



STAFF REPORT

TO: Board of Directors
FROM: Bill Hauck, Senior Hydrologist
DATE: September 7, 2015
SUBJECT: **Presentation and Discussion of TROA Operations During Drought Periods**

FINDINGS

- Under the Truckee River Operating Agreement (TROA) operations, TMWA's projected upstream drought reserve storage is more than adequate to meet customer demand for an additional five (5) years at current demands with repetitive 2015 hydrology, and actually improves with each successive year under the modeled worse-case scenario.
- Under current non-TROA operations, TMWA's projected upstream drought reserves are adequate for another two years at the current demand levels with repetitive 2015 hydrology, but are projected to begin falling short by late September 2017 as reserves are used up. In year eight (8) of the modeled worse-than-worse-case drought, upstream reserves are projected to completely run out during the summer 2018. TMWA would not be able to meet customer demand in years 2018-2020 at current levels under a non-TROA operation.

INTRODUCTION

In order to test the robustness of the region's water supply (in particular the back-up water supply) a hypothetical, five-year worse-than-worse-case hydrologic scenario was developed and processed through a RiverWare Truckee River operations model with actual initial starting conditions, under both a TROA and non-TROA operating regime.

The last four years (2012, 2013, 2014, and 2015) have been the driest back-to-back winters in recorded history, producing the smallest amount of runoff ever seen over a four year period in the Truckee River system. Out of 115 years of actual hydrologic data available for the Truckee River, 2015 was the driest on record. It had the lowest recorded snowpack and the lowest recorded natural runoff. It was also 12% drier than the previous driest year on record which was 1977. Water year 2015 is by any definition the worst water year on record. Creating a hypothetical hydrology that repeats actual 2015 hydrologic conditions for an additional five (5) years could be considered a worse-than-worse-case drought.

What was developed then modeled is in essence a nine-year drought with actual conditions through the first four years (2012-2015) with a repeat of 2015 hydrology for an additional five years (2016-2020). The 9-year drought used for these purposes to test the resiliency of the region's water supply is over two times more severe than the drought of record (1987-1994) plus the additional dry year (1987) currently used for planning purposes. The hypothetical drought has a total April-July runoff volume of just 590 thousand acre-feet (KAF) over the nine-year period compared to an April-July runoff total of 1,271 KAF for the drought of record (with a repeat of 1987) for a total of nine years.

DISCUSSION

The hypothetical drought with actual initialized starting conditions were processed in a RiverWare operations model developed by US Bureau of Reclamation in consultation with the TROA parties to simulate Truckee River operations under both TROA and non-TROA conditions.

The elevation of Lake Tahoe would not be any different under a TROA or non-TROA scenario as the elevation of the lake is currently below its natural outlet. With a repeat of 2015 hydrology for another five years, the elevation of Tahoe would continue to decline under both a TROA and non-TROA condition so that by the end of the fifth modeled year (December 31, 2020) it would be almost eight (8) feet below its natural outlet elevation of 6223.00 feet. See Figure 1 below which shows the continued decline in Tahoe's elevation over the next five years.

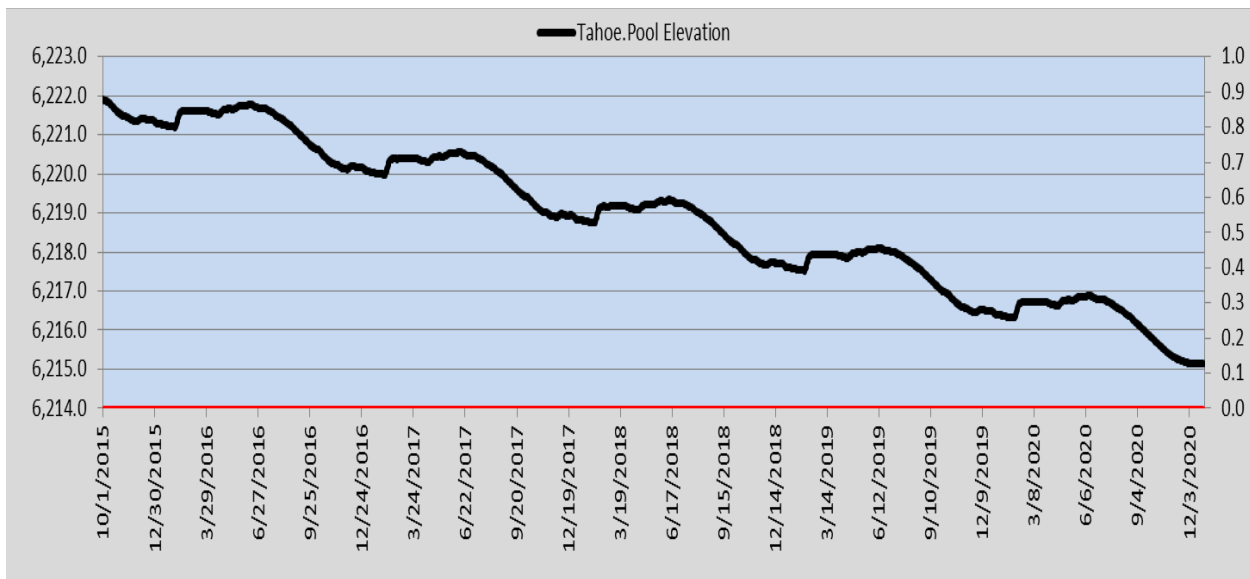


Figure 1. Lake Tahoe: TROA or non-TROA Scenario

The operation of Donner Lake would look very similar in either a TROA or non-TROA scenario also. The usable storage would continue to be released as part of TMWA's drought reserves to meet customer demand beginning on or about September 01 of each year. The lake would then be re-filled again in the spring so that by June 01 of each year storage would be approximately 80% of capacity. See Figure 2 which shows projected storage in acre-feet (2015-2020).

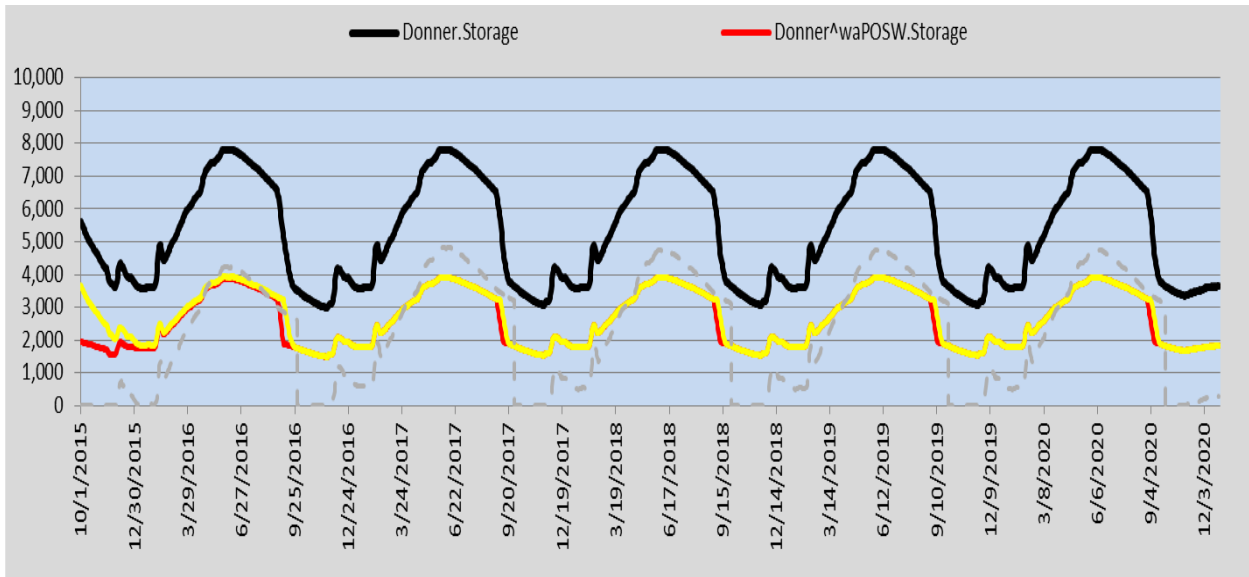


Figure 2. Donner Lake: TROA or non-TROA Scenario

Independence Lake would continue to be operated much like it has been to this point under a TROA scenario as well. See Figure 3 below which shows projected reservoir storage in acre-feet through 2020.

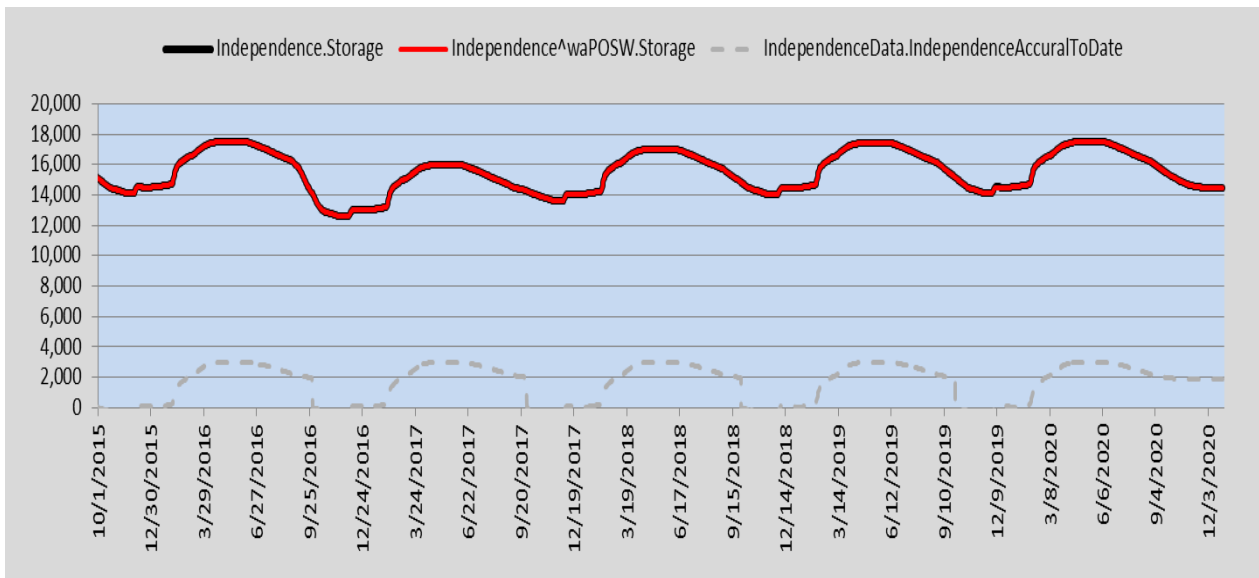


Figure 3. Independence Lake: TROA Scenario

The elevation of Independence Lake would be drawn down each fall as water is released to make room for upcoming spring runoff season and moved down into Stampede Reservoir. The lake would then be re-filled again each spring as usual.

Stampede Reservoir operations, however, would look significantly different under a TROA scheme. Under TROA (as conditions allow), TMWA will be able to begin holding back (in

Stampede Reservoir, among others) the consumptive use fraction of some of its previously unexercised water rights of up to 11,600 acre-feet per year. Figure 4 for example shows projected Stampede Reservoir storage for the next five years. The model shows that TMWA is able to store water throughout the entire planning window (2015-2020) building up drought reserves each year, and continuing to accrue more and more water each successive year.

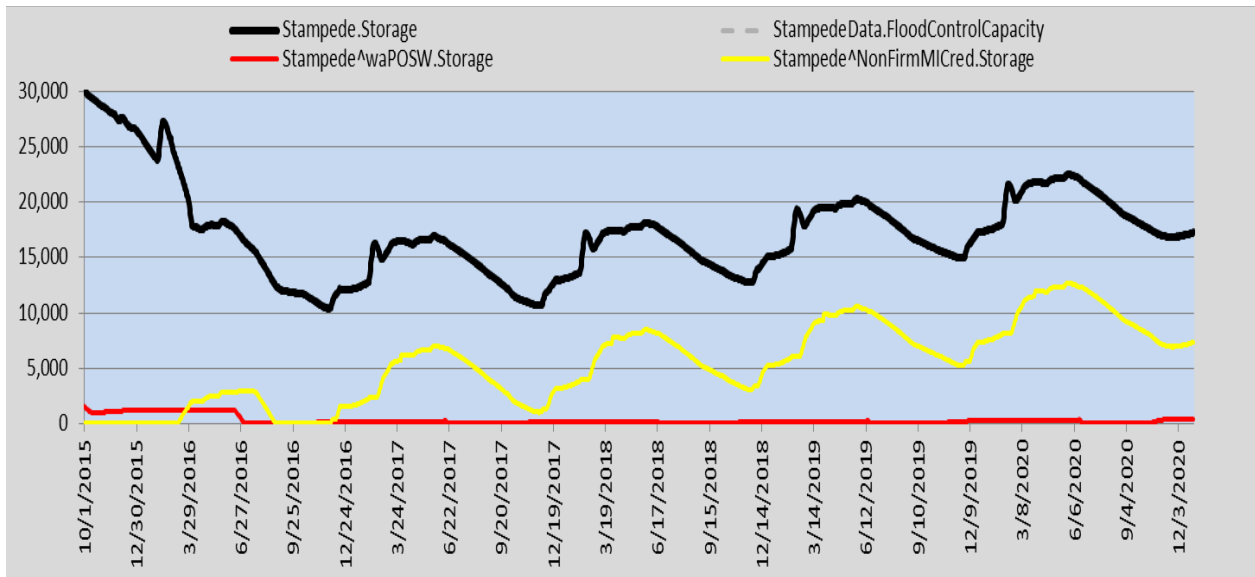


Figure 4. Stampede Reservoir: TROA Scenario

Between Stampede, Boca and Prosser reservoirs, the model results show that TMWA is able to establish the full 11,600 acre-feet each year. This is in addition to TMWA privately-owned water stored in Donner and Independence Lakes. Figure 5 illustrates this point and shows the cumulative surface water sources available each year through 2020 which TMWA would own and/or have available. It can be seen that throughout the course of the year TMWA fills, releases and re-fills these various buckets of water to create a water supply. And that in each year TMWA is using less drought reserve water than it requires or a portion of the total on-hand to meet customer demand, and is actually able continue to accrue and build-up storage, improving its upstream water supply position each year under a TROA operation.

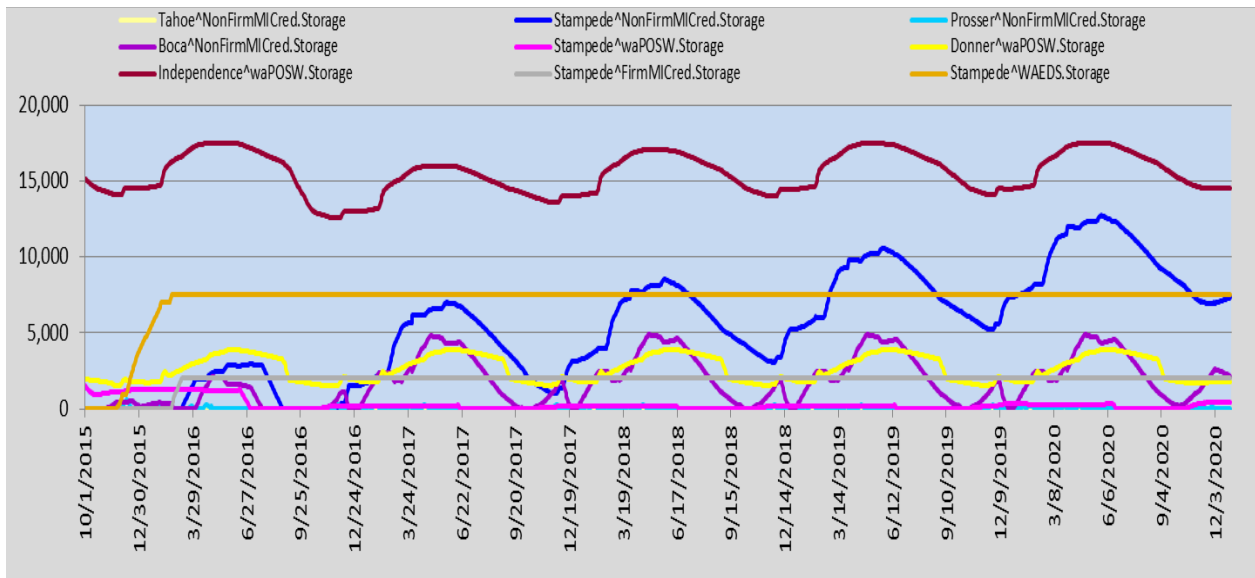


Figure 5. TMWA Total Surface Water Storage: TROA Scenario

Model results show that by the summer of 2020 (June 1st) TMWA would have over 46,000 acre-feet of combined stored surface water in reserve and available for backup (almost double what TMWA had going into the summer of 2015) at current demand levels. This occurs despite a repeat of the worst hydrological conditions for an additional four years (2016-2019). By the end of 2020 (Dec 31, 2020) TMWA would still have almost 34,000 acre-feet in reserve stored between Stampede and Boca Reservoirs and Independence Lake.

The non-TROA modeled scenario on the other hand, while quite resilient is not robust enough to withstand a repeat of 2015 hydrology for another five consecutive years. The results of the model show that TMWA can basically only make it through another two years at current demand levels. The model shows TMWA using roughly 12,000 acre-feet of Independence Lake storage next summer (2016) in order to meet customer demand. This would bring storage down to around 5,500 acre-feet just prior to the winter months of 2016/2017. See Figure 6. TMWA would go into the summer of 2017 with approximately 8,500 acre-feet of storage in Independence Lake which would then be used directly to meet customer demand starting on or about July 1, 2017.

The water stored in Independence Lake along with TMWA’s drought reserves in Donner Lake would be relied upon heavily and begin to run out by the end of September 2017. Figure 7 shows that by October 1, 2017 the model predicts that TMWA has no surface water left in storage. Note that the water shown as “Donner^waPOSW” in Figure 7 on Oct 1 is what is defined as dead storage (i.e. water that cannot be released to meet demand because it is below the natural outlet of the lake).

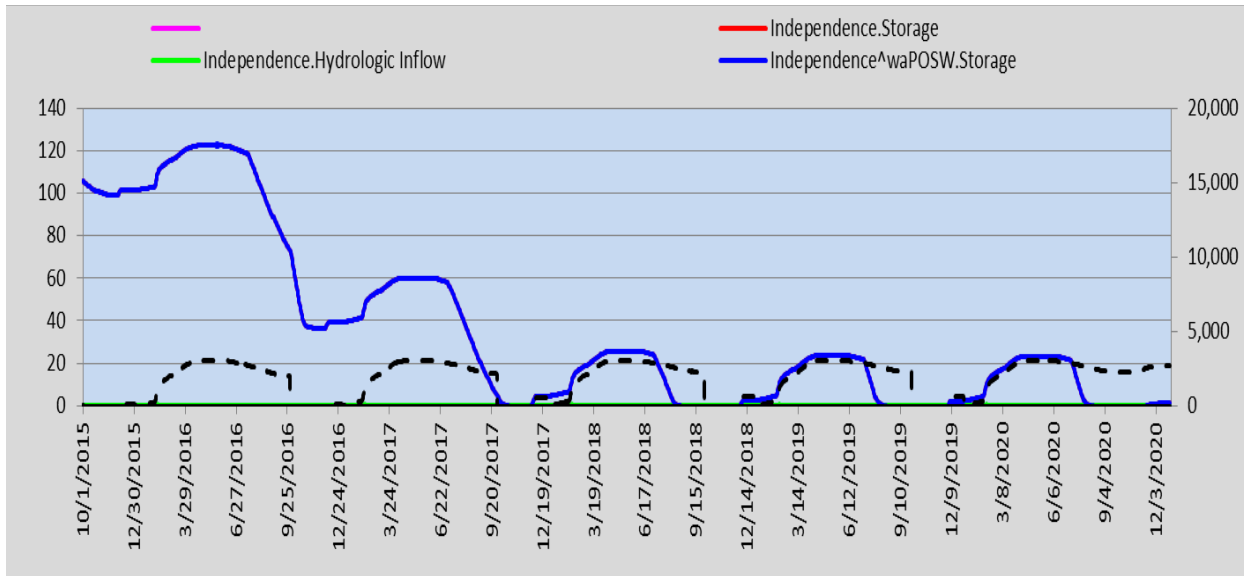


Figure 6. Independence Lake: non-TROA Scenario

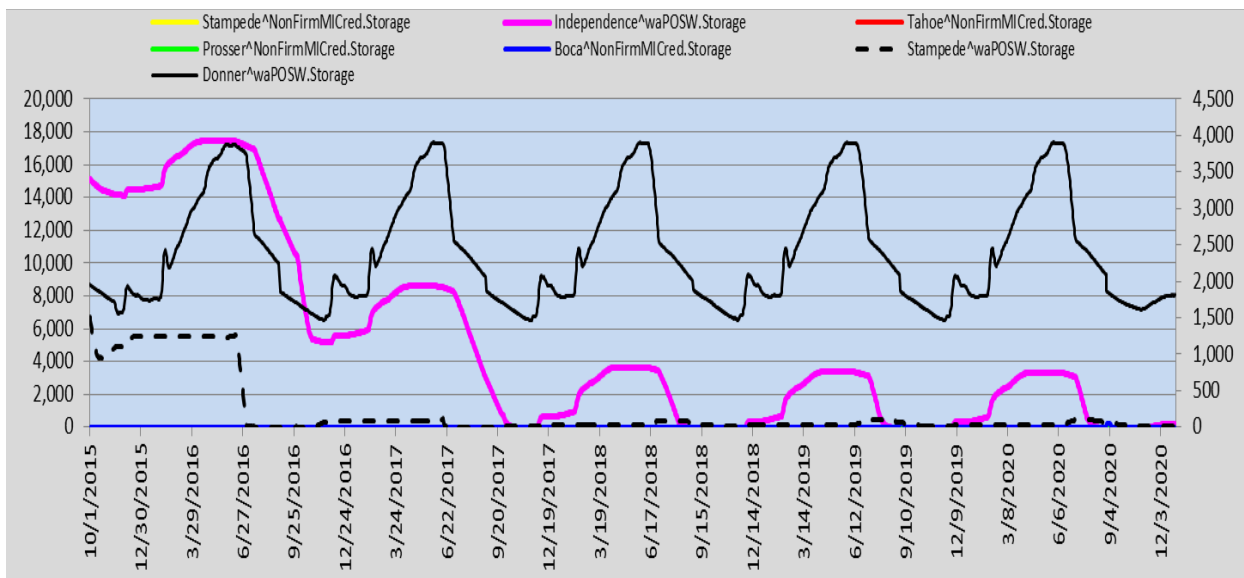


Figure 7. TMWA Total Surface Water Storage: non-TROA Scenario

SUMMARY

The results of the model runs show that with TROA the region can withstand a hypothetical drought more than 2 times as severe as the drought of record - the 1987-1994 drought plus additional dry year (1987) added onto the back end to create a nine-year event.

Under TROA operations, by the end of the nine-year simulated drought, the model shows that TMWA would still have almost twice as much upstream drought storage as it did going into the summer of 2015. The hypothetical hydrology created for this analysis repeated actual 2015 hydrology for an additional five years onto the end of the current four-year drought (2012-2015).

The additional 5 year worse-than-worse-case hydrology makes for a hypothetical drought unlike the Truckee River system has ever seen in recorded history.

Under a Non-TROA scenario the regional water supply would be able to hold up for another two years (through 2017) under modeled hydrological conditions. But by the October 1, 2017 TMWA would have exhausted its drought reserves. This means that TMWA would run out of drought storage by mid-summer 2018.