FUTURE DEMAND AND WATER SUPPLY OPTIONS

Update 2025

Montecito Water District

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ACRONYMS USED

AF – acre-feet
AFY – acre-feet per year
CCWA – Central Coast Water Authority
District – Montecito Water District
DWR – California Department of Water Resources
LOC – Level of Concern for projected future SWP deliveries
MWD – Montecito Water District
msl – Mean Sea Level
SGMA – Sustainable Groundwater Management Act
SWP – State Water Project
UWMP – Urban Water Management Plan
WSA – Water Supply Agreement with City of Santa Barbara

EXECUTIVE SUMMARY

MWD periodically examines its portfolio of water sources and compares them against current and future demand. This study updates the latest Future Demand and Water Supply Options Report, dated May 2020, using the latest Santa Ynez River/Cachuma modeling, State Water Project (SWP) availability forecasts, and current/future demand projections. This updated analysis includes potential future reductions in the Cachuma Project (Cachuma) allocation, a potential partial sale of SWP allocation/conveyance capacity, participation in a local groundwater storage program, an extended drought, and a temporary disruption in one of the MWD's primary sources of supply.

The supply/demand model used in this analysis runs in monthly time steps over an 83-year period of past hydrology (1942-2024). Phase I of the analysis examines current and future demand/supplies using current management strategies. Phase II builds on Phase I and examines various strategies to further shore up long-term water supply reliability including the partial sale of MWD's SWP Table A allocation/conveyance capacity and participation in a local groundwater storage program.

The results of the Phases I and II analyses indicate a relatively small amount of unsourced demand, also referred to as a water shortage, in only a few years over the modeled period. This unsourced demand was caused by conveyance limitations in/out of Cachuma and not a shortage of supply. Some or all of this unsourced demand may be met by temporarily pumping more groundwater and/or drawing more Jameson water, which is not limited by the Cachuma conveyance limitations. Alternatively, a small reduction in Customer demand through voluntary conversation could address the unsourced demand.

When the sale of 1,400 acre feet or approx. 43% of MWD's SWP allocation/capacity was modeled, unsourced demand did not increase substantially because Phase I modeling indicates limited use of SWP supplies over the modeled period.

Participation in a local groundwater storage program offers some advantages, such as not being constrained by conveyance restrictions in/out of Cachuma, offering some protection from infrastructure, fire, and earthquake disruptions, and could be used to address any unsourced demand. There are multiple sources of water available to fill a local groundwater storage program. These sources include unused Cachuma carryover water, Cachuma spill water, SWP supplies, and increased draws of Jameson Lake. Minimum storage capacity required is about 600 AF at 2045 demand levels.

The diversity of MWD's water sources provides resilience to temporary supply disruptions, such as the temporary loss of any one source for a period of time.

INTRODUCTION

MWD periodically examines its portfolio of water sources and compares them against current and future demand. The latest analysis was conducted in 2020, which, among other strategies included the potential for a long-term water supply contract with the City of Santa Barbara backed by its desalination plant (WSA). Since 2020, the availability of MWD's surface water supplies including SWP have diminished due to regulatory, environmental and climatic challenges. As a result of the continued reduction in the availability of SWP supplies and the significant improvements in water supply availability afforded by the WSA, MWD is considering other water supply strategies to further enhance future water availability including selling a portion of MWD's SWP allocation/conveyance capacity and participating in a local groundwater storage program in the Carpinteria Groundwater Basin. These strategies could help offset the financial impacts of MWD's acquisition of local drought-resistant water supplies, i.e., WSA, and eliminate any future projected unsourced demand. This 2025 analysis updates the previous work and considers both a partial sale of SWP supplies and participation in a local groundwater storage program.

UPDATING THE MODEL

The water supply model for the 2020 analysis used the hydrology from 1942 to 2020, along with then-current RiverWare modeling for the Santa Ynez River and modeling for delivery capabilities for the SWP. This 2025 analysis incorporates the hydrologic period of 1942-2024 (a total of 83 years), the Santa Ynez River hydrology included the RiverWare "Water Rights Order" model run, SWP availability[1], and MWD's 2024 updated bathymetric survey for Jameson Lake. In addition, the pipeline capacities that move water supplies into and out of Cachuma to MWD have been refined.

SWP capability was modeled by DWR for both current and future (2045) conditions. DWR has a single scenario for current conditions and three scenarios for future conditions. DWR modeling of current conditions yield an average of 51% of Table A available for Santa Barbara County. The future conditions include centroid inputs (middle of the spectrum of possible model inputs, called "50% level of concern" – average of 43% of Table A available for Santa Barbara County), inputs with less supply in assumptions ("75% level of concern" – average 40% of Table A), and inputs with worse-case assumptions ("95% level of concern" – average 37% of Table A). This analysis utilizes all three levels of concern for future conditions.

There are two significant conveyance constraints on water supplies for MWD that are included in the model. The first constraint is conveying imported supplies, e.g., SWP, into Cachuma from the SWP Coastal Branch Aqueduct. How that water is delivered depends upon the lake elevation in Cachuma. The three options for delivery of imported water to Cachuma have historically included (1) conveying water over Bradbury Dam (dam), (2) conveying water through the dam spillway, and (3) using the dam penstock. At lake levels greater than 720 ft msl, option #1 is used with a capacity of 2,843 AFY for MWD. At lake levels less than 720 ft above msl, option #2 can deliver 3,554 AFY for MWD. In addition, option #3 may be available when lake levels are either above 730 ft or below 665 ft above msl.

The second constraint involves the South Coast Conduit, the regional pipeline connecting Cachuma and Tecolote Tunnel to MWD's service area. At Cachuma Lake elevations greater than 662 ft above msl, MWD's capacity from Cachuma to Lauro Reservoir, located immediately ahead of the regional Cater Water Treatment Plant, is 389 AF/month (4,672 AFY). Below 662 ft above msl, MWD's capacity is 243 AF/month (2,920 AFY). This lower capacity is the result of the limited capacity of the emergency pumping barge in Cachuma, which is used when deliveries via

[1] California Department of Water Resources, 2024, Technical Addendum to the State Water Project Delivery Capability Report, 2023, 274p.

gravity are prohibited due to a low lake level; this capacity could potentially be improved with higher-capacity pumps, but further analysis would be needed.

Two additional updates were made to the model to optimize MWD's use of its water supplies. First, groundwater use is dependent upon the hydrology (wet, average, dry). Use is limited during wet conditions and increased gradually as conditions become dry. Second, SWP supplies are imported to Cachuma in advance of their need to help reduce the impact of the conveyance constraints into Cachuma. Any imported water stored in Cachuma is a risk of loss to spill during a wet year.

CUSTOMER DEMAND

Demand can vary significantly between wet and dry conditions. Current demand was calculated by using demand during the period 2017-2024, which includes a range of hydrologic conditions. The model calculates demand depending upon hydrologic conditions; demand during wet years is 3,717 AFY, during average years is 4,084 AFY, and during dry years is 4,452 AFY.

Future demand in 2045 uses the current demand above and projects an annual increase of 0.5% growth consistent with the Montecito Community Plan. This results in a 2045 projected demand of 4,152 AFY in wet years, 4,563 AFY in average years, and 4,974 AFY in dry years. Actual growth over the last 20 years has been about 0.25%, which lowers projected future demand. As discussed in the Phase I results, the sensitivity of this future demand was evaluated in the modeling.

PHASE I MODEL SCENARIOS

This 2025 update is separated into two phases: Phase I examines current and future demand and supply without additional strategies, and Phase II incorporates various potential strategies to Phase I modeling.

SCENARIO I-1

Current demand, current supplies, current priorities of use for each water supply.

a. With historical sequence of wet, average, and dry years;
b. With extension of the longest dry period by two years to test resiliency of supply.

SCENARIO I-2

Future demand in 2045, future supplies according to SWP centroid (50% level of concern) delivery projections; future Cachuma deliveries reduced by 20%-30%-40%. This future scenario would be considered to be medium risk on the risk spectrum.

SCENARIO I-3

To examine higher-risk scenarios, future demand in 2045 was used with future supplies according to SWP 50% and 75% levels of concern, future Cachuma deliveries were reduced by 20%-30%-40%, and the longest historical dry period was extended by two years.

Scenario Parameters	Demand	SWP	Cachuma Reduction	Extended Dry Period
Scenario I-1a	Current	2023 Adjusted	None	No
Scenario I-1b	Current	2023 Adjusted	None	Yes
Scenario I-2	Future	50% LOC	20-30-40%	No
Scenario I-3	Future	50-75% LOC	20-30-40%	Yes

Table 1. Parameters for Phase I scenarios.

PHASE I RESULTS

Phase I results indicate that there is minor unsourced demand at current demand, and slightly more at future demand. In years with unsourced demand, the amount of unsourced demand is 5% or less of the annual demand or up to 273 AFY (Table 2). In all cases, the unsourced demand was not caused by a shortage of water supply, but rather a limitation in conveyance capacity in the South Coast Conduit. This limitation occurs only when Cachuma storage is low (during very dry periods) and the capacity to bring water to the Cater Water Treatment Plant via the Emergency Pumping Barge is reduced. This reduced capacity affects supply availability anywhere from one to four months. MWD could overcome this capacity limitation by temporarily increasing supplies nearer its service area, such as Jameson Lake or groundwater.

When future demand is lowered by using a growth rate of 0.25% instead of 0.5%, the temporary unsourced demand is reduced by about half but not eliminated.

The details of the amount of each source used during the various model runs is shown in Figures A- 1 to A- 8) included in the appendix.

Scenarios I-2 and I-3 were run with several iterations – SWP 50% and 75% levels of concern and Cachuma reductions of 20%, 30%, and 40%. Results were similar because it was conveyance constraints that resulted in the shortfalls, and not a lack of the water source itself.

Scenario	% of Years	Largest Annual Unsourced Demand (% of Demand/AFY)
Scenario I-1a	4%	2%/74
Scenario I-1b	5%	2%/80
Scenario I-2 20%-40%	5%	5%/264
Scenario I-3 50%, 20%-40%	5%	5%/264
Scenario I-3 75%, 20%-40%	5%	5%/273

Table 2. Unsourced demand from results of 83 years of hydrology in the model.

Water from Cachuma is one of MWD's primary sources of supply. Table 3 indicates the various methods and quantities of use. At current demand, more carryover water is lost to spills because there is less demand for the water. The carryover water lost to spill is a potential source of supply for a local groundwater banking program. An additional source for a local groundwater banking program is spill water, which is little used because customer demand is typically low during these wet months.

Scenario	Directly from Allocation (Avg. AFY)	Spill Water Used (Avg. AFY)	Carryover Used (Avg. AFY)	Carryover Lost to Spill (Avg. AFY)
Scenario I-1a	959	26	45	1,536
Scenario I-1b	963	26	48	1,530
Scenario I-2 20%-40%	1,218 to 1,158	45	141 to 123	735 to 365
Scenario I-3 50%, 20%-40%	1,217 to 1,157	45	141 to 123	735 to 365
Scenario I-3 75%, 20%-40%	1,217 to 1,157	45	141 to 123	735 to 365

Table 3. Use of Cachuma supplies from results of 83 years of hydrology in the model.

An aspect of the water supply that is of interest is the use of SWP supplies by MWD. SWP is used in the model after the WSA (desal), Jameson/Doulton, Cachuma, groundwater, and Cachuma sources (except for dry years when SWP may be delivered to Cachuma in advance of its need to avoid conveyance constraints). SWP supplies are little used at current demand, with use increasing at 2045 demand (Table 4, Figure 1). Subsequently, unused SWP supplies in any year decreases from current demand to 2045 demand (Figure 2). At current demand, SWP supplies stored in SemiTropic are little used, with usage slightly increasing at 2045 demand (Figure 3).

Scenario	Allocation (Avg. AFY)	To Storage (Avg. AFY)	From Storage to Customers (Avg. AFY)	Unused (Avg. AFY)
Scenario I-1a	0	0	0	1,472
Scenario I-1b	0	0	0	1,464
Scenario I-2 20%-40%	17 to 90	0 to 10	0 to 9	1,188 to 1,224
Scenario I-3 50%, 20%-40%	23 to 96	2 to 12	2 to 11	1,124 to 1,164
Scenario I-3 75%, 20%-40%	23 to 96	1 to 4	1 to 4	1,036 to 1,072

Table 4. SWP use from results of 83 years of hydrology in the model.

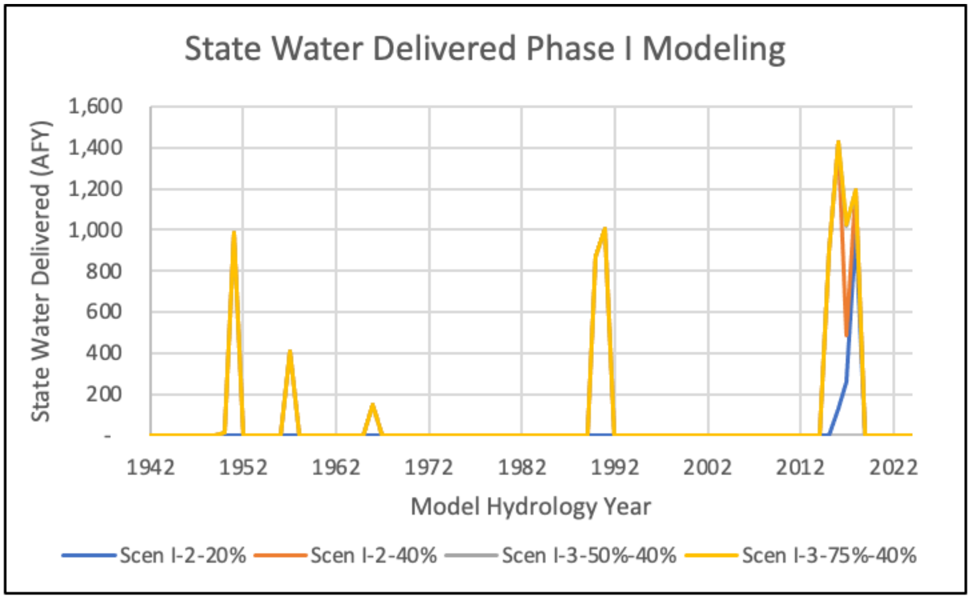

Figure 1. SWP delivered from results of 83 years of hydrology in the model.

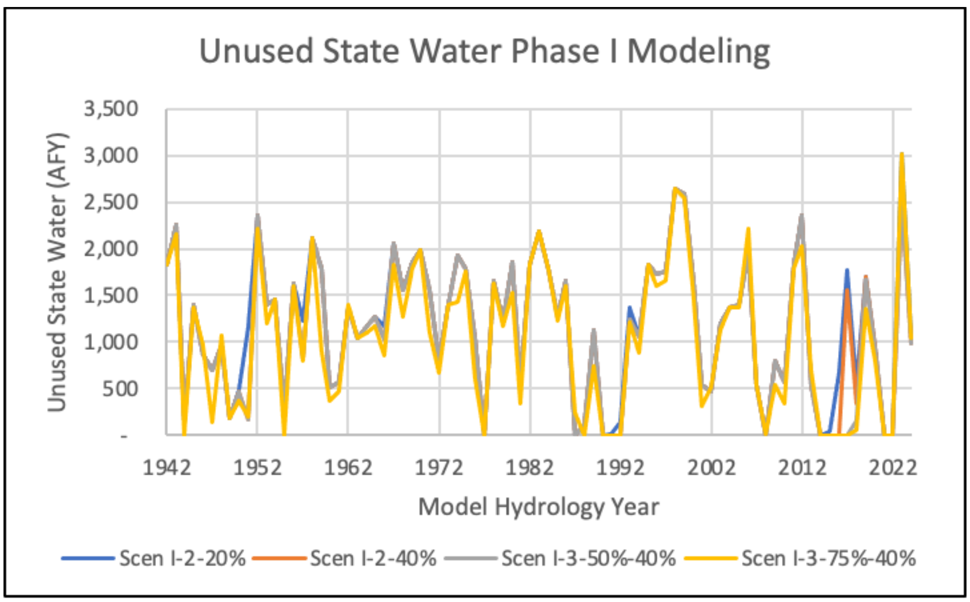

Figure 2. Unused SWP in a model year from results of 83 years of hydrology in the model.

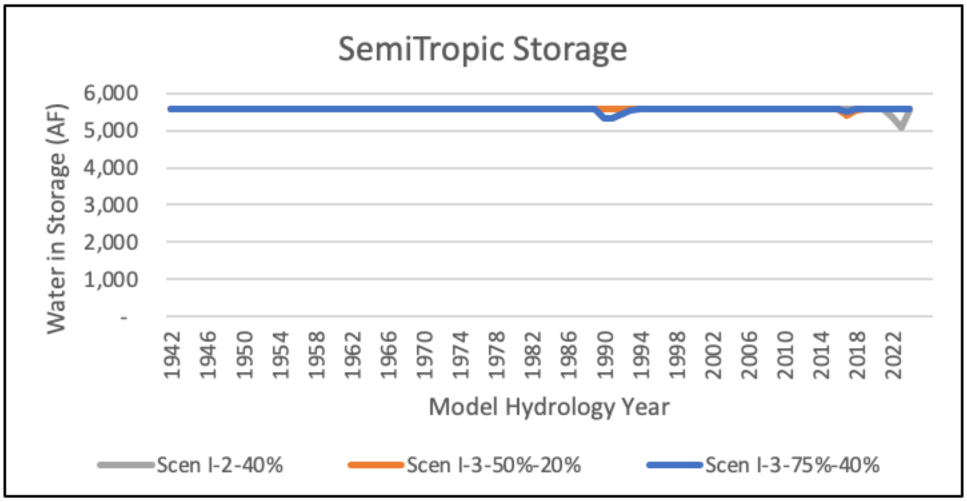

Figure 3. MWD water in storage with SemiTropic from results of 83 years of hydrology in the model.

Model results can be used to provide guidance for the upcoming Urban Water Management Plan (UWMP). This analysis differs somewhat from the format of the UWMP. Appendix C provides suggested input for the UWMP.

PHASE II MODEL SCENARIOS

Phase II models two water supply strategies that have the potential to further shore up MWD's long term water supply reliability while optimizing its limited resources. The first strategy is the potential permanent transfer (or sale) of a portion of MWD's SWP allocation/conveyance capacity or just conveyance capacity. The sale amount modeled was 1,400 AFY of allocation and a proportional amount of conveyance capacity. Phase II modeling includes various combinations of sales/no sale, SWP availability, and reductions in Cachuma allocation. The second strategy modeled is participating in a local groundwater storage program, potentially in the Carpinteria Groundwater Basin. The modeling investigates potential sources of water for banking, the total storage capacity needed, the rates of input/output, and its ability to address any projected unsourced demand.

Phase II modeling took a broader look at the range of supply availability, including the worse-case SWP future availability at the 95% "level of concern", a drought extending two years from historical trends, and a six-month interruption in the delivery of desal water.

PHASE II SCENARIOS INCLUDE:

Scenario II-1: Use current demand, current supplies with the permanent transfer (or sale) of a portion of MWD's SWP allocation and conveyance capacity.

Scenario II-2: Use current demand, SWP allocation and conveyance capacity sale, current supplies with the addition of local injection/extraction capability commensurate with the availability of surplus water to mitigate the projected unsourced demand. This scenario gives an approximation of the amount of local storage/extraction capacity required to meet projected unsourced demand at current demand levels.

Scenario II-3: Use future demand in 2045, future supplies according to SWP centroid (50% level of concern) delivery projections; future Cachuma deliveries reduced by 20%, 30%, or 40%. Addition of local injection/extraction capability commensurate with the availability of surplus water to mitigate the projected unsourced demand. This scenario gives an approximation of the amount of local storage/extraction capacity required to meet unsourced demand at 2045 demand levels.

a. Without sale of SWP;
b. With sale of portion of SWP allocation and conveyance capacity;
c. With sale of portion of SWP allocation conveyance capacity only, no local storage;
d. With sale of portion of SWP conveyance capacity only.

Scenario II-4: Use future demand in 2045, future supplies according to SWP 75% level of concern delivery projections; future Cachuma deliveries reduced by 30%; sale of portion of SWP allocation and conveyance capacity; addition of local injection/extraction capability commensurate with the availability of surplus water to mitigate the projected unsourced demand. This scenario is positioned between the centroid values and the worst-case values. Given the continued reduction in projected future availability of SWP and the uncertainty in future Cachuma allocation, this scenario may be the most realistic for future planning.

a. Without sale of SWP allocation and capacity;
b. With sale of SWP allocation and capacity.

Scenario II-5: Use future demand in 2045, future supplies according to SWP 95% level of concern delivery projections; future Cachuma deliveries reduced by 40%; the extension of drought conditions by two years, addition of local injection/extraction capability commensurate with the availability of surplus water to mitigate the projected unsourced demand. This scenario uses low supply assumptions and is considered on the high-risk side of the model runs.

a. Without sale of SWP allocation and capacity;
b. With sale of SWP allocation and capacity.

Scenario	Demand	SWP	Cachuma Reduction	Extended Dry Period	Sale	Local Storage
Scen II-1	Current	2023 Adjusted	None	No	Allocation, Capacity	No
Scen II-2	Current	2023 Adjusted	None	No	Allocation, Capacity	Yes
Scen II-3a	Future	50% LOC	20-40%	No	No	Yes
Scen II-3b	Future	50% LOC	20-40%	No	Allocation, Capacity	Yes
Scen II-3c	Future	50% LOC	20-40%	No	Capacity only	No
Scen II-3d	Future	50% LOC	20-40%	No	Capacity only	Yes
Scen II-4a	Future	75% LOC	30%	No	No	Yes
Scen II-4b	Future	75% LOC	30%	No	Allocation, Capacity	Yes
Scen II-5a	Future	95% LOC	40%	Yes	No	Yes
Scen II-5b	Future	95% LOC	40%	Yes	Allocation, Capacity	Yes

Table 5. Parameters for Phase II model runs.

PHASE II RESULTS

Phase II results indicate that without a local groundwater storage program, all scenarios result in small amounts of unsourced demand (Table 6). As in Phase I modeling, unsourced demand is a result of conveyance constraints in and out of Cachuma and not from a lack of supply. The sale of a portion of SWP allocation and conveyance capacity do not negatively impact the unsourced demand – there remains significant unused SWP supplies in all but the most extreme scenarios (i.e., scenario 5) after the sale is accounted for.

MWD's various supplies provide resilience to temporary loss of a source of a supply. A six-month disruption of WSA (desal) water was modeled to test this resilience. Depending upon when the loss occurs (wet, average, drought), unsourced demand varies from 0 AF to about 300 AF during the loss period. These shortages can be filled by temporarily increasing groundwater pumping and/or extra withdraws from Jameson Lake.

Scenario II-4b is considered to be the most likely combination of factors for future planning. This scenario uses SWP projections that are between centroid and worse-case values. It also uses a 30% reduction in future Cachuma allocations.

Scenario	% of Years	Largest Annual Unsourced Demand (% of Demand/AFY)
Scen II-1	4%	2%/74
Scen II-2	4%	2%/74
Scen II-3a, 20%-40%	5%-6%	5%/273-273
Scen II-3b, 20%-40%	5%-5%	5%/273-273
Scen II-3c, 20%-40%	5%	5%-5%/273-273
Scen II-3d, 20%-40%	5%	5%/273-273
Scen II-4a	5%	5%/273
Scen II-4b	5%	5%/273
Scen II-5a	5%	5%/273
Scen II-5b	5%	5%/273

Table 6. Results of 83 years of model. Unsourced demand is calculated before the possible addition of local groundwater storage program.

Scenario	Allocation (Avg. AFY)	Spill Water Used (Avg. AFY)	Carryover Used (Avg. AFY)	Carryover Lost to Spill (Avg. AFY)
Scen II-1	959	26	45	1,536
Scen II-2	961	26	46	1,534
Scen II-3a, 20%-40%	1,218 to 1,158	45	141 to 123	735 to 365
Scen II-3b, 20%-40%	1,218 to 1,158	45	141 to 123	735 to 365
Scen II-3c, 20%-40%	1,218 to 1,158	45	141 to 123	735 to 365
Scen II-3d, 20%-40%	1,218 to 1,158	45	141 to 123	735 to 365
Scen II-4a	1,194	45	144	531
Scen II-4b	1,194	45	144	531
Scen II-5a	1,161	45	119	364
Scen II-5b	1,157	45	123	365

Table 7. Results of Phase II modeling for Cachuma supplies.

Scenario	Directly to Customers (Avg. AFY)	To SemiTropic (Avg. AFY)	From SemiTropic to Customers (Avg. AFY)	Unused (Avg. AFY)
Scen II-1	0	0	0	735
Scen II-2	0	0	0	735
Scen II-3a, 20%-40%	17 to 99	0 to 3	0 to 3	1,188 to 1,132
Scen II-3b, 20%-40%	14 to 26	1 to 9	1 to 8	1,613 to 1,614
Scen II-3c, 20%-40%	17 to 96	0 to 3	0 to 3	1,190 to 1,156
Scen II-3d, 20%-40%	10 to 90	0 to 6	0 to 6	1,190 to 1,153
Scen II-4a	37	0	0	1,077
Scen II-4b	30	0	0	514
Scen II-5a	100	13	12	935
Scen II-5b	102	10	9	442

Table 8. Results of Phase II modeling for SWP supplies.

ADDITION OF LOCAL GROUNDWATER STORAGE PROGRAM

The advantage of a local groundwater storage program closer to MWD's service area is that the conveyance limitations in and out of Cachuma can be largely avoided. Four potential sources of water were investigated for such a program. Although each source was evaluated as a stand-alone source; in practice, storage water would likely be from a combination of the sources.

1) **Cachuma carryover water** – unused Cachuma allocation from a prior year that is in excess of 2,000 AF of carryover water.

2) **Cachuma spill water** – water that becomes available during spill months. While significant spill water can be available and is additive to the Cachuma allocation if delivered, spills are relatively short in duration and infrequent, demand is often low during wet periods, and the available capacity to store this water in a groundwater storage program would likely be relatively small.
3) **Unused SWP supplies** – whereas modeling has indicated a significant amount of unused SWP supplies in most scenarios, SWP supplies would likely be imported for storage during wetter, lower-demand years to avoid conveyance restrictions in/out of Cachuma.
4) **Additional Jameson draw for storage** – Jameson withdraw would increase during wet and average years, lowering the demand for Cachuma water. Because infrastructure limitations do not allow Jameson water to be transported directly to a storage program in Carpinteria, there would have to be an exchange such that Jameson water replaces some of MWD's demand, freeing Cachuma water for the storage program. The extra draw on Jameson would subsequently be replaced during spill years. The total Jameson withdraw including for storage is limited to 2,000 AFY pursuant to the Gin Chow ruling.

Evaluating how each source would be used for storage was accomplished in a two-step fashion. First, the availability of each source was determined for each month of the 83 years of the model. This availability took into account both the amount of potential source water and the conveyance restrictions in/out of Cachuma. Second, the size of the storage program for each of the four sources was determined so that there was no longer any unsourced demand. This step calculated the minimum required size of the bank to avoid unsourced demand. It does not include any safety margin for unforeseen weather or infrastructure problems. All of the sources used by themselves eliminated the unsourced demand, with the exception of Cachuma carryover water (Table 9). Cachuma carryover water could not be accumulated fast enough before the first drought in the model, so the storage project program would need to be "seeded" with initial storage water[2]. Carryover water subsequently performed as well as the other sources of storage water.

As part of the determination of minimum storage capacity, rates of input/output from storage were also determined (Table 10).

Scenario	Maximum Unsourced Demand without Local Storage	W/ Carryover Storage*	W/Spill Storage	W/ SWP Storage	W/ Jameson Storage
II-2	74	0	0	0	0
II-3a-20%	273	0	0	0	0
II-3a-40%	264	0	0	0	0
II-3b-20%	273	0	0	0	0
II-3b-40%	231	0	0	0	0
II-3d-20%	273	0	0	0	0

[2] This problem is in part based upon the sequence of hydrologic years in the model. If there was initially a long sequence of wet or normal years, "seeding" would not be required.

II-3d-40%	231	0	0	0	0
II-4a	273	0	0	0	0
II-4b	273	0	0	0	0
II-5a	278	0	0	0	0
II-5b	217	0	0	0	0

Table 9. Results of Phase II modeling for local storage program indicating that these storage sources eliminated unsourced demand. Although each water source was modeled individually – in practice, a combination of water sources might be used for storage. * Carryover water was not effective by itself unless the storage program was first "seeded" with most of its storage water; the other sources were self-sufficient in initially filling the storage capacity.

Demand	Minimum Storage Capacity (AF)	Injection/Extraction Rate (AF/month)
Current	200	45
2045	600	105

Table 10. Minimum capacities and injection/extraction rates for storage program at current and 2045 demand. The 2045 results are for the most likely scenario (Scenario II-4b).

Figure 4. Local storage of spill water, indicating the amount of water in storage. The first years of the figure indicate the initial filling of storage. Use of stored water occurs when there is unsourced demand. Subsequent re-filling of storage may not occur in a single spill year because of conveyance capacities (e.g., early 1950s).

CONCLUSIONS

All the model runs in both Phases I and II resulted in relatively small amounts of unsourced demand (74 to 273 AFY) in 4 to 5 years of the 83 years of the modeled period. This unsourced demand is caused by conveyance limitations in/out of Cachuma rather than a shortage of supply. Some or all of this unsourced demand can likely be met by temporarily pumping more groundwater and/or drawing more Jameson water, which are not limited by the Cachuma conveyance limitations. No additional supplies are considered in Phase II – any new supplies would increase the favorability of these findings.

Disasters, such as the collapse of local tunnels, are not considered in the worst-case scenarios modeled herein, and are not analyzed in this report. Disasters such as the collapse of one or more local tunnels, or a levee break/dam failure on the SWP, or a tsunami damaging the desal facility would obviously produce different results. The District's diverse water supply portfolio helps but does not eliminate the potential impacts of a disaster such as these.

When the sale of a portion of MWD's SWP allocation/conveyance capacity is modeled, projected unsourced demand does not increase substantially because SWP supplies are little used over the model period. The unsourced demand with the sale of a portion of MWD's SWP allocation/conveyance capacity is a maximum of 74 to 273 AFY (maximum 43 to 104 AF/month) and can be mitigated with temporarily increasing deliveries from Jameson and/or groundwater.

For future planning purposes, Scenario II-4b, which incorporates (1) SWP water at 75% LOC (40% reliable), (2) 30% reduction in Cachuma, (3) sale of a 42% (or 1,400 AF) of SWP allocation and conveyance capacity, and (4) acquisition of local groundwater storage, is considered the most realistic combination of centroid and worse case assumptions. The other scenarios provide an indication of the potential range of outcomes.

MWD has several options to decrease or eliminate unsourced demand. These include participation in a local groundwater storage program, increasing pumping capacity in/out Cachuma, increasing groundwater pumping (100-300 AFY), voluntary or mandatory reduction in water demand during anticipated shortages, and acquisition of a new local water supply such as additional desal or recycled water.

MWD has multiple sources of water available for storage in a local groundwater storage program. These sources include unused Cachuma carryover water, Cachuma spill water, unused SWP, and increased draws of Jameson storage. The advantage of local storage is that it is not constrained by conveyance restrictions in/out of Cachuma. The model indicates the minimum storage capacity required is about 600 AF at 2045 demand levels. The model indicates use of a local groundwater storage program fully mitigates any project unsourced demand. Alternatively, any new supplies and/or decrease in demand would also mitigate any unsourced demand.

MWD's diverse water supply portfolio provides resilience to temporary disruptions of supply, such as the temporary loss of WSA (desal) water for a period of time. Depending upon when the loss occurs (wet, average, drought), unsourced demand varies from 0 AF to about 300 AF during the loss period. These shortages can be filled by temporarily increasing groundwater pumping and/or extra withdraws from Jameson Lake.

Under certain rare circumstances (excluding disaster conditions), the District's full SWP allocation (3,300 AFY) and/or associated conveyance capacity could be necessary to avoid unsourced demand. These circumstances depend on many factors including hydrology statewide and the availability of each of the District's water sources. Although the commencement of desal deliveries in 2022 lessened the District's future reliance on imported water, that dependence under certain rare conditions remains. Modeling suggests that future reliance on imported supplies is extremely limited and that the permanent transfer of a portion of the District SWP allocation and conveyance capacity has little impact on unsourced demand. Conceivably, more severe drought conditions could plague California, resulting in a worse water supply condition than historically experienced. Under such a condition, e.g., both Jameson and Cachuma supplies become nearly depleted, desal deliveries and groundwater production coupled with a greater reliance on imported supplies would likely be necessary to mitigate unsourced demand to the greatest extent. If SWP conveyance capacity is reduced through the sale of a portion of the District's SWP allocation and conveyance capacity, the ability to mitigate the unsourced demand would be reduced and it could become challenging, if not impossible to fully mitigate the unsourced demand. As mentioned herein, there are potential future actions that could be implemented to help mitigate or eliminate the projected unsourced demand under these rare circumstances.

APPENDIX A. PHASE I GRAPHIC RESULTS

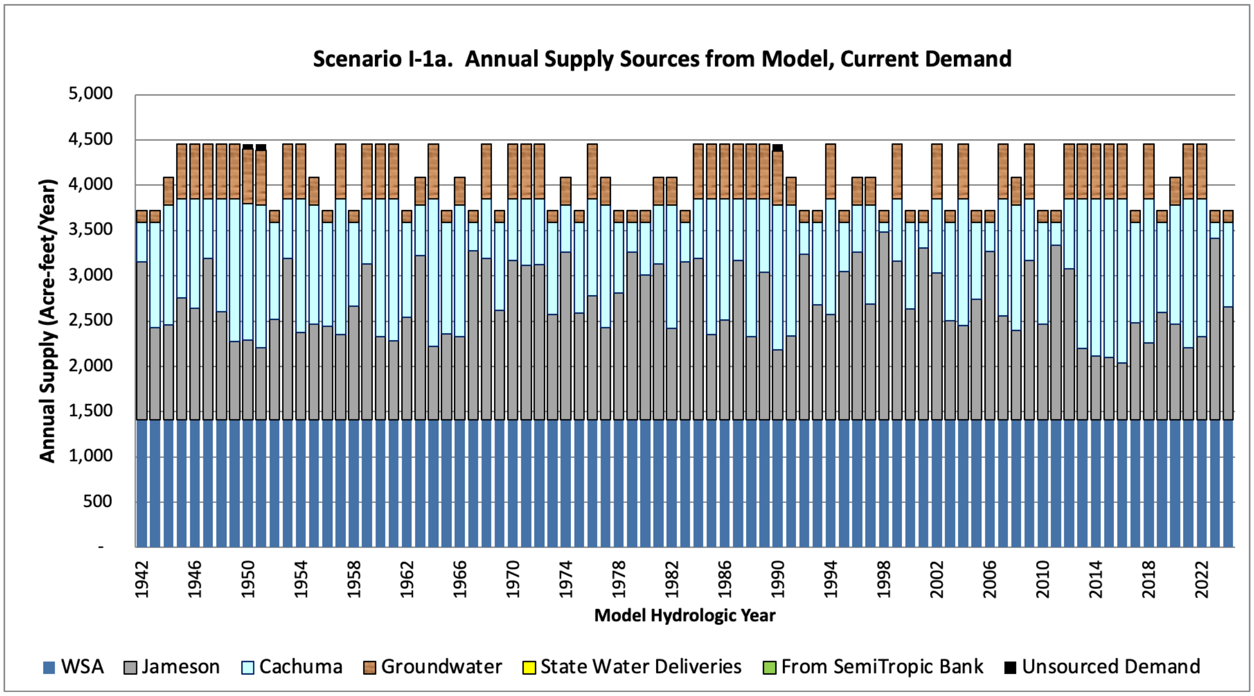

Figure A- 1 Sources of supply for Scenario I-1a from results of 83 years of hydrology in the model.

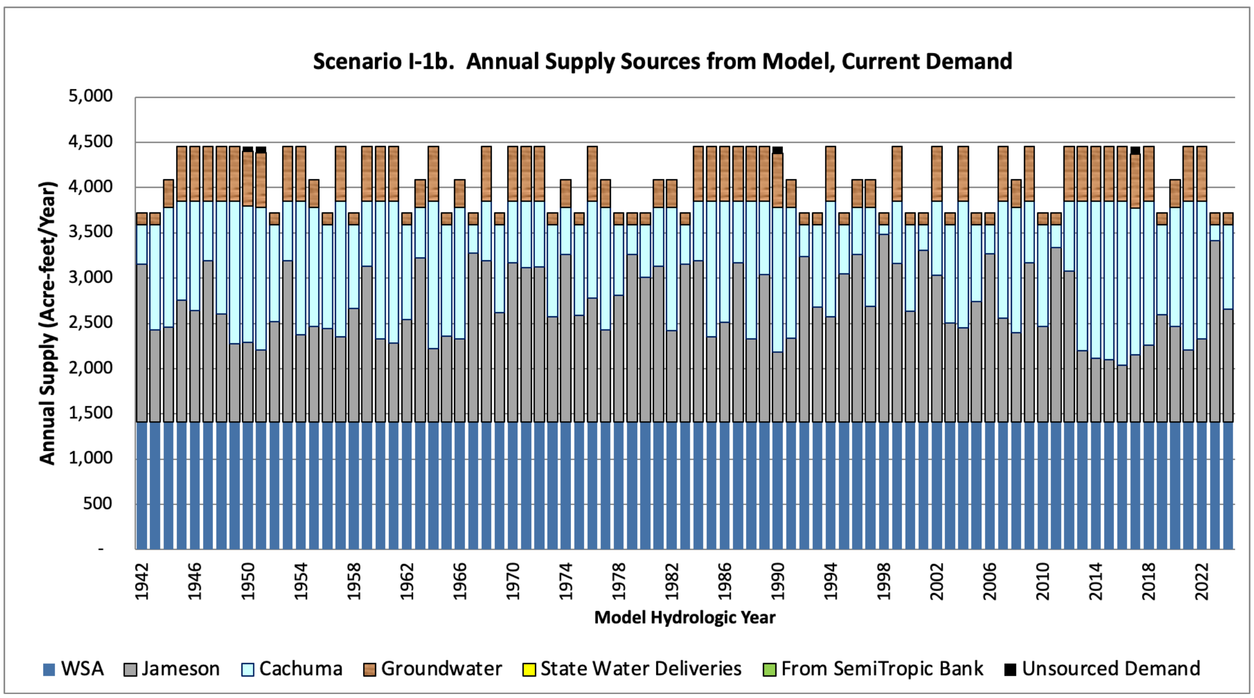

Figure A- 2. Sources of supply for Scenario I-1b from results of 83 years of hydrology in the model. This scenario increases drought by two years.

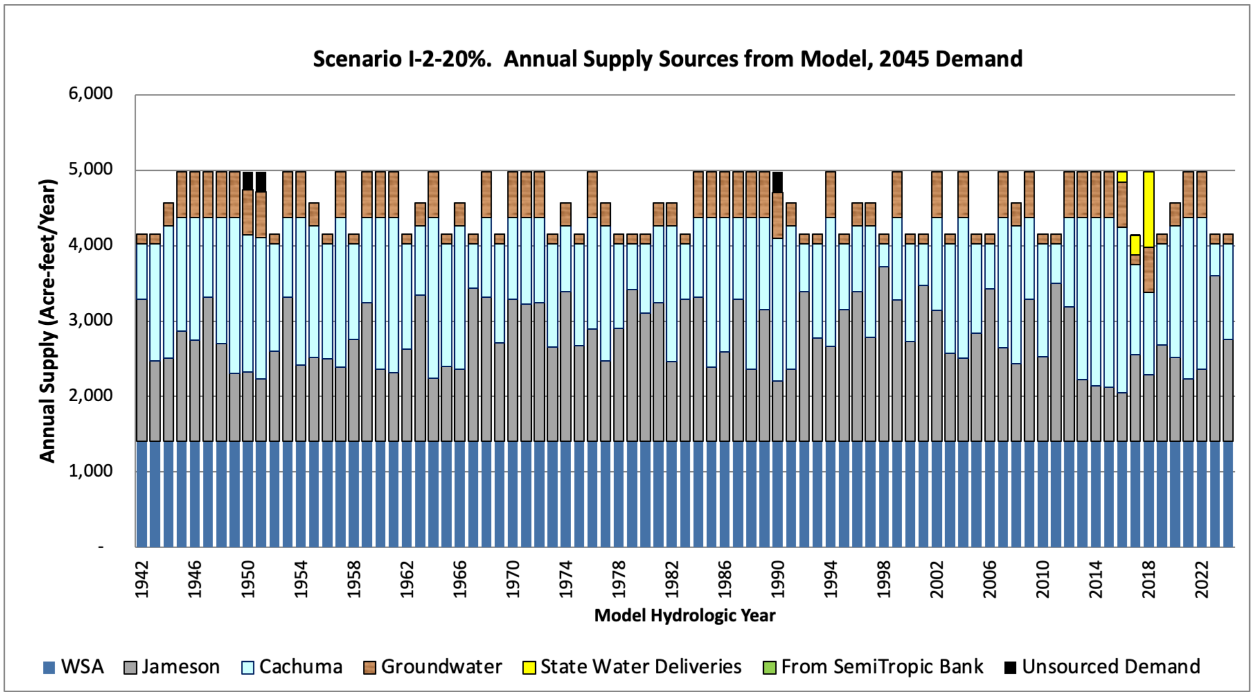

Figure A- 3. Sources of supply for Scenario I-2-20% from results of 83 years of hydrology in the model. Cachuma deliveries are reduced by 20%.

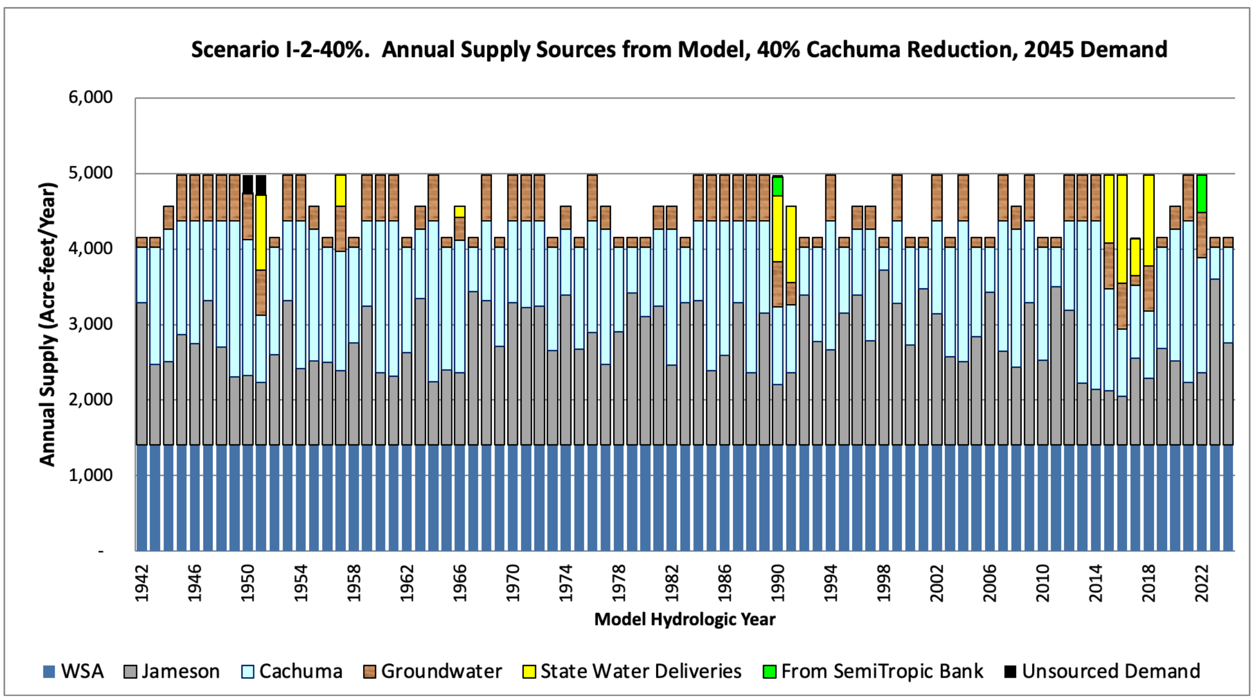

Figure A- 4. Sources of supply for Scenario I-2-40% from results of 83 years of hydrology in the model. Cachuma deliveries are reduced by 40%.

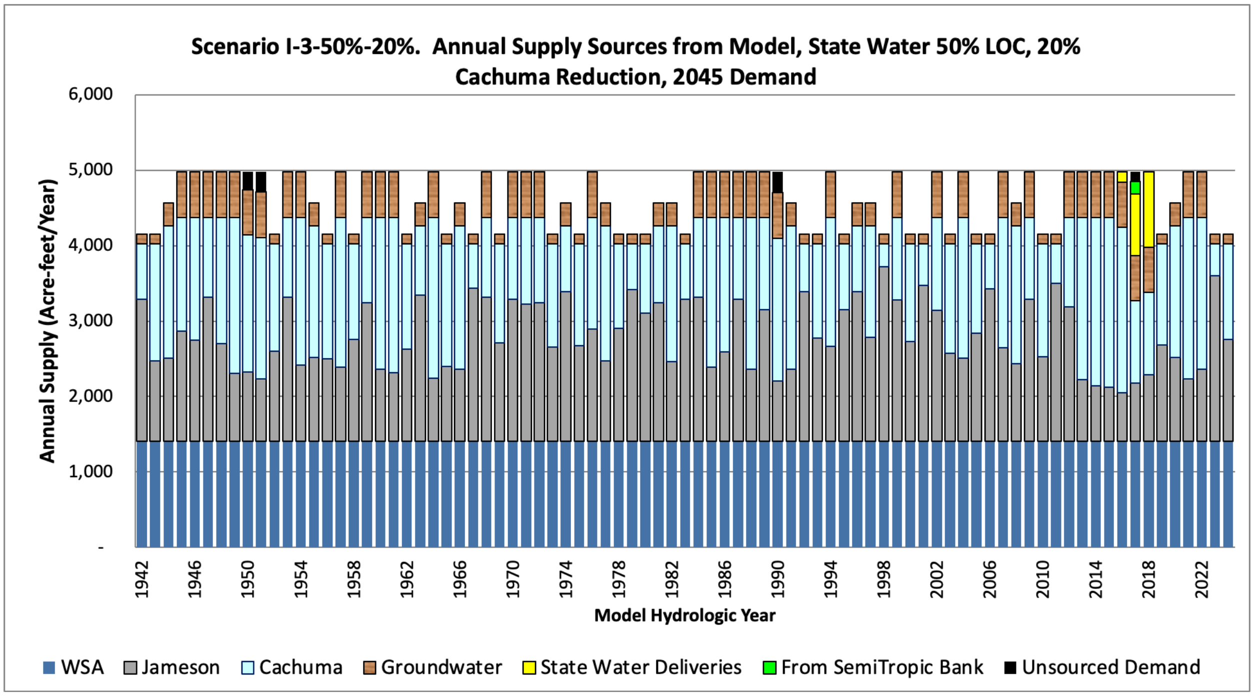

Figure A- 5. Sources of supply for Scenario I-3-50%-20% from results of 83 years of hydrology in the model. Future SWP deliveries are from centroid 50% Level of Concern, Cachuma deliveries are reduced by 20%, drought extended by two years.

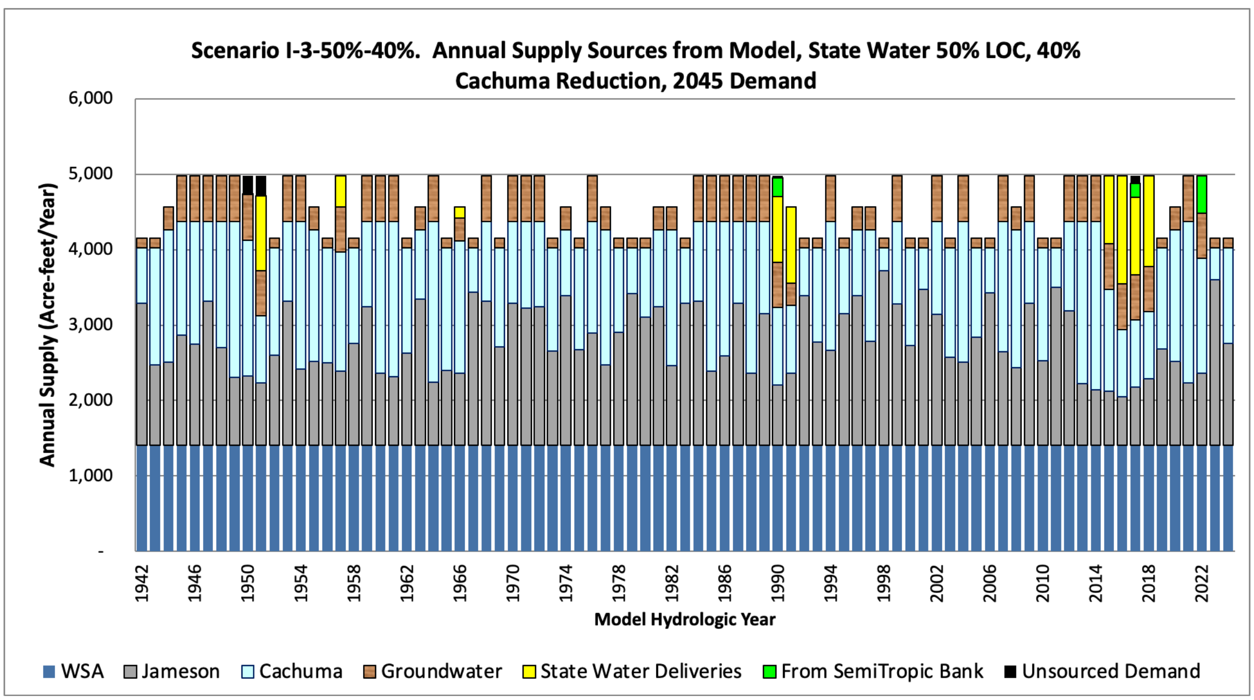

Figure A- 6. Sources of supply for Scenario I-3-50%-40% from results of 83 years of hydrology in the model. Future SWP deliveries are from centroid 50% Level of Concern, Cachuma deliveries are reduced by 40%, drought extended by two years.

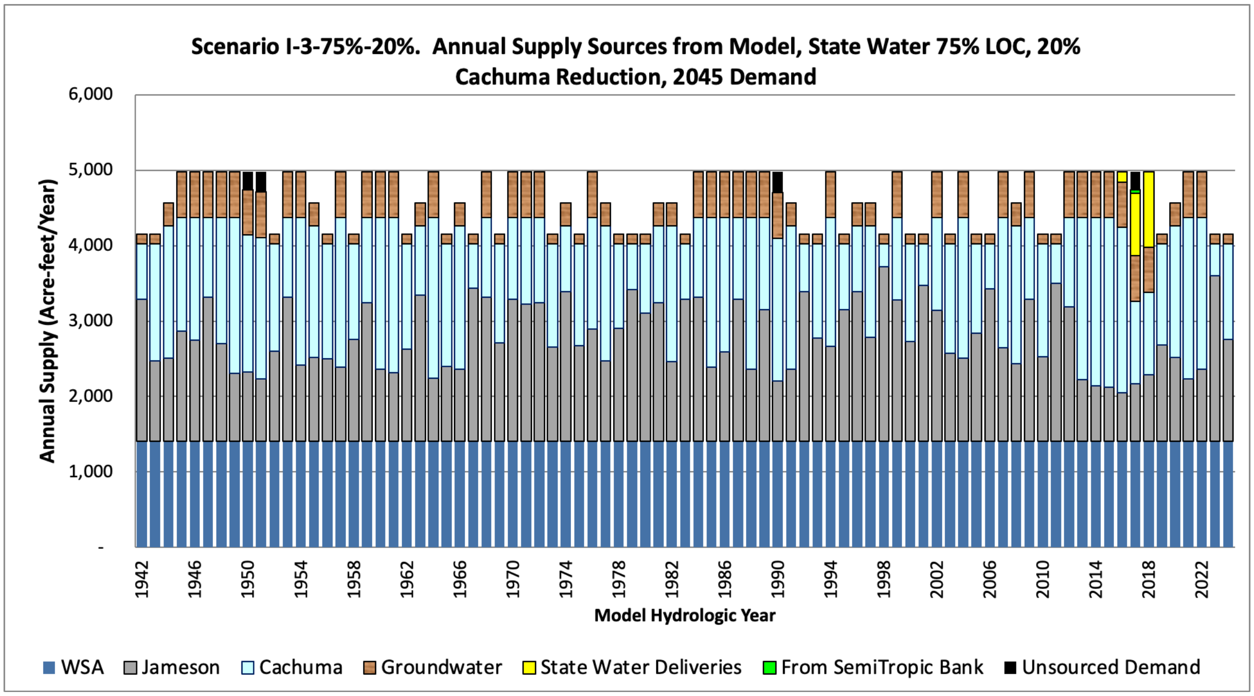

Figure A- 7. Sources of supply for Scenario I-3-75%-20% from results of 83 years of hydrology in the model. Future SWP deliveries are from 75% Level of Concern, Cachuma deliveries are reduced by 20%, drought extended by two years.

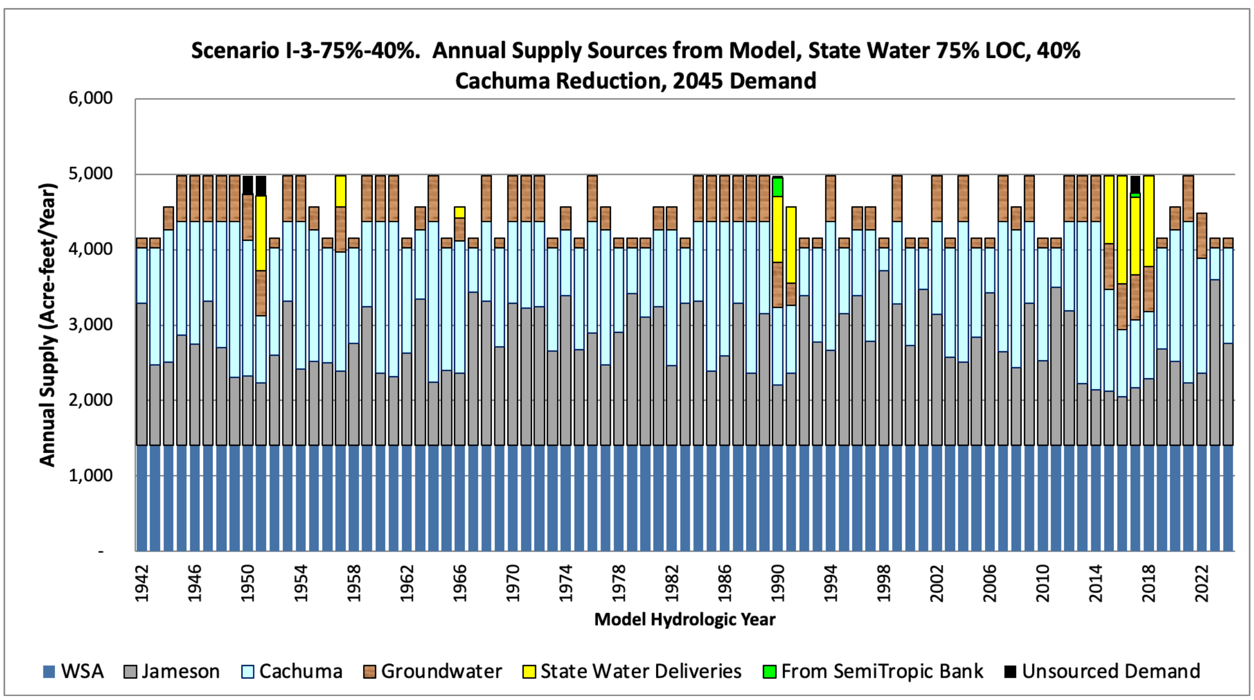

Figure A- 8. Sources of supply for Scenario I-3-75%-40% from results of 83 years of hydrology in the model. Future SWP deliveries are from 75% Level of Concern, Cachuma deliveries are reduced by 40%, drought extended by two years.

APPENDIX B. PHASE II GRAPHIC RESULTS

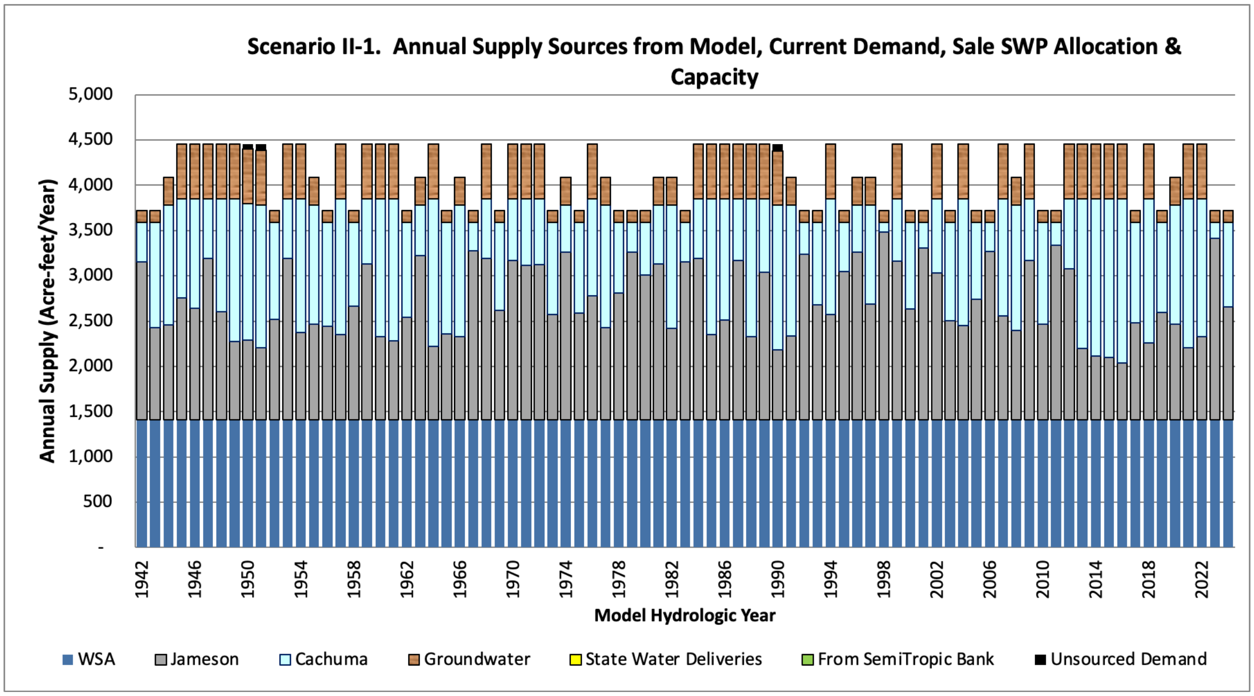

Figure B- 1. Sources of supply for Scenario II-1 from results of 83 years of hydrology in the model.

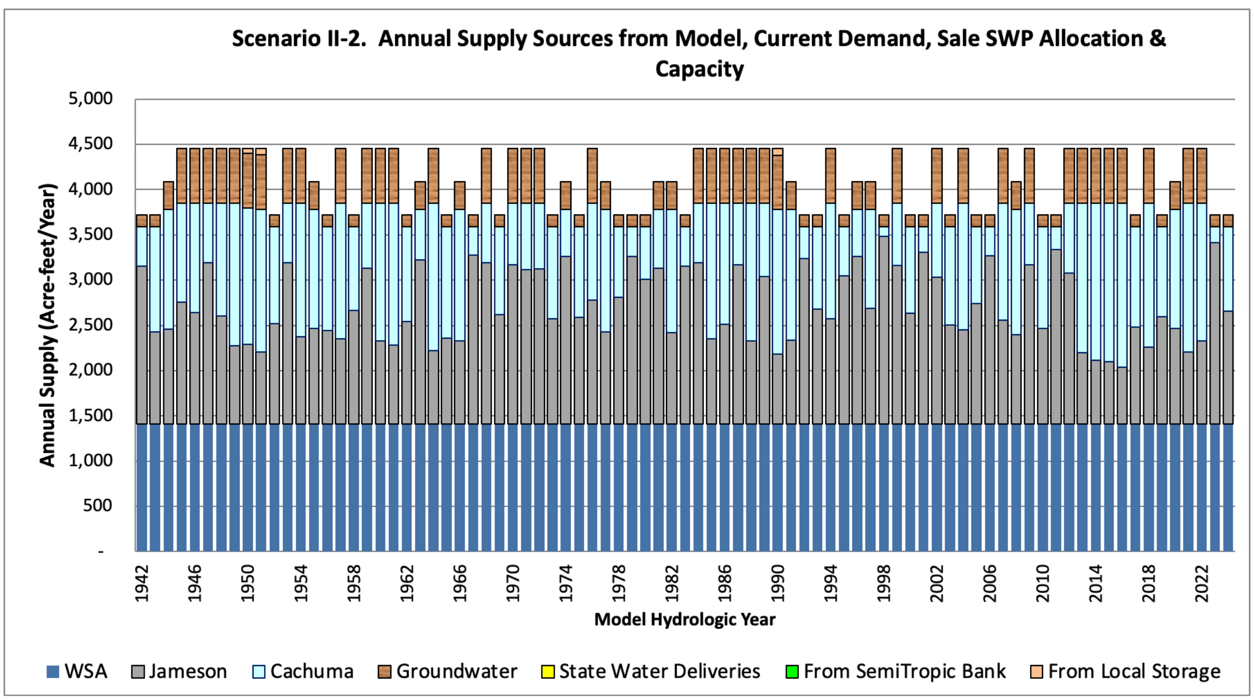

Figure B- 2. Sources of supply for Scenario II-2 from results of 83 years of hydrology in the model. Unsourced demand is replaced by supplies from local storage.

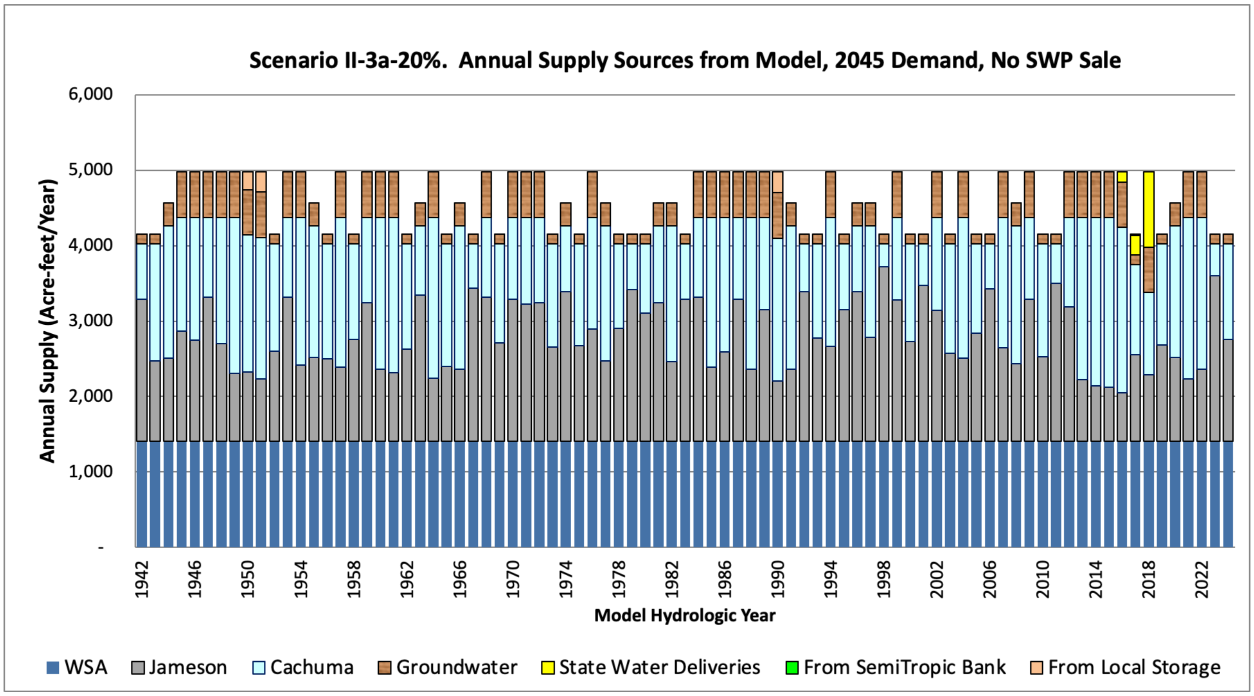

Figure B- 3. Sources of supply for Scenario II-3a-20% from results of 83 years of hydrology in the model. Future SWP is at 50% "level of concern", there is a 20% reduction in Cachuma allocations.

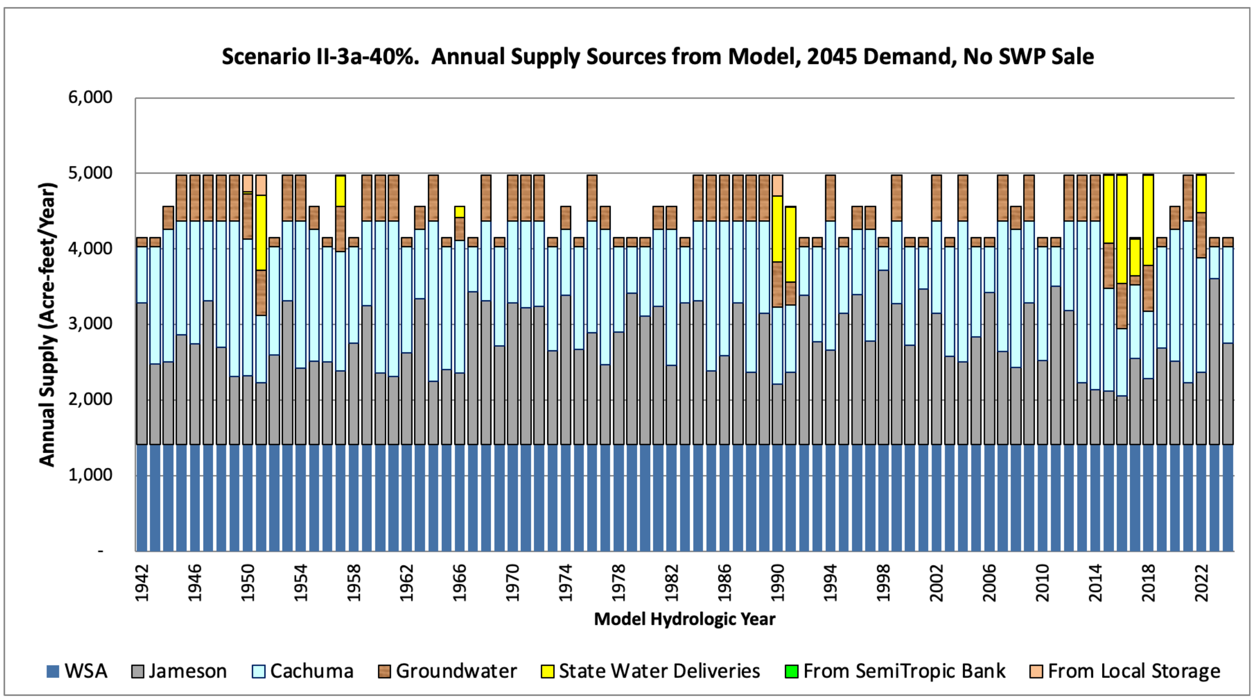

Figure B- 4. Sources of supply for Scenario II-3a-40% from results of 83 years of hydrology in the model. Future SWP is at 50% "level of concern", there is a 40% reduction in Cachuma allocations.

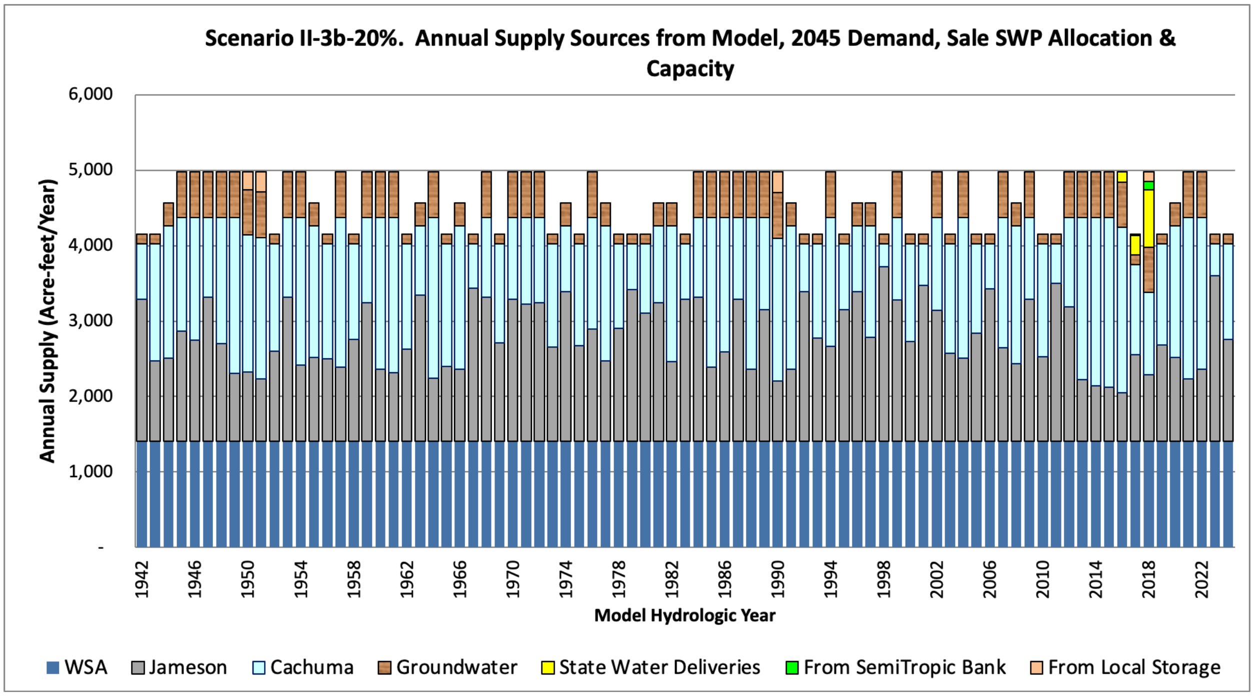

Figure B- 5. Sources of supply for Scenario II-3b-20% from results of 83 years of hydrology in the model. Future SWP is at 50% "level of concern", there is a 20% reduction in Cachuma allocations.

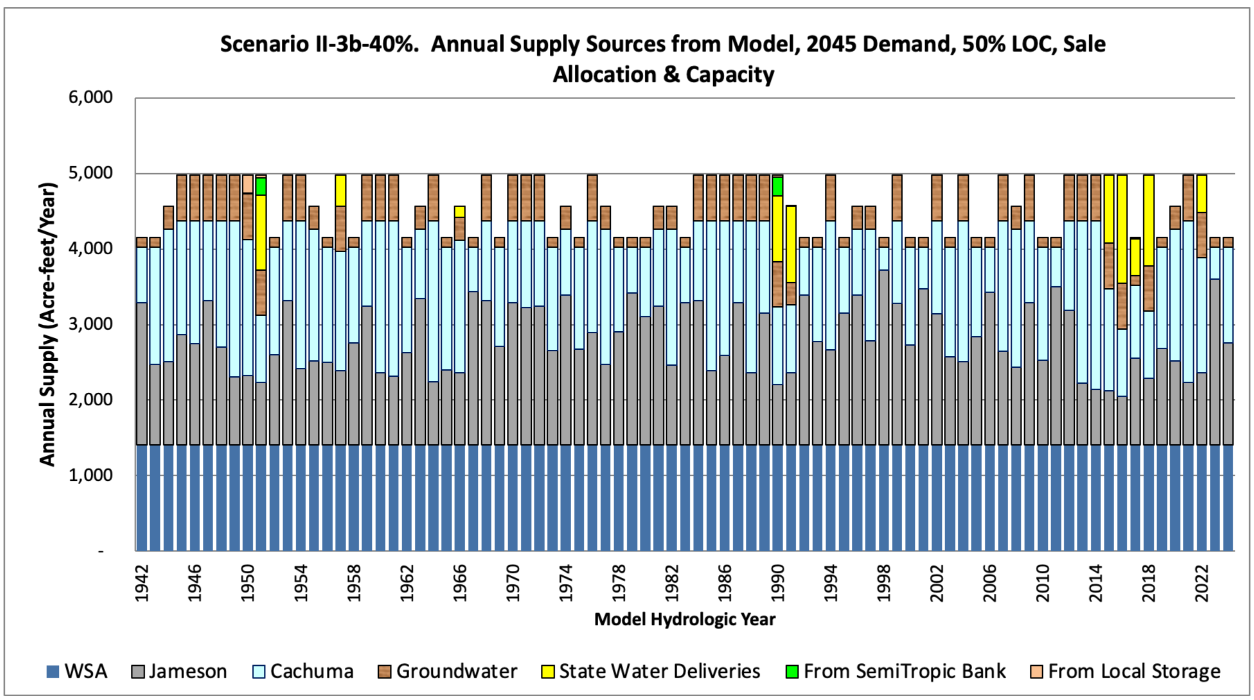

Figure B- 6. Sources of supply for Scenario II-3b-40% from results of 83 years of hydrology in the model. Future SWP is at 50% "level of concern", there is a 40% reduction in Cachuma allocations.

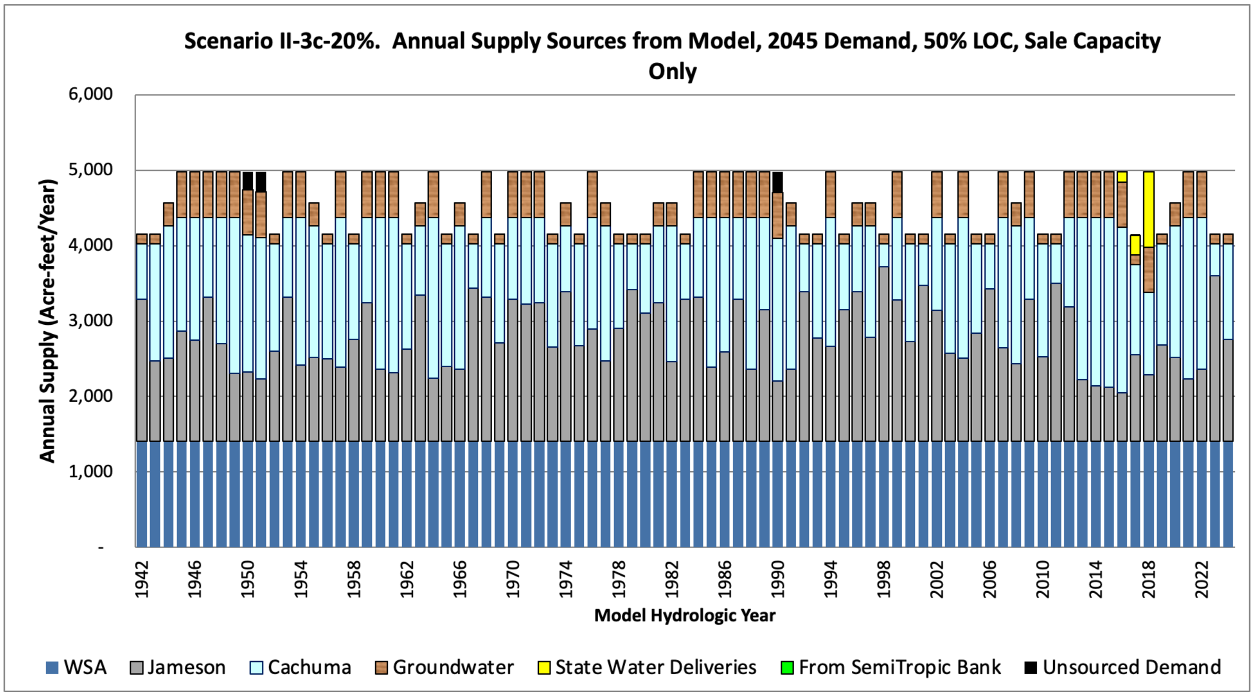

Figure B- 7. Sources of supply for Scenario II-3c-20% from results of 83 years of hydrology in the model. Future SWP is at 50% "level of concern", there is a 20% reduction in Cachuma allocations. There is no local storage to offset unsourced demand.

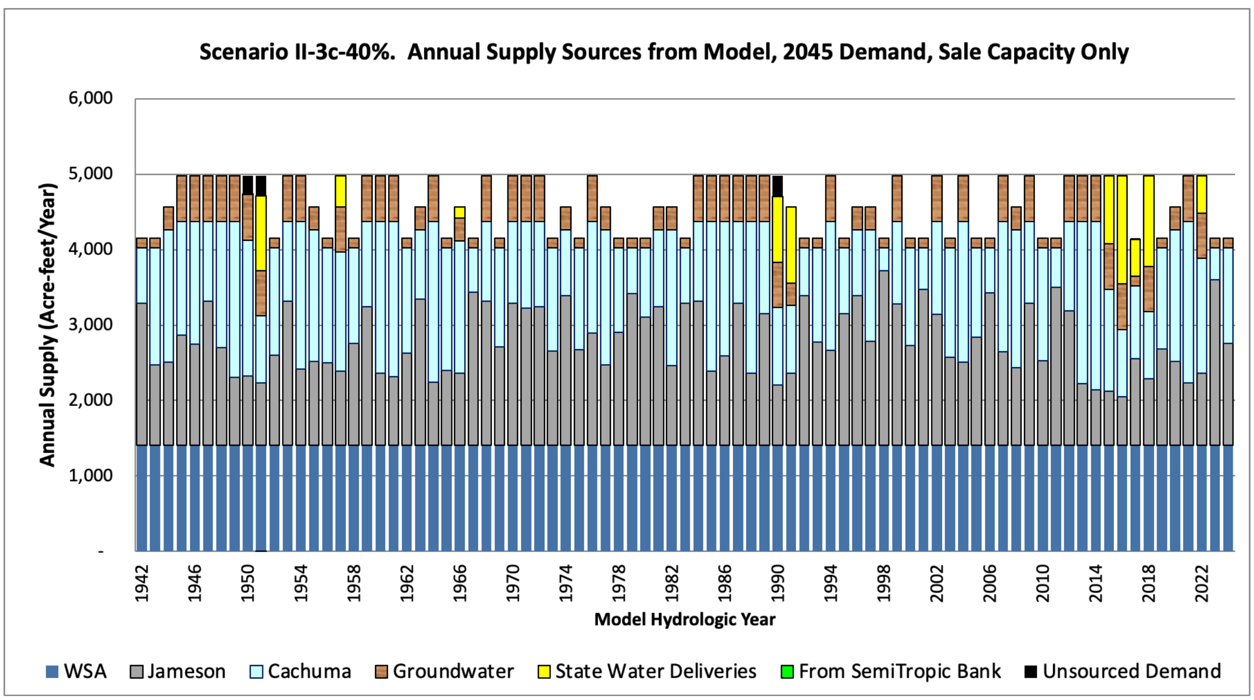

Figure B- 8. Sources of supply for Scenario II-3c-40% from results of 83 years of hydrology in the model. Future SWP is at 50% "level of concern", there is a 40% reduction in Cachuma allocations. There is no local storage to help offset unsourced demand.

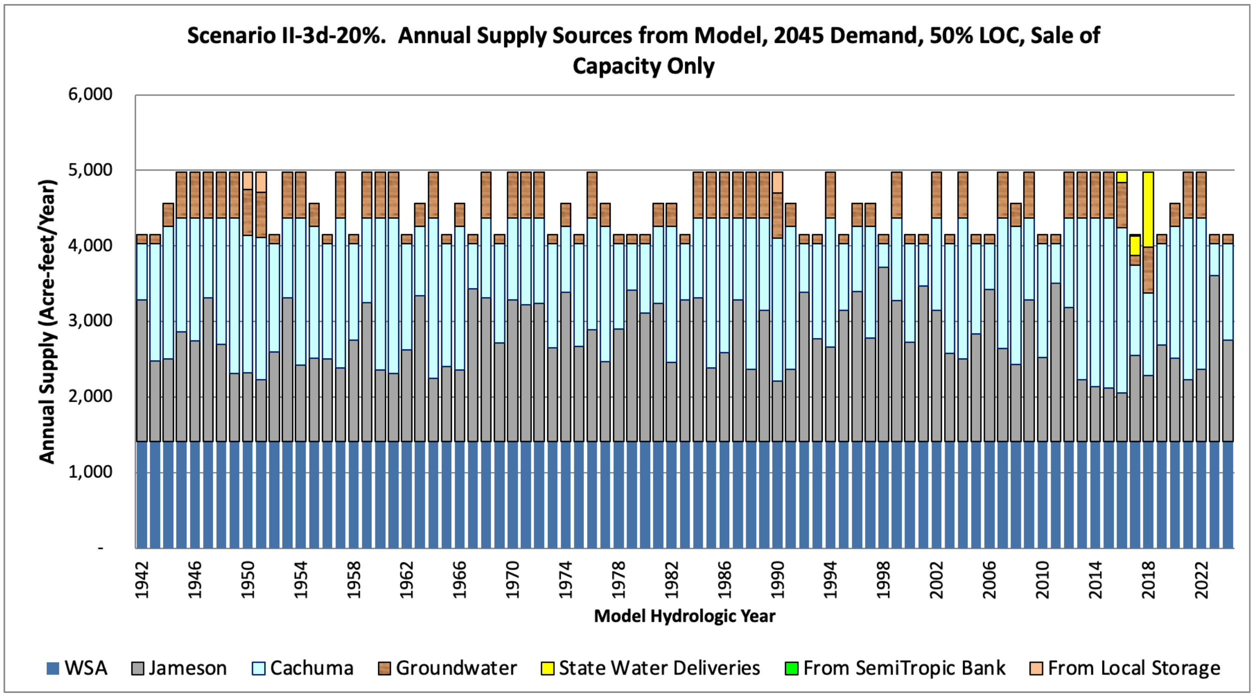

Figure B- 9. Sources of supply for Scenario II-3d-20% from results of 83 years of hydrology in the model. Future SWP is at 50% "level of concern", there is a 20% reduction in Cachuma allocations.

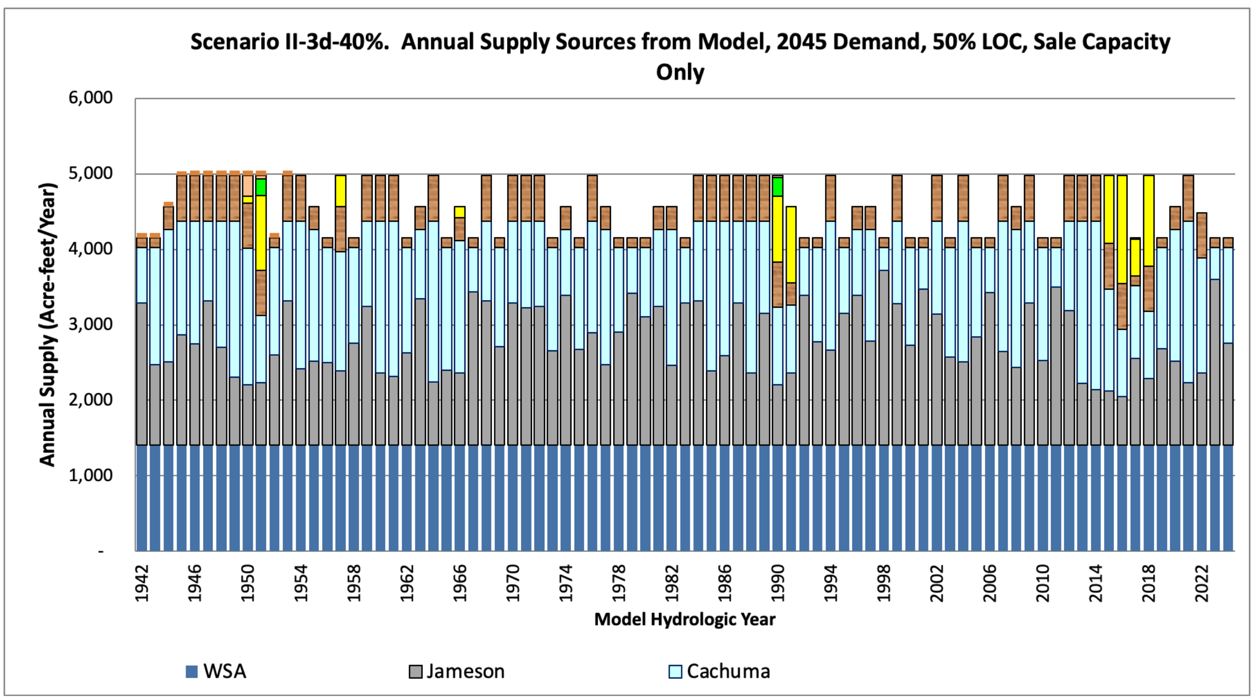

Figure B- 10. Sources of supply for Scenario II-3d-40% from results of 83 years of hydrology in the model. Future SWP is at 50% "level of concern", there is a 40% reduction in Cachuma allocations.

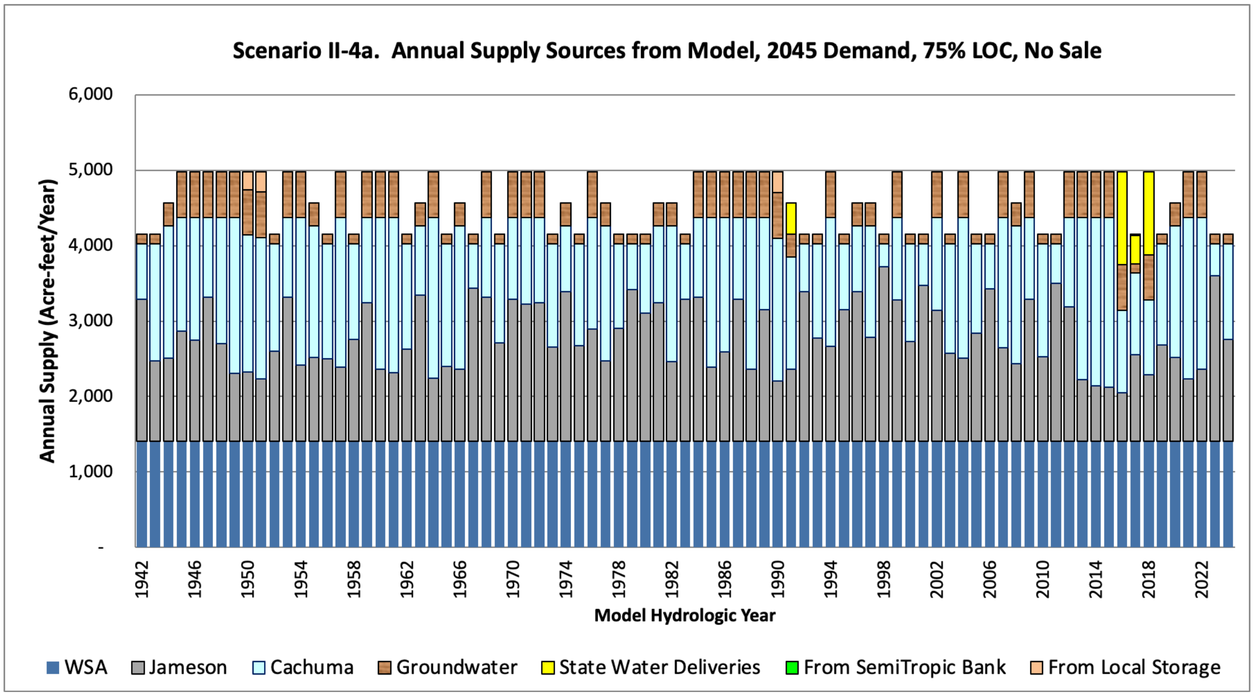

Figure B- 11. Sources of supply for Scenario II-4a from results of 83 years of hydrology in the model. Future SWP is at 75% "level of concern", there is a 30% reduction in Cachuma allocations.

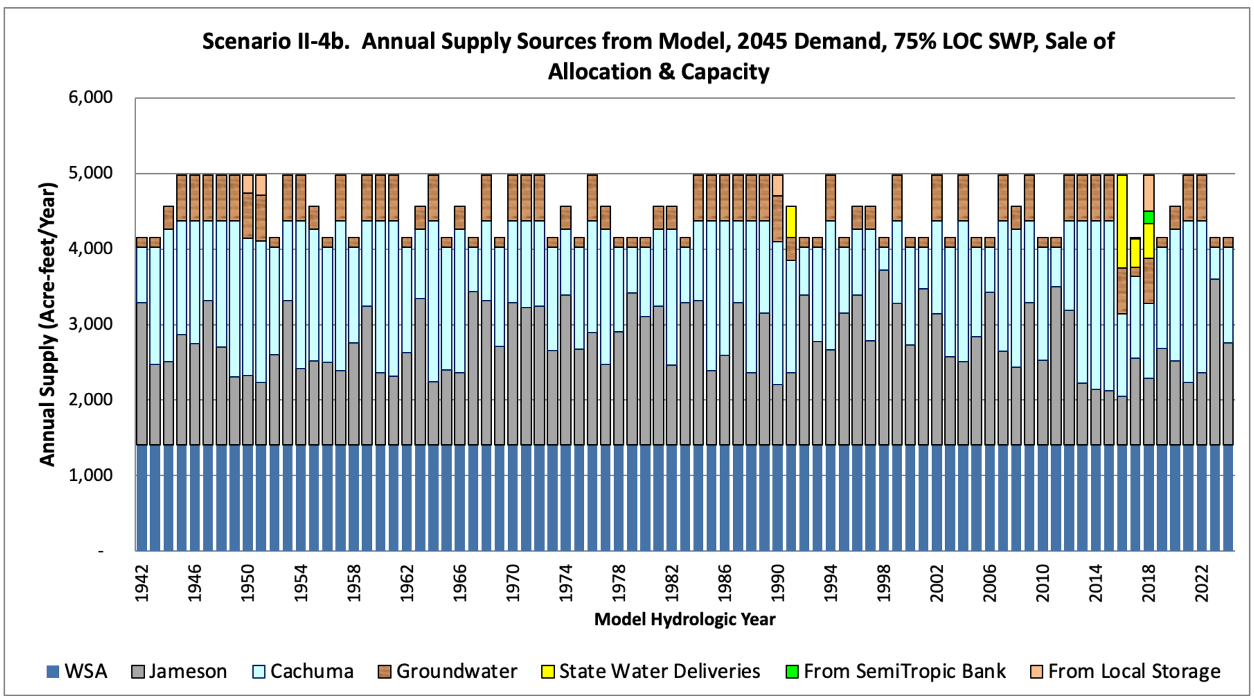

Figure B- 12. Sources of supply for Scenario II-4b from results of 83 years of hydrology in the model. Future SWP is at 75% "level of concern", there is a 30% reduction in Cachuma allocations.

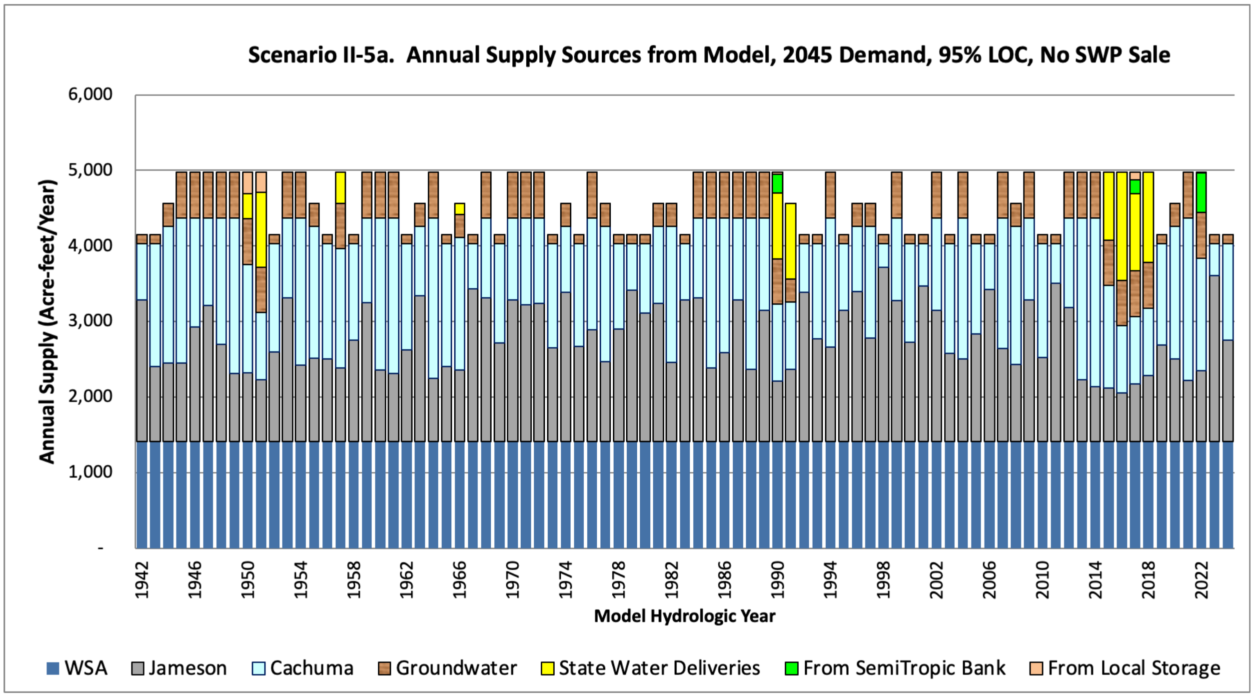

Figure B- 13. Sources of supply for Scenario II-5a from results of 83 years of hydrology in the model. Future SWP is at 95% "level of concern", there is a 40% reduction in Cachuma allocations. This is considered to be the worse-case for MWD water sources with no SWP sale.

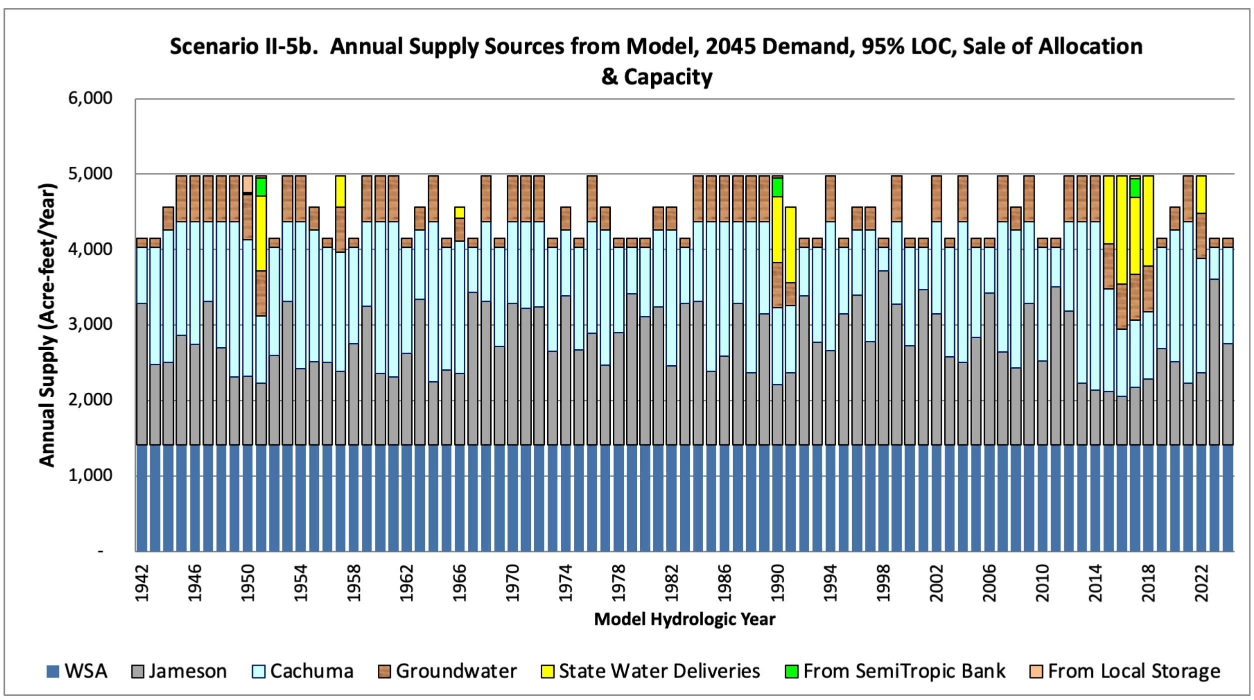

Figure B- 14. Sources of supply for Scenario II-5b from results of 83 years of hydrology in the model. Future SWP is at 95% "level of concern", there is a 40% reduction in Cachuma allocations. This is considered to be the worse-case for MWD water sources with a sale of a portion of SWP.

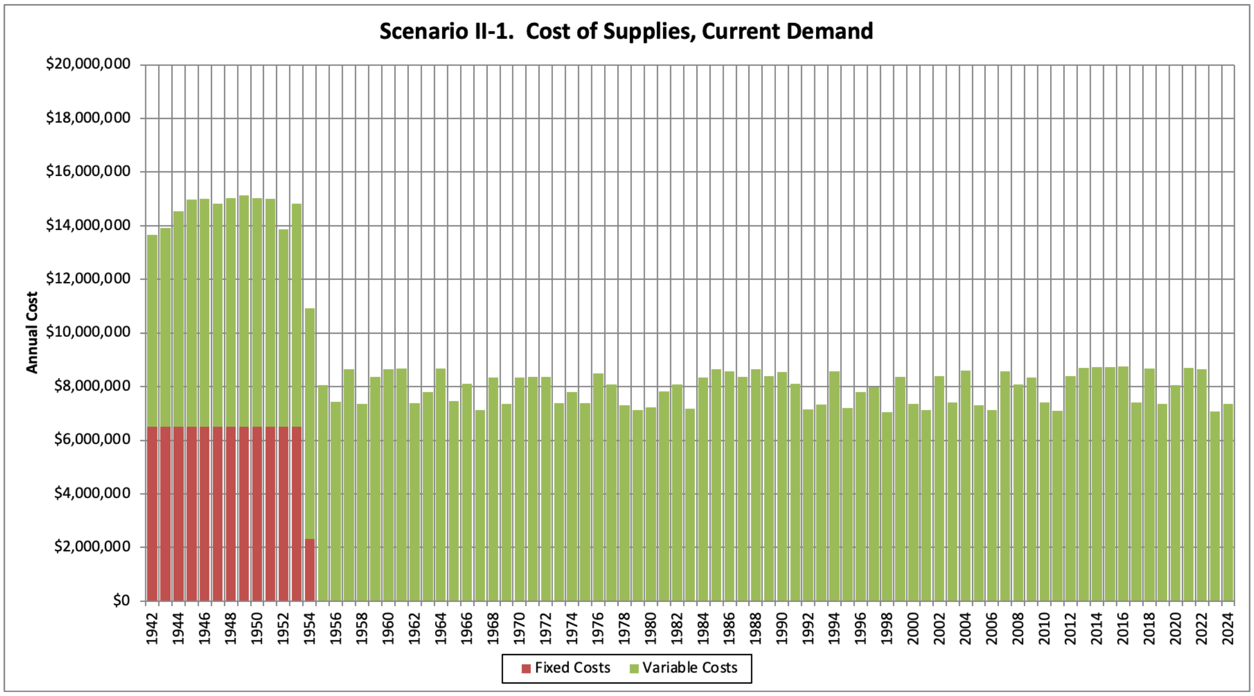

Figure B- 15. Cost of supplies for Scenario II-1 from results of 83 years of hydrology in the model.

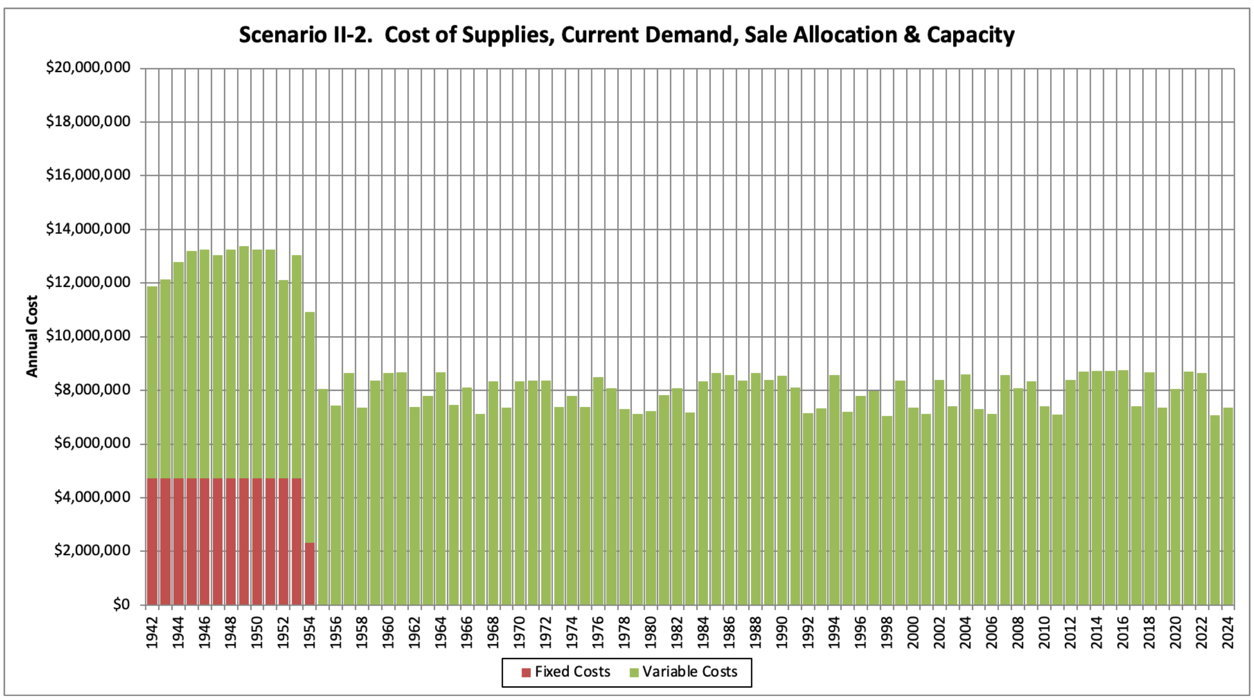

Figure B- 16. Cost of supplies for Scenario II-2 from results of 83 years of hydrology in the model. Current demand, sale of a portion of SWP allocation and capacity. The assumption is that SWP fixed costs would be reduced by an amount proportional to the amount of SWP sale.

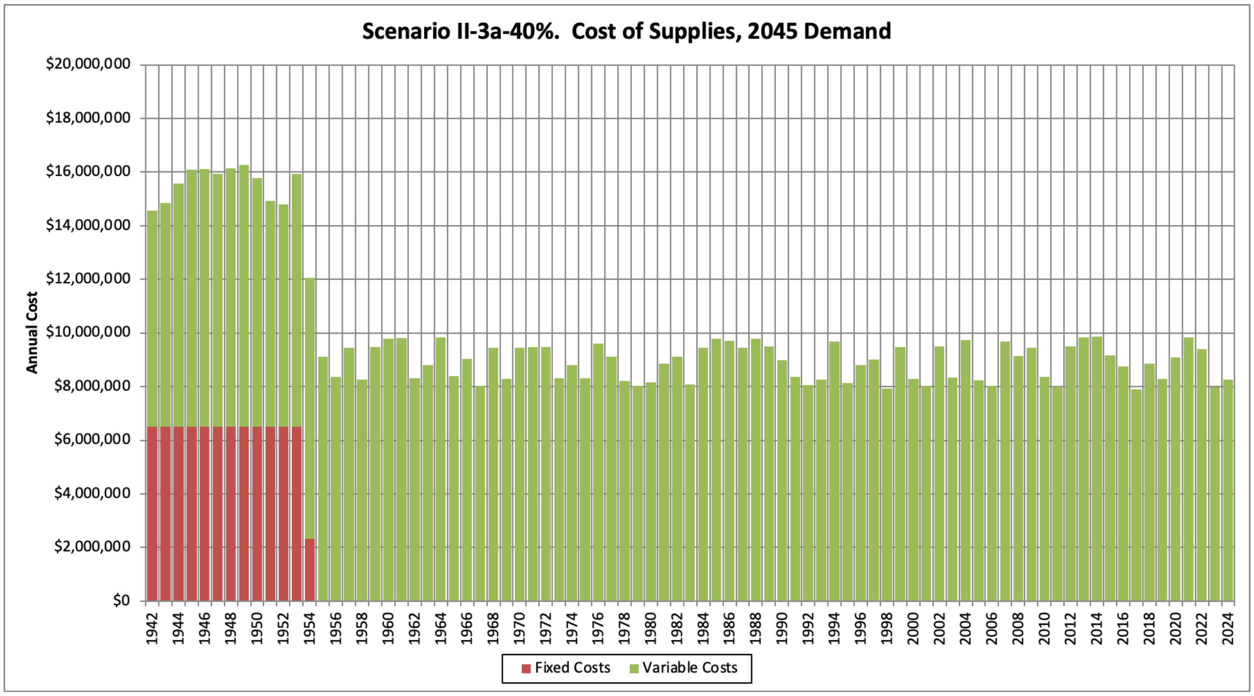

Figure B- 17. Cost of supplies for Scenario II-3a-40% from results of 83 years of hydrology in the model. SWP is at 50% "level of concern" and Cachuma allocations are reduced by 40%.

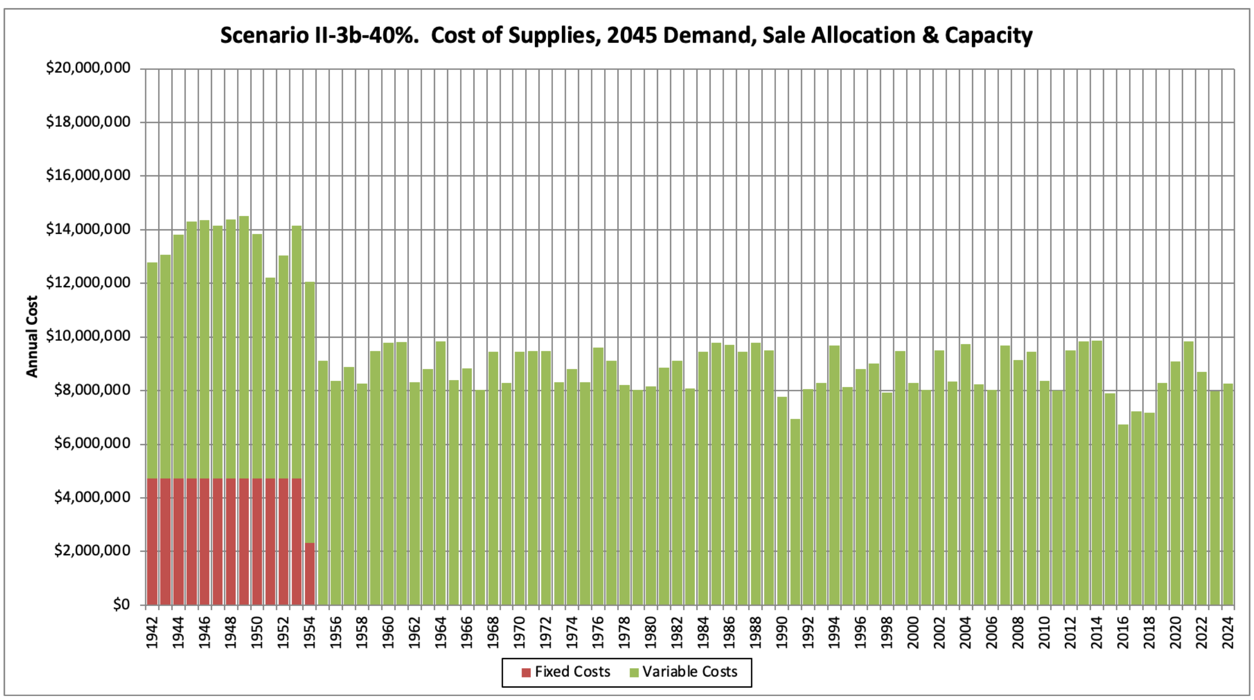

Figure B- 18. Cost of supplies for Scenario II-3b-40% from results of 83 years of hydrology in the model. 2045 demand, sale of a portion of SWP allocation and capacity. The assumption is that SWP fixed costs would be reduced by an amount proportional to the amount of SWP sale.

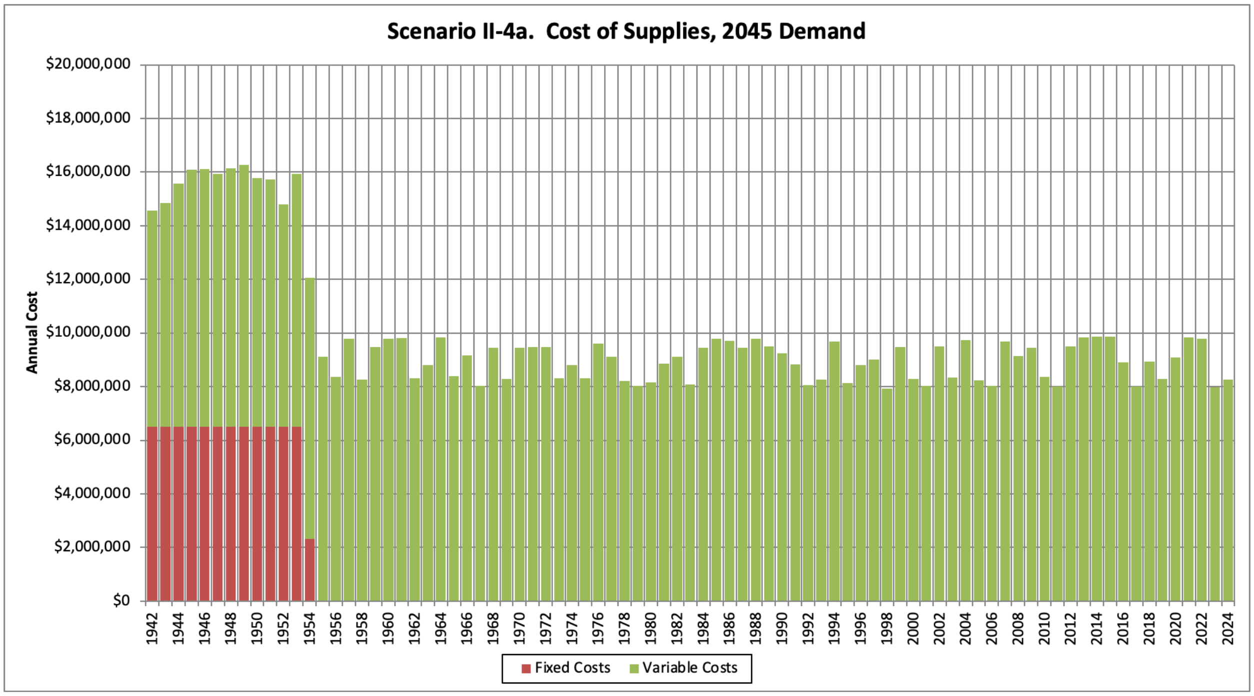

Figure B- 19. Cost of supplies for Scenario II-4a from results of 83 years of hydrology in the model. SWP is at 75% "level of concern" and Cachuma allocations are reduced by 30%.

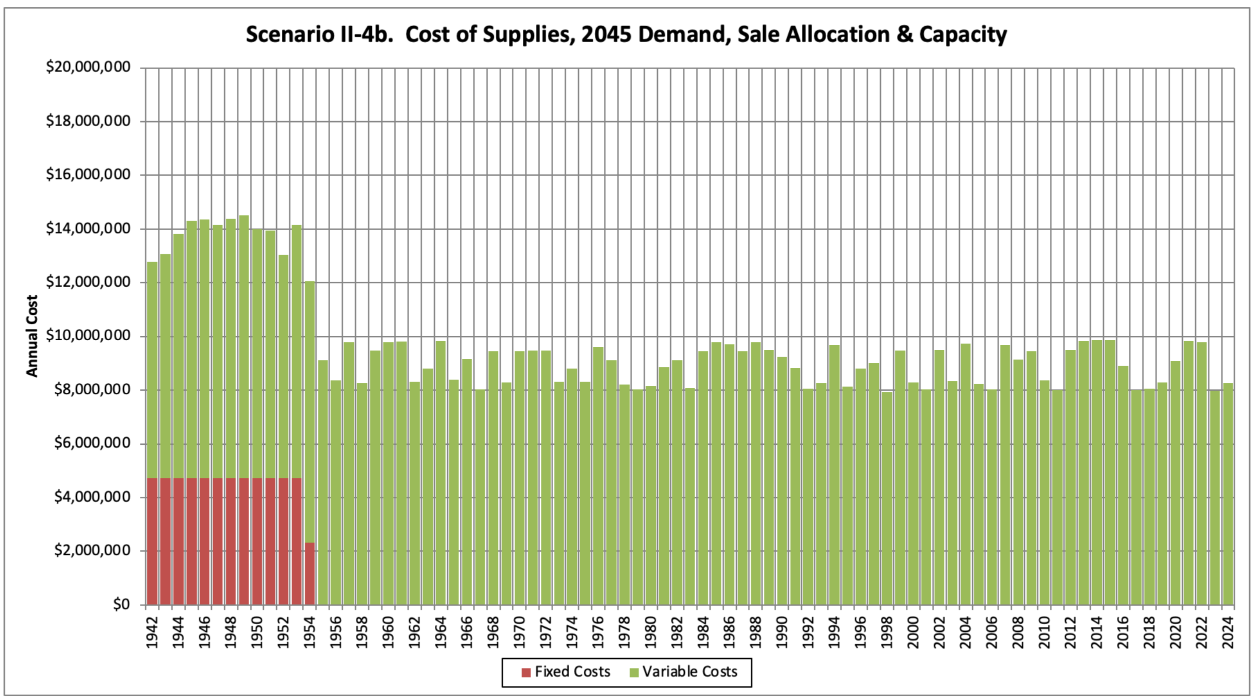

Figure B- 20. Cost of supplies for Scenario II-4b from results of 83 years of hydrology in the model. SWP is at 75% "level of concern" and Cachuma allocations are reduced by 30%. The assumption is that SWP fixed costs would be reduced by an amount proportional to the amount of SWP sale.

APPENDIX C. OTHER CONSIDERATIONS

Following discussions with MWD's Board of Directors, other potential strategies to avoid unsourced demand were also considered. These strategies attempted to overcome the decrease in pumping capacity out of Cachuma during the driest years by bringing in stored water from SemiTropic earlier in a dry sequence of years; this would potentially preserve supplies on the South Coast that are not subject to the Cachuma conveyance limitation. Also evaluated was using Jameson supplies in excess of the rule curve during these driest years. Scenario II-4b, which is considered to be the most realistic future scenario, was used as the basis for this evaluation. This scenario includes SWP 75% LOC (40% Table A average delivery), a 30% reduction in Cachuma allocation, and a sale of 1,400 AFY of SWP allocation. No additional supplies or storage projects are included in this scenario.

A second set of model runs involve more catastrophic scenarios – permanent loss of Jameson, Cachuma, or WSA (desal) following a partial sale of SWP. These scenarios test whether there is unsourced demand after SWP sale in these catastrophic events. Scenario II-4b was also used as the basis for these model runs.

Scenario II-6a – SemiTropic recovery early in sequence of dry years: This scenario examines whether it is beneficial to recover a portion of SemiTropic storage early in a dry-year sequence, transport it to Cachuma, and use it to satisfy unsourced demand. This scenario tested bringing in SemiTropic water in either the second, third, or fourth dry year in a row. **Results**: There was no unsourced demand in any of the years when SemiTropic water was delivered to Cachuma. Thus, the SemiTropic water was not used to meet demand and remained in storage in Cachuma. When there was unsourced demand later in the sequence of dry years, Cachuma Lake levels were low, and water was required to be pumped out of the reservoir. As discussed earlier in this document, conveyance rates are lower when pumping is required. Therefore, there was no remaining pumping capacity to transport SemiTropic water to the South Coast, and the SemiTropic water in Cachuma was eventually lost the next time Cachuma spilled. Thus, this strategy had no advantage in providing water to satisfy unsourced demand.

Scenario II-6b – SemiTropic recovery displaces Jameson use: This scenario is similar to Scenario II-6a, except Jameson water was not used in the year that SemiTropic water is recovered and transported to Cachuma. In theory, SemiTropic water would fill in the demand for Jameson water in that year, preserving Jameson storage for subsequent dry years. **Results:** As indicated in Table C- 1, eliminating Jameson supply in any year creates a small amount of unsourced demand (there is insufficient pumping capacity to bring SemiTropic or any other water from Cachuma to replace the Jameson supply). At the peak of the drought (in this case 2017), there is a small reduction in unsourced demand using this strategy. Thus, this strategy just trades unsourced demand from one year to another and is not particularly beneficial. In addition, the SemiTropic water brought to Cachuma was lost in the next Cachuma spill.

Unsourced Demand				
Scenario	II-4b	II-6b-2nd Dry Yr	II-6b-3rd Dry Yr	II-6b-4th Dry Yr
2013	-	7	-	-
2014	-	-	9	-
2015	-	-	-	4
2016	-	-	-	-
2017	20	13	13	13
2018	-	-	-	-

Table C- 1. Unsourced demand for Scenario II-6b when SemiTropic water is substituted for Jameson supplies in second, third, or fourth dry year in a row. There is a small amount of unsourced demand in the years when Jameson is not used, whereas there is a small reduction in unsourced demand in 2017 at the peak of the drought.

Scenario II-6c – Extra Jameson water used to meet unsourced demand: This scenario temporarily draws on Jameson in excess of the rule curve to meet unsourced demand. This extra draw is replaced the next time Jameson spills, which occurs on average every four years. **Results:** Figure C- 1 indicates that the extra draw reduces Jameson storage temporarily, but the storage is renewed at the next spill. This strategy appears to be viable for the small amount of unsourced demand identified in the modeling.

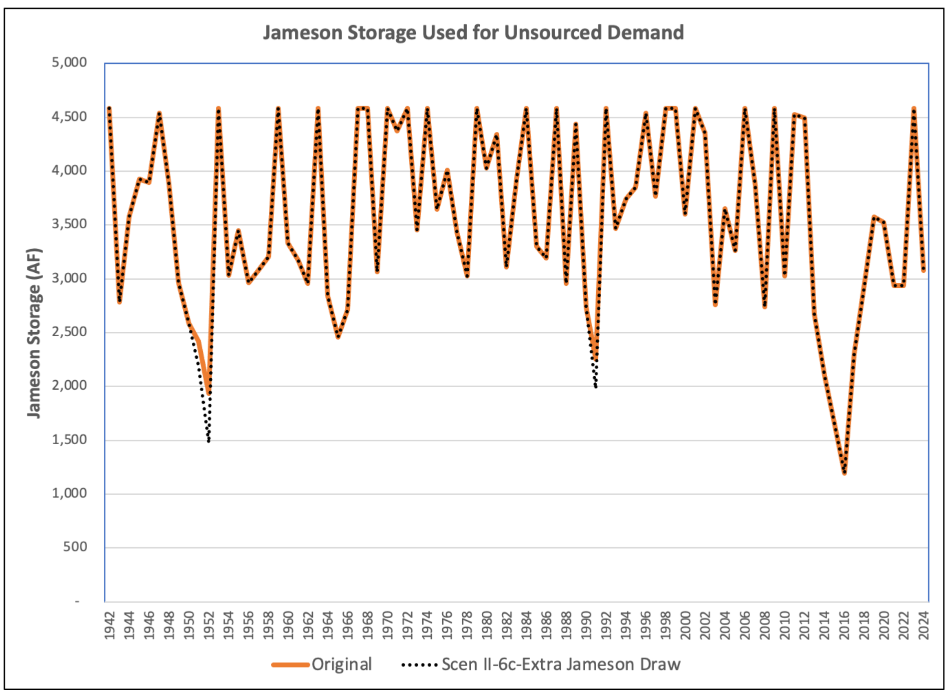

Figure C- 1. Storage in Jameson if there is a temporary extra draw greater than the rule curve to meet unsourced demand. This strategy was run through the 83 years of modeling in Scenario II-6c. Although Jameson storage is temporarily reduced, storage is restored during the next spill.

Scenario II-6d – Combination of Scenarios 6b and 6c: This scenario brings in 1,500 AF of SemiTropic water to Cachuma in third and fourth dry years, with Jameson use eliminated in those years. SemiTropic water would be used first to meet unsourced demand (if there is capacity to bring it from Cachuma to South Coast Conduit), with Jameson water filling in any remaining unsourced demand. **Results:** This combination of scenarios results in no unsourced demand in any of the 83 years of the model. There is significant use of

SemiTropic water during the droughts in the model, with only one year of significant increase in Jameson draws. There is loss of unused SemiTropic water when Cachuma spills – this can largely be mitigated by reducing the amount of SemiTropic water brought to Cachuma in the third and fourth dry years.

Drought Years	Extra Draw from Jameson (AF)	SemiTropic Water to Customers (AF)
1950	210	35
1951	38	215
1987	2	-
1988	-	614
1989	-	-
1990	28	418
2014	9	-
2015	4	892
2017	6	-

Table C- 2. Results on Scenario II-6d indicating the amount of extra draw from Jameson and the use of SemiTropic water during drought years. Unsourced demand is eliminated in these results.

Scenario II-6e – Loss of Jameson supply: In this scenario, Jameson supply is lost for the entire 83 years of the model. As with Scenario II-4b, 1,400 AFY of SWP is sold. By eliminating a supply source near MWD's service area, there is more reliance on bringing water through Lake Cachuma and its conveyance limitations. **Results**: There is unsourced demand greater than 1% of demand in 27% of the model years. The maximum unsourced demand in any year is 18% of demand, or about 900 AFY. The contributing factors in the unsourced demand are conveyance capacity bringing water out of Cachuma and SWP supply shortfalls. The SWP shortfalls occur when annual allocations are reduced during droughts. There is significantly more use of SemiTropic stored water in this scenario. Supplemental water purchases averaging 24 AFY (maximum year of 590 AF) could make up for a portion of these shortfalls – these purchases could reduce unsourced demand to 19% of modeled years and a maximum shortfall of 17% of demand, or 820 AFY. The remaining shortfalls are caused by conveyance limitations both in and out of Cachuma.

Scenario II-6f – Loss of Cachuma supply: In this scenario, Cachuma supply is low for the entire 83 years of the model. As with Scenario II-4b, 1,400 AFY of SWP is sold. **Results:** There is unsourced demand greater than 1% of demand in 37% of the model years. The maximum unsourced demand in any year is 44% of demand, or about 2,200 AFY. The contributing factors in the unsourced demand are SWP supply shortfalls and conveyance limitations. The SWP shortfalls occur when annual allocations are reduced during droughts and some average years. Supplemental water purchases averaging 163 AFY (maximum year of 1,390 AF) could make up for a portion of these shortfalls – these purchases could reduce unsourced demand to 28% of modeled years and a maximum shortfall of 43% of demand, or 2,150 AFY. The remaining shortfalls are caused by conveyance limitations both in and out of Cachuma.

Scenario II-6g – Loss of WSA (desal) supply: In this scenario, WSA supply is lost for the entire 83 years of the model. As with Scenario II-4b, 1,400 AFY of SWP is sold. **Results:** There is unsourced demand greater than 1% of demand in 28% of the model years. The maximum unsourced demand in any year is 35% of demand, or about 1,700 AFY. The contributing factors in the unsourced demand are both conveyance constraints to get water from Cachuma and SWP supply shortfalls. The SWP shortfalls occur when annual allocations are reduced during droughts. Supplemental water purchases averaging 46 AFY (maximum year of 712 AF) could make up for a portion of these shortfalls – these purchases could reduce unsourced demand to 23% of modeled years and a maximum shortfall of 35% of demand, or 1,700 AFY. The remaining shortfalls are caused by conveyance limitations both in and out of Cachuma.

Table 3-7. Projected Water Supply (AF)					
Source of Water Supply	**2025**	**2030**	**2035**	**2040**	**2045**
SWP / CCWA	1,683	1,617	1,551	1,485	1,419
Cachuma	1,591	1,591	1,591	1,591	1,591
Jameson Lake	960	960	959	959	958
Fox & Alder Creek Diversions	400	400	400	400	400
Doulton Tunnel Infiltration	385	385	385	385	385
Groundwater Wells	300	300	300	300	300
Stormwater	0	0	0	0	0
Recycled Water	0	0	0	0	0
Desalination	0	0	0	0	0
Supply from Storage (Semitropic Bank)	1,500	1,500	1,500	1,500	`1,500
Supplemental Water Purchases	0	0	0	0	0
Santa Barbara WSA	1,430	1,430	1,430	1,430	1,430
Santa Barbara Transfer per Juncal Agreement	-300	-300	-300	-300	-300
Total Supplies	7,949	7,883	7,816	7,750	7,683

Table 3-7. From 2020 Urban Water Management Plan with modifications.

Table 3-7 of the 2020 UWMP (Projected Water Supply – modifications shown above) contains a few numbers that are recommended to be updated. For normal year supply reliability, recommendations include:

SWP: Current supply is 1,683 AF (51% of Table A as per DWR 2023), 2045 supply is 1,419 AF (43% of Table A for 50% "level of concern" as per DWR 2023). SWP supplies do not include any future sales of allocation/conveyance.

Cachuma Project: Any future reductions in Cachuma supplies are not known at this time.

Jameson Lake: Average of "normal" years from model, which incorporates Rule Curve: Current supply is 960 AF; 2045 supply is 958 AF.

Doulton Tunnel Infiltration: Average of "normal" years from model derived from 1981-2024 actual data: Current supply is 385 AF; 2045 supply is also 385 AF.

Groundwater Wells: Model has 300 AF for normal years, current and 2045.

Recycled Water: Recycled is 0 AF in model for current and 2045.

SemiTropic: Model has very little SemiTropic used. UWMP may want to treat this differently.

Table 4-7 of the UWMP (Forecast Future Water Use) is recommended to be updated. See discussion in this study in section **Customer Demand**.