Section II: Description of the Agricultural Water Supply and Service Area

A. Physical Characteristics

1. Size of service area

The BMWD was formed on September 3, 1963, pursuant to Division 13 of the California Water Code, for the purpose of providing irrigation water from the State Water Project (SWP) to land within the District. The water supply contract between the District and Kern County Water Agency (KCWA or Agency) was executed on March 9, 1967. After contract execution with the Agency, the District commenced water deliveries in 1968.

The location of the District is included in Appendix 3, and the current map of the District is included in Appendix 5. The overall District history and size is summarized in Table 2. BMWD owns and operates an irrigation distribution system that encompasses 55,440 acres of agricultural lands in western Kern County, California, as shown in Appendix 5. All but about 6,400 acres in the District are farmable, although not all this acreage is currently being farmed. The net cropped area in 2020 is 24,556 acres, of which 24,204 is irrigated. Cropping patterns have not changed significantly in the last 5 years, and some specific cropping data from 2016-2018 is missing. For these years, constant cropping pattern was assumed for the sake of water budget calculations.

Table 2. Water Supplier History and Size

District	BMWD
Date of Formation	3-Sep-63
Source of Water	Applicable sources
Local Surface Water	
Local Groundwater	Limited
Wholesaler	Kern County Water Agency (KCWA)
USBR	
SWP	Via California Aqueduct
Service Area Gross Acreage	55,440 acres
Service Area Acreage	37,421 acres
Non-Service Area Acreage	31,236 acres

There are two categories of landowners with a water supply in BMWD—those landowners with contracts and those without (i.e., Contract and Non-Contract). Of the District's 92,800 AF of SWP Table A, approximately 86,872 AF is under contract and 4,982 AF is allocated to Non-Contract landowners in the District. This represents the total amount of water available by the District to allocate to landowners when the supply from the State Water

Project (SWP) is 100%. In certain years, this amount is reduced in proportion to the allocation (supply made available) from the SWP (e.g., at a 60% supply the amounts would be reduced to 52,568 AF and 2,992 AF respectively except in a water short year. The District primarily supplies agricultural water to growers within its boundaries. All of the water delivered by the District is delivered through the California Aqueduct.

Table 3. Expected Changes to Service Area

Change to Service Area	Estimate of Magnitude	Effect on the Water Supplier
Reduced Service Area Size	0	None anticipated
Increased Service Area Size	0	None anticipated
Other		
- Cropping Changes	0	None anticipated
- Reduced Irrigated Land	0	None anticipated

2. Location of the service area and water management facilities

BMWD is located within the southern San Joaquin Valley about 50 miles northwest of the City of Bakersfield. BMWD is located in the northwestern corner of Kern County on the eastern edge of the Temblor Range. State Highways 46 and 33 traverse the District boundaries. A location map of the District and its proximity to neighboring districts is included as appendix 3. Adjacent districts include Devil's Den Water District to the north, part of Belridge Water Storage District to the south, and Lost Hills Water District to the east.

SWP water is conveyed from SWP facilities located north of the Delta at Lake Oroville. The water is pumped through the Banks Pumping Plant for delivery into the California Aqueduct, which diverts into San Luis Reservoir. The amount of water that exceeds SWP demands is stored in San Luis Reservoir. From San Luis Reservoir, Dos Amigos Pumping Plant redirects water back into the California Aqueduct, which then routes water into the Coastal Branch of the Aqueduct for delivery to BMWD. Before BWMD receives delivery of the water, it must be lifted through a series of pump stations, the DWR's Las Perillas and Badger Hill Pumping Plants and Berrenda Mesa's Pump Station A. Therefore, water operations that are affected by BMWD water use include Lake Oroville, Banks Pumping Plant, California Aqueduct, San Luis Reservoir, Dos Amigos Pumping Plant, Coastal Aqueduct, Las Perillas Pumping Plant, Badger Hill Pumping Plant and BMWD Pump Station A. Figure 1 shows State Water Project Facilities. (Kern Fan Element, Habitat Conservation Plan, 1994).

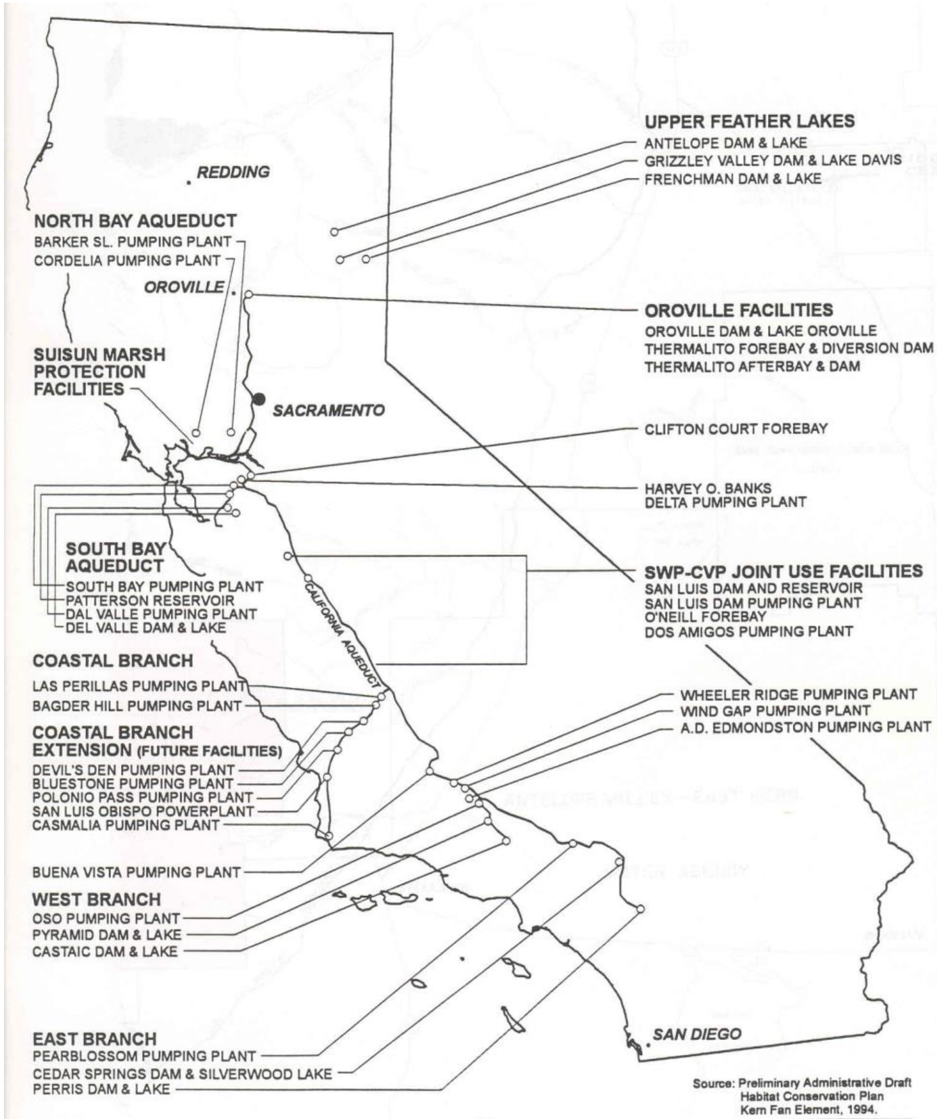

Figure 1. SWP Facilities

BMWD distributes SWP water via a network of storage facilities, a main canal, pipelines, pump stations, and control structures. BMWD 's first project as a public entity was the construction of Zone 1, the first phase of the distribution system completed on February 1968 in conjunction with the DWR. Construction of Zone 2, the second phase of distribution system, was completed in 1979. Table 4 provides a summary of existing irrigation facilities in BMWD.

Table 4. Water Conveyance and Delivery System	
System Used	**Number of Miles**
Unlined Canal	0
Lined Canal	15 mi
Pipelines	50 mi
Drains	0
Regulation Reservoirs	450 AF

BMWD's water conveyance and delivery system was designed mainly for gravity flow. Once water is pumped uphill 225 feet (by Pump Station A located at the terminus of Coastal Aqueduct), the water flows by gravity through a concrete lined canal. Gravity pipeline laterals feed lands that are lower in elevation than the canal. Since 2012, the District has installed automatic gate controls at canal check structures on its main canal. This equipment allows operators to (1) adjust water levels in the canals remotely via an internet connection (2) react more quickly to changes in water levels in the canals and (3) reduces the number of trips necessary to adjust the gates manually. All of which lead to more safe and efficient water management. There are portions of the District that are located on higher elevation than the canal. Water is delivered to higher elevation land with pump stations and pipelines.

The District owns and operates a total of seven reservoirs, two of the reservoirs are lined (Afterbay Reservoir and Still Reservoir), while the remaining five are unlined. Table lists the capacity of theses reservoirs. The District performed pond drop tests to determine the amount of seepage from the unlined reservoirs. The results indicated that the reservoir bottoms are sealed up because of the silts and small soil particles deposited over time.

Table 5. Water Supplier Reservoirs	
Number	7
BMWD Afterbay Reservoir	400 AF
Other end of system	50 AF
Total Capacity	450 AF

The District's main local surface storage is a 400 AF regulation reservoir (Afterbay Reservoir). This reservoir is used for short-term regulation of the District's main pump station (Pump Station A) and generally is not available for long-term storage of surplus waters. The Afterbay Reservoir provides the District enough capacity to curtail pumping during the peak energy period (noon to six), to minimize pumping costs and energy bills.

Other District facilities, located outside the District boundary, are groundwater banks that include the Pioneer Project and the Berrenda Mesa Project (Appendix 4). As a participant in these banking programs, BMWD has been actively banking SWP water when supplies exceed demands or when other surplus water is made available. During drought years, when SWP allocations are minimal, BMWD can recover water in the groundwater banking facilities to supplement SWP supplies. Annually, the maximum amount BMWD can extract from both banking projects is 43,500 AF. Currently, they have banked a total of about 113,458 AF in these projects. In addition, individual landowners have the ability to store water in other banking projects to augment their overall supplies.

As stated before, the majority of BMWD's conveyance system operates as a gravity water conveyance system. Gravity systems are energy efficient but can result in unavoidable operational spills to the downstream end users. BMWD has an operational spill water return facility. At the end of the main canal there is a 10-mile gravity pipeline to serve a landowner. There is a spill reservoir just upstream of the 10-mile gravity lateral. Occasionally, the spill reservoir is utilized but the water is not lost. A gate and pipeline connects the spill reservoir and the 10-mile gravity lateral. All water diverted into the spill reservoir is recovered and gravity fed into the 10-mile gravity lateral. BMWD does an exceptional job managing water for delivery and very rarely do operators have to spill into the reservoir.

Table 6 summarizes the spill recovery system.

Table 6. Tailwater/Spill Recovery System

System	Yes/No
District Operated Spill Recovery	Yes
Grower Operated Tailwater Recovery	No

All turnouts are designed to serve 160 acres at a flow rate of up to two and one-half cubic feet per second (2.5-cfs). Lateral turnouts will deliver water at a higher rate of up to 5-cfs during low total demand periods.

The District's distribution system can be classified as a fixed duration-restricted arrangement system with deliveries arranged in advance and a normal duration in 24-hour time intervals.

Growers within BMWD utilize all three of the major irrigation system types: micro irrigation, sprinkler and to a much lesser extent furrow. As drip irrigation technology became available, drip irrigation systems were installed on permanent crop acreage. By the 1980's, most of the permanent crops were converted from furrow or sprinkler systems to micro irrigation systems, either drip or fan-jet irrigation. Currently, pressurized micro irrigation systems (drip and fan-jet systems) account for 100% of the irrigated permanent crop acreage. The permanent crop acreage irrigated with micro irrigation has decreased from 28,275 acres in 1990 to around 24,556 acres in 2020 because of the transfers and economic impacts discussed earlier.

SWP water is among the most expensive surface water supplies in the State. Landowners in BMWD have some of the highest costs for surface water given the District's location and topography. Water delivered to BMWD must be pumped through two pump stations (Las Perillas and Badger Hill) on the Coastal Aqueduct as well as the District's own Pump Station A. When reduced water supplies are received, the costs increase dramatically. This alone is incentive enough for most growers to efficiently manage their water allocation. BMWD is a progressive district, and along with its landowners, uses the best available technology for conveying water to crops.

This Plan will describe BMWD's water conservation efforts currently being performed and practices they wish to incorporate into their existing system, policies, and management.

3. Terrain and soils

BMWD is located on the eastern edge of the Temblor Range. Topography is gentle, with foothills lying at the western edge. The western portion of BMWD is known as Antelope Valley, and is enclosed by the Temblor Range on three sides. The eastern portion of BMWD is known as Antelope Plain. Elevations range from 460 feet above sea level in the northeast to 1,200 feet in the southwest. Typical slopes range from 40 to 50 feet per mile in the central portion of BMWD. Table 7 summarizes the topography impacts to the irrigation of the land.

BMWD is mostly underlain with Quaternary alluvium, which in turn is underlain with the Tulare Formation of Pliocene/Pleistocene age.

The United States Department of Agriculture, Natural Resource Conservation Service (NRCS) (formerly the Soil Conservation Service), issued a soil survey of the northwestern portion of Kern County in the fall of 1988. This detailed soil survey included the Berrenda Mesa Water District area. A general soils map of the District taken from the NRCS soil survey is included as Appendix 6.

Table 8 gives the general characteristics of the major soil types within the District and accompanies Appendix 6. Three soil types exist in BMWD: Kimberlina fine sandy loam, Milham sandy loam, and Lewkalb saline alkali/Milham-Kimberlina complex (Appendix 6). All three-soil types are formed in alluvium derived primarily from sedimentary and granitic rock. Kimberlina fine sandy loam and Milham sandy loam are both deep, well-drained soils found on alluvial fans and plains. Milham sandy loam is found on low terraces, as well. Kimberlina fine sandy loam and Milham sandy loam are classified as prime farmland soils by the U.S. Department of Agriculture. Approximately 90 percent of the soils within BMWD are considered prime for agricultural activities and well drained. Noticeable erosion has not occurred on the irrigated and non-irrigated lands.

Land use within the BMWD consists primarily of agricultural lands. Approximately 24,556 acres are in agricultural production with the most common crops being pistachios, grain, carrots, pomegranates, and almonds. Other crops include carrots, hay citrus and grapes. Some livestock grazing also occurs on previously farmed land (fallow). Table 7 below shows the land use in the District. A majority of non-irrigated land (approximately 6,440 acres) in the service area is within non-farmable land (oilfields, mountain slopes, low (yield) producing land).

One rural community, Blackwell's Corner, is located within BMWD. Blackwell's Corner is the most developed community consisting of a restaurant, gas station, church, family residences, and the BMWD field office. No intensified urban areas are located within BMWD.

Table 7. 2020 Water Year Land Use

Crop	Acreage
Pistachios	16,390
Almonds	8,158
Citrus	3
Lavender	4
Total Irrigated Acreage	24,556
Fallow/Pasture	33,174
Total	57,730

Table 8. Landscape Characteristics

Topography Characteristic				% of the District				Effect on Water Operations and Drainage
Gently sloping land				100% Irrigated land				Land is adaptable to sprinkler and micro irrigation systems. There are no effects on water operations and drainage because of the existence of pressurized irrigation systems
Soil Unit	**Soil Name / Characteristic / Classification**	**Description**	**Total Area (acres)**	**Percent of District**	**Depth (in)**	**Clay (%)**	**Permeability (in/hr)**	**Effect on Water Operations and Drainage**
101	Aido clay, 9 to 30% slopes	Moderately deep, well drained soil is on hills and mountains. Formed in residuum derived dominantly from shale and sandstone.	16.3	0.03	10-26	40-60	0.06-0.2	No irrigation operations impact
					26-60	---	0.2 - 0.57	
102	Aido clay 30 to 50% slopes	Moderately deep, well drained soil is on hills and mountains. Formed in residuum derived dominantly from shale of fine grained and sandstone.	72.1	0.12	0-10	40-55	0.06-0.2	No irrigation operations impact
					10-26	40-60	0.06-0.2	
					26-60	---	0.2 - 0.57	
115	Bitterwater sandy loam, 9 to 15% slopes	Deep, well drained soil is on foothills. Formed in residuum derived dominantly from sandstone.	178.9	0.31	0-23	5-10	1.98 - 5.95	No irrigation operations impact
					23-60	5-10	1.98 - 5.95	
					60-70	---	1.98 - 5.95	
118	Bitterwater-Delgado association, 9 to 30% slopes	This unit is on foothills. This unit is 30% Delgado sandy loam. The Delgado soil is shallow and somewhat excessively drained. Formed in residuum derived dominantly from sandstone or shale.	465.0	0.80	0-2	8-20	1.98 - 5.95	No irrigation operations impact
					2-14	8-20	1.98 - 5.95	
					14-18	---	1.98 - 5.95	
		This unit is on foothills. This unit is 60% Bitterwater sandy loam. The Bitterwater soil is deep and well drained. Formed in residuum derived dominantly from sandstone.			0-23	5-10	1.98 - 5.95	
					23-60	5-10	1.98 - 5.95	
					60-70	---	1.98 - 5.95	
119	Bitterwater-Delgado association, 30 to 75% slopes	This unit is on foothills. This unit is 60% Bitterwater sandy loam. The Bitterwater soil is deep and well drained. Formed in residuum derived dominantly from sandstone.	0.5	0.00	0-23	5-10	1.98 - 5.95	No irrigation operations impact
					23-60	5-10	1.98 - 5.95	
					60-70	---	1.98 - 5.95	
		This unit is on foothills. This unit is 25% Delgado sandy loam. The Delgado soil is shallow and somewhat excessively drained. Formed in residuum derived dominantly from sandstone or shale.			0-2	8-20	1.98 - 5.95	
					2-14	8-20	1.98 - 5.95	
					14-18	---	1.41+	
129	Carollo-Twisselman saline alkali association, 2 to 15% slopes	Carollo (60% of area), clay loam, saline-alkali. Moderately deep and well drained soil is on hill tops. Formed in residuum derived dominantly from shale.	99.5	0.17	0-2	27-32	0 - 0.06	No irrigation operations impact
					2-15	40-60	0 - 0.06	
					15-30	30-40	0 - 0.06	
					30-60	---	0 - 0.06	
		Twisselman (40% of area), clay, saline-alkali. Deep and well drained soil is on side slopes and drainageways. Formed in alluvium derived dominantely from sedimentary rock.			0-9	40-60	0 - 0.06	
					9-60	35-60	0 - 0.06	
144	Delgado sandy loam, 5 to 30 percent slopes	Shallow, somewhat excessively drained soil is on hills. Formed in residuum derived dominantly from sedimentary rock.	41.9	0.07	0-2	8-20	1.98 - 5.95	No irrigation operations impact
					2-10	8-20	1.98 - 5.95	
					10-14	---	0.2 - 1.98	
163	Hillbrick-Rock outcrop complex, 50 to 75% slopes	This map unit is on hills and mountains. This unit is 65% Hilbrick sandloam and 15% Rock outcrop. The Hillbrick soil is shallow and well drained. Formed in residuum derived dominantly from weathered sandstone or shale.	1.4	0.00	0-15	8-18	1.98 - 5.95	No irrigation operations impact
					15-25	---	0.2 - 0.57	
166	Kecksroad silty clay loam, 5 to 15% slopes	This moderately deep, well drained soil is on hills. Formed in residuum derived dominantly from sedimentary rock.	26.6	0.05	0-11	30-40	0.2 - 0.57	No irrigation operations impact
					11-36	35-50	0.06-0.2	
					36-60	---	0.2 - 0.57	
167	Kecksroad silty clay loam, 15 to 50% slopes	This moderately deep, well drained soil is on hills. Formed in residuum derived dominantly from sedimentary rock.	13.7	0.02	0-11	30-40	0.2 - 0.57	No irrigation operations impact
					11-36	35-50	0.06-0.2	
					36-60	---	0.2 - 0.57	
168	Kettleman loam, 9 to 15% slopes	This moderately deep, well drained soil is on hills. Formed in residuum derived dominantly from sedimentary rock.	12.5	0.02	0-12	18-27	0.57 - 1.98	No irrigation operations impact
					12-22	18-30	0.57 - 1.98	
					22-60	---	0.2 - 0.57	
169	Kettleman loam, 15 to 50% slopes	This moderately deep, well drained soil is on hills. Formed in residuum derived dominantly from sedimentary rock.	106.1	0.18	0-12	18-27	0.57 - 1.98	No irrigation operations impact
					12-22	18-30	0.57 - 1.98	
					22-60	---	0.2 - 0.57	
171	Kettleman-Delgado-Rock outcrop complex, 15 to 50% slopes	Kettleman (45% of area) soil is moderately deep and well drained. Formed in residuum derived dominantly from sedimentary rock.	139.0	0.24	0-12	18-27	0.57 - 1.98	No irrigation operations impact
					12-22	18-30	0.57 - 1.98	
					22-60	---	0.2 - 0.57	
		Delgado (30% of area) soil is shallow and soemwhat excessively drained. Formed in residuum derived dominantly from sedimentary rock.			0-2	8-20	1.98 - 5.95	
					2-10	8-20	1.98 - 5.95	
					10-14	---	1.98 - 5.95	
172	Kilmer-Hillbrick complex, 15 to 50% slopes	This map unit is on hills and mountains. Kilmer (45% of area) loam soil moderately deep and well drained. Formed in residuum derived dominantly from shale or sandstone.	20.9	0.04	0-5	15-27	0.2 - 0.57	No irrigation operations impact
					5-14	27-35	0.2 - 0.57	
					14-32	18-35	0.2 - 0.57	
					32-36	---	0.2 - 0.57	
		This map unit is on hills and mountains. Hillbrick (40% of area) sandy loam soil is shallow and well drained. Formed in residuum derived dominantly from shale or sandstone.			0-15	8-18	1.98 - 5.95	
					15-25	---	0.2 - 0.57	
174	Kimberlina fine sandy loam, 0 to 2% slopes	Deep, well-drained soil on alluvial fans & plains. Formed in alluvium derived dominantly from granitic & sedimentary rock.	4826.8	8.31	0-9	6-18	1.98 - 5.95	No irrigation operations impact
					9-45	10-18	1.98 - 5.95	
					45-71	10-25	0.57 - 1.98	
175	Kimberlina sandy loam, 2 to 5% slopes	Deep, well-drained soil on alluvial fans & plains. Formed in alluvium derived dominantly from granitic & sedimentary rock.	625.3	1.08	0-9	6-18	1.98 - 5.95	No irrigation operations impact
					9-45	10-18	1.98 - 5.95	
					45-71	10-25	0.57 - 1.98	
177	Kimberlina gravelly sandy loam, 2 to 5% slopes	Deep, well-drained soil on alluvial fans and plains. Formed in alluvium derived dominantly from granitic and sedimentary rock.	68.0	0.12	0-25	6-18	1.98 - 5.95	No irrigation operations impact
					25-60	6-18	1.98 - 5.95	
185	Lewkalb, saline alkali-Milham-Kimberlina complex, 0 to 5% slopes	This map unit is on low terraces, alluvial fans, and plains. Kimberlina (20% of area) sandy loam is deep and well drained. Formed in alluvium derived dominantly from granitic and sedimentary rock.	1586.74	2.73	0-10	6-18	1.98 - 5.95	No irrigation operations impact
					10-60	10-18	1.98 - 5.95	No irrigation operations impact
		This map unit is on low terraces, alluvial fans, and plains. Lewkalb (40% of area) sandy loam is deep and well drained. Formed in alluvium derived dominantly from granitic and sedimentary rock.			0-23	6-18	1.98 - 5.95	No irrigation operations impact
					23-40	6-18	0.06-0.2	No irrigation operations impact
					40-65	6-18	0.06-0.2	No irrigation operations impact
		This map unit is on low terraces, alluvial fans, and plains. Milham (30% of area) sandy loam is deep and well drained. Formed in alluvium derived dominantly from granitic and sedimentary rock.			0-10	5-20	1.98 - 5.95	No irrigation operations impact
					10-49	20-35	0.2 - 0.57	No irrigation operations impact
					49-60	5-25	0.57 - 1.98	No irrigation operations impact
186	Lodo variant clay loam, 15 to 50% slopes	Shallow, somewhat excessively drained soil is on hills and mountains. Formed in residuum derived dominantly from sandstone or shale.	11.8	0.02	0-9	27-35	0.57 - 1.98	No irrigation operations impact
					9-13	---	0.2 - 0.57	
196	Milham sandy loam, 0 to 2% slopes	Deep, well-drained soil on alluvial fans, plains, & low terraces. Formed in alluvium derived dominantly from granitic & sedimentary rock.	7328.0	12.62	0-10	5-20	1.98 - 5.95	No irrigation operations impact
					10-49	20-35	0.2 - 0.57	
					49-60	5-25	0.57 - 1.98	
197	Milham sandy loam, 2 to 5% slopes	Deep, well drained soil on alluvial fans, plains, & low terraces. Formed in alluvium derived dominantly from granitic & sedimentary rock.	1259.1	2.17	0-10	5-20	1.98 - 5.95	No irrigation operations impact
					10-49	20-35	0.2 - 0.57	
					49-60	5-25	0.57 - 1.98	
206	Nacimiento-Kilmer complex, 30 to 50% slopes	This map unit is on hills and mountains. Kilmer (25% of area) loam soil is moderately deep and well drained. Formed in residuum derived dominantly from calcareous sandstone or shale.	38.45	0.07	0-5	15-27	0.2 - 0.57	No irrigation operations impact
					5-14	27-35	0.2 - 0.57	
					14-32	18-35	0.2 - 0.57	
					32-36	---	0.2 - 0.57	
		This map unit is on hills and mountains. Nacimiento (40% of area) silty clay loam soil is moderately deep and well drained. Formed in residuum derived dominantly from calcareous sandstone or shale.			0-13	27-35	0.2 - 0.57	No irrigation operations impact
					13-26	20-35	0.2 - 0.57	
					26-30	---	0.2 - 0.57	
211	Panoche clay loam, 0 to 2% slopes	Deep, well-drained soil on alluvial fans & plains. Formed in alluvium derived dominately from granitic or sedimentary rock.	26206.7	45.12	0-16	27-35	0.57 - 1.98	No irrigation operations impact
					16-60	18-35	0.57 - 1.98	
212	Panoche clay loam, 2 to 5% slopes	Deep, well-drained soil on alluvial fans & plains. Formed in alluvium derived dominately from granitic or sedimentary rock.	4179.2	7.20	0-16	27-35	0.57 - 1.98	No irrigation operations impact
					16-60	18-35	0.57 - 1.98	
213	Panoche clay loam, 5 to 9% slopes	Deep, well-drained soil on alluvial fans & plains. Formed in alluvium derived dominately from granitic or sedimentary rock.	85.4	0.15	0-16	27-35	0.57 - 1.98	No irrigation operations impact
					16-60	18-35	0.57 - 1.98	
	Pits		47.7					
219	Polonio loam, 2 to 9% slopes	Deep, well-drained soil on alluvial fans. Formed in calcareous alluvium derived dominately from sedimentary rock.	288.6	0.50	0-16	18-27	0.57 - 1.98	No irrigation operations impact
					16-60	18-30	0.2 - 0.57	
220	Pottinger very shaly clay loam, 2 to 9% slopes	Deep, well-drained soil on alluvial fans and terraces. Formed in alluvium derived dominately from shale.	23.4	0.04	0-23	25-35	0.2 - 0.57	No irrigation operations impact
					23-60	25-35	0.2 - 0.57	
235	Twisselman clay, 0 to 2% slopes	Deep, well-drained soil on alluvial fans. Formed in alluvium derived dom-inantly from sedimentary rock.	7714.4	13.28	0-14	40-60	0.06-0.2	No irrigation operations impact
					14-60	35-60	0.06-0.2	
236	Twisselman clay, 2 to 5% slopes	Deep, well-drained soil on alluvial fans. Formed in alluvium derived dom-inantly from sedimentary rock.	761.7	1.31	0-14	40-60	0.06-0.2	No irrigation operations impact
					14-60	35-60	0.06-0.2	
239	Typic Gypsiorthids-Kimberlina association, 0 to 5% slopes	Deep and well drained. Formed in alluvium derived dominantly from sedimentary rock.	126.5	0.22	0-9	6-18	1.98 - 5.95	No irrigation operations impact
					9-45	10-18	1.98 - 5.95	
					45-71	10-25	0.57 - 1.98	
251	Yribarren loam, 0 to 2% slopes	Deep, well drained soil on alluvial fans & plains. Formed in alluvium derived dominantly by sedimentary rock.	198.5	0.34	0-7	20-27	0.57 - 1.98	No irrigation operations impact
					7-19	35-55	0 - 0.06	
					19-22	15-35	0 - 0.06	
					22-60	15-30	0.2 - 0.57	
252	Yribarren clay loam, 0 to 2% slopes	Deep, well-drained soil on alluvial fans and plains. Formed in alluvium derived dominately from sedimentary rock.	446.2	0.77	0-7	20-27	0.57 - 1.98	No irrigation operations impact
					7-19	35-55	0 - 0.06	
					19-22	15-35	0 - 0.06	
					22-60	15-30	0.2 - 0.57	
253	Yribarren clay loam, 2 to 5% slopes	Deep, well-drained soil on alluvial fans & plains. Formed in alluvium derived dominantly by sedimentary rock.	1150.6	1.98	0-7	20-27	0.57 - 1.98	No irrigation operations impact
					7-19	35-55	0 - 0.06	
					19-22	15-35	0 - 0.06	
					22-60	15-30	0.2 - 0.57	
257	Water		67.4		---	---	---	

4. Climate

BMWD is characterized by a Mediterranean-type climate with dry, hot summers and mild, semi-arid winters with little rainfall and normally low humidity. Average daily maximum temperature in BMWD ranges from 91 to 97 degrees Fahrenheit in the summer, and from 58 to 69 degrees in the winter. The area is classified as a hot desert where precipitation is less than half of the potential evaporation. The rain season typically occurs from November to April, and ranges from 2.9 to 9.3 inches per year, with an average of 5.1 inches per year, where about nine-tenths of the rainfall occurs from November through April. The rainfall is sufficient for grazing purposes, but not sufficient for intensive agricultural purposes. Historical average climatology is presented in Table 9 and Table 10.

The growing season runs from May through October, although various crops are grown year-round. Reference evapotranspiration ranges from 52.4 to 62.8 inches per year with an average of 58.3 inches per year. The length of the growing season (frost-free period) is about nine months, or around 250 days per year that are available for growing most agricultural crops. The crops must be sustained by irrigation during the hot, dry summers.

Table 9. Summary Climate Characteristics

	#054 Blackwells Corner, 2006-2020
Climate Characteristic	**Value**
Average Annual Evapotranspiration (inches)	5.5
Average Annual Precipitation (inches)	0.4
Annual Minimum Precipitation (inches)* (2016)	(0) 0
Annual Maximum Precipitation (inches)* (2018)	(1.98) 1.8
Average Annual Minimum Temperature (ºF)	49.1
Average Annual Maximum Temperature (ºF)	76.7
Average Minimum Temperature (ºF) (January)	34.4
Average Maximum Temperature (ºF) (July)	97.2
Average Minimum Temperature Range (ºF) (November-April)	39.3
Average Maximum Temperature Range (ºF) (May-October)	89.3
Note:	
* Annual minimum and maximum precipitation correspond to the total minimum and maximum value recorded in the corresponding years.	

Table 10. Detailed Climate Characteristics				
	CIMIS Station #054 - Blackwells Corner, 2006-2020			
Month/Time	**Average Precipitation, Inches**	**Average Reference Evapotranspiration (ET_o), Inches**	**Average Minimum Temperature, ºF**	**Average Maximum Temperature, ºF**
January	1.09	1.71	34.39	56.25
February	0.71	2.52	35.87	61.86
March	0.99	4.28	42.41	67.85
April	0.51	6.11	46.55	74.72
May	0.44	8.20	52.86	82.56
June	0.01	9.19	60.46	91.67
July	0.02	9.90	66.15	97.21
August	0.02	8.78	64.58	95.83
September	0.08	6.49	59.45	90.03
October	0.14	4.32	50.19	78.69
November	0.44	2.42	41.17	66.79
December	0.67	1.60	35.30	57.01
Wet Season* (Nov-Apr)	0.74	3.13	39.33	64.17
Dry Season* (May-Oct)	0.71	46.89	58.95	89.33
Extreme Conditions (if applicable) [e.g., 100-year event]	NA	NA	NA	NA
Other	NA	NA	NA	NA
Notes:				
Wet season is defined for November through April. Dry season is defined for May through October.				
NA = Not applicable				

B. Operational characteristics

1. Operating rules and regulations

The District Board of Directors has adopted policies for allocation and delivery of water for agricultural use to lands within the District. Berrenda Mesa Water District Operating Rules and Regulations (April 5, 2000 revision) are used as a guideline for the operation and delivery of water to the water users (Appendix 8). The rules contain procedures to distribute irrigation water in a fair and equitable manner to the water users. As a complement, copies of the Water Supply Contract Standard Provisions (Appendix 7) and the Permanent Entitlement Transfer Policy (Appendix 9) are included.

As a Member Unit of the KCWA, a State Water Contractor, the District can only be as flexible with deliveries as the State DWR allows. Irrigation deliveries within the District can be classified as a fixed duration-restricted arranged schedule (Table 11). Most of the constraints placed on the District by DWR are passed on to the water user. BMWD is also a new to the WWA, who manages SGMA compliance and its land owners participation in WWQC who manages compliance with ILRP.

Table 11. Supplier Delivery System		
Type	**Check if Used**	**Percent of System Supplied**
On Demand		
Modified Demand		
Rotation		
Other (fixed duration-restricted arranged schedule)	x	100

Table 12. Water Allocation Policy					
	(Check if applicable)			**Allocation**	
Basis of Water Allocation	**Flow**	**Volume**	**Seasonal Allocations**	**Normal Year**	**Percent of Water Deliveries (%)**
Area within the service area					
Amount of land owned					
Riparian rights					
Other (Water supply contract amount)	*	x		2020	20% SWP Table A
Note: * Some turnouts can be prorated on some days based upon delivery capacity of facilities serving them. Available delivery capacities of distribution facilities are shared in proportion to water supply contract amounts held by turnout operators.					

As indicated on 12, the Board of Directors has adopted a water allocation policy, which establishes the amount of water available to the landowners and the cost of the water. The allocation is based on statewide water storage, yearly rainfall, snowpack, SWP and Delta operations restrictions, and other complex factors. The allocation is not finalized and adopted until after the rainy season and when the DWR has made runoff information available.

BMWD follows the same procedure for water ordering with its landowners that KCWA requires of its Member Units, as well as what the DWR requires of KCWA. Annual applications for a water supply must be submitted no later than September 1 of the preceding year. After reviewing all landowner applications, the District allocates to each based on total amount requested for the year, amount requested during any given month of the peak season, and the maximum pumping rate requested during the peak months of June, July, and August, if there is limited peaking capacity available. Applications may be submitted after the September 1 deadline; however, an allocation will be made to fill the late order only after satisfying all water requests submitted prior to September 1.

Water users are required to submit weekly orders showing the delivery rate (a 24-hour continuous uniform flow in cfs), required at each of the designated turnouts. Landowners schedule their own water. For example, a particular farmer requests water on Friday and needs his turnout to be open (2.5 cfs) from Monday to Friday (the following week); on

Monday between 6 am to 8 am the turnout is opened and on Saturday between 6 am to 8 am the turnout must be closed. Change orders must be requested 48 hours in advance. Table 13 shows the variation of water orders and shut-off lead times.

Table 13. Actual Lead Times

Operations	Hours/Days
Water orders	0-48 hours
Water shut-off/changes	0-48 hours

Water users with pressurized irrigation systems (drip/micro) may request irrigation water on an arranged demand (availability of water on request as consumed by the crop - typically from daily to every 2-3 days). Therefore, water order lead times may vary depending on the time of year, system capacity to move the water, and where water is needed in the system.

BMWD operates a decentralized water ordering and shut-off system**.** The canal operator (personnel who manage the water delivery to the water users) takes water orders from water users and coordinates deliveries based on demand and water flow capacity of the distribution system.

2. Water delivery measurements or calculations

BMWD employs a variety of water measurement methods. DWR maintains the flow measurement devices at each of Districts three SWP delivery points. Measurements are recorded daily. DWR has venturi flowmeters installed on the District's Pump Station A and Coastal Pump Station discharge pipelines (Table 14). Deliveries from District facilities are metered at each lateral and measured at each individual turnout by propeller flowmeters (Table 14). The propeller meters read in both instantaneous flow and totalizer readings for volume. The District flowmeters are read monthly and correlated to the monthly total measured by DWR for the same time period.

The District has utilized and continued to improve water orders and billing software since 2003 that helps calculate water costs and provide for a standardized billing process. The software has a database of landowner information including cropping patterns, water transfers, water usage, property ownership, water contract information, and historical water use.

The District has installed and continues to upgrade a SCADA system on its pump stations. SCADA is an acronym for **S**upervisory **C**ontrol **A**nd **D**ata **A**cquisition, a computer system used to monitor and control a plant or equipment. The SCADA system gathers information, such as if a motor failure occurs on a pump, transfers the information back to a central site, alerting the home station that a failure has occurred, carries out necessary analysis and control, such as determining if the pump operation is critical, and displays the information in a logical and organized fashion. The SCADA system also allows district staff to view water levels in forebays and afterbays. An added benefit is collecting, displaying, and storing real time pump efficiency (kwh/AF) and motor information (temperature, vibration, etc). The District also is working to add SCADA on its canal system.

The DWR-owned California Irrigation Management Information System (CIMIS) weather station located at Blackwell's Corner (CIMIS station (#54), gives landowners real time and historical data reports. Data is retrieved each day including reference Evapotranspiration (ETo), solar radiation, net radiation, air temperature, soil temperature, vapor pressure/relative humidity, precipitation, and wind speed which can be viewed at anytime. Station #54 has been operational since October 19, 1986 and continues to gather data. CIMIS has helped farmers with irrigation scheduling, duration, quantity and other important factors since its development.

Table 14. Water Delivery Measurements

Measurement Device	Frequency of Measurement (Days)	Frequency of Calibration (Months)	Frequency of Maintenance (Months)	Estimated Level of Accuracy (%)
Orifices (meter gates)				
Propeller Meters	cfs twice a week /AF monthly	As needed	As needed	<4%
Weirs				
Flumes				
Venturi Meters (i.e, DWR)	cfs and AF daily	As needed	As needed	<2%
Pump, Run Time				
Pump, KWH				
Other (e.g., some land owner operators)	cfs and AF daily	As needed	As needed	<4%

The District maintains daily delivery records for each turnout being used and maintains records of daily water orders from the SWP. A grower's water use to date and remaining allocation is calculated and maintained using the District's water management software (aka Latis).

DWR maintains records of daily diversions to the District and records of all diversions, water quality, and storage operations related to the SWP. Operational reports are distributed weekly and monthly to the District and published annually in DWR Bulletin 132.

3. Water rate schedules and billing

As discussed under Section II.B.1, the BMWD Board of Directors has established an irrigation water allocation policy. Water tolls are split into two categories, the base toll and the incremental toll.

The base water toll rate is established for each acre-foot of water under landowner contract or reserved for lands not under contract, regardless of location in the District.

Base water toll revenue pays for all District costs other than power and SWP variable costs. Current base water toll rate is $166.27 per acre-foot. This is not the true on farm cost however, since most years farmers receive less than 100% of their supply even though they are obligated to pay for their full supply.

An incremental water toll is charged for each acre-foot of water ordered each year and includes District power costs for pumping and SWP variable costs. These costs vary depending on the pumping plants serving an area, and the turnout location from State facilities. For 2020; State power costs totaled $34.69 per acre-foot foot (combined Dos Amigos and Las Perillas/Badger Hill on table 15 below); District incremental pumping cost range from $40 to $52 per acre-foot; and SWP water costs were $267.76 per acre-foot in the California Aqueduct. A Standby charge ($21.97/ac in 2020) is collected on all acres in the Service Area. Table 16 and Table 17 show BMWD has a uniform water allocation followed by an incremental water toll pricing structure.

Table 15. 2020 BMWD Water Toll/Pumping Rates

2020 Water Tolls				
DWR	$132.50			
BMWD	$33.77			
Base Water Toll	$166.27			
Dos Amigos	$22.49			
Total	$355.03			
Main Aqueduct			**Total**	
Aqueduct	$79.00		$267.76	
Aqueduct Booster	$59.00	$79.00	$326.76	
Coastal Branch				
LP/BH	$12.20	Incremental Charges		**Total**
Coastal	$34.00	Incremental Pumping	Incremental Rate Total	$234.96
Station A	$34.00			$234.96
Sec. 17		$-	$-	$-
Sec. 20-4		$52.00	$86.00	$286.96
Sec. 30-1		$40.00	$74.00	$274.96
Sec. 35		$-	$-	$-
Still		$-	$103.00	$303.96
2020 Standby Charge =	$21.97			

Table 16. Water Rate Basis			
Water Charge Basis	**Check if Used**	**Percent of Water Deliveries (%)**	**Description**
Volume of Water Delivered	x	100	Per acre and per AF basis
Rate and Duration of Water Delivered			
Acre			
Crop			
Land Assessment			
Other			
Landowner contract	x	x	Per AF of water contract

Table 17. Rate Structure		
Type of Billing	**Check if Used**	**Description**
Declining		
Uniform	x	$/AF
Increasing Block Rate		
Other		

No later than December 1, the District calculates the base uniform water toll and the incremental water toll rate for the ensuing year based upon the costs and charges the District expects to incur in delivering water (Table 17). Upon receiving water toll statements, landowners must immediately pay 25% of the statement and will be considered delinquent on January 2. On or before February 1, the District will re-estimate actual costs of delivering water based upon updated estimates and shall adjust the incremental water tolls accordingly. The adjusted statements will be sent to each applicant. 25% of the water tolls, as adjusted, are considered delinquent on March 1 and 50% are considered delinquent July 1. The remaining balance of the water tolls, as adjusted, shall be delinquent on March 1. On or before February 1, the following year, the District makes final adjustments to the incremental water tolls for water delivered during the prior year, based upon actual costs incurred, and appropriate credits or additional charges are issued.

Table 18. Frequency of Billing	
Frequency	**Check if Used**
Weekly	
Biweekly	
Monthly	
Bimonthly	
Other Water Tolls collected: 25% January 1, 25% March 1, and 50% July 1	x
Annually Standby May 25	x

4. Drought Management Plan and Water Shortage Allocation Policy

As described in Section IV the District relies on water transfers, supplemental water purchases, and groundwater banking programs as its primary mechanism for enduring periods of drought. Unlike farmers in other areas who can fallow lands during periods of drought, farmers in the District have permanent plantings (trees and vines) that require a minimum water supply to keep alive. In water short years these farmers use deficit irrigation (the application of water below full crop-water requirements) to reduce irrigation water use. This can result in reduced crop yields and, if taken to the extreme, no crop yield and long-term damage.

<u>Determining Drought Severity</u>
The District's primary water source is imported surface water supplies from the SWP. In the fall of each year, DWR operations staff review current Project storage and projected deliveries through the end of the year, and develop allocation projections for the following year based on a range of forecasted hydrology. DWR declares the initial allocation forecast for the following year at the end of November; this allocation is adjusted up or down as hydrology dictates.

District management maintains a close relationship with Kern County Water Agency and DWR operations staff and uses these allocation projections to determine water supply availability and level of drought severity. These projections are conveyed to District landowners for use in planning their farming operations and projecting supplemental water needs.

<u>Water Shortage Allocation</u>
During water short years, the District allocates water according to District policy as follows: the District will first provide water to holders of entitlement that have planted permanent crops based on the ratio of gross acreage of each landowner to the aggregate of gross acreage of all landowners (in permanent crops), up to 1.5 AF per acre. Once landowners of permanent crops have been supplied with at least 1.5 AF per acre, the District will provide water to owners of land not planted to permanent crops based on the ratio of gross acreage of each landowner to the aggregate of gross acreage of all landowners not planted in permanent crops, also up to 1.5 AF per acre. Table 19 summarizes how decreased water supplies are allocated.

Table 19. Decreased Water Supplies Allocations	
Allocation Method	**Check if used**
By crop	
Area in district	
Other	
Decrease Allocated Water	x
Restrict Water to Certain Crops	x
No specific policy	

<u>Alternative Water Supplies</u>
As discussed in Section IV, the District relies on banking, transfers, and exchanges to supplement its annual water supply. At all but the higher SWP water allocations, the District is proactive in seeking and securing supplemental water supplies. Since 2009, the District has collaborated in securing additional water with four other agricultural water districts that also rely heavily on the SWP for their water supplies. The other districts are Belridge Water Storage District, Dudley Ridge Water District, Lost Hills Water District, and Wheeler Ridge–Maricopa Water Storage District. Due to their common location on the Westside of the southern San Joaquin Valley, the five districts are informally referred to at the Westside Districts or Westside 5.

<u>Coordination and Collaboration</u>
In addition to the Westside 5, the District coordinates with neighboring local districts where there are common landholders to utilize limited supplies in the most beneficial manner.

<u>Revenues and Expenditures</u>
The majority of the District's expenses are DWR charges that are due regardless of the amount of water delivered. As the SWP allocation gets reduced, the actual cost of the water to the water users increases proportionately. For example, the District was expected to spend $13,190,844 million for its 2020 SWP water supply. At 100% allocation, this would equate to approximately $157.66/AF, but at the 2020 allocation of 20%, the unit charge rises to over $712.25/AF.

In addition, at lower SWP allocations, the market for supplemental water becomes more active, which results in higher unit costs to the water users.

BMWD has not had to enforce any wasteful water practices. As stated before, the price of water to BMWD landowners is of the highest anywhere in the state. Landowners are aware of this and use the water wisely. If necessary, the District would shut off service to any landowner deemed to be wasting water (Table 20).