024          | 27,300          |
| Avg 2020-2024 | 29,800          |
| Avg 1995-2024 | 28,000          |

### **4.3. Other Water Supplies**

The District does not actively import surface water from sources other than those listed in Section 4.1. In general, there are no uncontrolled inflows to the District, with the exception of Poso Creek, which is frequently dry but which, at times, is a source of unregulated inflow. Flows from Poso Creek are measured at weirs which enable the District to estimate inflows, except during storms when accurate measurements are not practicable.

### **4.4. Drainage from the Surface Area**

Drainage wells and surface drainage systems are not employed by the District. In some areas, groundwater below the root zone from excessive deep percolation is recoverable and can be used to supplement surface water. In these areas, the recovered water is generally of poorer quality than surface water but is suitable for agriculture. As Table 38 summarizes, there are no flows to saline sinks or perched water tables.

**Table 38. Drainage Discharges**

| Surface/Subsurface Drainage Path | AF   |
|----------------------------------|------|
| Flows to saline sink             | none |
| Flows to perched water table     | none |

## 4.5. Water Supply Quality

The District’s principal sources of imported water include the SWP, Kern River, and treated RPW. In addition, the District pumps and delivers groundwater from time to time. Water quality data are collected for each source of supply and compared to agricultural suitability and existing permits. Representative water quality data for surface water supplies historically delivered within the District are presented in Table 39 (2012). While these data are not intended to reflect current conditions, they provide a general indication of the relative quality of SWP and Kern River supplies, which have historically been considered good to excellent for irrigation use.

**Table 39. Source Water Quality Representative Assessment For 2012**

| Parameter       | Units | SWP    | Kern River |
|-----------------|-------|--------|------------|
| B               | mg/l  | 0.02   | 0.16       |
| Ca              | mg/l  | 22.5   | 18.2       |
| Mg              | mg/l  | 12.13  | 3.2        |
| Na              | mg/l  | 56.6   | 51.1       |
| K               | mg/l  | N/A    | 2.38       |
| Cl              | mg/l  | 79.8   | 72.0       |
| SO <sub>4</sub> | mg/l  | 38.87  | 24.5       |
| NO <sub>3</sub> | mg/l  | 3.2    | 0.47       |
| TDS             | mg/l  | 280.87 | 229.55     |

Furthermore, recall that Cawelo delivers water exclusively for irrigation uses. From this perspective, the quality of SWP water and Kern River water is considered good to excellent. Treated RPW is typically blended with other sources of supply in the District’s regulating reservoirs. The TDS concentration of treated RPW averages around 500 mg/L; however, after blending, the quality is typically no more than 450 mg/L, which is satisfactory for most agricultural uses in the District. While the groundwater quality is good in most parts of the District, there are areas where the concentrations of TDS and chlorides have exceeded the limits normally desired for irrigation of salt-sensitive crops levels, 450 mg/L and 140 mg/L, respectively.

The District manages the Cawelo Water District Coalition, which is a third-party group established to provide a pathway for landowners within the Cawelo Water District Coalition to comply with the CVRWQCB’s Irrigated Land Regulatory Program (ILRP). The ILRP focuses on priority water quality issues, such as pesticides and toxicity, nutrients, and sediments. The Cawelo Water District works directly with landowners to ensure compliance with ILRP requirements, which include required reporting with respect to the amount of nitrate being applied to croplands from all sources and implementation of best management practices to protect groundwater quality from overapplications of nitrates. Certain water quality data collected and reported as part of the ILRP are provided to the CVRWQCB and are available in the GeoTracker database for download and use.

Since Cawelo does not provide drainage facilities or assessment of on-farm subsurface drainage systems, the limitations associated with drainage reuse are not applicable to District operations.

## 4.6. Water Quality Monitoring Practices

The District actively monitors surface water and groundwater quality. Most monitoring locations are at District pumping stations where the principal surface water supplies from the SWP and Kern River are imported to the District. Samples are collected and analyzed at Pump Stations “A” and “B” on a monthly basis. Water quality reports are prepared by the treated RPW producers and provided to the CVRWQCB to illustrate compliance with regulations and guidelines contained in their respective discharge permits. Groundwater pumped from District deep wells is sampled in years of heavy use -- typically, during years of reduced surface water supplies. Table 40 provides general information on monitoring of source water quality in the District.

**Table 40. Water Quality Monitoring Practices**

| Source                   | Monitoring Location | Monitoring Practice      | Frequency of Analysis |
|--------------------------|---------------------|--------------------------|-----------------------|
| SWP                      | Pump Sta. “A”       | Agricultural Suitability | Monthly <sup>1</sup>  |
| Kern River               | Pump Sta. “B”       | Agricultural Suitability | Monthly               |
| Blended Treated RPW      | Reservoir “B”       | Agricultural Suitability | Monthly               |
| Groundwater <sup>2</sup> |                     | Agricultural Suitability | Annually              |

<sup>1</sup>Monitored by other entities and the DWR, on behalf of the District. Treated Oilfield Water monitoring follows the WDR’s Monitoring and Reporting Plans.

<sup>2</sup>Primarily on District-owned wells, but periodically includes some privately-owned wells.

Drainage water is essentially non-existent in the District. Therefore, Cawelo does not need to conduct monitoring of surface drainage.

## 5. Water Accounting and Water Supply Reliability

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### 5.1. Introduction

This section describes the various water uses and water supplies within Cawelo, providing an overall picture of how Cawelo's water supplies are used to meet water demands within the District's service area. The water budget is provided to quantify all significant inflows and outflows crossing the District boundary.

Cawelo Water District has initiated a detailed water budget study to improve accounting of water inflows, outflows, and changes in storage within the District. The study will develop a monthly water budget for the period 1995–2024 consistent with the Kern Subbasin groundwater model and will evaluate flows through the District conveyance system and land surface, including irrigated lands, recharge areas, and other land uses. The effort includes quality control and quality assurance (QC/QA) review of available flow measurements, delivery records, and other data used in the analysis. Results will improve understanding of water deliveries, groundwater pumping, evapotranspiration, recharge, and system losses, support improved measurement and operational practices, and provide more reliable input to regional groundwater and water management studies.

Water budget results presented in this AWMP section are provided on a calendar year basis. The typical irrigation season in Cawelo begins in March and extends into October and occasionally November, straddling two DWR-defined water years (October 1 to September 30). Summaries by DWR Components are included in Section 5.5.

### 5.2. Overview

The Cawelo water budget is presented as a single boundary water balance that quantifies all major inflows, outflows, and changes in storage within the Cawelo service area. A total of 15 individual flow paths are considered as part of the water budget. A schematic of the water budget structure is provided in Figure 11.

In general, flow paths are quantified monthly using available Cawelo data sources, weather data, and the Kern Subbasin Groundwater Model. All but one flow path are determined independently based on measured data or calculated estimates. The remaining flow path is calculated using the principle of conservation of mass (Equation 5-1), which states that the difference between total inflows and outflows for a given period is equivalent to the change in stored water within the Cawelo service area:

$$\text{Inflows} - \text{Outflows} = \text{Change in Storage} \quad [5-1]$$

The flow path that is calculated as the difference between all other inflows and outflows is referred to as the “closure term” because the mass balance equation is solved, or “closed,” for the unknown quantity. The closure term is selected based on the availability of supporting data and the relative magnitude and uncertainty of the flow paths. Generally, the largest or most uncertain flow path is selected as the closure term. Deep percolation of applied water was selected as the closure term to the balance.

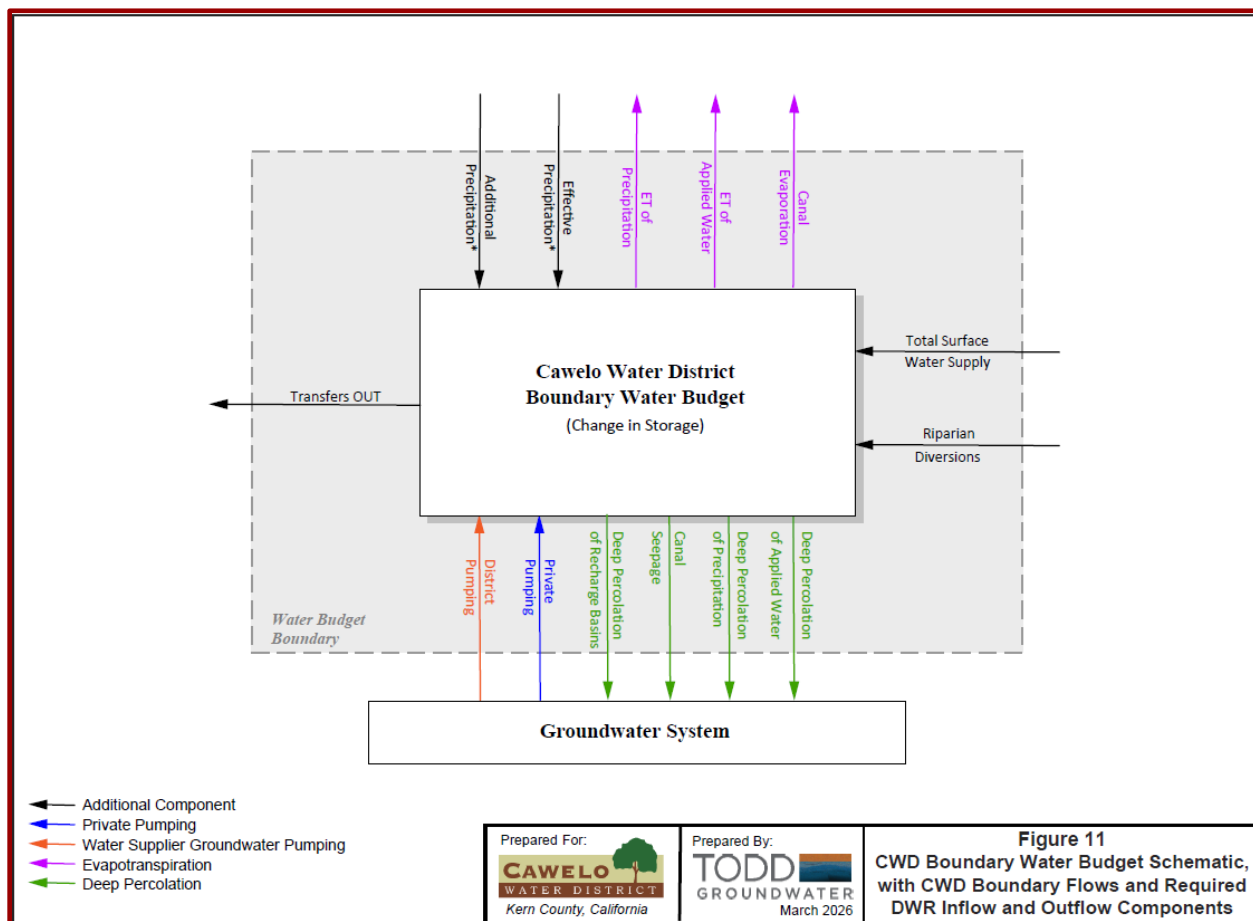


Figure 11. CWD Boundary Water Budget Schematic

### 5.3. Calendar Year Water Budget

Table 41 summarizes Cawelo’s primary water inflows for calendar years 2020 through 2024, including estimated riparian diversions from Poso Creek, total surface water supply, district groundwater

pumping, private pumping, and precipitation. These inflows represent the principal sources of water available for use within Cawelo.

**Riparian Diversions.** Estimated riparian diversions from Poso Creek are generally small relative to the District’s other water supplies, averaging approximately 500 acre-feet per year during the 2020–2024 period. Diversions were highest in 2023 at approximately 2,100 acre-feet, reflecting localized hydrologic conditions during that year. These estimates were developed based on measurements of Poso Creek flows where the channel crosses the District boundary at upstream and downstream monitoring locations.

**Surface Water Supply.** Total surface water supply inflows, as measured by district records, are the largest single inflow source, averaging 61,800 acre-feet annually from 2020–2024. Annual flows ranged from 31,600 acre-feet in 2022 to 131,200 acre-feet in 2023, reflecting variability water supply availability, operational decisions, and hydrologic conditions. All surface water inflows are measured and discussed in more detail in Section 4.1.

**District Groundwater Pumping.** Groundwater pumped directly by Cawelo for irrigation averaged 21,500 acre-feet per year during 2020–2024, with annual values ranging from 4,900 acre-feet in 2023 to 34,800 acre-feet in 2022. These values are based on measured flows and reflect operational adjustments in response to surface water availability.

**Private Pumping.** Privately pumped groundwater, estimated using the Kern Subbasin Groundwater Model, represents an important supplemental source for agricultural demand. Annual private pumping ranged from 12,400 acre-feet in 2023 to 45,600 acre-feet in 2022, averaging 29,800 acre-feet per year during the 2020–2024 period.

**Precipitation.** Local precipitation estimated using spatial PRISM<sup>2</sup> data, contributed an average of 25,700 acre-feet annually over the 2020–2024 period. Annual totals ranged from 16,600 acre-feet in 2022 to 38,200 acre-feet in 2023. Precipitation contributes to both direct soil moisture recharge and reduced irrigation demand.

**Historical Context.** Comparing the 2020–2024 averages to the long-term period of 1995–2024, total surface water inflows were somewhat below the long-term average (61,800 vs. 76,800 acre-feet), while district groundwater pumping was higher (21,500 vs. 11,600 acre-feet), indicating greater reliance on groundwater during recent lower-surface-water years. Private pumping and precipitation were near

historical averages.

The 2023 water year illustrates how Cawelo’s operations shift during wet conditions. Increased surface water deliveries significantly reduced groundwater pumping while enabling expanded recharge and water transfer activities, demonstrating the District’s role in regional conjunctive use management and groundwater basin replenishment. Overall, this water budget highlights the combined contributions of surface water, groundwater, riparian rights, and precipitation to meet irrigation demand within Cawelo, providing the foundation for subsequent calculations of distribution and applied water.

**Table 41. Calendar Year Inflows**

| Calendar Year        | Riparian Diversions <sup>1</sup> | Total Surface Water Supply Inflow <sup>2</sup> | District GW Pumping <sup>2</sup> | Private Pumping <sup>3</sup> | Precipitation <sup>4</sup> | Total Inflows  |
|----------------------|----------------------------------|--|----------------------------------|------------------------------|----------------------------|----------------|
| 2020                 | 400                              | 49,700   | 25,500                           | 20,600                       | 22,700                     | 118,800        |
| 2021                 | 0                                | 32,200   | 29,700                           | 43,000                       | 24,700                     | 129,600        |
| 2022                 | 0                                | 31,600   | 34,800                           | 45,600                       | 16,600                     | 128,500        |
| 2023                 | 2,100                            | 131,200  | 4,900                            | 12,400                       | 38,200                     | 188,700        |
| 2024                 | 0                                | 64,400   | 12,800                           | 27,300                       | 26,400                     | 130,900        |
| <b>Avg 2020-2024</b> | <b>500</b>                       | <b>61,800</b>                                  | <b>21,500</b>                    | <b>29,800</b>                | <b>25,700</b>              | <b>139,300</b> |
| Avg 1995-2024        | 600                              | 76,800   | 11,600                           | 28,000                       | 28,300                     | 145,300        |

<sup>1</sup>Estimated based on Poso Creek gage data

<sup>2</sup>Measured flows

<sup>3</sup>Output from Kern Subbasin Groundwater Model

<sup>4</sup><https://prism.oregonstate.edu/>

Table 42 summarizes Cawelo’s principal water outflows for calendar years 2020 through 2024, including evapotranspiration (ET) of applied water and precipitation, deep percolation, canal losses, transfers out, and changes in storage. These outflows represent the major pathways by which water leaves the Cawelo service area.

**Evapotranspiration (ET).** ET of applied water, representing the portion of delivered irrigation water consumed by crops, averaged 75,100 acre-feet per year over 2020–2024, ranging from 66,700 acre-feet in 2020 to 82,000 acre-feet in 2024. ET of precipitation contributed an average of 22,500 acre-feet per year, with annual values ranging from 14,700 acre-feet in 2021 to 32,200 acre-feet in 2023. These ET values are derived from the Kern Subbasin Groundwater Model.

**Deep Percolation.** Deep percolation of applied water, calculated as the closure term in the boundary

water balance, averaged 13,200 acre-feet annually during 2020–2024. Deep percolation from precipitation averaged 5,200 acre-feet per year, while water delivered to recharge basins, assuming negligible evaporation, contributed an average of 9,800 acre-feet annually. These values are based on the boundary water balance closure term and model outputs.

**Canal Losses.** Canal seepage, representing conveyance losses from the distribution system, averaged 6,800 acre-feet per year, while canal evaporation contributed approximately 100 acre-feet annually. Canal losses are estimated from distribution system analyses and reference ET. Although classified as a conveyance loss, canal seepage contributes to groundwater recharge within the Kern Subbasin and represents an incidental recharge benefit associated with surface water deliveries through the District distribution system.

**Transfers Out.** Water exported from the service area via transfers averaged 7,600 acre-feet per year, with the majority occurring in 2022 and 2023. Transfers out are based on measured flow records.

**Change in Storage.** Net changes in water stored in the root zone soil averaged approximately 1,100 acre-feet per year, with annual values ranging from –5,700 acre-feet in 2021 to 5,200 acre-feet in 2023. Changes in root zone storage reflect differences between total inflows and outflows in the crop root zone and are based on model outputs.

**Historical Context.** Compared to the long-term period of 1995–2024, ET of applied water was slightly lower than the historical average (75,100 vs. 84,100 acre-feet), canal seepage was higher (6,800 vs. 4,000 acre-feet), and deep percolation and ET of precipitation were near historical averages. Transfers out were above the long-term mean, reflecting recent operational decisions.

Overall, these outflow components highlight how ET, percolation, canal losses, transfers, and root zone storage changes contribute to water leaving the Cawelo system, providing a foundation for evaluating system efficiency and informing future water management strategies.

**Table 42. Calendar Year Outflows**

| Calendar Year        | ET of Applied Water <sup>1</sup> | ET of Precipitation <sup>1</sup> | Deep Percolation of Applied Water <sup>2</sup> | Deep Percolation of Precipitation <sup>1</sup> | Deep Percolation for Recharge Basin <sup>3</sup> | Canal Seepage <sup>4</sup> | Canal Evaporation <sup>4</sup> | Transfers Out <sup>5</sup> | Change in Storage <sup>1</sup> | Total Outflows - Change in Storage |
|----------------------|----------------------------------|----------------------------------|--|--|--|----------------------------|--------------------------------|----------------------------|--------------------------------|------------------------------------|
| 2020                 | 66,700                           | 24,400                           | 14,200   | 5,700  | 5,400  | 6,900                      | 100                            | 0                          | 4,600                          | 118,800                            |
| 2021                 | 79,800                           | 14,700                           | 13,000   | 3,800  | 4,600  | 8,000                      | 100                            | 0                          | -5,700                         | 129,600                            |
| 2022                 | 77,100                           | 16,500                           | 12,800   | 3,400  | 3,700  | 6,800                      | 100                            | 9,300                      | 1,000                          | 128,500                            |
| 2023                 | 70,100                           | 32,200                           | 16,300   | 9,000  | 28,900   | 8,300                      | 100                            | 28,900                     | 5,200                          | 188,700                            |
| 2024                 | 82,000                           | 24,700                           | 9,900  | 3,900  | 6,400  | 4,200                      | 100                            | 0                          | 200                            | 130,900                            |
| <b>Avg 2020-2024</b> | <b>75,100</b>                    | <b>22,500</b>                    | <b>13,200</b>                                  | <b>5,200</b>                                   | <b>9,800</b>                                     | <b>6,800</b>               | <b>100</b>                     | <b>7,600</b>               | <b>1,100</b>                   | <b>139,300</b>                     |
| Avg 1995-2024        | 84,100                           | 22,800                           | 17,000   | 5,700  | 8,700  | 4,000                      | 100                            | 3,000                      | 200                            | 145,300                            |

<sup>1</sup>Output from Kern Subbasin Groundwater Model

<sup>2</sup>Closure to the boundary balance

<sup>3</sup>Total volume of water delivered to recharge basins assuming evaporation is negligible

<sup>4</sup>Estimated based on distribution system analysis and reference ET from Spatial CIMIS <https://cimis.water.ca.gov/SpatialData.aspx>

<sup>5</sup>Measured flows

## **5.4. DWR Water Year Water Budget**

### ***5.4.1. Inflows***

The District's water budget components have been described in previous sections of this plan. Inflow elements of the water budget include the surface water elements described in Section 4.1 and the and groundwater elements described in Section 4.2. The District's water budget inflow components are provided in Table 43 for the period 2020 to 2024.

### ***5.4.2. Outflows***

The District's water budget components have been described in previous sections of this plan. Outflow elements of the water budget include the surface water elements described in Section 4.1 and the and groundwater elements described in Section 4.2. The District's water budget inflow components are provided in Table 44 for the period 2020 to 2024.

**Table 43. Water Budget Inflow Components – Cawelo Water District**

| Inflow Components   | AWMP Location for Supporting Calculations | Volume Quantification Method <sup>1</sup> | Percent Uncertainty <sup>1</sup> | Uncertainty Quantification Method <sup>1</sup> | Volume (AF/year) |                |                |                |                |
|---|---|---|----------------------------------|--|------------------|----------------|----------------|----------------|----------------|
|   |   |   |                                  |  | 2020             | 2021           | 2022           | 2023           | 2024           |
| Effective Precipitation. <sup>2</sup>   | 5,3                                       | Modeled                                   | 10%                              | Estimated                                      | 24,400           | 14,700         | 16,500         | 32,200         | 24,700         |
| Water Supplier Surface Water Diversions   | 5.3, 4.1                                  | Measured                                  | 5%                               | Measured                                       | 49,700           | 32,200         | 31,600         | 131,200        | 64,400         |
| Water Supplier Groundwater Pumping  | 5.3, 4.2                                  | Measured                                  | 5%                               | Measured                                       | 25,500           | 29,700         | 34,800         | 4,900          | 12,800         |
| Private Pumping   | 5.3, 4.2                                  | Modeled                                   | 25%                              | Estimated                                      | 20,600           | 43,000         | 45,600         | 12,400         | 27,300         |
| Other - Riparian Diversions   | 5.3, 4.1                                  | Estimated                                 | 100%                             | Estimated                                      | 400              | 0              | 0              | 2,100          | 0              |
| Other - Additional Precipitation (Total Precipitation minus Effective Precipitation) <sup>2</sup> | 5.3                                       | Modeled                                   | 30%                              | Estimated                                      | -1,700           | 10,000         | 100            | 6,000          | 1,700          |
| <b>Total Inflows</b>  |   |   |                                  |  | <b>118,800</b>   | <b>129,600</b> | <b>128,500</b> | <b>188,700</b> | <b>130,900</b> |

<sup>1</sup> The quantification methods and uncertainty represent the typical methods and uncertainties among all flow paths represented.

<sup>2</sup> Effective precipitation is equivalent to ET of Precipitation, which is accounted as an outflow from the Cawelo water budget. To account for all inflows, the additional precipitation (total precipitation minus effective precipitation) has also been added as an “Other” Inflow Component. Negative value indicate additional precipitation taken out of storage.

**Table 44. Water Budget Outflow Components – Cawelo Water District**

| Outflow Components              | AWMP Location for Supporting Calculations | Volume Quantification Method <sup>1</sup> | Percent Uncertainty <sup>1</sup> | Uncertainty Quantification Method <sup>1</sup> | Volume (AF/water year) |                |                |                |                |
|---------------------------------|---|---|----------------------------------|--|------------------------|----------------|----------------|----------------|----------------|
|                                 |   |   |                                  |  | 2020                   | 2021           | 2022           | 2023           | 2024           |
| Evapotranspiration <sup>2</sup> | 5C  | Modeled                                   | 10%                              | Estimated                                      | 91,200                 | 94,600         | 93,700         | 102,400        | 106,800        |
| Surface Outflows <sup>3</sup>   | 5C  | Estimated                                 | 5%                               | Estimated                                      | 0                      | 0              | 0              | 0              | 0              |
| Deep Percolation <sup>4</sup>   | 5C  | Calculated/<br>Modeled                    | 50%                              | Calculated                                     | 32,200                 | 29,400         | 26,700         | 62,500         | 24,400         |
| Other - Transfers Out           | 5C  | Measured                                  | 10%                              | Estimated                                      | 0                      | 0              | 9,300          | 28,900         | 0              |
| Other - Change in Storage       | 5C  | Modeled                                   | 20%                              | Calculated                                     | -4,600                 | 5,700          | -1,000         | -5,200         | -200           |
| <b>Total Outflows</b>           |   |   |                                  |  | <b>118,800</b>         | <b>129,600</b> | <b>128,500</b> | <b>188,700</b> | <b>130,900</b> |

<sup>1</sup> The quantification methods and uncertainty represent the typical methods and uncertainties among all flow paths represented.

<sup>2</sup> Evapotranspiration of Applied Water, Evapotranspiration of Precipitation, and Canal Evaporation

<sup>3</sup> Surface outflow from district lands is negligible.

<sup>4</sup> Deep Percolation of Applied Water, Deep Percolation of Precipitation, Deep Percolation from Recharge Basins and Seepage

## 5.5. Future Water Supply Reliability

Recall that the District contracted with the KCWA for the delivery of SWP water; however, shortages in this source of supply have been more frequent and larger than originally envisioned. This observation is largely due to the incomplete status of SWP facilities and increased regulatory restrictions on exports from the Sacramento-San Joaquin River Delta. In this regard, DWR Bulletin 160-09 (2009) articulated some of the water supply “challenges” facing the Tulare Lake Basin, of which Cawelo is a part. These challenges include the following:

- Water quality and environmental needs for the Delta are reducing the export volume of water pumped and available for delivery. For example, new biological opinions for endangered species and statutory requirements in December 2008 reduced export pumping by around 20-30 percent.
- Changes in the OCAP (Operations Criteria and Plan, USBR) could worsen delivery reliability issues of imported water from the CVP and SWP.
- The San Joaquin River Settlement will reduce CVP water diverted into the FKC, possibly by as much as 15 percent (on average) as interim flows began October 1, 2009, which also affects the availability of CVP 215 water.

According to the 2019 State Water Project Delivery Reliability Report (DWR 2020), the long-term reliability of surface water supplies to Southern California from the Delta is expected to average 58 percent of the contractual amounts.

Under a long-term contract with the City of Bakersfield, Cawelo received Kern River water in annual amounts which varied from less than 3,000 acre-feet in a “dry” year to nearly 40,000 acre-feet in a “wet” year. The supply under this contract is now unreliable and discussions are underway between the District and the City of Bakersfield regarding the possibility of future deliveries; however, this source of supply remains uncertain currently.

Cawelo is under contract with various oilfield operators to receive treated RPW in conformance with the CVRWQCB waste discharge requirements (Section 4). Supplies from this source are dependent on local oil production, inasmuch as the water is incidental to the production of oil. In recent years, the total delivery of treated RPW has ranged between 20,000 and 40,000 acre-feet and is expected to remain in this range for the foreseeable future.

Groundwater is pumped to the extent that irrigation water requirements exceed the other supplies available through the District. Accordingly, any reduction in the reliability of these other supplies will result in a commensurate increase in the use of groundwater. Increased use of pumped groundwater

will contribute to lower groundwater levels (and higher costs of energy for pumping) and may contribute to land surface subsidence.

Therefore, efficient water management practices and conjunctive management are critical for the well-being of the communities and districts that depend on these sources of water. In 2007, Cawelo joined several neighboring water agencies in adopting an IRWM Plan (Poso Creek IRWMP) which identified “water supply reliability” as the Region’s principal water resources concern going forward. The Poso Creek IRWMP identified and prioritized several projects to mitigate anticipated reductions in water supply reliability, several of which have been constructed, are under construction, or will be under construction in the near term. Some examples of the efforts Cawelo is making through the IRWMP, regarding improvements to District facilities and management, are illustrated in Sections 2 and 7 of this AWMP. A discussion of future changes to the District’s water supplies, in particular, from climate change, is presented in Section 7 of the plan.

## 6. Water Use Efficiency Quantification

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### 6.1. Overview

Water use efficiency is a fundamental component of Cawelo Water District’s water management strategy. Cawelo operates within the Kern Subbasin under a conjunctive use framework in which surface water supplies, groundwater pumping, root zone processes, and recharge operations are hydrologically interconnected.

Consistent with DWR AWMP guidance, water use efficiency is evaluated at the supplier scale using a water budget approach that distinguishes between:

- Crop consumptive use
- Agronomic water use
- Environmental water use
- Recoverable flows

These components are summarized and described below for calendar years 2020 through 2024.

### 6.2. Crop Consumptive Use (ET<sub>aw</sub>)

Crop consumptive use represents the portion of applied irrigation water that is evaporated, transpired, incorporated into plant biomass, or otherwise removed from the immediate hydrologic system.

In Cawelo’s water budget, crop consumptive use of applied water is represented by evapotranspiration of applied water (ET<sub>aw</sub>). ET<sub>aw</sub> is quantified as an outflow of the water budget and is derived from the Kern Subbasin Groundwater Model.

For calendar years 2020 through 2024, ET<sub>aw</sub> averaged 75,100 acre-feet per year, with annual values ranging from:

- 60,700 AF (2020)
- 79,800 AF (2021)
- 77,100 AF (2022)
- 70,100 AF (2023)
- 82,000 AF (2024)

These variations reflect differences in crop acreage, surface water availability, and climatic conditions.

### **6.3. Agronomic Water Use**

Agronomic water use represents applied water used for crop production purposes that is not consumed through evapotranspiration. These uses may include pre-irrigation for germination, leaching for salinity management, and frost protection.

Within Cawelo, agronomic water use is modest relative to total applied water and is estimated as 10% of the total crop water requirement as described in Section 3.1.

For 2020–2024, agronomic water use averaged 9,100 acre-feet per year, with annual values ranging from 8,400 AF to 10,200 AF.

These volumes represent intentional management applications that support crop productivity but do not constitute crop consumptive use.

### **6.4. Environmental Water Use**

There are no dedicated environmental water uses supplied from Cawelo’s irrigation deliveries within the District service area.

### **6.5. Recoverable Flows**

Recoverable flows include water that is not consumed by crops and remains available for beneficial reuse within the Kern Subbasin or by downstream users. These flows are critical to conjunctive management and groundwater sustainability.

Recoverable flows of applied water include Deep percolation of applied water (DPaw), Deep percolation from Recharge Basins, Change in Storage of Applied Water, and Canal Seepage.

- 29,400 AF (2020)
- 25,000 AF (2021)
- 25,500 AF (2022)
- 51,500 AF (2023)
- 22,400 AF (2024)

These recoverable volumes represent groundwater recharge and system recapture consistent with Kern Subbasin GSP accounting terminology.

## 6.6. Water Management Fraction (WMF)

Given the hydrologic interconnection between applied water, root zone processes, groundwater recharge, and canal seepage, the most appropriate efficiency metric for Cawelo is the Water Management Fraction (WMF) calculated on a total water supply basis.

The WMF is defined as:

$$\text{WMF} = \frac{(\text{ETaw} + \text{Deep Percolation of Applied Water} + \text{Canal Seepage} + \text{Change in Root Zone Storage of Applied Water})}{(\text{Total Water Supply} - \text{Transfers Out})}$$

This formulation is consistent with DWR AWMP guidance and Kern Subbasin groundwater accounting methodology.

For calendar years 2020–2024, Cawelo’s WMF was 99.9 percent. The high WMF indicates that essentially all water supplied to Cawelo is either consumed by crops (ETaw) or recoverable through groundwater recharge or downstream beneficial use. The primary non-recoverable component of the water budget is evaporation from the distribution system; however, this volume is minimal because Cawelo operates a predominantly pressurized, piped conveyance system with limited open water surface area. Distribution system evaporation averages approximately 100 acre-feet per year, representing a negligible fraction of total annual water supply.

**Table 45. Water Use Efficiency Fraction (Total Water Supply Basis), Acre-Feet**

| Year       | ETaw (AF)     | Recoverable Flows of Total Water Supply (AF) | Total Water Supply (AF) Net Transfers Out | WMF          |
|------------|---------------|--|---|--------------|
| 2020       | 66,700        | 29,400                                       | 96,200                                    | 99.9%        |
| 2021       | 79,800        | 25,000                                       | 104,900                                   | 99.9%        |
| 2022       | 77,100        | 25,500                                       | 102,700                                   | 99.9%        |
| 2023       | 70,100        | 51,500                                       | 121,700                                   | 99.9%        |
| 2024       | 82,000        | 22,400                                       | 104,500                                   | 99.9%        |
| <b>Avg</b> | <b>75,100</b> | <b>30,800</b>                                | <b>106,000</b>                            | <b>99.9%</b> |

## 7. Analysis of the Effects of Climate Change

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In accordance with the *2025 Guidebook*, Cawelo has updated the Analysis of the Effects of Climate Change to discuss expanded climate impacts and the vulnerability assessment of the 2019 Poso Creek IRWM Plan Update.

### 7.1. Effects of Climate Change on Agriculture's Water Demand

Several investigations were conducted by the United States Geological Survey (USGS) California Water Science Center (CAWSC) regarding hydrological effects of climate scenarios in the Sierra Nevada Mountain Range (USGS 2009; Water Resources Research, 2012). SWP water supplies are directly affected by the quantities of runoff and recharge in the Sierra Nevada Mountains. Each of these investigations predict that California's climate will become warmer (+2° to +4° C) and drier (10-15 percent) during the mid- to late-21st century, relative to historical conditions. These scenarios were based on a commonly accepted projection of 21<sup>st</sup> century climate from the GFDL CM2.1 (Geophysical Fluid Dynamics Lab Climate Model 2.1) global climate model, responding to assumptions of rapidly increasing greenhouse-gas (GHG) emissions. The California Energy Commission's Cal-Adapt web site predicts temperature differences in the District service area from a baseline historical average (1961 to 1990) to a projected average (2070 to 2090). The projection shows an increase in annual average temperature of about 3.4°F to 6.1°F under a low carbon and high carbon emission scenario, respectively. If these predictions materialize, the level of runoff from the Sierra Nevada Mountains is expected to be much less reliable, with quantities presumably declining over time. Reduced surface water deliveries for agriculture in the Central Valley, combined with increased demands for irrigation water due to the increasingly warmer, drier climate, will therefore result in increased use of groundwater. This in turn, would lead to the following impacts:

- Reduced base flow in streams;
- Reduced groundwater outflows;
- Increased depths to groundwater, and
- Increased land subsidence.

These combined effects have the potential to shift the District from a surface water dominated system, relying on groundwater to supplement years when surface supplies are inadequate to meet demand, to a groundwater dominated system (Water Resources Research, 2012). Increased depths to groundwater will also result in increased power and energy requirements for groundwater pumping, which has its own GHG implications and would increase the cost per acre-foot of water delivered to the farmers. Should climate change result in a reduction in available surface water supplies, the increased frequency and quantity of groundwater pumping by agricultural water districts and other users will lead to a

decrease of groundwater in storage without the necessary means of replenishing the depleted groundwater from storage. A greater examination of this is presented in the Region's respective GSPs submitted in 2020. According to another CAWSC study (Proceedings of the Eighth International Symposium on Land Subsidence, 2010), Kern County may experience land subsidence due to the increased demand on groundwater that may result from climate change.

Climate change is also expected to increase both daytime and nighttime temperatures in the Central Valley resulting in lengthening of the growing season. Cal-Adapt predicts that the number of days exceeding the "extreme heat threshold" of 104°F for the District service area will increase from a historical baseline average of 4 extreme heat days (1961-1990) to a projected average of 24 extreme heat days (2070-2090). Using the same baseline and projection years, the number of nights exceeding the "warm night threshold" of 73°F is expected to increase from 4 nights to about 22 nights. This general increase in temperatures coupled with greater variability and unpredictability in precipitation (depicted in decadal average projections by Cal-Adapt) is expected to lead to increases in evapotranspiration resulting from warmer seasons, thereby creating an increase in demand for irrigation water and an increase in the year-to-year variability of demand.

As seen in Section 3.4 of the 2019 IRWM Plan Update (Poso Creek IRWMP, 2019, p. 3-9), permanent crops (e.g. temperate fruit and nut trees) account for around 75 percent of the total irrigated area in the District. Areas with predominately permanent crop acreage may have reduced flexibility for adapting to changing climatic conditions since they require water in all types of water years, therefore "hardening" the demand. In addition, these types of crops generally require adequate winter chill to produce economically viable yield. Increased temperatures in the Central Valley are expected to reduce winter chill hours, thus causing adverse effects on crop yield. Today, the number of hours of winter chill in the San Joaquin Valley has shrunk from about 1,500 a few decades ago, to approximately 1,000 to 1,200 hours (PLoS ONE, 2009). By the end of the century, the safe winter chill needed for almonds, pistachios and apples is predicted to disappear.

## **7.2. Effects of Climate Change on Water Supply**

Cawelo's surface water supply is currently dictated by changes in the volume, nature, and timing of precipitation in the Sacramento-San Joaquin Delta as the receiving watershed is the source of supply for the SWP. The DWR examined 12 future climate scenarios in a report titled *Using Future Climate Projections to Support Water Resources Decision Making in California* (Chung et al. 2009) to assess future reliability issues with the SWP and the CVP due to climate change. For all climate projections studied, the reliability, and thus volume of water delivered, by the SWP and CVP water supply systems is expected to be reduced. For instance, average annual SWP exports under future climate scenarios from 2013 to 2033 conditions are projected to decrease 5.6 percent (DWR, 2013). Current long-term reliability predictions of SWP Table A deliveries, modeled under historic (1921-2003) precipitation

and runoff patterns and accounting for future conditions such as land use and climate change, are expected to decrease 6 percent from the historic average (DWR, 2013). These decreases in annual Delta exports would reduce water deliveries south of the Delta, which directly affects the water volume supplied to Cawelo. These effects would be magnified by similar changes to other potential surface water supplies, which have been used in the past by the District when water is available (e.g. Kern River, Poso Creek, etc.).

Local communities, rural residences, and businesses utilize groundwater from the Kern County Subbasin as a source of supply. Currently, Cawelo also recharges surplus surface water supplies to groundwater during wet years in spreading ponds across the District. Should climate change result in a reduction in water available from surface supplies, the increased frequency of groundwater pumping, from agricultural water districts and other users, will lead to a decrease in groundwater storage without the necessary means of replenishing the depleted storage.

### **7.3. Regional Vulnerability Assessment**

The Matrix below provides an assessment of the regional vulnerability to the potential climate change impacts, using the ‘Vulnerability Assessment Checklist’ found in the ‘Climate Change Handbook for Regional Water Planning’ (DWR, 2011). As previously stated, Cawelo Water District is a member of the Poso Creek RWMG. This Matrix is a modified version of the checklist provided in the 2019 Poso Creek IRWM Plan Update, gearing answers more specifically to Cawelo, and provides a further evaluation of the effects on regional water demands and supplies, as well as water quality, flooding events, environment and ecosystems, and hydropower systems.

Vulnerability ratings, identified in the Matrix, are based on presumed level of impact to regional conditions based on climate change considerations given in the checklist. For this assessment, the following rating system was used:

- “High” rating: expected impacts of climate change on listed item pose a severe risk to regional or District operations in the future, including, impacts that greatly inhibit the ability to deliver water supplies to users within the region or District.
- “Medium” rating: expected impacts of climate change on listed item pose a moderate risk to regional or District operations in the future, including, impacts that require management and planning changes in order to mitigate adverse effects.
- “Low” rating: expected impacts of climate change on listed item pose a low risk to regional or District operations in the future, including, impacts that may be mitigated through relatively simple planning or management changes, but are not critical to regional or District operations.
- “Not Applicable” (N/A) to the region or District or impacts that will not affect regional operations.

**Table 46. Modified IRWMP Climate Change Vulnerability Assessments Matrix**

| List No. <sup>1</sup>                    | Checklist Item   | Regional Conditions  | Vul. Rating |
|--|--|--|-------------|
| <b><i>I. Water Demand Assessment</i></b> |  |  |             |
| I.A                                      | Are there major industries that require cooling/process water in your planning region?   | Currently, requirements for cooling/process water are insignificant in Cawelo.   | Low         |
| I.B                                      | Does water use vary by more than 50% seasonally in parts of your region?   | Yes. Irrigated agriculture is the predominant use of water in the District. While annual water demands are consistent from year to year, there is considerable seasonal variation, with the highest demands occurring in the summer and lowest demands in the winter.  | Medium      |
| I.C                                      | Are crops grown in your region climate-sensitive? Would shifts in daily heat patterns, such as long heat lingers before night-time cooling, be prohibitive for some crops? | All crops grown in Cawelo are climate sensitive to some extent. Modest shifts in heating and cooling patterns are likely to affect crop yield; however, significant shifts could affect the viability of continuing to grow certain crops. As explained previously, the number of extreme heat days and warm nights is expected to increase in the area, which is likely to affect the quality and yield of crops.                                       | Medium      |
| I.D                                      | Do groundwater supplies in your region lack resiliency after drought years?  | Groundwater is necessary to maintain a sufficient water supply for the District. The resiliency of the District's groundwater resource is directly related to the reliability of surface water supplies, primarily the availability of water from the SWP since groundwater is used to meet demands that are not fulfilled by surface water supplies. To this extent, "resiliency" has been reduced.   | High        |
| I.E                                      | Are water use curtailment measures effective in your region?   | The District may refuse to deliver water to irrigators as a consequence for wasting water, either willfully, carelessly, or on account of defective ditches or pipelines. The District may also refuse to deliver water to inadequately prepared land or to users who flood certain portions of their land to an unreasonable depth in order to properly irrigate other portions. Water service may be resumed when these conditions have been remedied. | Medium      |
| I.F                                      | Are some in-stream flow requirements in your region either currently insufficient to support aquatic life, or occasionally unmet?  | While there are no in-stream flow requirements within Cawelo, the surface water supplies which are available to the District may be affected by such requirements at the sources of SWP supplies.  | Low         |

<sup>1</sup> Numbers based on checklist shown in Section 4.3 of the 'Climate Change Handbook for Regional Water Planning' (DWR, 2011).

**Table 46. Modified IRWMP Climate Change Vulnerability Assessments Matrix Cont.**

| List No. <sup>2</sup>                | Checklist Item   | Regional Conditions   | Vul. Rating |
|--------------------------------------|--|---|-------------|
| <b>II. Water Supply Assessment</b>   |  |   |             |
| II.A                                 | How much of the water supply in your region come from snowmelt?  | Yes. All surface water inflows are primarily a function of snowmelt runoff; however, the snowmelt does not occur within the Region <sup>2</sup> .   | High        |
| II.B                                 | Does part of your region rely on water diverted from the Delta, imported from the Colorado River, or imported from other climate-sensitive systems outside your region?                              | Yes. The District's primary source of imported surface water is the SWP, delivered through the Delta. As explained above, the SWP is vulnerable to climate change.  | High        |
| II.C                                 | Does part of your region rely on coastal aquifers? Has salt intrusion been a problem in the past?  | No.   | N/A         |
| II.D                                 | Could your region have difficulty in storing carryover surpluses from year to year?  | No. There is limited carryover available for SWP water in San Luis Reservoir. The most effective means of local regulation is with available groundwater storage. The District utilizes spreading ponds for direct recharge to facilitate replenishment of groundwater.   | High        |
| II.E                                 | Has your region faced a drought in the past during which it failed to meet local water demands?  | No. Water demands have been met through the use of groundwater which, during drought, can result in significant declines in groundwater levels. To the extent that surface water supplies are reduced in the future (as a result of climate change and/or regulatory constraints), recharge will be reduced, which will affect the availability of groundwater for meeting local water demands. | High        |
| II.F                                 | Does your region have invasive species management issues at your facilities, along conveyance structure, or in habitat areas?  | Invasive species issues are minimal in Cawelo, primarily consisting of algae growth in canals during times of low conveyance with low velocities or ponded water conditions.  | Low         |
| <b>III. Water Quality Assessment</b> |  |   |             |
| III.A                                | Are increased wildfires a threat in your region? If so, does your region include reservoirs with fire-susceptible vegetation nearby which could pose a water quality concern from increased erosion? | Wildfires are not a threat within District; however, depending on timing, direct recharge of groundwater in spreading ponds could be adversely impacted. There would be no threat to M&I uses within the District since all such uses are met with groundwater.   | Low         |

<sup>2</sup> For the entirety of this checklist, "Region" refers to the Poso Creek RWMG Region.

**Table 46. Modified IRWMP Climate Change Vulnerability Assessments Matrix Cont.**

| List No.                                     | Checklist Item  | Regional Conditions   | Vul. Rating |
|--|---|---|-------------|
| <b>III. Water Quality Assessment (cont.)</b> |   |   |             |
| III.B  | Does part of your region rely on surface water bodies with current or recurrent water quality issues related to eutrophication, such as low dissolved oxygen or algal blooms? Are there other water quality constituents potentially exacerbated by climate change? | Some local and regional canals seasonally have algae blooms that require maintenance, including minimal treatment or cleanup efforts. Algae blooms may become more frequent with climate change as a result of increased temperatures in Cawelo and less water moving through the canals. | Low         |
| III.C  | Are seasonal flows decreasing for some water-bodies in your region? If so, are the reduced low flows limiting the water-bodies' assimilative capacity?  | Poso Creek is the only "water body" in Cawelo with seasonal flows; however, whether seasonal flows are decreasing is unknown.   | N/A         |
| III.D  | Are there beneficial uses designated for some water bodies in your region that cannot always be met due to water quality issues?  | No.   | N/A         |
| III.E  | Does part of your region currently observe water quality shifts during rain events that impact treatment facility operation?  | No. M&I uses in Cawelo are supplied by groundwater pumping and surface water supplies are not treated for irrigation use.   | N/A         |
| <b>IV. Sea Level Rise Assessment</b>         |   |   |             |
| IV.A   | Already been observed in your region?   | Cawelo is located in the Southern San Joaquin Valley, and the concerns regarding coastal regions are not applicable.  | N/A         |
| IV.B   | Coastal structures, such as levees or breakwaters, in your region?  |   | N/A         |
| IV.C   | Is there significant coastal infrastructure, such as residences, recreation, water and wastewater treatment, tourism, and transportation at less than six feet above mean sea level in your region?   |   | N/A         |

**Table 46. Modified IRWMP Climate Change Vulnerability Assessments Matrix Cont.**

| List No.                                     | Checklist Item   | Regional Conditions  | Vul. Rating |
|--|--|--|-------------|
| <b>IV. Sea Level Rise Assessment (cont.)</b> |  |  |             |
| IV.D   | Climate-sensitive low-lying coastal habitats in your region?   | Cawelo is located in the Southern San Joaquin Valley, and the concerns regarding coastal regions are not applicable.   | N/A         |
| IV.E   | Are there areas in your region that currently flood during high tides or storm surges?                 |  | N/A         |
| IV.F   | Do tidal gauges along the coastal parts of your region show an increase over the past several decades? |  | N/A         |
| <b>V. Flooding Assessment</b>                |  |  |             |
| V.A  | Are critical infrastructure in your region lie within the 200-year floodplain?                         | Although flows in Poso Creek are infrequent, flooding of adjacent lands has occurred from time to time. The Poso Creek floodplain traverses the northern portion of the Region from east to west. Most of the area within the floodplain consists of irrigated agriculture.      | Medium      |
| V.B  | Does part of your region lie within the Sacramento-San Joaquin Drainage District?                      | No.  | N/A         |
| V.C  | Are artificial flood protection infrastructure exist in your region?                                   | No.  | N/A         |
| V.D  | Have flood control facilities (such as impoundment structures) been insufficient in the past?          | While there are no flood control impoundment structures in Cawelo, investigations have been conducted in the past to determine the technical and economic feasibility of constructing a dam on Poso Creek. Up to this point, the dam has not proven to be economically feasible. | Low         |
| V.E  | Are wildfires a concern in parts of your region?   | As noted in III.A (above), wildfires are not a concern in Cawelo; however, wildfires are a concern in the watersheds that provide the District with its surface water supplies.  | Low         |

**Table 46. Modified IRWMP Climate Change Vulnerability Assessments Matrix Cont.**

| List No.  | Checklist Item   | Regional Conditions  | Vul. Rating |
|---|--|--|-------------|
| <b>VI. Ecosystem and Habitat Vulnerability Assessment</b> |  |  |             |
| VI.A  | Does your region include inland or coastal aquatic habitats vulnerable to erosion and sedimentation issues?  | Coastal aquatic habitats are not applicable to the District. The potential for erosion or sedimentation exists along the channel of Poso Creek. Significant flow in Poso Creek is very infrequent.   | Low         |
| VI.B  | Does your region include estuarine habitats which rely on seasonal freshwater flow patterns?   | No.  | Low         |
| VI.C  | Do native fauna or flora populations live in your region?  | No.  | Low         |
| VI.D  | Do endangered or threatened species exist in your region? Are changes in species distribution already being observed in parts of your region?        | Yes. They consist of San Joaquin Kit Fox, Tipton Kangaroo Rat, and San Joaquin Woolly Threads. Whether or not changes in species distribution have occurred is unknown. The District supports the management efforts for endangered and threatened species led by the Tulare Basin Wildlife Partners, who actively monitor species distribution and habitat changes in the Region. | Medium      |
| VI.E  | Does the region rely on aquatic or water-dependent habitats for recreation or other economic activities?   | Recreational water use in Cawelo is limited to duck clubs which rely on seasonal flooding of ponds which have been developed for that purpose.   | Low         |
| VI.F  | Are there rivers in your region with quantified environmental flow requirements or known water quality/quantity stressors to aquatic life?           | No.  | N/A         |
| VI.G  | Do estuaries, coastal dunes, wetlands, marshes, or exposed beaches exist in your region? If so, are coastal storms possible/frequent in your region? | The Kern National Wildlife Refuge is located within the Region and manages some wetlands; however, coastal storms are not possible in Cawelo, owing to its location in the southern San Joaquin Valley.  | N/A         |
| VI.H  | Does your region include one or more of the habitats described in the Endangered Species Coalition's Top 10 habitats vulnerable to climate change?   | No. The Central Valley of California, where the District is located, is not listed as one of the 'Top 10' habitats vulnerable to Climate Change according to the 'It's Getting Hot Out There: Top 10 Places to Save for Endangered Species in a Warming World' Report (Endangered Species Coalition, 2010).  | N/A         |

**Table 46. Modified IRWMP Climate Change Vulnerability Assessments Matrix Cont.**

| List No.  | Checklist Item  | Regional Conditions   | Vul. Rating |
|---|---|---|-------------|
| <b>VI. Ecosystem and Habitat Vulnerability Assessment (cont.)</b> |   |   |             |
| VI.I  | Are there areas of fragmented estuarine, aquatic, or wetland wildlife habitat within your region? Are there movement corridors for species to naturally migrate? Is there infrastructure projects planned that might preclude species movement? | The Region includes the Kern National Wildlife Refuge, the Goose Lake bed, temporary wetlands in the form of duck clubs, and the channel of Poso Creek. Poso Creek traverses the Region from east to west and connects with the Refuge. The channel of Poso Creek provides an east-west movement corridor for wildlife, which extends from the foothills in the east to the trough of the San Joaquin Valley in the west. Flow in this reach of Poso Creek is infrequent. While infrastructure projects are planned which involve Poso Creek, they would not adversely affect the use of Poso Creek as a wildlife movement corridor. The RWMG has planned some projects to improve existing facilities while not changing the movement corridors.   | Low         |
| <b>VII. Hydropower Reliance Assessment</b>                        |   |   |             |
| VII.A   | Is there a source of electricity in your region?  | PG&E and SCE provide electrical services to Cawelo, and their sources of electricity are many and varied. As of 2012, SCE's electrical generation portfolio included less than 10% hydropower, while PG&E's was a little more than 10%. In both cases, the hydrogeneration takes place outside of the District service area.  | Low         |
| VII.B   | Are energy needs in your region expected to increase in the future? If so, are there future plans for hydropower generation facilities or conditions for hydropower generation in your region?  | It is reasonable to expect that energy needs in Cawelo will increase in the future as a result of increases in groundwater pumping with reductions in historically available surface water supplies (i.e., as a result of climate-induced changes in hydrology and/or increased regulatory constraints on surface water supplies imported to the District); and increases in groundwater pumping to satisfy higher ET requirements for irrigated agriculture (i.e., to the extent that "climate change" results in higher ET).<br><br>There is one existing small hydropower facility in the Region and one under development, both driven by imported SWP supplies. The combined capacity will be very small compared to the energy requirements of Cawelo, particularly during "dry" years. Future plans for hydropower generation facilities in the Region are unknown; however, any such plans would be limited to small hydropower which is incidental to the operation of irrigation conveyance and distribution systems. In this regard, based on currently available technology, solar generation has and will continue to be the dominant source of renewable energy for the District. | Low         |

The Score-Sheet (Table 47) summarizes the results of the vulnerability assessment presented in the Matrix. The seven sections of the assessment are listed in order of vulnerability, from highest to lowest.

**Table 47. IRWMP Climate Change Vulnerability Assessment Score-Sheet**

| Section No. <sup>1</sup>                     | Section Title                                  | Vulnerability Rating |          |           |           |
|--|--|----------------------|----------|-----------|-----------|
|  |  | High                 | Medium   | Low       | N/A       |
| II   | Water Supply Assessment                        | 4                    | 0        | 1         | 1         |
| I  | Water Demand Assessment                        | 1                    | 3        | 1         | 1         |
| V  | Flooding Assessment                            | 0                    | 1        | 2         | 2         |
| VI   | Ecosystem and Habitat Vulnerability Assessment | 0                    | 1        | 5         | 3         |
| III  | Water Quality Assessment                       | 0                    | 0        | 2         | 3         |
| VII  | Hydropower Reliance Assessment                 | 0                    | 0        | 0         | 2         |
| IV   | Sea Level Rise Assessment                      | 0                    | 0        | 0         | 6         |
| <b>Total Climate Change Assessment Score</b> |  | <b>5</b>             | <b>7</b> | <b>11</b> | <b>18</b> |
|  |  |                      |          |           |           |

<sup>1</sup>Numbers based on checklist shown in Section 4.3 of the ‘Climate Change Handbook for Regional Water Planning’ (DWR, 2011).

Based on the vulnerability assessment summarized in the Score-Sheet, “Water Supply” and “Water Demand” appear to have the highest level of vulnerability to potential Climate Change impacts for the District. This confirms the projected outlook for the District presented in Sections 7.2 and 7.1, respectively. The remaining sections assessed in the Score-Sheet, while important, do not pose as much of a projected risk to District water resources operations or management efforts.

## **7.4. Response to Effects of Climate Change**

Cawelo is committed to monitoring key indicators of climate change that affect the hydrology of the Sacramento-San Joaquin River Delta which, which in turn influences allocations of SWP water. The following are ways in which the District, as well as the RWMG, are responding to the above mentioned effects of climate change.

### ***7.4.1. Water Supply***

The goal of the District is to utilize the available surface water and groundwater resources as effectively as possible in meeting the requirements of the District’s water users. The District will work with the Department of Water Resources and applicable regulatory agencies to ensure there are adequate surface water supplies available to meet the growing conditions in the District’s service area. The 2019 Poso Creek IRWMP Update provided the following strategies which were deemed the most practical

and effective for climate change preparation in the Region, while also providing measurable benefits to current water management practices:

- Expand in-lieu service areas in the Region, by expanding water conveyance to lands which are currently dependent solely on groundwater supplies (i.e., reduce dependency on groundwater basin during “wetter” periods).
- Improve agricultural and urban water use efficiency.
- Expand groundwater recharge and banking efforts through expansion of spreading pond acreage to capture surplus wet-period water supplies and thereby help to maintain groundwater levels.
- Encourage changes in regional crop varieties that are more resistant to climate change.

#### ***7.4.2. Water Demand***

Some farmers are beginning to overcome climate changes, specifically reduced winter chill, by planting trees closer together and using new varieties. Studies are also now underway to prepare farmers for the likely impacts of climate change. Studies include breeding varieties of fruit trees which can withstand the decreased water chill hours, developing tools to aid crops in coping with insufficient chill, and researching the temperature responses of particular orchard crops to better understand potential long-term effects. However, some solutions such as replanting orchards with altered crop varieties may not be feasible for many irrigators.

The District will work to implement these strategies as applicable. As the District’s control over water supplies is limited, management practices used to respond to climate change will need to be adaptive in nature.

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## **8. Water Management Objectives**

In the development of the District's GSP, the District identified projects and management actions that are designed to improve management of the District's water resources by directly improving water use efficiency, through facility improvement projects, and by incentivizing more efficient water use by District landowners, through management actions such as establishing water budgets and pricing structures. The projects and management actions in the GSP will serve as the water management objectives for this AWMP. In combination with EWMPs, identified in the following section, these water management objectives will promote water use efficiency improvements in the District and contribute to sustainable management of surface water and groundwater resources.

Table 48 provides the list of projects and management actions developed in the District's GSP and adopted here as water management objectives.

**Table 48. Proposed/Implemented SGMA Projects and Management Actions for the Cawelo GSA**

| <b>P/MA #</b> | <b>P/MA Name</b>                | <b>Status</b> | <b>Summary</b>   | <b>Timeline Initiation</b> | <b>Timeline Completion</b> | <b>Expected Primary Benefit (AFY)</b> | <b>Estimated One-Time Cost<sup>1</sup></b> | <b>Potential Funding Source</b>                    |
|---------------|---------------------------------|---------------|--|----------------------------|----------------------------|---------------------------------------|--|--|
| CWD-1         | New Water Supply Purchases      | Implemented   | Acquire long-term water supply contracts to supplement supplies and build reserve storage. | 2020                       | Ongoing                    | 500                                   | \$8,000,000 <sup>1</sup>                   | Cawelo Water District (Assessments/Water Charges)  |
| CWD-2         | Friant Pipeline Project         | In-Process    | Construct pipeline, pump station, and turn-in/out structures to connect recharge basins.   | 2024                       | 2026                       | 2,160                                 | \$9,000,000                                | Cawelo Water District (Assessments)                |
| CWD-3         | Increase Recharge Capacity      | Functional    | Implement programs and incentives to increase groundwater recharge capacity.               | 2025                       | 2025                       | 400                                   | \$9,000,000                                | Cawelo Water District (Assessments)                |
| CWD-4         | New Cawelo GSA Banking Partners | In-Process    | Expand groundwater banking through third-party partnerships.                               | 2020                       | 2030                       | 500                                   | \$100,000 <sup>1</sup>                     | Third-Party Banking Partner; Cawelo Water District |
| CWD-5         | Paso Creek Flood Water Capture  | In-Process    | Construct facilities to capture flood flows from Paso Creek for recharge.                  | 2020                       | 2030                       | 150                                   | \$3,000,000                                | Cawelo Water District (Assessments/Water Charges)  |
| CWD-6         | Water Treatment Facilities      | In-Process    | Develop treatment facilities to treat produced water for agricultural irrigation.          | 2025                       | 2035                       | 20,000                                | \$11,250,000                               | Cawelo Water District (Assessments/Water Charges)  |
| CWD-7         | Surface Water Storage           | As-Needed     | Construct a 5,000 AF reservoir to increase surface water storage.                          | 2025                       | 2035                       | 500                                   | \$40,000,000                               | Cawelo Water District (Assessments)                |
| CWD-8         | Out of Cawelo GSA Banking       | As-Needed     | Evaluate groundwater banking projects outside the Cawelo GSA.                              | 2025                       | 2035                       | 1,250                                 | \$500,000 <sup>1</sup>                     | Cawelo Water District (Assessments/Water Charges)  |

|        |   |                   |   |           |         |     |        |                          |   |
|--------|---|-------------------|---|-----------|---------|-----|--------|--------------------------|---|
| CWD-9  | Voluntary Land Conversion                         | Implemented       | Incentivize conversion of irrigated farmland to groundwater recharge areas.       | 2025      | Ongoing |     | 2,000  | \$6,750,000              | Cawelo Water District (Assessments); GSA Landowners |
| CWD-10 | Secure Access to Additional Monitoring Location   | In-Process        | Obtain monitoring well locations to improve groundwater monitoring coverage.      | 2020      | 2025    |     | 0      | \$0                      | N/A   |
| CWD-11 | Crop Conversion and Irrigation Efficiency         | Implemented       | Encourage conversion to lower water use crops and improved irrigation efficiency. | 2020      | 2040    |     | 3,000  | \$0                      | Cawelo Water District; GSA Landowners               |
| CWD-12 | Agriculture to Urban Land Use Conversion          | Implemented       | Convert irrigated farmland to urban/commercial uses to reduce groundwater demand. | 2020      | 2040    |     | 1,500  | \$0                      | N/A   |
| CWD-13 | Short-Term Land Fallowing                         | Implemented       | Incentivize temporary fallowing during drought conditions.                        | As Needed | 2040    |     | 14,700 | \$5,600,000 <sup>1</sup> | Cawelo Water District (Assessments/Water Charges)   |
| CWD-14 | Long-Term Land Fallowing                          | Implemented       | Permanent retirement of irrigated land to reduce groundwater demand.              | As Needed | 2040    |     | 2,000  | \$22,250,000             | Cawelo Water District (Assessments/Water Charges)   |
| KSB-1  | Friant-Kern Canal Capacity Mitigation             | Feasibility Study | Coordinate with regional partners to address canal capacity constraints.          | 2020      | 2030    | N/A |        | Unknown                  | Cawelo Water District (Assessments)                 |
| KSB-2  | Coordination with Groundwater Regulatory Programs | Implemented       | Coordinate with regulatory programs and groundwater management efforts.           | 2020      | Ongoing |     | 0      | \$0                      | Cawelo Water District (Assessments)                 |

|        |  |                        |  |         |         |        |          |   |
|--------|--|------------------------|--|---------|---------|--------|----------|---|
| KSB-3  | Exceedance Policy                          | Implemented            | Establish policy to address exceedances of sustainability thresholds.          | 2024    | Ongoing | 0      | \$0      | Cawelo Water District (Assessments)                 |
| KSB-5  | Well Mitigation Program                    | Implemented            | Provide mitigation for domestic wells impacted by groundwater management.      | 2025    | Ongoing | 0      | \$0      | Cawelo Water District (Assessments); GSA Landowners |
| KSB-4  | Coordination with Basin Study              | Ongoing                | Coordinate with GSAs and basin studies to improve groundwater management data. | N/A     | Ongoing | 0      | \$25,000 | Cawelo Water District (Assessments)                 |
| KSB-6  | White Land Demand Management               | Initiating Development | Develop governance and demand reduction program for non-district lands.        | N/A     | 2030    | 20,410 | \$0      | Cawelo Water District; GSA Landowners               |
| KSB-7  | Well Registry                              | Ongoing                | Maintain and update subbasin well inventory and registry.                      | 2024    | Ongoing | 0      | \$0      | Cawelo Water District (Assessments)                 |
| KSB-8  | Consumptive-Use Study                      | Ongoing                | Maintain and improve subbasin consumptive-use study.                           | 2020    | Ongoing | 0      | \$0      | Cawelo Water District (Assessments); GSA Landowners |
| KSB-9  | California Aqueduct Subsidence Action Plan | Ongoing                | Implement mitigation actions if subsidence thresholds are exceeded.            | Ongoing | Ongoing | 0      | Unknown  | Unknown   |
| KSB-10 | RMW Data Gaps                              | Ongoing                | Address monitoring well data gaps identified in basin monitoring network.      | N/A     | 2026    | 0      | Unknown  | Unknown   |

<sup>1</sup> On-going cost not one-time cost

## 9. Water Use Efficiency Information

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### 9.1. EWMP Implementation and Reporting

*Table 49* describes the Efficient Water Management Practices (EWMPs) implemented in the District and identifies the EWMPs planned. Each EWMPs is sequenced with the same number referenced from the DWR publication *A Guidebook to Assist Agricultural Water Suppliers*.

*Table 50* of this report provides an estimate of efficiency improvements that have occurred since the last AWMP. *Table 51* identifies an implementation schedule, finance plan, and budget allotment for EWMPs implemented by the District.

The 2024 Cawelo Operations Budget for capital improvements contains direct capital expenditure. The description of implanted EWMPs shown here is supplemented by a specific list of recent improvements made to Cawelo maintained canals and conveyance channels, in Section 2.1 of this plan.

**Table 49. Report of EWMPs Implemented/Planned**

| EWMP No.                            | EWMP                         | Description   | Implemented | Planned | Not Cost Effective | Technically Infeasible |
|-------------------------------------|------------------------------|---|-------------|---------|--------------------|------------------------|
| <b>Critical EWMPs</b>               |                              |   |             |         |                    |                        |
| 1                                   | Water Measurement            | The District measures all deliveries using propeller meters with totalizers and maintains accuracy through regular monitoring and maintenance.  | ✓           |         |                    |                        |
| 2                                   | Volume-Based Pricing         | The District implements volumetric pricing based on measured water deliveries, linking cost directly to water use.  | ✓           |         |                    |                        |
| <b>Conditionally Required EWMPs</b> |                              |   |             |         |                    |                        |
| 1                                   | Alternative Land Use         | The District does not directly implement land use conversion programs; however, water supply conditions and groundwater sustainability requirements may influence grower land use decisions over time.            |             |         |                    |                        |
| 2                                   | Recycled Water Use           | The District actively integrates recycled water supplies, including treated oilfield recycled produced water, where water quality meets applicable standards, and evaluates opportunities to expand future use.   | ✓           |         |                    |                        |
| 3                                   | On-Farm Capital Improvements | The District does not directly finance on-farm irrigation improvements and considers this practice technically infeasible; however, it supports efficiency through evaluations and sharing funding opportunities. |             |         |                    | ✓                      |
| 4                                   | Incentive Pricing            | The District utilizes volumetric pricing that varies with hydrologic conditions, providing an economic signal that encourages efficient water use and supports conjunctive use.                                   | ✓           |         |                    |                        |
| 5                                   | Infrastructure Improvements  | The District has lined conveyance systems and completed capacity improvements to reduce seepage, improve delivery efficiency, and minimize operational constraints.   | ✓           |         |                    |                        |
| 6                                   | Ordering Flexibility         | While partially constrained by SWP delivery schedules, the District has implemented a web-based ordering system that improves demand management, billing integration, and user tracking.                          | ✓           |         |                    |                        |

**Table 49. Report of EWMPs Implemented/Planned**

| <b>EWMP No.</b>                    | <b>EWMP</b>                    | <b>Description</b>  | <b>Implemented</b> | <b>Planned</b> | <b>Not Cost Effective</b> | <b>Technically Infeasible</b> |
|------------------------------------|--------------------------------|---|--------------------|----------------|---------------------------|-------------------------------|
| 7                                  | Spill & Tailwater Management   | The District uses regulating reservoirs to balance supply and demand and minimize operational spills; growers manage on-farm tailwater.   | ✓                  |                |                           |                               |
| 8                                  | Conjunctive Use                | The District expands conjunctive use by delivering surface water to groundwater-dependent areas and continues evaluating additional opportunities.  | ✓                  | ✓              |                           |                               |
| 9                                  | Automated Canal Controls       | The District operates automated canal and pump control systems to improve delivery efficiency and system responsiveness.  | ✓                  |                |                           |                               |
| 10                                 | Pump Testing (Customer)        | The District supports pump efficiency evaluation by coordinating with service providers and informing growers of available testing services.  | ✓                  |                |                           |                               |
| 11                                 | Water Conservation Coordinator | The District Engineer serves as Water Conservation Coordinator and oversees implementation and reporting.   | ✓                  |                |                           |                               |
| 12                                 | Water Management Services      | The District provides water management services through engineering and operations staff and supports irrigation efficiency evaluations.  | ✓                  |                |                           |                               |
| 13                                 | Institutional Policy Review    | The District evaluates institutional constraints and has developed agreements and environmental documentation to support transfers, exchanges, and banking.   | ✓                  | ✓              |                           |                               |
| 14                                 | Pump Efficiency (District)     | The District monitors pump performance and conducts maintenance and testing as needed to maintain efficiency.   | ✓                  |                |                           |                               |
| <b><i>OTHER Optional EWMPs</i></b> |                                |   |                    |                |                           |                               |
| 1999 AWMC MOU A-4                  | Communication and Coordination | CWD currently works with PG&E, the Resource Conservation District (RCD), and neighboring districts to minimize water costs, increase water use efficiency, and reduce power and energy costs. The District will continue to maintain and promote communication and cooperation with other entities. | ✓                  |                |                           |                               |

**Table 50. Report of EWMPs Efficiency Improvements**

| EWMP No.                            | EWMP                                    | Since Last Report (AF or Descriptive)  | 5 Years (AF or Descriptive)   | 10 Years (AF or Descriptive)  |
|-------------------------------------|---|--|---|---|
| <b>Critical EWMPs</b>               |   |  |   |   |
| 1                                   | Water Measurement                       | The District measures all deliveries using propeller meters with totalizers and maintains accuracy through routine monitoring, calibration, and maintenance.   | Maintain measurement accuracy and compliance with SBx7-7 requirements.                      | Continue use of accurate measurement systems to support water accounting and management.              |
| 2                                   | Volume-Based Pricing                    | The District implements volumetric pricing based on measured water deliveries, linking cost directly to water use and hydrologic conditions.   | Maintain volumetric pricing structure to support efficient water use and demand management. | Continue pricing practices that encourage efficient water use and align with water supply conditions. |
| <b>Conditionally Required EWMPs</b> |   |  |   |   |
| 1                                   | Alternative Land Use                    | The District monitors crop types and irrigated acreage, which are predominantly permanent crops, and tracks water demand associated with land use. The District also provides a landowner evapotranspiration (ET) tool with daily and monthly data available within 24–48 hours. | Land use may evolve in response to water supply conditions and SGMA requirements.           | Continued monitoring of land and water use trends to support sustainable groundwater management.      |
| 2                                   | Recycled Water Use                      | Delivery and integration of treated oilfield recycled produced water (RPW), blended with other supplies and delivered to growers and recharge facilities.  | Expand capacity to receive and utilize additional recycled water supplies.                  | Continued use of recycled water to improve supply reliability and reduce groundwater reliance.        |
| 3                                   | On-Farm Irrigation Capital Improvements | The District does not directly implement or fund on-farm irrigation capital improvements. The District supports on-farm efficiency through irrigation evaluations and coordination with RCD programs.  | Continue supporting growers through technical assistance and funding program awareness.     | Ongoing support of irrigation efficiency improvements at the farm level.                              |
| 4                                   | Incentive Pricing Structure             | Implementation of volumetric pricing based on water deliveries and hydrologic conditions.  | Maintain pricing structure to encourage efficient water use and manage demand.              | Continue adaptive pricing strategies aligned with water supply conditions.                            |

**Table 50. Report of EWMPs Efficiency Improvements**

| <b>EWMP No.</b>                    | <b>EWMP</b>                            | <b>Since Last Report (AF or Descriptive)</b>   | <b>5 Years (AF or Descriptive)</b>  | <b>10 Years (AF or Descriptive)</b>  |
|------------------------------------|--|--|---|--|
| 5                                  | Infrastructure Improvements            | Completion and maintenance of conveyance improvements including canal lining, interties, pipelines, and pump stations to improve efficiency and flexibility. | Continue conveyance improvements and system upgrades to increase efficiency and capacity. | Ongoing infrastructure improvements to support long-term reliability and efficiency. |
| 6                                  | Order/Delivery Flexibility             | Use of arranged-demand delivery system with improvements in ordering and operational coordination.   | Enhance delivery flexibility within system constraints.                                   | Continue improving operational flexibility and customer service tools.               |
| 7                                  | Supplier Spill & Tailwater Systems     | Use of regulating reservoirs to manage supply and demand and minimize operational spills.  | Maintain system operations to minimize losses.  | Ongoing optimization of system operations.   |
| 8                                  | Conjunctive Use                        | Expansion of conjunctive use through groundwater recharge basins, recovery wells, and in-lieu recharge programs.   | Continue expansion of recharge and groundwater banking programs.                          | Ongoing conjunctive management to support groundwater sustainability.                |
| 9                                  | Automated Canal Controls               | Operation of automated pump stations and control systems (SCADA-based).  | Maintain and upgrade control systems as needed.   | Continued automation improvements to support system efficiency.                      |
| 10                                 | Customer Pump Test/Evaluation          | Support for irrigation efficiency through coordination with RCD and irrigation evaluation programs.  | Continue supporting pump efficiency awareness and evaluation.                             | Ongoing support of efficient irrigation practices.                                   |
| 11                                 | Water Conservation Coordinator         | The District Engineer serves as Water Conservation Coordinator and oversees AWMP implementation.   | Continue coordination and reporting functions.  | Ongoing oversight of water management programs.                                      |
| 12                                 | Water Management Services to Customers | Engineering and operations staff provide water management services and support irrigation evaluations through mobile lab programs and grower coordination.   | Continue providing water management services and improve tools for tracking water use.    | Ongoing technical support to improve water use efficiency.                           |
| 13                                 | Identify Institutional Changes         | Implementation of water transfers, exchanges, and banking programs and coordination with regional agencies.  | Evaluate opportunities to improve institutional flexibility.                              | Continued participation in regional water management strategies.                     |
| 14                                 | Supplier Pump Improved Efficiency      | Monitoring, maintenance, and operation of District wells and pumping facilities.   | Continue maintenance and efficiency improvements.   | Ongoing optimization of pumping operations.  |
| <b><i>OTHER Optional EWMPs</i></b> |  |  |   |  |
| 1999<br>AWMC                       | Communication and Coordination         | The District coordinates with PG&E, the Resource Conservation District (RCD), and neighboring  | Continue coordination with regional partners to   | Ongoing collaboration with agencies and stakeholders                                 |

**Table 50. Report of EWMPs Efficiency Improvements**

| <b>EWMP No.</b> | <b>EWMP</b> | <b>Since Last Report (AF or Descriptive)</b>  | <b>5 Years (AF or Descriptive)</b>                   | <b>10 Years (AF or Descriptive)</b>                   |
|-----------------|-------------|---|--|---|
| MOU A-4         |             | districts to improve water use efficiency, reduce costs, and support energy-efficient operations. | improve water management and operational efficiency. | to support long-term water management and efficiency. |

**Table 50. Schedule to Implement EWMPs**

| <b>EWMP No.</b>                         | <b>Description</b>                                 | <b>Implementation Schedule</b>                                  | <b>Finance Plan</b>                                  | <b>Budget Allotment (\$)</b> |
|---|--|---|--|------------------------------|
| <b>Critical EWMPs</b>                   |  |   |  |                              |
| 1                                       | Water Measurement                                  | On-going service  | Funded through annual operations budget              | —                            |
| 2                                       | Volume-Based Pricing                               | On-going service  | Funded through annual operations budget              | —                            |
| <b>Conditional EWMPs</b>                |  |   |  |                              |
| 1                                       | Alternative Land Use                               | Not implemented (grower-driven)                                 | No direct District funding required                  | 0                            |
| 2                                       | Recycled Water Use                                 | On-going service and expansion                                  | Funded through capital improvement program           | —                            |
| 3                                       | On-Farm Irrigation Capital Improvements            | Not implemented (technically infeasible; District support only) | Private landowner, NRCS, or external funding sources | 0                            |
| 4                                       | Incentive Pricing Structure                        | On-going service  | Funded through annual operations budget              | —                            |
| 5                                       | Infrastructure Improvements                        | Already implemented and on-going                                | Funded through capital improvement program           | —                            |
| 6                                       | Order/Delivery Flexibility                         | Already implemented and on-going                                | Funded through annual operations budget              | —                            |
| 7                                       | Supplier Operational Outflow and Tailwater Systems | Already implemented and on-going                                | Funded through annual operations budget              | —                            |
| 8                                       | Conjunctive Use                                    | On-going service and expansion                                  | Funded through capital improvement program           | —                            |
| 9                                       | Automated Canal Controls                           | Already implemented and on-going                                | Funded through annual operations budget              | —                            |
| 10                                      | Customer Pump Test/Evaluation                      | On-going service (support role)                                 | Funded through annual operations budget              | —                            |
| 11                                      | Water Conservation Coordinator                     | On-going service  | Funded through annual operations budget              | —                            |
| 12                                      | Water Management Services to Customers             | On-going service  | Funded through annual operations budget              | —                            |
| 13                                      | Identify Institutional Changes                     | On-going service  | Funded through annual operations budget              | —                            |
| 14                                      | Supplier Pump Improved Efficiency                  | On-going service  | Funded through annual operations budget              | —                            |
| <b>Additional EWMPs (1999 AWMC MOU)</b> |  |   |  |                              |
|   | Improve Communication Among Suppliers              | On-going service  | Funded through annual operations budget              | —                            |
|   | Facilitate Voluntary Water Transfers               | On-going service  | Funded through annual operations budget              | —                            |

## 9.2. Documentation for Non-Implemented EWMPs

Cawelo has chosen to implement each of the recommended EWMPs other than those categorized as “Not Applicable”. Although some measures are not locally cost-effective as individual water conservation measures, the District views them as elements of a broader, regional program that enables Cawelo to provide a high level of service to its agricultural customers and to responsibly manage surface water and groundwater resources in the District’s service area. This position is summarized below in Table 52.

**Table 51. Non-Implemented EWMP Documentation**

| WMP No. <sup>1</sup> | EWMP                       | (check one of both)    |                            | Justification/Documentation   |
|----------------------|----------------------------|------------------------|----------------------------|---|
|                      |                            | Technically Infeasible | Not Locally Cost-Effective |   |
| 3                    | On-Farm Irrigation Capital |                        |                            | CWD is not a provider of on-farm capital. All water conveyance facilities, including farm turnouts, are owned and operated by the District. |

<sup>1</sup> EWMP numbers correspond to Water Code §10608.48(c).

# 10. Supporting Agricultural Water Measurement Regulation Documentation

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## 10.1. Description of Water Measurement Best Professional Practices

As stated in Section 10608.48(b) of the California Water Code, all governed agricultural water suppliers are required to, “Measure the volume of water delivered to customers with sufficient accuracy to comply with subdivision (a) of Section 531.10” of the legislation. Furthermore, Section 531.10(a) requires that, “An agricultural water supplier shall submit an annual report to the department (DWR) that summarizes aggregated farm-gate delivery data, on a monthly or bi-monthly basis, using best professional practices.”

The Cawelo Water District makes deliveries of surface water and groundwater to farm delivery points, or “turnouts”, which are owned and metered by the District as explained in Section 2.2.2 (shown in Figure 7). Meter readings (delivered volumetric recording) at each turnout are taken every day that a turnout is running and at the end of every month by District staff, using propeller meters manufactured by McCrometer. These measurements support the District’s volumetric pricing structure, and compliance with volumetric measurement requirements.

Each turnout has a unique identifier that is used to track the time and location of each measurement and measurement readings are immediately enter into a mobile tablet which electronically downloads data into the District’s dispatch office. The data are then reviewed by a supervisor as a quality control procedure. Farm-level water delivery data are then assembled by the District and are made available to water users upon request throughout the season, which enables irrigators to monitor their water usage.

In practice, meters are only repaired or replaced when a meter is observed to be malfunctioning or when a water user questions a meter’s accuracy. In the latter case, if the questioned flow meter is tested and found to be within an acceptable accuracy, then the water user must pay for the testing process. Conversely, the District will fund the process to repair or replace the flow meter if the flow meter is not within an acceptable accuracy range.

## 10.2. Engineer Certification and Apportionment

The flow meters at each farm turnout measure District deliveries of water to each irrigator’s place of use. The flow meter is equipped with a “totalizer” which indicates the instantaneous flow rate and the cumulative total of water delivered.

The methodology used to determine whether the accuracy of a representative sample of District flow-

measurement devices complies with the requirements of Section 597.3(a) is described later in this section. Cawelo plans to adopt this methodology for field testing of existing flow metering devices and to present a report approved by a California-Registered Professional Engineer as the basis for ongoing compliance with SBx7-7. This practice complies with Section 597.3(a) of the California Water Code as stated below:

*The methodology used to determine the individual device accuracy values found in Section 597.3(a) will be verified by a Professional Engineer using industry accepted standards. These methods will take into account the differential in water levels and/or fluctuations in the flow rate or velocity during the delivery event and the type, size and characteristics of the measuring device being verified.*

### **10.3. Documentation of Water Measurement Conversion to Volume**

SBx7-7 requires an annual volumetric accuracy of within  $\pm 12$  percent on existing devices. Since Cawelo's flow measurement devices include totalizers (which directly record cumulative flow volume), the devices' accuracy in measuring flow rates is representative of their ability to measure volumetric deliveries. Therefore, the discussion presented later in this section relates testing the accuracy of measurement of flow rates applies equally to determination of the accuracy of measurement of volumes of delivered water.

Section 2.2.1 contains more information regarding specific District flow meter types and the assumption of volumetric measurement accuracy. The basis for this assumption can be found in the *SBx7-7 Flow Rate Measurement Compliance for Agricultural Irrigation Districts* by the Irrigation Training & Research Center of the California Polytechnic Institute, San Luis Obispo.

### **10.4. Legal Certification and Apportionment (Access to Farm-gates)**

Cawelo Water District staff may install, measure, maintain, operate, and monitor flow-measurement devices at all customer (farm) water diversions (turnouts) from the District's irrigation distribution system. As such, there are no institutional or legal impediments that restrict access to turnouts or measurement of water and, for the purposes of satisfying SBx7-7, there is no need to measure water upstream of points of delivery to individual customers.

### **10.5. Device Corrective Action Plan**

As noted above, currently the District repairs or replaces flow meters only when there is some obvious deficiency in their performance or when a water user questions the accuracy of a meter. Cawelo will continue this practice on an ongoing basis separate from a sampled meter testing schedule for SBx7-

7 compliance, assuming the meter in question was not part of the randomly-sampled compliance testing and found to be within acceptable accuracy limits.

All meter devices identified to have measurement accuracies that depart by more than  $\pm 12$  percent from flows measured by a calibrated device (shared with neighboring North Kern WSD) will be sent to the district shop for assessment. If the shop is not able to correct the inaccuracy in flow measurement, the device will be replaced. After installation in the field, the accuracy of repaired meters will be verified using a calibrated device, and an affidavit will be submitted by a California-registered Professional Engineer certifying the accuracy of each repaired meter to be within  $\pm 10$  percent by volume. New replacement meters will be laboratory certified by their manufacturer prior to installation to have an accuracy of measurement within  $\pm 6$  percent by volume. Repair or replacement of these flow meters will be completed within three years of approval of this testing program by the DWR.

## **10.6. Farm Gate Measurement and Device Accuracy Compliance**

SBx7-7 requires that agricultural water suppliers measure the volume of water delivered to customers with sufficient accuracy to comply with standards described in the legislation. These standards are presented below:

### **10.6.1. Measurement Options at the Delivery Point or Farm-gate of Single Customer**

*An agricultural water supplier shall measure the volume of water delivered at the delivery point or farm-gate of a single customer. If a device measures a value other than volume, for example, flow rate, velocity or water elevation, the accuracy certification must incorporate the measurements or calculations required to convert the measured value to volume. An existing measurement device shall be certified to be accurate to within  $\pm 12$  percent by volume.*

### **10.6.2. Initial Certification of Device Accuracy**

*For existing measurement devices, the device accuracy shall be initially certified and documented by either:*

- *Field-testing that is completed on a random and statistically representative sample of the existing measurement devices. Field-testing shall be performed by individuals trained in the use of field-testing equipment and documented in a report approved by an engineer.*
- *Field-inspections and analysis completed for every existing measurement device. Field-inspections and analysis shall be performed by trained individuals in the use of field inspection and analysis and documented in a report approved by an engineer.*

### **10.6.3. Protocols for Field Testing**

*Field-testing shall be performed for a sample of existing measurement devices according to manufacturer's recommendations or design specifications and following best professional practices. It is recommended that the sample size be no less than 10 percent of existing devices, with a minimum of 5, and not to exceed 100 individual devices*

*for any particular device type. Alternatively, the supplier may develop its own sampling plan using an accepted statistical methodology.*

*If during the field-testing of existing measurement devices, more than one quarter of the samples for any particular device type do not meet the relevant accuracy criteria, the agricultural water supplier shall provide in its Agricultural Water Management Plan a plan to test an additional 10 percent of its existing devices, with a minimum of 5, but not to exceed an additional 100 individual devices for the particular device type. This second round of field-testing and corrective actions shall be completed within three years of the initial field-testing.*

*Field-inspections and analysis protocols shall be performed, and the results shall be approved by an engineer for every existing measurement device to demonstrate that the design and installation standards used for the installation of existing measurement devices meet the relevant accuracy standards and that operation and maintenance protocols meet best professional practices.*

#### **10.6.4. District Compliance with Water Measurement Requirements**

The District intends to implement the flow-measurement verification program described in this section during the current AWMP cycle. Implementation of the sampling and testing program was deferred in recent years due to significant staff and resource commitments associated with other regulatory compliance efforts, including development and implementation of the Kern Subbasin Groundwater Sustainability Plan (GSP) under the Sustainable Groundwater Management Act (SGMA), as well as related groundwater management and reporting requirements. With these efforts largely completed, the District plans to initiate the meter testing and verification program during the current planning cycle to ensure continued compliance with SBx7-7 agricultural water measurement requirements.

SBx7-7 offers the water supplier the opportunity to “develop its own sampling plan using an accepted statistical methodology”. Therefore, to comply with the requirements of SBx7-7 Cawelo intends to identify a set of randomly selected turnouts that equates to approximately 10 percent of the District’s total irrigated area (around 3,600 acres served) instead of simply 10 percent of the 365 active District turnouts. Note there are 379 total turnouts in the District; however, only 365 are regularly supplied by the District.

As with many other irrigation districts, there is a wide range in the acreage served by a given farm turnout (turnouts range from 4 to 18 inches in size and serve 1 to 640 acres) and the population of turnouts is skewed towards turnouts serving small fields (<100 acres). The skewed distribution among field sizes served by a type of turnout leads to the result that a simple random selection of measurement devices is likely to generate a sample for testing that includes a disproportionately large number of turnouts making small deliveries. The likely outcome of random selection of 10 percent of

the turnouts from this population would be to identify a sample that served substantially less than 10 percent of the irrigated acreage and thus delivered less than 10 percent of the water.

According to the publication SBx7-7 Flow Rate Measurement Compliance for Agricultural Irrigation Districts by the ITRC of the California Polytechnic Institute, San Luis Obispo, a precise methodology can be developed where the selected sample of measuring devices is based not upon a percentage of the number of turnouts but upon a percentage of the acreage served and water delivered. The ITRC manual recommends application of a probability-proportional-to-size (PPS) sampling method designed to generate a randomly selected sample of measurement devices that serves at least 10 percent of the irrigated acreage.

Flow rates measured at each of those turnouts within the sample population will be compared with measurements recorded by a calibrated ultrasonic flowmeter to determine the accuracy of measurement. For these tests, all readings will be taken for a period of 10 minutes at each turnout. Because the propeller meters used by the District are equipped with totalizers, errors detected in the measurement of flow rates correspond with errors in measurement of delivered water volumes, with measurement error being defined as the percentage departure between the propeller flowmeter reading and the corresponding reading taken with the calibrated ultrasonic meter. This formula for computing error conforms to the following language from Section 572.2 of the legislation.

*“Accuracy” means the measured volume relative to the actual volume, expressed as a percent. The percent shall be calculated as  $100 \times (\text{measured value} - \text{actual value}) / \text{actual value}$ , where the “measured value” is the value indicated by the device or determined through calculation using a measured value by the device, such as flow rate, combined with a duration of flow, and “actual value” is the value as determined through laboratory, design or field testing protocols using best professional practices.*

The sequence of steps proposed to identify a representative population of turnouts for verification of flow measurement is as follows:

Step 1: *Formulate a list of turnouts* with the relative acreage land supplied by each turnout (i.e. size of farm).

Step 2: *Assign a number range to each turnout based on the acreage served by the device.* For example, a turnout serving two acres would be assigned two numbers in sequence and a turnout serving 120 acres would be assigned 120 numbers. As such, each device will be weighted by the acreage served and, hence, by the volume of water delivered. This weighting process structures the randomly selected sample so that it will be statistically representative of the accuracy of flow measurement for the total volume of water delivered within the District.

Step 3: *Select a random set of turnouts* from the entire list that represents at least 10 percent of the total irrigated area serviced. This can be accomplished by numbering each of the turnouts (1 through 365)

and using a limited random number generator for the selection process.

Once a particular device is selected, that device would be designated for testing and the device would be withdrawn from the pool available for future selection. This procedure will be followed until devices that represent 10 percent of the irrigated acreage, based on the assigned number range, are identified for testing.

Step 4: *Evaluate selected turnouts with calibrated device and record data.* Flow measurement devices at turnouts selected for testing in Step 3 will be evaluated by Cawelo for accuracy, and measured accuracy will be retained for ten years or two AWMP cycles as per §597.4(c).

Step 5: *Determination of compliance.* Cawelo will estimate the annual volumetric accuracy of measurement of the selected sample of flow measurement devices. The District will expand their number of turnout samples if the accuracy is determined to be outside the limit imposed by SBx7-7 to determine the extent of any measurement issues. Non-compliant turnouts will be repaired or replaced by the District.

## **11. Demonstration of Reduced Reliance on the Delta**

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The Delta Plan provides a regulatory process for activities that qualify as “covered actions.” The Delta Reform Act established a self-certification process for demonstrating consistency of “covered actions” with the Delta Plan. State and local agencies proposing “covered actions,” prior to initiating the implementation of that action, must prepare a written certification of consistency with detailed findings as to whether the covered action is consistent with applicable Delta Plan policies and must submit that certification to the Delta Stewardship Council (DSC).

As the District is anticipating participating in various projects that would be considered “covered actions”, including multi-year water transfers, conveyance facilities, or new diversions that involve transferring water through or exporting water from the Delta, it has elected to prepare a demonstration of its consistency with the Delta Plan and Delta Reform Act. The data and information provided herein is consistent with Section (c)(1) of Policy WR P1, Reduced Reliance on the Delta Through Improved Regional Water Self-Reliance.

To comply with WR P1, the regulation specifies that water suppliers have done the following: (see 23 CCR Section 5003 (c)):

- Completed a current Urban or Agricultural Water Management Plan (Plan) which has been reviewed by the Department of Water Resources for compliance with the applicable requirements of Water Code Division 6, Parts 2.55, 2.6, and 2.8;
- Identified, evaluated, and commenced implementation, consistent with the implementation schedule set forth in the management Plan, of all programs and projects included in the Plan that are locally cost effective and technically feasible which reduce reliance on the Delta; and,
- Included in the Plan, commencing in 2015, the expected outcome for measurable reduction in Delta reliance and improvement in regional self reliance. The expected outcome for measurable reduction in Delta reliance and improvement in regional self- reliance shall be reported in the Plan as the reduction in the amount of water used, or in the percentage of water used from the Delta watershed. For the purposes of reporting, water efficiency is considered a new source of water supply, consistent with Water Code Section 1011(a)

The following information provides “self-certification” of the District’s compliance with Delta Reform Act and each of the three criteria listed above from WR P1.

### **11.1. Completion of an Agricultural Water Management Plan (23 CCR Section 5003 (c)(1)(A))**

The District has prepared this 2025 Agricultural Water Management Plan update, in compliance with Water Code §10800 – 10853 (the Agricultural Water Management Planning Act), which requires agricultural water suppliers to submit to the DWR an Agricultural Water Management Plan that addresses the elements listed in Water Code §10826. An agricultural water supplier is defined as a

water supplier, either publicly or privately owned, providing water to 10,000 or more irrigated acres, excluding the acreage that receives recycled water.

The AWMP has been approved by the District’s Board of Directors and submitted to DWR according to the schedule presented in Table 1-1.

## **11.2. Implementation of Locally Cost-Effective Projects (23 CCR Section 5003 (c)(1)(B))**

This update to the District’s AWMP demonstrates the District’s implementation of cost-effective programs and actions to maximize its efficient use of all available water supplies. This program and projects are listed and described in Section 8, Water Management Objectives and in Section 9, Efficient Water Management Practices Information.

As demonstrated in this AWMP the District is proactive in reuse of treated oilfield produced water and in improving conveyance and recharge facilities to enhance the efficient operation of the District, it also supports programs that assist local landowners in improving their own efficient water management practices. Since the District’s formation it has continually developed projects and programs to promote best water management by adding recharge and conveyance capacity. The District is one of several districts in Kern County to implement a groundwater banking and conjunctive use program to improve the management of local and state-wide water supplies. Through the years the District has continued to make improvement to its conveyance, recharge, and distribution facilities to increase the capacity of its conjunctive use program and interconnection with neighboring districts. The District has supported increased efficiencies in its distribution facilities and in landowner irrigation systems. Table 53 below provides an overview of the major projects and program that have been implemented by the District.

**Table 52 Implementation of Water Management and Efficiency Project.**

| Year   | Water Management Action   |
|--|---|
| 2012 Cross Valley Canal to Calloway Canal Intertie | Regional water conveyance capacity improvement  |
| 2012 Calloway Canal Lining                         | Regional water conveyance capacity improvement and conservation of water seepage loss |
| Friant-Kern Canal and 8-23 Canal Intertie Pipeline | Conveyance and GW Recharge Improvement  |

## **12. Reduction in Delta Reliance and Improved Regional Self Reliance (23 CCR Section 5003 (c)(1)(C))**

When addressing the issue of reduced Delta reliance, it is important to note that the District’s Delta water supplies delivered as SWP consist of one third of the total diverted water supply. Table 54 identifies the portion of the District’s water deliveries which are met with Delta water supplies.

**Table 53. Percent of Delta and Non-Delta Water Supplies**

| Period  | Delta Supplies | Non-Delta and Local Water Supplies |
|---------|----------------|------------------------------------|
| 2016    | 23,025         | 58,914                             |
| 2017    | 35,701         | 115,353                            |
| 2018    | 12,178         | 44,698                             |
| 2019    | 39,092         | 84,793                             |
| 2020    | 11,236         | 45,652                             |
| Average | 24,246         | 69,882                             |

Furthermore, the information presented in this AWMP demonstrates the District’s compliance via a clear reduction in the District’s reliance on the Delta and improved regional self-reliance using the metrics of 1) utilization of oil field produced water and 2) increased recharge capacity for wet-period water deliveries from the Friant-Kern Canal. The increase in recharge capacity and wet period water delivery over time demonstrates a reduction in the percentage of water used from the Delta for the production food crops.

As documented in Section 4.1, Surface Water Supply, and Section 5, Annual Water Budget, the District has been and will continue to increase water supplies from local and other non-SWP sources. Even with an increase in such sources, the District will also need to maximize, whenever possible, deliveries of SWP contract water to opportunistically replenish its local groundwater supply via the District’s extensive conjunctive use program. Historic reductions in Delta exports, due to regulatory constraints, have unfortunately increased local reliance on groundwater resources, which in turn triggered the passage of the Sustainable Groundwater Management Act. As the District implements SGMA, its landowners will be required to reduce their reliance on groundwater. Without reliable deliveries of the District’s SWP contract allocation, and absent the development of other non-Delta water supplies, landowners in the District will be forced to consider fallowing acres of prime and productive farmlands.

To demonstrate improvements to water use efficiency the District used development of facilities to increase the absorptive capacity for recharge of wet period water as a metric. The District has contributed to regional conveyance improvements and in-district recharge capability that will enhance groundwater recharge as identified previously in this AWMP.

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