From: Ronald Gertson <ronaldg59@gmail.com>
Sent: Friday, October 05, 2018 12:19 PM
To: LCRAWMP
Subject: WMP public comments

*****From an external source – Think before you click. *****

LCRA WMP staff,

This submission is intended to serve as our formal submission of the oral comments I made at the meeting yesterday, Oct. 4. CWIC has retained Joe Trungale to accomplish modeling runs on our behalf. Those runs have demonstrated there are a number of changes to the current LCRA model run that could significantly benefit water availability for first and second crop in less critical years. We recognize that the curtailment scheme in LCRA's base model run merely assumes the same curtailment criteria as was adopted in the 2015 WMP.

The addition of significant additional water supplies from the Arbuckle Reservoir combined with LCRA's decision to model lower stored water demands for irrigation from the highland lakes makes it possible to accomplish the following changes within the TCEQ framework:

1) Lower the trigger for moving from Normal to Less Severe Drought from 1.6 to 1.4 MAF.
2) Lower the trigger for beginning second crop curtailment from 1.55 to 1.4 MAF.
3) Use any of unused first crop allocation as of July 1 (out of the initial 178,000 ac-ft) to fulfill second crop allocation up to the full second crop allocation of 66,000 ac-ft.

It is our request that these changes be made in this newest revision to the WMP.

The WMP originated with the intent of establishing a predictable, reliable balance between firm and interruptible water demands while holding firm users whole through a repeat of the drought of record. It is our understanding that interruptible supplies are not to be unnecessarily interrupted, and should be met to the maximum extent possible. LCRA's modelling is not accomplishing this as we have demonstrated by successfully modelling the above changes. These changes drastically reduce the number of modeled first and second crop partial curtailments.

Please do not hesitate to contact me to further discuss these requests.

Sincerely,
Ronald Gertson
Chair, CWIC
Ronaldg59@gmail.com
979-758-4670

From: Jordan Furnans <jordan.furnans@lrewater.com>
Sent: Friday, October 05, 2018 3:06 PM
To: John Hofmann; David Wheelock; LCRAWMP
Subject: Formal Request - WAM Files for Firm Yield Computation

*****From an external source – Think before you click. *****

Hello John, David -

I'd like to formally request the WAM files used by LCRA in performing firm yield modeling as presented at the WMP meeting on 10/4/2018. I need these files ASAP so that I may review them and provide comments by LCRA's requested 10/12/2018 deadline.

Thanks!

Jordan

Jordan Furnans, PhD, PE, PG
Vice President & Manager - TX Operations
NSPS Certified Hydrographer

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From: Jordan Furnans <jordan.furnans@lrewater.com>
Sent: Monday, October 08, 2018 9:06 AM
To: LCRAWMP
Subject: Lower curtailment triggers?

***From an external source – Think before you click. ***

Hello LCRA -

I heard that after the meeting on Thursday, CWIC members presented the idea of lower curtailment triggers and still maintaining the 600k limit. Can you provide me with the material they presented to support this claim? I'd like to review it in prep for my comments to be submitted on Friday.

Thanks

Jordan

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COMMENTS ON
ASSUMPTIONS UNDERLYING THE WATER AVAILABILITY MODEL USED TO SUPPORT DEVELOPMENT OF THE LCRA WATER MANAGEMENT PLAN REVISION
2. LOWER BASIN RELIABLE RUN-OF-RIVER SUPPLIES
Steve Box, Environmental Stewardship

Environmental Stewardship (ES) recognizes that the LCRA has taken the position that groundwater-surface water interaction is not within the scope of the WMP process[1]. However, LCRA uses the term "base flow" [2] in section 2.2 of the WAM assumptions in a way that is confusing. Base flow is a term used in surface water management to mean a measure of groundwater contribution to surface water flows. Since "reliable run-of-river" monthly flows described in section 2.2 of the WAM assumption are not, according to our discussion, truly base flows, we would suggest that another term be used. However, we believe it is important to recognize that any quantity of flow not otherwise accounted for in the surface water mass balance calculation is likely groundwater and should be recognized as such. We further assert that understanding and quantifying true base flows in the reaches of the river identified in the WAM assumptions are important to managing flows running through the lower basin in order to protect environmental subsistence flows and to more accurately manage releases from the Highland Lakes.

The reliability of groundwater base flows during base-dry and drought conditions are of high concern to ES and should be given adequate consideration and protection as LCRA seeks to efficiently manages water in the lower basin to achieve its goals of 1) delivering water from the Highland Lakes and 2) protecting environmental flows. Given the uncertainties related to surface-water flows and releases from the Highland Lakes during drought, groundwater flow must be relied upon to a great extent to provide environmental flows to ensure that both subsistence instream flows and freshwater inflows to the bay are met to the greatest extent possible. Due to the role that the interaction between groundwater and surface water play in ensuring "reliable" supplies for environmental flow and other uses, we find it perplexing that the LCRA is insisting on the position that these are outside the scope of the WMP revisions.

ES conducted an analysis of what appears to be the basis for the quantities estimated by LCRA staff for the specific reaches of the river in section 2.2 of the subject document. ES' analysis used the information cited in INTERA's report to the CL-BBASC focusing primarily on the studies in Section 4, Previous Colorado River Surface Water-Groundwater Studies. Gain-Loss studies by LCRA's then hydrologist Geoffrey Saunders seem to fit the data pretty well and should serve as the foundation for estimating the contribution of groundwater "base flow" that <u>should</u> be available in these reaches.

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[1] LCRA Water Management Plan Update Process: Participant comments through Aug. 31, 2018, and LCRA responses, Comments from Environmental Stewardship, *LCRA's response: Groundwater-surface water interaction is outside the scope of the WMP revision. Determining the amount of groundwater that may have contributed to base flows in the Colorado River is outside the scope of the WMP revision. Environmental Stewardship may wish to review the naturalized flows for the Colorado River, which include numerous dry periods over the period of record, including recent drought years.*

[2] INTERA. August 2017. Final Report: Field Studies and Updates to the Central Carrizo-Wilcox, Queen City, and Sparta GAM to Improve the Quantification of Surface Water-Groundwater Interaction in the Colorado River Basin (CL BBASC Report), Sections 2, 3 and 4 discuss the relationship between groundwater and base flow.

Based on the above and observation 6, ES encourages LCRA to investigate how the estimated reliable run-of-river supplies can be better measured and managed to "limit" or otherwise guide releases and how those decisions impact on environmental flows throughout the lower basin. For example, what would be the impact if all of the reliable run-of-river limiting values were set at zero (0) and the model depended only on reliable surface water to meet all modeled obligations? What is happening in the alluvium that impacts on base flows in the river channel?

Estimates of Groundwater Base Flows in the lower Basin.

Based on LCRA Staff estimates (Table 2), Saunders' data (Tables 3-5) and our observations, ES finds that groundwater flows in the reaches of the river selected by LCRA for inclusion in the WAM below the Highland Lakes are generally greater than the "reliable flows"; Columbus to Wharton being the exception (Table 1).

Table 1. Differences between LCRA WMP WAM Assumptions and Saunders estimates

Average of Saunders Studies				Difference WMP WAM
	cfs	ac-ft/yr	ac-ft/mo	ac-ft/mo
Austin to Bastrop*	66	47,995	4,000	-4,000
Bastrop to Columbus	82	59,042	4,920	-1,020
Columbus to Wharton	33	23,907	1,992	1,141
Wharton to Bay City	55	39,483	3,290	-1,723
Total Saunders Studies	235	170,426	14,202	-5,602
WMP WAM	186	134,400	11,200	
Difference	50	36,026	3,002	

* Average for 2005 and 2008

We are particularly concerned that the estimate of reliable flows in the Austin to Bastrop reach is set at zero (0) ac-ft/yr. This seems to be a concession that the groundwater contribution from the Carrizo-Wilcox aquifer formations will continue to be negatively impacted by groundwater pumping in the Simsboro formation and therefore cannot be relied upon. Certainly Saunders' 2005 findings for the segment are an indicator of the impact of ALCOA's pumping in the 1990's as observed below, while the 2006 and 2008 findings demonstrate that current conditions in the aquifer are such that historic outflows to the river and its tributaries are still attainable. Groundwater discharges to the Colorado River have been measured for the Carrizo-Wilcox Aquifer in Bastrop County. The measurements ranged from about 22,000 to 36,000 acre-feet per year (Table 6).

The estimate for the Columbus to Wharton reach may be overly optimistic if consideration is given to the information ES provided in our earlier comments regarding the groundwater pumping trends in this reach. Likewise, groundwater outflows to the river in the Wharton to Bay City reach are at risk. Saunders' studies predate the most recent drought that seems to have increased reliance on groundwater pumping for irrigation in this reach since by the installation and use of groundwater wells for irrigation.

Collectively, the above-stated concerns should also be of high interest to the LCRA and other stakeholders interested in having a reliable and sustainable source of water in the lower basin through this and future planning periods while protecting environmental flows.

Observations on the Tables

1. The Mansfield Dam to Austin reach of the river was not included in the Saunders studies.
2. The Austin to Bastrop reach does not cross any other aquifers other than the Carrizo-Wilcox Aquifer in the reach above Bastrop. Therefore the Utley to Bastrop reach estimated by Saunders is a good fit to the Austin to Bastrop reach for purposes of estimating base flow contribution from groundwater.
3. In 2012 Saunders reported " In the reach from Tom Miller Dam in Austin to Bay City, the river was found to gain a total of 183 cfs in November 2010 and 177 cfs in November 2011," Saunders 2012. As such the LCRA WAM Assumption, less the Mansfield Dam to Austin reach would be about 142 cfs, which is low when the Austin to Bastrop reach is set at zero (0), relative to Saunders' estimate.
4. The low cfs reading of -9 in the Austin to Bastrop reach in Saunders 2005 report is likely attributable to ALCOA's Sandow pumping of about 25,000 acre-feet per year during the 1990's that ended after 1999 and before 2005. Pumping for mining purposes in these periods are now available in the updated GMA-12 GAM pumping file (personal communications).
5. The Utley to Bastrop reach crosses outcrop portions of the Carrizo-Wilcox Aquifer consisting of the Hooper, Simsboro, Calvert Bluff and some of the Carrizo formation. As such this reach is a good estimate of the contribution of groundwater from the Carrizo-Wilcox aquifer to base flows.
6. In the report on the 2005 flows (Table 4) Saunders' noted, "The field investigation generally confirmed earlier estimates of travel time and streamflow gain. An interesting finding was that travel time, according to the hydrographs and river miles between gauges, appeared to exceed measured velocities of streamflow. This could be due to underflow in the alluvium, allowing some component of the water to flow down-gradient to the southeast without having to follow bends and meanders in the river channel."

LCRA Estimates and Saunders' Studies

Table 2. LCRA Staff Estimates

2018 WMP WAM Assumptions Base flow reliable river flows estimated by LCRA staff stipulated in WMP WAM			
Specific Reach of River	**ac-ft/month**	**cfs**	**ac-ft/year**
Mansfield Dam to Austin gauge	2,600	43.07	31,200
Austin gauge to Bastrop gauge	0	0.00	
Bastrop gauge to Columbus gauge	3,900	64.60	46,800
Columbus gauge to Wharton gauge	3,133	51.90	37,596
Wharton gaguge to Bay City gauge	1,567	25.96	18,804
TOTAL	**11,200**	**185.53**	**134,400**

Table 3. Saunders 2005 Estimates

Saunders, 2005 Data from November 1999			
	cfs	**ac-ft/yr**	**Aquifer**
Austin to Bastrop	-9	-6,520	CW
Bastrop to Columbus	118	85,484	CW/RK/QC/YJ/GC
Bastrop to Smithville	59	42,742	CW/RK/QS
Smithville to LaGrange	-22	-15,938	YJ
LaGrange to Columbus	81	58,680	GC
Columbus to Wharton	10	7,245	GC
Wharton to Bay City	98	70,996	GC
	217	**157,205**	

Table 4 Saunders 2006 Estimates

Saunders, 2006 Data from November 2005			
	cfs	**ac-ft/yr**	**Aquifer**
Austin to Bastrop			
Utley to Bastrop	98	70,996	CW
Bastrop to Columbus	45	32,600	CW/RK/QC/YJ/GC
Bastrop to Smithville	-48	-34,774	CW/RK/QS
Smithville to LaGrange	22	15,938	YJ
LaGrange to Columbus	71	51,436	GC
Columbus to Wharton	56	40,569	GC
Columbus to Altair	-4	-2,898	
Altair to Wharton	60	43,447	
Wharton to Bay City	11	7,969	GC
Wharton to Lane City	47	34,049	
Lane City to Bay City	-36	-26,080	
	210	**152,134**	

Table 5. Saunders 2008 Estimates

Saunders, 2009 Data from November 2008				Average*		
	cfs	ac-ft/yr	Aquifer	cfs	ac-ft/yr	ac-ft/mo
Austin to Bastrop						
Utley to Batsrop	34.5	24,993	CW	66	47,995	4,000
Utley to Bob Bryant Park	34.5	24,993	CW			
Bob Bryant to Colovista	-4	-2,898	CW			
Colovista to Smithville	-0.5	362	RK/QC			
Bastrop to Columbus				82	59,042	4,920
Bastrop to Smithville	-4.5	-3,260				
Smithville to LaGrange						
LaGrange to Columbus						
Columbus to Wharton				33	23,907	1,992
Columbus to Altair						
Altair to Wharton						
Wharton to Bay City				55	39,483	3,290
Wharton to Lane City						
Lane City to Bay City						
	34.5	**24,993**		**235.3**	**170,426**	**14,202**

* Average of 2005 and 2008 for Austin to Bastrop: 2005 and 2006 for others.

Table 6. Measured Groundwater Discharge to the Colorado River From the Carrizo-Wilcox Aquifer in Bastrop County[3,4,5]

Year	Discharge (cfs)	Discharge (ac-ft./yr.)	Remarks
1918	36	26,060	USGS
2005	50	36,200	LCRA
2008	30	21,720	Saunders

[3] Saunders 2009, page 3.

[4] Note: modeling performed by the TWDB estimated the discharge to the Colorado River to be approximately 45,000 acre-feet per year. TWDB/LCRA (Texas Water Development Board and Lower Colorado River Authority), 1989, *A Digital Model of the Carrizo-Wilcox Aquifer within the Colorado River Basin of Texas,* January 1989, page 45.

[5] ES notes that there is a discrepancy between this statement made in Saunders 2009, page 3 as cited in Table 6 and the data presented in Saunders 2006 estimate where discharge in the Austin to Bastrop reach is 98 cfs and 70,996 ac-ft./yr.

COMMENTS OF THE CENTRAL TEXAS WATER COALITION REGARDING LCRA'S PROPOSED UPDATES TO ITS 2015 WATER MANAGEMENT PLAN

SUBMITTED VIA EMAIL TO LCRAWMP@lcra.org
October 12, 2018

On behalf of the Central Texas Water Coalition (CTWC), thank you for the continuing opportunity to submit comments, questions, and items for discussion with respect to LCRA's development of an updated Water Management Plan (WMP) for the operation of Lakes Buchanan and Travis. These comments include responses to matters raised during or after the most recent LCRA informational meeting on October 4, 2018.

Availability of Water Modeling Details and Data

CTWC wishes to perform a detailed review of LCRA's Firm Yield modeling, which was presented at the 10/4/2018 WMP meeting. To date, it appears that LCRA has not made any of that modeling available for outside scrutiny. In view of the short remaining timeframe for the WMP development process, we would appreciate the release of that information as soon as possible.

CTWC's comments on CWIC's Proposed Approach

After the formal portion of the WMP meeting on October 4th, Ronald Gertson of the Colorado Water Issues Committee of the Texas Rice Producers Legislative Group made a short presentation on some revisions to the WMP that his interest group is proposing. As we understand it, Mr. Gertson proposed: 1) lowering the 1.6 million acre-feet (MAF) trigger for both irrigation seasons to 1.4 MAF; and 2) allowing irrigators to add (bank) all of the allocated water not used in 1st crop into the 2nd crop allocation. Mr. Gertson indicated that his group had asked a consultant to evaluate these proposals, and the water availability modeling results showed that these changes did not cause LCRA's storage reservoirs to drop below 600,000 AF, the minimum combined storage requirement in the 2015 WMP. His stated goal was to further reduce curtailments and allow irrigation customers to have a more reliable supply.

Concerns:

1. The proposal appears to negate the impact of the extended hydrology and additional water from the new Arbuckle Reservoir. This will take more water from the lakes and likely keep them at a lower level than the 2015 WMP before Arbuckle. This will get worse as continued growth causes Firm Demand to continue to increase. As such, lower lake elevations and associated combined

storage levels would make the Firm customers more vulnerable to curtailments during extended droughts, which runs counter to the requirement from the Adjudication **that releases to Interruptible customers must not cause curtailment of Firm customers.** The resultant lower lake levels will also increase the risks related to water access issues for fire-fighting operations.

2. If the expected proposal were to be approved by LCRA, this would mean that all of the costly conservation savings by Firm customers would be transferred to Interruptible customers – who obtain water at greatly discounted rates. Firm customers should be allowed to "bank" their conservation savings via a higher combined storage requirement such as 750,000 AF.
3. CTWC strongly requests that LCRA pursue a more conservative approach to address the low inflows "new normal" situation. This is an issue, as statistical analysis shows that the inflow data prior to 2008 is no longer reliable for planning. Inflows may not be sufficient to maintain the combined storage level at 600,000 AF. In our view, the minimum combined storage should be increased. 750,000 AF should assist LCRA in meeting its obligations for water supplies, demonstrate that the new Arbuckle Reservoir provides a tangible benefit to Highland Lakes storage, and could allow Firm customers to capture their conservation savings.

Consideration of Firm Customer Diversion Points in Water Availability Modeling

Analysis by CTWC shows that water availability from the Highland Lakes is still very tight to support Firm Water customers in the upper basin. LCRA's approach for calculating Firm Yield does not take the actual diversion points of all Firm customers into account. As such, it is unclear how close to the edge we actually are in terms of water availability for new Firm Water sales and if there are any actual water reserves in the upper basin. Looking at the September 1, 2018 list of LCRA customers with contracts for firm raw water supplies, LCRA has issued Firm Water commitments totaling 419,083 acre-feet. This number does not include downstream losses, required environmental flows, and the LCRA Board's 50,000 acre-feet reserved for future use. At the same time, LCRA has presented a new Firm Yield of 418,800 acre-feet. This need for improvements in water availability modeling is particularly relevant since LCRA is relying heavily on additional downstream reservoirs to build up its overall system yield, when the majority of LCRA's Firm customers are located hundreds of miles upstream of those reservoirs, and essentially all of the other new potential water supplies appear to also be out of reach of these same Firm customers. Please explain how much of the 50,000 AF Board Reserve is still available to support the Firm Yield of the Highland Lakes versus the System Yield of the basin.

Recommendations:

- Incorporate the location of the actual diversion points of LCRA's larger customers into the water availability modeling for Firm Yield calculations. This recognizes that some of the Firm customers can only obtain water from Lake Buchanan, and that this limitation should be considered within the water availability models.

Impact of Allocated Interruptible Sales on Actual Water Availability for Firm Customers

When the WMP was first developed in 1989, the actual Firm Demand was much lower and comprised a much lower percentage of the Firm Yield of the Highland Lakes. In addition, the average inflows during the period-of-record at that time were over 1 million acre-feet per year, which provided a major cushion that quickly supported reservoir recovery after periods of drought. These factors supported the initiation of an over-draft practice for Interruptible use that became incorporated into the WMP. It was recognized that this practice would have to change as the Firm Demand approached the Firm Yield, however, no mechanism that links the Firm Yield and associated actual Firm Demand and the actual current inflow trend was developed to manage this transition.

If we fast-forward to today's conditions, all of the fundamental factors that supported the initial WMP process and its tolerance for very high annual stored water releases to Interruptible customers have all significantly changed in an adverse direction. It could be said that the need for the Emergency Orders between 2012-2015 were driven by the sustained very low inflows, and the associated very low combined storage levels provided an early warning signal. Specifically, the fundamental drivers are:

1. the actual Firm Demand has significantly increased driven by rapid growth in Central Texas;
2. the Firm Yield of the Highland Lakes that currently supports the vast majority of the Firm Demand has declined;
3. the high average annual inflows, which supported the over-draft process in the early WMPs, have dramatically declined to a much lower "new normal" driven by higher temperatures and adverse changes in the watershed;
4. water from the new Arbuckle Reservoir cannot directly support the Firm customers in the upper basin and no control mechanisms have been identified for incorporation into the WMP that would reliably keep any of the potential benefits from the downstream Reservoir in the Highland Lakes;
5. the System Yield approach by LCRA does not benefit the Firm Customers in the Upper Basin; and
6. currently identified new potential water supply projects by LCRA do not increase the Firm Yield of the Highland Lakes.

Recommendations:

- The time has come where a much more rigorous process needs to be developed to directly link and carefully manage the Firm Yield of the Highland Lakes, the actual usage from the Highland Lakes by LCRA's Firm customers and environmental requirements, and the Interruptible releases contemplated by the WMP, and to end the risky over-drafting practices that now exist.

- The combined firm yield of the Highland Lakes is the maximum amount of water that can be delivered from the lakes in all years through a repeat of the drought of record. This firm yield should then be considered as the maximum amount of water that LCRA can reliably provide out of the Highland Lakes in any given year. Interruptible releases, or releases made to satisfy needs other than those of LCRA Firm contract holders, should be thus limited to the difference between the firm yield and the expected firm and environmental usage for the 2025 planning period. As firm customer usage increases over time, the amount available for interruptible use should correspondingly decrease.

- LCRA should manage their system so that total annual usage out of the Highland Lakes does not exceed the calculated combined firm yield of the Highland Lakes. LCRA should develop an accounting and water use tracking method that ensures that all water usage and releases from the Highland Lakes is accounted for against the annual usage cap (equal to the firm yield). Release requests should be limited by LCRA so that all annual releases do not exceed the combined firm yield of the Highland Lakes.

Need to Address Lack of a Safety Reserve Associated with Firm Yield Process

The current Firm Yield approach used by LCRA provides no margin of safety or reserve water, meaning that it allows the water level in the Lake Travis and Lake Buchanan reservoirs to be essentially drawn down to ZERO. Given the very adverse downward shift in annual inflows, which used to provide a major cushion at the old inflow levels, it is time to consider the need for development and implementation of a Safe Yield approach that would provide a reserve for Firm Demand. As noted above, LCRA's Firm Water customers now hold contracts for more water than the new Firm Yield that was recently presented to the stakeholders.

Addressing Released but Not Diverted Orders for Interruptible Stored Water

As mentioned in its prior comments, CTWC believes that the financial value of the stored water released for LCRA's Interruptible customers should be recovered by LCRA, and LCRA's determinations of available stored water for use by Interruptible customers should not identify "ordered but not diverted" water as a new supply merely because it has moved from the Highland Lakes to the Arbuckle Reservoir. LCRA should assess fees for all of the water released for downstream irrigation customers, and LCRA should benefit from the release of stored water for Interruptible customers, whether or not the downstream customer diverts the ordered water. As such, it seems appropriate to assess a fee to those customers who choose not to take the water released for them similar to LCRA's assessment of reservation fees on its Firm customers, AND to recalculate the allocation of stored water available for such customers by deducting the volumes of water that were released but not diverted by

that customer to assure that WMP-calculated Interruptible water allocations are not exceeded.

In recent weeks, as LCRA has released additional background documents for this WMP update, we have continued to study this issue and we wish to reiterate the comments above, as well as the high priority nature of these concerns.

The WAM Monthly Model Output from 9/24/2018 indicates that, at times, significant volumes of stored water may be released from the Highland Lakes for LCRA's downstream customers, but that water is not always diverted by the customers who ordered the water. To be clear, CTWC is not advocating that customers who order water must always be required to divert it, as such a position would encourage wasteful, non-beneficial uses of the water released from storage for such a request. Certainly, CTWC understands and respects the occurrence of intervening events, such as heavy rains, that may change an Agricultural Interruptible customer's need for water. But we also believe that LCRA's current way of handling stored water that is "ordered but not diverted" (OND water) should be closely scrutinized and adjusted to avoid the negative consequences of the current practice.

The handling of OND water deserves attention at this point in time for several reasons. First, there has been a major downward shift in the inflows that supply the water stored in the upstream lakes. As a result, and acknowledging the general rule that water flows downhill, management of a diminished supply of water in the upstream storage reservoirs is the key to the ability to deliver the required volumes of water to the Firm Water customers located in the upper basin, as well as the key to the ability to make timely and sufficient deliveries of water to downstream customers.

Second, the sheer magnitude of the stored water that is released but not diverted demands attention. In recent years, according to LCRA's documents, releases have far exceeded the average 46,000 acre-feet (AF) per year volume observed over the historic period of record. In the past, LCRA records indicate that as much as 88,000 AF were released but not diverted. In recent years, over 72,000 AF was released in 2016, almost 76,000 AF was released in 2010, and 44,000 AF was released in 2011, the same year that over 433,000 AF of Highland Lakes water was reported as used for downstream Agricultural Use and the storage in LCRA's upstream reservoirs experienced dramatic declines.

Third, in the absence of management controls on OND water, there are serious reliability questions on the output of WAM runs as related to the ability to gauge how close we actually are relative to the 600,000 AF minimum combined storage threshold. If the timing and frequency of OND water is unpredictable, and the total potential volume of OND water is essentially unlimited, it seems logical that these uncertainties would put the accuracy of water availability modeling work into question.

Fourth, given the trend of much lower inflows and the limited supply of available water for Firm Water customers located in the upper basin, it seems that the entire OND

management practice should be carefully evaluated. For comparison purposes, the 2016 OND release volume of 72,000 AF represents about one-half of the entire City of Austin's annual water usage. As LCRA knows, its water resources are limited and valuable, and developing new water supplies can be very expensive, requiring many years of dedicated time and effort, in order to identify, fund, and implement new water projects. As a result, LCRA's methods for handling OND water warrant close attention and evaluation.

Fifth, it is unclear how the OND water is accounted for with respect to its potential capture in the Arbuckle Reservoir downstream. Is it counted toward the total maximum allocations for an Irrigation Operation? Please explain how this water is handled with respect to allocations for each Irrigation Operation, as well as how this water is handled in LCRA's water availability modeling.

Sixth, it appears that LCRA gains no revenue from its release of stored water that becomes OND water. LCRA should evaluate mechanisms for allocating this water to the customers who ordered it, along with options for recovering at least some of LCRA's costs associated with the release of the water. Also, please explain how OND water is considered when LCRA sets rates for its various customers, and how the customers for this water contribute toward recovery of LCRA's costs-of-service.

Recommendations:

- LCRA should develop and implement procedures for management of "ordered but not diverted" (OND) water, and these management procedures should be specifically described in LCRA's next WMP.

- A new monthly reporting process is needed to track releases of stored and storable water from the Highland Lakes, including OND water. An analogous process should be used for the Arbuckle Reservoir.

- Management of OND water presents an opportunity for helping to extend the effective water supply. Given the cost and difficulty of development of new water, particularly in the upper basin, it appears, at a minimum, that a strong control and accounting system is needed, and strong consideration should be given to significantly limiting the practice.

- LCRA should also evaluate mechanisms for directly allocating and charging a meaningful fee for this water to the customers who ordered it. Price adjustments could be made if this OND water is captured by the Arbuckle Reservoir, and subsequently ordered and used. However, OND water should not provide additional water over and above the total annual Interruptible water provided for in the WMP.

Respectfully submitted,
Jo Karr Tedder
CTWC President