Water Resources

MASTER PLAN

2011-2015

mesa·az

Celebrating 100 years of municipal water

100 YEARS

The City of Mesa after the turn of the 20th century

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Acronyms

AADF – Annual Average Daily Flow, the total volume of wastewater flowing into a wastewater facility during any consecutive 365 days, divided by 365 and expressed in units of mgd

AF – Acre-feet, one AF equals the volume of one acre with one foot of water, or 325,851 gallons of water

ADWR – Arizona Department of Water Resources, the agency that oversees the water resources within Arizona

AMA – Active Management Area, the region where water resources have the highest regulatory oversight.

AS&R – Annual Storage and Recovery, the process of recharging and recovering water from underground within an annual period of time.

CAP – Central Arizona Project, the 336 mile long canal that diverts Colorado River water at Lake Havasu through Maricopa, Pinal, and Pima counties.

CAWCD – Central Arizona Water Conservation District, the political subdivision that is the current operator of the CAP canal.

CFS – cubic feet per second, the flow volume of a moving body of water, 1 CFS equals 7.48 gallons per second

GMA – Groundwater Management Act, adopted by Arizona to protect the groundwater aquifers within the AMA areas.

GRUSP – Granite Reef Underground Storage Project, an area of land where various types of water are recharged into the groundwater aquifer and stored for future recover and use.

GSF – Groundwater Savings Facility, a facility that uses renewable water supplies in lieu of using groundwater will receive credits for each AF of groundwater saved

IPR – Indirect Potable Reuse, this the process of converting non-potable reclaimed water into potable water supplies through a process of recharge and recovery or similar aquifer process

LTSC – Long-Term Storage Credits, these are credits accumulated for the physical recharge of wet water at a USF site.

MAF – Million Acre-Feet, a volume of water, sometimes used with a unit of time for example MAF per year

MGD – Million Gallons per Day, a volume based on millions of gallons and time units of day

NCS – New Conservation Space, the new volume of water that can be stored behind the Roosevelt Dam based on the constructed expansion project that entitled additional water supplies.

OM&R – Operations, Maintenance, and Replacement costs

SRP – Salt River Project, a water provider that delivers water originating from the Salt and Verde Rivers to member lands

SROG – Sub-Regional Operations Group, the working group that performs the function of ensuring the operations of the 91st Avenue Water Reclamation Plant that delivers water to Palo Verde Nuclear Power Generating Station and others.

USF – Underground Storage Facility, a facility that is capable of recharging and storing water underground for future recovery and use.

WDUA – Water Development and Use Agreement, an agreement with SRP that allows the City to deliver SRP water to land owners that are located On-Project

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1.0 PLAN OVERVIEW AND PURPOSE

The requirements of providing a safe, reliable and affordable water supply to all residential, commercial, and industrial sectors of the City are very complex. Development and use of Mesa's water resources must be carefully planned to meet the demands of each sector.

This Water Resources Master Plan includes updated water demand and supply projections, updated information on current supplies and water supply development, reclaimed water management, water conservation programs, and supply shortage and firming planning. In addition, this Plan recommends actions needed to provide adequate, reliable, and economical water supplies far into the future. The demand forecasts used in this Plan are those developed and used in the City's Water Master Plan Update 2010. Projections are thus consistent with Mesa's overall general planning efforts.

2.0 BACKGROUND

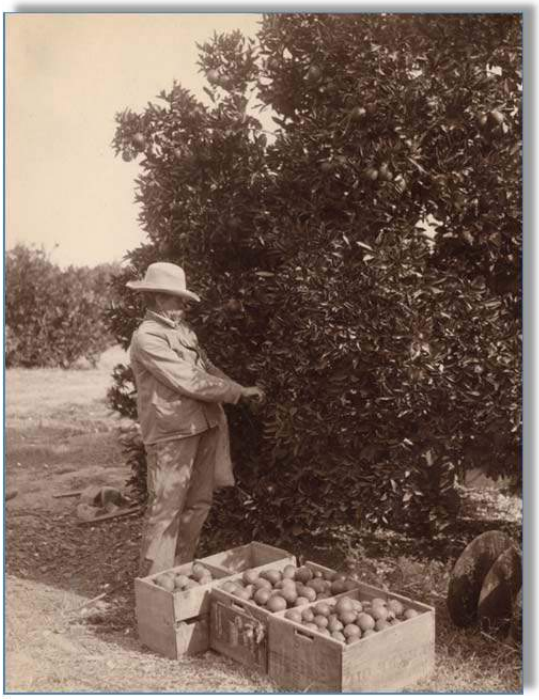


Figure 2.1 – Photo showing orange harvesting at Reed Orange Grove, Mesa - ca 1908 (Photo provided by the SRP Research Archive)

2.1 SALT RIVER VALLEY WATER USERS ASSOCIATION

In 1889, the Salt River Valley enjoyed an advanced irrigation system, but still suffered from summer droughts. Crops and cattle were dying. The community needed a more permanent solution. This led three men to load up pack mules in the middle of August to scout dam sites in the sandstone and red rock mountains along the Salt River northeast of the Valley. Those men -- William Breckinridge, James McClintock and John R. Norton -- identified the Tonto Basin dam site in a narrow canyon 80 miles northeast of Phoenix. They believed a dam at the site could store the winter snow and rain runoff from the mountains above the Salt River providing a steady supply for delivery through the canals in the summer. The site would become the location for Theodore Roosevelt Dam.

For more than a decade, private companies and local communities tried unsuccessfully to finance a dam at the Tonto site. Meanwhile, a national movement was growing for federal financing of water reclamation projects. George H. Maxwell, a California water lawyer, became the leader of an alliance of business interests and advocates for federal irrigation projects throughout 16 Western states. Arizona businessman Benjamin A. Fowler quickly assumed leadership among local advocates. By 1901, Fowler was in Washington, DC, to lobby Congress on Arizona's behalf. Fowler and Maxwell worked together with Rep. Francis G. Newlands of Nevada and Sen. Henry Hansbrough of North Dakota on draft

legislation that would provide a way for local organizations in the West to borrow money from the federal government to build water storage and delivery projects.

When Theodore Roosevelt became President, the four gained an ally. President Roosevelt knew the future of the United States lay beyond the Mississippi River, and even beyond the Great Plains. He also understood that the management of the West's natural resources - especially water -- was key to its future. Roosevelt signed the National Reclamation Act on June 17, 1902. The act authorized the financing mechanism advocated by Fowler and his cohorts.

A triumphant Fowler returned to Arizona and began organizing citizens to take advantage of the new law. To obtain the loan necessary to build the dam, settlers had to use their own land as collateral. The owners of 200,000 acres of Valley land formed the Salt River Valley Water Users Association (SRVWUA), and became shareholders in the organization, according to how much land they owned.

Judge Kibbey wrote the Articles of Incorporation for the SRVWUA, which prescribed how the Association would be organized and managed and would represent the landowners to the government. Fowler became the Association's first president. Shortly thereafter, the dam project at Tonto Basin site became one of the first five projects authorized under the Reclamation Act.
(SRP, 2011)

Figure 2.2 – Photo showing Mesa's earliest Water Department building and City Hall - ca 1878 (Photo by the Arizona Museum of Natural History)

2.2 HISTORY OF MESA'S WATER RESOURCES UTILITIES

In 1904, P.E. Fuller applied to the Town Council for a franchise to operate a private water system to serve the City. Approval for this was not forthcoming, and in 1910, the Council established a Water Works Board. A $150,000 bond issuance was used to construct the first major waterworks improvements. Before the establishment of Mesa's Water Department, the citizens of Mesa obtained drinking water from the canals or from wells that they or their neighbors dug themselves.

2.3 THE GROUNDWATER MANAGEMENT ACT

Groundwater levels in the Phoenix-Mesa metropolitan area have been adversely impacted by historic overuse of groundwater. Overuse of groundwater has several negative consequences, the most significant of which is to a city's economy associated with an unreliable water supply. During the mid-1900s, as Arizona cities evolved from an agricultural to an urban economy, policy makers became increasingly concerned about the adequacy of water supplies to support the state's growth. In 1963, the Supreme Court Decree ends twelve years of litigation between California and Arizona over the Colorado River. Arizona's 2.8 million acre foot (AF) allocation was confirmed, clearing the way for construction of the Central Arizona Project (CAP).

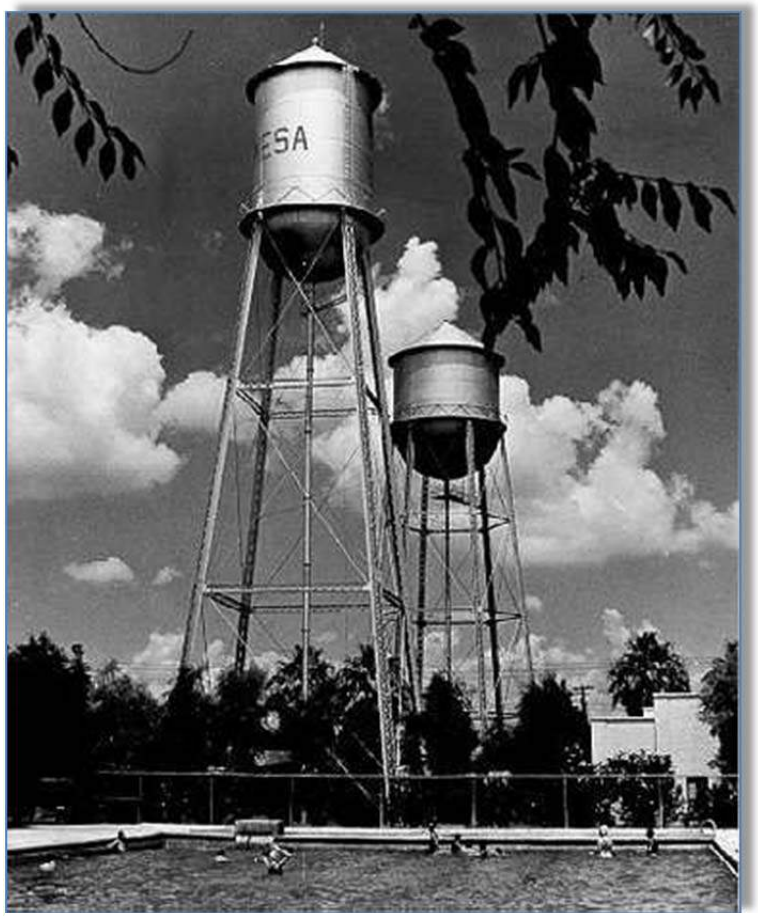


Figure 2.3 – Photo showing Mesa's twin water towers at Rendezvous Park - ca 1950s (Photo by the Arizona Museum of Natural History)

In 1971, the Central Arizona Water Conservation District (CAWCD) was formed to operate the physical canal distribution system of Colorado River water, repay the construction costs to the United States (about $4 billion), and deliver this water to the various contractors. It is governed by a 15 member elected board from Maricopa, Pima, and Pinal counties served by the project. It also has authority to levy an ad valorem tax from these counties. In 1973, the Central Arizona Project (CAP) canal construction began. The canal was completed and water was delivered from the Colorado River to Tucson in 1992.

After several earlier failed efforts, water users eventually came together in 1980 to develop a comprehensive groundwater management plan known as Arizona's Groundwater Management Act (GMA). The overall purpose of this new innovative law was to preserve and extend the life of the groundwater aquifers in the regions expected to receive CAP water. Five Active Management Areas (AMAs) were created. The GMA also set up rules to regulate all current and future groundwater pumping within AMA's.

The Arizona Department of Water Resources (ADWR) administers and enforces the Groundwater Code. The highest level of management, with the most restrictive provisions, is applied to AMAs where groundwater overdraft is most severe. The overall goal of the Phoenix AMA is to achieve safe-yield by 2025. Safe-yield is a term that means a long-term balance between the amount of groundwater withdrawn in an AMA and the amount of natural and artificial recharge available to recharge groundwater.

The Groundwater Code places restrictions on municipal and industrial use of groundwater. These restrictions were put in place with the goal of significantly reducing or eliminating the reliance on pumping more groundwater than is naturally replaced or artificially recharged. As a result of these restrictions, Mesa has progressively increased its use of renewable surface water supplies relative to non-renewable groundwater supplies. On average, the City uses approximately 95% renewable surface water supplies and 5% either groundwater or renewable surface water supplies that have been stored underground for later recovery.

2.4 WATER RESOURCES SUPPLY, DEMANDS, AND INFRASTRUCTURE

It is useful to take a closer look at the spatial aspect of water demand, water supply, and infrastructure within Mesa's service area. Analysis in this Plan is mostly broken down by the spatial variation between On-Project versus Off-Project lands and their associated water demands.

The lands within Mesa's water service area that fall within the boundaries of the Salt River Project (SRP) have access to surface water from the Salt and Verde Rivers and delivered through the SRP system. This area is referred to as being On-Project. The term Off-Project describes the lands outside of these boundaries (Figure 2.4).

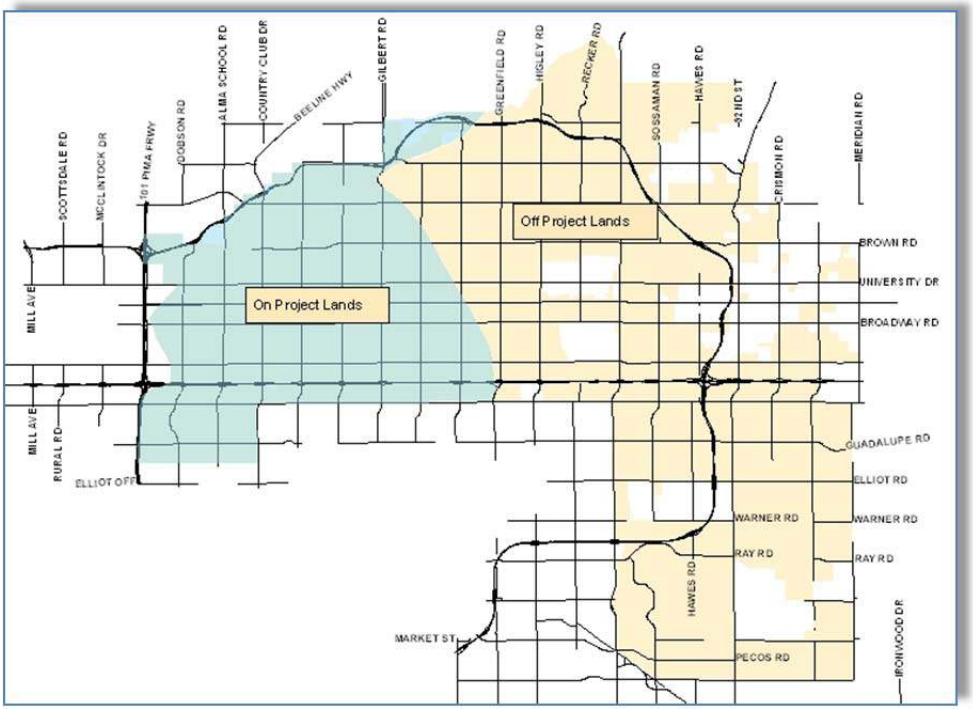


Figure 2.4 – Map showing On-Project lands, in light-green color and Off-Project lands in light-yellow color.

The principal difference between On-Project and Off-Project lands is important mainly because water available through SRP is tied to those specific lands and can only be used on these Lands. Demand characteristics are also different for On-Project versus Off-Project, and different infrastructure serves On-Project versus Off-Project lands.

3.0 WATER RESOURCES MISSION AND POLICIES

The mission of the Water Resources Department is to plan, maintain, and protect the City's water supplies in the most efficient and effective manner possible to ensure superior water services to its current and future customers, improve the quality of life for residents and visitors, and ensure economic stability and prosperity for Mesa's businesses and industries. To integrate and support these missions, the Water Resources Department jointly develops policies regarding:

- Water supply and infrastructure planning and development
- Reclaimed water use
- Groundwater use
- Artificial recharge
- Water demand management

- Social and environmental considerations
- Drought mitigation planning and development

These policies, discussed above, helped guide the development of the Water Resources Plan.

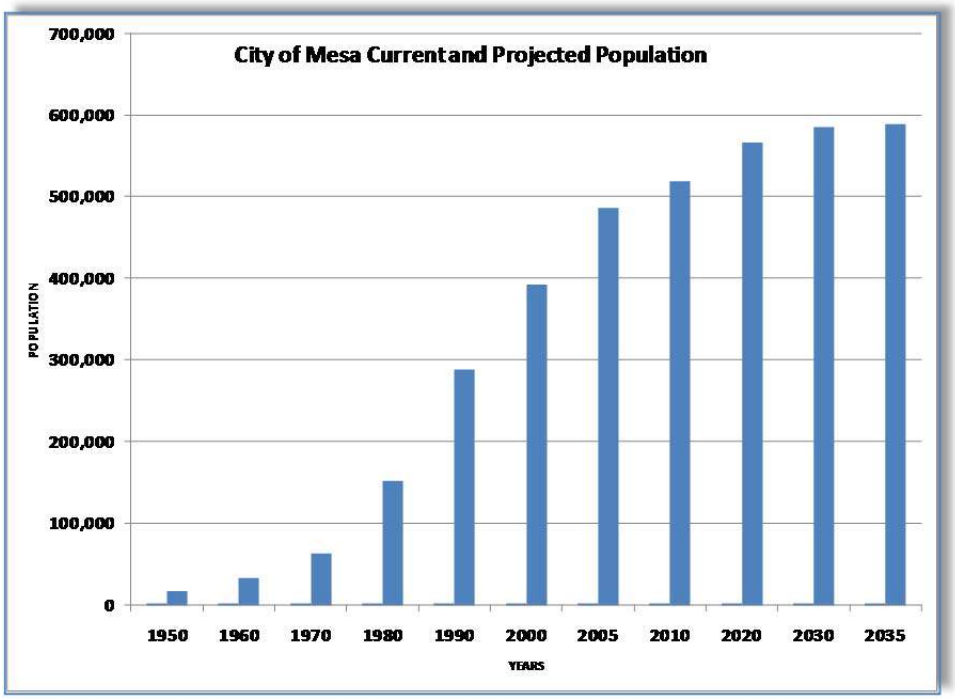


Figure 3.1 – Chart showing the current and projected population for Mesa 1950 – 2035. Data based on actual and projected data obtained by the Maricopa Associations of Governments (MAG)

3.1 POPULATION

With the exception of the 1920's, when the cotton prices plummeted, Mesa's population increased by at least 79% every decennial census through 1990. In 1990 the census showed Mesa to have the highest growth rate of any city over 100,000 in the United States. The City grew from a population of 152,404 in 1980 to 288,091 in 1990. In 2002, Mesa's population was estimated to be 426,841, according to the U.S. Census Bureau. In fact, Mesa's population grew by more than 37% between 1990 and 2000, (Figure 3.1) much higher than the national average growth rate of 13%. From humble beginnings, Mesa has developed into the third largest city in Arizona and the 40th largest city in the United States. The Census Bureau now designates the Valley as the Phoenix-Mesa Metropolitan Area.

With dramatic historical and projected population growth, the City management has continuously ensured that enough water supplies are available to meet the current and projected water demands. Mesa's forefathers clearly understood that water resources were vital to ensuring a prosperous and viable future.

3.2 WATER SUPPLY AND INFRASTRUCTURE DEVELOPMENT

Being able to ensure water supplies are available for the City's current and projected demands, reliably firmed, resistant to shortages, and can be consistently delivered to all customers requires the following actions:

- Plan and develop sufficient water supplies and infrastructure capacity to provide reliable, high-quality water supplies to the City's entire water service area during years of normal or drought water supply conditions.
- Plan and develop a robust and diverse water portfolio with sufficient redundancy to minimize the chance of interruptions in water service caused by new legal, regulatory, environmental, natural, or other restrictions on the development or use of any particular supply source.
- Plan and develop infrastructure that supports the goal of a robust and diverse water supply portfolio.
- Plan and develop water treatment, water reclamation, and distribution system redundancy to minimize the chance of water outages due to facility outages or malfunctions.

Figure 3.2 – Photo showing Downtown Mesa – ca 1960 (Photo provided by the SRP Research Archive)

- Plan and develop ways to maintain, augment and protect the water supply portfolio and infrastructure in the most efficient and effective manner possible.
- Plan and develop alternative water supply and infrastructure development projects using an integrated least-cost or cost-benefit planning principle.

3.3 RECLAIMED WATER

- Continue to develop and use current and new future reclaimed water as an integral part of Mesa's water supply portfolio and develop and maintain the necessary reclaimed water infrastructure.
- Maximize efficient development and use of reclaimed water, giving due consideration to water quality, public acceptability, and cost.

3.4 GROUNDWATER MANAGEMENT

- Use groundwater in a manner consistent with the goals of the Arizona Groundwater Management Act.
- Develop, maintain, and protect groundwater table elevations over the long-term throughout the service area through aquifer management strategies, prudent groundwater pumping and robust local and regional artificial recharge.

- Operate wells with the primary purpose of meeting customer needs and with the secondary purpose of aquifer management.
- Cooperate with local water provider partners in developing a regional aquifer management plans through the efforts of, but not limited to, the East Valley Water Forum.

3.5 WATER DEMAND MANAGEMENT

- Comply with conservation goals established by the 1980 Groundwater Management Act and decadal management plans of the Phoenix AMA.
- Develop, maintain, and improve water demand models for the City's water service area that can disaggregate water demand affects geographically such as weather, temperature, evapotranspiration, exterior water use, demographics, housing stock, seasonal affects, workers, and other variables.

4.0 MESA WATER DEMAND PROFILES

4.1 CITY OF MESA TOTAL WATER DEMANDS

Mesa's water demands have increased from 65,000 AF/year in 1990 to 95,000 AF/year in 2002, (Figure 4.1). Water demands started trending downwards due in part to increased water conservation efforts. The more significant decrease in water demands that started in 2007 is attributable in part to various economic factors and a population decrease highlighted in the 2010 census.

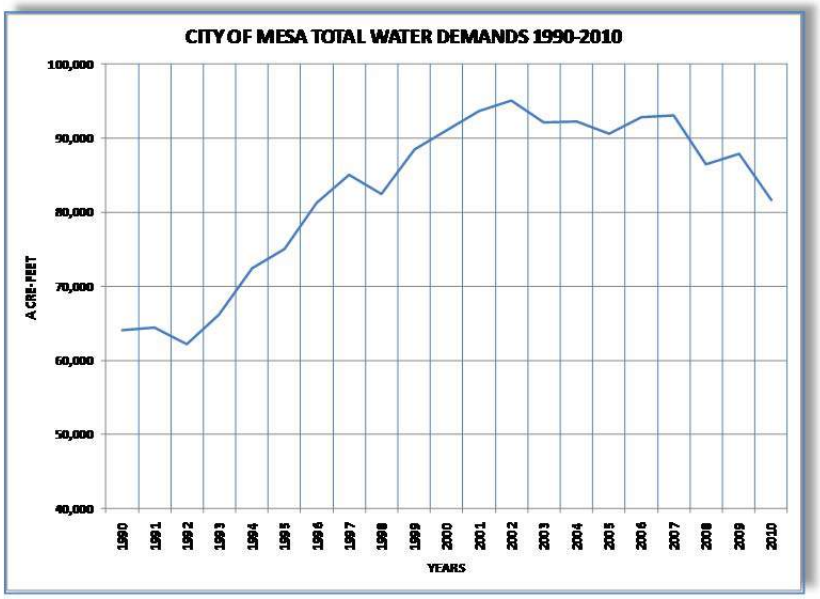


Figure 4.1 – Chart showing total water service area demands for 1990-2010

4.2 SINGLE FAMILY RESIDENTIAL DEMANDS

Figure 4.2 illustrates that On-Project single family residential water demands were quite stable from 1990 through 1999 and that there were some declines from 2000 through 2010. However, Off-Project single family residential water demands increased from 1990 through 2006 with some minor declines from 2007 through 2010.

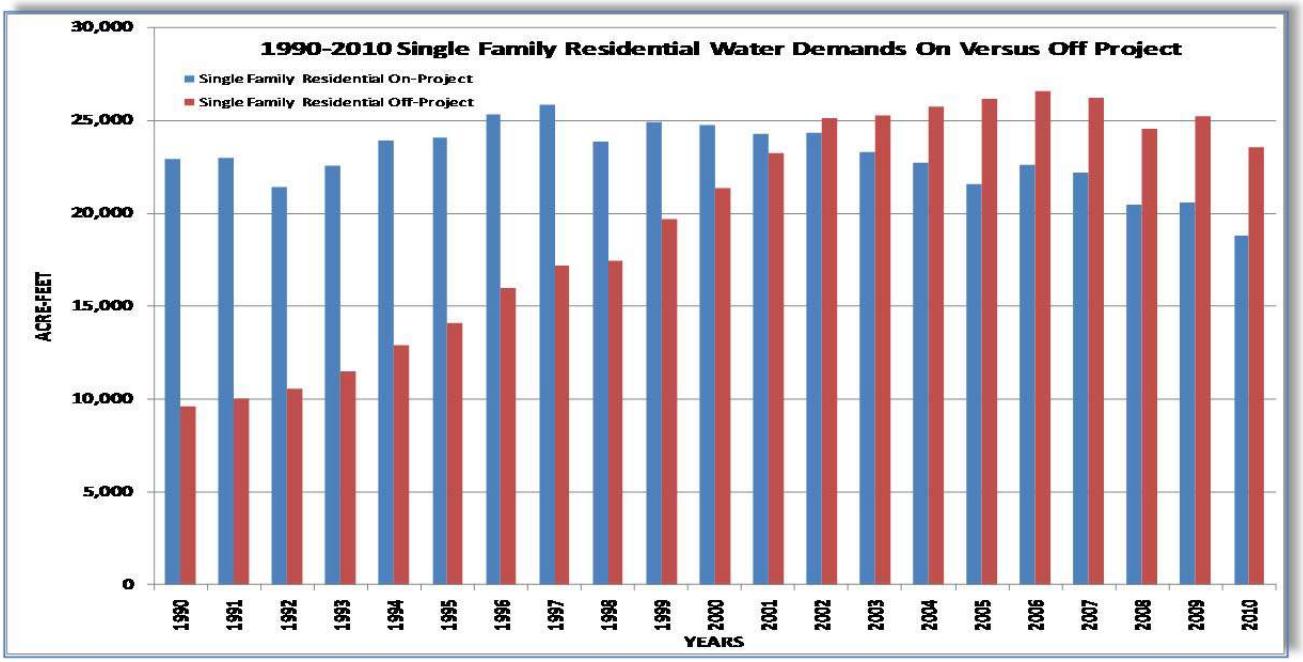


Figure 4.2 –Chart showing single family residential water demands for On-Project (Blue) versus Off-Project (Red)

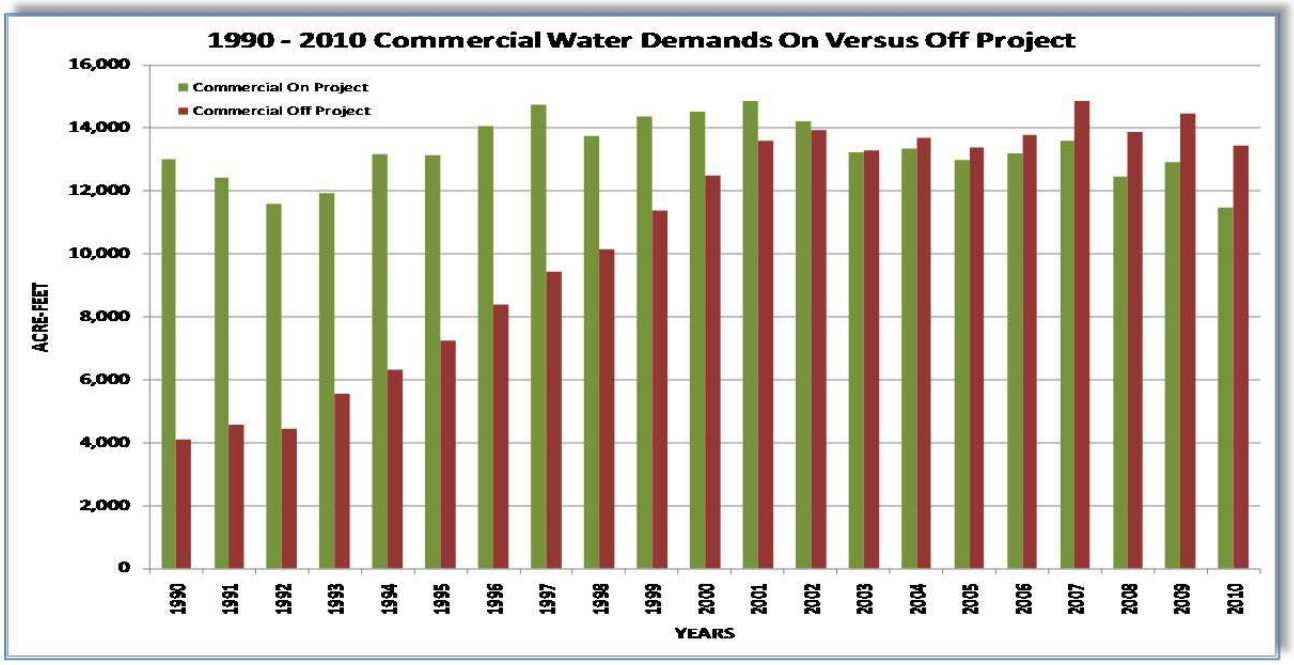


Figure 4.3– Chart showing commercial water demands for On-Project (Green) versus Off-Project (Red)

4.3 COMMERCIAL DEMANDS

Figure 4.3 illustrates that On-Project commercial water demands increased from 1990 through 2001 and, after leveling off, decreased from 2007 through 2010. However, Off-Project commercial water demands increased consistently from 1990 through 2002 and leveled off from 2003 through 2010.

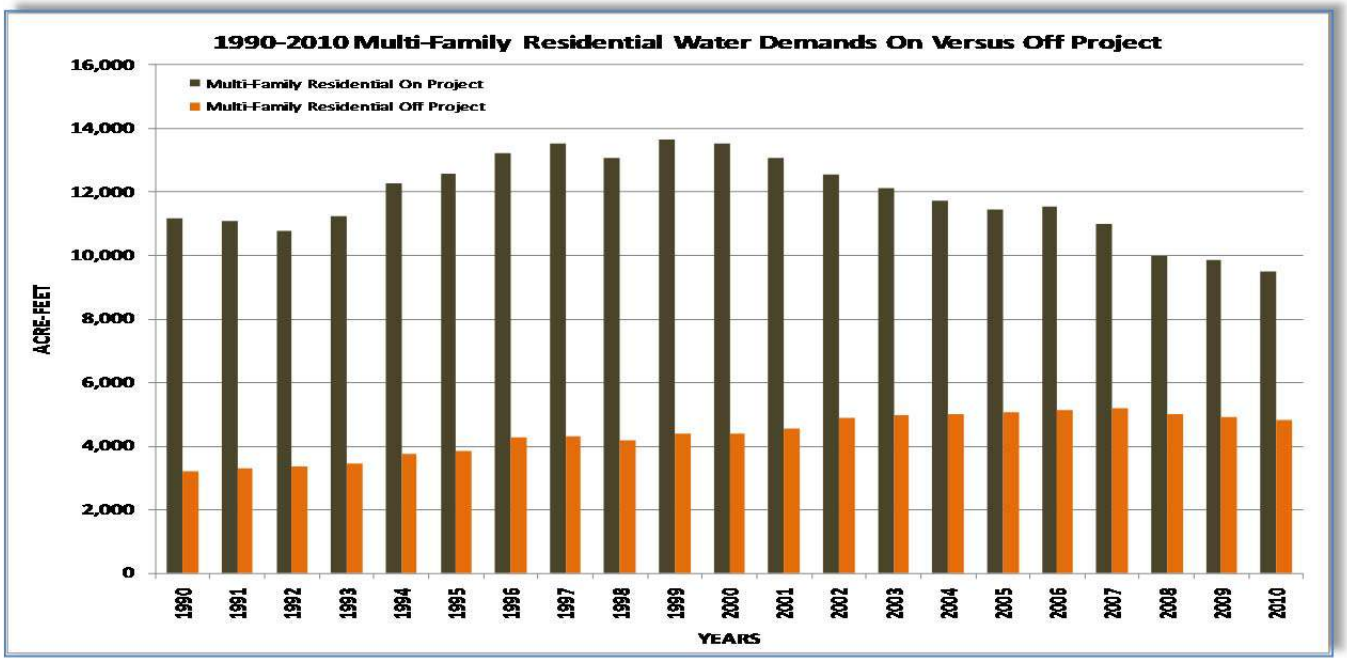


Figure 4.4–Chart showing multi-family residential water demands for On-Project (Brown) versus Off-Project (Orange)

4.4 MULT-FAMILY DEMANDS

Figure 4.4 illustrates that On-Project multi-family residential water demands are more than double the Off-project demands and were quite stable from 1990 through 2000 but declined from 2001 through 2010. Off-Project multi-family residential water demands have been slowing increasing from 1990 to 2007 and seem to have reached a plateau.

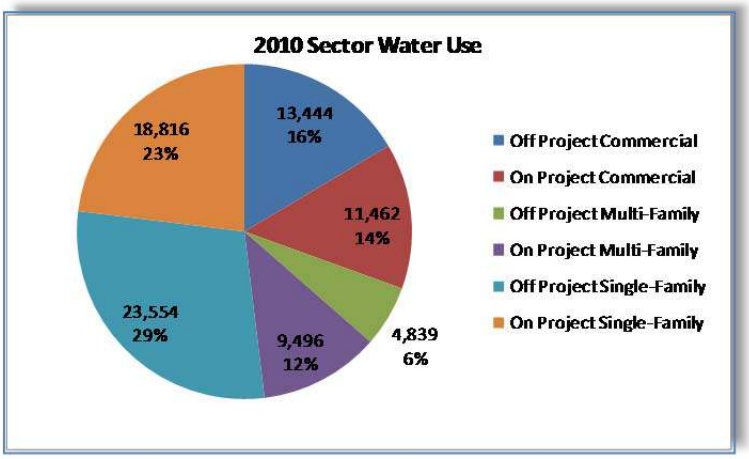


Figure 4.5 – Chart showing the 2010 On versus Off-Project water demands (Note: units are in AF/year)

In 2010, single-family residential uses constituted 52% of Mesa's total water demands (Figure 4.5). Another 18% was attributable from multi-family uses such as apartment complexes and mobile home communities. Also, nearly 31% of the total demand was attributable to commercial uses.

4.5 ON-PROJECT VERSUS OFF-PROJECT WATER DEMANDS

In 2010, approximately 49% of Mesa's water demand occurred within the SRP boundaries (On-Project) and the remaining 51% of Mesa's water demand occurred Off-project.

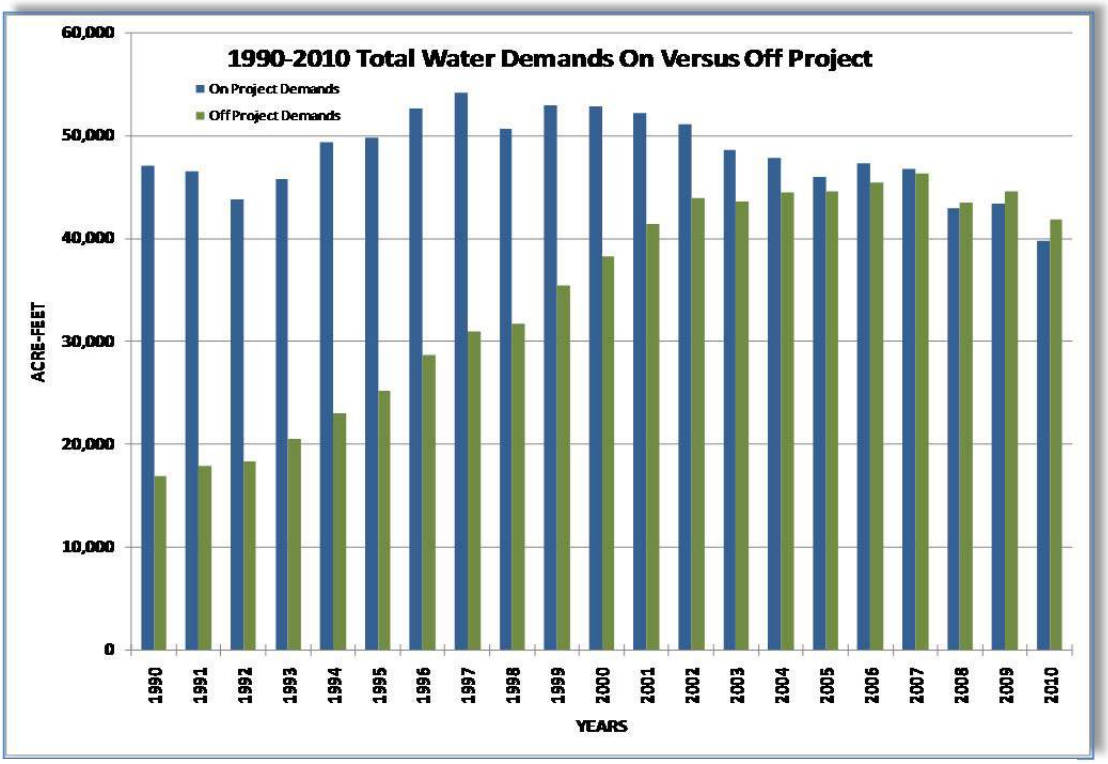


Figure 4.6 – Chart showing total water demands for On-Project (Dark-Blue) versus Off-Project (Light-Green)

The SRP On-Project lands and Off-Project lands have access to different water resources, consume different amounts of water, and have different water use characteristics. The differences in consumption and water use characteristics are shown in Figures 4.2-4.4 above.

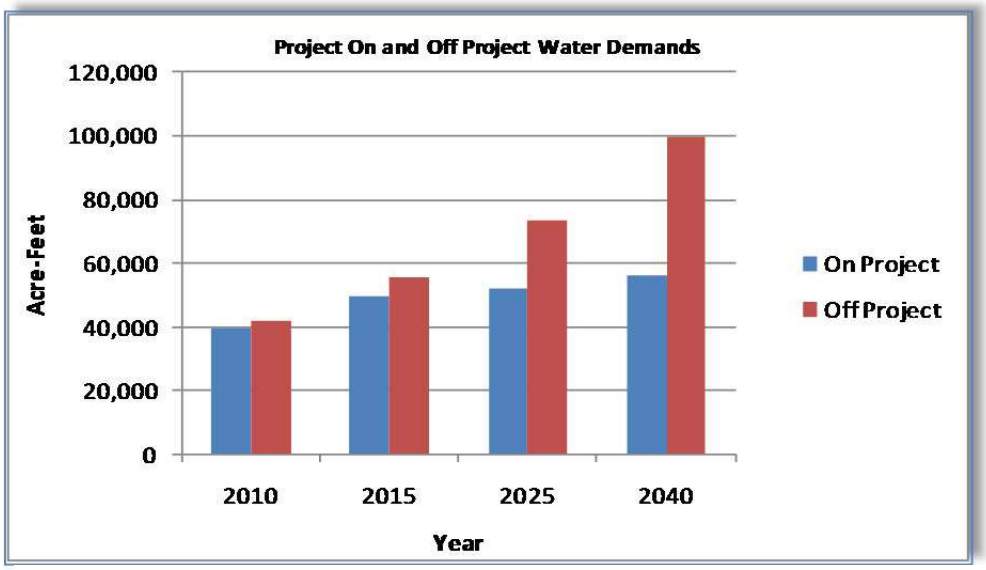


Figure 4.7 – Chart showing projected On versus Off-Project water demands for 2010 - 2040.

The historic difference between On-Project and Off-Project demands is shown in Figure 4.6 Also, Off-Project demands are projected to dramatically increase by approximately 57,000 AF from 2010 to 2040, (Figure 4.7) according to the 2010 Water Master Plan Update.

5.0 SUPPLY AND DEMAND ON-PROJECT

5.1 PROJECTED DEMAND ON-PROJECT

Illustrated in Figure 5.1, On-Project demand is predicted to remain relatively stable over the next 30 years. On-Project demand is projected to only increase approximately 16,000 AF from 2010 to 2040.

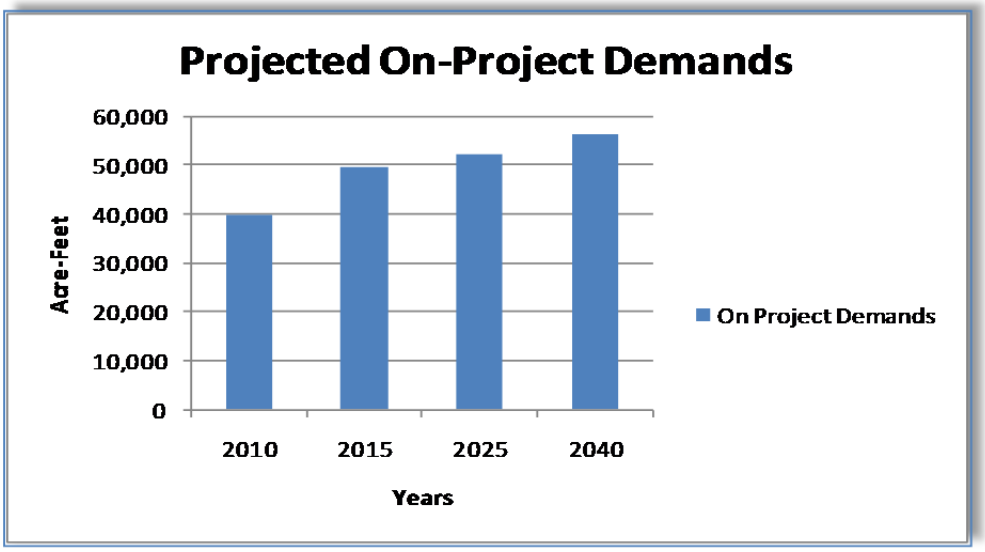


Figure 5.1 – Chart showing Projected On-Project water demands from 2010 to 2040

5.2 ON-PROJECT WATER SUPPLIES DURING A NORMAL YEAR

Just after the turn of the 20th century, as construction began on the Tonto Dam, the SRVWUA worked out differences among its members, or shareholders, and clarified their water rights through a lawsuit, Hurley vs. Abbott. Settled in 1910, the decision became known as the Kent decree in recognition of the presiding judge, Edward H. Kent. It is a landmark in water law that still governs water management in Arizona today.

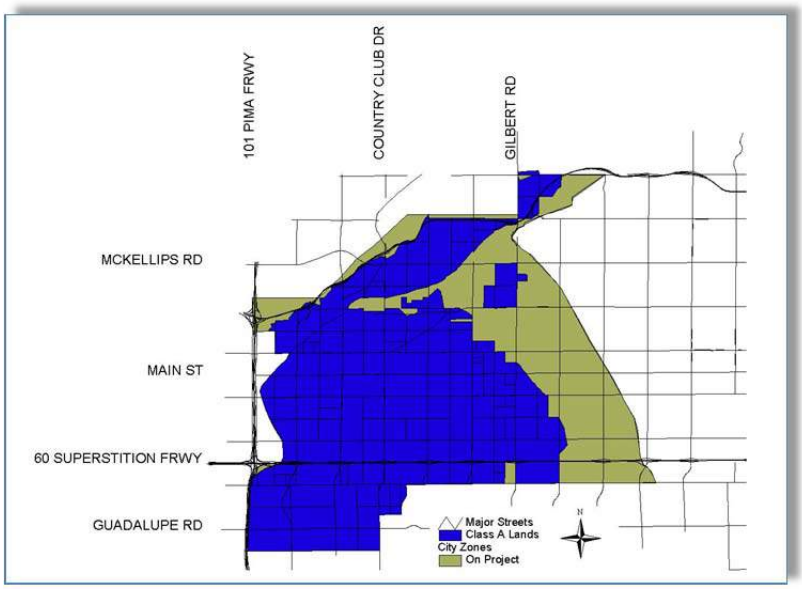


Figure 5.2 – Map showing Class A lands (15,000 plus acres) associated with Normal Flow entitlements within the total On-Project lands (Map data provided by SRP)

Mesa has a large quantity of land within its corporate boundary that has Normal Flow water rights from the Salt and Verde Rivers identified by the Kent Decree. Normal Flow is the amount of water in the River at various stages available for appropriation and the amount of loss in the water delivery. The maximum total amount of Normal Flow is approximately 58,000 miners inches or 1,450 cubic feet per second (CFS) or 2,875 AF per day (AF/D). The Kent Decree pointed out flood water as water flowing within the river over and above the maximum Normal Flow, and pointed out Stored Water, as the amount of water stored within the rivers reservoir system. The rights to flood or stored water became appropriated later through beneficial use filings by land owners desiring to become members of the SRVWUA.

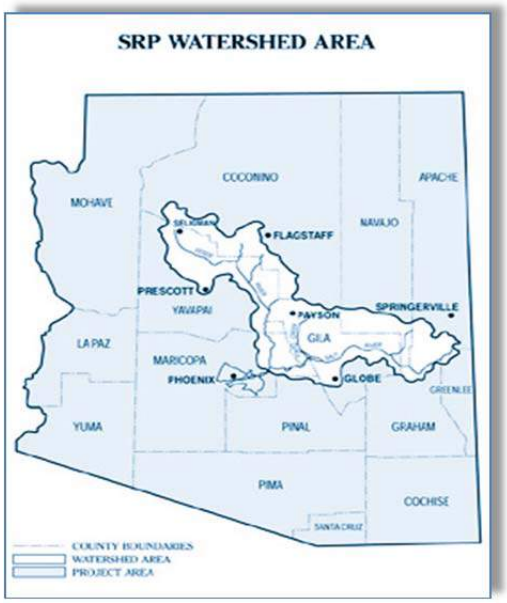


Figure 5.3 – Map showing the 13,000 square mile watershed of the Salt and Verde Rivers (Map created by SRP)

Specific lands within Mesa have appropriated water based on historical annual water use and recorded date of use. Not all lands within Mesa qualified for this water appropriation, and the lands that did qualify were segregated into specific classes or priority lands. The highest class of these lands has access to Normal Flows. These lands are classified as Normal Flow lands and Class A Lands. Class B and C lands are lands that were determined to have a lesser right based on historical water use and date of use. Class B and C lands cannot use Normal Flow water but may use Stored Water. Later, by agreement between the Federal government and the Salt River Valley Water Users Association (SRVWUA) Stored Water was made available for Classes A, B, and C lands. Rights to SRP water are appurtenant to certain lands within the SRVWUA. The term appurtenant means; that with few exceptions, the rights to the water is attached solely to the land, and cannot be moved or used on other lands. Therefore, while Mesa is fortunate to have more than 26,000 acres of land that carries appropriable Salt and

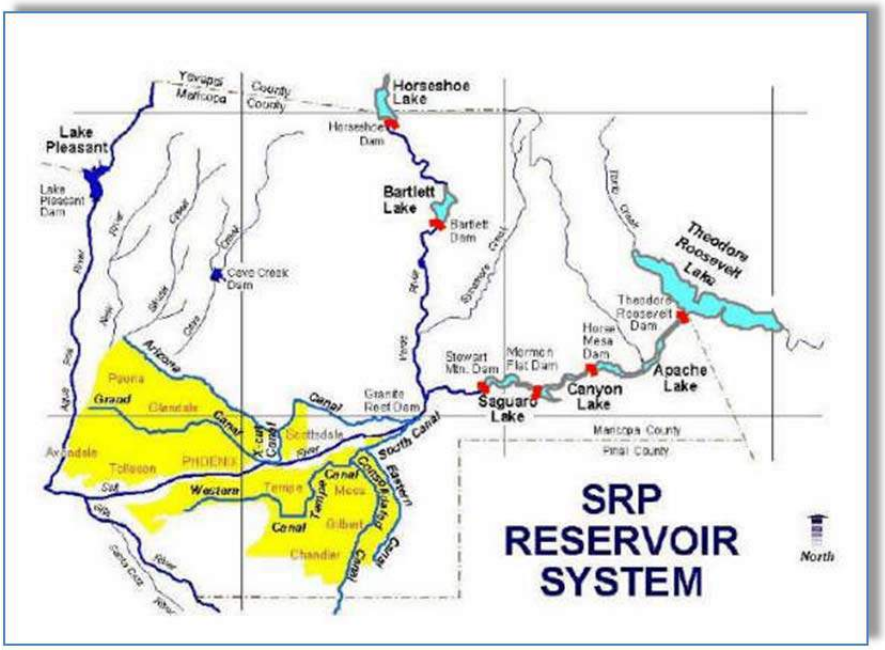


Figure 5.4 – Map showing the geographic location of the six SRP reservoirs (red dots) and the service area (in yellow), and the main canal system, (Map created by SRP)

Verde River water rights, this water cannot be used anywhere but on the land to which the rights are appurtenant. Figure 5.2 shows the lands within Mesa's On-Project lands that have rights to Normal Flow.

There are approximately 26,650 eligible acres of On-Project Lands within Mesa. Of all eligible acres, the City serves water for approximately 25.85 acres of Normal Flow only lands, just over 15,200 acres of Class A lands of which 165.2 acres reside at the Townsite, and just under 6,000 acres of Class B & C lands totaling just over 21,000 acres. SRP still delivers water to just over 5,500 acres of On-Project lands within Mesa. Normal Flow water is allocated to Normal Flow Only lands and Class A lands based on a formula established by the Kent Decree. However, based on recorded Normal Flows from 1950-2010, a projection of low, medium, and high flows available to Mesa's Normal Flow lands can be estimated at 20,793, 38,928, and 58,030 AF/year respectively. However, full use of the Normal Flow value is dependent on the water demand for the City's Normal Flow and Class A lands.

Figure 5.5 – Photo taken on December 4th, 1906 showing the Roosevelt Dam construction. (Photo by the Arizona Museum of Natural History)

Water is stored behind six reservoirs (dams) located on the Salt and Verde Rivers (Figure 5.4). These reservoirs receive water from precipitation that drains from a 13,000-square-mile watershed (Figure 5.3). Water is released from these reservoirs, where it is later diverted for use by several Valley municipalities, farmers, and other smaller water users. SRP also augments its surface water supplies by pumping groundwater wells to augment surface water deliveries when enough surface water is not available. The majority of SRP water received by Mesa is treated to Safe Drinking Water Standards at the Val Vista Water Treatment Plant (VVWTP).

The amount of SRP water available to the SRP water providers is difficult to quantify because this amount changes each year based on the quantity of water stored in SRP reservoirs, and the current and projected flows of the Salt and Verde Rivers. However, in most normal years, a SRP water provider is entitled to three AF per acre, most of which is surface water. Of the approximate 26,000 acres of SRP eligible lands in Mesa, approximately 15,060 acres are Class A lands that are entitled to Normal Flow.

5.3 DEVELOPED WATER RIGHTS

Mesa has access to two types of groundwater delivered by SRP. The first type of groundwater is called Developed Water. Annually the SRVWUA develops the allocation amount of water to its members each year, and in some instances, a portion of this allocation may be pumped as groundwater or developed water. For example, the SRP Board may set the allocation to 3 AF per acre, of which 1 AF of this delivered water may be pumped groundwater. However, some years when the flow of the rivers and reservoirs are abundant the 3 AF per acre water allocation may be met with surface water only and developed water may not be required.

Second, Mesa is currently entitled to slightly less than 25,000 AF per year of what is called Pump Right Water. In 1929 and 1948, the SRVWUA instituted programs that provided shareholders with the opportunity to augment their water supplies by investing in the construction of a total of seventy-nine (79) deep wells within the Salt River Reservoir District (SRRD). These programs were offered primarily in response to: the need for additional water supplies for specific shareholders; and, the drought conditions of the late 1940's where runoff in the Salt and Verde watersheds was significantly below average. Only those shareholders who invested in the programs were able to use this augmentation device.

Figure 5.6 – Photo taken in 1937 showing the construction of the SRP South Canal (Photo by the Arizona Museum of Natural History)

Pump Right Water is groundwater from the SRP system that can be pumped from only certain member lands that have these pump rights. In most years, groundwater or pump right water is not desirable to Mesa because 1) the Groundwater Code specifies that any groundwater Mesa uses is

going to be debited from the City's groundwater allocation within its designation of assured water supplies; and 2) there is a fourfold commodity cost increase using Pump Right Water versus Stored and/or Developed Water. However, both developed water and pump right water become very valuable as an augmentation supply during times of significant Salt and Verde River shortages caused by drought.

As a result of the previously discussed water supplies available to the City, Mesa could have 126,890 AF of available water supplies in some years. This would be enough water to meet current, committed, and future projected On-Project water demands.

Figure 5.7 – Photo showing an automobile next to an SRP Canal – ca turn of the 20th century (Photo provided by the SRP Research Archive)

In the early 1990's, the Valley municipalities and SRP assisted in the development of a storage and recovery program that allows municipalities increased flexibility in making use of their SRP surface water supplies. Under this program, a municipality may deliver some of its SRP water to the Granite Reef Underground Storage Project (GRUSP) where it is artificially recharged into the aquifer. The municipality is then assigned an Annual Storage and Recovery (AS&R) credit for each AF recharged. The AS&R credits must be recovered through permitted municipal wells within the same month that the water was recharged and the water must be used on SRVWUA lands. Primarily, this program allows Mesa to continue to use SRP surface water during times when the Val Vista WTP or the SRP canal system are unavailable due to scheduled maintenance or other reasons.

The amount of Salt and Verde River water appropriable to Mesa is mostly a fixed amount that is projected to change very little over time. As mentioned previously, this water is appurtenant to the land. Mesa gains access to that water when the landowner cuts over their portion of water to the City so that the City can in turn serve this water to the landowner through the municipal water delivery system. Legally, this transfer of water occurs through an existing contract between SRP and Mesa called the Water Delivery and Use Agreement (WDUA). Some landowners have not cut over their portion of SRP water to the City and instead receive direct and untreated water deliveries from SRP. Approximately 21,107 acres of the 26,650 total eligible acres within Mesa have been cut over to the City leaving 5,543 acres yet to be cut over.

6.0 WATER SUPPLIES UNDERGROUND

6.1 GROUNDWATER CREDITS

Water supplies throughout Mesa's service area are supplemented by Mesa's access to Groundwater or Long-term Storage Credits, which can be used from any designated water production or recovery well within Mesa's water service area.

In 2010 the City of Mesa was re-designated as having a 100-year assured water supply that could meet all of the City's current, committed, and future projected water demands. Part of the re-designation process recognized a groundwater allowance within City's water portfolio which is a water supply that can be used On- and Off-Project lands.

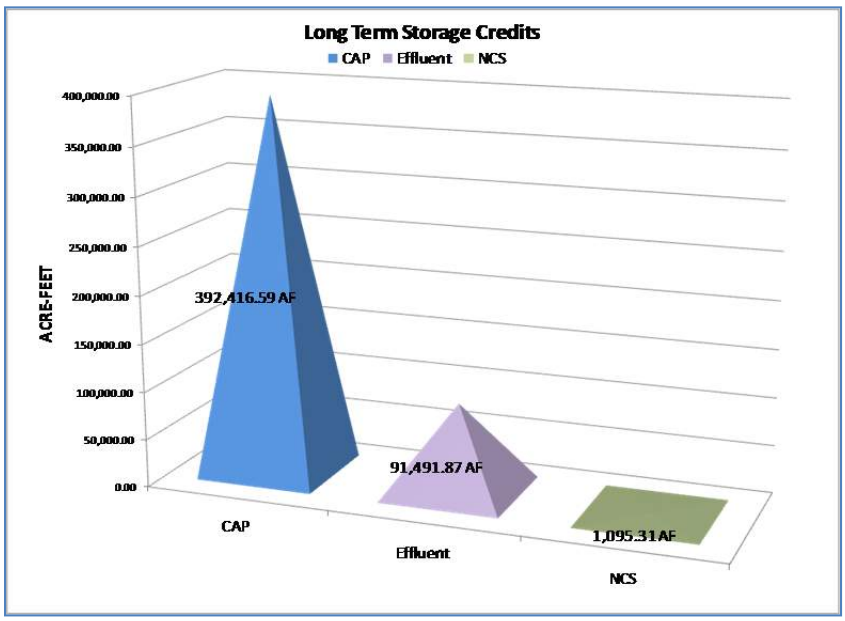


Figure 6.1 – Chart showing the various types of water that Mesa has recharged and received a long term storage credit.

6.2 LONG-TERM STORAGE CREDITS

Long-term Storage Credits are created through the artificial recharge of qualifying water supplies that include: Central Arizona Project (CAP) water, Surface water supplies, and effluent at a permitted underground storage facility (USF) or groundwater savings facility (GSF). For every 1.0 AF of CAP water recharged at GRUSP, 0.95 AF is credited to the City as a CAP Long-term Storage Credit (LTSC) with the 0.05 AF cut to the aquifer. For each 1.0 AF of reclaimed water recharged and stored, about 0.99 AF is credited to the City as an effluent LTSC with a small loss (0.01 AF) associated with the recharge facility losses. At the end of 2009 Mesa had accumulated 485,003.77 AF of Long-term Storage Credits consisting of: 1) 392,416.59 AF of CAP water; 2) 91,491.87 AF of effluent; and 3) 1,095.31 AF of Plan 6 (NCS) water, (Figure 6.1.).

Water pumped from City wells (excluding AS&R water), and/or water received through the SRP system as SRP Developed Water or Pump Right Water is legally counted against the City's Groundwater Allocation and/or Long-term Storage Credit accounts within the City's Designation of Assured Water Supplies.

7.0 SUPPLY AND DEMAND OFF-PROJECT

7.1 HISTORIC DEMAND OFF-PROJECT

Ilustrated in Figure 7.1, Off-Project demand has nearly tripled over the last 20 years. Single Family Residential remains the highest Off-project demand.

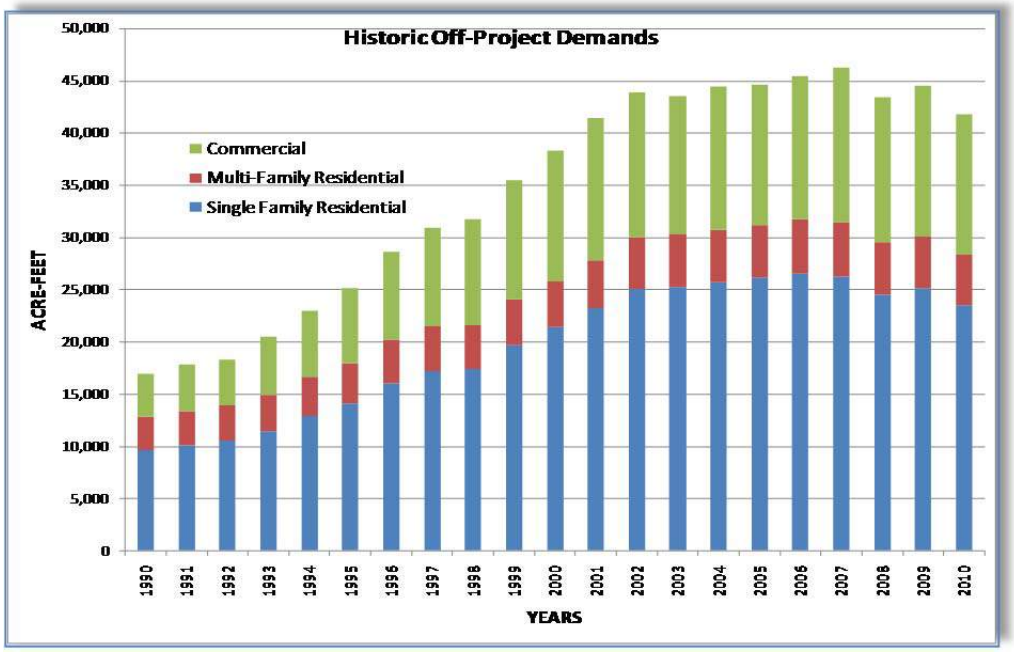


Figure 7.1 – Chart showing the historical water demands for Off-Project from 1990-2010

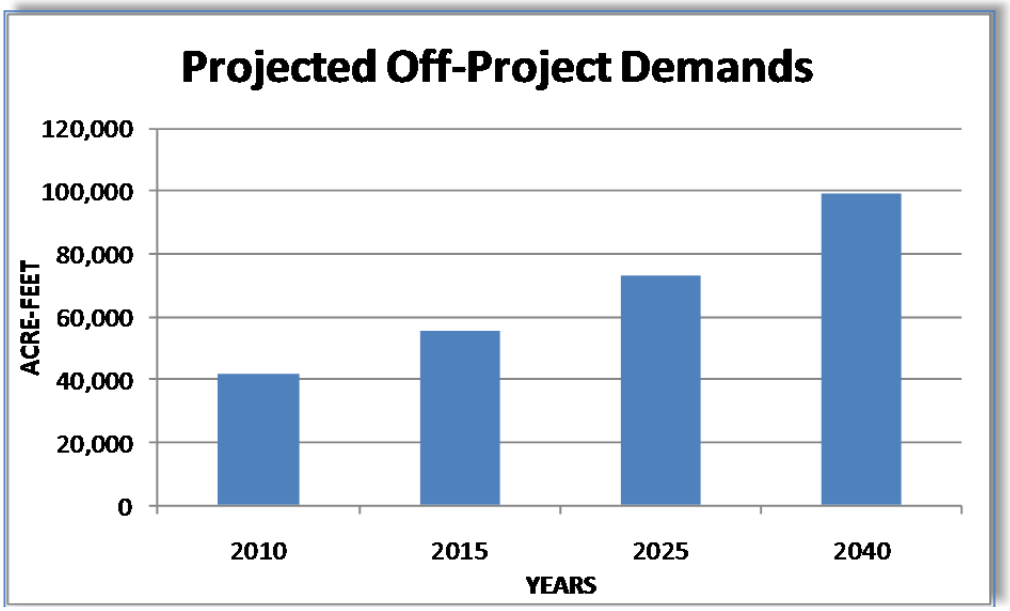


Figure 7.2 – Chart showing the projected water demands for Off-Project from 2010 - 2040

7.2 PROJECTED OFF-PROJECT DEMAND

Illustrated in Figure 7.2, it is predicted that demand Off-Project will increase by 130 percent in the next 25 years.

7.3 OFF-PROJECT WATER SUPPLIES

Colorado River Water delivered through the Central Arizona Project (CAP) is Mesa's principal source of Off-Project water supplies. The CAP staff operates and maintains the canal and water deliveries. The CAP is governed by the Central Arizona Water Conservation District (CAWCD) which is a political subdivision encompassing Maricopa, Pinal, and Pima Counties. The CAP pumps water from the Colorado River at Lake Havasu for delivery to the three counties via a 336 mile-long canal. Among the Lower Colorado River Basin States, Arizona has

the junior water right of which CAP is the junior right within Arizona. This means that Nevada, California, and various entitled lands on the main stem of the Colorado River are entitled to take their water before the CAP allocation can be diverted. Priorities on the Colorado River are important because they dictate how much water each user can divert during times of shortage. Arizona's Colorado River water has a unique priority system. Present perfected rights, as described in the Supreme Court Decree in *Arizona v. California* are the most senior or first priority (P1) rights. Federal Reservations and Perfected Rights established before September 30, 1968 are second priority (P2). Third priority (P3) water rights are held by water users that executed contracts with the United States on or before September 30, 1968. Second and third priority rights are coequal. Fourth priority (P4) rights are held by water users with contracts, Secretarial Reservations or other rights established with the United States after September 30, 1968. The CAP water supply is primarily fourth priority (P4). Fifth priority (P5) water users have contracts for any unused Arizona entitlement water, while sixth priority (P6) water users have contracts for any surplus apportionment of water.

Figure 7.3 – Photo showing the Mesa Dairy & Ice Company – ca 1907 (Photo provided by the SRP Research Archive)

While the total water currently delivered through the CAP is physically from the river; meaning molecules of Colorado River water, Mesa's water delivery on paper is segregated into various legal titles, prices, and priority. Currently, Mesa has access to CAP Subcontract water, Wellton-Mohawk water, Hohokam water, Salt River Pima-Maricopa Indian Community (SRPMIC) Lease water and SRPMIC settlement water through the CAP system. Most water received through the CAP system is treated to drinking water standards at Mesa's Brown Road Water Treatment Plant (BRWTP), and can be used anywhere (both On- and Off-Project) in Mesa's water service area.

7.4 CAP MUNICIPAL AND INDUSTRIAL WATER (M&I)

From 1984 to present, Mesa has entered into and/or modified its Subcontract with the United States Bureau of Reclamation (USBR) and the CAWCD to receive what is called Municipal and Industrial (M&I) Priority CAP water. The City's total amount includes Amendment No. 1 to the City of Mesa's CAP subcontract executed on October 9, 1986, increasing Mesa's entitlement from 20,129 to 29,527 AF/year in light of Mesa's acquisition of the water utility systems of Desert Sage Water

Company, Desert Sands Water Company, and Crescent Valley Utility Company; Amendment No. 2 to Mesa's CAP subcontract executed on August 22, 1991, increasing Mesa's entitlement from 29,527 to 33,459 AF/year in light of Mesa's acquisition of Turner Ranches Water Co.; Amendment No. 3 to Mesa's CAP subcontract executed on November 17, 1993, increasing Mesa's entitlement from 33,459 to 34,292 AF/year in light of Mesa's assumption of Williams Air Force Base's CAP allocation; Amendment No. 4 to Mesa's CAP subcontract executed on December 20, 1995, increasing Mesa's entitlement from 34,292 to 34,888 AF/year in light of Mesa's acquisition of 596 AF of Queen Creek Irrigation District's CAP M&I allocation. Amendment No. 5 to Mesa's CAP subcontract executed on May 4, 2000, increasing Mesa's entitlement from 34,888 to 36,388 AF/year in light of Mesa's acquisition of 1,500 AF of Arizona State Land Department's (ASLD) CAP water allocation. Also, pursuant to Sec. 104(b) (1) of the Arizona Water Settlements Act of 2004, Pub. L. 108-451, 7,115 AF of previously un-contracted M&I water was reallocated to the City of Mesa bringing its total entitlement to 43,503 AF/year. Mesa's entitlement of 43,503 AF/year of M&I Priority water in accordance with Subcontract No. 07-XX-30-W0501 was executed on June 7, 2007.

Within the various types of water delivered through the CAP canal, M&I water has the highest priority equal with Indian water, meaning that during times of shortage M&I and Indian water are shorted last after the CAP excess and agriculture water is shorted.

7.5 WELLTON-MOHAWK WATER

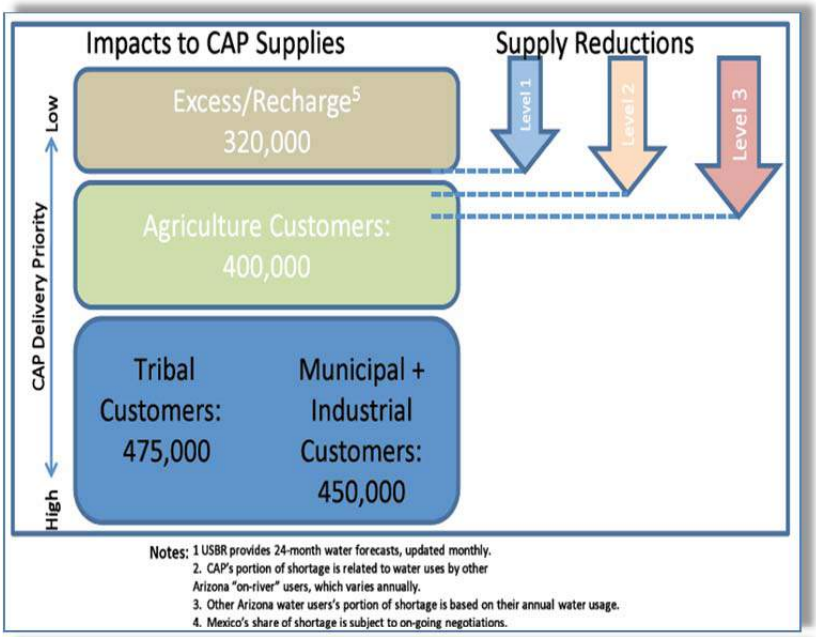
In 1989, Mesa and other municipalities within the SRP service area created a Cities River Waters Exchange provision within the Salt River Pima Maricopa Indian Water Settlement, of which has been referred to as the cornerstone of the settlement agreement. The cities collectively dedicated 20,000 AF/year of their SRP water entitlements to the SRPMIC Indian Community. In exchange, the United States agreed to obtain water rights from the Wellton-Mohawk Irrigation and Drainage District (WMIDD). The WMIDD is located on the Colorado River near Yuma. Wellton-Mohawk's water is diverted directly from the Colorado River. Through this exchange, Mesa obtained water rights to 2,761 AF/year of this WMIDD water to be delivered through the CAP canal. The WMIDD water has a Priory

Figure 7.4 – Photo showing the March 2, 1978 flood on the Salt River. Flooded area includes portions of North Country Club Drive (Photo by the Arizona Museum of Natural History)

Three (P3) right, which is higher than its M&I CAP subcontract water entitlements. Therefore, it will be last to be shorted within the CAP and is Mesa's highest priority Colorado River water and most likely will never be impacted during shortages.

7.6 HOHOKAM WATER

In December of 1993, Mesa signed a Subcontract with the U.S. Bureau of Reclamation and the CAWCD for delivery of a water supply referred to as Hohokam water. Hohokam water is CAP Agricultural Priority water originally contracted to the Hohokam Irrigation and Drainage District (HIDD) in Pinal County. According to the original agreement between the United States, CAWCD, HIDD, and various municipalities, the municipalities agreed to pay monies to accelerate the construction of certain features of the regulatory storage division of the CAP and Cliff Dam through the Plan Six Facilities Trust Fund. The cities would get in return an entitlement for a water supply developed as a result of the construction and operation of the additional conservation capacity. However, in accordance with the Energy and Water Appropriations Act of 1988 (P.L. 100-202), the United States eliminated Cliff Dam as a feature for regulatory storage of the CAP. The Secretary of the Interior agreed to use best efforts to secure a water supply for the cities that would be comparable to what would have been generated by Cliff Dam. The HIDD released its portion of the reallocated CAP water subcontract to the United States which was transferred to the cities of Chandler, Mesa, Phoenix, and Scottsdale. Agricultural Priority water has a priority lower than that of M&I Priority water.



Entity	Level 1 (1,075')	Level 2 (1,050')	Level 3 (1,025')
CAP[2]	Up to 320,000	Up to 400,000	Up to 480,000
Other Arizona[3]	0 to 32,000	0 to 40,000	0 to 48,000
Nevada	13,000	17,000	20,000
Mexico[4]	67,000	83,000	100,000

Figure 7.5 – Chart showing the projected water shortages on the CAP Canal, due to drought and which contractors would be impacted based on their priority (Chart created by CAP)

Historically, the amount of Hohokam water available to Mesa varied from year to year depending on the available supply of CAP Agricultural Priority water. As part of the Arizona Water Settlement Act, Mesa's total HIDD allocation was quantified to 4,924 AF/year.

7.7 SALT RIVER PIMA MARICOPA INDIAN COMMUNITY (SRPMIC) LEASE WATER

In accordance with the SRPMIC water settlement agreement, the Secretary of the Interior and the SRPMIC agreed to amend their 1980 contract to include 13,300 AF/year of CAP water for leases to the cities for 99 years. Mesa obtained a lease of 1,669 AF (12.55% shareholder) per year of SRPMIC Indian Priority water. The lease expires in 2098.

7.8 SALT RIVER PIMA MARICOPA INDIAN COMMUNITY (SRPMIC) SETTLEMENT WATER

In accordance with the SRPMIC water settlement agreement, Mesa is entitled to 627 AF/year of Roosevelt Water Conservation District (RWCD) Agricultural Priority water. However, when RWCD's entitlement to CAP Agricultural water is so reduced by RWCD's eligible acres that it can no longer take 3,000 AF/year of CAP Agricultural water, the Secretary of the Interior shall make available the difference between 3,000 AF/year and the amount of water assigned to the City pursuant to the agreement, or in Mesa's case, is approximately 376 AF/year.

Figure 7.6 – Photo showing crop irrigated within Mesa – ca 1972 (Photo provided by the SRP Research Archive)

7.9 WHITE MOUNTAIN APACHE TRIBE (WMAT) WATER SETTLEMENT

On December 8th, 2010, the President signed H.R. 4783, authorizing the White Mountain Apache Tribe water rights quantification settlement. The bill provides United States' funding for water infrastructure improvements for the WMAT community. As a member of this settlement agreement, Mesa will become a 100 year leasee for 3,157 AF of CAP M&I water. Of this total leased water supply, 866 AF will be firmed to M&I priority water and 2,291 AF will have the priority equal to CAP NIA priority water. This agreement is under final review by the U.S. Attorney's Office and is estimated to become effectuated in 2013.

7.9 SALT AND VERDE RIVER WATER FROM NEW CONSERVATION SPACE AT ROOSEVELT DAM

In 1986, the United States, the CAWCD, Maricopa County Flood Control District, SRP, Chandler, Mesa, Phoenix, Scottsdale, Tempe, and the State of Arizona, reached agreement on funding for an increase in capacity to Roosevelt Dam. In exchange for its monetary contribution, Mesa is entitled to 15% of the capacity in the New Conservation Space (NCS), up to a maximum of just over 67,958 AF/year when available and used in accordance with the NCS Operating Agreement and permit.

Currently in 2011 Mesa had approximately 32,000 AF of NCS water stored at the dam. NCS water is treated at the Val Vista Water Treatment Plant or delivered to the Granite Reef Underground Storage Project (GRUSP) for recharge purposes. This water can be used anywhere in Mesa's water service area.

8.0 RECLAIMED WATER SUPPLIES

8.1 RECLAIMED WATER SUPPLIES

In 2010, Mesa produced a total of approximately 40,000 AF of reclaimed water at its Northwest, Southeast, SROG collection area, and Greenfield Water reclamation Plants. Several decades ago, the public's interest of reclaimed water was not what it is today. Today reclamation and wastewater treatment technology is continually improving and providing some of the highest quality water supplies for reuse. While reclaimed water was and is widely used for water intensive turf facilities and filling artificial lakes, it is more beneficially being used for generating power at the Palo Verde Nuclear Power Generating Station and providing stored supplies for indirect potable reuse (IPR). IPR is the recharge and storage of reclaimed water below the land surface within an aquifer's groundwater storage system that will be recovered and used in the future during times of surface water shortage.

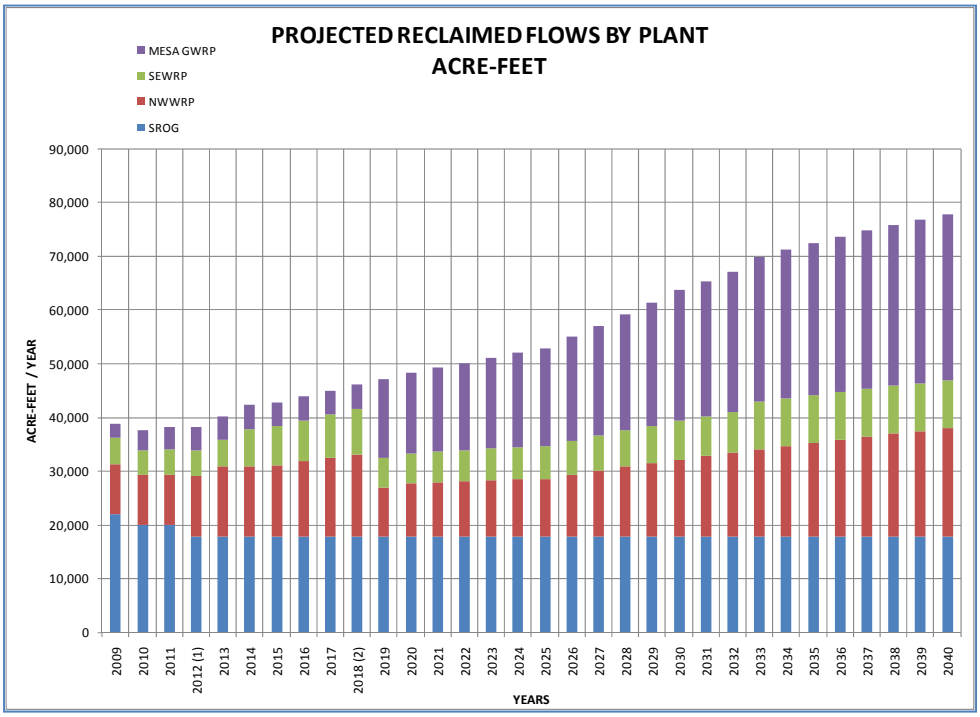


Figure 8.1 – Chart showing the current and projected reclaimed water resources available from 2009 – 2040.

8.2 SUB-REGIONAL OPERATIONS GROUP – (SROG)

In 2010, the City delivered approximately 19,000 AF of reclaimed water to the Sub-Regional Operations Group (SROG) at the 91st Avenue Water Reclamation Plant. Reclaimed water from the plant is used by the Palo Verde Nuclear Power Generating Station. This multi-city effort ensures efficient power production through the use of reclaimed water which saves groundwater supplies, and provides affordable energy for the entire State ensuring economic prosperity. Also, through the multi-city agreement some of this water has been dedicated to the Buckeye Irrigation District for irrigation, Arizona Game and Fish Department, and the U.S. Conservation Laboratory towards wildlife habitats and ecosystem and riparian health along the Salt River.

8.3 GILA RIVER INDIAN COMMUNITY EXCHANGE AGREEMENT

As part of the Gila River Indian Community (GRIC) Water Settlement, Mesa and the GRIC agreed to an exchange of water whereby Mesa delivers up to 29,400 AF/year of reclaimed water for the Community's irrigation uses and in exchange the City diverts up to 23,520 AF of the Community's CAP water supply. In effect, the exchange allows Mesa to convert a non-drinking water supply into a potable supply, while maintaining its legal classification as effluent. Also, this CAP water supply has its Operations, Maintenance, and Replacement (OM&R) cost portion paid through the Lower Basin Development Fund and therefore this water supply currently costs about half of regular CAP supplies.

8.4 LONG-TERM STORAGE CREDITS – (LTSC)

Mesa continues to deliver reclaimed water from the Northwest Water Reclamation Plant (NWWRP) to the GRUSP where effluent is recharged into the groundwater aquifer or termed underground storage facility (USF). Once this water has been recharged, the City receives a long term storage credit (LTSC similar to a bank's savings account) through ADWR accounting. The LTSC then provides a legal withdrawal authority to recover these water supplies in the future when needed. CAP water can also be delivered to GRUSP via the CAP Salt Interconnect Facility (CSIF) where CAP water can flow into the Granite Reef Dam and GRUSP. However, City has earned the majority of its CAP LTSC through the use of a Groundwater Savings Facility (GSF). Arizona created the GSF program to ensure that the State utilized its entire allocation of CAP water. This plan allows USF permittees to create LTSCs by CAP subcontractors partnering to deliver CAP water to irrigators for use in-lieu of irrigators using groundwater. The groundwater not used then becomes assigned to the USF permittees LTSC account. As of 2009, the City has earned slightly more than 485,000 AF of LTSC in total.

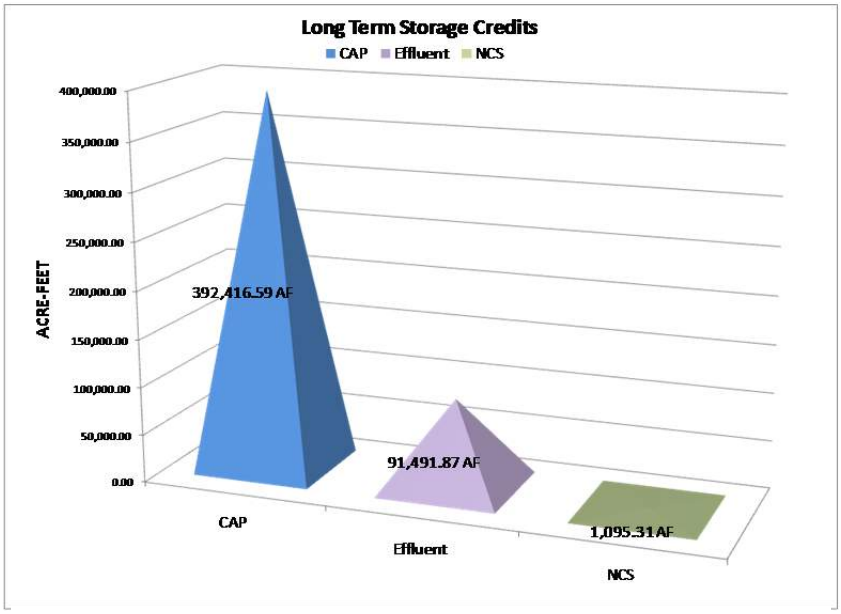


Figure 8.2 – Chart showing the various types of water that Mesa has recharged and received a long term storage credit.

9.0 PROJECTED SUPPLY AND DEMAND IN NORMAL YEARS

9.1 OFF-PROJECT DEMANDS AND SUPPLIES

Projected demand and supplies Off-Project are shown in Figure 9.1 below. There are three important points to be made from this Chart. First, assuming that Mesa's growth does not outpace expected demands projected in Mesa's general plan, Mesa can reasonably expect to meet future demands with its current Off-Project water resources portfolio. Second, Mesa's ability to meet future demands beyond 2025 is heavily dependent on its ability to make efficient use of its reclaimed water resources through the GRIC Exchange Agreement or recharge opportunities. Third, in a normal water year

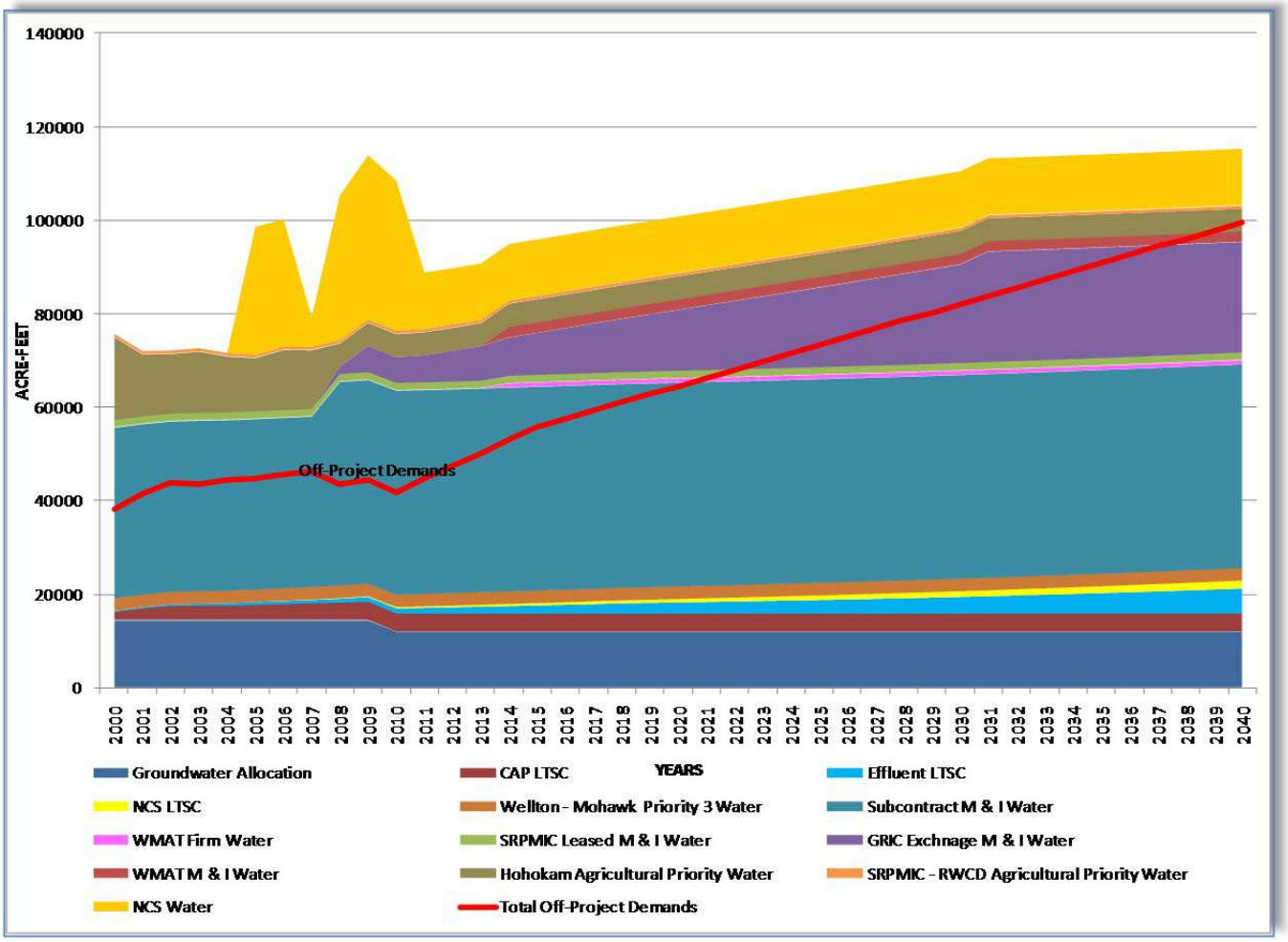


Figure 9.1 – Chart showing the various types and priority/vulnerability of water supplies available to meet Off-Project demands shown as red line. Water supplies at the top indicate most vulnerable while water supplies at the bottom are most secure meaning drought proof or having a back-up supply or firming obligation.

slightly more than 20% of Mesa's water demands could ultimately be provided through groundwater pumping and the recovery of LTSC via wells. However, during times of significant shortages on the Colorado River and the Salt and Verde Rivers, Mesa's surface water supplies with an agricultural priority, M & I priority, and NCS water supplies could become impacted. This means that Mesa will

need to maintain enough well capacity to pump enough water to meet at least 30,000 AF/year of demands but could be as high as 45,000 AF/year during dramatic surface water shortages at build-out for Off-Project demands.

10.0 MEETING FUTURE DEMAND AND MANAGING ISSUES

Mesa has the necessary water resource supplies to meet build-out demands but there are several impediments to a fail-safe scenario and therefore Mesa must manage its water resources with great care. In this section, these impediments are examined and recommendations are made regarding the efficient and careful management of Mesa's water resources.

10.1 MANAGEMENT OF RECLAIMED WATER

Figure 10.1 suggests that without efficient development of reclaimed water supplies, Mesa will be unable to meet future demand. Efficient development of reclaimed water supplies necessitates the collection, and treatment of wastewater to a very high standard, and reuse through exchange agreements, recharge and recovery and direct deliveries.

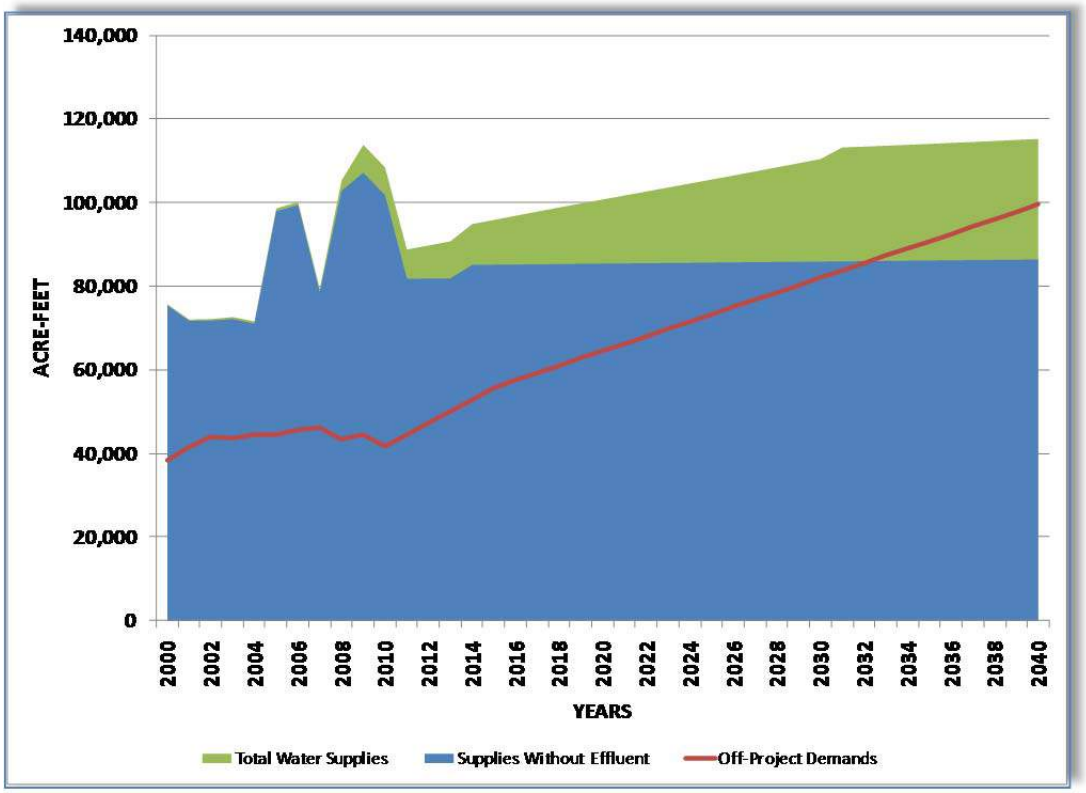


Figure 10.1 – Chart showing the total available Off-Project water supplies minus effluent (Blue area) and total available water supplies including effluent (Green area) and the total Off-Project demands (shown as red line)

10.2 RECLAIMED WATER FROM THE NORTHWEST WATER RECLAMATION PLANT (NWWRP)

Current treatment design capacity at the Northwest Water Reclamation Plant (NWWRP) is 18 million gallons per day (MGD). Currently the NWWRP annual average daily flow (AADF) is slightly more than 8 MGD and produces approximately 9,000 AF of reclaimed water per year. Reclaimed water from the

NWWRP is available for recharge at the Granite Reef Underground Storage Project (GRUSP) (Figure 10.3). If needed, flows may be diverted to the 91st Avenue Wastewater Treatment Plant (SROG).

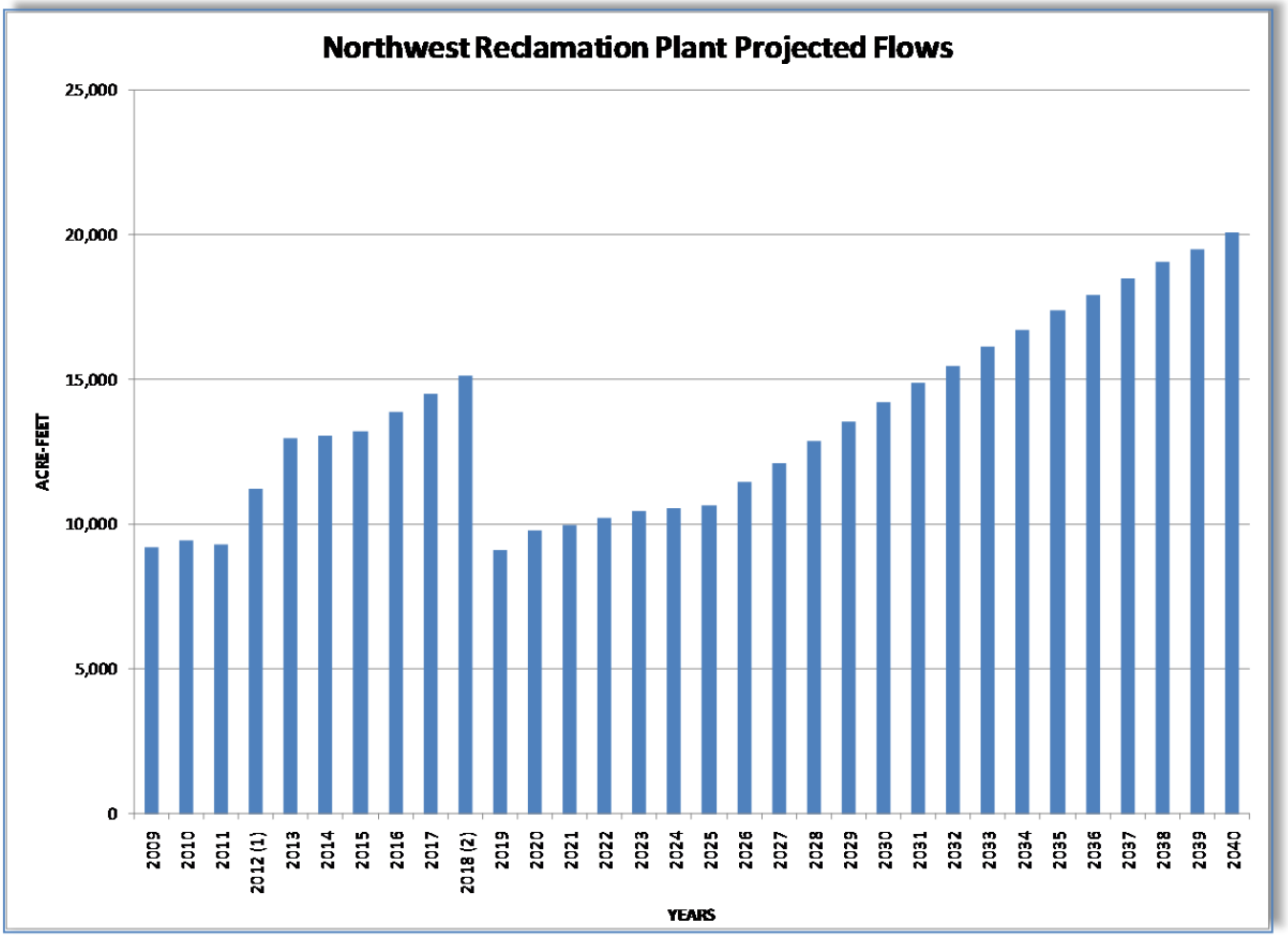


Figure 10.2– Chart showing the total current and future projected reclaimed water available from the Northwest Water Reclamation Plant (NWWRP). Notes: (1) - indicating the completion of the Brown Road sewer relief line completed; (2) indicating a the completion of the pump-back station

There are two anomalies that will affect the volume of reclaimed water produced at the NWWRP plant. First, in 2012, a sewer relief line will be completed at Brown Road that will divert an additional 2.0 MGD to the NWWRP and is illustrated in Figure 10.2. The second anomaly occurs in 2019 when a pump-back system is scheduled for completion that will capture a significant amount of wastewater water that would have gone to the NWWRP and/or the 91st Avenue Wastewater Treatment Plant. Instead, the wastewater gets diverted to the Greenfield Water Reclamation Plant (GWRP). This will cause a significant decrease in reclaimed water at the NWWRP beyond 2019 and a significant increase in reclaimed water at the GWRP in 2019 illustrated in (Figure 10.2 & 10.4).

The NWWRP flows are projected to be slightly less than 10,000 AF/year in 2019 and increase to approximately 20,000 AF/year by 2040. Mesa will continue to explore and optimize reclaimed water use options for its reclaimed water supplies at the NWWRP. With drought looming on the horizon for the Colorado River and potentially the Salt and Verde Rivers, the importance of reclaimed water that

can be stored underground and recovered during shortages becomes greatly underscored. Currently, Mesa transports reclaimed water to the GRUSP through a constructed reclaimed water transmission main that runs east from the NWWRP along the Loop 202 to GRUSP as illustrated in Figure 10.3.

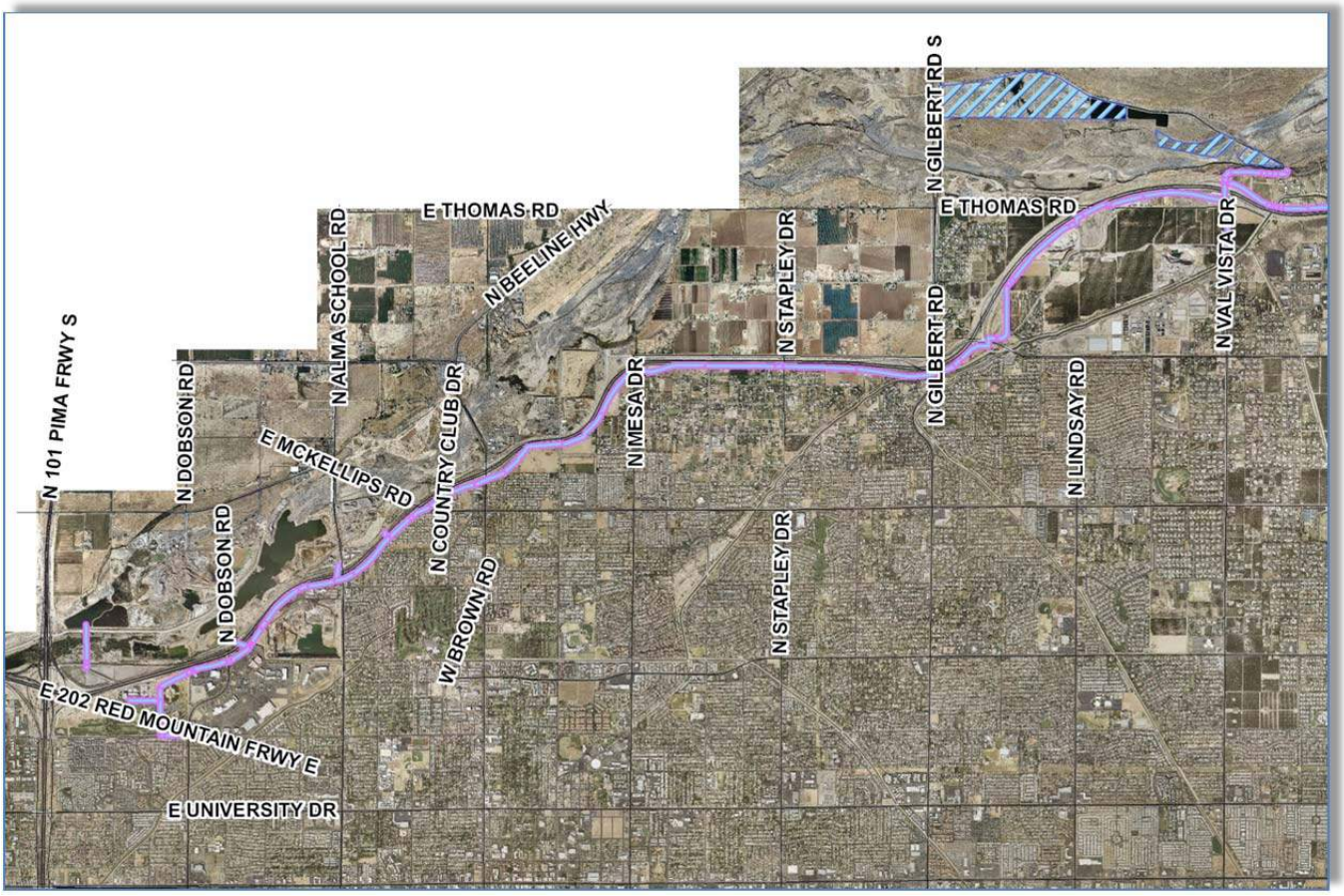


Figure 10.3 – Map showing the reclaimed water line (Purple Line) from the NWWRP (Red Arrow) to GRUSP (Blue Hatched polygon).

10.3 RECLAIMED WATER FROM THE GREENFIELD WATER RECLAMATION PLANT (GWRP)

Mesa, Gilbert, and Queen Creek are co-owners of the Greenfield Water Reclamation Plant (GWRP) located at Greenfield and Queen Creek Roads in Gilbert. This plant went online in early 2007. The current plant capacity is 16.0 MGD and Mesa's current plant capacity is 4.0 MGD. Mesa's flows are projected to be slightly more than 30,000 AF/year in 2040 (Figure 10.4). Similar to the reclaimed water line constructed from the NWWRP to GRUSP, a reclaimed water line was constructed from the GWRP that is capable of delivering reclaimed water to the Gila River Indian Community's (GRIC) irrigation canal system. As described in the previous section, once the reclaimed water is delivered to the Indian Community, the City receives an amount of CAP exchange water.

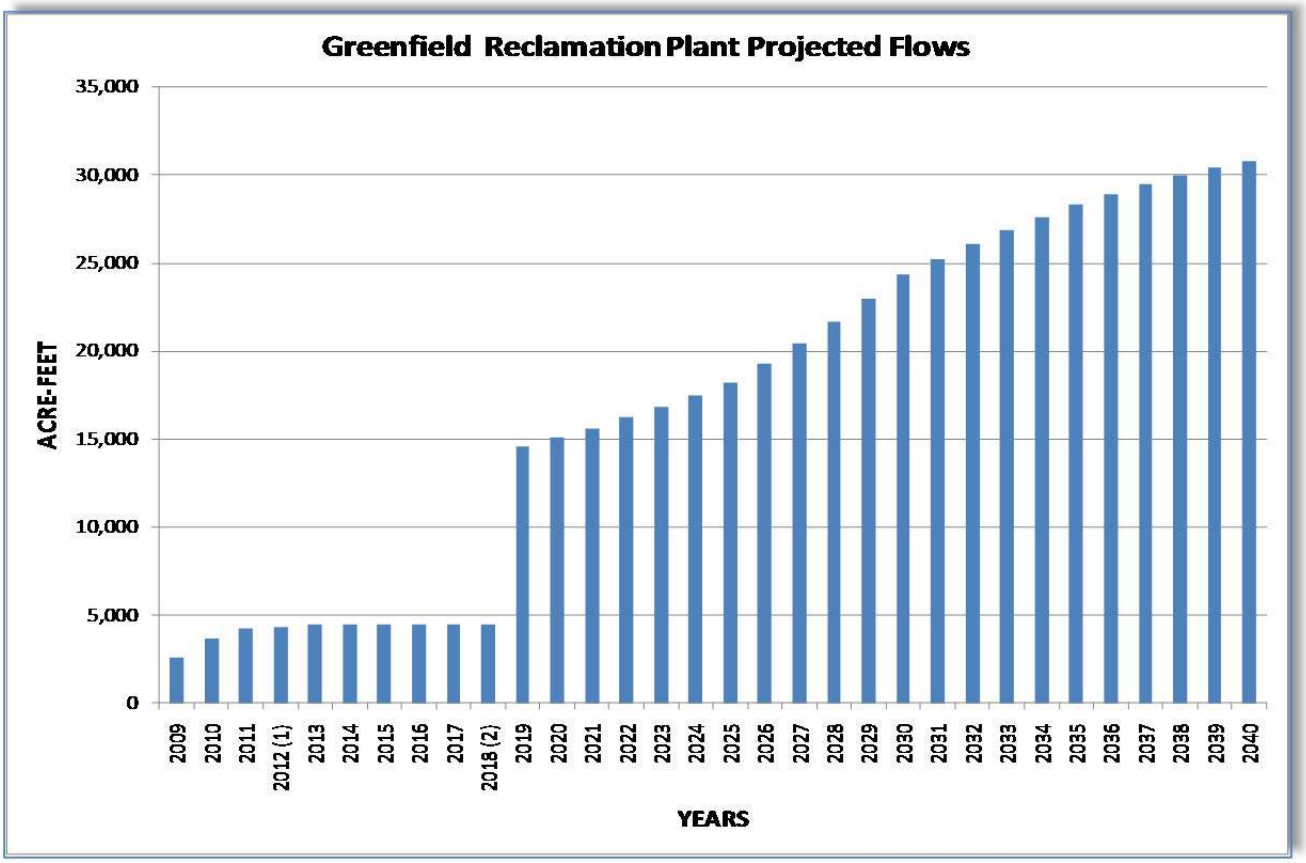


Figure 10.4 – Chart showing Mesa's current and future projected wastewater flows to the Greenfield Water Reclamation Plant (GWRP).

10.4 RECLAIMED WATER FROM THE SOUTHEAST WATER RECLAMATION PLANT (SEWRP)

The Southeast Water Reclamation Plant (SEWRP) has a current capacity of 8.0 MGD. Wastewater from the SEWRP can also be pumped to the Baseline Road Interceptor for treatment at the 91st Avenue Water Reclamation Plant (SROG).

To ensure efficient use of reclaimed water from the SEWRP, Mesa has constructed a reclaimed water line from the SEWRP to the GWRP ensuring additional effluent flows to the Gila River Indian Community. Also, an effluent line was constructed to deliver reclaimed water to the Turner Ranches (Leisure World) for their turf irrigation.

Reclaimed water from the SEWRP and GWRP can be utilized alone or in tandem to meet the GRIC water exchange obligations. The amount of water from the SEWRP and GWRP needed for delivery to the Community will vary over time. However, Mesa will need a place to beneficially use or recharge water in the future from the SEWRP and GWRP that is above what is needed for the GRIC obligation. Various feasibility opportunities are currently being explored.

While recharge feasibility is critical for underground storage and recovery opportunities for anticipated future surface water shortfalls, additional reclaimed water opportunities may present

themselves in the future. Power requirements continue to increase for Arizona and if future power generating stations are required to be built here within Arizona, a reliable water supply other than groundwater will be required for generating electricity. Also, the need for direct delivered reclaimed water is anticipated to increase significantly in the future as all groundwater and surface supplies have or will be allocated.

10.5 RECLAIMED WATER FROM THE 91st AVENUE WATER TREATMENT PLANT

Currently, Mesa is a 14.29% capacity owner of the 91st Avenue Wastewater Treatment Plant (aka SROG) which equates to 29.22 MGD (32,730 AF/year) of treatment capacity. Mesa sent approximately 30,000 AF of wastewater to the 91st Avenue plant in 2004. However, in 2009 this volume was reduced to 22,067 AF and further reduced to 19,272 AF in 2010. It is projected that Mesa will send 16 MGD, or slightly less than 18,000 AF/year, of flows to meet the minimum flow requirements to SROG. This reduction is principally due to the City having enough treatment capacity to generate and beneficially use its own reclaimed water supplies for other higher priority uses. The management of the City's reclaimed water has, and will be, one of the most complex, challenging, and important issues in Mesa's water resources planning.

Figure 10.5 – Photo showing the Tres Rios constructed wetland project at the 91st Avenue Wastewater Treatment Plant (Photo by Donna Paladino)

Reclaimed water from SROG is used not only to generate affordable electric power for the State, but also for irrigation in the Buckeye Irrigation Company (BIC). The BIC acquired the right in 1966 to purchase 30,000 AF of water generated at the 91st Avenue Plant. The BIC is approximately 22,000 acres of irrigated lands in the Buckeye Valley west of Phoenix. Also, a portion of reclaimed water is passed through an engineered wetland that provides some additional finishing. The wetland is called Tres Rios (Figure 10.5), meaning three rivers, and is supported by the Arizona Game and Fish Department in part through the Heritage Fund. Also, the U.S. Water Conservation Laboratory has been directly involved in conducting scientific studies around the use of effluent for engineered water bodies and irrigation.

10.6 ADEQUATE WELL CAPACITY

Figure 10.6 suggests that based solely on Off-Project surface water supplies, Mesa can meet its projected Off-Project demands through the year 2035. Without any additional Off-Project surface water supplies the City will need to rely on either groundwater supplies and/or other water supplies stored underground and available through recovery wells such as CAP, NCS, or effluent water supplies. The over allocation of the Colorado River and constant threat of drought will undoubtedly create shortages to CAP subcontractors. While the Federal government and the State

of Arizona have made efforts towards firming portions of Indian and subcontract shorted supplies, these processes will create increased recovery of groundwater and/or other water stored underground. Therefore, it is vital that Mesa maintain well capacity adequate to meet demand during both normal and drought periods.

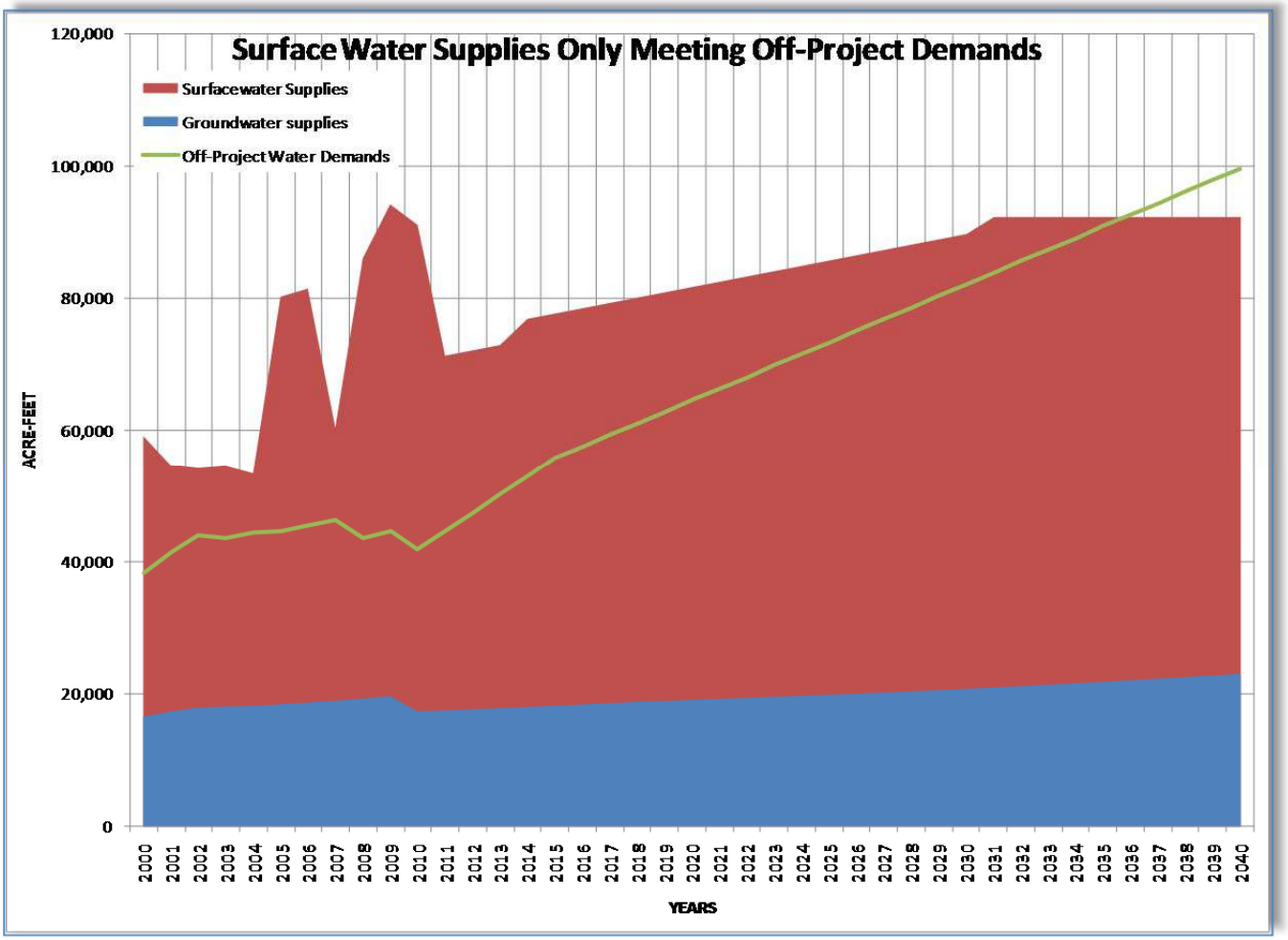


Figure 10.6 – Chart showing the total Off-Project water demands (Green line) and the total quantity of Off-Project surface water supplies (Red area) available to meet demands and the total amount of groundwater supplies (Blue area) ***Note: the blue area is not added to the red area numbers creating a sum total, but placed in front of the red area as a comparison.***

There are many Federal, State and local threats to Mesa's water supplies that require staff from the Water Resources Department and City Attorney's Office to spend significant time understanding these threats and ensuring they are abated.

11.0 PROTECTING LEGAL AVAILABILITY OF SUPPLIES

11.1 INDIAN COMMUNITY WATER RIGHT CLAIMS

Because Arizona's water rights are based on prior appropriation (first in time, first in right), Indian communities often have very strong claims to surface water in Arizona that pre-date cities' rights. Also, the United States ensures that Indian water will be physically available (firmed) for use even in

times of shortage. The Valley cities that are primarily dependent on surface water along with State and Federal authorities and the Indian communities have worked for more than 30 years to settle these claims amicably. The cities have found that Indian water settlements have and will continue to play a crucial role in shaping the future of water rights in Arizona.

Figure 11.1 – Photo showing Mesa's O.S. Stapley Hardware Company, ca at the turn of the 20th century (Photo provided by the SRP Research Archive)

To date, settlements with the Salt River Pima-Maricopa Indian Community (SRPMIC), Fort McDowell Indian Community (FMIC), Yavapai-Prescott Indian Community (YPIN), San Carlos Apaches (SCA), and the Gila River Indian Community (GRIC) have been completed. In 2010, the United States passed the White Mountain Apache Tribe Water Rights Quantification Act. It is anticipated that this will become effective around 2013.

Indian water rights settlements provide an alternative to years of litigation that can be extremely time consuming and expensive. More importantly, settlements reached between parties are much more mutually beneficial than court decrees or the uncertainty of litigation. With only a few remaining tribes with potential claims that potentially could impact Mesa's surface water rights, Mesa will continue to engage in these discussions and enable the settlement of these claims where possible.

11.2 THE GILA RIVER ADJUDICATION

In December of 2004, President Bush signed Public Law 108-451 that authorized the Gila River Indian Community's water rights settlement and amended and reauthorized the Southern Arizona's Water Rights Settlement Act of 1982. In 2007, Interior Secretary Kempthorne signed the required Statements of Findings and completed the legislative requirements. This water settlement provides access to renewable water supplies and the financial resources necessary to develop Indian community land and water resources.

11.3 VERDE RIVER BASIN DEVELOPMENTS

Population growth in the Verde Valley and the Prescott Area has exploded. A significant portion of water used by these communities is sub-flow (surface water) taken from the river alluvium or groundwater pumped from the aquifers that feed into the Verde River system. In fact, within the Prescott AMA the cities of Prescott, Prescott Valley and Chino Valley all draw their water supplies

from the Little Chino Aquifer that feeds the Upper Verde River. Currently, the amount of all groundwater and sub-flow pumping is approximately two to three times the amount of water that is naturally, incidentally, and artificially being recharged back into the aquifer. The groundwater levels are dropping between 2.5 to 5 feet per year according to the most recent (2005) USGS regional study. This overdraft will not only have a negative effect on the base-flow of the Verde River but potentially poses risks of a Federal taking within the U.S. Endangered Species Act. The Upper Verde River portion is currently listed and protected under the U.S. Endangered Species Act. Any reduction in base flow of the Verde River would have its most deleterious impacts during times of drought. Mesa and other Valley cities have concerns regarding Verde River flows, SRP has been attempting to expedite the adjudication process, and SRP recently filed an injunction against some of the most egregiously "illegal" water users in the Verde Valley. Mesa must continue to monitor Verde River Basin issues including the adjudication and lawsuits.

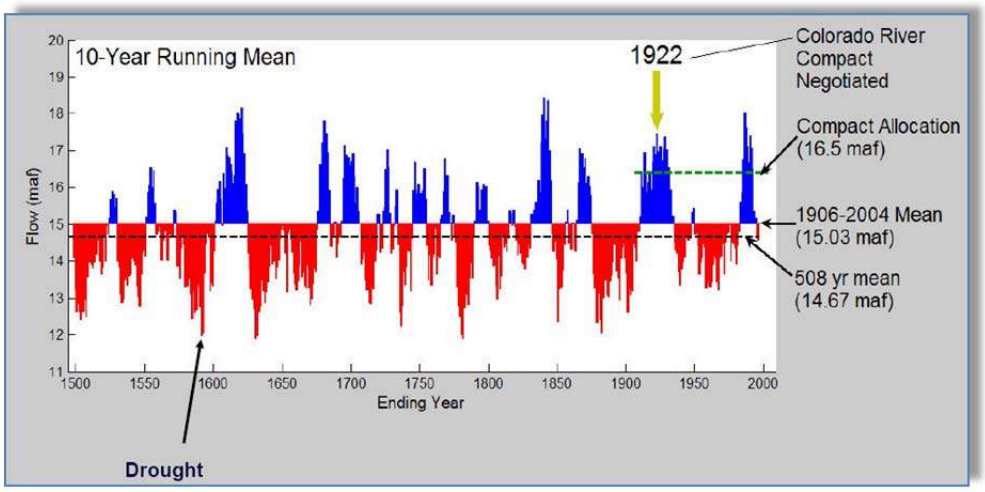


Figure 11.2 – Chart showing the 10-year running mean for the Colorado River based on tree ring data from the year 1500 to 1906and actual river discharge data from 1907 to 2004 (Chart from the University of Arizona Laboratory of Tree Ring Research – CLIMAS)

11.4 THE COLORADO RIVER

Various tribes along the Colorado River, including the Hopi and Navajo, have pending claims to the river that are complex with uncertain outcomes. Because the CAP holds the lowest priority on the Colorado River, all of these claims have the potential to impact CAP water supplies and therefore Mesa's Colorado River water supplies within its portfolio. Mesa must monitor these developing claims diligently.

Figure 11.3 – Photo of groundbreaking ceremony for the CAP Canal May 6th, 1973 on the shores of Lake Havasu (Photo by the Arizona Museum of Natural History)

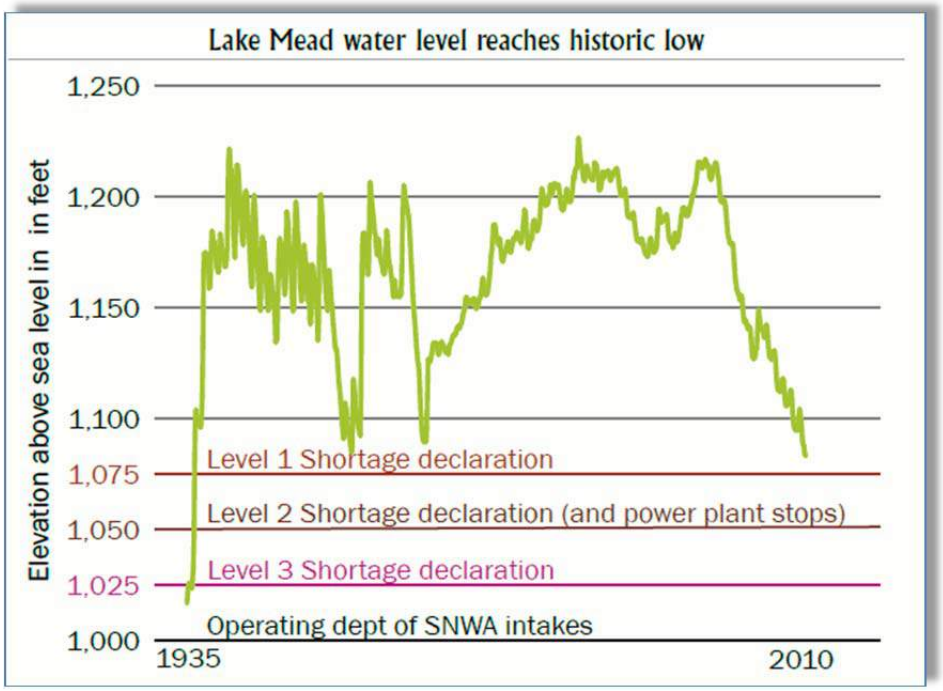


Figure 11.4– Chart showing historic lake levels of Lake Mead and the lake levels where shortage declaration will occur (Chart created by CAP)

Various Colorado River long-range reconstruction flow studies using tree ring data conducted by the United States Geological Survey (USGS) and the University of Arizona (U of A) et al, suggest that the Colorado River has been over allocated (Figure 11.2) due to the limited amount of river data used for the 1922 Compact and allocation of the river. This research suggests that the data used for the compact was the wettest 100-year period of the Colorado River for the past 500 years, (Figure 11.2). Therefore, based on this data, the river was most likely over-allocated. Based on 100-years of river data, the river was calculated at a 16.5 million AF (maf)/year mean flow. However, the 500 year tree ring study suggests a 14.67 maf/year mean. Therefore, when the river discharges at its 500-year mean and the demand on the river is at an allocation of 16.5 maf/year, there will be a shortage on the river of about 1.83 maf/year. However, during times of drought, the over-allocation and drought components will amplify the shortages on the Colorado River.

The Colorado River is now in the 11th year of the worst prolonged drought ever recorded during the last 100-years of its recorded history. This drought has significantly stressed the water supplies on the Colorado River for both the lower and upper basin states. Due to its severity, the U.S. Department of Interior and the Upper and Lower Basin states initiated negotiations in 2005 to determine if common ground could be reached for guidelines for Lower Basin shortages and the coordinated operations of Lake Powell and Lake

Figure 11.5 – Photo showing Lake Mead's reduced surface elevation caused by the prolonged drought (Photo by Mike Krawczynski)

Mead. In 2007, the Record of Decision established interim guidelines for lower basin shortages and the coordinated operations of Lake Powell and Lake Mead. As part of this record of decision, a shortage is declared when the Lake Mead water table elevation is measured at 1,075 feet above mean sea level (msl) (Figure 11.4).

In 2010, Lake Mead's surface water elevation dropped to 1,081 ft msl which was very close to the 1,075 msl trigger point elevation identified within the Record of Decision. The Secretary of the Interior approved additional flows from Lake Powell, to augment Lake Mead. Also, the amount of water in storage available at Lake Powell will determine the amount of augmented water it can provide to Lake Mead according to the Record of decision. Therefore, if the surface water elevation at Lake Mead continues to drop to the identified elevation, (Figure 11.4), a shortage declaration (call on the river) will result unless Lake Powell is able to augment Lake Mead. For example, if Lake Mead's surface water elevation drops to 1,050 ft msl and Lake Powell cannot augment Lake Mead a shortage declaration is initiated and the power production at the dam ceases.

11.5 INTERNATIONAL BOUNDARY AND WATER COMMISSION - IBWC

On April 4th, 2010, a 7.2 magnitude earthquake shook Mexico and severely damaged irrigation canals within Irrigation District #14 Rio Colorado in the Mexicali Valley. A landmark agreement was created between the United States and Mexico during the International Boundary and Water Commission (IBWC) in Minute 318. From 2011 through 2013 the U.S. agreed to leave a total of 260,000 AF within Lake Mead's storage for future releases to Mexico. This agreement has provided some additional relief to Lake Mead.

Figure 11.6 – Photo showing Downtown Mesa ca 1920s (Photo provided by the Arizona Museum of Natural History)

11.6 MULTI-SPECIES CONSERVATION PLAN

Another program developed between 1996 and 2005 was the Multi-Species Conservation Plan (MSCP). In April 2005, the Secretary of the Interior signed the Record of Decision for the Lower Basin Multi-Species Conservation Plan. This plan details a 50-year effort which includes the goal of creating more than 8,100 acres of riparian, marsh and backwater habitat for four listed species and 16 other species native to the lower Colorado River. It also includes measures to protect and enhance an additional two listed and four non-listed species

The U.S. Department of the Interior will provide 50 percent of the program's estimated $626 million cost, and California, Nevada, and Arizona will jointly provide the other 50 percent (CA-50%, NV-25%

and AZ-25%). The implementation activities are based on adaptive management principles, which allow program conservation measures to be adjusted over time based on monitoring and research. The Bureau of Reclamation, in consultation and partnership with a Steering Committee made up of representatives from the 56 participating entities, is the primary implementing agency for this activity. In December 2004, a final Environmental Impact Statement for this effort was developed which includes a Habitat Conservation Plan and a Biological Assessment.

In accordance with the 1944 treaty between the United States and Mexico, approximately 1.5 million AF a year of Colorado River water, that meets certain salinity requirements at Morelos Dam on the border, must be available to Mexico at the border. The Yuma Desalting plant was built by the Bureau of Reclamation (BOR) and designed to desalt drainage return flows from the Wellton-Mohawk Irrigation and Drainage District (Wellton-Mohawk) prior to their release into the Colorado River near Morelos Dam. The plant was necessary to ensure that the United States met its water quality obligation to Mexico.

11.7 THE YUMA DESALINATION PLANT

The Yuma Desalination Plant (YDP) construction was substantially complete in 1992. The plant operated at about 10% capacity until the plant's planned operations were interrupted in 1993 due to the Gila River flood that damaged the Main Outlet Drain Extension. At an estimated annual cost of $30 million, the plant has not operated since, except for a 3 month test in 2007 and a 12-month test in 2010. The Wellton-Mohawk's salty drainage water, approximately 100,000 AF/year (an amount approximately equal to Mesa's total annual water demand), has been delivered through a canal to the Cienega de Santa Clara in Mexico. The Cienega has since become an important environmental habitat (Figure 11.7). Because this water does not meet the correct water quality standards and is not delivered at Morelos Dam as required by the treaty with Mexico, the water does not count towards the 1.5 maf/year United States' treaty obligation to Mexico and becomes essentially free water to Mexico.

Figure 11.7 – Photo showing the Cienega de Santa Clara in Mexico (Photo by Tony Herrera)

The importance of the YDP will only increase with time as the USBR and CAP look to this 100,000 AF/year of water that could be beneficially stored and used within Arizona, versus the continuous delivery of this water to Mexico that does not count towards our treaty obligations.

Operation of the YDP would cut flows to the Cienega by around 70 percent and the water's salinity would increase more than 200 percent, effectively impacting the habitat. Environmentalists have lobbied hard to prevent operation of the YDP. The USBR also is not particularly anxious to operate the YDP due to the annual costs.

In March 2010, the CAP, in cooperation with the USBR and Mexico, conducted a 1/3-scale pilot run of the plant for one year and treated a total of approximately 30,000 AF. In March 2011, the pilot test was completed and over 30,000 AF was conserved during the test at a cost of $293/AF. The actual costs were realized at 35% below what was predicted.

The fate of the Cienega de Santa Clara in Mexico and the YDP is uncertain. The issues are complex and should be resolved without CAP and other Arizona water users bearing the burden of the United States' obligation to Mexico. The City of Mesa must monitor these issues to ensure they do not negatively affect the City.

Figure 11.8 – Photo showing the Mesa canal in 1912 (Photo provided by the SRP Research Archive)

11.8 CONSERVATION AS A SOURCE OF SUPPLY

The City has actively promoted water conservation for more than 20 years as a way to stretch existing water supplies, minimize the need for costly water infrastructure projects, and maximize sustainability in meeting future water needs. The conservation efforts have largely advocated using renewable water supplies, promoting a lifestyle or behavior change – accepting that we live in the desert, realizing that water resources are scarce, and putting into practice wise water use habits. Conservation as a means to meet demands may be critically important during times of severe drought when extraordinary and expensive water supplies and infrastructure changes are necessary to meet customer demands.

While the City can meet current and future Off-Project water demands through 2035 through the use of renewable surface water supplies alone, additional groundwater or water stored underground will

be needed to augment renewable surface water supplies beyond 2035. The quest for new renewable surface water supplies will continue for not only Mesa but other water service areas within the CAP service area. Mesa will need to prioritize the below list of items through costs-benefit analysis or net present value (NPV) assessments.

- Acquire and develop additional renewable surface water supplies
- Ensure recharge capacity to store eligible water supplies underground for future use
- Develop and construct new surface water supply, treatment and delivery facilities and infrastructure
- Ensure the highest and best use of effluent that provides the greatest rate of return.

11.9 WORKING COOPERATIVELY

The acquisition of water supplies, the use and/or development of delivery infrastructures, water treatment or recharge facilities, and environmental impacts and assessments regarding the point of diversion or withdrawal and beneficial use of the supplies require significant cooperation between water stakeholders, State and Federal agencies, and water political subdivisions. These monumental tasks can only be realized financially through the economy of scales achieved by cooperation. Mesa has established a long standing philosophy of economies of scale whenever possible, and has cooperative arrangements regarding water resources and infrastructure with most of its neighboring cities including: Phoenix, Gilbert, Apache Junction, Queen Creek, the Gila River Indian Community, the Salt River Pima-Maricopa Indian Community, and Salt River Project.

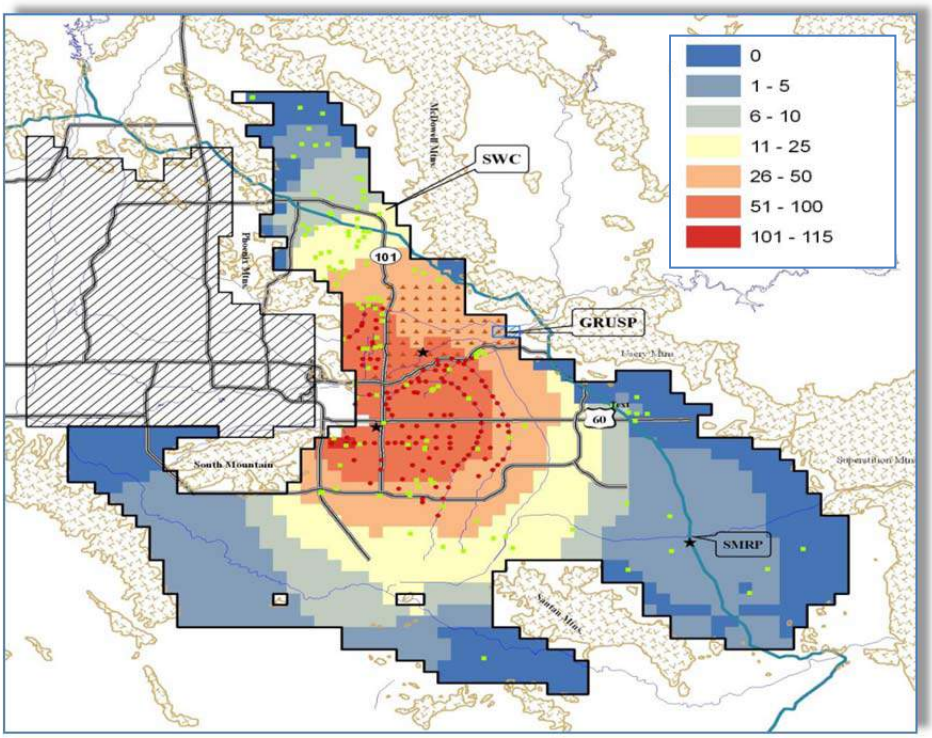


Figure 11.9 – Map of groundwater model showing the projected groundwater impacts from predicted SRP pumping caused by surface water shortages from 2011 to 2030 (Map image from the East Valley Water Forum 2011 Drought Model) Note: legend units in feet

Mesa was instrumental in creating a grass-roots regional water planning group known as the East Valley Water Forum (EVWF). The EVWF was developed as a forum through which water providers can discuss regional water issues, learn from one another's experience, and work together

cooperatively. The EVWF has been very active and has created several important tools including: 1) a water infrastructure map that has better enabled members to identify opportunities to partner in infrastructure development; 2) an East Salt River Valley Groundwater Management Plan, based on input from local water providers and a hydrogeologic model developed by ADWR; and 3) a cooperative groundwater flow model developed by ADWR and the USBR to better understand the impacts from increased groundwater pumping due to surface water shortages on the SRP and CAP systems. Figure 11.9 illustrates the potential impacts of significant increased SRP groundwater pumping during times of surface water shortages. The model suggests that within Mesa, ground-water levels would decrease up to 100-115 feet with increased pumping from 2011 to 2030. SRP will not be the only entity with increased groundwater pumping within the East Valley due to surface water shortages and therefore the impacts to the groundwater system could be more severe. Mesa needs to continue its involvement in the EVWF and work towards regional solutions towards these and other associated water resource issues.

11.10 DROUGHT

Some climatologists have suggested that the current drought, of which we are now 11 years into, is by far the worst within recorded history of the southwest. Mesa is well prepared for this drought through very progressive planning efforts that include: 1) the underground storage of nearly 500,000 AF of various types of water supplies that can be recovered as needed during times of drought induced surface water shortages to either the CAP or SRP systems; 2) working with its neighbors in utilizing renewable water supplies versus the continued and increased withdrawals of groundwater; 3) the cooperative efforts of various water providers that currently recharge water at the GRUSP which replenishes groundwater underneath the East Salt River Sub-basin and Mesa; and 4) the recently permitted recharge facility just east of Mesa known as the Superstition Mountain Recharge Project which will ensure groundwater replenishment to Mesa's east where significant groundwater pumping has been occurring through the members and member service areas of the Central Arizona Groundwater Replenishment District (CAGRD).

11.11 AQUIFER MANAGEMENT

The East Salt River Valley Sub-basin encompasses the eastern part of the AMA and includes a portion of the City of Phoenix, the cities of Scottsdale, Tempe, Mesa, and Chandler, and the towns of Superior, Apache Junction, Gilbert and Queen Creek. The thickness of basin-fill sediments ranges from less than 100 feet, near the basin margins, to over 10,000 feet southeast of Gilbert. The primary source of groundwater (49%) is from the lower basin fill, with another 40% withdrawn from the middle basin fill and only 11% is withdrawn from the upper basin fill (ADWR, 2005).

Earth fissuring and subsidence have occurred in the ESRV sub-basin due to localized pumping. These occurrences are found near Apache Junction and in the vicinities of Queen Creek, North Scottsdale and Paradise Valley (ADWR, 2005).

The ESRV has diverse water providers ranging from those who have secured substantial renewable surface water supplies to those that have and remain solely on non-renewable groundwater supplies.

12.0 EAST VALLEY WATER FORUM

The City of Mesa was instrumental in the creation of East Valley Water Forum (EVWF). In 2001 the EVWF formed as a voluntary partnership of Federal and State water agencies, Municipalities, irrigation districts, and interested stakeholders involved in water resource management within the East Salt River Valley (ESRV) groundwater sub-basin (Figure 12.1). Since its inception, the Forum has worked to ensure that groundwater remains a long-term viable source of water. To that end, the Forum members share ideas, identify common interests, and discuss and explore water infrastructure development and groundwater resource management strategies.

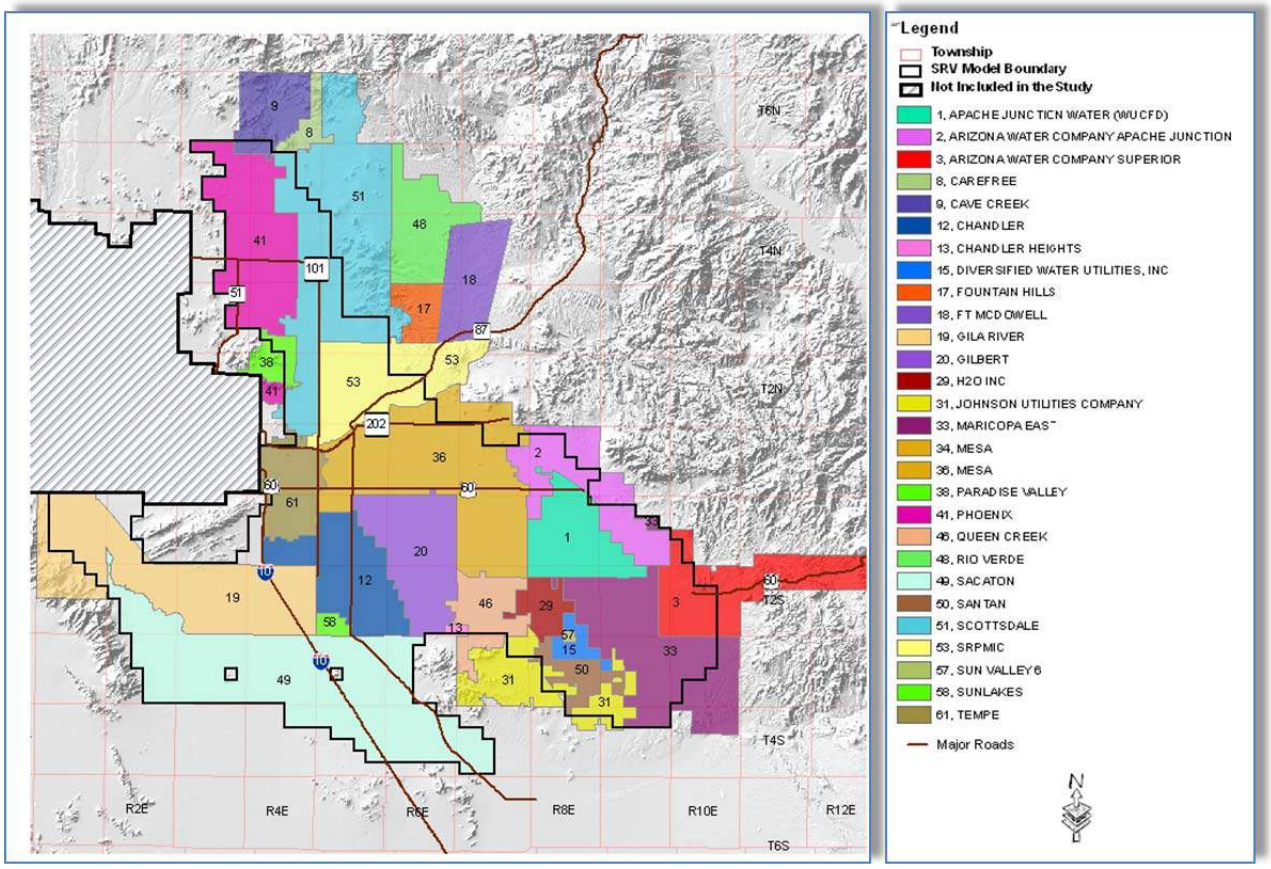


Figure 12.1 – Map showing the water planning areas for the EVWF stakeholders within the East Salt River Valley Sub-Basin (indicated by black line). Map produced by ADWR for the EVWF Management Plan.

12.1 THE EAST VALLEY WATER FORUM RECEIVES FUNDING

In early 2003, the Arizona Department of Water Resources (ADWR) awarded the Forum a grant through the Phoenix Active Management Area Water Management Assistance Fund to produce an "East Valley Area-Wide Water Management Plan" (Plan). As stated in the grant, the purpose of the Plan is to: ***"****enable water providers in the East Valley and other key entities to more effectively plan for and manage water use in the East Valley including artificial groundwater recharge, groundwater pumping and recovery****.*** ADWR and the Forum anticipated the Plan would *"provide a better*

understanding of water conditions associated with projected groundwater pumping, and recharge and recovery of surface water and effluent." In addition to the grant, the ADWR Hydrology Division provided staff that developed models to display groundwater conditions based on Plan scenarios. The U.S. Bureau of Reclamation (USBR) also contributed significant funding and valuable staff support.

12.2 THE MANAGEMENT PLAN

The Forum's planning efforts focused on identifying and evaluating the impacts of three water supply and demand scenarios through the use of ADWR's groundwater model. To a large degree, the successful and sustainable management of water resources in Central Arizona (including the East Valley) is contingent upon aquifer management programs that mitigate:

(1) Severe groundwater overdrafts,
(2) Groundwater cones of depression, and
(3) Groundwater mounding

Physical and legal access to surface water supplies varies among water providers in the East Salt River Valley. Some water providers have significantly invested to secure the legal rights and have built considerable infrastructure to receive, treat, and deliver surface water from the Salt, Verde, and Colorado Rivers. These same water providers have also typically developed groundwater supplies to either augment surface water demands or be available to supplement demands during drought. Other water providers are heavily or solely dependent on groundwater to meet water demands. All water providers in the East Valley have access to groundwater and are withdrawing it from the same aquifer (the East Salt River Valley Sub-basin). However, those providers with limited or no access to surface water are placing ever greater demands and strains on the regional aquifer than those with access to surface water. This strain is particularly acute in areas of the basin where water over-withdrawals have been ongoing or near the mountain fronts (aquifer fringes).

Several key recommendations were developed as a result of the Water Management Plan. The general recommendation suggested: A) the East Valley water providers should work collaboratively to develop additional surface and reclaimed water supplies for the eastern portion of the sub-basin because the best way to preserve groundwater levels is to limit full dependence on groundwater to preserve the supply for drought purposes; B) the East Valley water providers should work collaboratively to manage regional groundwater levels; and C) the East Valley water providers should continue collaborative work through the East Valley Water Forum.

The detailed key recommendations underscored through stakeholder meetings include:

(1) Water providers in the East Valley should apply for an allocation of Non-Indian Agricultural (NIA) priority CAP water when such water becomes available for reallocation beyond 2012.
(2) Apache Junction Water Company, Arizona Water Company, Queen Creek Water Company, CAGRD, and other water providers to the east should explore the possibility of wheeling additional surface water supplies through the existing and future surface water treatment plants.

- Mesa currently treats and delivers CAP water for Apache Junction, but water providers should examine the possibility of increased deliveries to alleviate groundwater pumping demand. This would help mitigate the cone of depression near Meridian Road.
- NIA water, CAP water leased from Arizona Indian tribes, State Land Department CAP water, excess CAP water, and potentially even mainstem Colorado River water could potentially be wheeled through Mesa's surface water treatment plants.

(3) Cities and towns west of the CAP canal should investigate preservation of agricultural canals and laterals that could be used to transport water from the CAP canal to future surface water treatment plants or recharge facilities.

(4) Cities and towns east of the CAP canal should collaborate to construct regional wastewater treatment facilities as a means to increase the use of renewable reclaimed water supplies either through direct use or recharge.

(5) CAGRD Member Service Areas and water providers serving Member Lands should consider the possibility of delivering surface water supplies directly to customers.

(6) CAGRD Member Service Areas and Member Lands should consider alternatives that would dedicate a percentage of reclaimed water supplies generated from these developments to groundwater replenishment within the area of hydrologic impact of their groundwater withdrawals.

(7) The City of Chandler and the Town of Gilbert, in their development of a regional surface water treatment plant to serve their customers, should consider the possibility of partnering with the Gila River Indian Community to potentially serve its northern portion.

(8) The Cities of Scottsdale, Tempe and Mesa should consider the possibility of partnering with the Salt River Pima-Maricopa Indian Community in the development of water and wastewater treatment and delivery infrastructure.

(9) Water providers in the East Valley should participate in policy discussions about bringing additional Colorado River water to Central Arizona via the CAP canal.

(10) The Towns of Queen Creek and Gilbert should consider the possibility of exchanging some of their reclaimed water generated at the Greenfield Water Reclamation Plant for CAP water from the Gila River Indian Community.
    - The reclaimed water could be piped to the Community via Mesa's pipeline that goes to the reservation boundary.
    - CAP water received in exchange could be wheeled through Mesa's or Gilbert's existing infrastructure directly to customers.

(11) The Forum should explore the possibility of a future requirement that new demands beyond the year 2020 be met through direct delivery of renewable surface water supplies where recharge cannot offset the detrimental impacts of groundwater pumping.

(12) The Forum should explore the possibility of moving existing groundwater pumping to areas where recharge can offset the detrimental impacts of such groundwater pumping.

(13) The Superstition Mountains Recharge Facility should be developed as expeditiously as possible with as much recharge capacity as possible.

(14) Apache Junction Water Company, Arizona Water Company, and other water providers in the area should make the effort to locate future wells further south and away from the Meridian Road cone of depression.

(15) The City of Scottsdale, the Arizona-American Water Company (Paradise Valley), and other water providers in that area should make an effort to locate future wells further away from the Paradise Valley cone of depression.
(16) EVWF (Forum) members should explore arrangements to recharge water in areas where groundwater levels are declining and recover that water in areas where groundwater levels are rising.
    - When possible, Mesa, the Salt River Pima-Maricopa Indian Community, the Salt River Project, and other water providers should consider the use of wells in the Granite Reef Underground Storage Project area to help ensure that it can operate at full capacity.
    - Future wells should be located as close to the future Superstition Mountains Recharge Facility as possible.
(17) Water providers should develop recharge facilities, including direct injection wells, where physically and economically feasible. Providers should explore partnerships that make their development less costly.
(18) Forum members should explore the possibility of instituting regulations for Active Management Areas that allow siting of groundwater recharge and recovery facilities based upon net benefits to the aquifer rather than upon avoidance of harm.
(19) Forum members should work with the Central Arizona Project, the Arizona Water Banking Authority, the Arizona Department of Water Resources, and other agencies to encourage the development of a regional recovery plan as expeditiously as possible.
(20) Water conservation programs should be continued and strengthened.

The East Valley Water Forum provides an important organizational framework for the development and implementation of innovative water management solutions. The Management Plan along with the current Drought Scenario Modeling Report represents the first steps in an ongoing process.

13.0 ON-PROJECT DEMAND / SUPPLY DURING DROUGHT

13.1 WATER SUPPLY REDUCTIONS

Surface water reductions caused by drought on the SRP system are infrequent. However, from 2001 to 2004, Mesa experienced surface water supply reductions from SRP caused by drought. Drought induced supply reductions cause physical, legal-institutional, and financial impacts. These following impacts are explained for a supply reduction on the SRP system.

13.2 PHYSICAL IMPACTS OF SUPPLY REDUCTIONS

While Mesa experienced an SRP surface water supply reduction caused by drought impacts from 2001-2004 it did not experience a physical water supply reduction. SRP and Mesa made up the surface water shortfall with a category of groundwater rights from lands within the SRP service area called Developed water discussed previously. Mesa takes delivery of its SRP water very high up on the SRP canal system, nearly all of the water delivered to Mesa is physically surface water, not groundwater. What this means is that even when Mesa is taking delivery of groundwater from SRP, it is being delivered physically as surface water and the impact is therefore invisible to Mesa's water supply infrastructure.

As explained above, Mesa may have availability to more than 100,000 AF of water from the SRP system during a normal year. Moreover, Mesa received nearly 10,000 AF of Normal Flow water in 2002, a year when watershed runoff into the SRP system was only 32% percent of the median. Mesa is also entitled to Special Pump Right water regardless of shortage. To this end, for Mesa to actually experience a physical water shortfall from the SRP water supplies available for delivery, SRP water supplies would have to be cut from their normal 3 AF/acre per year to less than 1 acre-foot per acre. Given that SRP has enough well capacity to pump approximately 2 AF per acre of groundwater for its service area, ensures that the chances of Mesa experiencing an overall supply reduction from SRP that would actually impact the ability of Mesa to meet On-Project demands is remote.

Even in the worst case-scenario where Mesa experienced a physical supply reduction of SRP supplies, Mesa has enough well capacity On-Project to meet approximately 80% of average winter customer demands using Mesa's own water rights.

13.3 LEGAL, INSTITUTIONAL AND FINANCIAL IMPACTS

The legal-institutional impacts of an SRP supply reduction caused by drought are more substantial. When Mesa replaces lost SRP surface water supplies with SRP developed groundwater or Pump Right Water supplies, the use of this water is legally called groundwater and must be replenished. This means that the water use must be replenished by debiting either Mesa's Groundwater Allowance or Mesa's Long-term Storage Credit from its water portfolio on an acre-foot per acre-foot basis.

SRP surface water is the least expensive source of water available to Mesa and currently is $14.50 per AF. Pump Right water is currently around $45.00 per AF, or three times the amount of regular SRP surface water, and therefore the use of this replacement water would have negative financial implications to the City. However, the use of the City's long-term storage credits may be even more costly as certain types of water that were recharged and stored underground have a much higher commodity cost and additional costs associated with the recharge facility and replacement of the those stored water supplies.

Besides the additional costs for the City to use its Groundwater Allowance or Long-term Storage Credit accounts, there are future costs to consider because these underground water supplies may need to be replaced in order for Mesa to retain this portion of its designation of assured water supplies.

14.0 OFF-PROJECT DEMAND / SUPPLY DURING DROUGHT

14.1 CAP SUPPLIES AND DROUGHT

Mesa receives water with varying priorities through the CAP system and thus they vary in vulnerability when a shortage occurs on the Colorado River. Hohokam water (4,924 AF/year) and SRPMIC settlement water (627 AF/year) have an agricultural priority on the CAP system and would be first reduced or cut during shortages. However, after the year 2042 the Hohokam water converts into an M&I priority and will no longer be the first cut during shortages on the Colorado River. As

mentioned previously, the Wellton-Mohawk water (2,622 AF/year) has a P3 priority which is a higher priority than CAP water and would be reduced or cut last. SRPMIC leased water (1,699 AF/year) and the GRIC exchange CAP water is firmed by the United States, and regardless of if the water may be cut during severe shortages, the City would be assured to receive an available supply to make up any shorted quantity by the United States.

The Arizona Water Banking Authority (AWBA) was created in 1996 with the goal of making full beneficial use of Arizona's Colorado River water entitlement. The AWBA was created in part to store Arizona's current excess quantity of Colorado River water. This stored water could then be used to meet the needs of municipal and industrial CAP users in times of shortages or disruptions of the CAP system. As of 2010, the AWBA had stored a total of 3.7 maf of Colorado River water underground at a cost of $271 million. The AWBA, ADWR, CAWCD, and the USBR have started discussions regarding a process for recovery and delivery of stored CAP water for CAP M&I and Indian subcontractors. There are many unknowns at this time that must be resolved that include: 1) if AWBA water is not Project Water as defined in the Amended Stipulation and Master Repayment Contract what is needed to allow non-Project Water to be delivered via the U.S. CAP Canal; 2) how does Project Power factor into

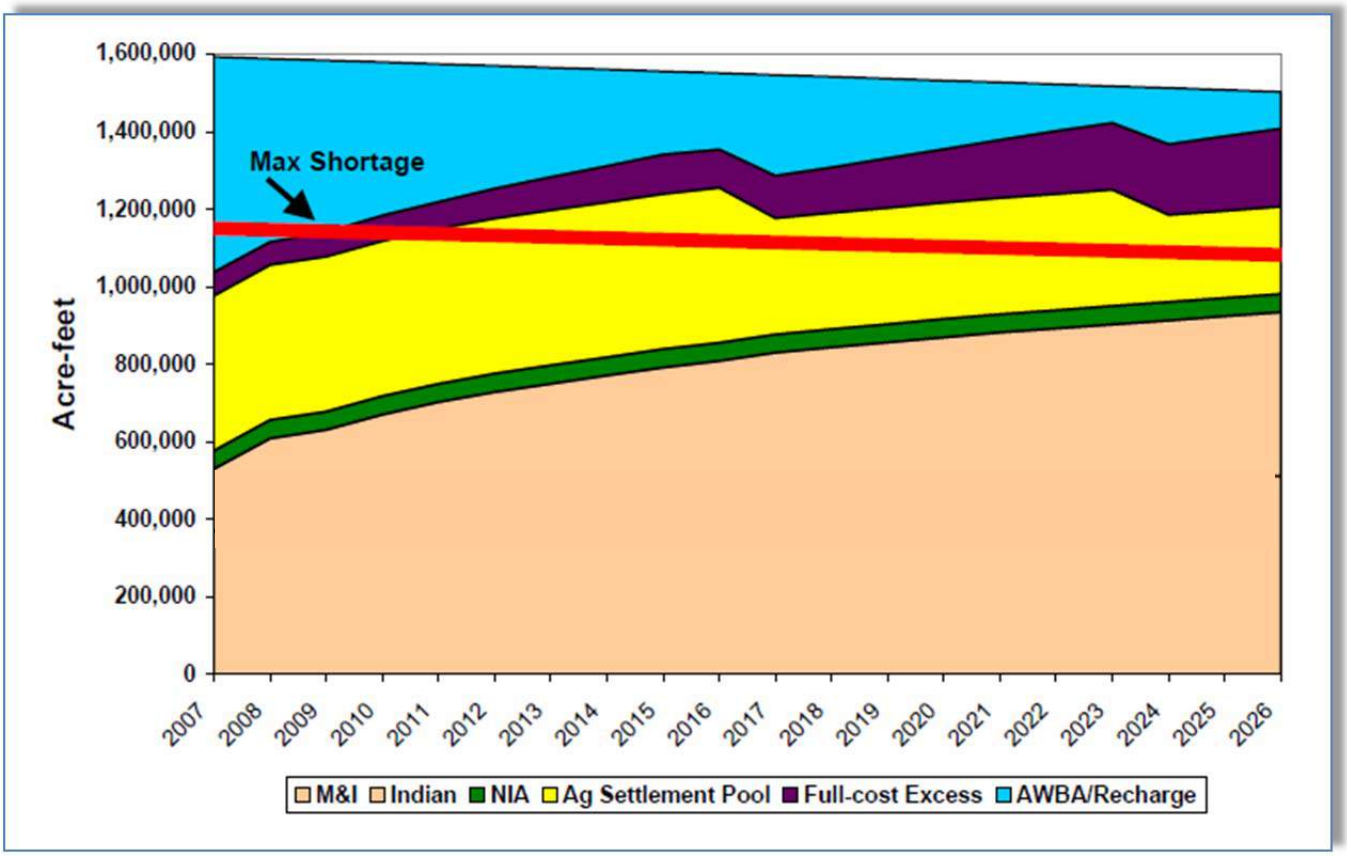


Figure 14.1 – Chart created by the CAP showing the projected "worst" water shortages on the CAP Canal, according to the Record of Decision and the determined Lower Basin shortage quantities (Chart created by CAP)

the energy requirements for recovery and delivery of AWBA credits; 3) if wet water is not delivered to specific contractors how will the entity produce wet water and be compensated for using its own

power and infrastructure versus the CAP Canal; 4) what process will determine the total quantities of AWBA water apportioned for each entity during shortages. Because Mesa might decide to receive AWBA water delivered as a legal authority (paper document), the City would have to pump more stored water through its own wells. Mesa will need to ensure it maintains enough well production or capacity to meet both On– and Off-Project demands during surface water shortage year(s) that could occur independently or simultaneously on the CAP and SRP water supply systems.

In June of 2007 the Central Arizona Project created a Colorado River Shortage forecast model with an average, bad, and worst case scenario regarding shortages on the Colorado River and its effect on deliveries in the CAP system. Also, the Department of Interior has concluded its efforts with the Upper and Lower Basin states regarding Lower Basin shortages and how to better manage Lake Powell and Lake Mead. In December 2007 the Department of Interior released its Record of Decision (ROD) for interim guidelines valid through 2026. The ROD defined normal, surplus or shortage conditions on the river through measurable storage conditions at Lake Mead and river flow volumes. The ROD also defined lower basin shortage sharing based on specific Lake Mead elevation trigger levels. However, the ROD also provided additional releases from Lake Powell authorized by the Secretary to provide stabilization of Lake Mead. Because the CAP still has an Excess Pool of about 320,000 AF/year and an Agricultural Pool of about 400,000 AF/year, it has a current buffer of 700,000 AF/year that can be shorted without affecting M & I and Indian water supplies. Figure 14.1 illustrates that under the worst-case Lower Basin shortage scenario, indicated by the red line, Indian, M & I, and NIA water supplies should not be impacted or shorted during the entire interim period (2007-2026). Also, if the 3.7 million AF stored by the AWBA for shortage is considered, when could the M & I subcontractors actually experience a physical shortage?

Beyond the interim period, as the Agricultural and NIA water converts to M & I and Indian water, eventually shortages could occur if a prolonged drought persists. However, these shortages will be made up by the AWBA through the recovery of stored water to Indian and M & I subcontractors as mentioned previously. Also, the City of Mesa has been very diligent in establishing a substantial quantity of stored water underground. Therefore, beyond 2026, it is not exactly clear when Mesa or any other M & I subcontractor will actually incur a shortage whereby it cannot be made whole through a firming process. Some of the complex variables that need to be understood through local and regional forecast modeling efforts include: 1) the severity and length of shortage on the Colorado River; 2) what new Lower Basin shortages will be established in a new plan that will supersede the ROD; 3) how quickly will the AWBA stored water credits be consumed through firming obligations; and 4) how long will the City's stored water be able to augment prolonged shortages beyond the AWBA.

Once again it should be emphasized that the City will need to monitor these activities and be a vital stakeholder in these processes. Currently, the AWBA, CAWCD, USBR, and ADWR are having a series of meetings to determine the inter-relationship between the agencies and how water stored through the AWBA can be recovered and delivered to firm Indian and M & I subcontractors. The City is paying particular attention to this process to ensure that it is treated consistent and fair because not all subcontractors have the same abilities to recover or take water deliveries in the same manner. Therefore, the City desires a program that would not create subsidies or additional costs but create

opportunities for economies of scale and/or volunteer incentive programs based on the unique characterizations of each water provider.

14.2 NCS SUPPLIES AND DROUGHT VULNERABILITY

Because NCS water is created and recognized when Roosevelt Dam is nearly full, NCS water is not expected to be available during times of drought on the Salt and Verde River system. However, it should be noted that the SRP system is much flashier in behavior as compared to the Colorado River system. Therefore, a single significant storm event or season on the Salt River can potentially provide significant water in the SRP reservoir storage system and create multiple years of drought relief.

14.3 GROUNDWATER CREDITS

Water pumped from underground within the aquifer is inherently drought proof, but not considered a renewable resource. The legal authority to pump this water occurs through the City's designation of assured water supplies as groundwater through a Groundwater Allowance or Long-term Storage Credits through an underground storage account. During times of declared shortage on the Colorado River, Mesa can expect to see its SRPMIC settlement water (627 AF/yr) and Hohokam CAP water supplies, (4,924 AF/yr) become partially or entirely shorted due to their agricultural priority, (Figure 14.1). Again, it is currently not forecasted that M & I or Indian water will see any shortages during the Interim period or before 2026.

During times of drought on the SRP system where the reservoirs have been significantly depleted, Mesa will not have access to its NCS surface water. While Mesa has taken most of this water directly, the NCS water supply has more value as a water supply to be recharged and recovered later during shortages. Therefore, the loss of this water supply does not impact Mesa's ability to meet On– or Off-Project demands but a lost opportunity to accumulate Long-term Storage Credits.

14.4 CITY OF MESA DROUGHT PLAN

Mesa's City Council adopted a revised Drought Management Plan in 2009. The City of Mesa Drought Management Plan complements ongoing water resource and water operations planning efforts and is designed to be a flexible tool to plan for, mitigate, and respond to drought conditions.

15.0 CONCLUSIONS AND RECOMMENDATIONS

Water demands Off-project is projected to double by build-out. While it appears as though Mesa has the water resources necessary to meet demand now and in the future, efficient management and continued protection of Mesa's water resources are vital to ensuring Mesa's water future. Mesa must continue working towards maximizing its use of reclaimed water resources, and must ensure that it has adequate well capacity Off-Project to meet demands in both normal and drought periods.

Legal protection of Mesa's water portfolio will become more challenging in the future as surface water supplies become completely allocated and groundwater supplies continue to be over-allocated. Mesa has provided significant assistance towards various Indian settlements that has helped get them completed. However, Mesa must be vigilant as there are remaining Indian

settlements yet to be completed along with the adjudication process unfolding that could potentially impact Mesa.

The groundwater available in the East Salt River Valley must be sustained through robust aquifer management. The opportunities in the future for increased efficiency and protection of stored water supplies underground will only be accomplished through better partnerships with surrounding and regional entities, and the water related agencies of the State and Federal Government. Mesa must continue its role as a leader and very strong advocate for the use of renewable water supplies and continue its role as a leader for drought preparedness and protector of water stored underground for drought emergencies in the East Valley. Mesa needs to continue its participation in the East Valley Water Forum with sincere and optimistic hopes that this forum can bring the necessary parties together and unite them in regional cooperation, thus assuring economic prosperity and quality of life for all East Valley residents, businesses, and industries. Also, Mesa must continue to be vigilant at all levels of government and attend relevant venues because each level can impact Mesa's current or future water supplies and thus impact the City's future prosperity.