2020 Urban Water Management Plan

Mojave Water Agency

Final – Adopted May 27, 2021

Prepared by:

Tully & Young
Comprehensive Water Planning

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List of Preparers

Tully & Young, Inc.
Gwyn-Mohr Tully, J.D.
Greg Young, P.E.
Kris Olof
Galen Davis
Dave Bolland
Jingcheng Xu

Mojave Water Agency
Nicholas Schneider – Project Manager
Kathy Cortner
Allison Febbo
Adnan Anabtawi
Emmett Campbell
Jeff Ruesch

This 2020 Urban Water Management Plan was prepared under the direction of a California licensed civil engineer.

Executive Summary
Layperson's Description

After the devastating drought in the late 1970s, the California Legislature declared California's water supplies a limited resource, subject to ever-increasing demands, and that the long-term, reliable supply of water is essential to protect California's businesses, communities, agricultural production, and environmental interests. The Legislature also recognized a need to strengthen local and regional drought planning and increase statewide resilience to drought and climate change. Thus, in 1983, the California Legislature created the Urban Water Management Planning Act (UWMPA).[1] The UWMPA requires urban water suppliers serving over 3,000 customers or supplying at least 3,000 acre-feet of water annually to prepare and adopt an urban water management plan every five years,[2] and demonstrate water supply reliability in a normal year, single dry year, and droughts lasting at least five years over a twenty-year planning horizon.[3] The UWMPA also requires each urban water supplier to prepare a drought risk assessment and water shortage contingency plan.[4] And last, beginning in July 2022, each urban water supplier must prepare an annual water supply and demand assessment.[5] The California Legislature emphasizes that aggregating all of these legal requirements at the urban water supplier management level will improve local, regional, and statewide water planning and water resilience.

At a practical level, the Urban Water Management Plan (UWMP) is the legal and technical water management foundation for urban water suppliers throughout California. A well-constructed UWMP will provide the supplier's elected officials, management, staff, and customers with an understanding of past, current, and future water conditions and management. The UWMP integrates local and regional land use planning, regional water supply, infrastructure, and demand management projects as well as addresses statewide challenges that may manifest through climate change and evolving regulations. Thoughtful urban water management planning provides an opportunity for the supplier to integrate supplies and demands in a balanced and methodical planning platform that addresses short-term and long-term planning conditions. In brief, the UWMP gathers, characterizes, and synthesizes water-related information from numerous sources into a plan with local, regional, and statewide practical utility.

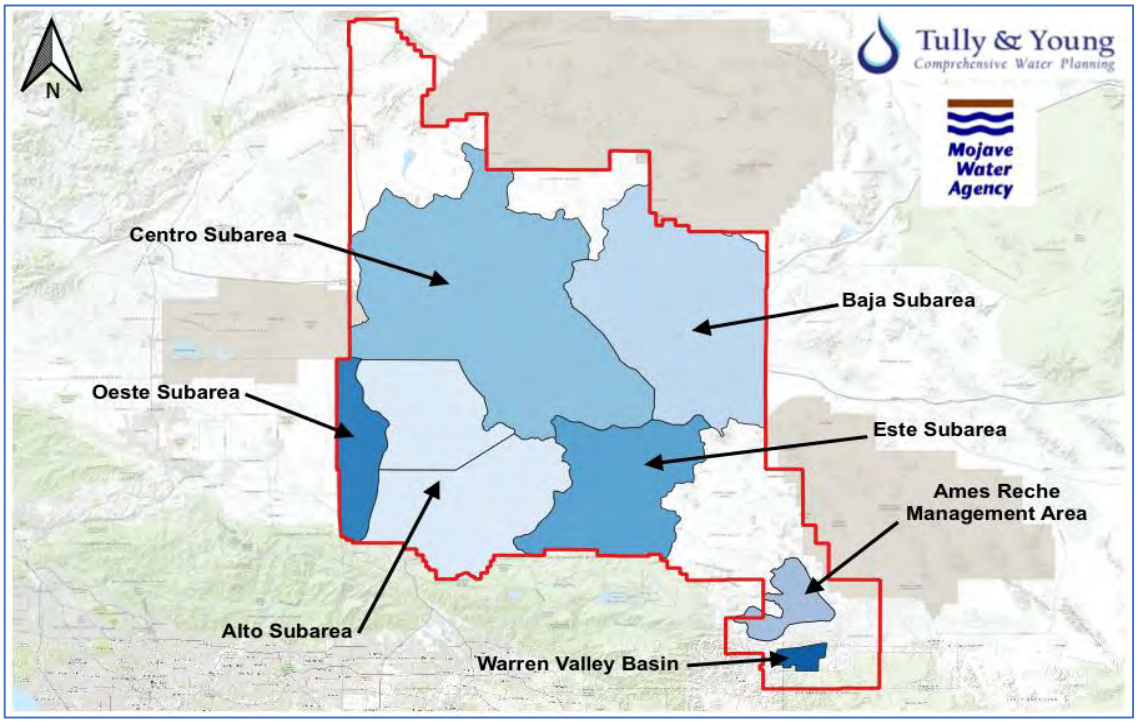
[1] California Water Code Section 10610 *et seq*. (Chapter 1 added by Stats. 1983, Ch. 1009, Sec. 1) and its subsequent amendments
[2] California Water Code Section 10610 *et seq*.
[3] California Water Code Sections 10631-10635
[4] California Water Code Sections 10632
[5] California Water Code Sections 10632.1

ES-1 Mojave Water Agency

The Mojave Water Agency (MWA) was formed in 1960 as a special act district codified in Chapter 97 of the California Water Code Appendix as the Mojave Water Agency Law (MWA Law).[6] The MWA Law states that MWA was created, in part, "to do any and every act necessary to be done so that sufficient water may be available for any present or future beneficial use of the lands and inhabitants of the agency…."[7] The MWA Law further establishes that MWA's service area boundaries include very specific geographical locations in San Bernardino County as shown in Figure ES-1.[8] As such, MWA's fundamental purpose is to improve water service reliability within MWA's service area boundary.

The MWA service area encompasses approximately 4,900 square miles of eastern San Bernardino County. Its service area is divided into seven Subareas, each one affiliated with a groundwater management area. MWA is a State Water Project (SWP) contractor, Watermaster for the Mojave Basin Area Adjudication, administrator for the Warren Valley Basin Judgment, and wholesale supplier to numerous retail water suppliers, some of which are preparing their own UWMPs. There are numerous smaller retail suppliers in the MWA service area which do not meet the Urban Water Management Planning Act's minimum threshold statutory criteria as well as numerous individual water users that serve smaller private parcels. MWA's goals include sound fiscal and organizational policies, effectively managing water resources in conjunction with the SWP, maintaining water quality, and promoting efficient use of the regions resources through regional conservation programs and public awareness.

Figure ES-1: MWA Water Service Boundary with Adjudicated and Managed Groundwater Areas



[6] California Water Code Appendix, Mojave Water Agency Law, Section 97-1 *et seq*., 1960.
[7] MWA Law Section 97-1.5.
[8] MWA Law Section 97-1.

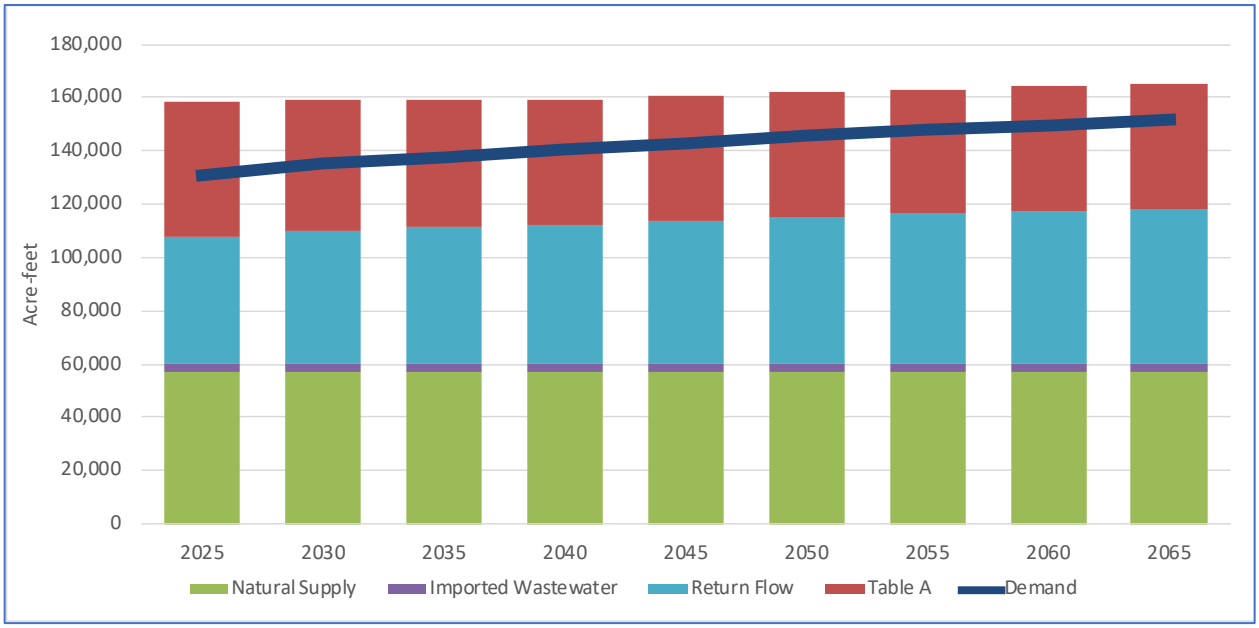
ES-2 MWA Water Service Reliability

Mojave Water Agency aggregates the regional water supplies and demands in this 2020 Urban Water Management Plan (UWMP) through its roles as a wholesale water purveyor of State Water Project supplies, Watermaster of the Mojave Basin Area Adjudication, and administrator for the Warren Valley Basin Judgment. All of these efforts necessitate examination of water supplies at a region-wide level in order to ensure supply reliability among the numerous regional retail purveyors and others that depend upon the regional water resources.

MWA has extended the planning horizon considered in this 2020 UWMP from the statutorily required twenty-year timeline to a much longer forty-five-year period through 2065. This extended planning horizon allows MWA and the regional retail water purveyors to address longer-term land use planning, water planning, and infrastructure considerations. Moreover, the extended timeline will assist MWA's Board of Directors in examining historical and long-term trends in water resources conservation, management, and use in order to ground current and future decision-making. Together, these considerations help improve regional coordination and planning.

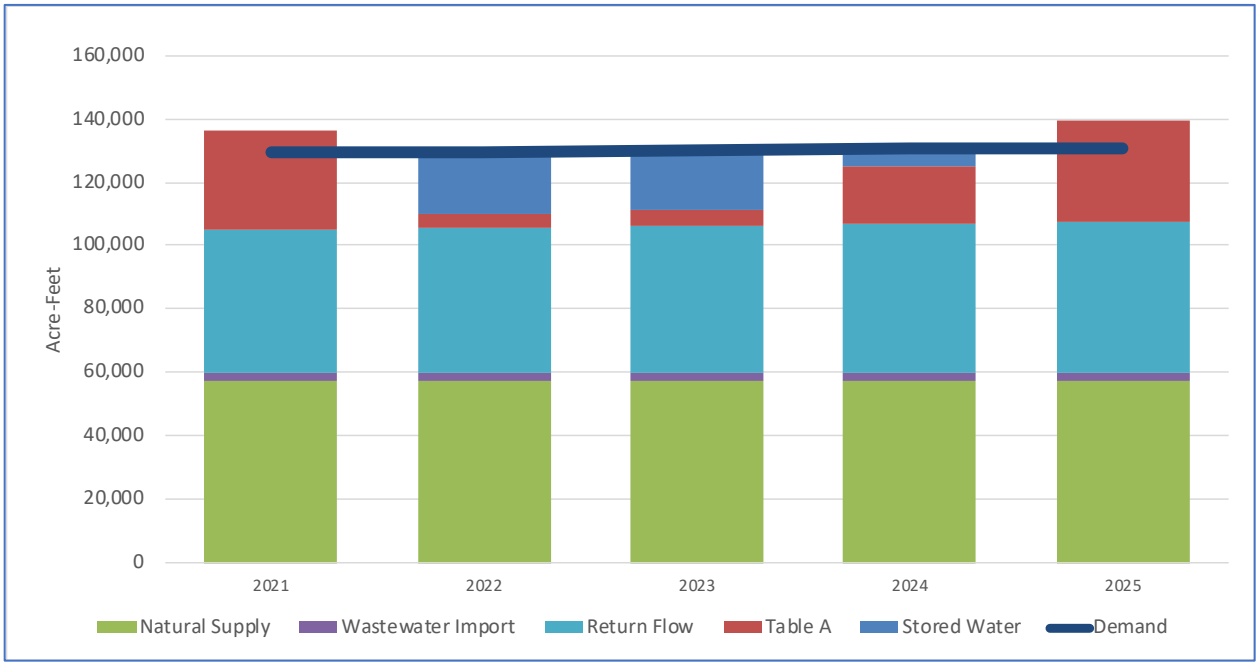
As shown in Figure ES-2, MWA has reliable water supplies through the 2065 planning horizon. MWA has assessed the available natural supplies through the applicable adjudications and agreements, the long-term availability of imported wastewater, the return flow attributable to water use in the MWA service area, as well as its long-term access to SWP Table A Contract supplies. In addition, MWA stores water both within MWA's service area boundaries and outside its boundaries to manage short-term water shortage conditions. Together, these supplies make up MWA's regional water asset portfolio that is actively managed by MWA and the regional retail agencies to ensure long-term reliability.

Figure ES-2: MWA's Water Service Reliability through 2065



MWA also manages its water supplies to address projected dry conditions. Specifically, MWA captures and stores surplus imported water in normal and wet years to use those stored water assets to meet regional demands in dry years. These actions stabilize annual fluctuations in recurring supplies that may not meet regional demands under certain dry conditions. In other words, any surplus imported supplies are captured and stored for future delivery to improve long-term supply reliability. MWA has stored over 200,000 acre-feet of water to mitigate dry conditions. Figure ES-3 shows a putative water reliability assessment for a drought lasting five consecutive years where MWA uses stored water to offset fluctuations in its SWP supplies.

Figure ES-3: MWA's Drought Risk Assessment from 2021 through 2025



In summary, MWA's diverse surface water supply portfolio, combined with its coordinated management of groundwater resources with retail purveyors, provide stable and reliable water supplies to meet MWA's current and 2065 future water demands in its service area.

Chapter 1
Introduction

Formed in 1960, the Mojave Water Agency (MWA or Agency) was created to fulfill the critical role of doing "any and every act necessary, so that sufficient water may be available for any present or future beneficial use of the lands and inhabitants within the Agency's jurisdiction."[9] The aquifers in MWA's service area have been in overdraft since the early 1950s, with residents using more water than is replaced naturally by the limited rainfall and surface water from the Mojave River and its tributaries flowing down from the San Bernardino Mountains to the south. The Mojave River Adjudication further reaffirmed and stipulated MWA's mission of managing local water supply and tasked MWA to seek and secure supplemental water supplies to improve the groundwater overdraft conditions and ensure the quality of life within its boundaries.

The MWA service area encompasses approximately 4,900 square miles of eastern San Bernardino County. Its service area is divided into seven Subareas, each one affiliated with a hydrological groundwater basin. MWA is a State Water Project (SWP) contractor and acts as Watermaster and wholesale supplier to ten (10) retail water suppliers that are large enough to require preparing their own Urban Water Management Plans. There are many other much smaller retail suppliers in the MWA service area which do not meet the Urban Water Management Planning Act's minimum threshold statutory criteria. MWA's goals include sound fiscal and organizational policies, effectively managing water resources in conjunction with the SWP, maintaining water quality, and promoting efficient use of the region's resources through regional conservation programs and public awareness.

Ensuring an adequate supply of water is available to serve the existing and future regional water needs for the groundwater users in MWA's service area is a critical component of successful operations. This Urban Water Management Plan (UWMP) draws on local, regional, and statewide input to synthesize information from numerous sources into a reliable water management action plan designed to assist Staff and the Board of Directors in their decision-making.

1.1 Background and Purpose

MWA has prepared this 2020 UWMP to comply with the Urban Water Management Planning Act (UWMPA) requirements for urban water suppliers. This 2020 UWMP addresses the Agency's water management planning efforts to assure adequate water supplies to meet forecast demands over the next 45 years. As required by the UWMPA, the Agency's 2020 UWMP specifically assesses the availability of its supplies to meet forecast water uses during average, single-dry, and five consecutive

[9] 1 MWA Law, Chapter 97-1.5, July 21, 1960

drought years through 2065. Verification that future demands will not exceed supplies and assuring the availability of supplies in dry-year conditions are critical outcomes of this 2020 UWMP.

The 2020 UWMP is an update to the Agency's 2015 UWMP and presents new data and analysis as required by the California Department of Water Resources (DWR) and the California Water Code (CWC) since 2015. The 2020 UWMP is also a comprehensive water planning document that describes existing and future supply reliability, forecasts future water uses, presents demand management progress, and identifies local and regional cooperative efforts to meet projected water use.

The UWMP is designed to be a valuable water management and planning tool to guide and inform the MWA Board of Directors, managers, staff, local retail water suppliers, customers, and the State of California about its water management practices. The UWMP reflects the Agency's planning assumptions and goals and should be used in combination with other planning resources and documents over the UWMP planning horizon.

The State of California's drought vulnerability and the additional pressures of climate change and population growth have emphasized the importance of planning ahead to meet water demands with potentially at-risk water supplies. Such forward planning is an important outcome of the 2020 UWMP.

1.2 Basis for Plan Preparation

MWA qualifies as an Urban Water Supplier as described in Water Code Section 10617: "An urban water supplier includes a supplier or contractor for water, regardless of the basis of right, which distributes or sells for ultimate resale to customers." Under this definition, MWA is a Wholesale Water Supplier providing water for municipal purposes to more than 3,000 customers or 3,000 acre/feet of water per year. These qualifications require the preparation of an Urban Water Management plan every five years.

The State Legislature passed numerous new requirements since the 2015 UMWP which are detailed throughout this 2020 UWMP.[10] Major updates to the requirements are listed below along with a reference to the corresponding section in which they are addressed in this document.

- **Five Consecutive Dry-Year Water Reliability Assessment:** The Legislature modified the dry-year water reliability planning from a "multiyear" time period to a "drought lasting five consecutive water years" designation. This statutory change requires a Supplier to analyze the reliability of its water supplies to meet its water use over an extended drought period. This new requirement is addressed in Chapter 3—Water Supply, Chapter 4–Water Use, and Chapter 5—Water System Reliability.
- **Drought Risk Assessment (DRA):** Due to the extensiveness of recent California droughts and the variability associated with climate change predictions, the California Legislature created a DRA requirement for UWMPs. The DRA requires assessment over a five-year period from 2021 to 2025 that examines water supplies, water uses, and the resulting water supply reliability for five consecutive dry years. MWA's water supplies are addressed in Chapter 3 – Water Supply;

[10] California Water Code Section 10608 to 10608.44; Section 10609 to 10609.38; Section 10610 to 10657

the DRA is addressed in Chapter 5— Water System Reliability, and Chapter 6—Water Shortage Contingency Plan.

- **Seismic Risk:** The Water Code now requires evaluation of seismic risk to water system infrastructure and the creation of a mitigation plan. Incorporating the water system into regional or county hazard mitigation planning is an important aspect of this new statue. Seismic risk is addressed in Chapter 6.
- **Water Shortage Contingency Plan:** In 2018, the Legislature modified the UWMPA to require a Water Shortage Contingency Plan (WSCP) with specific elements. The WSCP is a document that provides a Supplier with an action plan for a drought or catastrophic water supply shortage. The WSCP is in Chapter 6 of this UWMP.
- **Groundwater Supplies Coordination:** 2020 UWMPs are required to be consistent with Groundwater Sustainability Plans following the 2014 Legislature enactment of the 2014 Sustainable Groundwater Management Act (SGMA). Most of the groundwater supplies in MWA's service area are subject to adjudications or stipulated agreements. MWA's Groundwater Supplies are described in Chapter 3—Water Supply.
- **Lay Description:** A synopsis of the fundamental determinations of the UWMP is a new statutory requirement in 2020. This section of the is intended for new staff, new governing members, customers, and the media, and it can ensure a consistent representation of the Supplier's detailed analysis.

1.3 Coordination and Outreach

As required by the UWMPA, Mojave Water Agency has coordinated with nearby agencies while developing this UWMP in order to ensure consistency with other related planning efforts such as city and county General Plans, local retail suppliers' UWMPs, Water Master Plans (WMP), Adjudications and Stipulations, and Groundwater Sustainability Plans (GSP). This requirement includes coordination with (a) water suppliers that share a common water source, (b) relevant water management agencies that affect the Agency's water assets, and (c) relevant public agencies that may have land use or other regulatory relationships with the MWA. Qualified retail suppliers within the MWA service area are completing their own UWMPs and it should be noted that specific conditions within those individual retail service areas are addressed in the retailers' individual UWMPs. The Agency has prepared this 2020 UWMP in coordination with all regional water purveyors and has appropriately notified and coordinated with other appropriate local government agencies as listed in Table 1-1.

As stipulated in Water Code Section 10621(b), every urban water supplier shall conduct a public hearing in order to encourage active involvement from diverse elements of the community. The Agency sought public participation with a public hearing and appropriate notices as required by law. These coordination efforts and Statutory Requirements for Notice are also included in Table 1-1.

Table 1-1: Public and Agency Coordination

Coordinating Agencies	Coordinate Regarding Demands	Sent Copy of Draft UWMP	Sent 60-Day Notice	Notice of Public Hearing
Cities, Counties, Customers and Interested Parties				
Liberty Utilities - Apple Valley Water Company	X	X	X	X
Bighorn-Desert View Water Agency	X	X	X	X
City of Adelanto Water District	X	X	X	X
County Service Area 64	X	X	X	X
County Service Area 70 J	X	X	X	X
Golden State Water Company - Barstow System	X	X	X	X
Helendale CSD	X	X	X	X
Hesperia Water District	X	X	X	X
Hi-Desert Water District	X	X	X	X
Joshua Basin Water District	X	X	X	X
Phelan Pinon Hills CSD	X	X	X	X
Victorville Water District	X	X	X	X
San Bernardino County Planning Department			X	X
California Department of Water Resources		X		
Local Agency Formation Commission (LAFCO) for San Bernardino County			X	
General Public				X

1.3.1 Water Supplier Information Exchange

Water Code Section 10631 requires wholesale and retail water agencies to provide each other with information regarding water supply and demand. Since MWA receives water from the State Water Project and provides water as a wholesaler to its retail customers, it has coordinated on both sides with supply and demand information as noted in Table 1-1.

1.3.2 Statutory Requirements for Notice

In accordance with the UWMPA, notification of the UWMP update was provided to cities and counties within the service area at least 60 days prior to the public hearing of the plan as required by Section 10621(b) of the Water Code. Electronic copies of the final UWMP will be provided to the County no later than 30 days after its submission to DWR.

1.4 UWMP Adoption

MWA held a public hearing regarding its 2020 UWMP on May 27, 2021. Before the hearing, a draft was made available for public inspection at the MWA office building and on MWA's website. Pursuant to CWC Section 10642, general notice of the public hearing was provided through publication of the

hearing date and time in local media under the requirements of Government Code section 6066 and posting of the hearing at MWA's offices.

MWA's elected body adopted this 2020 UWMP on May 27, 2021. The adopted 2020 UWMP will be submitted to DWR, provided to the County and the State Library, and posted on MWA's website.

MWA plans to submit all required documentation related to the UWMPA through the DWR submittal website soon after adoption. These include the following required DWR Excel workbooks:

- "FINAL Submittal 2020 UWMP Tables 04.02.2021.xls"
- "FINAL Energy Use Tables 04.01.21.xls"

1.5 Document Organization

This UWMP is organized as follows:

- Chapter 2 provides a description of the MWA service area, demographic characteristics, and climate, and describes the future population the Agency anticipates needing to serve.
- Chapter 3 describes MWA's current and future water supplies and the availability of the supplies through 2045.
- Chapter 4 details the customer uses, including the past and future estimated uses, and describes the MWA's past and on-going demand management measures.
- Chapter 5 presents the MWA's water system service reliability into the future, including an assessment of reliability if a drought occurred over the next five consecutive years.
- Chapter 6 is MWA's stand-alone water shortage contingency plan, incorporated as a chapter in this UWMP, but also available to be shared and utilized separate from the UWMP.

NOTE TO DWR:

Mojave Water Agency has written this UWMP primarily as a water resources planning tool to effectively manage water supply, reliability and demand. This UWMP also satisfies all the requirements of the Urban Water Management Planning Act (UWMPA).

The body of the document provides narratives, analysis and data that DWR requests in its 2020 UWMP Guidebook, including changes to the California Water Code since 2015. Efforts have also been made to include enhancements to this document wherever possible as recommended in the 2020 UWMP Guidebook.

To facilitate review by DWR for compliance with the UWMPA, data from the body of the document has been transferred into required DWR submittal tables consistent with the organization of the tables in Appendix E of the 2020 UWMP Guidebook. These tables are separately uploaded to DWR's web portal. This UWMP has been reviewed for adequacy according to the UWMP Checklist as contained in Appendix F in the 2020 UWMP Guidebook.

Chapter 2
Water Service and System Description

The MWA service area encompasses approximately 4,900 square miles in the eastern San Bernardino County, California (see Figure 2-1). This area, in the southeastern part of the state, is a portion of the larger Mojave Desert which reaches into Nevada with small areas that extend into Utah and Arizona. The Mojave Desert is the driest desert in North America, and while it is sparsely populated compared to its total area, it does support large communities with significant water demands. The MWA region is a closed topographic basin with virtually no hydrological outlets. Elevation levels range from 5,500 feet in the San Bernardino Mountains to 1,500 feet near Afton Canyon at the eastern boundary.

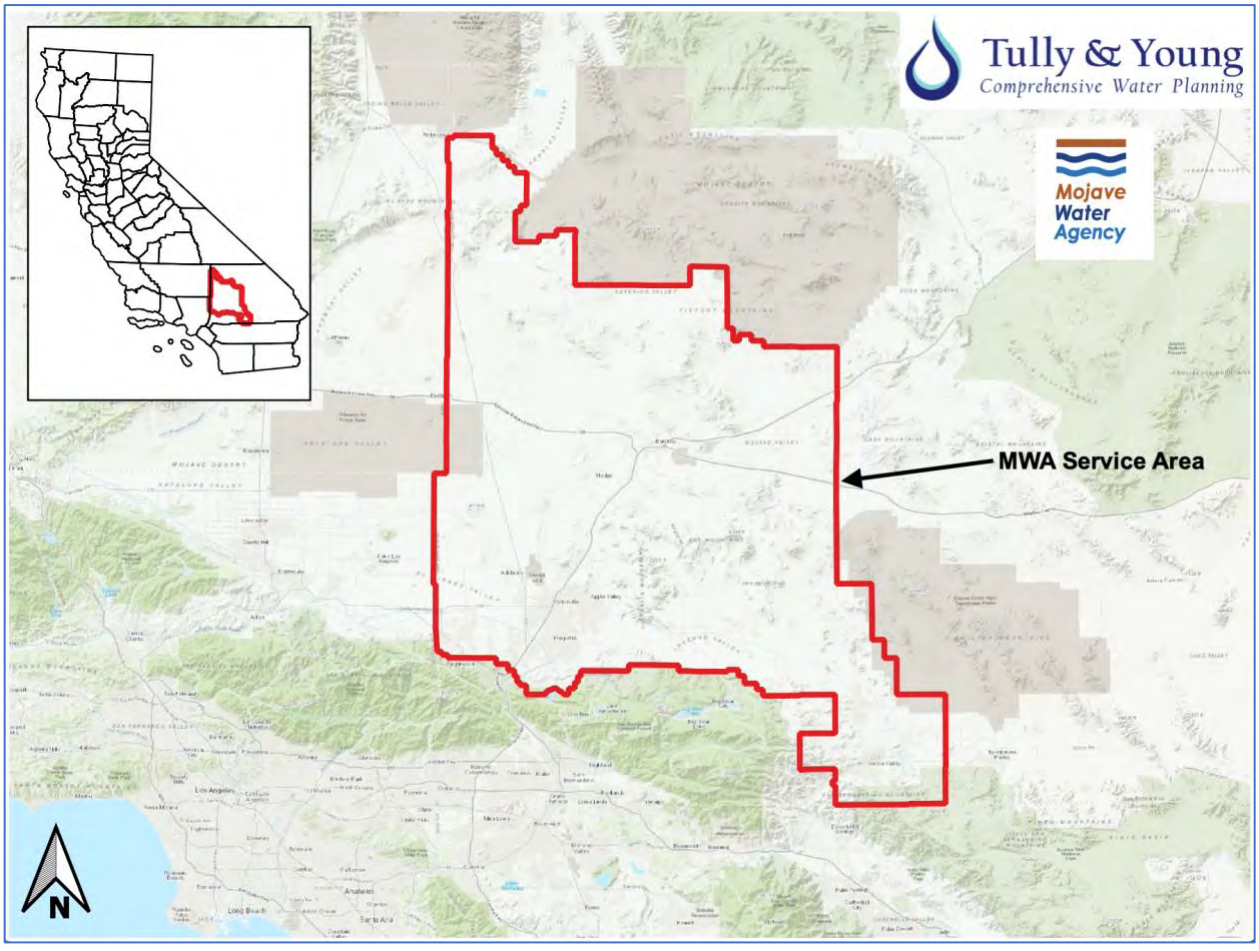
The Mojave River is central to MWA history and settlement in the region. The river is more of an ephemeral stream which derives its flow from drainage of 217 square miles of the northern slope of the San Bernardino Mountains. Early farmers aggressively planted the Victor Valley with fruit trees and crops, which by the 1950s created serious water overdraft. This overdraft led to a halt in development in the area. Legislation for the State Water Project (SWP) passed in 1959 to begin work on the California Aqueduct, along with the Davis-Grunsky Act, which allowed regions the opportunity to form local water agencies. Soon after, in 1960, the Mojave Water Agency was formed.

MWA's service area is divided into seven divisions, each one represented by a publicly elected board member who serves a four-year term. The Board uses a committee format to inform decisions and receive recommendations for voting matters with each committee member serving a one-year term (or until a successor is appointed). These committees generally meet once a month and include: Engineering and Operations Committee; Legal, Legislative and Public Information Committee; Morongo Basin Pipeline Commission; Personnel, Finance and Security Committee; Planning, Resources and Technology Committee; and Technical Advisory Committee.

MWA's Sphere of Influence (SOI) is generally contiguous with its service area, however there are two areas within the SOI that are currently not in its service area. Golden State Water Company serves Wrightwood community's 2,700 customers on the southern boundary of the MWA SOI. The other area is near Grass Valley Creek, which is a tributary to the Mojave River. These two areas are at the base of the San Bernardino Mountains and are part of the headwaters that connect the drainage to the groundwater basins that are part of the Mojave Basin Area Adjudication. The service area and SOI are shown in Figure 2-1. MWA, serving as the court appointed Watermaster according to the Mojave Basin Area Adjudication, coordinates with these entities within the SOI to ensure established water supplies into the subbasins are maintained. An overview of the Mojave Basin Area Adjudication is described in Section 2.1 and more details follow in Chapter 3.

Water supply for MWA's service area is sourced almost entirely from pumped groundwater from the various basins, subbasins, and aquifers in the area. Groundwater is recharged by natural storm water flows, infiltration of the Mojave river and tributaries, SWP imports to recharge basins, wastewater imports, and irrigation and wastewater return flow. Two water projects were developed to deliver much needed supply to additional locations in MWA's service area from the SWP. The Morongo Basin Pipeline was completed in 1995 and supplies more than 60,000 people in Morongo Basin. The Mojave River Pipeline completed in 2006 provides critical recharge of Mojave River Basin groundwater delivering up to 45,000 acre-feet per year to the area to help offset dwindling supplies from regional growth and pumping of groundwater. Four groundwater recharge basins receive replenishment from the pipeline, in addition to a connection at High Desert Power Project in Victorville. Chapter 3 describes MWA's water supply in detail.

Figure 2.1: Water Service Area Map



2.1 Mojave Water Agency Service Area Adjudication History

The following provides a detailed discussion about the establishment of important hydrologic subareas that are critical components of MWA's management of water assets within its service area.

2.1.1 Mojave Basin Area

Determining water rights and how to manage the over-drafted supply and increasing demand, along with factoring the higher cost of imported water from the SWP, initiated the first adjudication efforts in MWA's service area in the 1960s. In 1965, Morongo Basin was annexed into MWA's service area adding 35.5 square miles to MWA's boundary. The Morongo Basin was a sixth but separate area that added management and delivery obligations beyond the five other distinct hydrological subareas within the Mojave Basin Area: Este (East Basin), Oeste (West Basin), Alto (Upper Basin), Centro (Middle Basin) and Baja (Lower Basin).

A second effort at adjudication in the MWA service area, starting in 1990, proved more successful. The effort resulted in full adjudication of the Mojave Basin Area in 2002.[11] It began when the City of Barstow and the Southern California Water Company filed a complaint against upstream (and up-basin) water users claiming that lowering groundwater levels and water availability due to withdraws reduced the amount of water available to downstream users. A year later, Mojave Water Agency filed a cross-complaint declaring that native waterflow of the Mojave River and basin area groundwater was not sufficient to meet current and future demands. The cross-complaint asked the court to determine surface and groundwater rights for the Mojave Basin Area. Negotiations over the next two years produced a Stipulated Judgment in January 1996 that formed a class of producers which used 10 acre-feet or less per year that were dismissed from litigation and offered an equitable solution for the remaining water producers that use over 10 acre-feet per year. The Riverside Superior Court appointed MWA as Watermaster for the area as part of the Judgment. Appeals by non-stipulated parties continued over the next several years with the California Supreme Court finally ruling on the case in August 2000. Most of the appealing parties have stipulated to the Judgment since the 1996 ruling.

This judgment helps maintain proper water balances between the Mojave Basin Area's five distinct, but interrelated, subareas (Este, Oeste, Alto, Centro, Baja). The Alto Transition Zone was also defined as a sub-management unit to better understand the water flow from Alto to Centro. Some subareas were found to historically receive natural water flow from upstream subareas; to maintain that relationship, annual obligations are set according to average annual natural flow baselines defined in the Judgment at Base Annual Production (BAP). The Judgment established a Free Production Allowance (FPA) allocation to Producers based on each Producer's percentage share of the BAP which is set each year by the Watermaster. FPA is reduced over time until it comes within 5% of the Production Safe Yield (PSY) defined by the Judgment. All water produced in excess of any Producer's share of the FPA must be replaced by the Producer, either by payment to the Watermaster of funds sufficient to purchase Replacement Water, or by transfer of unused FPA from another Producer. The court can review and

[11] Full Judgment text here: http://www.mojavewater.org/files/Judgment_5iftmzvq.pdf

adjust the FPA for each Subarea on an annual basis as appropriate. The dynamics of the FPA are discussed in more detail in Chapter 3.

2.1.2 Warren Valley Basin

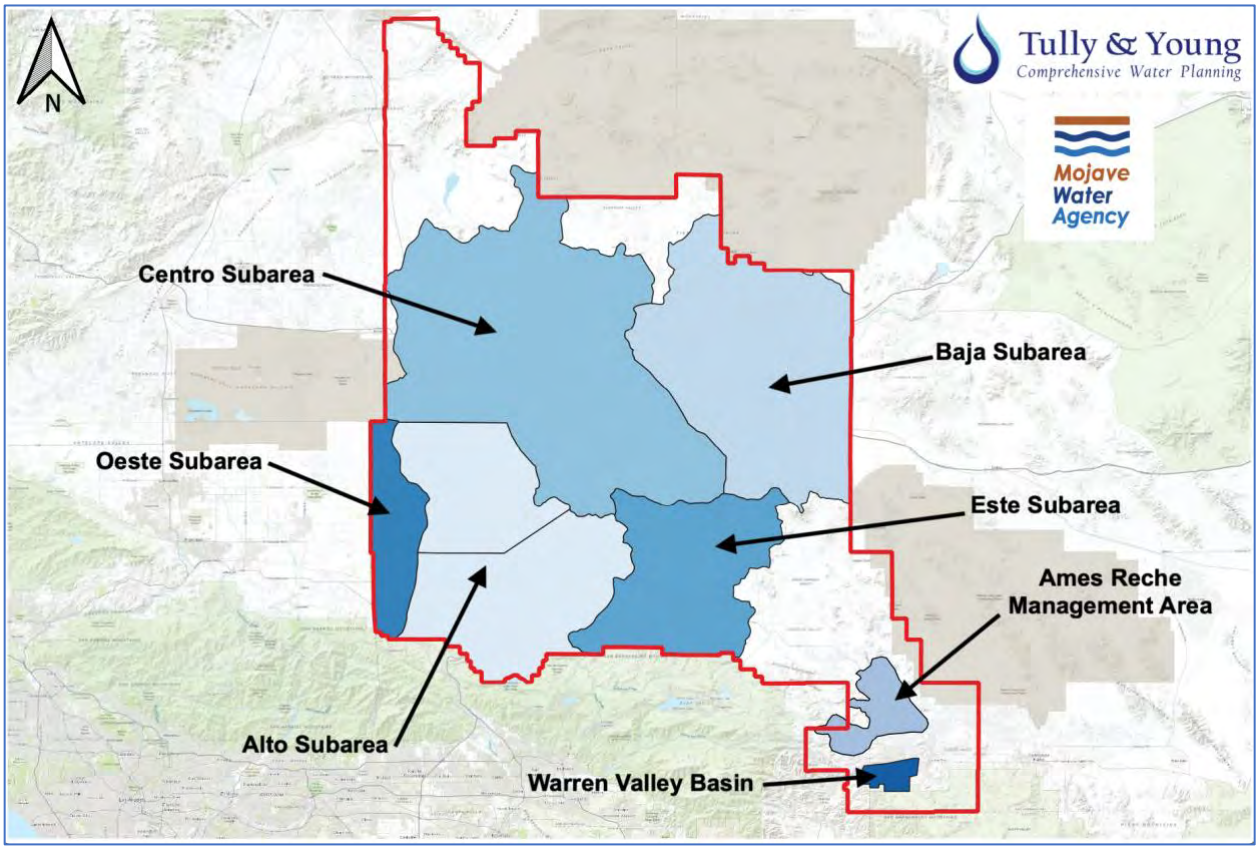
Groundwater within the Morongo Basin and Johnson Valley Area supplies the Town of Yucca Valley and surrounding areas. This is known as the Warren Valley Basin and, after extractions began exceeding supplies in the 1950s, the area was adjudicated in 1977 in a decision known as the Warren Valley Judgment. Hi-Desert Water District (HDWD) was appointed Watermaster in the Judgment and was ordered to help develop solutions to halting overdraft. A comprehensive approach was developed by the Watermaster Board which included adopting a Basin Management Plan that called for SWP water delivery from MWA through the Morongo Basin Pipeline to address demand and replenish overdraft. The Judgment is described in more detail in Chapter 3.

2.1.3 Ames Valley Basin

In 2014 the Ames/Reche Groundwater Storage and Recovery Program and Management Agreement replaced and superseded the original adjudication called Ames Valley Basin Water Agreement between HDWD and Bighorn-Desert View Water Agency (BDVWA) established in 1991. It was created for the construction and operation of the HDWD Mainstream Well located in the Ames Valley Basin. The 2014 Agreement was established by BDVWA, HDWD, County of San Bernardino, with administrative support provided by MWA, and the Stipulation and Amended and Restated Judgment was finalized by the Superior Court of California, County of Riverside in September 2014. The Ames/Reche Management Area includes 95 square miles encompassing the communities of Flamingo Heights, Landers, Pioneertown, and Yucca Mesa. The Judgment is described in more detail in Chapter 3.

A map of the Mojave Water Agency adjudicated areas is shown in Figure 2-2.

Figure 2-2: Adjudicated Areas



2.2 Integrated Regional Water Management Plan (IRWM)

In 2004 MWA and its regional partners adopted the first IRWM to establish a collaborative, stakeholder driven effort to manage water resources in the region. The latest IRWM plan was approved in 2014 with an amendment finalized in May 2018 after the IRWM Plan Standards were updated with Proposition 1 2016 IRWM Guidelines[12]. The IRWM covers objectives, resources management strategies, localized water and land use planning, and other DWR requirements. The Regional Water Management Group (RWMG) includes Mojave Water Agency, Victor Valley Wastewater Reclamation Authority, a Technical Advisory Committee, Mojave Desert Resource Conservation District, and Morongo Basin Pipeline Commission. The planning efforts identified in this program address necessary supply and infrastructure improvements with regional benefits to further long-term supply reliability.

[12] MWA IRMW 2018 Amendment Text: https://www.mywaterplan.com/files/MWA-IRWM-2018-Addendum_Final-Draft.pdf

2.3 Retail Water Suppliers

The Mojave Water Agency service area has many large, medium, and small urban retail water purveyors that provide water service to residents and businesses within the service area from local groundwater supplies. Among these are twelve that are specifically identified for purposes of this UWMP as they represent the predominant urban water uses in the region. Ten of these suppliers are required to complete their own Urban Water Management Plans, while the other two are not yet required to complete an UMWP.[13] Table 2-1 lists these twelve suppliers, approximate service area size, and estimated total connections.

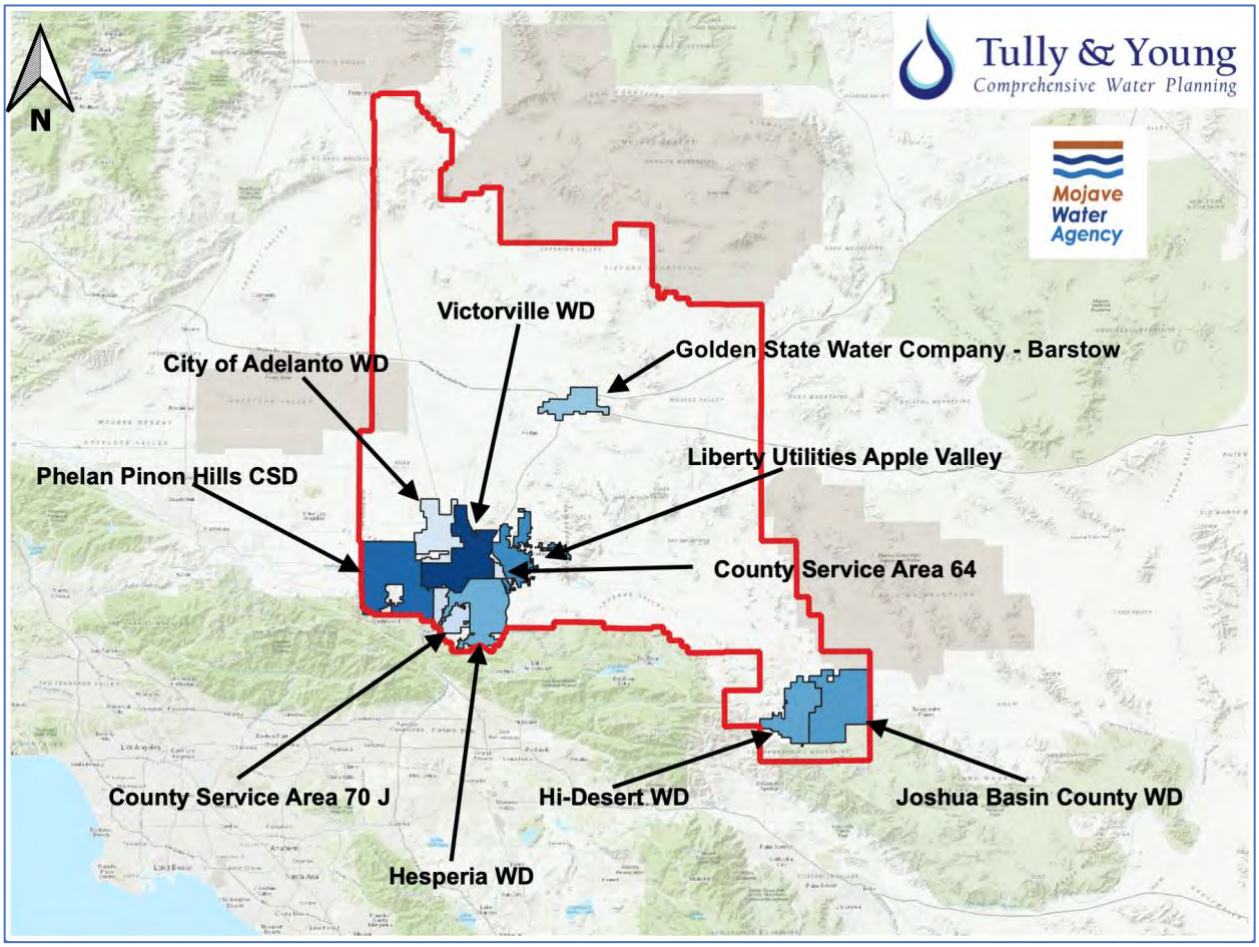
In addition to these urban retail suppliers, water users in the MWA service area also include irrigated agriculture, small public water systems, rural domestic residential users and a handful of industrial users.

Table 2-1: Retail Water Suppliers

Retails Supplier	Service Area (sq. miles)	Approximate Connections
City of Adelanto's Water Department	53	8,200
Liberty Utilities (Apple Valley Ranchos Water) Corp.	51	21,000
County Service Area 64	4	4,000
County Service Area 70J	28	3,400
Golden State Water Company - Barstow	33	9,300
Hesperia Water District	78	27,200
Hi-Desert Water District	57	10,800
Joshua Basin Water District	97	5,700
Phelan Piñon Hills Community Service District	118	7,200
Victorville Water District	85	36,000
Bighorn-Desert View Water Agency	n/a	< 3,000
Helendale Community Services District	n/a	< 3,000

[13] California Water Code Section 10620 requires an urban supplier serving more than 3,000 connections or 3,000 acre-feet to prepare an UWMP.

Figure 2-3: Large Retail Supplier Locations[14]



2.4 Service Area Climate

Located in the High Desert region of San Bernardino County, the climate in the service area of the Mojave Water Agency is more extreme than the lowland areas of Southern California. As is typical of the Mojave Desert, the area is very arid because of the rain shadow effect of the surrounding mountains. The summers are extremely hot and dry with occasional monsoonal thunderstorms that can bring flash flooding and hail. Most of the precipitation happens in winter, with snowfall possible, although much lighter than what occurs in the surrounding mountains and melting quickly.

The two major settlements in the service area are Victorville and its surrounding communities in the Victor Valley, and Barstow, which lies 32 miles to the north. Victorville averages 2,900 feet in elevation with Barstow lying at a lower average of 2,200 feet. The elevation change leads to slight differences in reported climate data for the two cities, therefore the following discussion reports data for each location to acknowledge the differences in climate throughout the large service area.

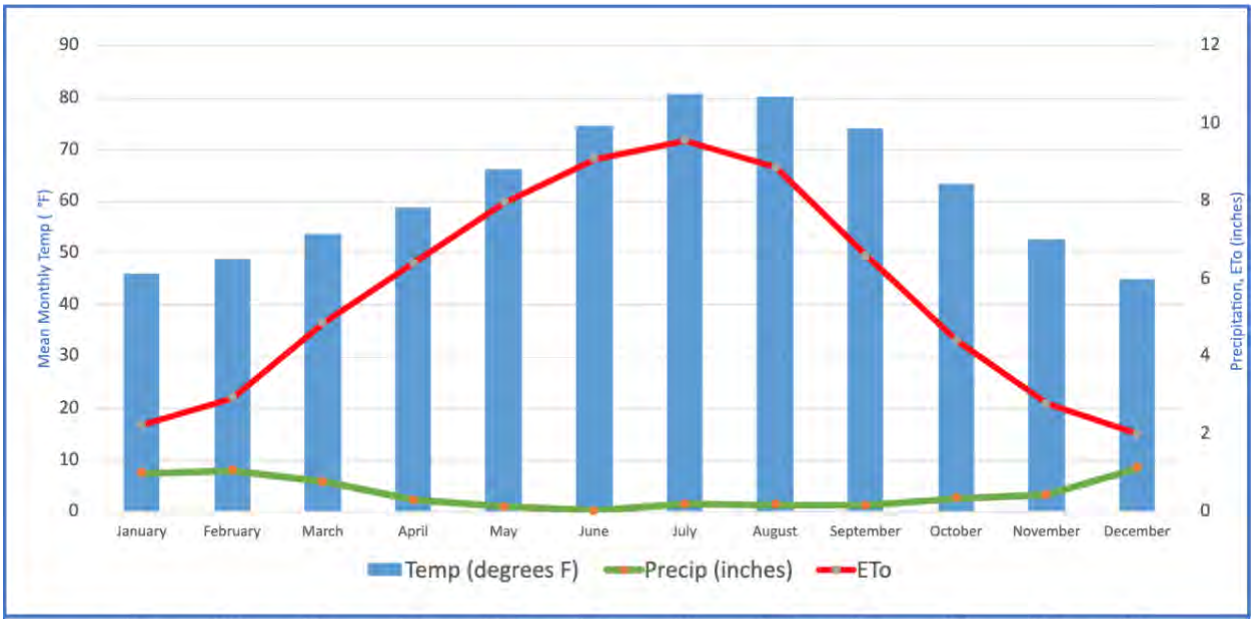
[14] Only the ten retail agencies preparing UWMPs are shown in this figure.

Historical averages show January as the coolest and wettest month, and July as the hottest and driest. The wet season is from December to March with a 30-year annual average rainfall of 5.80 inches for Victorville and 5.00 inches for Barstow. The annual mean temperature is 61 degrees for Victorville and 64 degrees for Barstow, but the High Desert climate leads to extreme temperature ranges with highs during the summer months regularly hitting the upper 90s for Victorville and past 100 degrees for Barstow, and lows in winter dropping to averages in the lower 30s in Victorville and mid 30s in Barstow.

Other climate characteristics of the MWA service area include monsoonal moisture in the later summer, which can cause thunderstorms. These thunderstorms do not deliver nearly as much rainfall as desert regions further east and the region receives and only a small fraction of the annual precipitation as the eastern areas. Snowfall in Victorville during the winter, if it occurs, is light and tends to melt before accumulating. Snow in Barstow is much rarer and occurs infrequently. Autumn averages very warm and dry conditions still and becomes cooler by November with rainfall beginning as California's monsoonal season begins. Winter conditions usually appear by late November. Spring is usually warm during the days although low temperatures are still quite cool. Rainfall usually tapers off by May.

Figure 2-4 shows the average monthly temperature, rainfall, and evapotranspiration (ETo) for the service area. This figure reports data from Victorville which is central to the MWA service area. Actual annual rainfall totals deviate quite significantly from the 30-year average as illustrated in Figure 2-5. In most years, precipitation totals fall below the mean.

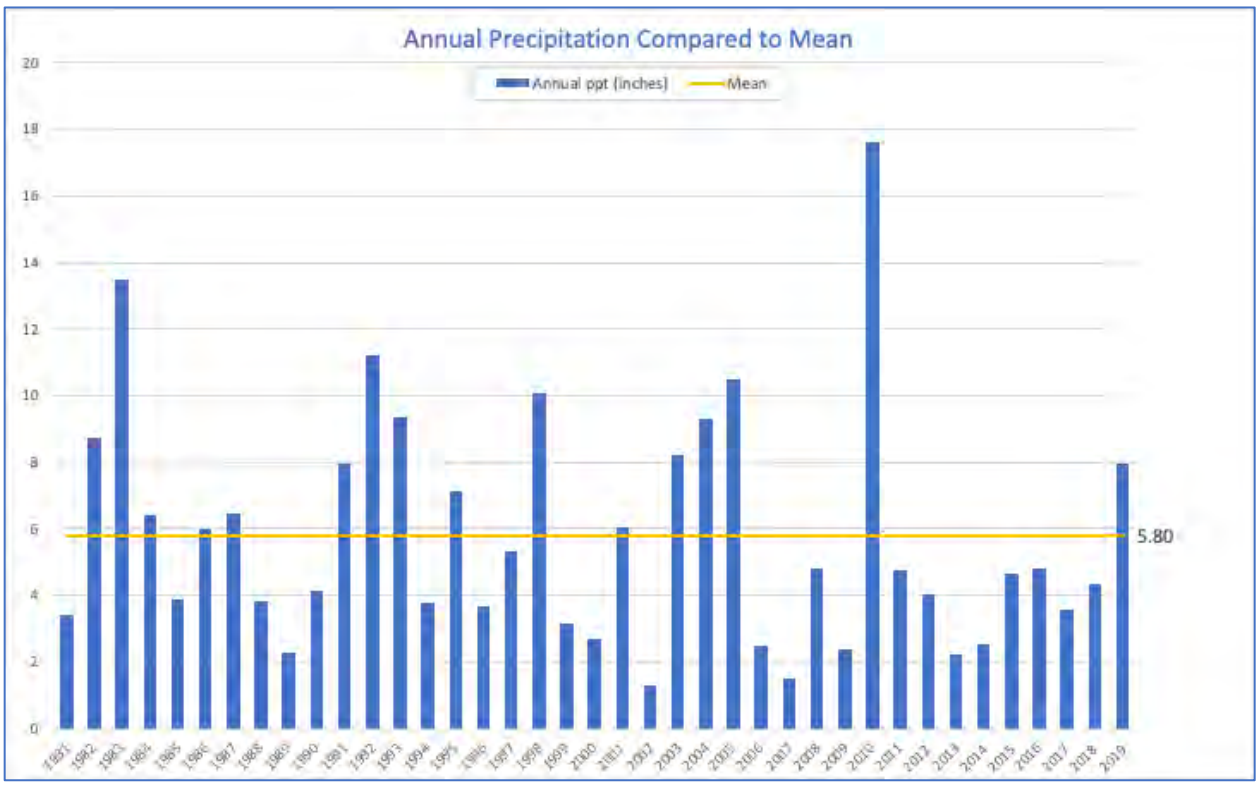
Figure 2-4: Average Climate Conditions[15]



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temp	46.0	48.7	53.6	58.8	66.2	74.5	80.7	80.1	74.1	63.4	52.6	45.0
Precip	1.00	1.08	0.77	0.30	0.13	0.04	0.19	0.19	0.17	0.35	0.44	1.14
ETo	2.24	2.94	4.87	6.42	7.97	9.09	9.57	8.88	6.60	4.41	2.78	2.00

[15] Temperature and rainfall data represents annual averages from 1981-2019 from the PRISM Climate Group https://prism.oregonstate.edu/ Location: Lat: 34.5450 Lon: -117.3310 Elev: 2887ft; ETo data is from CIMIS Victorville - San Bernardino - Station 117, Mar 1994-Nov 2020

Figure 2-5: Annual Precipitation Variability (1981 – 2019)



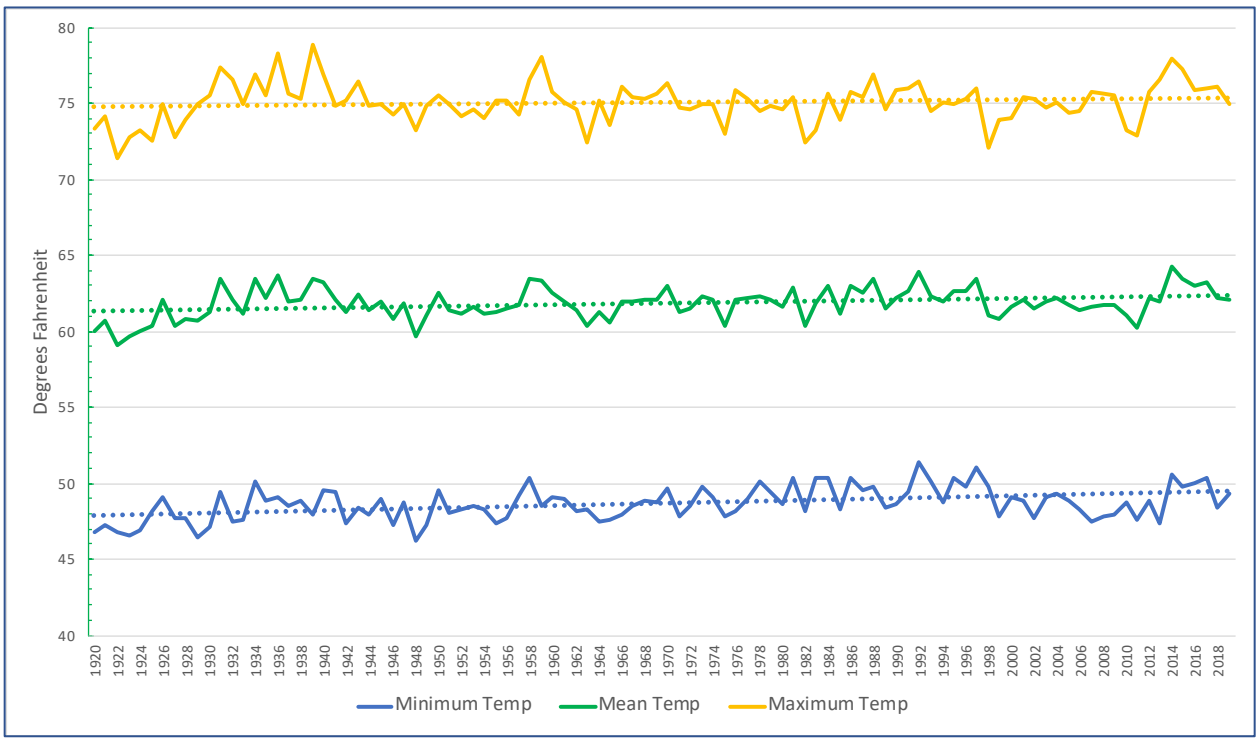
2.4.1 Climate Change

While the California Water Code does not prescribe specific climate change planning and management measures for water suppliers, it does emphasize that climate change is appropriate to consider when assessing drought risk assessment, water conservation and use efficiency, and demand management and supply—both in an historical and projected context.

The Mojave Water Agency provides imported water from Northern California and the Sacramento Delta through the State Water Project (SWP). Any effect from climate change that impacts water flows from the Sierra Nevada snowpack into these regions impacts SWP contractors that depend on SWP water deliveries, including MWA. The State Water Project Final Delivery Capability Report compiled by the state Department of Water Resources addresses the capabilities of the SWP to operate during more intense flood and drought cycles predicted to occur as a result of future climate change, including risk management for the Delta against rising sea levels. These effects are discussed further in Chapter 3.

As shown by the trendlines in Figure 2-6, the region has seen gradual warming in average temperatures over the past 100 years. Increasing temperatures locally within the service area can result in higher evapotranspiration, leading to additional water demand.

Figure 2-6: Historical Annual Temperature (1920-2019)[16]



The Mojave Integrated Regional Water Management Plan included a climate change assessment that evaluated the vulnerability of the region's surface water supplies, future frequency of flooding, and a complete inventory of greenhouse gas (GHG) emissions from the water sector. The plan offers a roadmap for the MWA to cooperate with its retail suppliers to meet federal and state requirements for conservation and reducing GHG from operations.

This 2020 UWMP Update includes additional climate change assessments in Chapter 3, Chapter 4, and Chapter 5.

2.5 Current and Projected Population, Land Use, Economy, and Demographics

Service area population and land use projections are critical to developing a useful planning framework as population dynamics and growth are a primary influence on water use. These projections directly influence planning measures for system supply, delivery, infrastructure, and demand management. Similarly, MWA service area's economic, social, and demographic trends give valuable insight to water management and planning. This section of the UWMP addresses these factors to provide a supportable basis for forecasting future water use. In 2020, MWA commissioned an update to its 2015 population

[16] Temperature data is from the PRISM Climate Group https://prism.oregonstate.edu/ Location: Lat: 34.5450 Lon: -117.3310 Elev: 2887ft

study to reflect on-going changes to local demographic and population characteristics.[17] This 2020 update provides the foundation for population information included in the following subsections and for the water use forecasts provided in Chapter 4.

2.5.1 Current Population and Historic Trends

The estimated population for the MWA service area was 487,923 for 2019, representing 22.3% of the total population of San Bernardino County. This is a significant increase from the turn of the 21st century when the service area only accounted for 16.0% of the population of the entire county. There was a sizeable migration into the incorporated cities within the MWA between 2000 to 2010; their annual average growth rate outpacing the overall county rate of 1.9%: Adelanto (5.9%), Apple Valley (2.5%), Hesperia (3.6%), and Victorville (5.8%). Between 2011 to 2019, that growth rate slowed to: 1.1% for Adelanto and 1.0% for Victorville, still outpacing the 0.8% rate for the county. Table 2-2 provides the MWA service area population.

Table 2-2: Population – Historical (1990 through 2019)

1990	2000	2010	2011	2012	2013
266,232	321,264	453,649	457,776	462,455	467,393

2014	2015	2016	2017	2018	2019
470,748	473,810	477,940	481,932	484,593	487,923

2.5.2 Projected Population

To forecast projected service area population as accurately as possible requires consideration of the past growth rate, local economic predictions, and current and projected land uses. Importantly, one of the recent statutory updates to the UWMP Act states urban water suppliers "shall coordinate with local or regional land use authorities" regarding land uses that may affect water management planning.

Population growth for California has been revised downward repeatedly as birthrates and migration have declined. San Bernardino County is no exception to this trend. From 2007 to 2018, birthrates in San Bernardino County dropped 24.2%. Net migration averaged below zero between 2010 to 2019. However, the incorporated cities of the MWA service area still have some of the most affordable housing in the entire Southern California region, which should keep growth rate above the county average. Growth is still projected to be above the state and county averages through 2060, but the rate is slower than previously forecasted. The University of California, Riverside, Center for Economic Forecasting and Development's MWA population update (the UCR Study) estimates the population of the MWA service area to increase by 39.2% in the next 40 years, compared to 21.1% for the entire county and 12.9% for the state at-large.

Permits for new home construction declined dramatically between 2010 to 2019 compared to the previous decade. In 2004, the pre-recession peak, more permits were issued for the MWA service area

[17] *Mojave Water Agency Population Forecast, 2020 Edition*, August 2020, UC Riverside School of Business Center for Economic Forecasting and Development

than during the entire last decade. However, a slow resurgence is now occurring. In 2019, 1,081 new home permits were issued, which is the most in the past 12 years. This and other important factors were evaluated in the UCR Study to derive projected populations for the entire MWA service area from 2020 through 2065. This population estimate was provided in the UCR Study using several different subdivisions within MWA's service area, including an estimate for population growth within each of the retail water service purveyors listed in Table 2-1. Table 2-3 provides the population estimates for the entire MWA service area and for the larger urban water supplier and through 2065. Notably, some of the retail urban service areas are expected to grow significantly, while others have only nominal growth. Victorville Water District, serving the growing city of Victorville, and Hesperia Water District, serving the growing city of Hesperia, are expected to see the most significant growth.

The projected population growth is reflected in several known development projects as well as expected but yet-to-be named new developments that will be necessary to accommodate the expected growth.

Table 2-3: Population – Projected (2020 through 2065)

	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065
Mojave Water Agency Service Area	492,319	533,170	567,855	592,849	614,931	634,934	653,017	669,424	684,247	697,603
Large Urban Water Supplier										
Liberty Utilities - Apple Valley Water Company	62,081	65,745	68,699	71,045	73,215	75,146	76,847	78,364	79,710	80,904
Bighorn-Desert View Water Agency	4,118	4,178	4,243	4,298	4,349	4,397	4,441	4,482	4,520	4,555
City of Adelanto Water District	35,811	39,238	41,958	44,242	46,159	47,770	49,125	50,269	51,238	52,062
County Service Area 64	11,244	11,691	12,099	12,390	12,646	12,884	13,103	13,304	13,490	13,661
County Service Area 70 J	10,162	10,356	10,554	10,721	10,876	11,021	11,153	11,275	11,387	11,491
Golden State Water Company - Barstow System	32,154	32,574	33,017	33,427	33,801	34,135	34,432	34,697	34,934	35,145
Helendale CSD	6,629	6,725	6,830	6,919	7,001	7,078	7,149	7,215	7,276	7,333
Hesperia Water District	97,380	107,045	115,279	121,959	128,221	133,910	139,001	143,602	147,734	151,431
Hi-Desert Water District	25,653	26,600	27,414	28,124	28,751	29,306	29,796	30,231	30,615	30,956
Joshua Basin Water District	10,227	10,375	10,536	10,673	10,800	10,919	11,029	11,131	11,225	11,313
Phelan Pinon Hills CSD	20,836	21,136	21,465	21,744	22,003	22,245	22,469	22,676	22,869	23,048
Victorville Water District	134,273	154,831	172,220	183,018	192,113	200,486	208,262	215,447	222,044	228,069

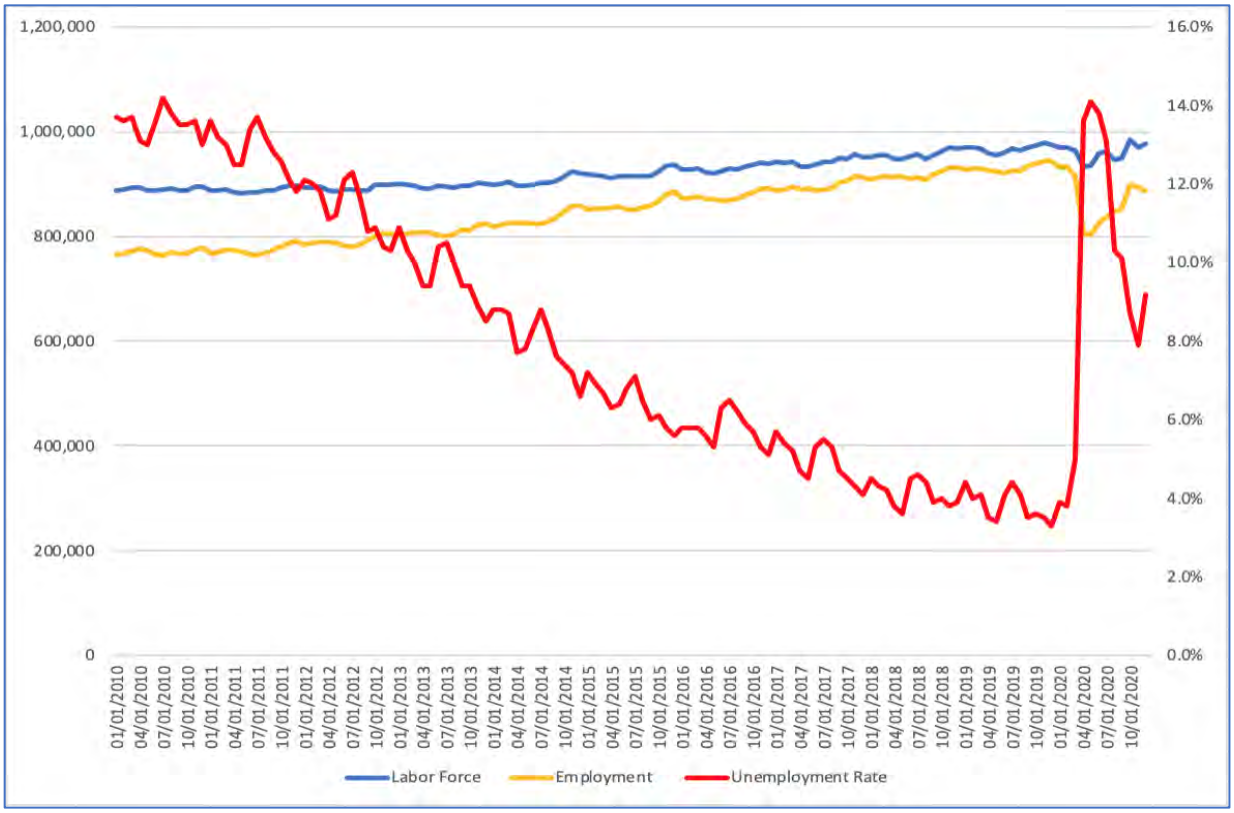
2.5.4 Economic Trends & Other Social and Demographic Factors

The Inland Empire has seen some of the strongest employment growth in California since the end of the Great Recession, with the third largest workforce of the state's metropolitan areas. As a logistical hub for the region, there has been significant employment increases in the transportation, trade, and warehouse industries. With relatively more affordable housing compared to areas closer to the coast, there is also a large commuter population that work in nearby Los Angeles and Orange Counties. The

number of residents commuting to jobs in neighboring counties is expected to increase in the near-term as housing prices continue to rise and supply remains constrained. Over the past decade, the employment growth rate for nonfarm labor in the Inland Empire outpaced all other regions in Southern California and sustained less economic impact from the Covid-19 recession than Los Angeles, Orange, or San Diego Counties. A main driver of this explosive growth has been in logistics, which ballooned at a rate of 47.7%, three times the rate of neighboring counties.

The Covid-19 recession has severely impacted the service sector, especially leisure/hospitality and in-store retail. The healthcare sector has also experienced significant job losses as patients cancel routine and elective procedures due to the mandated lockdowns. The total non-farm employment rate contracted 10% in the first four months of the pandemic. However, demand for transportation and warehousing increased, driven by a shift to online commerce and direct-to-consumer shopping. Although cities in the MWA service area offer more affordable housing compared to the rest of the region, relatively lower paying jobs in the booming logistics industry may not be enough to overcome the desirability of other states, especially Texas and Arizona, which are attracting large numbers of Californians with their booming economies. California is expected to continue losing residents in net domestic migration, although positive net foreign migration is currently offsetting that loss.

Figure 2-5: San Bernardino County Employment Data, 2010 - 2020[18]



[18] U.S. Bureau of Labor Statistics

2.6 Delivery System Details

This subsection focuses specifically on Mojave Water Agency's potable water delivery system. The water supplies delivered through this system are described in Chapter 3, with water uses described in Chapter 4.

The MWA manages the groundwater basin for the many retail agencies with five existing sources of water: natural supply, SWP resources, return flow, wastewater imports from outside of the MWA service area, and stored water.

Local groundwater supply is naturally recharged by surface water from the Mojave River and its watershed. Most of this water enters MWA area aquifers from the San Bernardino Mountains as rainfall and snowmelt. Local pumped groundwater accounts for nearly all the water supplied to residential, commercial, and agricultural users in the area. Production wells are common throughout the region, ranging from small homeowner wells to the large municipal water supplier wells, some of which pump millions of gallons per day. Each retail water supplier serving over 3,000 AF/YR is required to complete its own UWMP describing their individual delivery system detail. This UWMP focuses on the MWA wholesale delivery system.

MWA relies on SWP supply to supplement groundwater supplies. Two major pipelines bring water from the California Aqueduct. The Mojave River Pipeline is approximately 76 miles long, extending from the Aqueduct in the Phelan area to four groundwater recharge sites along the Mojave River. These basins are located at Hodge, Lenwood, Daggett/Yermo, and Newberry Springs. The Mojave River Pipeline delivers up to 45,000 acre-feet of water per year to the Mojave Basin Area. The second major pipeline linking the SWP to the Mojave service area is the Morongo Basin Pipeline which currently delivers water to groundwater recharge sites in Hesperia, Landers, Yucca Valley, and Joshua Tree. It is a 71-mile underground pipeline built by MWA which brings recharge water to Deep Creek and Rock Springs within the Mojave Basin Area, Ames/Reche, and percolation ponds within the Hi-Desert Water District and Joshua Basin Water District in the Morongo Basin. MWA also owns and operates the Oro Grande Wash Pipeline to deliver water to the Mojave Basin at Amethyst Basin.

The Deep Creek/Rock Springs recharge facility delivers water from the SWP directly to the Mojave River bed. This floodplain zone has high percolation rates allowing water to recharge the aquifer directly upstream of the area with the highest groundwater pumping demand in MWA's service area. The facility includes a pipeline which extends south along the river from the Morongo Basin Pipeline, a flow control facility and outlet. It can recharge a maximum of approximately 40,000 acre-feet per year.

The Amethyst Basin facility, completed in 2019, delivers SWP water to recharge the Oro Grande Wash in Victorville just east of Sycamore Street and Amethyst Road in Victorville. It provides flood control and allows recharge through a series of dikes and recharge ponds. Water from the State Water Project is delivered to the recharge ponds through a pipeline that connects to the California Aqueduct at the Highway 395 turnout. Recharge capacity is about 8,000 acre-feet per year.

The Ames/Reche recharge facility delivers water from the State Water Project directly to the Pipes Wash in Landers, located north of Yucca Valley. The Ames/Reche facility consists of a pipeline extending west

from the Morongo Basin Pipeline at Winters Road to an outlet in Pipes Wash. Construction of the pipeline, flow control facility, and outlet was completed in 2014. The turnout is planned to flow up to a maximum capacity of five cubic feet per second, recharging a maximum of approximately 1,500 acre-feet per year.

Silverwood Lake is a reservoir owned and operated by the State of California and DWR. At the California Aqueduct terminus in Hesperia, water is siphoned into the lake where it is stored for use in San Bernardino and Inland Empire areas. MWA takes deliveries of SWP from the lake via the Cedar Springs Dam which releases into the Mojave River.

MWA also operates the Regional Recharge and Recovery Project (R-Cubed) which is a conjunctive use project which stores SWP deliveries in recharge sites in the floodplain aquifer along the Mojave River in Hesperia and southern Apple Valley. MWA's production wells, located just downstream from the aquifers, recover and deliver the stored water through pipelines directly to water providers, including Liberty Utilities in Apple Valley, City of Adelanto, City of Hesperia, Golden State Water Company, San Bernardino County Service Area 64, and the Victorville Water District.

2.7 Energy Intensity

Among the statutory changes enacted with new requirements for 2020 UMWPs, an urban supplier shall include any of the following information it can readily obtain in the 2020 UWMP:[19]

- An estimate of the amount of energy used to extract or divert water supplies.
- An estimate of the amount of energy used to convey water supplies to the water treatment plants or distribution systems.
- An estimate of the amount of energy used to treat water supplies.
- An estimate of the amount of energy used to distribute water supplies through its distribution systems.
- An estimate of the amount of energy used for treated water supplies in comparison to the amount used for nontreated water supplies.
- An estimate of the amount of energy used to place water into or withdraw from storage.
- Any other energy-related information the urban water supplier deems appropriate.

Referred to as "Energy Intensity Reporting" for urban water suppliers, energy Intensity is defined as: total amount of energy expended in kilowatt-hours (kWh) by the urban water supplier on a per acre-foot (AF) basis to take water from the location where the urban water supplier acquires the water to its point of delivery.

For purposes of the 2020 UWMP, MWA uses the Total Utility Approach for reporting its energy intensity. This method sums the annual energy consumed for all water management processes, divided by total volume of water in acre feet. These processes include extraction, diversion, conveyance, placement into storage, treatment, and distribution, as applicable. Hydropower generation also occurring within the

[19] California Water Code Section 10631.2(a).

MWA system is considered a net benefit and subtracted from the total use. The total energy intensity is reported in Table 2-4.

Table 2-4: Energy Intensity – Total Utility Approach for October 2019 through September 2020

	Sum of All Water Management Processes	Hydropower	Net Utility
Volume of Water Entering Process (acre-feet)	5,824	1,476	4,348
Energy Consumed (kWh)	5,461,865	632,590	4,829,275
Energy Intensity (kWh/acre-foot)	938	429	1,111

Chapter 3
Water Supply

This section describes Mojave Water Agency's (MWA) water supply sources. The description includes the historical sources available to MWA as well as projected water supply sources through 2065.[20] MWA uses this significantly longer time horizon, beyond the recommended 25-years, to anticipate supply reliability, project development, and system operational actions within its boundaries. MWA delivers water supplies to retail agencies and end users by making surface water deliveries to groundwater systems in the MWA service area boundary that can be extracted by other water users.

MWA categorizes its supply sources in essentially two groupings. The first grouping includes supply sources that are generally available on an annual basis. These sources include MWA's State Water Project supplies that are made available each year. Other sources may occasionally fall into this category but are not incorporated into the 2020 UWMP. The second set of supply sources are those that MWA could make available in any given year but are generally not renewable in MWA's supply portfolio once they are used. In other words, although they can be replaced, like a water savings account, they are not guaranteed to be replaced on an annual basis. MWA's long-term water supply management actions focus on optimal utilization of its annually available supply sources and protection of its pre-stored supply sources to guard against extended drought conditions and catastrophic outage impacting water users in its service area. This section describes MWA's water supply portfolio and develops a supply matrix that integrates the supply sources to reflect MWA's operational objectives.

3.1 MWA Surface Water Supply Sources

In June of 1963, MWA entered a State Water Project water service contract (SWP Contract) with the State of California Department of Water Resources (DWR). The SWP Contract authorized DWR to deliver SWP water to MWA under certain terms and conditions. MWA's original SWP Contract has numerous amendments that modify the original 1963 terms and conditions. The SWP Contract was "consolidated" into the "Consolidated Contract" to provide a more approachable reference document" for contract terms.[21]

[20] The UWMP Act mandates a 20-year planning horizon and the UWMP Guidebook recommends a 25 year planning horizon.

[21] The Consolidated Contract has the following disclaimer: "This document integrates Mojave Water Agency's State Water Project water supply contract and amendments to the contract entered into since June 22, 1963. It is intended only to provide a convenient reference source, and the Department of Water Resources is unable to provide assurances that this integrated version accurately represents the original documents. For legal purposes,

MWA's water supply activities intersect with groundwater management in the MWA service area. MWA provides its SWP surface water for groundwater recharge as part of the Mojave Basin Area Adjudication (Mojave Adjudication) and the Warren Basin Adjudication (Warren Adjudication). For both adjudications, MWA imports SWP water through its SWP Contract and delivers the water to various recharge sites to meet the essential purposes of the adjudications. MWA also stores its water assets in the Mojave Basin and the Morongo Basin for future access and delivery for intended uses. The details of these groundwater management activities are described later in this section.

3.1.1 State Water Project Overview

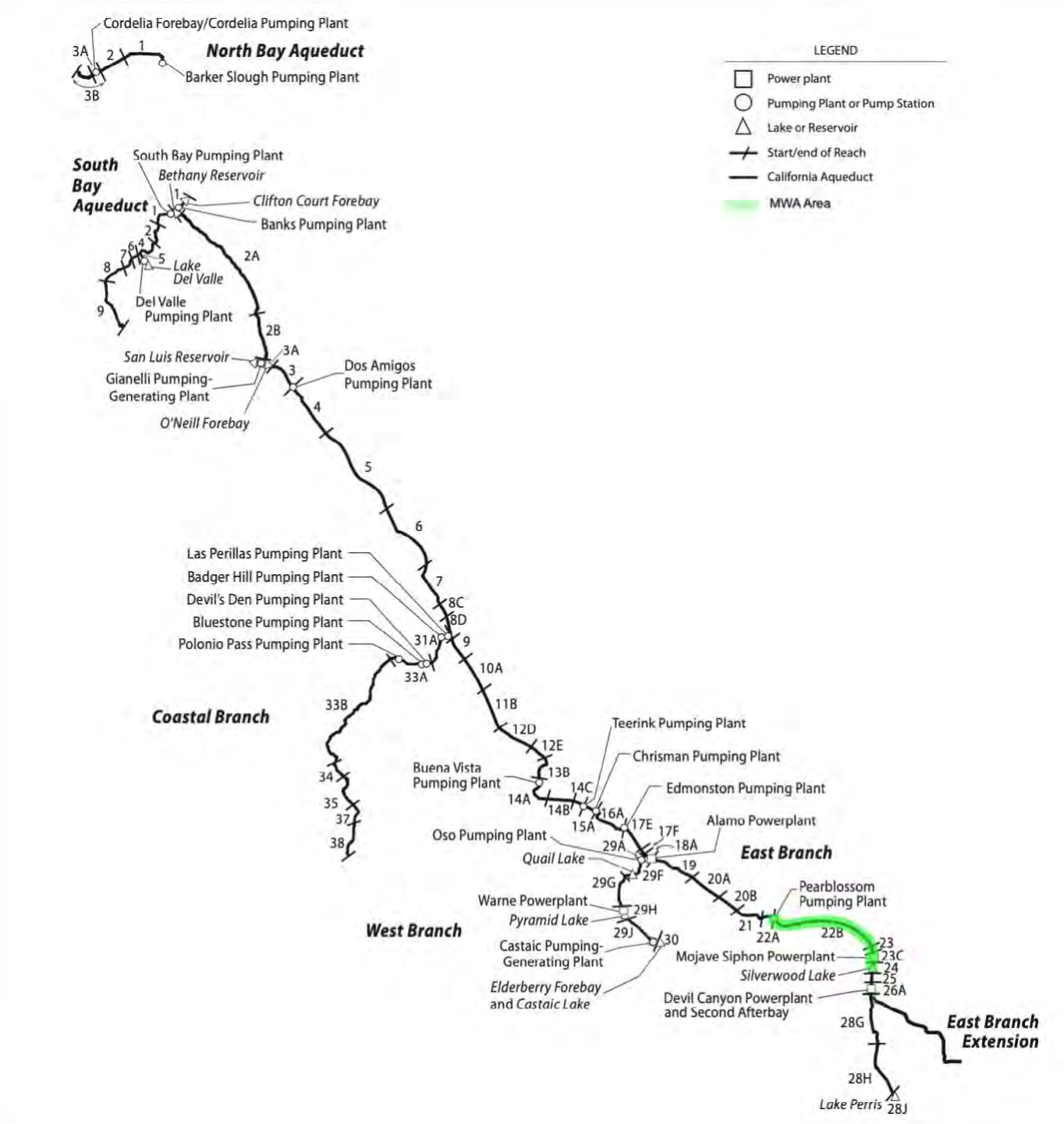
The State Water Project (SWP) is the largest state-built, multi-purpose water project in the country. It was authorized by the California State Legislature in 1959, with the construction of most facilities completed by 1973. Today, the SWP includes 28 dams and reservoirs, 26 pumping and generating plants, and approximately 660 miles of aqueducts.

The primary water source for the SWP is the Feather River, a tributary of the Sacramento River. The water flowing in the Feather River is captured by the SWP Oroville dam in the Oroville reservoir. Storage released from the Oroville reservoir flows down natural river channels to the Sacramento-San Joaquin River Delta (Delta). While some SWP supplies are pumped from the northern Delta into the North Bay Aqueduct or diverted by SWP contractors upstream, the vast majority of SWP supplies are pumped from the southern Delta into the 444-mile-long California Aqueduct. The California Aqueduct conveys water along the west side of the San Joaquin Valley through seven pumping facilities and eventually to the Edmonston Pumping Plant, where water is pumped over the Tehachapi Mountains. From there, the California Aqueduct divides into the East and West Branches. MWA takes its SWP deliveries from the East Branch of the California Aqueduct. MWA delivers its SWP supplies to recharge local groundwater basins through transmission pipelines, recharge facilities, and direct releases from Silverwood Lake, an SWP regulating reservoir. Figure 3-1 below depicts the SWP facilities that deliver water to MWA and Figure 3-2 details the sections of the Mojave Division Reaches of the California Aqueduct.

MWA is one of 29 water agencies that have a SWP Contract with DWR. Each SWP contractor's SWP Contract contains a "Table A Annual Amount" which lists the contracted maximum amount of water an agency may receive under its contract. Table A Annual Amount is also used in determining each contractor's share of the total SWP water supply DWR determines to be available each year. The total planned annual delivery capability of the SWP and the sum of all contractors' maximum Table A Annual Amount amounts was originally 4.23 million acre-feet.

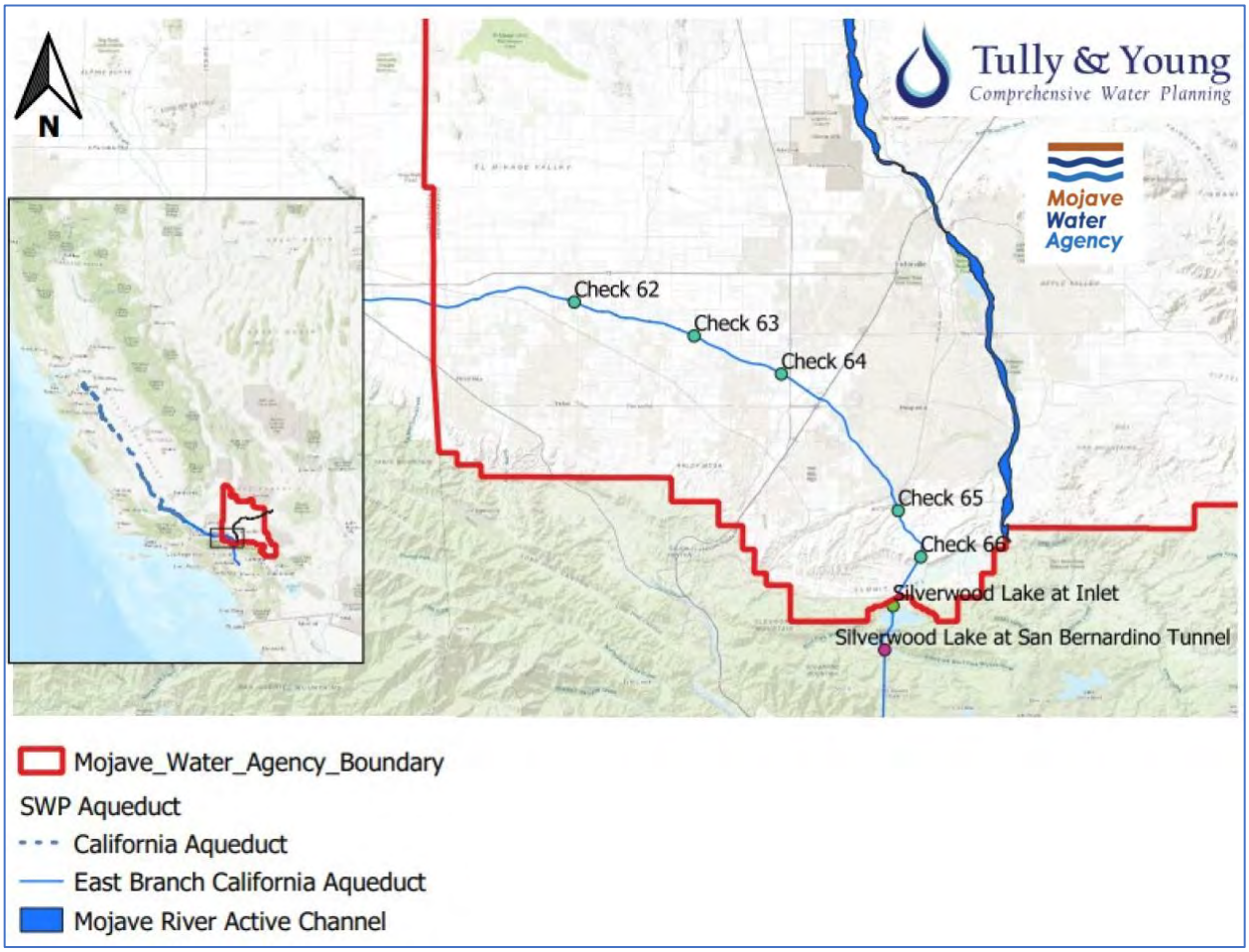
or when precise accuracy is required, users should direct their attention to original source documents rather than this integrated version."

Figure 3-1: SWP Facility Map[22]



[22] Modified Figure B-4 from DWR Bulletin 132-20

Figure 3-2: SWP Mojave Division Aqueduct Reach Sections

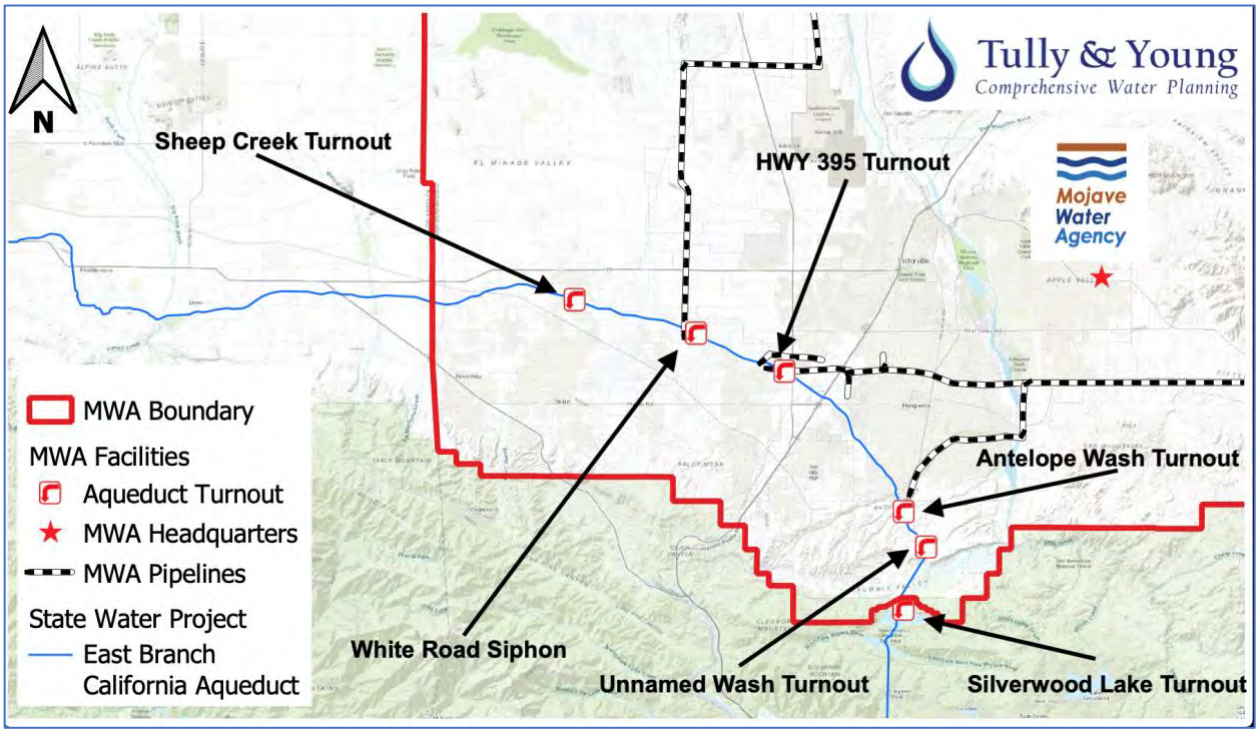


The initial SWP storage and conveyance facilities were designed to meet contractors' water demands with the construction of additional storage facilities planned as demands increased. However, few additional SWP storage facilities have been constructed since the early 1970s and a portion of the original conveyance design was never completed. SWP conveyance facilities were generally designed and have been constructed to deliver Table A amounts to all contractors. The maximum Table A Annual Amount amounts of all SWP contractors now totals about 4.133 million AF[23] but full Table A Annual Amount deliveries to all SWP contractors rarely occurs.

MWA diverts its SWP water from the East Branch of the California Aqueduct. MWA has six turnout locations on the East Branch (identified from West to East): Sheep Creek Turnout, White Road Turnout, Highway 395 Turnout, Antelope Siphon Turnout, Unnamed Wash, and Cedar Springs Dam (Silverwood Lake). These turnouts are used to deliver water to recharge facilities located throughout the MWA service area. Figure 3-3 below depicts the Mojave Water Agency water turnout and delivery facilities.

[23] The Final State Water Project Delivery Capability Report, DWR, August 2020 at 30.

Figure 3-3: SWP Mojave Turnouts



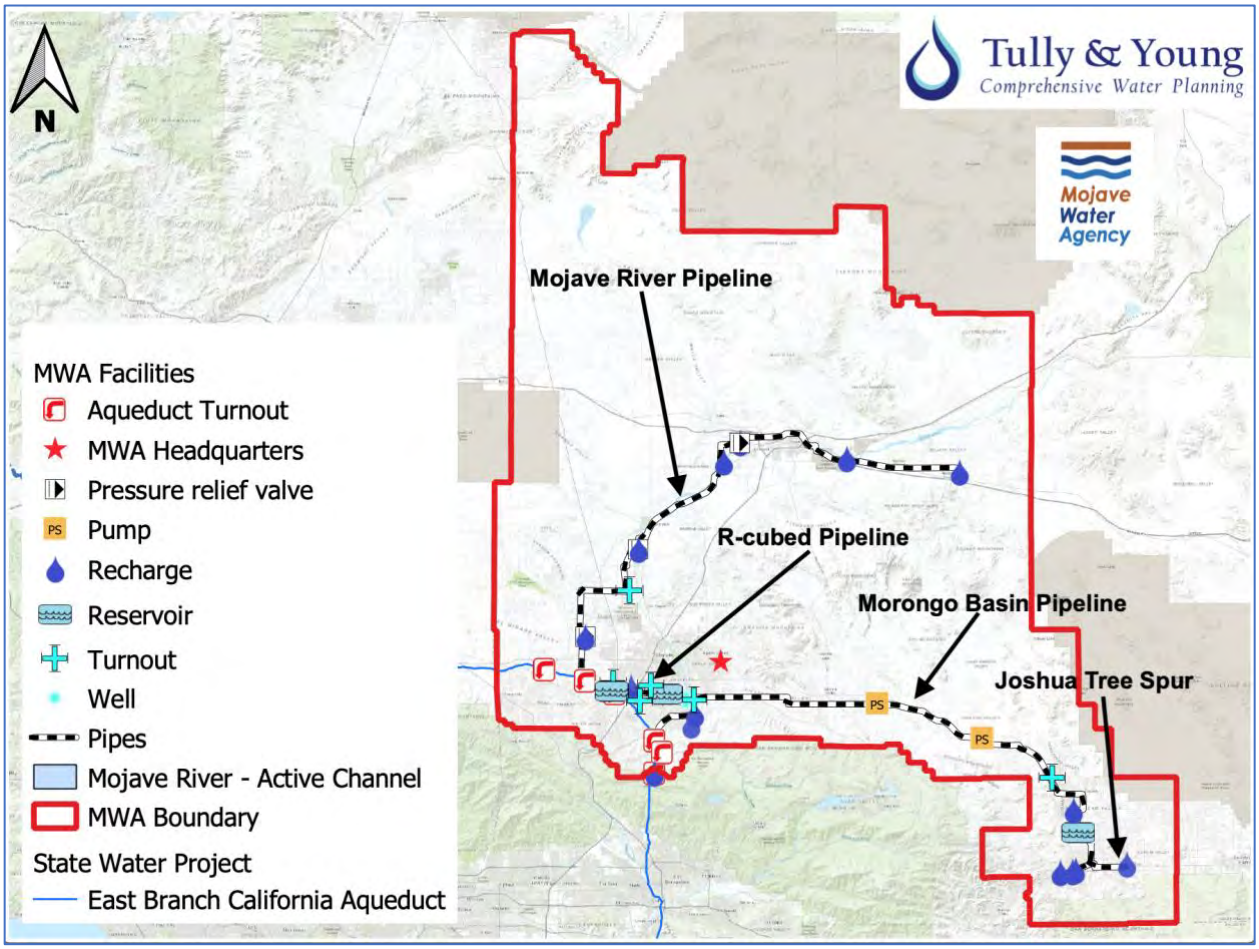
The numerous turnout and recharge locations typify MWA's fundamental responsibility: to bring SWP surface water into the MWA service area to recharge the groundwater basins. Four major conveyance projects affect the delivery and recharge of MWA water supplies throughout its service area: (1) the Mojave River Pipeline; (2) the Oro Grande Pipeline; (3) the Morongo Basin Pipeline; and (4) Cedar Springs Dam Cone Valve. These facilities provide the backbone infrastructure for MWA's water management activities. The groundwater basins and MWA's roles and responsibilities related to the groundwater basins are further described in later sections of this document.

Table A Allocations

MWA's Table A Annual Amount was 82,800 acre-feet per year up through 2014. From 2015-2019, MWA's Table A Contract Allocation was 85,800. Since 2020, MWA's Table A Contract Allocation is 89,800 acre-feet. MWA's Table A Annual Amount represents a maximum contract amount that could be available each year assuming that the SWP could deliver 100% of contract supplies to all SWP contractors. The last 100% allocation year occurred in 2006.[24] The characterization of the history of MWA's Table A Annual Amount is important in understanding the historically available supplies to MWA and how the available supplies have been managed. MWA's SWP Contract has numerous components that allow MWA to administer and control the annually available SWP water supplies.

[24] State Water Project Historical Table A Allocations Years 1996-2020.

Figure 3-4: MWA Facilities



Historical SWP Table A Allocations

Normally, SWP Table A allocations are less than 100% of MWA's Table A Annual Amount. Annual SWP Table A allocations fluctuate based upon hydrology, water storage, and regulatory criteria in the Delta. MWA's Table A Annual Amount and its water storage and banking activities have rendered these fluctuations less problematic than they might otherwise be for other SWP contractors that rely on direct SWP deliveries. Table 3-1 below shows the MWA Table A Annual Amount from 2010 through 2020, the SWP Table A percent allocation, and the final available Table A allocation amount (Table A) from 2010-2020.

Table 3-1: SWP Table A Allocations and Deliveries (values in acre-feet)

Year	Table A Annual Amount	Percent Allocation	Allocation Amount
2010	82,800	50%	41,400
2011	82,800	80%	66,240
2012	82,800	65%	53,820
2013	82,800	35%	28,980
2014	82,800	5%	4,140
2015	85,800	20%	17,160
2016	85,800	60%	51,480
2017	85,800	85%	72,930
2018	85,800	35%	30,030
2019	85,800	75%	64,350
2020	89,800	20%	17,960

Future SWP Allocations and Long-Term Reliability

DWR has suggested that it is less likely that 100% allocation years will occur on a regular basis in the future. In August 2020, DWR finalized the "2019 SWP Delivery Capability Report" (DCR) that outlined the probable future water supply allocations for the SWP system. The DCR showed variations in future Table A deliveries based upon hydrological and regulatory conditions. These conditions are summarized in Table 3-2 below.

Table 3-2: SWP Estimated Table A Deliveries from DCR[25] (values in 1,000 acre-feet)

Year	Long Term Average		Single Dry Year (1977)		Dry Periods							
					2 Year Drought (1976-1977)		4-Year Drought (1931-1934)		6-Year Drought (1987-1992)		6 Year Drought (1929-1934)	
2017 Report	2,571	62%	336	8%	1,206	29%	1,397	34%	1,203	29%	1,408	34%
2019 Report	2,414	58%	288	7%	1,311	32%	1,228	30%	1,058	26%	1,158	28%

As shown in Table 3-2, SWP long-term average reliability shows a long-term average downward trend from 62% in the 2017 SWP Delivery Capability Report to 58% in the 2019 DCR. Further, in the future condition with climate change and sea level rise scenario discussed within the Technical Addendum of the DCR, SWP long-term average reliability reduces to 52%. Consistent with the 2019 DCR, MWA characterizes the 2020 SWP long-term average reliability at 58% declining to 52% by 2040. MWA maintains a 52% Table A Annual Amount availability through its planning horizon of 2065. Thus, in 2020, MWA's projected Table A Annual Amount is characterized as 58% of 89,800 acre-feet or 52,084 acre-feet per year. In 2025, the long-term reliability is reduced to 56.5%. In 2030 it is reduced to 55% and in 2035 it is reduced to 53.5%. From 2040 through 2065 MWA's Table A Annual Amount is 52% of 89,800

[25] The Final State Water Project Delivery Capability Report (DCR), California Department of Water Resources (DWR), August 2020 at 30. Values in TAF/Yr.

acre-feet or 46,696 acre-feet. Table 3-3 shows the projected Table A Normal year long-term average deliveries from 2025 through 2065.

Table 3-3: SWP Future Table A Projected Normal Year Deliveries (values in acre-feet)

2025	2030	2035	2040	2045	2050	2055	2060	2065
50,737	49,390	48,043	46,696	46,696	46,696	46,696	46,696	46,696

The 2017 and 2019 DCR depict the single driest year as 1977 with an 8% allocation estimate in 2017 and a 7% allocation estimate in 2019. However, the single lowest historical SWP allocation occurred in 2014 at 5% as shown in Table 3-1. As such, out of an abundance of caution, MWA will use 5% of 89,800 acre-feet or 4,490 acre-feet per year as the single dry year allocation through 2065.

The DCR also identifies various drought periods for purposes of characterizing SWP allocation percentages that would accompany those drought periods. The averaging of the allocations over the course of the drought period is not representative of MWA's drought planning preparedness. As such, MWA will use the following drought characterization for its short-term and long-term planning: dry year 1 at 35%; year 2 at 5%; year 3 at 5%; year 4 at 20%; and year 5 at 35%. This characterization adequately represents a critical drought over five consecutive year period with two extreme drought years imbedded in the assessment. MWA uses these two extreme drought conditions out of an abundance of caution to ensure its available supplies meet its long-term demands. Table 3-4 shows the normal year, single dry year, and five consecutive dry years planned SWP Table A Allocation for Mojave Water Agency through 2025.

Table 3-4: Future SWP Allocations by Year Type (values in acre-feet)

Year		SWP Contract Table A	Percent Allocation	Allocation Amount
Normal		89,800	58%	52,084
Single Dry		89,800	5%	4,490
Multi-Year Drought	2021 (1st year)	89,800	35%	31,430
	2022 (2nd year)	89,800	5%	4,490
	2023 (3rd year)	89,800	5%	4,490
	2024 (4th year)	89,800	20%	17,960
	2025 (5th year)	89,800	35%	31,430

Table 3-5 shows the normal year, single dry year, and five consecutive dry years planned SWP Table A Allocation for MWA through 2065.

Table 3-5: Future SWP Allocations by Year Type from 2025-2065 (values in acre-feet)

Total Supply		2025	2030	2035	2040	2045	2050	2055	2060	2065
Normal		50,737	49,390	48,043	46,696	46,696	46,696	46,696	46,696	46,696
Single Dry Year		4,490	4,490	4,490	4,490	4,490	4,490	4,490	4,490	4,490
Multi-Year Drought	Year 1	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430
	Year 2	4,490	4,490	4,490	4,490	4,490	4,490	4,490	4,490	4,490
	Year 3	4,490	4,490	4,490	4,490	4,490	4,490	4,490	4,490	4,490
	Year 4	17,960	17,960	17,960	17,960	17,960	17,960	17,960	17,960	17,960
	Year 5	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430	31,430

The characterizations of MWA's SWP Table A Allocation long-term reliability reflect numerous hydrological and regulatory issues that inform the DCR modeling, are reasonable assessments related to SWP system management, and reflect MWA's local conditions. Long-term water management hydrological and regulatory issues include the Bay-Delta Water Quality Control Plan, the Coordinated Operations Agreement, the Delta Biological Opinion, the Delta Conveyance Project, modifications to San Luis Reservoir, SWP seismic considerations, DWR's Emergency Planning, and assessments related to MWA's local groundwater conditions and climate. MWA thoughtfully engages on all these issues and undertakes actions that help mitigate supply related impacts that may be caused by one or more listed items. These issues are all considered in MWA's planning and incorporated into its supply characterizations in this 2020 UWMP.

Table A Carryover Water

MWA's SWP Contract allows it to forego delivery of its allocated SWP Table A supply and retain a portion of that allocated supply in storage for future use. This retained supply is termed "Carryover" and is governed under Article 56 of MWA's SWP contract. Carryover water is water that is released from Oroville dam and reservoir, re-diverted at the Delta, and then stored in San Luis Reservoir – an offstream reservoir located just outside the City of Santa Nella at the junction of Interstate 5 and California State Highway 152. San Luis Reservoir is jointly owned and operated by the state and federal governments and all SWP contractors may use the storage facility to manage Carryover water supplies. In short, the San Luis Reservoir receives, regulates, and stores exported water derived from the State Water Project and Federal Central Valley Project.

The amount of water that MWA may carryover in any given year is subject to a set of rules that implicate all SWP contractors throughout California. MWA delivers its Table A supplies to Carryover in San Luis Reservoir with an expectation that it will be able to divert all or a portion of these supplies in a subsequent year. If water supplies are abundant, San Luis Reservoir may "spill." When San Luis Reservoir reaches a "spill" stage, DWR may release MWA's Carryover under a set of reservoir release rules as they apply in the context of all entities with stored water in San Luis Reservoir. Nevertheless, MWA generally retains a portion of its Table A supply as Carryover in any given year and continues to maintain a Carryover balance. Table 3-6 shows MWA's Carryover balance from 2010 through 2020.

Table 3-6: MWA Historic SWP Carryover Storage and Use

Year	Source	Available Carryover
2010	97-12 Historic Delivery Database	268
2011	97-12 Historic Delivery Database	41,400
2012	97-12 Historic Delivery Database	33,120
2013	Finalization Report	3,839
2014	Finalization Report	2,419
2015	Finalization Report	1,169
2016	Finalization Report	11,719
2017	Finalization Report	42,900
2018	Finalization Report	53,246
2019	Finalization Report	44,507
2020	Finalization Report	40,424

MWA will manage its Table A Carryover supplies in future years based upon the hydrological and regulatory conditions. The Table A Carryover supplies result from multiple variables that are tied to the SWP Table A annual allocation, operations in San Luis Reservoir, and water supply management by MWA throughout its service area. Accordingly, water years 2012 through 2016 above are generally representative of a five-year Carryover supply availability for MWA and include 2014 and 2015, two of the driest years on record. For planning purposes, however, MWA conservatively estimates future Carryover supplies in a normal year to be approximately 20,000 acre-feet and carryover in a single dry year to be approximately 2,000 acre-feet. The future normal year Carryover supply represents less than half of MWA's normal year allocation based upon DWR's 2019 DCR.[26] Table 3-7 shows the representative Table A Carryover supply in a normal water year.

Table 3-7: Normal Year Table A Carryover Supplies (AFY)

Year	Table A Carryover Supply
Normal	20,000

MWA's Table A Carryover supplies are incorporated into its stored water management portfolio. Although MWA may use its Carryover supplies under normal year conditions, it generally preserves these supplies to manage shortage conditions derived from an extended drought or catastrophic water outage. As such, for planning purposes, this 2020 UWMP incorporates MWA's Table A Carryover supply as a component of stored water for its water management purposes contemplated in this Chapter.

MWA Groundwater Banking

MWA also directly stores imported water supplies in groundwater basins within the MWA service area. MWA's total stored water in the Mojave Basin Adjudication subbasins in September 2020 was

[26] This conservative number was chosen based upon the ongoing negotiations between DWR and SWP Contractors to determine SWP water that will be permitted as carryover in San Luis Reservoir. We anticipate that this number will be more than 20,000 acre-feet in a normal year but use this figure out of an abundance of caution.

approximately 191,915 acre-feet. Table 3-8 shows MWA's groundwater storage accounts in the various Mojave Basin Adjudication Subareas. As an aside, MWA is charged with using its currently banked supplies by 2036 per the Mojave Basin Adjudication discussed later in this chapter but anticipates replenishing banked supplies on a regular basis to extend this use timeline.

Table 3-8: MWA Groundwater Stored by Mojave Basin Subarea (September 2020).

Mojave Basin	Alto	Baja	Centro	Este	Oeste
191,915	141,219	24,754	24,622	1,320	0

MWA also stores water in other local groundwater basins under other storage agreements for a total storage of 192,948 acre-feet. Specifically, MWA stores water in the Morongo Basin under two separate agreements in the Ames-Reche and Joshua Basin.[27] Table 3-9 depicts MWA's total current groundwater storage in all areas in the Mojave Service Area boundary.

Table 3-9: MWA Total Stored Groundwater (September 2020).

Total Groundwater Storage	Mojave Basin	Ames-Reche	Joshua Basin
192,948	191,915	373	660

MWA will continue to store groundwater in the identified basins. Table 3-10 shows the future storage conditions through 2065. It is important to note that MWA continues to build its stored groundwater supplies in all areas and is addressing additional management actions that will increase the annual storage when water is available. This continued management objective in local groundwater basins helps mitigate long-term drought and catastrophic outages.

Table 3-10: MWA Future Stored Groundwater

Years	Mojave Basin	Ames-Reche	Joshua Basin	Total
2020-2065	191,915	373	660	192,948

Nevertheless, for purposes of this 2020 UWMP, 200,000 AF is used as the baseline stored groundwater number for assessing available supplies. This figure includes the groundwater stored in the local basins as well as carryover water supplies stored in the State Water Project. Furthermore, additional storage may be available in the future in other areas. MWA will manage its annual supplies to maintain its long-term storage balance to mitigate against dry conditions and catastrophic outages.

[27] Water assets are also stored with Hi-Desert Water District but those are not incorporated into this total assessment.

Water Transfers and Exchanges

MWA also engages in water transfers and exchanges involving its SWP assets. Historically, MWA has both received and delivered water through these transfers and exchanges with various agencies throughout California. Specifically, MWA has most recently engaged in transfers and exchanges with Metropolitan Water District of Southern California, Central Coast Water Authority, Santa Clara Valley Water District (Valley Water), Kern County Water Agency, and Dudley Ridge Water District. Future MWA transfers and exchanges depend upon the allocations available to MWA and other water purveyors, MWA's Carryover objectives, MWA's in service area groundwater banking opportunities, and the financial viability of engaging in transfers and exchanges. MWA engages in transfers and exchanges but characterizes any obtained supplies as supplementary sources to its existing supplies for its customers. MWA does not rely on transferred or exchanged supplies to meet the water reliability projections contained in this 2020 UWMP.

3.2 MWA Managed Groundwater

Water supply derived from Managed Groundwater is the primary source of water for all entities within the MWA service area. As noted above, MWA supports the groundwater management within its service area by importing water supplies that are used to replenish groundwater extractions and support the legal and regulatory requirements of the applicable management structures. MWA is the court appointed Watermaster for the Mojave Basin Area Adjudication and provides a management service to ensure compliance with the legal documents. MWA also assists other entities within its service area in managing groundwater under other legal criteria and agreements. Accordingly, MWA has important responsibilities in supporting water supply development in the various groundwater basins within its boundary.

3.2.1 Groundwater Basin Description

The MWA service area overlies all or a portion of 36 groundwater basins and subbasins as defined by DWR Bulletin 118.[28] Collectively, these basins and subbasins are broadly grouped into two larger hydrogeologic distinct areas – the South Lahontan Hydrologic Region and the Colorado River Hydrologic Region. Groundwater basins along the Mojave River and adjacent areas are referred to as the Mojave River Groundwater Basin and is commonly referred to as the Mojave Basin Area. Remaining basins in the southeastern Mojave Region are generally referred to as the Morongo Basin/Johnson Valley Area or "Morongo Area" with the exception of the Lucerne Valley. The Lucerne Valley subbasin is divided along the Helendale Fault with the southwest portion in the Mojave River Groundwater Basin and the northeast portion in the Morongo Area. Surface water drainage of Lucerne Valley is in the Colorado River Hydrologic Region but is not included in with the "Morongo Basin Area," isolating this area due to the hydrogeologic conditions.

The Mojave River Groundwater Basin is the larger and more developed of the two areas. The 36 groundwater basins and subbasins are listed in Table 3-11 and grouped by the South Lahontan (Region 6) and Colorado River (Region 7) Hydrologic Regions. The Mojave Service Area also overlaps a small

[28] https://water.ca.gov/Programs/Groundwater-Management/Bulletin-118

portion of a DWR basin in the South Coast Hydrologic Region (Region 8) as shown by the last subbasin listed in Table 3-11 – the Upper Santa Ana Valley. These Basins are also shown on the map in Figure 3-4 below.

Groundwater flow in the Morongo Area is complex but is generally from south to north in Johnson Valley and from west to east-northeast elsewhere in the area. Natural recharge originates primarily from the mountains on the southern and western boundaries of the Morongo Area, resulting in groundwater flow gradients to the north, east, and south adjacent to the boundaries, before turning to the east-northeast. Groundwater flow is complicated locally by pumping, faulting, shallow bedrock, and enhanced recharge basins. For example, in the vicinity of the developed area of Yucca Valley, groundwater flow is controlled to some extent by local recharge basins.

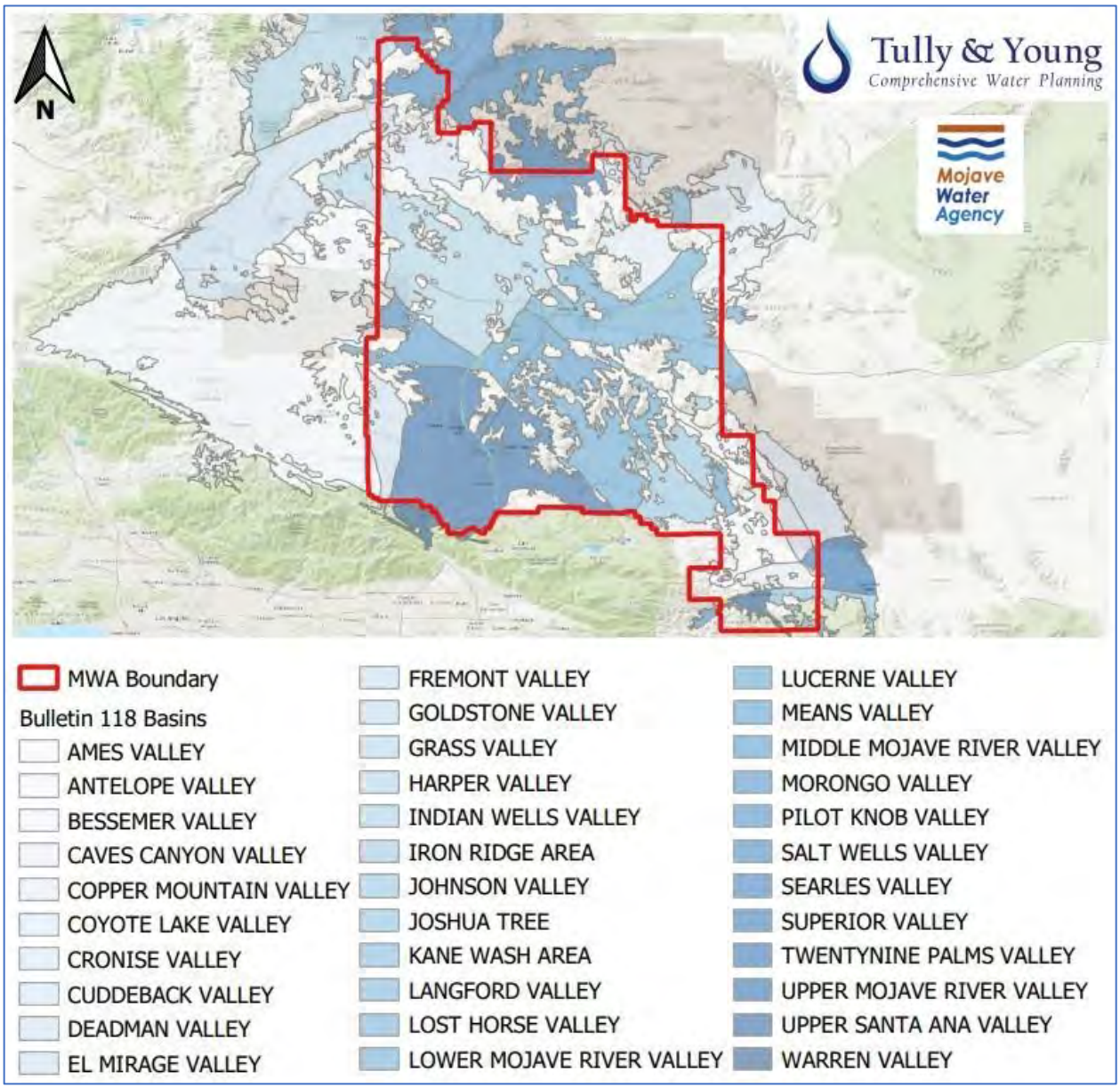
Table 3-11: DWR Groundwater Basins

DWR Basin	Groundwater Basin Name	DWR Basin	Groundwater Basin Name
South Lahontan Hydrologic Region		**Colorado River**	
6-35	Cronise Valley	7-10	Twentynine Palms Valley
6-36	Langford Valley	7-11	Copper Mountain Valley
6-37	Coyote Lake Valley	7-12	Warren Valley
6-38	Caves Canyon Valley	7-13	Deadman Valley
6-40	Lower Mojave River Valley	7-13	Deadman Valley
6-41	Middle Mojave River Valley	7-15	Bessemer Valley
6-42	Upper Mojave River Valley	7-16	Ames Valley
6-43	El Mirage Valley	7-17	Means Valley
6-44	Antelope Valley	7-18	Johnson Valley
6-46	Fremont Valley	7-18	Johnson Valley
6-47	Harper Valley	7-19	Lucerne Valley
6-48	Goldstone Valley	7-20	Morongo Valley
6-49	Superior Valley	7-50	Iron Ridge Area
6-50	Cuddeback Valley	7-51	Lost Horse Valley
6-51	Pilot Knob Valley	7-62	Joshua Tree
6-52	Searles Valley	8-2	Upper Santa Ana Valley
6-53	Salt Wells Valley		
6-54	Indian Wells Valley		
6-77	Grass Valley		
6-89	Kane Wash Area		

The Mojave River is the largest river in the Mojave Basin Area, formed by the confluence of the West Fork of the Mojave River and Deep Creek. These streams originate in the northwestern San Bernardino Mountains. The Mojave Basin Area is essentially a closed basin meaning that very limited amounts of groundwater enter or exit the basin. However, within the basin, groundwater movement occurs between the different Subareas, as well as groundwater-surface water and groundwater-atmosphere interchanges. Groundwater is recharged into the basin predominantly by infiltration of stormflow runoff water from the San Bernardino Mountains into the Mojave River. Other sources of recharge include infiltration of storm runoff into small streams and desert washes, and other activities such as irrigation return flows, wastewater discharge, and enhanced recharge with imported water.

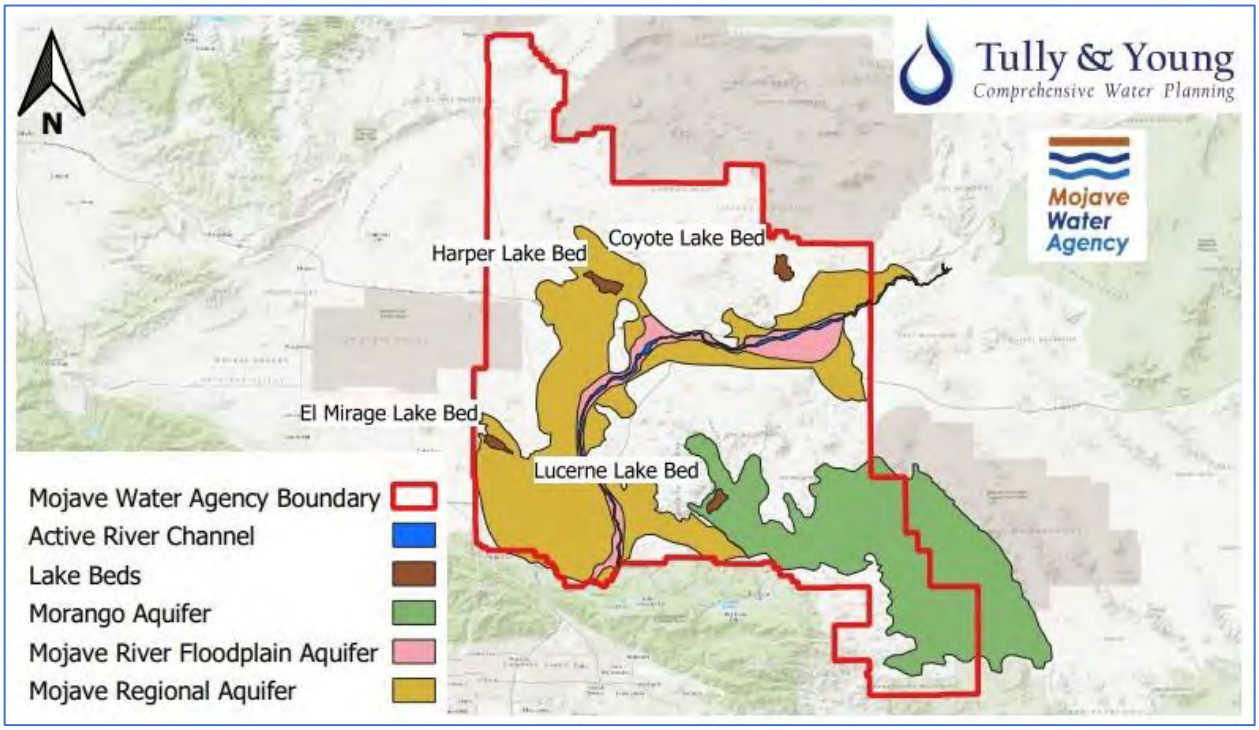
Groundwater is discharged from the Mojave Basin Area primarily by well pumping, evaporation through soil, transpiration by plants, seepage into dry lakes where accumulated water evaporates, and seepage into the Mojave River.

Figure 3-4: DWR Basins in MWA Area



Recent investigations by MWA, USGS, and others have resulted in an improved understanding of the geology and hydrogeology of the Mojave Basin Area. Specifically, a more refined examination of the hydrostratigraphy has allowed for differentiation between the more permeable Floodplain Aquifer that has a limited extent along the Mojave River and the more extensive but less permeable Regional Aquifer. The aerial extent of the Floodplain and Regional aquifers is shown in Figure 3-5. In the Mojave Basin Area, Alto, Centro, and Baja Subareas contain both the Floodplain Aquifer and the Regional Aquifer while Oeste and Este Subareas only contain the Regional Aquifer.

Figure 3-5: Floodplain and Aquifers in MWA Area



The Floodplain Aquifer is composed of sand and gravel weathered from metamorphic and granitic rocks of the San Gabriel and the San Bernardino Mountains, respectively, and deposited in a fluvial environment. The Floodplain Aquifer is directly recharged by infiltration of surface flows from the Mojave River during the winter rainy season. Recharge is greater near the mountain front where surface flows are more frequent.

The Regional Aquifer underlies and surrounds the Floodplain Aquifer with interconnected alluvial fan and basin fill deposits. The Regional Aquifer is generally recharged by groundwater movement from the Floodplain Aquifer to the Regional Aquifer, infiltration of runoff from the higher altitudes of the San Gabriel and San Bernardino Mountains, and smaller amounts of runoff from local intermittent streams and washes.

The Morongo Area includes 15 groundwater basins/subbasins that cover portions of the Morongo Area as defined in this plan as shown in Table 3-11. Several of these basins lie mostly outside of the MWA service area, have low population, and are essentially undeveloped with respect to groundwater. The remaining basins have been grouped into six regions for the Morongo Area.

There are two important subareas within the Morongo Areas. The first is the Warren Valley Basin. The Warren Valley Basin covers an area of approximately 17,200 acres and includes the water-bearing sediments beneath the town of Yucca Valley and the surrounding area. The Warren Valley Basin is bounded in the north by the Pinto Mountain fault, on the south by the bedrock outcrop of the Little San Bernardino Mountains, on the east by a bedrock constriction called the "Yucca Barrier," and on the west by a bedrock constriction and a topographic divide. A 1977 judgment established the rights to extract groundwater from the Warren Valley Basin and will be described in more detail later in this chapter.

Natural recharge to the Warren Valley Basin includes direct percolation of precipitation and percolation of ephemeral streamflow from Water Canyon and Covington Canyon.

The second important subarea is the Ames Valley Basin that is an important source of groundwater for producers within the Mojave Water Agency service area. The Ames Valley Basin covers an area of approximately 110,000 acres and is bounded by the San Bernardino Mountains on the west, Iron Ridge to the north, the Hidalgo Mountain on the northeast, and various fault-lines on the east and northern boundaries. The Ames Valley Basin is also subject to stringent groundwater extraction and recharge rules under the Ames/Reche Groundwater Storage and Recovery Program Management Agreement described elsewhere in this chapter.

3.2.2 Mojave Basin Area Adjudication[29]

The adjudication of the Mojave Basin Area was the legal process that allocated the right to produce water from the available natural water supply. Until adjudication proceedings were initiated and an independent Court issued the Mojave Basin Area Judgment, water production rights and obligations had never been defined in the Mojave Basin. Triggered by the rapid growth within the Mojave Water Agency service area, particularly in the Victor Valley area (the cities of Adelanto, Apple Valley, Hesperia, Victorville, and surrounding communities), the City of Barstow and the Southern California Water Company filed a complaint in 1990 against upstream water users claiming that the increased withdrawals and lowering of groundwater levels reduced the amount of natural water available to downstream users. The complaint requested that 30,000 acre-feet of water be made available to the Barstow area annually and that MWA obtain supplemental water for use in throughout MWA's service area.

The Mojave Water Agency then filed a cross-complaint that declared that the native waters of the Mojave River and underlying groundwater were insufficient to meet the current and future demands. The cross-complaint asked the court to determine the water rights of all surface water and groundwater users within the Mojave Basin Area and the Lucerne and El Mirage Basins. Two years of negotiations resulted in a proposed Stipulated Judgment that: 1) formed a minimal class of producers using 10 acre-feet or less per year who were dismissed from the litigation, and 2) offered a physical solution (an equitable remedy designed to alleviate overdrafts in a basin, consistent with the constitutional mandate to prevent waste and unreasonable water use and to maximize the beneficial use of the limited resource) for water production by the remaining producers. The Riverside Superior Court (Court) bound the stipulating parties to the Stipulated Judgment in September 1993, and further bound the non-stipulating parties to the terms of the Stipulated Judgment in January 1996 following trial. The Court appointed the Mojave Water Agency as Watermaster of the Mojave Basin Area.

Some of the non-stipulating parties appealed the Judgment of the Superior Court, and the Appellate Court issued a final decision in June 1998. The final decision of the Appellate Court held the stipulating parties to the terms of the Stipulated Judgment, but excluded the appealing parties with the exception of one appellant who sought a revised water production right under the Judgment. MWA requested the

[29] Twenty-Sixth Annual Report of the Mojave Basin Area Watermaster for Water Year 2018-19, May 1, 2020 at 2-8 (hereafter "Watermaster Report").

California Supreme Court to review the Appellate Court's decision and the Supreme Court affirmed the majority of the Appellate Court's decision but overturned the decision of the Appeals Court as to the one party seeking additional production rights. Since 1996, most of the appealing parties have stipulated to the Judgment.

For management purposes, the Mojave Basin Area is separated into five distinct "Subareas" as shown in Figure 3-6, namely Oeste, Este, Alto, Centro, and Baja. The Subarea boundaries are generally based on hydrologic divisions defined in previous studies (California Department of Water Resources (DWR) 1967), evolving over time based on a combination of hydrologic, geologic, engineering, and political considerations. Also, for the purposes of implementing the Judgment, the northern part of the Alto Subarea was defined as a sub-management unit – the Alto Transition Zone. This zone was created to acknowledge local geology and to better understand the water flow from Alto to Centro.

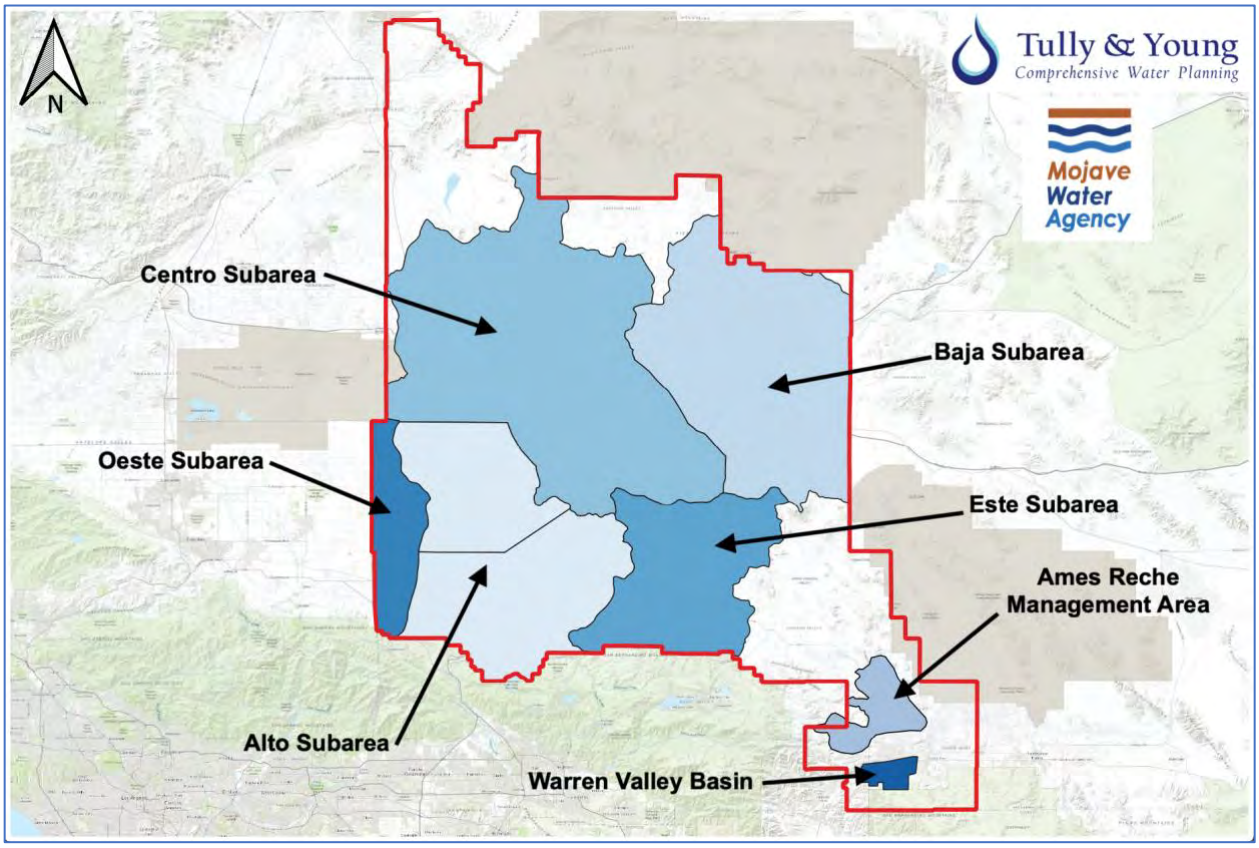
The Mojave Basin Judgment assigned Base Annual Production (BAP) rights to each producer using 10 acre-feet or more, based on historical production during the period 1986-1990. Parties to the Judgment are assigned a variable Free Production Allowance (FPA), which is a percentage of the BAP set annually by the Court for each Subarea based on the recommendation of the Watermaster. The BAP is reduced or "ramped-down" over time until FPA comes within 5 percent of the Production Safe Yield (PSY) as defined by the Judgment. The FPA is set as follows for each Subarea for water year 2020-2021:[30]

- Alto Subarea - 65 percent of BAP for agriculture and 55 percent of BAP for municipal and industrial
- Oeste Subarea - 65 percent of BAP
- Este Subarea - 70 percent of BAP
- Centro Subarea - 70 percent of BAP
- Baja Subarea – 25 percent of BAP

Any Producer that pumps more than their FPA must purchase Replacement Water from the Watermaster equal to the amount of production in excess of their total available FPA or transfer unused FPA from another party within their Subarea. Funds collected for Replacement Water are then used by the MWA for purchase of SWP supplies and recharged into the Subarea they were produced from. In addition to purchasing water to offset the Replacement Water Obligations under the Judgment, MWA purchases and stores water in the Mojave Basin Area for future obligations.

[30] Watermaster Report at 37. Revised by Court Order on 6/16/20 revising Watermaster report to reduce Alto FAP and Court Order on 8/18/2020 revising Watermaster report to reduce Oeste FAP.

Figure 3-6: Adjudicated Areas in MWA

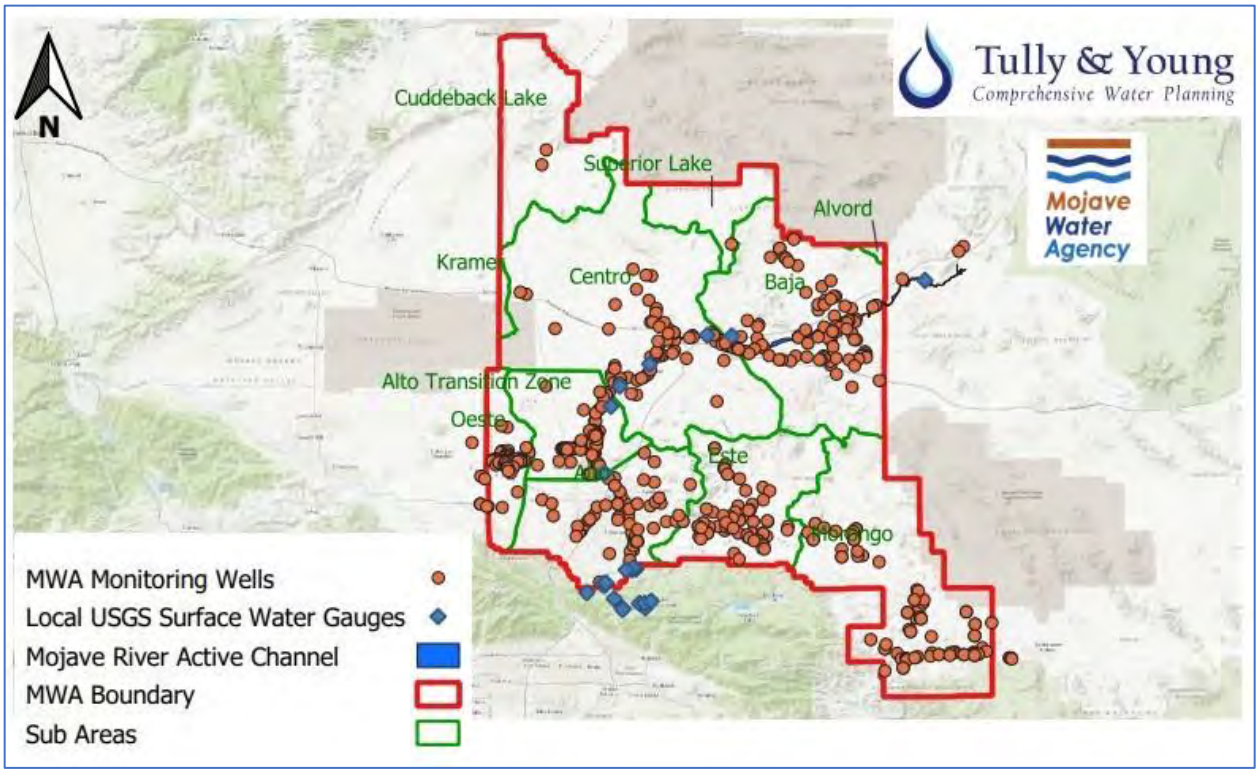


In addition to conducting regional groundwater management, in 1990 MWA entered into a joint agreement with the USGS to develop and fund the Cooperative Water Resources Program (CWRP). The CWRP provides funding for a) groundwater level measurement and groundwater quality sampling activities across the Mojave River and Morongo groundwater basins; b) stream gage maintenance and continuous flow monitoring of the Mojave River; c) continuous and discrete sampling of Mojave River water quality; and d) review and uploading of data collected under the CWRP and other MWA groundwater monitoring programs to the publicly available USGS National Water Information System (NWIS) website. Using these data, MWA tracks water level trends and fluctuations throughout the service area. And, as part of basin characterization activities, multiple regional groundwater modeling projects have been developed in the MWA service area to aid in management of groundwater. MWA continues to apply and refine these models in key management areas to better manage water quantity and quality.

The MWA maintains a comprehensive groundwater monitoring program consisting of approximately 850 wells. The Watermaster tracks water production within each of the five Subareas in the Mojave Basin Area as part of the Watermaster's investigation into Subarea conditions and recommendations on groundwater pumping amounts. The Watermaster relies on MWA's groundwater level monitoring program along with production records to make recommendations regarding the sustainability for each of the Subareas. Figure 3-7 shows the locations of groundwater level monitoring and surface water

gauges. A summary of the recent water level trends for each of the five Subareas in the Mojave Basin Area is presented below.

Figure 3-7: Groundwater Monitoring Locations



3.2.3 Warren Valley Adjudication and Ames/Reche Agreement

The Warren Valley Basin is also subject to a Court Judgment (Warren Valley Basin Judgment) that is administered by the Hi-Desert Water District acting as the Court-appointed Watermaster. The Warren Valley Basin Judgment established the exclusive rights to extract groundwater from the Warren Valley basin among overlying and appropriative right holders that were parties to the case. The Hi-Desert Water District (Hi-Desert) is the only remaining appropriative water right holder after purchasing all rights from the Yucca Water Company, Ltd. The Warren Valley Basin Judgment ordered the development of a physical solution for the Basin and established a requirement to import water supplies to recharge the depleted basin conditions.

Hi-Desert Water District has coordinated operations with MWA to support the Warren Valley Basin Judgment requirements. The need for supplemental water supply sources necessitated development of the Morongo Basin Pipeline that delivers MWA water supplies for recharge in the Warren Valley Basin. The water levels within the Warren Valley Basin continue to be monitored and reported by the Watermaster each year. The current groundwater levels have generally increased since the Watermaster began implementation of groundwater recharge and other management actions.

MWA's water management actions support both the Mojave Basin Adjudication and the Warren Valley Basin Judgment. In fact, numerous water management agreements have been developed to guide

management actions, including the Ames/Reche Groundwater Storage and Recovery Program Management Agreement (Ames/Reche Agreement), the Morongo Basin Pipeline Project Agreement, the 2002 Memorandum of Understanding between MWA, and Improvement District Morongo. The various agreements complement the objectives and management actions contemplated in the Mojave Basin Area and the Warren Valley Basin Judgment.

The Ames/Reche Amended Judgment ratifying the Ames/Reche Agreement was finalized in September 2014 and, as part of the amended judgment, MWA is required to prepare annual monitoring reports. The Ames/Reche Agreement covers a 95 square mile area and includes Bighorn Desert View Water Agency, Hi-Desert Water District, County of San Bernardino Service Area 70 W-1, and County of San Bernardino Service Area 70 W-4. Since 2012, water levels across the Ames/Reche Management Area appear to be relatively stable.[31] The Annual Baseline Amount for groundwater pumping was established at 1,646 acre-feet per year and the total pumping from the basin since 2013 has hovered around 1,200 acre-feet per year.[32] Nevertheless, continued oversight and monitoring by MWA will continue in the Ames/Reche Management Area to assist the participating agencies in preserving and protecting the Ames/Reche Management Area's groundwater assets.

The Ames/Reche Agreement is an important mechanism in groundwater management because it provides for a more comprehensive regulation of the groundwater supplies protected in the judgment, including provisions of supplemental water supplies for beneficial use, allocation of water production, storage and transfer rights to all of the public entity water retailers utilizing the subject groundwater supply, and continuing monitoring of water supply quality and quantity, all subject to the Court's continuing jurisdiction. MWA provides administrative support over monitoring the basin to ensure protection of the basin for the Parties and their end users.

3.2.4 Managed Groundwater Supplies

Managed groundwater characterizes the primary water supply in the Mojave Basin Area and the Morongo Basin Area. Water pumped from wells supply retail agencies and consumers within the MWA service area. Although total naturally occurring groundwater within each of these areas is significant, the actual average annual sustainable safe yield of the various basins is much lower than the total groundwater storage would suggest.[33] Moreover, water quality considerations from naturally occurring elements further reduce "usable" groundwater resources without adequate mixing with alternative sources. And, as noted above, the historical groundwater depletion through anthropogenic pumping of groundwater wells in MWA's service area necessitated legal solutions to sustain the areas long-term management objectives. These legal solutions are discussed in more detail in other portions of this section.

The managed groundwater system incorporates a number of sources that mix and blend to become the groundwater sources available in the basins. Local supplies consisting of percolated natural supplies, wastewater imports, imported water, and return flows derived from wastewater and irrigation make up

[31] Ames-Reche Management Area Reporting Update for Years 2018-19, May 2020 at 3 ("Ames-Reche Report").
[32] Ames-Reche Report at 5.
[33] Salt and Nutrient Management Plan, Kennedy-Jenks and Todd Engineers, December 2015 (34,914,190).

the total managed groundwater supply. Percolated natural supplies are derived from stream flow in the drainage basins like the Mojave River as well as infiltrating natural precipitation. Wastewater imports come from areas outside MWA's service area that augment the supplies in the groundwater basin. Imported recharged supplies are mostly derived from MWA's SWP Table A Annual Amount described in Section 3.1. Return flows are percolated supplies that are derived from non-consumptive uses including septic system percolation, applied irrigation water, treated wastewater, and returns through storm drains or non-revenue water supplies. Together, these supplies constitute the managed groundwater that make up the majority of supply in MWA's service area.

Table 3-12 provides a summary of the managed groundwater supplies, excluding SWP recharged supplies derived from surface water imports through 2025, and Table 3-13 shows the aggregated managed groundwater supplies available through 2065.

Table 3-12: MWA Managed Groundwater Supplies through 2025

Year		Natural Supply	Wastewater Import	Return Flow	Total
Normal		57,349	2,800	44,347	104,496
Single Dry		57,349	2,800	44,347	104,496
Multi-Year Drought	2021 (1st year)	57,349	2,800	45,004	105,153
	2022 (2nd year)	57,349	2,800	45,660	105,809
	2023 (3rd year)	57,349	2,800	46,322	106,471
	2024 (4th year)	57,349	2,800	46,988	107,137
	2025 (5th year)	57,349	2,800	47,655	107,804

Table 3-13: MWA Service Area Total Managed Groundwater Supplies through 2065

Total Supply		2025	2030	2035	2040	2045	2050	2055	2060	2065
Normal		107,804	110,062	111,329	112,603	114,014	115,289	116,445	117,490	118,432
Single Dry Year		107,804	110,062	111,329	112,603	114,014	115,289	116,445	117,490	118,432
Multi-Year Drought	Year 1	107,804	110,062	111,329	112,603	114,014	115,289	116,445	117,490	118,432
	Year 2	107,804	110,062	111,329	112,603	114,014	115,289	116,445	117,490	118,432
	Year 3	107,804	110,062	111,329	112,603	114,014	115,289	116,445	117,490	118,432
	Year 4	107,804	110,062	111,329	112,603	114,014	115,289	116,445	117,490	118,432
	Year 5	107,804	110,062	111,329	112,603	114,014	115,289	116,445	117,490	118,432

Natural Supply

Mojave Water Agency characterizes the natural supplies available for the Mojave Basin Area and the Morongo Basin Area as 57,349 acre-feet per year.[34] This supply is derived from a reasonable assessment of natural supply available and the groundwater basins conditions as provided through the applicable groundwater management entities. The long-term average natural supplies are fed by percolated

[34] Natural supplies are derived from MWA's 2015 UWMP at page 3-1.

precipitation and natural runoff in area stream systems. And although these supplies may fluctuate on an annual basis, the long-term average supply availability should remain relatively constant.[35] The natural supply also includes treated wastewater flow from Crestline Sanitation District that is included in flows in the West Fork Mojave River.[36] Tables 3-12 and 3-14 show the long-term average natural supply availability as remaining constant through the 2065 planning horizon contemplated in this 2020 UWMP.

Table 3-14: MWA Natural Supplies through 2065

Natural Supply		2025	2030	2035	2040	2045	2050	2055	2060	2065
Normal		57,349	57,349	57,349	57,349	57,349	57,349	57,349	57,349	57,349
Single Dry Year		57,349	57,349	57,349	57,349	57,349	57,349	57,349	57,349	57,349
Multi-Year Drought	Year 1	57,349	57,349	57,349	57,349	57,349	57,349	57,349	57,349	57,349
	Year 2	57,349	57,349	57,349	57,349	57,349	57,349	57,349	57,349	57,349
	Year 3	57,349	57,349	57,349	57,349	57,349	57,349	57,349	57,349	57,349
	Year 4	57,349	57,349	57,349	57,349	57,349	57,349	57,349	57,349	57,349
	Year 5	57,349	57,349	57,349	57,349	57,349	57,349	57,349	57,349	57,349

Return Flow

When water supplies are extracted from the groundwater basins, a portion of the water pumped is consumed and another portion of the extracted water is returned to the groundwater aquifer and becomes part of the available water supply. This "return flow" is an important component of the MWA service area's managed groundwater. For example, nearly all indoor water use is assumed to be returned to the basin either by percolation from septic tanks or treated wastewater effluent produced by municipal wastewater facilities. The Watermaster Report calculates consumptive use for each producer in each subarea of the Mojave Basin Area Adjudication.[37] The calculation is based on production amount, type of use, and an evaluation of processes that consume water.

Return flows shown in Tables 3-12 and 3-15 are calculated as a percent of the previous years' water production for each water use category, as defined by the Watermaster. Return flow factors, on a regional basis, average approximately 42 percent of the groundwater production, although this amount can vary significantly by Subarea and on an annual basis. Importantly, as water extractions increase in the MWA Service Area, the return flows will also increase over time. However, as system efficiencies improve in the MWA service area, the return flows may begin to slowly decline. Nevertheless, for purposes of this 2020 UWMP, we assume the return flows to be a percentage of the total groundwater

[35] Water Supply in the Mojave Water Agency and Its Demand on the State Water Project, Nicholas Schneider and Jeffrey Ruesch, 2020 at 1 (hereafter "Supply Report").
[36] Supply Report at 2.
[37] Watermaster Report at 39-40.

production.[38] This methodology is consistent with investigation of consumptive use in the MWA service area by the Watermaster.[39]

Table 3-15: MWA Return Flow Supplies through 2065

Return Flow		2025	2030	2035	2040	2045	2050	2055	2060	2065
Normal		47,655	49,913	51,180	52,454	53,865	55,140	56,296	57,341	58,283
Single Dry Year		47,655	49,913	51,180	52,454	53,865	55,140	56,296	57,341	58,283
Multi-Year Drought	Year 1	47,655	49,913	51,180	52,454	53,865	55,140	56,296	57,341	58,283
	Year 2	47,655	49,913	51,180	52,454	53,865	55,140	56,296	57,341	58,283
	Year 3	47,655	49,913	51,180	52,454	53,865	55,140	56,296	57,341	58,283
	Year 4	47,655	49,913	51,180	52,454	53,865	55,140	56,296	57,341	58,283
	Year 5	47,655	49,913	51,180	52,454	53,865	55,140	56,296	57,341	58,283

Imported Wastewater

Treated wastewater effluent is imported to the MWA service area from three wastewater entities serving communities in the San Bernardino Mountains outside MWA's service area. Treated wastewater effluent from the Lake Arrowhead Community Services District is imported to the Alto Subarea and effluent from the Big Bear Area Regional Wastewater Agency is imported to the Este Subarea. MWA also receives treated wastewater flow from Crestline Sanitation District that is already accounted for in the natural groundwater recharged supply as noted in Section 3.2.4.1. Wastewater imports from outside MWA represent a relatively small portion of MWA's overall water supply portfolio. Nevertheless, for purposes of this 2020 UWMP we assume approximately 2,800 acre-feet will be delivered into the MWA Service Area on an average annual basis through the 2065 planning horizon. Tables 3-12 and 3-16 show the long-term available imported wastewater supply.

Table 3-16: MWA Imported Wastewater Supplies through 2065

Wastewater Supply		2025	2030	2035	2040	2045	2050	2055	2060	2065
Normal		2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800
Single Dry Year		2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800
Multi-Year Drought	Year 1	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800
	Year 2	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800
	Year 3	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800
	Year 4	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800
	Year 5	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800

Current and projected total use within MWA's service area is summarized in Table 3-17 below (details are provided in Chapter 4.

[38] The percentage of consumptive use was defined by the Consumptive Use tab of the GPCD Future Demand Calcs V12 spreadsheet

[39] Memorandum from Robert C. Wagner, P.E., Watermaster Engineer to Kathy Cortner, regarding 2019-2020 Watermaster Methodology for Return Flow Estimates, March 30, 2021.

Table 3-17: MWA Service Area Current and Projected Total Water Use

Water User Category	Current	2025	2030	2035	2040	2045	2050	2055	2060	2065
Total Large Retailer	69,900	74,900	79,100	81,300	83,600	86,100	88,500	90,600	92,500	94,300
Small Water Systems and Rural Domestic	11,100	13,500	13,800	14,000	14,200	14,400	14,600	14,800	14,900	15,100
Other (Industrial, golf course, recreational)	21,800	21,800	21,800	21,800	21,800	21,800	21,800	21,800	21,800	21,800
Agricultural	26,600	20,600	20,600	20,600	20,600	20,600	20,600	20,600	20,600	20,600
Total Water Use in Service Area	129,400	130,800	135,300	137,700	140,200	142,900	145,500	147,800	149,800	151,800

3.3 Water Quality

Water quality is a critical consideration in the MWA service area. All consumer water supplies are derived from groundwater extractions that blend many sources of water. MWA provides imported State Water Project water supplies to the groundwater basins in its service area. MWA has committed significant resources to maintain water quality in its service area in order to prevent future degradation.

3.3.1 State Water Project Water Quality

State Water Project (SWP) water quality is monitored by the California Department of Water Resources (DWR) Division of Operations and Maintenance. DWR maintains 16 continuous water quality monitoring stations located throughout the State Water Project and data from these stations is regularly uploaded to the California Data Exchange Center (CDEC). The parameters for monitoring SWP water quality include the following: electrical conductivity, water temperature, turbidity, pH, and fluorescence. MWA participates in DWR's Municipal Water Quality Investigations Program in order to preserve service area water quality. SWP water quality changes as the water moves from the precipitation and snowmelt runoff to its termination areas in southern California. Water quality measurements at each station are important for tracing water quality constituents in the SWP system.

Of the 16 water quality monitoring stations, Check 66 is located closest to Mojave Water Agency's turnouts and Check 41 is examined to align operational decisions and data monitoring. Check 66 is located at an elevation of 3,448 feet in San Bernardino County near the City of Hesperia in the South Lahontan hydrologic region. Figure 3-8 through Figure 3-10 show the measured publicly available electrical conductivity, temperature, and turbidity at Check 66 since 2010. Figure 3-11 shows pH at the Check 41 Kern measurement location and Figure 3-12 shows fluorescence at Pacheco Pumping Plant.[40]

[40] These locations were chosen because Check 66 did not have these water quality parameters and the Kern location (Check 41) and Pacheco Pumping Plant locations were the nearest to Check 66.

Figure 3-8: Check 66 Electrical Conductivity 2010-2020

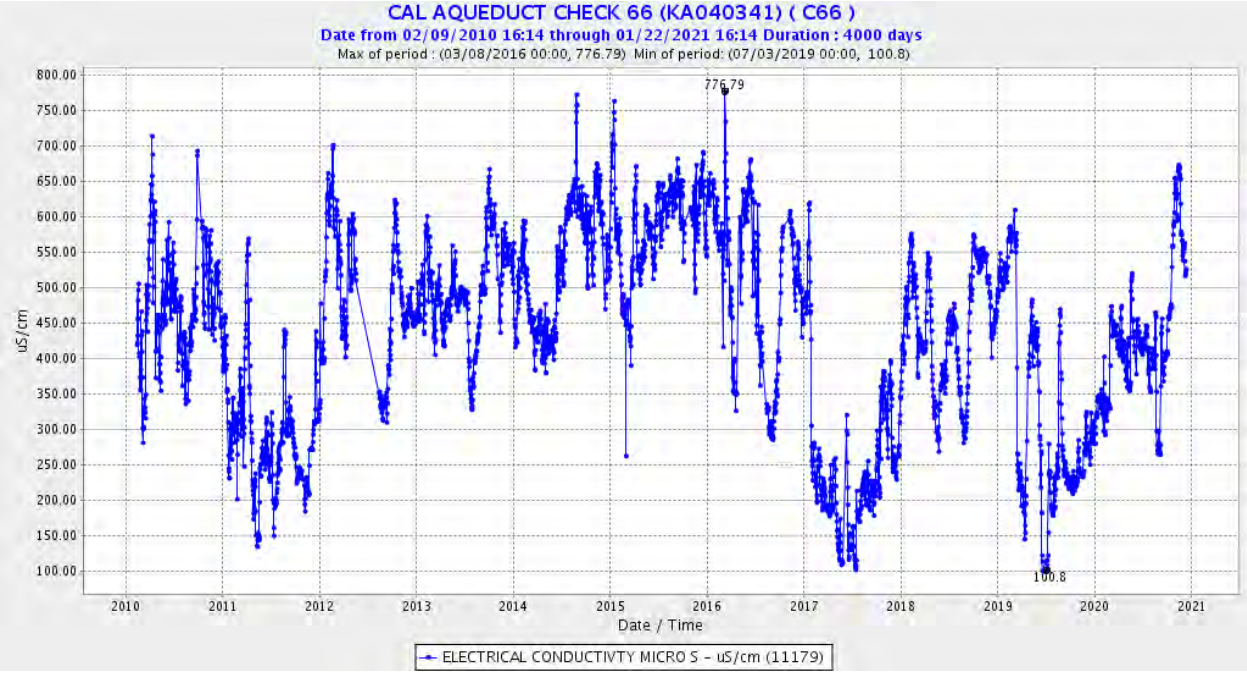


Figure 3-9: Check 66 Water Temperature 2010-2020

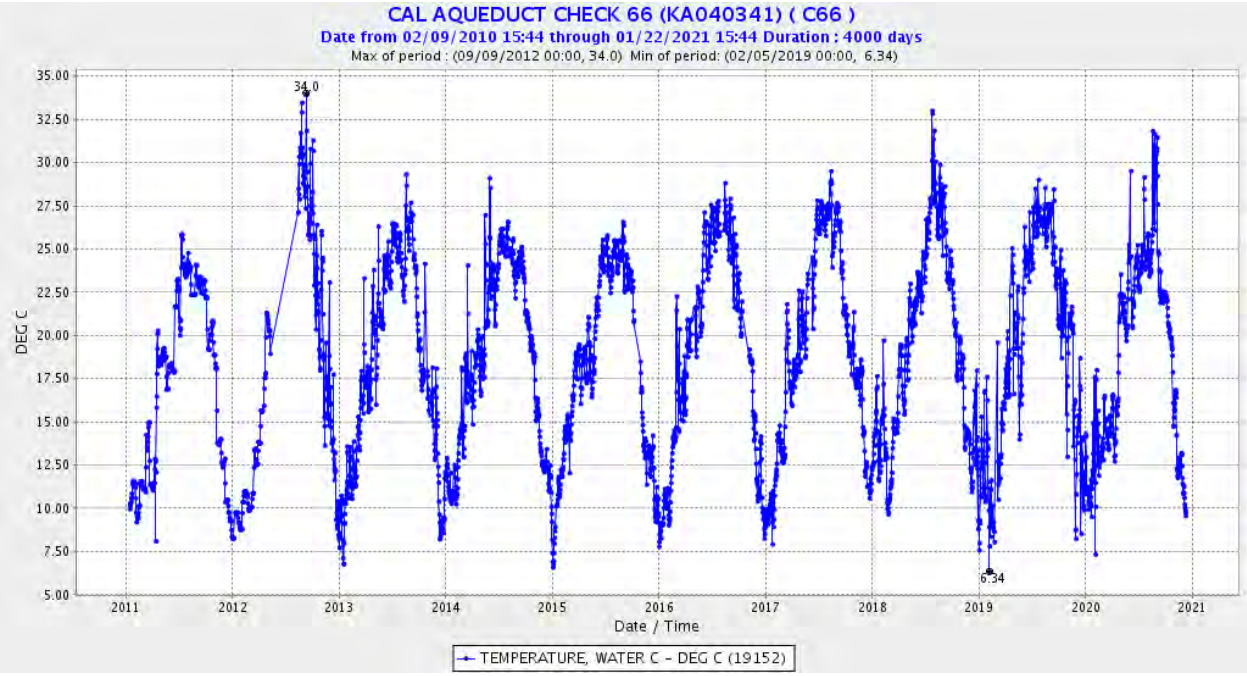


Figure 3-10: Check 66 Turbidity 2010-2020

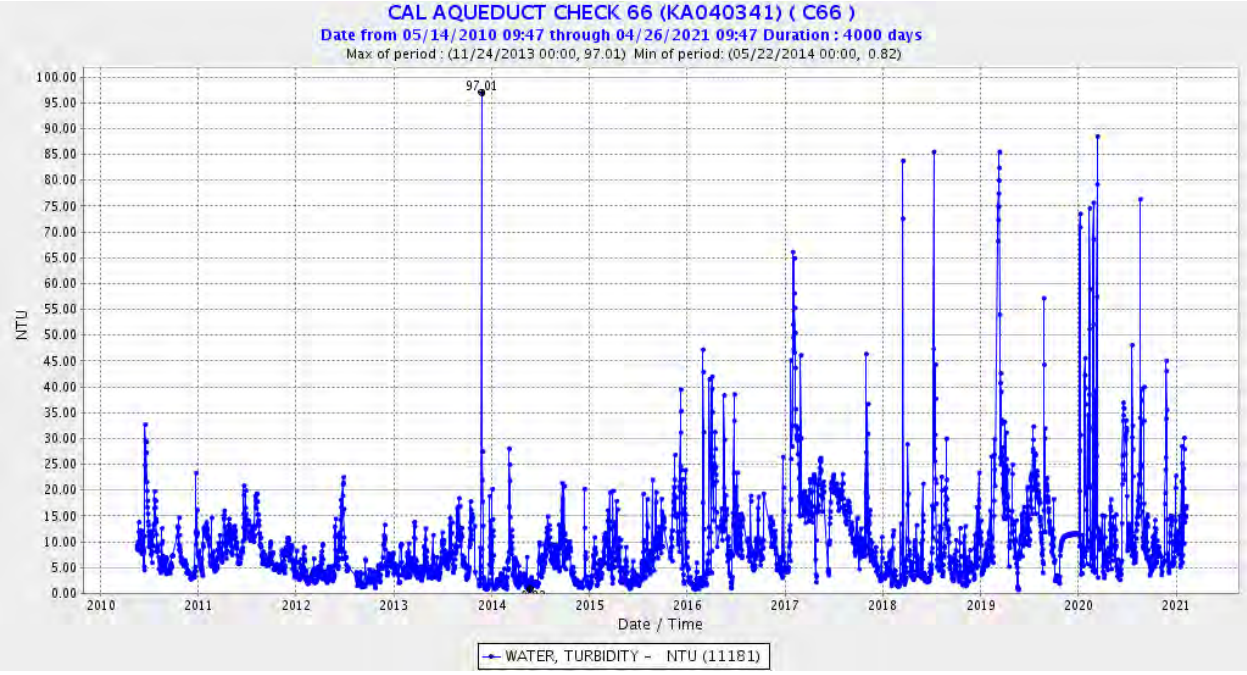


Figure 3-11: Check 41 (Kern) pH Value

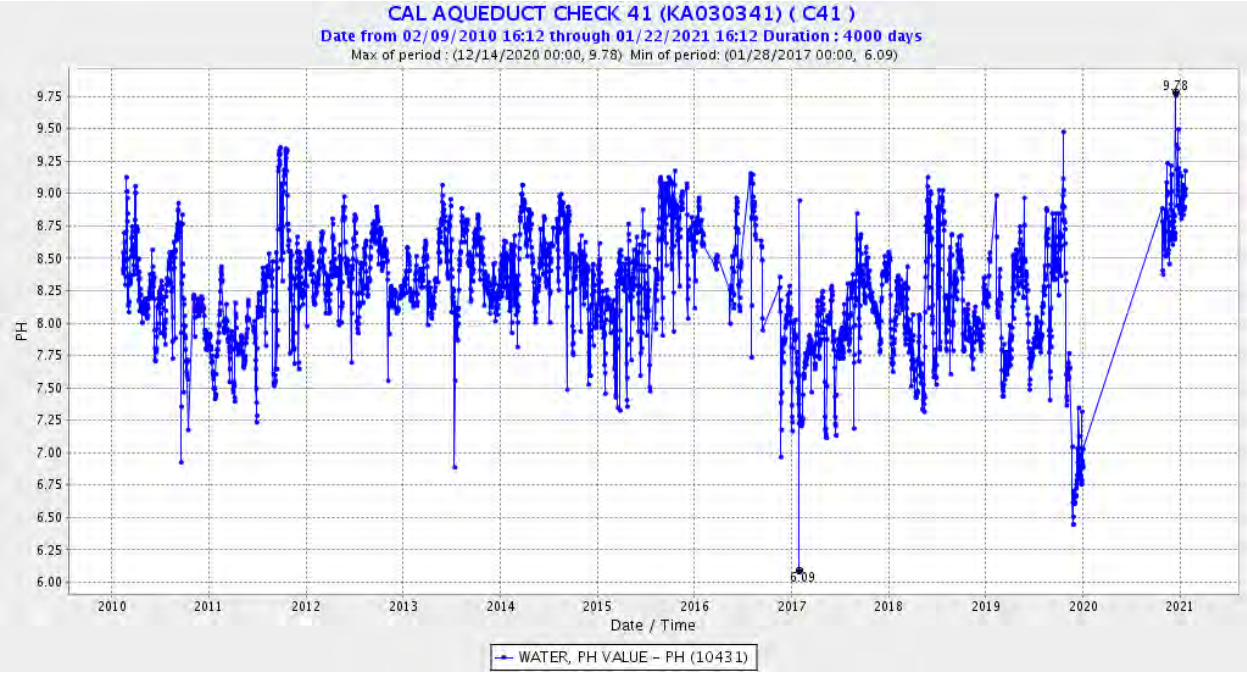
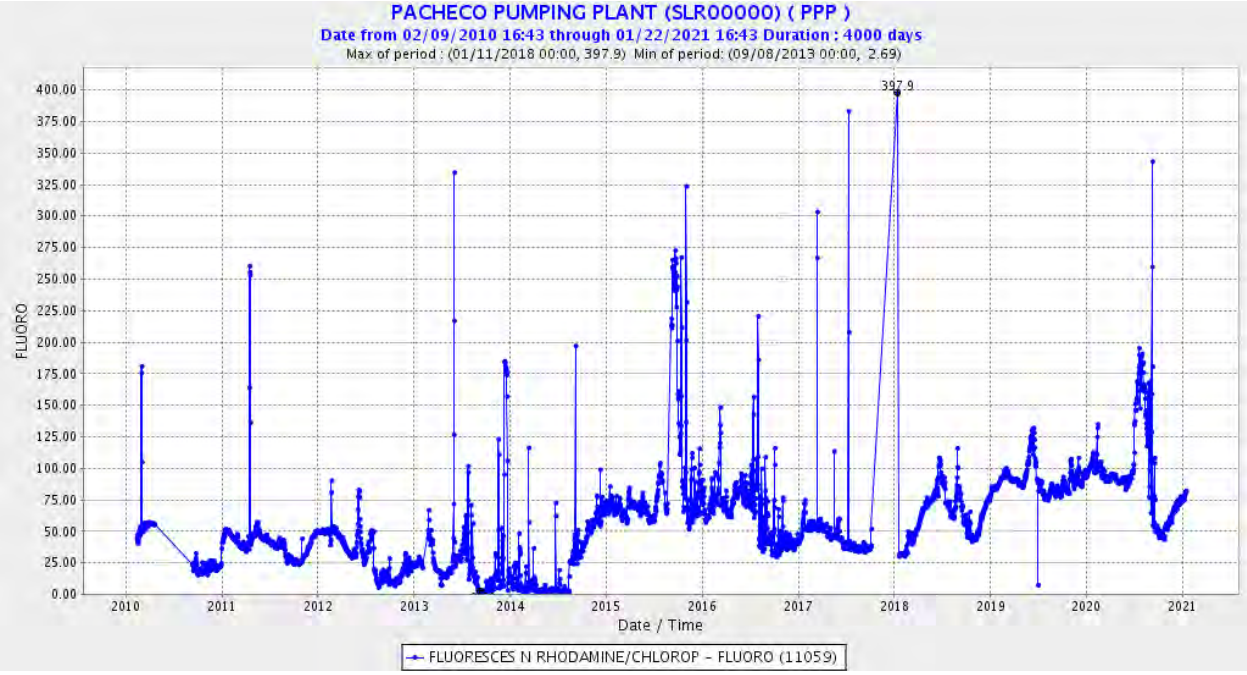


Figure 3-12: Pacheco Pumping Plant Fluorescence 2010-2020



3.3.2 Groundwater Quality and Monitoring in the MWA Service Area

MWA has made efforts to greatly increase the understanding of the water quantity and quality of the groundwater basins that lie within its service area. As noted previously in this chapter, MWA established a program with the USGS to maintain an 850 well monitoring network. Water levels from these wells are recorded on a regular basis and several of the wells are tested for water quality on a rotating sampling schedule.

Numerous studies dating back to the early 1900's have been conducted by various agencies to characterize groundwater quality in the Mojave service area and further the understanding of the Mojave River and Morongo Groundwater Basins. The most recent study was the Mojave Salt and Nutrient Management Plan completed in 2015.[41] Despite local groundwater quality degradation, these studies generally confirmed the suitability of groundwater for beneficial uses in the Region. Groundwater quality data, including intrinsic tracers, have been used to confirm sources of groundwater recharge and travel times along interpreted flow paths in the Floodplain and Regional aquifers. Investigations have also been conducted to identify the source and occurrence of key naturally occurring groundwater contaminants, including hexavalent chromium and arsenic, in the Mojave Desert region.

The impairment of groundwater from the perspective of its beneficial use as drinking water is determined by comparing concentrations of constituents of concern in the groundwater against drinking water maximum contaminant levels (MCLs) and agricultural water quality parameters needed for specific crops. MCLs consist of primary and secondary MCLs. Primary MCLs are assigned to constituents

[41] All of the relevant water quality studies are available at http://www.mojavewater.org/regional-studies.html. (Hereafter "2015 Salt and Nutrient Plan").

for which a health-based risk is associated with consumption of water that exceeds a particular concentration. Secondary MCLs are assigned to constituents for which there is no considered health risk, but for which there may be aesthetic concerns such as taste, odor, color, etc. above a particular concentration. Key groundwater constituents of concern in the MWA service area include arsenic, nitrates, iron, manganese, Cr-VI, fluoride, and total dissolved solids (TDS). Some of these constituents are naturally occurring in desert environments while others are associated with human (anthropogenic) activities. Measurements exceeding drinking water standards have been found for some of these constituents within the Mojave River Basin and the Morongo Basin. Groundwater in these areas may require treatment prior to consumption.

MWA's Salt and Nutrient Management Plan (SNMP) provides an evaluation of potential groundwater quality issues that may result from sources of salts and nutrients. The SNMP addresses whether these constituents would unreasonably degrade groundwater quality and potentially decrease the beneficial uses of groundwater within the basin. For the MWA SNMP, TDS and nitrate were analyzed as appropriate indicator constituents of salts and nutrients.

Total salinity is commonly expressed in terms of TDS as milligrams per liter (mg/L). TDS concentrations in the groundwater are influenced by the chemistry of the aquifer and quality of water recharging the aquifer. TDS is not a health hazard at typical groundwater concentrations but can be an aesthetic issue and can shorten the useful life of pipes and water-based appliances in homes and businesses. TDS monitoring data are widely available for source waters (both inflows and outflows) in the service area, and because TDS is a general indicator of total salinity, TDS is an appropriate indicator of salt loading. TDS concentrations generally increase in downgradient portions of the Mojave River Basin and along groundwater flow paths away from the primary recharge source in the basin, the Mojave River. Elevated TDS concentrations (greater than 1,000 mg/L) are generally associated with natural processes including mineralization and evaporation beneath dry lake beds. In the Morongo Basin, groundwater TDS concentrations generally increase along groundwater flow paths away from the southwestern margins of the basin where mountain-front recharge occurs.

Nitrate is a widespread contaminant in California groundwater. In drinking water, high nitrate levels can have acute health problems in infants less than six months old, causing a condition called methemoglobinemia, commonly known as "blue baby syndrome". Long-term health impacts in adults are not well-known. High levels of nitrate in groundwater are associated with agricultural activities, septic systems, confined animal facilities, landscape fertilization, and wastewater treatment facilities. Nitrate does occur naturally in groundwater – however, natural nitrate levels in groundwater are generally very low (typically less than about 10 mg/L as nitrate-NO3).

The volume-weighted average of existing TDS and nitrate-NO3 concentrations were calculated for each of the 22 analysis subregions. Results are summarized in Table 3-12. Average subregional TDS concentrations vary considerably, ranging from 153 mg/L to 1,716 mg/L across the MWA service area. Average TDS concentrations are very low in the upgradient portions of the Mojave River Basin (less than 300 mg/L) and increase along the pathways along and away from the Mojave River due to natural processes (e.g., mineralization) and impacts from anthropogenic loading. As shown in Table 3-19, eight of the nine downgradient analysis subregions composing the Alto Transition Zone, Centro, and Baja

Subareas have average TDS concentrations at or above 500 mg/L (Baja - Floodplain is the lone exception). In the Morongo Basin, average TDS concentrations are generally below the recommended secondary MCL for TDS of 500 mg/L. Exceptions include Lucerne Valley (north) (1,716 mg/L) and Johnson Valley (678 mg/L), where elevated TDS concentrations primarily reflect a high degree of mineralization and dry lakebed evaporation. Elevated TDS concentrations are naturally characteristic of dry lakes in arid desert environments.

Nitrate-NO3 concentrations are generally low across the service area. Average subregional concentrations are approximately 6.0 mg/L. Average nitrate-NO3 concentrations exceed 15 mg/L in Centro – Floodplain and Warren Valley. Additionally, nitrate-NO3 concentrations are slightly elevated (between 7.5 and 10 mg/L) in Centro – Regional (west), Alto Transition Zone – Floodplain (Helendale), and Alto – Right Regional. In the Centro Subarea, elevated nitrate concentrations are associated with historical and existing agricultural operations (crop field and dairies) and other naturally occurring processes. In the Alto-Right Regional Subregion, septic tank return flows are likely the most significant contributing factor to slightly elevated groundwater nitrate concentrations. In the Warren Valley, elevated nitrate concentrations are associated with historical entrainment of septage following managed aquifer recharge operations and a high density of septic tanks in the subregion.

The emerging water quality constituents of concern are per-and polyfluoroalkyl substances (PFAS) and perfluorooctanoic acid (PFOA). These chemical constituents are generally produced through chemical manufacturing of items like Teflon pans, stain resistant carpet, and fast-food packaging. Acceptable levels for PFAS and PFOA compounds are regulated by the State of California and have recently been lowered. As such, the regulatory actions may have some impact on the regional availability of groundwater supplies. MWA and the regional purveyors are addressing this emerging issue in the region-wide management of groundwater resources and imported supplies that augment the local sources.

Table 3-18: Average Existing TDS and Nitrate Concentrations by Subregion[42]

SNMP Analysis Subregion	Average Existing TDS Concentration (mg/L)	Average Existing Nitrate-NO3 Concentration (mg/L)
MOJAVE RIVER BASIN		
Baja - Floodplain	401	3.9
Baja - Regional	617	1.4
Centro - Floodplain	711	20.7
Centro - Regional (east)	618	3.2
Centro - Regional (west)	711	7.7
Centro - Regional (Harper Dry Lake)	1,028	4.0
Alto Transition Zone - Floodplain (Helendale)	915	10.0
Alto Transition Zone - Floodplain	500	3.4
Alto Transition Zone - Regional	529	3.9
Alto - Floodplain (Narrows)	205	4.3
Alto - Floodplain	177	3.3
Alto - Left Regional	310	0.9
Alto - Mid Regional	153	3.5
Alto - Right Regional	579	7.5
Oeste - Regional	781	2.5
Este - Regional	299	4.3
MORONGO BASIN		
Lucerne Valley (north)	1,716	5.6
Lucerne Valley (south)	472	5.7
Johnson Valley	678	6.2
Ames-Means Valley	330	5.7
Warren Valley	243	15.4
Copper Mountain-Giant Rock	247	7.5
Joshua Tree	202	14.7

[42] Salt and Nutrient Plan at 4-17.

3.3.3 Groundwater Monitoring and Protection

The general goal of groundwater protection activities is to maintain the groundwater and the aquifer to ensure a reliable high quality water supply. Activities to meet this goal include continued and increased monitoring, data sharing, education and coordination with other agencies that have local or regional authority or programs. The current MWA groundwater monitoring program includes groundwater quality data collected by MWA and the USGS through their cooperative water resources program and through the Drinking Water Program directed by the State Water Resources Control Board Department of Drinking Water (SWRCB DDW).

As noted in earlier in this chapter, MWA maintains a comprehensive groundwater monitoring program. Under the CWRP program, MWA technical field staff participate in annual workshops led by the USGS California Water Science Center Quality Assurance Team to review and audit field techniques and QA/QC protocols related to equipment maintenance, instrument calibration, groundwater level measurement, and groundwater quality sampling.

The SWRCB DDW enforces the monitoring requirements established in Title 22 of the CCRs for drinking water wells and all the data collected must be reported to the DDW. Title 22 also designates the regulatory limits (e.g., MCLs for various water contaminants, including volatile organic compounds, non-volatile synthetic organic compounds, inorganic chemicals, radionuclides, disinfection byproducts, general physical constituents, and other parameters). Title 22 testing applies to potable public drinking water systems. MWA performs Title 22 testing only on water produced for the R^3 distribution system which supplies wholesale potable water to retail water suppliers.[43] All retail water purveyors are subject to drinking water standards set by the Federal Environmental Protection Agency (EPA) and the SWRCB DDW.

MWA has developed and actively maintained a Key Well program to support ongoing groundwater management activities, including monitoring of groundwater levels and water quality within the MWA service area. Wells in the Key Well program include a combination of dedicated monitoring wells, scientific investigation wells, domestic water supply wells, and agricultural irrigation wells. Public water supply wells are not included in the Key Well program but data from these wells are tracked and included in the MWA database. Important wells identified or installed during scientific studies are continually added to the Key Well program.

There are a range of groundwater contamination sites across the region. These sites are regulated by the Lahontan and Colorado River Basin Regional Water Quality Control Boards and are not a major concern regarding a detriment to water supply on a regional basis at this time.

[43] Groundwater quality data are submitted electronically and are available for download online at the SWRCB water quality analyses data and download page: http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/EDTlibrary.shtml .

3.4 Desalination Opportunities

The California UWMP Act requires a discussion of potential opportunities for use of desalinated water (Water Code Section 10631(i)) In the past, MWA has evaluated potential options for developing desalination projects. However, none of the opportunities are currently practical or economically feasible for MWA, and MWA has no current plans to pursue them. Therefore, desalinated supplies are not included in the supply summaries in this Plan.

As discussed elsewhere in this document, the groundwater supplies in the MWA service area are not considered brackish in nature, and desalination is not required. There are brackish supplies near the dry lakes, but it is not practical to pump, treat and potentially induce migration of better quality water to the dry lake areas. However, MWA and the retail water purveyors could partner with other SWP contractors and provide financial assistance in construction of other regional groundwater desalination facilities in exchange for SWP supplies. The desalinated water would be supplied to users in communities near the desalination plant, and a similar amount of SWP supplies would be exchanged and allocated to MWA from the SWP contractor. In addition, should an opportunity emerge with a local agency other than an SWP contractor, an exchange of SWP deliveries would most likely involve a third party, such as Metropolitan Water District. Most local groundwater desalination facilities would be projects implemented by retailers of SWP contractors and, if an exchange program were implemented, would involve coordination and wheeling of water through the contractor's facilities to MWA.

Because the MWA service area is not in a coastal area, it is neither practical nor economically feasible for MWA to implement a seawater desalination program.

3.5 Delta Reliance

MWA continues to demonstrate reduced reliance on water supplies derived from the Delta and regional self-sufficiency. The reduced reliance and regional self-sufficiency are attributable to significant advances in developing recycled and reusable water supplies combined with a region-wide emphasis on water use efficiency among MWA and the retail agencies. Table 3-19 below shows the reduced reliance analysis for the MWA service area. The MWA service area's Reduced delta reliance and improved regional self-sufficiency are detailed in Appendix A.

Table 3-19: Reduced Delta Reliance

Year	2010	2015	2020	2025	2030	2035	2040	2045
Total Water Supplies from the Delta Watershed	34.2%	34.2%	31.9%	28.7%	26.2%	24.4%	22.9%	22.2%
Change in Water Supplies from the Delta Watershed		-0.1%	-2.4%	-5.6%	-8.0%	-9.8%	-11.4%	-12.1%

3.6 Climate Change

While the California Water Code does not prescribe specific climate change planning and management measures for water suppliers, it does emphasize that climate change is appropriate to consider when assessing drought risk assessment, water conservation and use efficiency, and demand management and supply – both in an historical and future-projection context. MWA's primary climate change concern involves its capability of providing imported SWP water for groundwater recharge. As shown in this section, MWA uses DWR's 2019 DCR to assess current and future reliability of SWP Contract Table A supplies. The 2019 DCR modified the normal year reliability of Table A Annual Amounts from 62% to 58% by incorporating, among other things, climate change. In addition, the 2019 DCR used a 7% supply reliability number for a single dry year. These characterizations are depicted in Table 3-2. As shown in Table 3-3, MWA chose to taper its long-term SWP projections to a 52% reliability by 2040 to account for climatic variability consistent with the 2019 DCR future climate change scenario. And, as shown in Table 3-4, MWA used the driest year on record with the lowest Table A percentage allocation of 5% to characterize both the single dry year supply availability as well as two of the five years in the 5-year drought scenario. Finally, MWA also considered the driest year on record to reflect its Table A Carryover supplies that may be available in order to best consider climatological variability. Accordingly, MWA's conservative approach to capture supply availability captures future unpredictable climatological issues that may impact water supply reliability.

3.7 Supply Summary

This section summarizes the total supplies available in the Mojave Water Agency service area. The total current and projected supplies that will be used in the MWA Service Area from 2020 through 2065 are shown in Tables 3-20 and 3-21.

Table 3-20: Current and Projected Supplies next 5 years

Year		Total Supplies
Normal		156,580
Single Dry		129,400
Multi-Year Drought	2021 (1st year)	136,583
	2022 (2nd year)	129,700
	2023 (3rd year)	130,000
	2024 (4th year)	130,400
	2025 (5th year)	139,234

Table 3-21: Current and Projected Supplies through 2065

Total Supply		2025	2030	2035	2040	2045	2050	2055	2060	2065
Normal		158,541	159,452	159,372	159,299	160,710	161,985	163,141	164,186	165,128
Single Dry Year		130,800	135,300	137,700	140,200	142,900	145,500	147,800	149,800	151,800
Multi-Year Drought	Year 1	139,234	141,492	142,759	144,033	145,444	146,719	147,875	149,800	151,800
	Year 2	130,800	135,300	137,700	140,200	142,900	145,500	147,800	149,800	151,800
	Year 3	130,800	135,300	137,700	140,200	142,900	145,500	147,800	149,800	151,800
	Year 4	130,800	135,300	137,700	140,200	142,900	145,500	147,800	149,800	151,800
	Year 5	139,234	141,492	142,759	144,033	145,444	146,719	147,875	149,800	151,800

Chapter 4
Water Use

Understanding water use characteristics throughout the region is essential to enable Mojave Water Agency to reliably and cost-effectively manage water supplies to continue to support the water needs within its service area. As described in Chapter 2, MWA manages water supplies for the urban, rural, industrial, recreational, and agricultural users throughout an expansive area in eastern San Bernardino County. This section quantifies the current regional water use within the service area and forecasts future needs for a planning horizon extending to 2065. This comprehensive projection of water use becomes the foundation for integration with MWA's water supplies (see Chapter 3) to assess long-term water system reliability (see Chapter 5).

This chapter is organized as follows:

- Current Regional Water Use – This subsection presents data reflecting regional water use for 2015 through 2020.
- Forecasting Regional Water Use – This subsection presents the derivation and results of future regional water use within the service area and compares the new forecasts to those developed for MWA's 2015 UWMP.
- Demand Management Measures – This subsection provides a narrative description of regional-level water demand management measure implemented by MWA over the past five years and describes planned measures for the foreseeable future.
- Forecasting Regional Water Use for DRA and Annual Assessment – This subsection focuses on the subset of the regional water use forecast necessary for completing the five-year Drought Risk Assessment (DRA) and defining the "unconstrained demand" for purposes of annual water supply and demand assessment.

4.1 Current Regional Water Use

As described in Chapter 2 and Chapter 3, MWA manages an array of water supplies to help assure sufficient and reliable water supplies for use by large and small urban retailers, rural domestic users, industry, and agriculture.

Water use is tracked and recorded within each of the five Subareas in the Mojave Basin Area by the Mojave Watermaster and included in annual Verified Production reports. The large urban water suppliers also track their individual production and report it to the State Water Resources Control Board as part of monthly reporting. Collectively, this information is summarized and presented in Table 4-1 for 2015 through 2020 for the (1) twelve large retailers; (2) small potable water systems and domestic users; (3) others including golf courses, industry, and recreational uses; and (4) agricultural users.

This recent and current regional water use helps MWA understand water use trends, effects of long-term demand management measures, effects of groundwater basin adjudication requirements (see Chapter 3), and other pertinent water use factors relevant to forecasting future water use. This data also provides insight into the relative magnitude of water use among differing retail customers, trends in urban water needs, and the downward trend of agricultural use.

Table 4-1: Regional Water Use 2015 to 2020 (values in acre-feet)[44]

Water User Category		2015	2016	2017	2018	2019	2020
Large Retailer	Liberty Utilities - Apple Valley Water Company	9,582	9,216	9,470	9,542	9,364	9,802
	Bighorn-Desert View Water Agency	454	468	546	561	543	619
	City of Adelanto Water District	3,927	4,184	4,301	4,205	4,378	4,333
	County Service Area 64	2,362	2,465	2,666	3,012	2,594	2,701
	County Service Area 70 J	1,480	1,512	1,612	1,649	1,497	1,617
	Golden State Water Company – Barstow System	5,254	5,148	5,478	5,567	5,476	5,677
	Helendale CSD (estimated)	1,942	1,958	1,973	1,988	1,998	2,000
	Hesperia Water District	12,489	13,209	13,425	13,608	12,449	14,043
	Hi-Desert Water District	2,838	2,915	2,830	2,854	2,799	2,947
	Joshua Basin Water District	1,359	1,350	1,350	1,368	1,243	1,306
	Phelan Pinon Hills CSD	2,727	2,586	2,661	2,737	2,632	2,948
	Victorville Water District	19,274	18,480	19,094	17,496	20,919	21,865
	Total Large Retailer	63,687	63,492	65,406	64,588	65,893	69,858
Small Water Systems and Rural Domestic		13,163	12,141	12,720	16,896	12,393	11,014
Other (Industrial, golf course, recreational)		21,100	20,600	21,700	23,600	21,600	21,720
Agricultural		38,800	39,400	33,000	32,200	30,100	26,600
Total Water Use in Service Area		136,750	135,633	132,826	137,284	129,986	129,192

4.2 Forecasting Regional Water Use

Forecasting future regional water needs begins with an understanding of the existing regional needs and trends, recognizing the additional customers expected through growth, and considering the factors that will influence the water use of both existing and new customer well into the future – especially factors that directly affect the efficiency of water use.

Pursuant to California Water Code 10610.4(c), an urban water supplier "*shall be required to develop water management plans to actively pursue the efficient use of available supplies*." One challenge from this directive is reflecting how the pursuit of efficient use is best represented in the forecasted water use that are the cornerstone of good planning. As required by the Act, the future water use of both existing

[44] Bighorn-Desert View Water Agency and Helendale CSD have fewer than 3,000 connections and server less than 3,000 acre-feet annually and are therefore not considered an "urban retail water supplier" per definition of the California Water Code. Thus, these agencies do not prepare UWMPs or submit monthly data to the SWRCB and the values in this table are estimated.

customers and those added over the 45-year planning horizon should reflect the "efficient use" of water.

The following subsections detail the assumptions used to forecast regional water use within the MWA service area, separated into the needs of (a) large retailers and (b) other water users, including small suppliers and domestic users, agricultural users, and others.

4.2.1 Forecasting Needs of Large Retailer Water Use

There are several factors that affect the forecast of future use for large retailers, ranging from State and local landscape regulations, building code requirements, and other water-use mandates, to changes in the types of housing products being offered. These factors are incorporated into determining appropriate per-dwelling unit or per-customer connection water demand values for use in forecasting future water needs. Relevant characteristics of the factors include:

- California Model Water Efficient Landscape Ordinance
- Green Building Standards Code (hereafter the "CAL Green Code")
- Per-capita urban water conservation objectives

As described in Chapter 2, population growth is primarily expected to occur within these large urban suppliers' service areas with an associated increased demand placed upon the water supplies managed by MWA within the various basins. Forecasting the needs of these future customers within each large retailer is dependent upon the growth assumptions and the unique water use characteristics of existing customers in each retail service area.

As detailed in Table 2-3, MWA-commissioned population forecast provided estimated population growth within each of the 12 large urban water retailers.[45] This growth will include a range of residential and non-residential uses within the larger retail service areas, depending on the varied development proposals already approved (but not yet built) and to be proposed. Residential customers will include both single-family dwelling units built under a variety of densities and multi-family residential dwelling units. Non-residential uses are expected to include a blend of commercial, institutional, industrial, and active landscapes such as parks, in ratios similar to the current residential-to-non-residential connections.

For purposes of this UWMP, the forecasted future demand will reflect the needs of existing customers and future new customers. The methodology to forecast existing customer use and new customer use varies slightly but is primarily based upon multiplying the population of each by a gallons-per-capita-per-day water factor.

Existing Customer Future Use

For each large retail supplier, data submitted by each to the State Water Resources Control Board (SWRCB) to satisfy reporting regulations was obtained to establish the recent and current water use characteristics. This included total water produced for each month for 2020. The total annual

[45] As noted previously, ten of these suppliers are also required to prepare UWMPs, while the other two have yet to trigger the UWMPA threshold.

production (see Table 4-1) was divided by the retailer's population, generating a gallons-per-capita-per-day (gpcd) value that is representative of the retail supplier's total gpcd when considering all residential and non-residential users. This information established a "current" gpcd for the population that was used to create a representative gpcd for future customers as discussed below.

For the existing customers future use, the gpcd was either (1) held constant or (2) reduced slightly to reflect expected conservation through replacement of fixtures and appliances, continued adoption of a conservation ethic, and modifications of irrigated landscapes, as well as a function of continued implementation of the retailer's and MWA's ongoing conservation programs. A unique analysis was prepared and discussed with each large retail supplier to allow for customized conservation levels. Conservation values ranged from 0% to 5% reduction from the current demand representation.

New Customer Future Use

In addition to the retailer-reported information to the SWRCB is information regarding the percentage each retail agency serves to residential customers, a key value for the SWRCB's determination of the "residential gallons-per-capita-per-day" water use – or "r-gpcd." Using the total r-gpcd value as well as the wintertime r-gpcd values, which often were slightly lower than during summer months, an estimate of the (1) residential versus non-residential per-capita use and (2) the residential indoor versus outdoor per-capita water use factor was derived for each retail supplier.

These estimated gpcd values were then used to create an anticipated gpcd value for each new customer. The new gpcd values for each large retail suppliers were created using the following steps:

1. As stipulated by the Water Code, each new residential user should have an indoor factor of 55 gpcd, dropping to 50 gpcd in the future.[46] For purposes of this forecast, 55 gpcd is used for all new customers until 2030, then 50 gpcd is used for growth through 2065.

2. Using the residential indoor versus outdoor gpcd estimate from the existing customer data, an outdoor gpcd value was determined (as the difference between total r-gpcd and the estimated indoor r-gpcd). This outdoor value was added to the indoor value of 55 gpcd or 50 gpcd to generate a total residential gpcd value for future customers.

3. The different between the residential gpcd and the total gpcd created a representative non-residential gpcd value unique to each large retail supplier. This non-residential gpcd was added to the residential gpcd to create an expected total gpcd for each new customer.

4. The new gpcd value was multiplied by the incremental additional population anticipated during each five-year increment through 2065.

[46] The assumed per-person rate of 55 gallons per day is derived from California Water Code Section 10609.4(a)(3), which states a value of 55 gallons per capita (i.e., per person) per day ("gpcd") be used for estimating indoor residential use targets. Water Code Section 10609.4(a) establishes the indoor residential water use 'standard' to be 52.5 gpcd beginning in 2025 and as low as 50 gpcd by 2030, though the Water Code also provides provisions for the water use target to revert above 50 gpcd. For purposes of this UWMP, the higher value of 55 gpcd is assumed.

Using this methodology, discussing the results with each large retail supplier, and making any requested refinements provided MWA with a reasonable forecast of the future needs of the larger retail suppliers. The resulting values, rounded up to the nearest 10 acre-feet, are provided in Table 4-3.

4.2.2 Forecasting Needs of Other Water Users

While the large retail suppliers comprise about 60% of the water use within MWA's service area, the remaining 40% encompasses several significant water using categories: irrigated agriculture (approximately 15%), small retail suppliers and domestic users (approximately 10%), and industrial and recreational (approximately 15%). MWA tracks and records these use categories as part of annual validated pumping reports prepared by the Watermaster. The methodology used to forecast water use within each is described in the following subsections.

Agricultural Users

As described in Chapter 3, agricultural users are subject to the Mojave Basin Area Adjudication and are assigned a Free Production Allowance (FPA) that is monitored by the Watermaster. As one of the region's historically higher water users, agricultural users have experienced to the most reduction over the past twenty years to align with the Adjudication and FPAs and are nearing expected steady-state use. Based on agricultural users' historic record and anticipated reductions in FPA within the Mojave Basin to get groundwater production within sustainable yield, MWA expects the water demand of this class of users to drop to 20,600 acre-feet as a long-term average annual use by 2025, which is assumed to stay constant through 2065. Table 4-2 provides recent pumping history and the anticipated future condition.

Table 4-2: Agricultural Pumping (values in acre-feet per year)

	1995	2000	2005	2010	2015	2020	2025 to 2065
Agricultural Use	87,700	56,100	37,900	36,100	38,800	26,600	20,600

Small Suppliers and Domestic Users

The MWA service area includes more than 35 small public water systems[47] and numerous private domestic users pumping less than 10 acre-feet annually.[48] Water use for the small public systems is metered and reported, while use by the small private pumpers – predominantly reflecting rural residential domestic use – are estimated by the Watermaster. As reflected in Table 2-3, population is expected to grow throughout the MWA service area, with expected increases also in rural populations and connections to small water systems. The population within this class of users currently is estimated to be about 41,000 and is expected to grow to between 47,000 to 48,000 by 2065.

[47] Small public water systems serve less than 3,000 connections or less than 3,000 acre-feet annually but are permitted by the State and required to meet public drinking water standards. Systems of this size are not required to prepare UWMPs.

[48] Individuals pumping less than 10 acre-feet annually (minimal producers) were excluded from the various adjudication judgements and are estimated.

Future water needs of this class is estimated by dividing the reported total water use by the population to derive a per-capita use factor. Based upon the available data, the approximately 41,750 people in this class had a total water use of approximately 11,100 acre-feet in 2020 (see Table 4-1). This results in a per-capita use of 240 gpcd (or 0.27 acre-feet per year). To reflect recent variances, the same information for 2015 through 2019 was also evaluated, with resulting values ranging from 267 gpcd to 366 gpcd (or 0.30 to 0.41 acre-feet per year). Including 2020, an average per-capita use of 280 gpcd (or 0.32 acre-feet per year) for 2015 through 2020 was determined to be representative of future conditions.

This value was applied to the incremental population growth described in Chapter 2 to develop estimated future water needs for each five-year increment to 2065. The results are shown in Table 4-3.

Other Users

Other users include a variety of industrial users, recreational uses, and golf courses that are individually tracked and collectively reported by MWA within these three categories. These uses occur throughout the MWA service area. According to the available data, while annual variations occur, the recent aggregate water use for this class has remained relatively consistent (see Table 4-1). Because of this consistency, future water needs for this class were estimated by averaging the past five years and holding the value constant through 2065. The estimated use is included in Table 4-3.

4.2.3 Summary of Forecast Water Use

Based upon the estimated water needs of the different primary water users, MWA anticipates a 15% to 20% increase in water need between current conditions and 2065, predominantly attributed to anticipated population growth. Table 4-3 presents the forecast regional water needs through 2065, reflecting approximately 20,000 to 25,000 acre-feet more annual water use by 2065 than in 2020.

Table 4-3: Future Regional Water Use (values in acre-feet per year)[49]

Water User Category		2025	2030	2035	2040	2045	2050	2055	2060	2065
Large Retailer	Liberty Utilities - Apple Valley Water Company	10,220	10,520	10,700	10,870	11,150	11,380	11,600	11,780	11,950
	Bighorn-Desert View Water Agency	630	630	640	640	650	650	650	660	660
	City of Adelanto Water District	4,640	4,870	5,010	5,140	5,310	5,440	5,550	5,640	5,730
	County Service Area 64	2,770	2,810	2,840	2,850	2,900	2,940	2,980	3,020	3,050
	County Service Area 70 J	1,630	1,640	1,650	1,650	1,680	1,690	1,710	1,730	1,750
	Golden State Water Company - Barstow System	5,730	5,780	5,830	5,870	5,920	5,960	6,000	6,040	6,070
	Helendale CSD	2,000	1,980	1,970	1,960	1,970	1,980	1,990	2,000	2,010
	Hesperia Water District	15,260	16,290	16,990	17,740	18,420	19,030	19,580	20,070	20,520
	Hi-Desert Water District	3,060	3,150	3,230	3,290	3,360	3,410	3,460	3,500	3,540
	Joshua Basin Water District	1,310	1,310	1,310	1,300	1,320	1,330	1,340	1,350	1,360
	Phelan Pinon Hills CSD	2,970	2,990	3,000	3,010	3,040	3,060	3,090	3,110	3,140
	Victorville Water District	24,720	27,090	28,190	29,250	30,480	31,610	32,670	33,630	34,520
	Total Large Retailer	74,900	79,100	81,400	83,600	86,200	88,500	90,600	92,500	94,300
Small Water Systems and Rural Domestic		13,500	13,800	14,000	14,200	14,500	14,700	14,900	14,900	15,200
Other (Industrial, golf course, recreational)		21,800	21,800	21,800	21,800	21,800	21,800	21,800	21,800	21,800
Agricultural		20,600	20,600	20,600	20,600	20,600	20,600	20,600	20,600	20,600
Total Water Use in Service Area		130,800	135,300	137,800	140,200	143,100	145,600	147,900	149,800	151,900

4.2.4 Comparison to 2015 UWMP Forecasts

The forecast future regional water needs in Table 4-3 are significantly lower than forecast in MWA's 2015 UWMP. This lower forecast results from three primary factors:

- Lower projected population than assumed in 2015 – For 2015, MWA used the population projection prepared by Beacon Economics, the same firm that prepared the population update for 2020. Based upon conditions in 2015, the analysis assumed a population by 2040 of

[49] Bighorn-Desert View Water Agency and Helendale CSD have fewer than 3,000 connections and server less than 3,000 acre-feet annually and are therefore not considered an "urban retail water supplier" per definition of the California Water Code. Thus, these agencies do not prepare UWMPs or submit monthly data to the SWRCB and the values in this table are estimated.

695,647. The updated analysis projects the 2040 population to be 614,931 (see Table 2-3), a significantly lower estimate.

- On-going reductions in per-capita water use by large retailer customers – Due to several factors not evident when estimating per-capita use for the 2015 UWMP, future per-capita use projected for the 2015 UWMP was slightly higher for 2020 than actual per-capita use as reported by the large retail suppliers. Ultimately, however, the per-capita use factors estimated in 2015 for the 2060 planning horizon were similar to that calculated using the methodology described previously.
- State mandates – additional urban water use standards codified in the California Water Code have been adopted since the 2015 UWMP was prepared. These standards, such as the Model Water Efficient Landscape Ordinance and a lowering residential indoor standard to 50 gpcd beginning in 2030, also have a net effect on per-capita use factors for the growing population.

Based upon the comparison, as represented in Table 4-4, the majority of the difference in near-term and long-term regional water use forecasts results from the revised population forecast. While lower per-capita use and further presumed reductions in agricultural pumping also contribute, the population adjustments cause most of the variance.

Table 4-4: Comparison to 2015 UWMP Forecasts

	2020	2025	2030	2035	2040		2060
Regional Water Use Forecast (acre-feet per year)							
2015 UWMP	148,366	153,186	159,079	165,164	170,700		188,747
2020 UWMP	129,192	130,800	135,300	137,800	140,200		149,800
Regional Population Forecast							
2015 UWMP	499,967	543,265	593,809	646,489	695,647		850,144
2020 UWMP	492,319	533,170	567,855	592,849	614,931		684,247

4.2.5 Adjusting Water Use Forecasts for Single-Dry and Multiple Dry Conditions

The regional water use forecast represents expected water needs under normal climatic conditions. Often, to reflect lower rainfall conditions which may trigger water users to begin irrigating sooner, adjustments to this forecast should be made. However, in the high desert climate of the Mojave and Morongo areas, water users are generally not managing landscape or agricultural irrigation systems based upon any variance from "normal." In other words, rainfall to meet landscape or crop water needs is not relied upon, thus the lack of it does not change behavior as it may in climates with higher rainfall.

As a result, the regional forecast presented in Table 4-3 is not adjusted for single dry or multiple dry years. The regional forecast represents the "unconstrained demand" that would be expected in all year types.[50]

[50] California Water Code Section 10632(a)(2) states water suppliers should use "unconstrained demand" when performing their annual water supply and demand assessment. This reflects the expected demand prior to implementing shortage response actions as detailed in a Water Shortage Contingency Plan.

4.2.6 Climate Change Considerations

Including climate change in a water use analysis aids in understanding the potential effects on long-term reliability, which in turn, allows MWA to proactively begin planning appropriate responses. For example, hotter and drier weather may lead to an increased demand in landscape irrigation, especially during spring and fall months, increasing the pressure on water supplies that may have availability restrictions during these periods.

However, as indicated previously, the High Desert climate already has low rainfall and extreme temperatures. Thus, adjustments for the near-term planning horizon are not warranted.

Long-term effects of climate change may increase the evapotranspiration rates of irrigated crops and landscapes. But such effects will be nominal when compared to the existing rates already occurring in the high desert climate. Furthermore, the anticipated continued reduction in agricultural use consistent with the Mojave Basin Judgement will have a greater impact on future use than the likely increase in evapotranspiration rates into the future. MWA will continue to assess the potential effect of climate change in future UWMPs and other regional water planning efforts.

4.3 Demand Management Measures

Pursuant to California Water Code Section 10631(e)(2), MWA provides a narrative discussion of several foundational water demand management measures it implements or participates within. This information helps demonstrate MWA's commitment to efficient resource management.

In addition to a long history of its own conservation programs, MWA is the founding member of the Alliance for Water Awareness and Conservation (AWAC), a locally organized coalition committed to achieving water conservation goals within the region.[51]

The following describes the foundational demand management measures (DMMs) that underpin the MWA's operations and management of regional water supplies. These particular DMMs represent existing policies and long-standing budgeted conservation programs.

4.3.1 Metering

MWA does not provide water directly to the region's water uses and does not have traditional distribution system metering. With the primary functions including managing the import of SWP, it does not have a traditional metering system. MWA does replenish the groundwater basin by recharging imported SWP water at several locations throughout the service area, as described in Section 3. The SWP water is metered at the turnouts from where MWA receives the water into its service area. All connections in the MWD service area are metered.

[51] https://www.mojavewater.org/files/AWAC-FAQs.pdf

4.3.2 Public Education and Outreach

Working in conjunction with AWAC, public information programs that promote efficient water use are implemented throughout the MWA service area. Outreach has included the production of educational and informational materials and literature; public service announcements and paid advertisements; flyers and bill inserts for retailers; a conservation website; and articles in newsletters, Chamber of Commerce publications and regional newspapers. Additionally, MWA assists in hosting and staffing workshops on conservation, sponsors and hosts public events and booths at community functions including the Innovator's High Desert Water Summit Program, and works with retailers to further their conservation goals through special projects based on their individual needs.

Several years ago, MWA created and began long-term funding of a Strategic Partners Program. This program offers grants to community organizations and educational facilities to promote water conservation. One of the key achievements of this program is the funding of the Water Management Academy in conjunction with Victor Valley College. This program is training future water managers in proper conservation and water resource management. In addition to funding, MWA assists with curriculum development and provides speakers for this program.

MWA working with AWAC continues the regional conservation slogan and campaign "Save Water: Live Like a Desert Native", which reminds citizens that living in a desert region requires continual conservation. The message focuses on learning how to efficiently use water resources by taking tips from the native plants that not only survive but thrive in the arid, desert region. The Agency has invested heavily in this campaign, placing billboards, signs, and flyers, as well as making public presentations.

4.3.3 Water Conservation Program Coordination and Staffing Support

MWA engages the San Bernardino County Water Conference each year and seeks to have two full-time water conservation program staff with an annual budget of $1,000,000. Additionally, other MWA staff from various departments provide technical and administrative support, and serve as speakers at a variety of events. The conservation budget is used to fund various rebate and conservation and education programs. In the past, the conservation team has facilitated a Cash for Grass rebate program, toilet rebates, Weather Based Irrigation Controller (WBIC) rebates, clothes washer rebates, and other fixture replacement programs.

4.3.4 Other Demand Management Measures

MWA has actively engaged in numerous specific DMMs over the past several years, as represented by the list below. These demonstrate the proactive role MWA takes within the region to promote efficient use of limited water resources.

- Mojave Water Agency's ABC's of Water – bi-monthly presentations from 2015-2019
- Mojave Water Agency's Today in Water – bi-monthly presentations during the year of 2019
- High Desert Opportunity (2015, 2018)
- High Desert Water Symposium (2018)
- Innovators High Desert Water Summit (2016, 2017, 2018, 2019, 2020)

- County Service Area 64 Water Conservation Fair (2015, 2016, 2017, 2018, 2019)
- County Service Area 70 Water Conservation Fair (2016, 2017, 2018)
- Barstow Water Wise Festival (2018, 2019)
- Home and Garden Show (2015, 2016, 2017, 2018, 2019)
- Eucalyptus Elementary School, Hesperia, Environmental Day (2018, 2019)
- Eucalyptus Elementary School, Hesperia, Earth Day (2018, 2019)
- Contenta Middle School, Yucca Valley, Water Education Festival (2016, 2017, 2018, 2019)
- Helendale Earth Day Celebration (2016, 2017, 2018, 2019)
- Joshua Basin Water District Water Education Day (2015, 2016, 2017, 2018, 2019)
- Mojave Environmental Education Consortium – Youth Environmental Leadership Conference (2019)
- Victor Valley College Fall Plant Sale (2017, 2018, 2019)
- City of Victorville Fall Festival (2016, 2017)
- Morongo Basin Orchid Festival (2017, 2018, 2019)
- Phelan Phun Days (2017, 2018)

In addition, since mid-2020 MWA has sponsored several remote learning classes for large retail suppliers on subjects such as Residential Leak Detection and California Native Plants Use in Landscaping.

4.3.5 Distribution System Asset Management

MWA operates both a potable and non-potable water system. Both systems are operated in a manner that meets regulatory requirements. Both systems use flow control facilities that use Supervisory Control and Data Acquisition (SCADA) to remotely monitor and manage valves, reservoirs, and flow control facilities. The non-potable water system consists of State Water Project raw water, while the potable system uses low turbidity water pumped from the Mojave River aquifer system. Flow meters are utilized in both systems to accurately meter water flows from the various turnouts and pumps. The potable water system has a chlorination system that is operated in a manner that meets regulatory requirements.

Both the potable and non-potable water systems have regular maintenance on pumps, valves, tanks, pipelines, cathodic protection, and other supporting infrastructure. Because raw water can have debris and dense algal growth, the non-potable water system screens require frequent cleaning to ensure proper flow. The potable water system has frequent water quality testing to ensure Title 22 compliance.

4.3.6 Wholesale Supplier Assistance

MWA provides both technical and financial assistance to the retail agencies for implementing conservation programs and strategies, working with suppliers and cities individually, collectively and through AWAC. Budget for the last three years of program support was $1,000,000 annually.

MWA provides the following support to its retailers, individually or through AWAC:

- Free conservation devices: faucet aerators, showerheads, and hose nozzles.

- Large landscape Cash for Grass rebates: Customers are offered $1.00 per sq. ft. of turf converted to desert adaptive landscaping with a 25 percent canopy coverage for lot sizes ranging from 20,000 to 500,000 sq. ft.
- Public Information and Education Programs.

4.4 Forecasting Water Use for the DRA and Annual Assessment

The California Legislature created two new UWMP requirements to help suppliers assess and prepare for drought conditions: The Drought Risk Assessment,[52] and the Annual Water Supply and Demand Assessment.[53] These new planning requirements were established in part because of the significant duration of recent California droughts and the predictions about hydrological variability attributable to climate change.

The Drought Risk Assessment (DRA) requires assessing water supply reliability over a five-year period from 2021 to 2025 that examines water supplies, water uses, and the resulting water supply reliability under a reasonable prediction for five consecutive dry years.

As a slight variant, the Annual Water Supply and Demand Assessment (Annual Assessment) undertakes a similar analytical exercise as the DRA but is to focus on actual, and not hypothetical, conditions anticipated for the upcoming water year. The previously presented water use forecasts facilitate both planning exercises as described in the following subsections.

4.4.1 Projecting Water Use for 5-year Drought Risk Assessment

A critical component of new statutory language for the 2020 UWMP cycle is the requirement to prepare a five-year DRA using a supplier-defined hypothetical drought conditions expected to occur from 2021 through 2025. This drought condition is meant to allow suppliers to test the resiliency of their water supply portfolio and their Water Shortage Contingency Plan actions to meet severe conditions.

DWR recommends that suppliers first estimate expected water use for the next five years without drought conditions (also known as unconstrained demand). In other words, unconstrained demand is water demand absent any water supply restrictions and prior to implementing any short-term WSCP demand-reduction actions. If normal water use includes water conservation programs, either currently implemented or planned for implementation, estimated water use values would incorporate the effect of those conservation programs when reporting projected water use during this period.

For MWA, the increase in regional water use forecast for 2025 is equally distributed between the 2020 representation and 2025. The resulting forecast is presented in Table 4-5.

[52] California Water Code Section 10635(b)
[53] California Water Code Section 10632.1

Table 4-5: Forecast DRA Water Use for 2021 through 2025 (acre-feet per year)

Regional Use Class	2021	2022	2023	2024	2025
Total Large Retailer	70,900	71,900	72,900	73,900	74,900
Small Water Systems and Rural Domestic	11,600	12,000	12,500	13,000	13,500
Other (Industrial, golf course, recreational)	21,800	21,800	21,800	21,800	21,800
Agricultural	25,300	24,000	22,800	21,700	20,600
Total Water Use in Service Area	129,600	129,700	130,000	130,400	130,800

4.4.2 Projecting Water Use for Annual Reliability Assessments

MWA will need to perform an Annual Assessment and submit the findings to DWR beginning in 2022. To evaluate the plausible water service reliability conditions under current "normal" and "single-dry" conditions, as further described in Chapter 5, it is recommended that MWA use the 2020 regional water use shown in Table 4-1.

Chapter 5
Water System Reliability

This chapter provides the Mojave Water Agency's (MWA) water system reliability findings as required under Water Code Section 10635 and provides reliability information MWA may use in completing an annual supply and demand assessment under Water Code Section 10632.1.

Assessing water service reliability is the fundamental purpose for MWA in preparing its 2020 UWMP. Water service reliability reflects MWA's ability to demonstrate that the regional water needs, including those of the retail urban suppliers, may be satisfied under projected hydrological and regulatory conditions. MWA's 2020 UWMP considers the reliability of meeting water demands by analyzing plausible hydrological variability, regulatory variability, climate conditions, and other factors that impact the regional water supplies. The reliability assessment looks beyond MWA's past experience and considers what could be reasonably foreseen in the future in order to reflect potential water supply planning scenarios. This chapter synthesizes the details imbedded in Chapters 3 and 4 and provides a rational basis for future decision-making related to supply management, demand management, and project development. This chapter presents three system reliability findings:

- Five Year Drought Risk Assessment: The 2021 through 2025 Drought Risk Assessment (DRA) for MWA's service area.
- Long-Term Service Reliability: The reliability findings for a Normal Year, Single Dry Year, and Five Consecutive Dry Years in five-year increments through 2065.
- Annual Reliability Assessment: The reliability findings for an existing condition for both a Normal Year and Single Dry Year that can inform an annual supply and demand assessment for 2021 or 2022.

In summary, MWA has reliable water supplies to meet retail demands within its service area.

5.1 Fundamental Reliability Considerations

Mojave Water Agency aggregates the regional water supplies and demands in this 2020 Urban Water Management Plan (UWMP) through its roles as a wholesale water purveyor of State Water Project supplies, Watermaster of the Mojave Basin Area Adjudication, and administrator for the Warren Valley Basin Judgment. These efforts necessitate examination of water supplies at a region-wide level in order to ensure supply reliability among the numerous regional retail purveyors and others that depend upon the regional water resources.

MWA has extended the planning horizon considered in this 2020 UWMP from the statutorily required twenty-year timeline to a much longer forty-five-year period through 2065. This extended planning

horizon allows MWA and the regional retail water purveyors to address longer-term land use planning, water planning, and infrastructure considerations. Moreover, the extended timeline will assist MWA's Board of Directors in examining historical and long-term trends in water resources conservation, management, and use to ground current and future decision-making. Together, these considerations help improve regional coordination and planning.

MWA procured a regional population analysis from UC Riverside and Beacon Economics (Beacon) to analyze population trends in the MWA service area.[54] Beacon concluded that although the population was increasing in the MWA service area, it was increasing at a slower rate than had been considered under the 2015 UWMP. Specifically, in the 2015 UWMP the regional population was projected to reach 695,647 people by 2040[55] but the 2020 projections show a more modest population of 614,931 people by 2040 and 697,603 people by 2065.[56]

The regional water demands are tied to these population projections. Importantly, the 2060 regional water demands projected in 2015 of 188,747 acre-feet are significantly higher than the 149,300 acre-feet of water demands currently projected for 2060; 2065 demands are currently projected at 152,100 acre-feet (see Chapter 4). The reduction in the overall projected demands from the 2015 projections is due in large part to the reduced population projection, but also reflects successful water conservation and water efficiency efforts by MWA and retail agencies throughout the MWA service area. These reduced long-term average demands affect the water management and project development actions by MWA and its retail partners.

Similarly, the averaged reliability of State Water Project (SWP) supplies that are used for groundwater replenishment throughout the region have also declined from 62% SWP reliability in 2015[57] to as low as 52% reliability by 2040. MWA extends the SWP reliability projection through the 2065 planning horizon. These reliability numbers are derived from California Department of Water Resources' (DWR) 2020 Delivery Capability Report (DCR).[58] Nevertheless, despite these long-term changes in SWP supply availability, MWA and the regional retail agencies can demonstrate that the region has reliable water supplies available to meet the regional water demands through 2065. In short, regional water supplies within the Mojave Water Agency service area boundaries are reliable during normal, single dry, and five consecutive dry years through 2065. Figure 5-1 below shows the Mojave Water Agency's individual water supplies compared against the water demands from 2025 through 2065.

[54] *Mojave Water Agency Population Forecast, 2020 Edition*, August 2020, UC Riverside School of Business Center for Economic Forecasting and Development. (UCR Study)

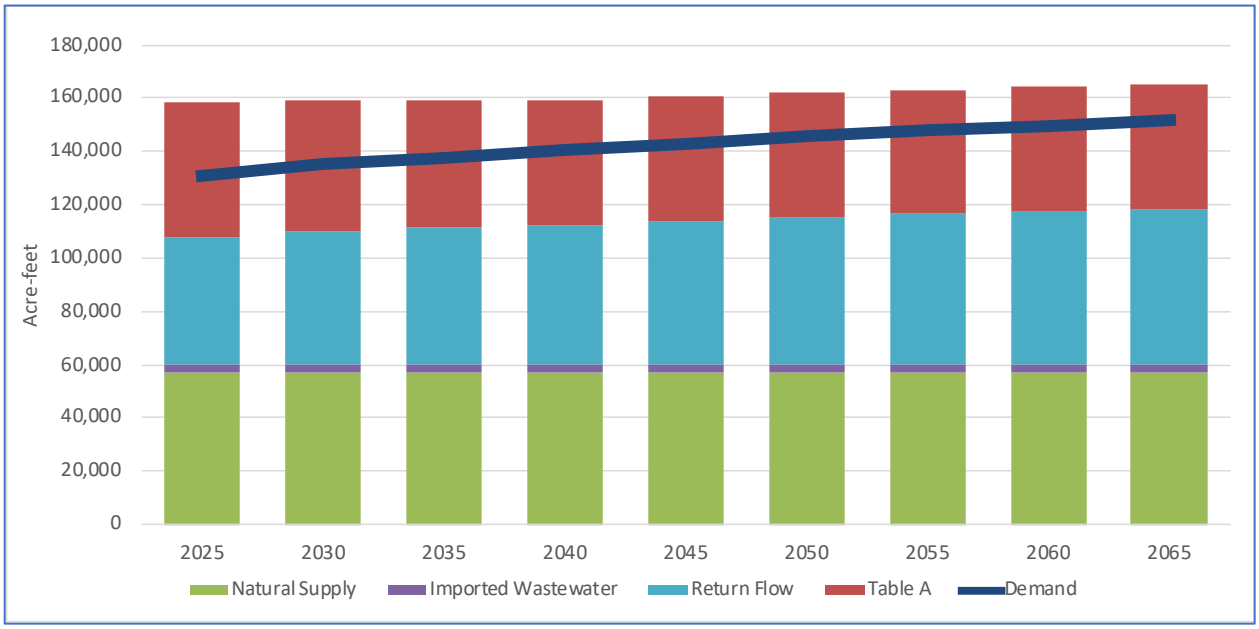
[55] Mojave Water Agency 2015 Urban Water Management Plan at 2-2.

[56] UCR Study.

[57] Mojave Water Agency 2015 Urban Water Management Plan at 3-1 citing DWR's 2015 Delivery Capability Report.

[58] The Final State Water Project Delivery Capability Report (DCR), California Department of Water Resources (DWR), August 2020 at 30.

Figure 5-1: Representation of MWA's Normal Year Water Reliability from 2025 through 2065



5.2 MWA Five Year Drought Risk Assessment

The MWA Service Area has a unique water supply portfolio and system operations. As noted in Chapter 3, the regional supplies that are included in MWA's service area include State Water Project Table A Annual Amount, Natural and Recharged Groundwater, Imported Wastewater, Return Flow, and Stored and SWP Carryover supplies. These supplies are managed in different locations both inside and outside MWA's service area. For example, although MWA brings its annual SWP Table A allocation into its service area for delivery into the Mojave Basin Area and Morongo Area groundwater systems, it also may store some of its Table A allocation within the SWP under the Carryover provisions in Mojave's SWP Contract or may store portions of the Table A allocation in regional groundwater basins for use in later years. As such, the annual management of the diverse water supply sources in the regional water supply portfolio forms the supply reliability assessment described in this Chapter.

MWA manages its water supplies to address projected dry conditions. Specifically, MWA captures and stores surplus imported water in normal and wet years to use those water assets to meet regional demands in dry years. These actions stabilize annual fluctuations in supplies that may not meet regional demands under certain dry conditions. In other words, any surplus imported supplies are captured and stored for future delivery to improve long-term supply reliability. As noted in Chapter 3, MWA has stored over 200,000 acre-feet of water to mitigate dry conditions.

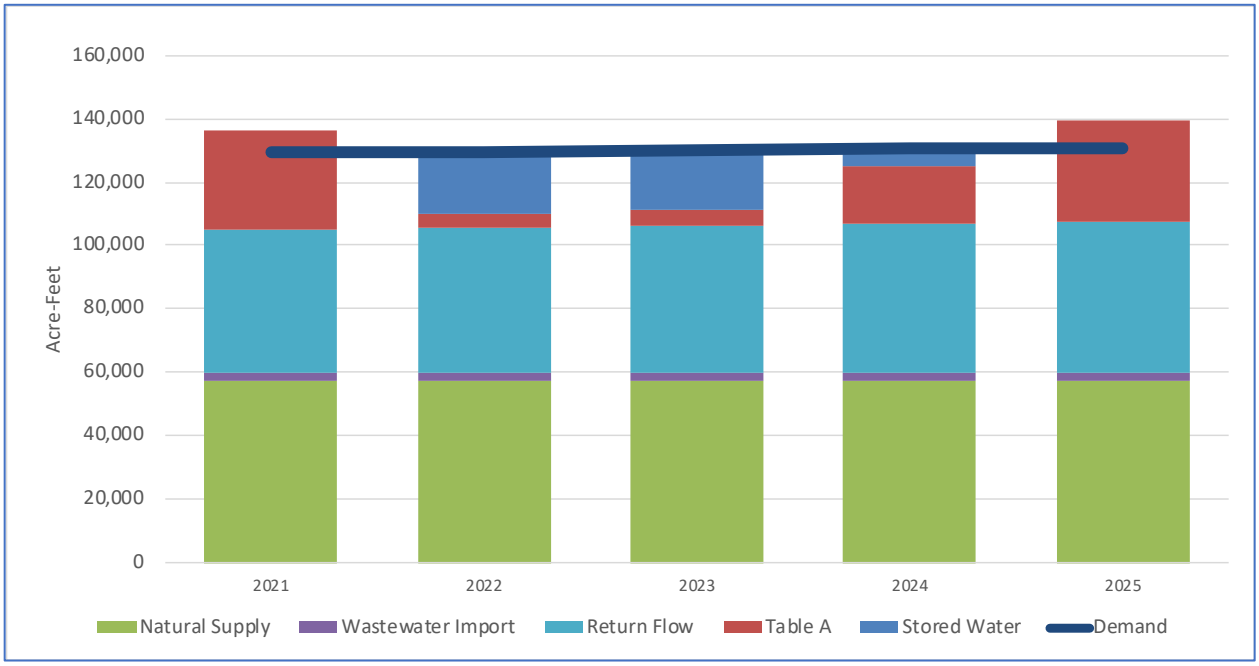
Table 5-1 below shows MWA's five-year Drought Risk Assessment (DRA) that integrates all of the regional water supplies for 2021 through 2025 as described in Chapter 3 and reflects the dry year water uses described in Chapter 4. As the table shows, MWA has surplus water assets available in the first and fifth years of a projected dry period but must meet demands in the second, third, and fourth years of the dry period by utilizing stored water supplies.

Table 5-1: MWA Five Year Drought Risk Assessment

	2021	2022	2023	2024	2025
Supply	136,583	129,700	130,000	130,400	139,234
Demand	129,600	129,700	130,000	130,400	130,800
Difference	6,983	0	0	0	8,434

Figure 5-2 below shows the Mojave Water Agency's individual water supplies compared against the water demands in five consecutive dry years from 2021 through 2025. The important component to note is that MWA uses a portion of its stored water assets in the middle of the drought period to make up deficits in the imported supply. On the shoulder years, where imported supplies in combination with other supplies exceed the demands, the excess water can be stored for future use as either carryover supply in the SWP system or as banked groundwater in local basins.

Figure 5-2: Representation of MWA's Drought Risk Assessment from 2021 through 2025



5.3 MWA Long Term Service Reliability

The Urban Water Management Planning Act directs urban water purveyors to analyze water supply reliability in a normal, single dry, and five consecutive dry years over a 20-year planning horizon. The 2020 UWMP Guidebook recommends extending that period to 25 years to provide a guiding document for future land use and water supply planning through the next UWMP cycle.[59] MWA prefers to extend

[59] https://water.ca.gov/Programs/Water-Use-And-Efficiency/Urban-Water-Use-Efficiency/Urban-Water-Management-Plans

the planning horizon over a 45-year period. The following subsections describe the long-term water service reliability for MWA through 2065.

5.3.1 Normal and Single Dry Conditions 2025-2065

MWA's long term service reliability is characterized in normal, single dry, and five consecutive dry years through 2065. MWA's future water supplies in normal and single dry conditions depicted in this section reflect the same hydrological, regulatory, and institutional criteria associated with each water asset as described in Chapter 3. In normal years, for example, SWP supplies are generally constrained only by the projected Table A allocations derived from DWR's 2020 Delivery Capability Report. In dry years, additional hydrological, regulatory, and institutional issues may constrain the availability of water that reduce SWP supply availability based on reduced allocation percentages as noted in Chapter 3. However, other future water supplies, like return flow, tend to grow in annualized volumes as annualized demands grow in parallel. All this information is described in detail in Chapter 3 and is reflected in the tables below.

MWA's future water demands in normal and single dry conditions through 2065 reflect the same considerations described in previous sections of this chapter. In both normal and dry conditions, demands tend to reflect anticipated uses based upon the climatological conditions in the Mojave Water Agency service area. Future water demands are generally predicted to increase as land uses and populations within MWA's service area grow. This information is detailed in Chapter 4 and reflected in the numbers shown in the tables below. In normal years, MWA projects surplus water conditions that allow it to store water for dry conditions. In a single dry year, MWA uses its stored water assets to satisfy the regional demands. Table 5-2 shows the normal year supplies and demands on an annual timestep from 2025 through 2065.

Table 5-2: Normal and Single Dry Year Water Supply and Demand in MWA through 2065

Normal Year	2025	2030	2035	2040	2045	2050	2055	2060	2065
Supply	158,541	159,452	159,372	159,299	160,710	161,985	163,141	164,186	165,128
Demand	130,800	135,300	137,700	140,200	142,900	145,500	147,800	149,800	151,800
Difference	27,741	24,152	21,672	19,099	17,810	16,485	15,341	14,386	13,328

Single Dry Year	2025	2030	2035	2040	2045	2050	2055	2060	2065
Supply	130,800	135,300	137,700	140,200	142,900	145,500	147,800	149,800	151,800
Demand	130,800	135,300	137,700	140,200	142,900	145,500	147,800	149,800	151,800
Difference	0	0	0	0	0	0	0	0	0

5.3.2 MWA Five Consecutive Dry Years through 2065

MWA defines drought condition lasting five consecutive years as one that constrains MWA from obtaining some of its water supplies in its MWA water supply portfolio due to hydrological, regulatory,

and institutional constraints. These conditions include more restrictive regulatory constraints that limit its Table A allocation but do not limit the availability of groundwater resources or wastewater imports.

The future dry year projections show MWA using more on stored water as its population grows and water demands increase. These future conditions indicate that MWA will use more stored water to meet future dry year demand conditions. Specifically, MWA continues to increase its use of stored water supplies in years two, three and four of a five consecutive year drought through the entire planning horizon. But importantly, starting in 2060, MWA will begin to use its stored water supplies to manage both year one and year five of a projected five consecutive dry year scenario. This gradual decrease in supply availability and eventual loss of surplus in years one and five would also impact MWA's ability to store surplus water in those years. Accordingly, although MWA will have adequate water supplies to meet the regional demands for five consecutive dry years in 2065, the region will be using more of MWA's stored water supplies to handle those conditions. These issues are described in significant detail in Chapter 3 and reflected in the monthly reliability table below. Table 5-3 below shows the water supply and demand conditions for MWA's service area in five consecutive dry years from 2025 through 2065.

Table 5-3: Five Consecutive Dry Years Water Supply and Demand in MWA's Service Area through 2065

		2025	2030	2035	2040	2045	2050	2055	2060	2065
Year 1	Supply	139,234	141,492	142,759	144,033	145,444	146,719	147,875	149,800	151,800
	Demand	130,800	135,300	137,700	140,200	142,900	145,500	147,800	149,800	151,800
	Difference	8,434	6,192	5,059	3,833	2,544	1,219	75	0	0
Year 2	Supply	130,800	135,300	137,700	140,200	142,900	145,500	147,800	149,800	151,800
	Demand	130,800	135,300	137,700	140,200	142,900	145,500	147,800	149,800	151,800
	Difference	0	0	0	0	0	0	0	0	0
Year 3	Supply	130,800	135,300	137,700	140,200	142,900	145,500	147,800	149,800	151,800
	Demand	130,800	135,300	137,700	140,200	142,900	145,500	147,800	149,800	151,800
	Difference	0	0	0	0	0	0	0	0	0
Year 4	Supply	130,800	135,300	137,700	140,200	142,900	145,500	147,800	149,800	151,800
	Demand	130,800	135,300	137,700	140,200	142,900	145,500	147,800	149,800	151,800
	Difference	0	0	0	0	0	0	0	0	0
Year 5	Supply	139,234	141,492	142,759	144,033	145,444	146,719	147,875	149,800	151,800
	Demand	130,800	135,300	137,700	140,200	142,900	145,500	147,800	149,800	151,800
	Difference	8,434	6,192	5,059	3,833	2,544	1,219	75	0	0

5.4 Annual Reliability Assessment

The MWA may consider current supply and demand conditions and perform an annual water supply and demand assessment (Annual Assessment) pursuant to Water Code Section 10632.1 to evaluate real-time or near-term circumstances that are different than the DRA scenario. This assessment would evaluate actual current water supply and use conditions. For purposes of this UWMP, the "current" water use conditions as described in Chapter 4 are compared to the availability of MWA's existing water supplies as described in Chapter 3. Two scenarios are illustrated for the MWA service area:

- Normal Year condition: reflects the availability of supplies under normal conditions and the "current" water uses.
- Single-Dry Year condition: reflects the availability of supplies under a severe, single-dry year and elevated "current" water uses reflecting increased demands expected in a single dry year.

5.4.1 MWA Normal Year Supply and Current Demand

MWA defines a normal year condition as one that allows the agency to obtain water supplies from all sources under its water supply portfolio under normalized conditions. These conditions include normally anticipated regulatory constraints on its SWP Table A allocation and availability of the managed groundwater resources and stored water supplies. These conditions are described in significant detail in Chapter 3 and reflected in the supply determinations shown below.

Normal year demands include the anticipated demands based upon historical trends in water usage in non-drought conditions in MWA's service area. Demands in normal conditions generally are lower in the wetter months and higher in the drier months but these are aggregated in the annual demand figure shown below. The normal year demand also accounts for reasonable water conservation measures derived from improved efficiencies in indoor fixtures, improved management of outdoor landscape irrigation, and a general awareness of the value of long-term water conservation at the consumer level. These demand conditions are described in significant detail in Chapter 4 and reflected in the demand figure shown below. Table 5-4 below shows the normal year water supply and demand conditions for MWA's service area. In a normal year, MWA has surplus supplies available.

Table 5-4: Normal Year Water Supply and Demand in MWA

Normal Year	Current
Supply	156,580
Demand	129,400
Difference	27,180

5.4.2 MWA Single Dry Year Supply and Dry-Year Current Demand

MWA defines a single dry year condition as one that constrains MWA from obtaining some of its water supplies in its MWA water supply portfolio due to hydrological, regulatory, and institutional constraints. These conditions include more restrictive regulatory constraints on its SWP Table A supplies, yet unconstrained conditions on the region's ability to access managed groundwater resources and stored water supplies. The restrictive conditions manifest in changed management of MWA's water supply portfolio in a single dry year condition by requiring MWA to access its stored water assets to meet demands. The changed water management conditions are described in significant detail in Chapter 3.

Single dry year demands include the anticipated demands based upon historical trends in water usage in drought conditions by MWA's customers. As described in Chapter 4, demands in dry conditions in the Mojave Service Area remain stable because of the climatological conditions. Table 5-5 below shows the single dry year water supply and demand conditions for MWA's service area.

Table 5-5: Single Dry Year Water Supply and Demand in MWA

Single Dry Year	Current
Supply	129,400
Demand	129,400
Difference	0

5.5 MWA Regional Water Supply Reliability Summary

Mojave Water Agency has a robust water supply portfolio capable of meeting the water demands in normal, single dry, and five consecutive dry years from 2020 through 2065. MWA's diverse water supply portfolio coupled with the system's flexible operations render the supply reliable in all year types including reasonable planned growth through 2065.

Chapter 6
Water Shortage Contingency Plan

This Water Shortage Contingency Plan (WSCP) addresses the plan preparation requirements in Water Code Section 10632 of the Urban Water Management Planning Act (The Act). The WSCP is incorporated into the 2020 Urban Water Management Plan (UWMP) and used by Mojave Water Agency (MWA) to respond to water shortage contingencies in the MWA service area as they may arise.

MWA provides wholesale water to retail agencies within its service area. The retail agencies are the direct purveyor of water service to retail customers. As such, MWA relies on a coordinated approach to water shortage management with the retail water agencies within its service area. MWA's efforts in Water Shortage Contingency Planning are focused on maintaining and augmenting groundwater supplies in order to mitigate against extended drought conditions and catastrophic water outages. And because MWA is a wholesale urban water supplier, elements that pertain only to retail water suppliers are not addressed in this WSCP.[60] This chapter will address all aspects of MWA's WSCP actions and address specific outage scenarios that MWA's water management actions alleviate.

Section 10631 of the Urban Water Management Plan Act lists the following required elements for wholesale water purveyors:

1. An analysis of water supply reliability
2. Procedures for conducting an annual water supply and demand assessment
3. Six standard water shortage levels corresponding to progressive ranges of up to 10, 20, 30, 40, and 50 percent shortages and greater than 50 percent shortage and the shortage response actions that align with the defined shortage levels.
4. Communication protocols and procedures
5. A description of legal authorities
6. A description of financial consequences
7. Reevaluation and improvement procedures
8. Special Water Feature Distinction (10632(b))
9. Plan Adoption, Submittal, and Availability

[60] Water Code sections 10632(a)(6), 10632(a)(8)(C), and 10632(a)(9) apply exclusively to retail urban purveyors.

This WSCP is a stand-alone plan that may be adopted independently from the UWMP and may be amended or refined and readopted as needed over coming months and years independently from the UWMP.

6.1 Water Supply Reliability Analysis

Mojave Water Agency is a special act district created in 1960 under Chapter 97 of the California Water Code Water Appendices. MWA service area covers 4,900 square miles in San Bernardino County and delivers water for regional groundwater management that is used by numerous retail water purveyors, ten of which are required to prepare an UWMP under the Urban Water Management Planning Act. Regional water supplies consist of naturally recharged groundwater, return flows, wastewater imports and imported State Water Project supplies. These supplies are discussed in greater detail in Chapter 3.

The water demands in the MWA service area currently serve a population approaching 500,000 people that is expected to grow to nearly 700,000 people by 2065.[61] MWA's service area demand analysis includes both the population assessment and relevant land use information provided by each retail provider. In short, the MWA service area demands are set to increase from 129,645 acre-feet per year in 2020 to over 142,000 acre-feet per year in 2045. Moreover, MWA's regional demands projection for 2065 exceed 150,000 acre-feet. These long-term demands are included in the 2020 UWMP in order to improve long-term water management and planning actions. These demands are discussed in detail in Chapter 4.

MWA has sufficient available regional supplies to meet the regional demands through 2065. These supplies include not only the sources noted above, but also stored water within the SWP system and groundwater storage within the MWA service area. In concert with the supplies noted above, these stored supplies allow MWA to provide reliable water supplies to retail agencies in dry year conditions. Accordingly, as shown in Chapter 5, MWA has reliable water supplies available to meet normal, single dry, and five consecutive dry year water demands through 2065.

6.2 Annual Water Supply and Demand Assessment Procedures

The WSCP describes MWA's procedural methodology for managing shortages and developing its Annual Water Supply and Demand Assessment (Annual Assessment). The Annual Assessment will be submitted to DWR by July 1 each year with the first Annual Assessment due July 1, 2022. The Annual Assessment examines MWA's anticipated water reliability for the current year and one additional dry year to determine what, if any, water shortages stages may be triggered during the required period. The Annual Assessment will be used by MWA decisionmakers to prepare for and initiate implementation of any needed response actions, as well as to inform customers, the general public, interested parties, and local, regional, and state government entities to prepare for such required actions, if necessary.

[61] *Mojave Water Agency Population Forecast, 2020 Edition*, August 2020, UC Riverside School of Business Center for Economic Forecasting and Development

6.2.1 Analytical and Decision-making Processes

MWA plans to conduct its Annual Assessment according to the following timeline and process:

By February 1	Initial data collection, analysis, and coordination with retail agencies
By March 1	Preliminary Draft Annual Assessment subject to internal review
By April 1	Draft Annual Assessment and results briefing for MWA decision-makers
By May 1	Approval of Annual Assessment to MWA Decision-makers
By June 1	Public Release of Annual Assessment and Public Notifications
By July 1	Submit Annual Assessment to DWR in advance of July 1 deadline

MWA will prepare its Annual Assessment using the following key data and analytical methods:

- Prepare supply estimates for each water source for the analysis period.
- Update unconstrained regional demand and estimate anticipated actual water use for the analysis period.
- Update infrastructure assessment, including estimated water supply production capability on a monthly basis for the analysis period.
- Identify and quantify any locally applicable factors that may influence or disrupt supplies during the analysis period.

For the purposes of conducting the Annual Assessment, MWA's definition of "dry year" mimics characteristics of 2014-2015 water year.

6.2.2 Submittal Procedure

MWA will submit its Annual Assessment to DWR via email by July 1 each year. At the time of DWR submittal, MWA will also notify all retail water agencies, the public, and other stakeholders concerning the results of the Annual Assessment and where it is available for review.

6.3 Six Standard Water Shortage Stages and Shortage Response Actions

The WSCP requires water suppliers to adopt six water shortage stages, which correspond to progressively severe water shortage conditions (up to 10%, 20%, 30%, 40%, 50%, and greater than 50% percent shortage) as compared to the normal reliability condition. These water shortage stages have been standardized to allow for a consistent regional and statewide approach to conveying the relative severity of water supply shortage conditions. Changes in supply availability will trigger an appropriate water shortage stage. MWA will then implement the response actions as specified below.

The WSCP is required to identify locally appropriate shortage response actions that align with the defined shortage stages and include demand reduction actions, supply augmentation actions, system

operational changes, and mandatory prohibitions against specific water use practices that are in addition to state-mandated prohibitions and appropriate to the local conditions. For each response action the WSCP is to provide an estimate of the extent to which the gap between supplies and demand will be reduced by implementation of the action.

MWA has grouped the actions to be taken during a water shortage condition into six stages, providing flexibility to address water shortages up to and exceeding the 50 percent shortage level condition. The following is an overview of the staged response MWA could follow during a given water shortage condition including sequential Stages (1-6) based on shortage severity, relative supply conditions for each stage, and percent shortage reduction levels. MWA will adopt the six standard water shortage stages for this 2020 WSCP as shown in Table 6-1.

Table 6-1: Shortage Stages and Response Actions

Shortage Stage	Shortage Percentage	Shortage Response	
1	Up to 10%	• Access Stored Supplies, as needed • Access Flexible Supplies, as needed • Implement Voluntary Demand Reduction	• 0-100% met by Storage • 0-100% met by Flexible Supplies • 0-10% met by communicating voluntary demand reduction
2	10%-20%	• Access Stored Supplies, as needed • Access Flexible Supplies, as needed • Implement Voluntary Demand Reduction • Reduce R^3 Deliveries	• 0-100% met by Storage • 0-100% met by Flexible Supplies • 0-20% met by communicating voluntary demand reduction • 0-20% through reduced R^3 deliveries
3	20%-30%	• Access Stored Supplies, as needed • Access Flexible Supplies, as needed • Implement Voluntary Demand Reduction • Reduce R^3 Deliveries	• 0-100% met by Storage • 0-100% met by Flexible Supplies • 0-30% met by communicating voluntary demand reduction • 0-30% through reduced R^3 deliveries
4	30%-40%	• Access Stored Supplies, as needed • Access Flexible Supplies, as needed	• 0-100% met by Storage • 0-100% met by Flexible Supplies • 0-30% met by communicating voluntary demand reduction

		• Implement Voluntary Demand Reduction • Reduce R^3 Deliveries	• 0-30% through reduced R^3 deliveries
5	40%-50%	• Access Stored Supplies, as needed • Access Flexible Supplies, as needed • Implement Voluntary Demand Reduction • Reduce R^3 Deliveries	• 0-100% met by Storage • 0-100% met by Flexible Supplies • 0-30% met by communicating voluntary demand reduction • 0-30% through reduced R^3 deliveries
6	More than 50%	• Access Stored Supplies, as needed • Access Flexible Supplies, as needed • Implement Voluntary Demand Reduction • Reduce R^3 Deliveries	• 0-100% met by Storage • 0-100% met by Flexible Supplies • 0-30% met by communicating voluntary demand reduction • 0-30% through reduced R^3 deliveries

Stage 1 (up to 10 percent shortage) – When Stage 1 is implemented, voluntary water conservation is encouraged. The drought situation is explained to the public and governmental bodies. MWA explains the possible subsequent water shortage stages in order to forecast possible future actions for the retail agencies. The activities performed by MWA during this stage include, but are not limited to:

- Implementation of all Voluntary Water Conservation Measures to a level addressing up to 10% water conservation savings.
- Public information campaign consisting of distribution of literature, speaking engagements, website updates, bill inserts, and conversation messages printed in local newspapers.
- Educational programs in area schools.
- Initiating a Conservation Hotline, a toll-free number with trained Conservation Representatives to answer customer questions about conservation and water use efficiency.
- Access stored supplies to address supply deficits, as needed
- Access alternative water supplies to address supply deficits, as needed

Stage 2 (11 - 20 percent shortage) – When Stage 2 is implemented, voluntary water conservation is strongly encouraged. MWA coordinates actions with regional retail water purveyors. The drought situation is explained to the public and governmental bodies. MWA explains the possible subsequent water shortage stages in order to forecast possible future actions for the customer base. The activities performed by MWA during this stage include, but are not limited to:

- Implementation of all Voluntary Water Conservation Measures to a level addressing up to 20% water conservation savings.

- Public information campaign consisting of distribution of literature, speaking engagements, website updates, bill inserts, and conversation messages printed in local newspapers.
- Educational programs in area schools.
- Expanding the Conservation Hotline, a toll-free number with trained Conservation Representatives to answer customer questions about conservation and water use efficiency.
- Access stored supplies to address supply deficits, as needed
- Access alternative water supplies to address supply deficits, as needed
- Reduce R^3 deliveries as appropriate with retail agencies

Stage 3 (21 - 30 percent shortage) – When Stage 3 is implemented, voluntary water conservation is strongly encouraged and demand reduction measures are repeatedly communicated. MWA coordinates actions with regional retail water purveyors and emphasizes MWA's ability to assist with supply re-allocation. The seriousness of the drought situation is explained to the public and governmental bodies. MWA explains the possible subsequent water shortage stages in order to forecast possible future actions for the customer base. The activities performed by MWA during this stage include, but are not limited to:

- Implementation of all Voluntary Water Conservation Measures to a level addressing up to 30% water conservation savings.
- Aggressive public information campaign consisting of distribution of literature, speaking engagements, website updates, bill inserts, and conversation messages printed in local newspapers.
- Educational programs in area schools.
- Expanding the Conservation Hotline, a toll-free number with trained Conservation Representatives to answer customer questions about conservation and water use efficiency.
- Access stored supplies to address supply deficits, as needed
- Access alternative water supplies to address supply deficits, as needed
- Reduce R^3 deliveries as appropriate with retail agencies

Stage 4 (31 - 40 percent shortage) – When Stage 4 is implemented, voluntary water conservation is strongly encouraged and demand reduction measures are repeatedly communicated. MWA coordinates actions with regional retail water purveyors and assesses opportunities for supply reallocation among participating retail water purveyors. The seriousness of the drought situation is explained to the public and governmental bodies. MWA explains the possible subsequent water shortage stages in order to forecast possible future actions for the customer base. The activities performed by MWA during this stage include, but are not limited to:

- Implementation of all Voluntary Water Conservation Measures to a level addressing up to 30% water conservation savings.
- Aggressive public information campaign consisting of distribution of literature, speaking engagements, website updates, bill inserts, and conversation messages printed in local newspapers.
- Educational programs in area schools.

- Expanding the Conservation Hotline, a toll-free number with trained Conservation Representatives to answer customer questions about conservation and water use efficiency.
- Access stored supplies to address supply deficits, as needed
- Access alternative water supplies to address supply deficits, as needed
- Reduce R^3 deliveries as appropriate with retail agencies

Stage 5 (41 - 50 percent shortage) – When Stage 5 is implemented, voluntary water conservation is stressed to all regional purveyors and demand reduction measures are repeatedly communicated. MWA coordinates actions with regional retail water purveyors and assesses opportunities for supply reallocation among participating retail water purveyors. The dire situation caused by the water shortage is explained to the public and governmental bodies. MWA explains the possible subsequent water shortage stages in order to forecast possible future actions for the customer base. The activities performed by MWA during this stage include, but are not limited to:

- Implementation of all Voluntary Water Conservation Measures to a level addressing up to 30% water conservation savings.
- Aggressive public information campaign consisting of distribution of literature, speaking engagements, website updates, bill inserts, and conversation messages printed in local newspapers.
- Educational programs in area schools.
- Expanding the Conservation Hotline, a toll-free number with trained Conservation Representatives to answer customer questions about conservation and water use efficiency.
- Access stored supplies to address supply deficits, as needed
- Access alternative water supplies to address supply deficits, as needed
- Reduce R^3 deliveries as appropriate with retail agencies

Stage 6 (greater than 50 percent shortage) – When Stage 6 is implemented, voluntary water conservation is stressed to all regional purveyors and demand reduction measures are repeatedly communicated. MWA coordinates actions with regional retail water purveyors and assesses opportunities for supply reallocation among participating retail water purveyors. The emergency situation caused by the water shortage is explained to the public and governmental bodies. MWA explains conditions leading to supply reductions to all retail purveyors. The activities performed by MWA during this stage include, but are not limited to:

- Implementation of all Voluntary Water Conservation Measures to a level addressing up to 30% water conservation savings.
- Aggressive public information campaign consisting of distribution of literature, speaking engagements, website updates, bill inserts, and conversation messages printed in local newspapers.
- Educational programs in area schools.
- Expanding the Conservation Hotline, a toll-free number with trained Conservation Representatives to answer customer questions about conservation and water use efficiency.
- Access stored supplies to address supply deficits, as needed
- Access alternative water supplies to address supply deficits, as needed

- Reduce R^3 deliveries as appropriate with retail agencies

6.3.1 Supply Augmentation Actions

The following water supply augmentation actions may be used as response actions for the appropriate Water Shortage Stage. MWA may access its stored water sources in various locations inside and outside its service area. This storage occurs as carryover water in the SWP as well as groundwater storage within the MWA Service Area. These stored supplies may be transferred or exchanged with other purveyors that can assist in providing water supplies to MWA's service area. In addition, MWA will work with the California Department of Water Resources (DWR) to access supplies that may be made available in the statewide conveyance systems. Lastly, MWA may take additional supply augmentation actions that become available during the identified water shortage condition like acquiring water from other entities through transfers or exchanges that may be delivered into MWA's service area.

6.3.2 Operational Changes

The following water system operational changes may be used as response actions for the appropriate Water Shortage Stage. MWA may use its water storage and conveyance facilities to expedite water acquisitions, transfers, and exchanges that may alleviate identified water shortage conditions. MWA will assess the utility associated with full operational capacity at its R^3 facility and coordinate operational actions with retail agencies that will help address water shortage conditions. Moreover, where operational flexibility exists in MWA's six turnouts from the East Branch of the State Water Project, MWA may exercise operational options to facilitate water shortage mitigation actions.

6.3.3 Emergency Response Plan for Catastrophic Water Shortages

This section identifies actions to be undertaken by MWA to prepare for, and implement during, a catastrophic interruption of water supplies. A catastrophic interruption could result from natural and man-made events that causes a water shortage severe enough to trigger a Stage 1-6 water supply shortage condition. In addition, MWA's SWP water supplies are conveyed through the California Aqueduct system operated by DWR, and DWR has created several emergency plans to address catastrophic outages. This section addresses the catastrophic outage scenarios and relevant actions that MWA will undertake should a catastrophic outage occur.

Earthquakes are an issue of concern in the Mojave Basin region. The southern portion of the San Andreas Fault borders the western edge of Mojave Water Agency's Service Area and an earthquake on that fault could significantly impact water service and infrastructure. The California Department of Water Resources (DWR) has noted that an earthquake could damage the California Aqueduct conveyance system through structural damage or electrical failures which could potentially halt water deliveries to MWA. In short, an earthquake may create regional turmoil that could impact local infrastructure or cause power outages for extended periods of time.

DWR has a contingency California Aqueduct outage plan for restoring the California Aqueduct to service should a major break occur because of an earthquake or other catastrophic reason. DWR estimates that a major break in the California Aqueduct would take approximately four months to repair. Although extended water supply shortages may manifest for MWA's imported water supplies, the retail agencies

and MWA have alternative water supplies available to meet fundamental customer demands. Retail agencies have access to managed groundwater throughout the MWA Service Area and MWA has stored imported water supplies that could be used to meet crisis conditions. Local effects of a catastrophic outage on local water systems may require additional cooperative efforts among regional water purveyors.

In addition to earthquakes, the SWP could experience other emergency outage scenarios. Past examples include slippage of aqueduct side panels into the California Aqueduct near Patterson in the mid-1990s, the Arroyo Pasajero flood event in 1995 (which also destroyed part of Interstate 5 near Los Baños), flood damage to the East Branch of the Aqueduct in 2015, and various subsidence and leakage repairs needed along the Main Branch and East Branch of the Aqueduct since the 1980s. All of these outages were short-term in nature (on the order of weeks to several months), and DWR's Operations and Maintenance Division worked diligently to devise methods to keep the Aqueduct in operation and continue SWP deliveries while repairs were made. Thus, the SWP contractors generally experienced no interruption in total annual deliveries but local actions to mitigate the outage were implemented.

It is important to note that all of MWA's SWP imported supply is used to replenish groundwater recharge facilities. These groundwater augmentation efforts insulate regional purveyors against an outage of the SWP system. As noted in Chapter 3, MWA has over 200,000 acre-feet of stored water available for extraction and use in the MWA service area. Combining this stored water with other stored supplies by the local retail agencies as well as the existing groundwater supplies in the region, MWA and its wholesale member agencies may sustain water supplies in a catastrophic outage of the SWP delivery systems. Even an interruption in SWP supplies for several months would not provide any immediate threat to potable water deliveries from groundwater production wells.

MWA developed its Regional Recharge and Recovery Project, known as "R^3," to increase flexibility in its water system. The R^3 project is a basin management tool and conjunctive use project that distributes stored water via groundwater wells pumping from the Mojave Basin to local retail water purveyors. This groundwater pumping production is done to benefit each of the retail water agencies and in lieu of pumping from other groundwater production facilities of these retail agencies. This groundwater management project allows water to be pumped in a portion of the basin to be used in lieu of other groundwater production in other portions of the basin so that the various areas of the basin can be actively managed. The R^3 project includes groundwater recharge facilities, groundwater production wells, booster pumps, storage reservoirs, interconnections to the retail customer water system, water meters, and chlorination facilities. The R^3 facilities provide redundant capacity to the retail agencies during catastrophic outage events. Although MWA may stop deliveries in the R^3 facilities to the retail agencies at any time, the facilities may help provide water supplies during crisis conditions. In short, working in parallel with the retail agencies, the R^3 facilities can be used to supplement the facilities that each retail water agency may have to handle catastrophic outages.

The R^3 facilities also have a separate Emergency Response Plan (ERP).[62] This ERP identifies emergency procedures, response actions, and responsible personnel that would be activated in the event of an emergency with the R^3 facilities. Specifically, the ERP addresses responses to leaks or service

[62] R^3 System Emergency/Disaster Response Plan Update 2019, Mojave Water Agency.

interruptions, low pressure, power outage, contamination, and physical destruction of the R^3 facilities.[63] Accordingly, MWA's R^3 ERP provides an additional buffer against emergency and catastrophic outage that may impact Statewide, regional, or local water distribution and treatment facilities.

The area's water sources are generally of good quality, and no insurmountable problems resulting from industrial or agricultural contamination are foreseen. If contamination did result from a toxic spill or similar problematic event, the contamination would be isolated and should not significantly impact the total water supply in the region. In addition, such an event would be addressed in the retailers' emergency response plan as well as the R^3 ERP.

6.3.4 SWP Emergency Outage Scenarios

There are numerous events that could result in significant outages and potential interruption of service. Examples of possible nature-caused events include a levee breach in the Delta near the Harvey O. Banks Pumping Plant, a flood, an earthquake event that severely damages the California Aqueduct along its San Joaquin Valley traverse, or an earthquake event along the East Branch of the California Aqueduct. Such events could impact some or all SWP contractors south of the Delta.

The response of DWR, MWA, and other SWP contractors to such events would be highly dependent on the type and location of any such event. In typical SWP operations, water flowing through the Delta is diverted at the SWP's main pumping facility, located in the southern Delta, and is pumped into the California Aqueduct. During the relatively heavier runoff period in the winter and early spring, Delta diversions generally exceed SWP contractor demands, and the excess is stored in San Luis Reservoir. The SWP California Aqueduct terminal reservoirs, such as Pyramid and Castaic Lakes, are also replenished during these periods. During the summer and fall, when diversions from the Delta are generally more limited and less than contractor demands, releases from San Luis Reservoir are used to make up the difference in deliveries to contractors. The SWP share of storage capacity at San Luis Reservoir is 1,062,000 AF.

MWA receives its SWP deliveries through the East Branch of the California Aqueduct. The other contractors receiving deliveries from the East Branch are Metropolitan Water District, Antelope Valley-East Kern Water Agency, Palmdale Water District, Crestline-Lake Arrowhead Water Agency, Desert Water Agency, San Gabriel Valley Municipal Water District, San Bernardino Valley Municipal Water District, San Gorgonio Pass Water Agency, and Coachella Valley Water District. The East Branch has two terminal reservoirs, Silverwood Lake and Lake Perris, which were designed to provide emergency storage and regulatory storage (i.e., storage to help meet peak summer deliveries) for several of the East Branch contractors. However, MWA does not have contract rights to storage capacity in those reservoirs. Silverwood Lake is within the MWA service area and releases from the lake flow into the primary groundwater basins within the MWA service area. In addition to SWP storage south of the Delta in San Luis Reservoir and the terminal reservoirs, a number of contractors have stored water in groundwater banking programs in the San Joaquin Valley and more recently along the East Branch, and many also have surface and groundwater storage within their own service areas.

[63] ERP at 2-3.

Three scenarios that could impact the delivery to MWA of its SWP supply or other supplies delivered to it through the California Aqueduct are described below. For each of these scenarios, it was assumed that an outage of six months could occur. MWA's ability to meet demands during the worst of these scenarios is presented following the scenario descriptions.

Scenario 1: Levee Breach near the Sacramento-San Joaquin Delta

The California Department of Water Resources (DWR) has estimated that in the event of a major earthquake in or near the Delta, regular water supply deliveries from the SWP could be interrupted for up to three years, posing a substantial risk to the California business economy. Accordingly, a post-event strategy has been developed which would provide necessary water supply protections. The plan has been coordinated through DWR, the Army Corps of Engineers (Corps), Bureau of Reclamation, California Office of Emergency Services (Cal OES), the Metropolitan Water District of Southern California, and the State Water Contractors. Full implementation of the plan would enable resumption of at least partial deliveries from the SWP in less than six months.

DWR Delta Flood Emergency Management Plan ("Emergency Pathway"). DWR has developed the Delta Flood Emergency Management Plan to provide strategies for a response to Delta levee failures, which addresses a range of failures up to and including earthquake-induced multiple island failures during dry conditions when the volume of flooded islands and saltwater intrusion are large. Under such severe conditions, the plan includes a strategy to establish an emergency freshwater pathway from the central Delta along Middle River and Victoria Canal to the export pumps in the south Delta. The plan includes the pre-positioning of emergency construction materials at existing and new stockpiles and warehouse sites in the Delta, and development of tactical modeling tools (DWR Emergency Response Tool) to predict levee repair logistics, water quality conditions, and timelines of levee repair and suitable water quality to restore exports. The Delta Flood Emergency Management Plan has been extensively coordinated with state, federal and local emergency response agencies. DWR, in conjunction with local agencies, the Corps and Cal OES, regularly conduct simulated and field exercises to test and revise the plan under real time conditions.

DWR and the Corps provide vital Delta region response to flood and earthquake emergencies, complementary to an overall Cal OES structure. Cal OES is preparing its Northern California Catastrophic Flood Response Plan that incorporates the DWR Delta Flood Emergency Management Plan. These agencies utilize a unified command structure and response and recovery framework. DWR and the Corps, through a Delta Emergency Operations Integration Plan, would integrate personnel and resources during emergency operations.

Levee Improvements and Prioritization. The DWR Delta Levees Subvention Program has prioritized, funded, and implemented levee improvements along the emergency freshwater pathway and other water supply corridors in the central and south Delta region. These efforts have been complementary to the DWR Delta Flood Emergency Management Plan, which along with use of pre-positioned emergency flood fight materials in the Delta, relies on pathway and other levees providing reasonable seismic performance to facilitate restoration of the freshwater pathway after a severe earthquake. Together, these two DWR programs have been successful in implementing a coordinated strategy of emergency preparedness for the benefit of SWP and CVP export systems. Moreover, levee improvements along the

pathway and Old River levees consisting of crest raising, crest widening, landside slope fill and toe berms meet the needs of local reclamation districts and substantially improve seismic stability to reduce levee slumping and create a more robust flood-fighting platform. Many urban water supply agencies have participated or are currently participating in levee improvement projects along the Old and Middle River corridors.

Scenario 2: Complete Disruption of the California Aqueduct in the San Joaquin Valley

The 1995 flood event at Arroyo Pasajero demonstrated vulnerabilities of the California Aqueduct (the portion that traverses the San Joaquin Valley from San Luis Reservoir to Edmonston Pumping Plant). Should a similar flood event or an earthquake damage this portion of the California Aqueduct, deliveries from San Luis Reservoir could be interrupted. DWR has informed the SWP contractors that a four-month outage could be expected in such an event. MWA's assumption is a six-month outage.

Arroyo Pasajero is located downstream of San Luis Reservoir and upstream of the primary groundwater banking programs in the San Joaquin Valley. Assuming an outage at a location near Arroyo Pasajero that resulted in the California Aqueduct being out of service for six months, supplies from San Luis Reservoir would not be available to those SWP contractors located downstream of that point. This would include MWA.

Scenario 3: Complete Disruption of the East Branch of the California Aqueduct

The East Branch of the California Aqueduct begins at a bifurcation of the California Aqueduct south of Edmonston Pumping Plant, which pumps SWP water through and across the Tehachapi Mountains. From the point of bifurcation, the East Branch is an open canal. If a major earthquake (e.g., an event similar to or greater than the 1994 Northridge Earthquake) were to damage a portion of the East Branch, deliveries could be interrupted. The exact location of such damage along the East Branch would be key to determining emergency operations by DWR and the East Branch SWP contractors. Specifically, MWA's six turnouts on the system could all be differently impacted, and some potentially not impacted at all. For this scenario, it was assumed that the East Branch would suffer a single-location break and deliveries of SWP water from north of the Tehachapi Mountains or of contractor water stored in groundwater banking programs in the San Joaquin Valley would not be available. It was also assumed that Silverwood and Perris dams would not be damaged by the event and that water in Silverwood and Perris Lakes would be available to the East Branch SWP contractors.

In any of these three SWP emergency outage scenarios, DWR and the SWP contractors would coordinate operations to minimize supply disruptions. Depending on the particular scenario or outage location, some or all of the SWP contractors south of the Delta might be affected. But even among those contractors, potential impacts would differ given each contractor's specific mix of other supplies and available storage. During past SWP outages, the SWP contractors have worked cooperatively to minimize supply impacts among all contractors. Past examples of such cooperation have included certain SWP contractors agreeing to rely more heavily on alternate supplies, allowing more of the outage-limited SWP supply to be delivered to other contractors, and exchanges among SWP contractors, allowing delivery of one contractor's SWP supply or other water to another contractor, with that water being returned after the outage was over.

Of these three SWP outage scenarios, the scenario of an East Branch outage along with no delivery of stored water from Silverwood Lake presents the worst-case scenario for MWA. In this scenario, MWA and retail agencies would continue to rely solely on local managed groundwater supplies (native water, natural recharge, return flow, and stored imported water). An assessment of the supplies available to meet demands in MWA's service area during a six-month East Branch outage is presented in Table 6-2. The outage focuses on the supply-side of outage mitigation and does not include modified demand numbers that would likely occur at the retail level.

Table 6-2: Regional Available Supplies for Catastrophic Outage[64]

Emergency Outage	Native Supply	Wastewater Import	Return Flow	Stored Water	Total
Outage Year 1	57,349	2,800	44,415	25,145	129,709
Outage Year 2	57,349	2,800	44,415	25,209	129,773

Seismic Risk Assessment and Hazard Mitigation Plan

Beginning January 2020, CWC Section 10632.5 mandates urban water suppliers include in their UWMP a seismic risk assessment and mitigation plan to assess the vulnerability of each of the various facilities of a water system and mitigate those vulnerabilities. This requirement can be met by submittal of a copy of the most recent adopted local hazard mitigation plan (LHMP) or multi-hazard mitigation plan under the federal Disaster Mitigation Act of 2000 (Public Law 106-390) if the local hazard mitigation plan or multi-hazard mitigation plan addresses seismic risk. MWA intends to submit a copy of the San Bernardino County Multi-Jurisdictional Hazard Mitigation Plan, approved by the Federal Emergency Management Agency (FEMA) on July 13, 2017 (HMP).[65] This Hazard Mitigation Plan is currently under review and may have updates before the next Urban Water Management Plan cycle in 2025.

The fundamental hazards identified in this plan include Earthquake, Wildfire, Flood, Drought, Terrorism and Climate Change. The HMP addresses the vulnerabilities associated with these items, the other plans and financial issues that impact implementation of the HMP, as well as a comprehensive mitigation strategy. Accordingly, the HMP is incorporated by reference into MWA's WSCP.

6.4. Communication Protocols

MWA will engage in specific communication protocols in developing and implementing the WSCP and coordinate with the Regional Water Purveyors and neighboring public agencies to communicate water shortage conditions. MWA will seek to engage customers and provide notice with locally relevant actions that further the water shortage response actions. These actions may include:

- Publishing information on MWA's website.

[64] The total depicted in Table 6-2 represents projected demands in 2021 and 2022, respectively. As noted in Chapter 3, if these demands in this shortage condition are higher, the difference will be supplemented with additional stored water.

[65] http://cms.sbcounty.gov/portals/58/Documents/Emergency_Services/Hazard-Mitigation-Plan.pdf

- Establishing a telephone hotline.
- Coordinating through direct correspondence with local agencies on water supply management
- Preparing social media posts to communicate MWA actions.
- Advertising actions on other local audio and video media.
- Coordinating voluntary and mandatory water shortage condition activities with other local agencies.

Taken together, these communication actions will result in a more effective implementation of MWA's WSCP.

6.5 Legal Authorities

MWA is empowered to implement and enforce its water shortage response actions specified in this section through the following legal authorities: California Water Code Water Appendix, Chapter 97, the Mojave Basin Area Adjudication, and the Warren Valley Judgment. MWA has authorities to manage water supplies in its service area, including management of SWP supplies and R^3 facilities. MWA's role as Watermaster under the Mojave Basin Area Adjudication empower it with the authorities to address excessive water use among participating agencies. The Warren Valley Judgment addresses unauthorized or excessive use issues among the participating agencies. However, MWA does not have direct authority to limit groundwater pumping within its service area.

6.6 Financial Consequences of WSCP

MWA has assessed the financial conditions associated with developing and delivering water supplies within its service area boundary. As shown in Chapter 3, MWA has developed alternative water supplies that can be accessed to continue water deliveries during extended dry conditions. Accordingly, although MWA may experience minor financial fluctuations due to water shortage conditions, the redundancy in its water storage systems as well as its coordinated approach to managing dry conditions with the retail agencies will insulate MWA from significant financial consequences. Therefore, this WSCP does not anticipate that implementation of MWA's WSCP will create financial conditions that are detrimental to MWA.

6.7 Re-evaluation and Improvement Procedures

MWA will continually review and assess its procedures for implementing the WSCP. Specifically, MWA will use the monitoring and reporting protocols identified above as a quality assurance and quality control measure to understand the effectiveness of water shortage activities. These re-evaluation and improvement procedures will include developing reports, memoranda, and presentations that assess the effectiveness of water shortage actions and the WSCP. These protocols will be continually assessed and updated by MWA management staff.

6.8 Special Water Feature Distinction

MWA's water shortage response actions focus on health and safety issues and working with retail agencies to manage available supplies. MWA will work with the retail agencies on communicating and implementing those agencies' special water feature distinction issues that may arise during critical water shortage conditions.

6.9 Plan Adoption, Submittal, and Availability

The WSCP has been adopted, submitted, and is available as required by the Urban Water Management Planning Act. As a stand-alone document, the WSCP is also subject to separate adoption, submittal, and availability processes, and whenever it is separately amended or revised in the future. MWA has followed all applicable law in adopting the WSCPs. The current adopted WSCP for the shall be available to its customers and to the to all local agencies in Mojave Water Agency's service area within San Bernardino County no less than 30 days before its adoption. A copy of the current WSCP is available for public inspection during business hours at www.mojavewater.org and is available for download at www.mojavewater.org/planning.html.

Appendix A
MWA Delta Reliance

This Appendix provides the Delta Reliance assessment for the Mojave Water Agency (MWA) and the retail water service agencies located within MWA's service area boundary. These retail agencies in MWA's service area boundary covered by this assessment include: Liberty Utilities – Apple Valley Water Company, Bighorn-Desert View Water Agency, City of Adelanto Water District, San Bernardino County Service Area 64, San Bernardino County Service Area 70J, Golden State Water Company – Barstow System, Helendale Community Services District, Hesperia Water District, Hi-Desert Water District, Joshua Basin Water District, Phelan Pinon Hills Community Services District, and Victorville Water District. These retail agencies are subject to the minimum threshold requirements of the Urban Water Management Planning Act (UWMP Act) and work with MWA on managing regional water supplies. Additional entities that are not currently subject to the UWMP Act but may subject to the UWMP Act in the future and that rely upon water supplies derived from MWA's and the retail agencies' management are also considered in this assessment. Last, this assessment is consistent with all applicable water management activities within the MWA service area boundary including the Mojave Basin Area Adjudication, the Warren Valley Basin Judgment, and the Ames/Reche Groundwater Storage and Recovery Program Management Agreement.

A.1 Delta Reform Act and Certification of Consistency

The Delta Reform Act of 2009 required state and local agencies to prepare a written certification of consistency with Delta Plan policies before initiating a covered action in the Delta.[66] The written certification of consistency must be submitted to the Delta Stewardship Council and include detailed findings as to whether the covered action is consistent with applicable Delta Plan policies.[67] The submitted certification of consistency may be appealed by any person and the Delta Stewardship Council may grant the appeal to address contested issues.[68] In short, water suppliers that anticipate participating in a proposed covered action must comply with the requirements of the Delta Reform Act.

Proposed covered actions may include a conveyance facility or a new diversion that involves transferring water through, exporting water from, or using water in the Delta. For urban purveyors that may participate in a proposed covered action, should provide information in their Urban Water Management Plans (UWMP) that can be used to demonstrate consistency with the Delta Plan. Specifically, the urban purveyors need to demonstrate consistency with Delta Plan Policy WR P1 –

[66] California Water Code section 85057.5.
[67] California Water Code section 85225.
[68] California Water Code section 85225.10-85225.25.

Reduce Reliance on the Delta Through Improved Regional Water Self-Reliance (WR P1).[69] WR P1 subsection (a) states that:

> Water shall not be exported from, transferred through, or used in the Delta if all of the following apply:
>
> (1) One or more water suppliers that would receive water as a result of the export, transfer, or use have failed to adequately contribute to reduced reliance on the Delta and improved regional self-reliance consistent with all of the requirements listed in paragraph (1) of subsection (c);
>
> (2) That failure has significantly caused the need for the export, transfer, or use; and
>
> (3) The export, transfer, or use would have a significant adverse environmental impact in the Delta.

WR P1 subsection (c)(1) further defines what adequately contributing to reduced reliance on the Delta means in terms of (a)(1) above. WR P1 subsection (c)(1) states:

> Water suppliers that have done all the following are contributing to reduced reliance on the Delta and improved regional self-reliance and are therefore consistent with this policy:
>
> (A) Completed a current Urban or Agricultural Water Management Plan (Plan) which has been reviewed by the California Department of Water Resources for compliance with the applicable requirements of Water Code Division 6, Parts 2.55, 2.6, and 2.8;
>
> (B) Identified, evaluated, and commenced implementation, consistent with the implementation schedule set forth in the 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
>
> (C) Included in the Plan, commencing with 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 analysis in this Appendix includes all of the elements described in WR P1(c)(1) that need to be included in a water supplier's UWMP to support a certification of consistency for a future proposed covered action.

[69] Cal. Code Regs., tit. 23 section 5003.

A.2 Expected Outcomes for Reduced Delta Reliance and Regional Self Sufficiency

The expected outcomes for this Delta reliance and improved regional self-reliance assessment were developed using guidance described in Appendix C of DWR's Urban Water Management Plan Guidebook 2020 issued in March 2021 (Guidebook 2020). The data used in this assessment represent the total regional efforts of MWA and the retail agencies and were developed as part of a region-wide coordination process. Table A-1 shows MWA's expected outcomes for reduced Delta reliance.

Table A-1: Expected Outcomes for Reduced Reliance on the Delta

Year	2010	2015	2020	2025	2030	2035	2040	2045
Total Water Supplies from the Delta Watershed	34.2%	34.2%	31.9%	28.7%	26.2%	24.4%	22.9%	22.2%
Change in Water Supplies from the Delta Watershed		-0.1%	-2.4%	-5.6%	-8.0%	-9.8%	-11.4%	-12.1%

The methodology for demonstrating reduced reliance on the Delta is consistent with DWR's Guidebook 2020. MWA calculated its expected outcomes for reduced Delta reliance by measuring its current and anticipated water use against a baseline condition. MWA chose 2010 normal water year as its baseline. Data for the 2010 baseline were taken from relevant regional planning documents. MWA then assessed its Delta Reliance against the 2010 baseline for years 2015 through 2045.

The analysis uses normal water year demands to assess the supplies that would be used in the future. In addition, because WR P1 considers water use efficiency savings as a source of supply, the UWMP Act 20% water conservation mandates and the rules governing quantification help support water use efficiency quantification in the MWA service area. Table A-2 shows the MWA service area demands without water use efficiency and the reported water use efficiency.

Table A-2: Demands Without Water Use Efficiency

Total Service Area Water Demands (Acre-Feet)	2010	2015	2020	2025	2030	2035	2040	2045
Water Demands with Water Use Efficiency	145,066	138,009	129,595	130,043	134,326	136,679	139,045	141,772
Reported Water Use Efficiency	-	17,735	33,701	46,803	54,025	59,962	64,920	68,828
Water Demands without Water Use Efficiency	145,066	155,744	163,296	176,846	188,351	196,641	203,965	210,600

MWA must also report the expected outcomes for measurable improvement in regional self-reliance. Table A-3 shows the expected outcomes for supplies contributing to regional self-reliance.

Table A-3: Supplies Contributing to Regional Self-Reliance

Water Supplies Contributing to Regional Self-Reliance	2010	2015	2020	2025	2030	2035	2040	2045
Water Use Efficiency	-	17,735	33,701	46,803	54,025	59,962	64,920	68,828
Water Recycling	62,000	47,825	52,536	47,495	49,699	50,930	52,172	53,559
Conjunctive Use Projects	54,045	57,349	57,349	57,349	57,349	57,349	57,349	57,349
Water Supplies Contributing to Regional Self-Reliance	116,045	122,909	143,586	151,647	161,073	168,241	174,441	179,736
Service Area Water Demands without Water Use Efficiency	2010	2015	2020	2025	2030	2035	2040	2045
Service Area Water Demands without Water Use Efficiency	145,066	155,744	163,296	176,846	188,351	196,641	203,965	210,600
Change in Regional Self Reliance (Acre-Feet)	2010	2015	2020	2025	2030	2035	2040	2045
Water Supplies Contributing to Regional Self-Reliance	116,045	122,909	143,586	151,647	161,073	168,241	174,441	179,736
Change in Water Supplies Contributing to Regional Self-Reliance		6,864	27,541	35,602	45,028	52,196	58,396	63,691
Percent Change in Regional Self Reliance	2010	2015	2020	2025	2030	2035	2040	2045
Water Supplies Contributing to Regional Self-Reliance	80.0%	78.9%	87.9%	85.8%	85.5%	85.6%	85.5%	85.3%
Change in Water Supplies Contributing to Regional Self-Reliance		-1.1%	7.9%	5.8%	5.5%	5.6%	5.5%	5.4%

The data presented in this section demonstrate the expected outcomes for reduced Delta reliance and regional self-sufficiency. The information contained in this Appendix is also intended to be an addendum to MWA's 2015 UWMP consistent with WR P1 subsection (c)(1)(C) as well as an addendum to participating retail agencies as desired. The information has been noticed and presented in accordance with applicable law.