CASITAS MUNICIPAL WATER DISTRICT

2021 LAKE CASITAS WATER SUPPLY AND DEMAND STUDY

Adopted by the Casitas Board of Directors

March 23, 2022

FINAL

EXECUTIVE SUMMARY

District Introduction

Casitas Municipal Water District provides wholesale and retail water service to western Ventura County and is governed by a five-member elected Board of Directors (Board). Originally named the Ventura River Municipal Water District, Casitas was formed in 1952 to provide supplemental water in its service area. The service area includes agricultural, residential, commercial, governmental, and industrial uses. Wholesale customers include the City of Ventura, some special districts, and mutual water companies. In June 2017, Casitas acquired the Ojai Water System (OWS) from Golden State Water Company (GSWC) and absorbed those customers as retail customers.

Water Supplies

All water supplies are local, consisting of groundwater wells and surface water in Lake Casitas. Lake Casitas was formed by the construction of Casitas Dam by the US Bureau of Reclamation in 1958. The total lake capacity is 237,761 acre-feet (AF) as of 2017. The Robles Diversion and Fish Passage Facility is located on the north end of the Ventura River and allows Casitas to divert river flow to the Robles Canal to supply Lake Casitas. Operation of the Robles Facility is under the jurisdiction of the 2003 non-jeopardy Biological Opinion (BO) prepared by National Marine Fisheries Service (NMFS) due to the listing of steelhead trout as an endangered species. As of December 31, 2019, Lake Casitas was at approximately 30 percent of capacity (72,267 AF in storage) due to the ongoing drought.

The District operates two water systems known as the Casitas System and the Ojai System, with the Casitas System being the larger of the two systems. The Casitas System is primarily supplied by Lake Casitas along with one groundwater well, the Mira Monte Well, located in the Upper Ventura River Groundwater Basin. The Ojai System is primarily supplied by groundwater wells in the Ojai Groundwater Basin, with supplemental supply from the Casitas System.

Historical Lake Casitas Water Supply Studies

The water supply availability from Lake Casitas was previously studied by the USBR in the 1954 evaluation of the Ventura River Project, and later by the District in the 1989 and 2004. In the "Water Supply and Use Status Report" (Casitas, 2004), the Safe Yield of Lake Casitas was determined to be 20,480 AFY based on a mass-balance model that tracks Lake Casitas inflows, outflows (including evaporation) and change in storage to simulate operations over a time series of assumed hydrology conditions.

2019-2021 Evaluation of Lake Casitas Supply

During 2019 through April 2021, the Lake Casitas mass-balance yield model was updated to include:

- Extended hydrologic period of record of 1945-2018 (from previous of 1945-1999)
- Incorporated results of recent Lake Casitas bathymetric survey – reduced maximum storage capacity from 254,000 AF to 237,761 AF

- Added function to compute reservoir spills
- Incorporated Robles Diversion operations based on 2003 Biological Opinion requirements and 2018 Critical Drought Protection Measures
- Reduced modeled Robles diversions based on a diversion efficiency of 70 percent, consistent with operational data since the Fish Passage Facility was constructed.
- Improved method of calculating monthly net evaporation loss.

In April 2021, the Board adopted a Lake Casitas safe yield of **18,420 acre-feet per year (AFY)** and a supply safety factor of **-15 percent** and a climate change adjustment of **-4.3 percent** was applied for planning purposes. When these two factors are included, the combined planned operational yield from Lake Casitas and the Mira Monte well is determined to be **15,010 AFY**.

SAFE YIELD MODELING ASSUMPTIONS AND RESULTS
HISTORICAL HYDROLOGY, NO MINIMUM ALLOWABLE STORAGE (DEAD POOL), NO WEAP*

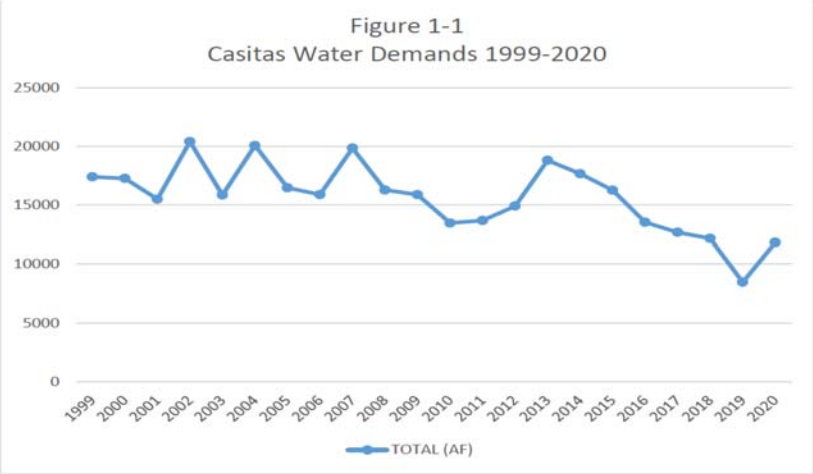
Model Simulation Assumptions	**Modeled Safe Yield based on Various Historical Hydrology Periods**		
Historical Hydrologic Period	1945 - 2006	1956 - 2018	1945 - 2018
Constant Demand (AFY)	Safe Yield	Safe Yield	Safe Yield
Initial Lake Volume (AF)	237,761	237,761	237,761
Minimum Allowable Storage (AF)	950	950	950
Robles Diversion Efficiency (%)	70%	70%	70%
Supplemental Water (AFY)	0	0	0
Climate Change Adjustment (%)	0%	0%	0%
WEAP Demand Adjustment	No	No	No
Model Simulation Results			
Minimum Calculated Storage (AF)	970	950	970
Month/Year of Minimum Calculated Storage	Oct-65	Dec-18	Oct-65
Safe Yield (AFY)	**18,420**	**21,253**	**18,420**

*Assumes modeled demands are not reduced in accordance with the WEAP as lake levels decline.

Water Demands

Demands on the Casitas system over the last several decades have ranged from a high of approximately 24,000 AF in 1989 to a low of approximately 8,545 AF in 2019.

Figure 1-1 shows a snapshot of water demands over the last two decades (1999-2020). In general, agricultural customers make up the majority of demand at 50 percent. Wholesale customers comprise approximately 30 percent and retail customers 20 percent.



Currently, every Casitas customer has an assigned water allocation. Casitas manages customer demands through the Water Efficiency Allocation Program (WEAP), which includes conservation targets based on lake level.

Casitas is currently in Stage 3 of the WEAP with mandated 30 percent conservation. Customers who exceed their allocation pay penalties for overuse.

The average demands on the Casitas System over the last 10 years from 2011- 2020 was approximately **14,525 AFY** (including losses), which includes periods before and after the WEAP was implemented.

Projected Demand

In April 2021, the Board adopted **14,525 AFY** as the projected demand for the Casitas system to be used for planning purposes. The service area is not expected to see significant development which would cause this projected to demand to increase.

Statistical Summary:

- Lake Casitas Capacity: **237,761 Acre-Feet (AF)**
- Lake Casitas Safe Yield: **18,420 AF per Year** (AFY)
- Casitas System Operational Yield: **15,010 AFY** (Lake Casitas plus Mira Monte Well)
- Projected Demand: **14,525 AFY**

BACKGROUND OF THE STUDY

The Board of Directors authorized a consulting services agreement with Stantec in January 2019 to prepare the Comprehensive Water Resources Plan (CWRP). An overview of the draft CWRP was presented at a Board Workshop held on February 8, 2020, and the draft CWRP report was released for public review from June 26, 2020 through August 24, 2020. Several public comments were received on the draft CWRP report, which were provided to the Board of Directors on September 23, 2020 and December 9, 2020.

On December 9, 2020, the Board of Directors discussed the need for additional Board meetings to discuss the goals of the Comprehensive Water Resources Plan. The Board continued to meet and discuss the CWRP at subsequent meetings held on December 16, 2020; December 23, 2020; January 15, 2021, February 17, 2021, and February 26, 2021.

At the January 15, 2021 meeting, the Board directed staff to revise the hydrologic modeling assumptions used to estimate the future Lake Casitas operational yield as follows, and prepare a demand and supply analysis for further discussion.

Revised hydrologic modeling assumptions for future Lake Casitas Yield:

- Safe Yield approach that models the largest yield that can be withdrawn from the lake in every year without dropping below the minimum allowable storage level
- Historical hydrologic period from 1945-2018
- Minimum Allowable Storage of 950 AF, which is the dead pool elevation at which water can no longer flow by gravity to the water treatment plant
- Robles Diversion Efficiency of 70%
- Initial Lake Volume of 237,761 AF (full reservoir)
- Provide safety factors to account for future uncertainty

This report provides a summary the future long-term demand analysis, future long-term supply analysis, and long-term supply and demand scenarios.

FUTURE LONG-TERM DEMAND ANALYSIS

The following is a summary of historical demands, planned future demands, and additional considerations related to uncertainty in future demands.

Historical Demands

A summary of actual water produced from Lake Casitas for customer demands and system losses is presented in Table 1, based on 5-year periods going back to 2006. In addition, historical water demands by customer class are shown in the tables and figures in Attachment 1. Casitas implements managed demand reductions as lake levels decline according with the Water Efficiency Allocation Plan (WEAP), and the effect of this type of demand management during droughts is apparent during the post-1989 and post-2016 periods.

TABLE 1. WATER PRODUCED FROM LAKE CASITAS AT MARION WALKER WATER TREATMENT PLANT[1]

	2006-2010	2011-2015	2016-2020
5-Year Average	17,760	17,509	11,296
Annual Minimum	14,637	14,841	7,668
Annual Maximum	21,326	20,402	14,151

[1] Data reported by Calendar Year. All units are Acre-Feet per Year.

Demands from Agricultural and Resale customers together make up the majority of Casitas' customer demands, representing 84% of total average demands from 2006-2015 and 73% from 2016-2020. Annual demands from these customers can vary significantly from year to year. Unconstrained demands for water typically increase during dry periods and decrease during wet periods. However, both of these customer classes have demonstrated lower water use from Casitas in response to the recent drought (refer to tables and figures in Attachment 1) and the District's associated demand management measures through the WEAP, including a $5.00/HCF[1] Conservation Penalty in 2016 which currently remains in place.

Draft Comprehensive Water Resources Plan Planned Demands

The Draft CWRP was based on a future average non-drought demand of 16,000 AFY for the Casitas System (which includes approximately 525 AFY added to the Ojai system), and a future average non-drought demand of 2,350 AFY for the Ojai system, for a total combined demand of 17,825 AFY (16,000 – 525 + 2350 = 17,825). These demands represent the amount of water produced to meet both customer uses and losses in the water delivery systems. Additional information can be found in Sections 3 and Appendix C of the Draft CWRP report.

The Draft CWRP planned demands were approximately 10% less than previously planned long-term demands of 17,500 AFY for the Casitas system and 2,570 AFY for the Ojai system to reflect that the recent drought will likely result in some permanent changes in customer water use in the long-term. Water demands typically rebound after drought periods, but do not fully return to pre- drought levels due material changes such as replacement of landscaping, irrigation systems, and appliances with more water-efficient devices. A comparison of Draft CWRP planned demands and previous UWMP planning demands is presented in Attachment 1 (Table 3). For purposes of this analysis, the distribution of demand by customer class is assumed to be consistent with previous planning reports.

[1] HCF = One Hundred Cubic Feet = 1 Unit

Additional Considerations related to Agricultural and Resale Demands

Agricultural and Resale customers rely on groundwater as a primary supply, and use Lake Casitas water as a backup. There are several processes currently underway related to groundwater pumping, including the Sustainable Groundwater Management Act, the City of Ventura's groundwater adjudication lawsuit, and the State of California's Ventura River Instream Flow Study. The outcome of these processes is currently unknown, and all have the potential to limit the availability of groundwater during certain periods; which could increase demands on Lake Casitas. Until more information is known regarding future groundwater availability, there is some uncertainty in long-term future demands on Lake Casitas.

Planning for Demand Uncertainty

The Draft CWRP assumed a future planned demand of 16,000 AFY for the Casitas System, and a planned demand of 17,825 AFY for the entire District service area including the Ojai System. The following is a summary of considerations related to future demand uncertainty:

- Planned demand on the Casitas System is less than the historical average demands prior to implementation of the WEAP (2006-2015).
- Planned demand is lower than previous UWMP planning demands, since it assumes demands will rebound but not fully return to pre-drought levels.
- Future groundwater supplies may be less than were available historically, and there is a potential for increased reliance on Casitas (particularly from Resale and Agricultural customers).

However, current water demands on the Casitas System are less than 16,000 AFY and it could take several years before average demands increase to that level. The average demands on the Casitas System over the last 10 years from 2011-2020 was approximately 14,525 AFY[2] (including losses), which includes periods before and after the WEAP was implemented.

Demands will be tracked over time, and once more information is known regarding future groundwater availability, then additional adaptive management measures could be taken (such as increased demand management or alternative supply development).

2020 Urban Water Management Plan Demands

Every five years, the District prepares an Urban Water Management Plan (UWMP) in accordance with California Water Code. The UWMP outlines the reliability of water sources over a 20-year timeframe, demand management measures and water shortage contingency plans, and progress toward meeting State target reduction goals for water consumption.

The Board adopted the 2020 UWMP on June 23, 2021. The long-term planned demands in the 2020 UWMP reflect the average demands over the last 10 years, which are 14,525 AFY on the Casitas System and 1,850 AFY on the Ojai System. The Casitas System has supplied the Ojai System an average of 461 AFY over the last 10 years. Therefore, the combined total planned demand is 15,914 AFY (14,525 + 1850 – 461 = 15,914).

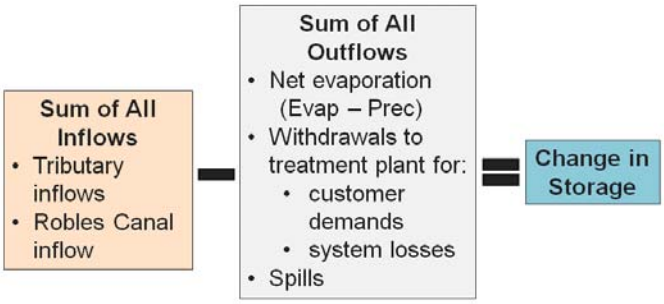
[2] Based on Lake Casitas releases to Marion Walker water treatment plant and one groundwater well in production.

FUTURE LONG-TERM SUPPLY ANALYSIS

The water supply availability from Lake Casitas was previously studied by the United States Bureau of Reclamation in the 1954 evaluation of the Ventura River Project, and later by the District in the 1989 and 2004. In the most recent study (2004), the Lake Casitas safe yield was estimated to be 20,540 AFY (assuming potential impacts of the 2003 Robles Biological Opinion operating criteria and the removal of Matilija Dam).

The Lake Casitas yield model is a mass-balance model that tracks Lake Casitas inflows, outflows (including evaporation) and change in storage to simulate operations over a time series of assumed hydrology conditions (refer to Figure 1 below). The previous Lake Casitas yield analyses used historical hydrology in the simulations. That includes historical data for direct inflows to Lake Casitas from tributaries, flows in the Ventura River on which diversions at the Robles Diversion Structure were based, and net evaporation from the Lake.

FIGURE 1. MASS BALANCE MODEL IN EXCEL FOR ESTIMATING LAKE CASITAS YIELD



Current Yield Model Updates and Improvements

As part of the Draft CWRP, the yield model was updated to include the following improvements:

- Extended hydrologic period of record of 1945-2018 (from previous of 1945-1999)
- Incorporated results of recent Lake Casitas bathymetric survey – reduced maximum storage capacity from 254,000 AF to 237,761 AF
- Added function to compute reservoir spills
- Incorporated Robles Diversion operations based on 2003 Biological Opinion requirements and 2018 Critical Drought Protection Measures
- Reduced modeled Robles diversions based on a diversion efficiency of 70 percent, consistent with operational data since the Fish Passage Facility was constructed
- Improved method of calculating monthly net evaporation loss

The planned Lake Casitas yield is dependent on various policy assumptions and criteria, such as assumed hydrologic assumptions (probabilistic versus historic), minimum allowable storage, and future withdrawals to meet demands, and others. In regard to withdrawals for demands, the model is programmed to evaluate both a “safe yield” approach with constant withdrawals every year, as well as a “safe demand” approach that incorporates demand reductions as lake levels decline according with the District’s Water Efficiency and Allocation Program.

Policy Assumptions and Criteria related to Yield Modeling

On January 15, 2021, the Board directed staff to use the modeling and policy assumptions as follows, which results in a Lake Casitas safe yield of 18,420 AFY. These policies are revised from the Draft CWRP, and resulted in a higher Lake Casitas yield than reported in the Draft CWRP.

- Safe Yield approach that models the largest yield that can be withdrawn from the lake in every year without dropping below the minimum allowable storage level
- Historical hydrologic period from 1945-2018
- Minimum Allowable Storage of 950 AF, which is the dead pool elevation at which water can no longer flow by gravity to the water treatment plant
- Robles Diversion Efficiency of 70%
- Initial Lake Volume of 237,761 AF (full reservoir)

In addition, the Board directed staff to provide considerations for a safety factor for future hydrologic uncertainty.

Supply Safety Factor

The revised modeling and policy assumptions are based on historical hydrology. However, historical hydrology cannot be expected to repeat itself, and hydrologic variability from year to year is significant (refer to Attachment 1, Figure 3). Future droughts could be more severe than the droughts in the 1945-2018 historical record. Because the Casitas System is dependent on surface water for its water supply, its exposure to risk from future changes in regional climate and hydrology is significant. A safety factor is intended to account for uncertainty of future supply availability.

Additionally, on February 26, 2021, the California Department of Fish and Wildlife (CDFW) released Draft Instream Flow Recommendations for the Lower Ventura River and Coyote Creek. The CDFW flow recommendations are expected to be considered in a groundwater-surface water model currently under development by the State Water Resources Control Board (SWRCB) which will evaluate groundwater pumping and surface diversions and their impact on instream flows. Based on preliminary analysis of the CDFW Instream Flow Recommendations, the potential supply impacts would exceed the supply safety factors considered herein. Therefore, this analysis will need to be revisited once more information is known regarding the SWRCB modeling study.

Climate Change

A report titled *Projected Changes in Ventura County Climate* was prepared by the Desert Research Institute in 2019. The report was commissioned by Watersheds Coalition of Ventura County, of which Casitas is a member, and can be found on their website www.wcvc.ventura.org under Climate Resilience Resources.

The projected climate change impacts for the Casitas service area include:

- Winters may get wetter with shorter duration/high intensity precipitation due to atmospheric rivers, resulting in increased potential for flash flooding.

- Shoulder seasons may have more dry days.
- Potential increase in wildfire frequency due to spring/fall drying.
- Increased drought susceptibility and increased water demand due to increasing temperatures and evapotranspiration rates.
- Good agreement across models for increase in inland area temperatures between 3 – 5°F and coastal areas between 2 – 3°F.
- More days exceeding extreme/impactful temperature thresholds.

These effects were assumed to generally compensate for each other. Increased evaporation of six inches/year was found to reduce the Lake Casitas safe yield for historical inflow hydrology by 4.3 percent[3]. This factor was applied to results of yield simulations to account for potential future climate change.

As with any climate modelling efforts, there is uncertainty. These potential impacts are the results of the best tools available at this time and are meaningful in their applicability to the service area and can support decision-making.

[3] From 2020 Casitas MWD Draft Comprehensive Water Resources Plan (CWRP) (See Attachment 2)

FUTURE LONG-TERM SUPPLY AND DEMAND SCENARIOS

Table 2 presents a summary of potential future demands and existing supplies. Two demand levels on the Casitas System are presented ranging between 14,525 AFY and 16,000 based on the last 10 years of production data and the Draft CWRP, respectively.

The projected existing supplies reflect the revised Lake Casitas modeling and policy assumptions, with varying levels of supply safety factors (ranging between 0-20 percent). All scenarios assume a 4.3% reduction in supply reflecting a climate change adjustment consistent with the Draft CWRP assumptions. The projected existing supply for the Casitas System ranges between 14,080 AFY and 17,800 AFY depending on the level of safety factor.

A description of the Ojai System demand and supply is provided subsequently.

TABLE 2. FUTURE DEMAND AND SUPPLY COMPARISON, WITH VARIOUS DEMAND AND SAFETY FACTOR SCENARIOS

All units in AFY unless noted otherwise.

Casitas System

FUTURE DEMAND					
Draft CWRP:	16,000	16,000	16,000	16,000	16,000
Average Last 10 Years (2011-2020) [1]:	14,525	14,525	14,525	14,525	14,525
PROJECTED EXISTING SUPPLY					
Modeled Lake Casitas Safe Yield:	18,420	18,420	18,420	18,420	18,420
Planned Groundwater Well Yield:	180	180	180	180	180
Supply Safety Factor:	0%	-5%	-10%	-15%	-20%
Climate Change Adjustment:	-4.3%	-4.3%	-4.3%	-4.3%	-4.3%
Projected Supply:	17,800	16,870	15,940	15,010	14,080

Ojai System

FUTURE DEMAND	
Draft CWRP:	2,350
Average Last 10 Years (2011-2020):	1,850
PROJECTED EXISTING SUPPLY	
Planned Casitas System Yield:	461
Ojai Well Yield[2]:	2,300
Projected Supply:	2,761

Notes

[1] Includes 461 Acre-Feet of net demand from the Ojai Water System based on 10 year average (2011-2020).

[2] Includes work underway (and expected to be complete by 2025) to improve condition and production rates of Ojai Wells.

Figure 2 and Table 3 present the modeled Lake Casitas storage levels and yields based on varying levels of supply safety factors.

FIGURE 2. MODELED LAKE CASITAS STORAGE LEVELS WITH VARIOUS SAFETY FACTOR SCENARIOS

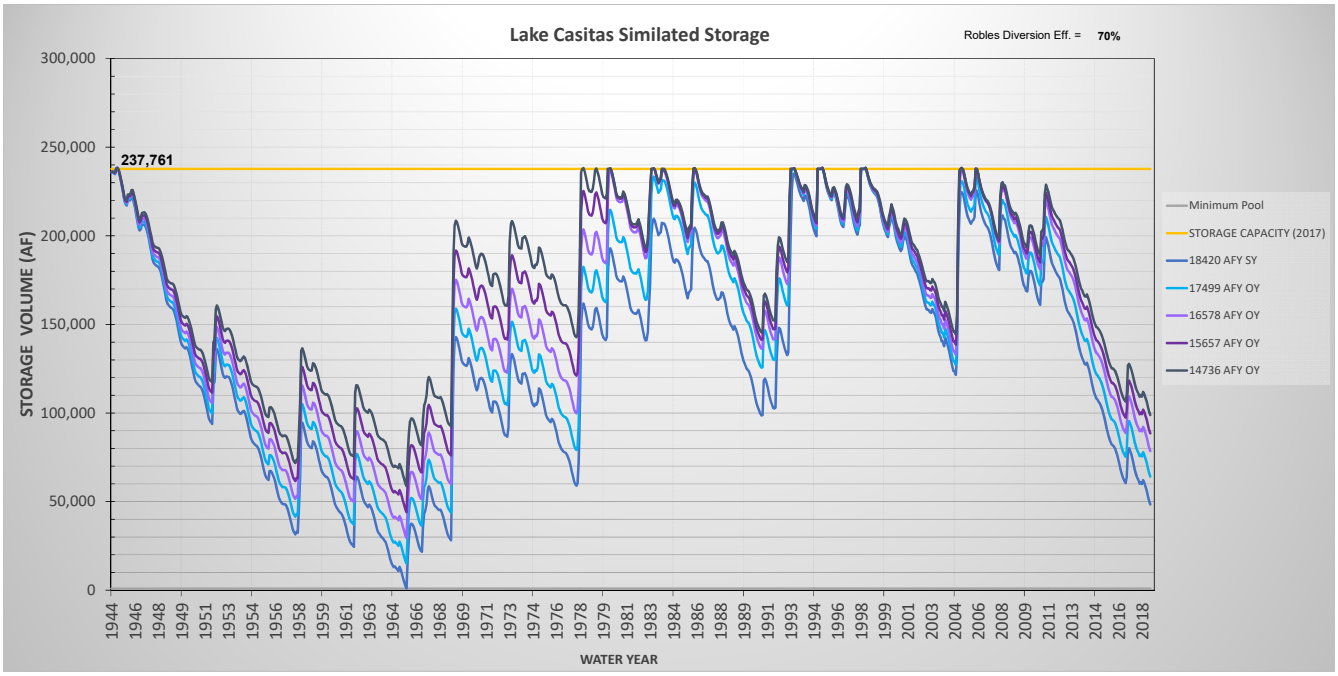


TABLE 3. MODELED LAKE CASITAS MINIMUM STORAGE LEVELS WITH VARIOUS SAFETY FACTOR SCENARIOS

Safety Factor	Lake Casitas Yield, AFY	Minimum Storage Level, AF
---------	18,420	970
-5%	17,499	15,049
-10%	16,578	29,439
-15%	15,657	44,068
-20%	14,736	58,783

Projected Water Use

On April 21, 2021, the Board adopted 14,525 AFY as the projected demand or the Casitas system to be used for planning purposes. The service area is not expected to see significant development which would cause this projected to demand to increase.

For the Ojai System, the Board adopted 1,850 AFY as the projected demand for planning purposes. The Casitas System has supplied the Ojai System an average of 461 AFY over the last 10 years. Therefore, the combined total planned demand is 15,914 AFY (14,525 + 1850 – 461 = 15,914).

Demands for the period 2011-2020 were averaged for each customer type and these percentages were used to develop the projected demands by customer class.

Planned Casitas System Operational Yield

On April 21, 2021, the Board of Directors adopted a planned Casitas System operational yield of 15,010 Acre-Feet pre Year. The planned operational yield is based on the updated modeling results, a -4.3 percent climate change adjustment based on the anticipated changes to precipitation and a -15 percent supply safety factor to account for uncertainty in modeling assumptions.

The operational yield for the Casitas system is sufficient to provide supplies through an extended drought period lasting 10-20 years depending on reservoir levels at the start of the dry period.

Planned Ojai System Supply Yield

Casitas acquired the Ojai System from Golden State Water Company in June 2017. The Ojai System receives water from Ojai Basin groundwater and two interconnects supplying water from the Casitas System. Approximately 461 AFY of the planned demands on the Casitas System are for deliveries to the Ojai System. The 2017 acquisition included several groundwater wells, with some wells over 45 years old and in need of rehabilitation and replacement. The wells acquired by GSWC were unable to produce their original design capacity of 4,404 AFY and average Ojai wellfield production from 1994-2016 was about 1,800 AFY. Casitas has made progress in improving the condition of the wells, although work is still underway and not yet completed. The well improvements are anticipated to provide an average production of 2,300 AFY.

Ongoing Analysis

As has been Casitas MWD's practice in the past, supply and demand conditions will continue to be tracked over time. In the event that more information comes to light regarding possible impacts to these conditions, additional analysis as to these impacts on Casitas' water supplies and demands would be required to account for changed conditions.

ATTACHMENTS

Attachment 1:

- Figure 1. Historic Water Use by Customer Class (Line Chart)
- Figure 2. Historic Water Use by Customer Class (Area Chart)
- Figure 3. Historical Lake Levels, Inflow, and Drought Periods
- Table 1. Summary of Water Use from 2006-2020 (Casitas and Ojai Systems)
- Table 2. Summary of Water Use from 2016-2020 (Casitas System Only)
- Table 3. Comparison of Planning Demands

Attachment 2:

- Excerpt from 2020 Casitas MWD Draft Comprehensive Water Plan

Figure 1. Historic Water Use by Customer Class (Line Chart)
All data is by Fiscal Year.

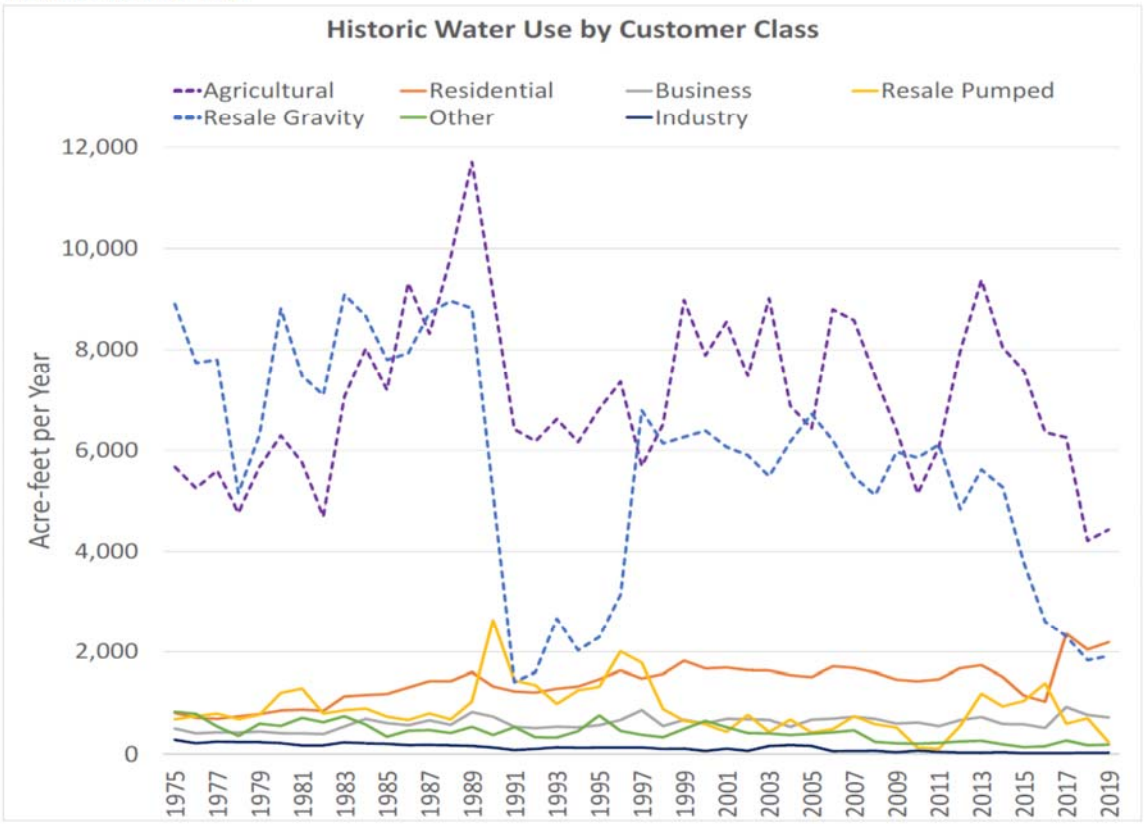


Figure 2. Historic Water Use by Customer Class (Area Chart)
All data is by Fiscal Year.

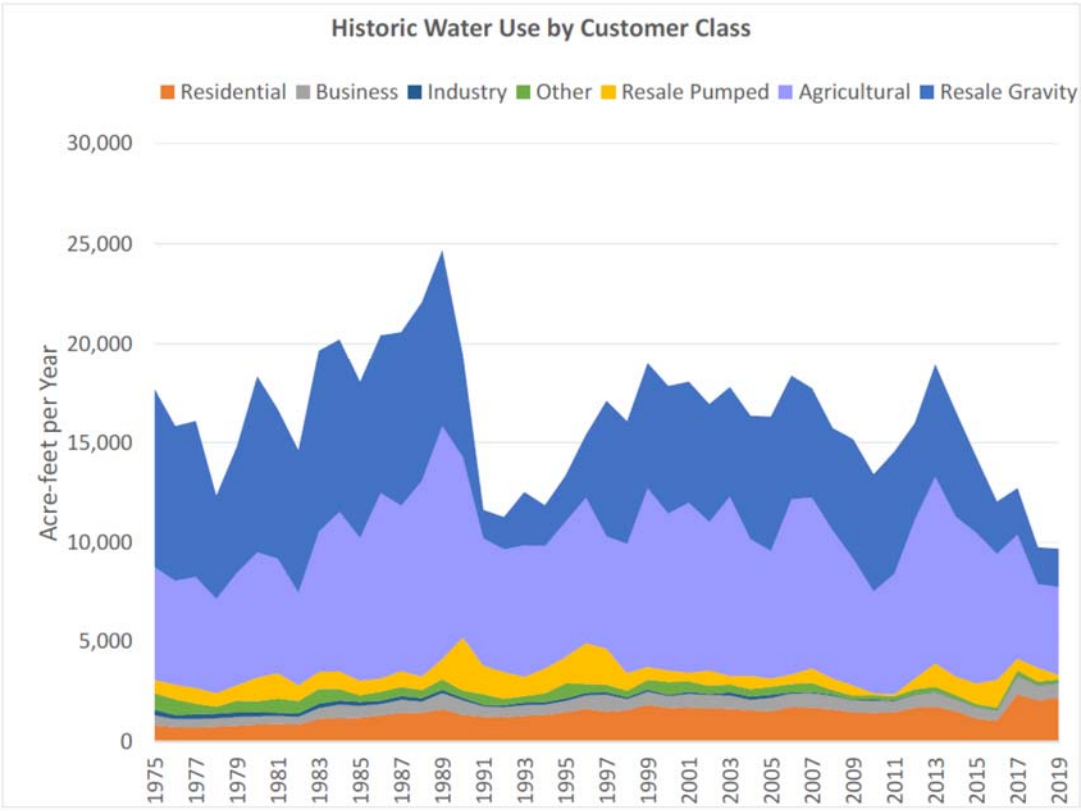


Figure 3. Historical Lake Levels, Inflow, and Drought Periods

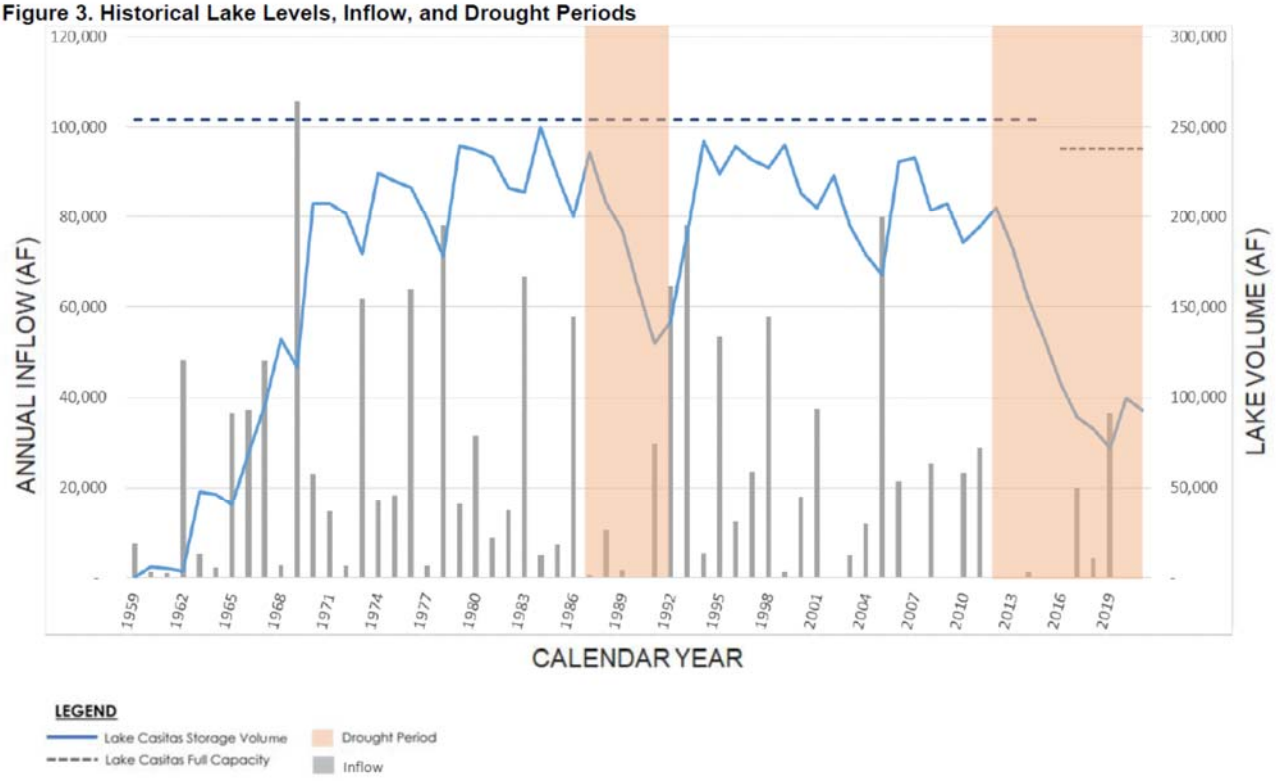


Table 1. Summary of Water Use from 2006-2020 (Casitas and Ojai Systems) [1,2]

	2006-2015			2016-2020[3]		
	Min	Max	Average	Min	Max	Average
Retail	2,135	3,064	2,623	1,900	3,531	3,109
Retail Agriculture	4,800	8,857	7,290	3,767	6,961	5,464
Resale	4,927	8,150	6,355	1,627	3,969	3,019
TOTAL	13,474	19,859	16,268	8,479	12,830	11,592

[1] Represents metered customer demands (does not include system losses).
[2] Data reported by calendar year. All units in Acre-Feet per Year.
[3] The Ojai Water System was acquired in 2017, which increased Retail demands by approximately 1,570 AFY and reduced Resale demands by about 300 AFY on average from 2017-2020. Ojai demands are served by the Casitas System and Ojai Basin groundwater wells.

Table 2. Summary of Water Use from 2016-2020 (Casitas System Only) [1,2]

	2016	2017	2018	2019	2020	Average
Retail	1,900	1,990	1,962	1,668	2,006	1,905
Retail Agriculture	6,961	6,337	4,945	3,701	5,116	5,412
Resale	3,969	2,769	3,632	1,627	3,095	3,019
Ojai Interconnects	664	193	411	67	369	341
Total	13,494	11,288	10,950	7,063	10,586	10,676

[1] Represents metered customer demands (does not include system losses).
[2] Data reported by calendar year. All units in Acre-Feet per Year.

Table 3. Comparison of Planning Demands

Casitas System Demand Category	Planned Future Demand		
	2015 UWMP[1] (2040 Projections)	Draft CWRP[2,3] (2040 Projections)	Percent Reduction in Planned Demand
Retail	2,889	2,628	9%
Retail – Agricultural	7,705	7,009	9%
Resale	6,260	5,695	9%
Subtotal	16,855	15,332	9%
Water Loss	645	668[4]	-4%
Total Water Demand	17,500	16,000	9%

Notes
All data is reported in AFY except where noted otherwise.
[1] The 2015 UWMP demand/supply comparisons are based on 17,500 AFY, and did not include estimated water loss. Demands by water use category have been adjusted accordingly.
[2] Draft CWRP demand projections include 525 AFY for the Ojai system.
[3] Estimated future water use by customer class is assumed to be the same distribution as 2015 UWMP projections.
[4] Based on average water loss in 2018 and 2019. Assumes water loss is proportional to pipe length between Casitas and Ojai systems.

Ojai System Demand Category	GSWC 2010 UWMP (2035 Projections)	Draft CWRP[1] (2040 Projections)	Percent Reduction in Planned Demand
Retail	NA	2,093	NA
Water Loss	NA	257[2]	NA
Total Water Demand	2,570	2,350	8%

Notes:
[1] The Draft CWRP assumes 525 AFY of Ojai System demands would be met by the Casitas system.
[2] Based on average water loss in 2018 and 2019. Assumes water loss is proportional to pipe length between Casitas and Ojai systems.

EXCERPT FROM 2020 CASITAS MWD DRAFT COMPREHENSIVE WATER RESOURCES PLAN

4.1.4 Climate Variability and Climate Change Analysis

Estimates of future Lake Casitas yield account for climate variability (annual variation in climate and streamflow based on historical records) and climate change (shift in temperature and precipitation due to global climate drivers).

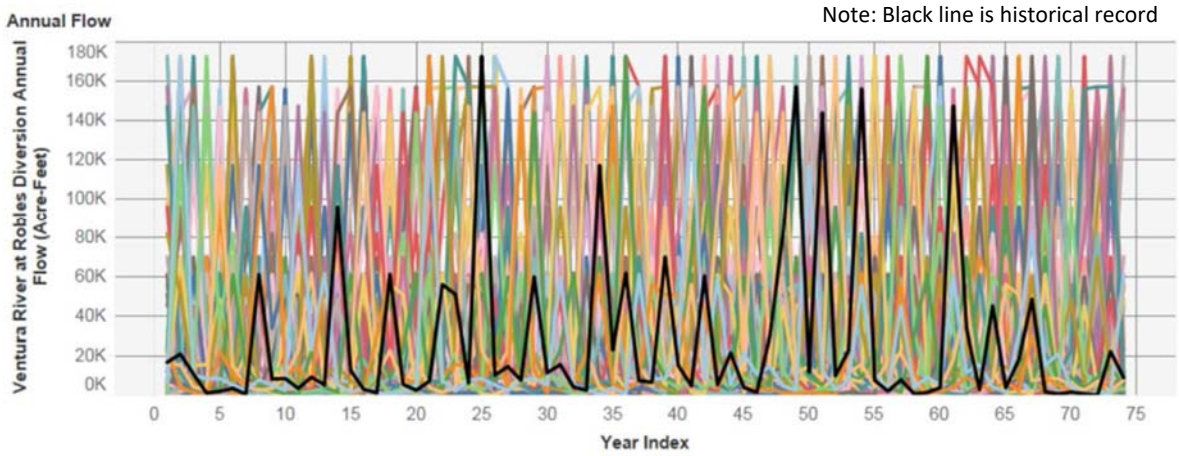


Figure 4-5: *Plot of 100 74-year Monthly Time Series for Ventura River Streamflow at Robles Diversion, Based on Historical Record*

Natural hydrologic variability was incorporated into the Lake Casitas yield analysis by generating one hundred 74-year hydrologic datasets (traces) derived from the historical dataset and having the same basic statistics (e.g., standard deviation and serial correlation of annual streamflows) as the historical record (**Figure 4-5**). Annual historical natural inflows to the lake and Ventura River streamflows at the Robles Diversion structure were reshuffled 100 times, maintaining the long-term serial correlation between annual streamflows. Monthly distribution of flows within each year was unchanged. The result was 100 hydrologic datasets that were used as input for the Lake Casitas Yield Model.

Downscaled climate change information for Ventura County (Western Regional Climate Center, 2019) was used to adjust Lake Casitas yield estimates for potential future changes in climate conditions (temperature and precipitation). Key findings for Ventura County climate change include:

- Increased average temperature
- Increased maximum temperatures by 3-5 degrees F
- Increased and/or decreased average annual precipitation
- Increased number of dry days (3-4 per year)
- Increased precipitation intensity; wettest 5% of days will contribute 10% more to
- annual precipitation
- Increased evapotranspiration by 2.5 to 6.5 inches/year, with highest increases in
- inland areas
- Decreased runoff production (conversion of rainfall to runoff)

Some potential climate change conditions could decrease Lake Casitas inflow and others could increase it. These effects were assumed to generally compensate for each other. Increased evaporation of six inches/year was found to reduce the Lake Casitas safe yield for historical inflow hydrology by 4.3 percent. This factor was applied to results of yield simulations to account for potential future climate change.

***Figure 4-6**: Lake Casitas Safe Yield for Synthetic Hydrologic Sequences*

Of the 100 synthetic hydrologic traces generated for the CWRP, about two-thirds result in lower Lake Casitas safe yield than the historical hydrology (**Figure 4-6**). This persistence toward drier conditions has a significant effect on the reliable yield the Lake could supply in the future.