Texas Commission on Environmental Quality

INTEROFFICE MEMORANDUM

To: Sarah Henderson, Project Manager
Water Rights Permitting Team
Water Rights Permitting & Availability Section

Date: July 1, 2015

From: Kathy Alexander, Ph.D.
Technical Specialist
Water Rights Permitting & Availability Section

Subject: Lower Colorado River Authority
WRPERM5838
CN600253637
Colorado River, Colorado River Basin
San Saba, Llano, Lampasas, Burnet, Blanco, Travis, Bastrop, Fayette, Wharton, Matagorda, and Colorado Counties

Non-Substantive Changes to Technical Memorandum

On June 26, 2015 the Lower Colorado River Authority (LCRA) provided comments on staff's June 11, 2015 technical review. Staff revised the next-to-last sentence of the third paragraph on Page 5 to reference the correct date of March 1. The revised memorandum is attached.

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WATER AVAILABILITY REVIEW ADDENDUM

LCRA's Water Management Plan and Proposed Amendments

The Water Management Plan for the Lower Colorado River Basin (WMP) defines the Lower Colorado River Authority's (LCRA) water management programs and policies in accordance with the Final Order of Adjudication of the water rights for the Lower Colorado River Authority, the Enabling Act of the Lower Colorado River Authority, General Law of the State of Texas, particularly the Texas Water Code, LCRA's Certificates of Adjudication Nos. 14-5478 and 14-5482, the Commission's Orders concerning the WMP, and the water policies of the LCRA's Board of Directors. TCEQ considers the WMP to be part of LCRA's water rights. Amendments to the WMP were last approved by the Texas Commission on Environmental Quality (TCEQ) on January 27, 2010.

The 2010 TCEQ order approving the previous amendment to the WMP required LCRA to file another amendment to address the following in its WMP:

- Interruptible curtailment procedures to ensure LCRA can satisfy projected firm customer demands during intense drought conditions such as those experienced over the past several decades;
- Evaluation of the criteria for determining a drought worse than the Drought of Record;
- Evaluation of the minimum combined storage in Lake Travis and Buchanan that would be necessary or appropriate to protect firm water customers either during a repeat of the Drought of Record or under worse conditions;
- Incorporation of changes to address LCRA's agreements with STP Nuclear Operating Company (STPNOC);

- LCRA's 2007 agreement with the City of Austin regarding return flows in the lower Colorado River;
- Revisions to LCRA's procedures for providing water for environmental flows using the best scientific data available including provisions to accommodate changing conditions within a year, limiting intra-daily fluctuations in streamflows, and, to the maximum extent reasonable, specification of an overall instream flow regime.

LCRA submitted the original application on March 12, 2012 (hereinafter 2012 WMP) and staff completed technical review on April 15, 2013. The application was sent to notice and the comment period ended on May 28, 2013. On June 3, 2013, TCEQ notified the LCRA that staff would be performing further evaluation to take into account recent streamflow data and public comments. On June 26, 2013, TCEQ held a meeting to obtain input from stakeholders throughout the Colorado Basin.

TCEQ performed an intensive and detailed modification of the 1940-1998 naturalized streamflows and updated these streamflows to extend the period of record from 1940-2013. TCEQ used the extended naturalized streamflows (1940-2013) to model LCRA's proposed interim curtailment curves for interruptible agricultural releases in the 2012 WMP application, and to review LCRA's proposal to change the combined firm yield.

Based on the updated models, staff determined that the curtailment curves in the 2012 WMP application would not be sufficient to protect firm customers during extraordinary drought conditions such as those experienced in the 1950s or the current drought, or less severe droughts. TCEQ's modeling demonstrated that the WMP should include a more robust and comprehensive drought management regime that accounts for extraordinary drought conditions and less severe droughts. The drought management regime would likely need to include more stringent curtailment curves with a higher limit on when interruptible water releases would be completely curtailed during drought conditions. TCEQ made the report available to the public on May 16, 2014. The report is available at http://www.tceq.texas.gov/assets/public/agency/lcra/DraftNaturalizedStreamflowandModelingReport_5_16_2014_Reportonly.pdf

On October 31, 2014, LCRA submitted a revised and supplemental application to amend its WMP (hereinafter 2014 WMP) which was intended to replace the 2012 WMP application. The 2014 WMP application largely reflect the proposed changes in TCEQ's May 16, 2014 report. LCRA also submitted an updated model file on November 18, 2014. In addition, on January 7, 2015, TCEQ held a meeting to obtain input on its May 16, 2014 report and LCRA's 2014 WMP application from stakeholders in the Colorado River Basin. LCRA submitted additional models on March 5, 2015 that incorporate LCRA's proposed 2014 WMP amendment into TCEQ's Full Authorization model.

LCRA subsequently filed another revision to its application on May 21, 2015 to delete the part of its application requesting to remove from the WMP those elements of LCRA's Raw Water Drought Contingency Plan that are required by TCEQ's rules in 30 Tex.

Admin. Code Chapter 288 but not required by prior WMP orders.

LCRA's 2014 Water Management Plan Definitions and Revisions

Definitions
LCRA provides definitions for specific terms and concepts that are used in and only applicable to its WMP. Some of these terms and definitions (Section G of LCRA's Executive Summary) are:

Combined Firm Yield of Lakes Buchanan and Travis: the calculated firm yield of Lakes Buchanan and Travis when operated as a system, incorporating LCRA's agreements and operating assumptions regarding calls on the upper basin. The combined firm yield is based on the 1940s to 1950s historic Drought of Record;

Combined Storage: the total volume of water stored in Lakes Buchanan and Travis at a given point in time. For purposes of making various determinations under this WMP, the Combined Storage means the total of the daily average volume of water in Lakes Buchanan and the daily average volume of water in Lake Travis;

Drought of Record (DOR): the worst hydrologic drought for which streamflow records are available and is considered to be the period of time during recorded history when natural hydrologic conditions provided the least amount of water supply. For the WMP, the Drought of Record is the drought of the 1940s and 50s;

Drought Worse than the Drought of Record (DWDR): a drought condition identified by the LCRA Board of Directors where an ongoing drought has a real likelihood of becoming a new Drought of Record. A DWDR declaration would trigger action to cut off interruptible stored water and implement mandatory pro rata curtailment of Firm Water demands;

Evaluation Date: the date, either March 1 or July 1, on which LCRA will determine the Water Supply Condition, Interruptible Stored Water available for agriculture and effective environmental flow criteria;

Firm Water: water that can be supplied on a consistent (or "firm") basis from Lakes Buchanan and Travis through a repeat of the worst drought in recorded history for the lower Colorado River basin, which is the drought of the 1940s and 50s, while honoring all downstream water rights. This drought is known as the Drought of Record;

First or Main Crop Season: refers to the first part of the irrigation season when LCRA may be providing water to the downstream agricultural operations for agricultural purposes; this part of the irrigation season normally runs from March through about July and is coincident with growing of the first or main crop of rice...;

Inflows into Lakes Buchanan and Travis: the total inflows into Lakes

Buchanan and Travis based upon flow readings at certain gages upstream of Lakes Buchanan and Travis (without any adjustment for the Pass-Through of water to meet downstream demands associated with senior water rights);

Interim Demands: for Firm Water demands, a level of demand about halfway between year 2010 and 2020 projected demands...(that) take into account the timing in which certain demands are expected to occur;

Interruptible Stored Water: water from Lakes Buchanan and Travis that must be cut back or cut off during drought or times of shortage to ensure that LCRA can meet Firm Water customer demands;

Pass-Through: the amount of inflows into the Highland Lakes that is being passed through the lakes to meet demands of senior water right holders downstream;

Second or Ratoon Crop Season: refers to the second part of the irrigation season when LCRA may be providing water to the downstream agricultural operations for agricultural purposes; this part of the irrigation season normally runs from about August through mid-October and is coincident with growing of the second or "ratoon" crop of rice...;

Storable Inflows: For purposes of making the determination of water available from Lakes Buchanan and Travis to help meet certain environmental flows, the term "Storable Inflows" means the Inflows into Lakes Buchanan and Travis based upon flow readings at certain gages upstream of Lakes Buchanan and Travis minus any required Pass-Through of Inflows;

Water Supply Condition: a condition based upon Combined Storage and Inflows into Lakes Buchanan and Travis that is used to determine Availability of Interruptible Stored Water and environmental flow criteria. The three Water Supply Conditions are: Normal, Less Severe Drought and Extraordinary Drought.

Revisions

LCRA's revisions to the 2010 WMP fall within four areas: (1) Interruptible Stored Water Availability; (2) new environmental flow criteria based on the most recent scientific studies and implementation of that criteria; and (3) recalculation of the combined firm yield. These substantive changes are discussed in detail below.

1. Interruptible Stored Water Availability

Firm demands take precedence over all other uses; therefore, the proposed amendment to the WMP requests a reduction in interruptible supplies to offset the increase in firm water demand. The reduction is achieved by revising the annual interruptible water supply curtailment policy. Under the 2014 WMP, LCRA will determine availability of Interruptible Stored Water for its Gulf Coast, Lakeside operations and Pierce Ranch separately for First and Second Crop and apply volumetric limits on the availability of Interruptible Stored Water

for each Crop Season. The amount of water available for these irrigation operations will be based on a Water Supply Condition: "Normal", "Less Severe", or "Extraordinary Drought" combined with a look-ahead test. Under the requirements in the WMP for the look-ahead test, if the LCRA Board determines that the Combined Storage would drop below 900,000 acre-feet in the upcoming Crop Season or below 600,000 acre-feet within twelve months, LCRA will not begin releasing water for non-Garwood irrigation operations for that Crop Season.

2. Environmental Flow Criteria

Under the 2010 WMP, LCRA committed 33,440 acre-feet of firm water to help meet environmental needs. LCRA does not propose to change this amount. The 2014 WMP includes changes to the operational procedures that it will use to help meet environmental flow needs and includes an increase in the total average annual combination of Firm and Interruptible Stored Water to help meet these needs. Under the 2014 WMP, the environmental flow criteria can change throughout the year, the criteria used from March through June are based on the Combined Storage on March 1 and the criteria for July through February of the following year are based on the Combined Storage on July 1. The 2014 WMP also includes annual and multi-year caps, consistent with the amounts simulated in development of the 2014 WMP for periods when Combined Storage is below 1.3 MAF. In the event of a pro rata curtailment of Firm Water supplies, the applicable environmental flow criteria will be subject to the same percentage reduction as LCRA's Firm Water customers.

The 2014 WMP includes new instream flow targets based on the most recent scientific studies. These instream flow targets can be found in Tables 2-3 and 4-3 of the 2014 WMP. In previous WMPs, the applicable flow level (target or critical) for instream flows for the coming year was based on the combined storage in Lakes Buchanan and Travis on January 1. LCRA's proposed amendment to the WMP includes two trigger dates. The amount of water provided for instream flows, i.e. whether subsistence, base-dry, or base- average flow levels would apply, will be determined on March 1 for March through June and on July 1 for July through February of the following year. Table 4-4 provides the combined storage triggers at which specific instream flow levels apply.

The 2014 WMP also includes additional criteria for the Bastrop gage and specific operational criteria to meet the instream flow criteria (Pages 4-13 and 4-14 of the 2014 WMP). LCRA will not manage water in the lower Colorado River to specifically provide for pulse flows under the 2014 WMP. However, LCRA will monitor pulse flows during the time period that this amendment to the WMP is in effect to assess whether pulse flows are occurring at the frequency recommended in the 2008 instream flow study of the lower Colorado River.

LCRA's revised freshwater inflow criteria are also based on the most recent

scientific studies. The freshwater inflow criteria include five levels of inflow and a desired achievement guideline for each level. An explanation of the criteria can be found in Table 2-4. and the specific numerical values can be found in Tables 2-5, and 4-6. The 2014 WMP also includes two-month operational criteria to help meet the range of freshwater inflow needs. Tables 2-6 and 4-6 detail the operational criteria LCRA will use to provide freshwater inflows to Matagorda Bay and Table 4-5 provides the values for spring and fall freshets. In all months LCRA will provide, to the extent of Storable Inflows, at least 15,000 acre-feet per month to help meet the Threshold level. For other levels, at the end of each month, to the extent of Storable Inflows, Storable Inflows will be provided as necessary to help meet the Operational Criteria. The 2014 WMP also includes additional limitations which may reduce the amount of water LCRA provides to help meet freshwater inflow needs (Pages 4-16 through 4-17). The combined storage triggers at which specific freshwater inflow levels will apply can be found in Table 4-7.

3. Combined Firm Yield

LCRA requests a change to the combined firm yield of Lakes Buchanan and Travis. Under the 1988 Adjudication Order, LCRA's firm commitments shall not exceed the combined firm yield. The Combined Firm Yield represents the maximum amount of water LCRA can commit from Lakes Buchanan and Travis for firm water supply. In addition, the LCRA Board has reserved 50,000 acre-feet of the combined firm yield for future needs. The previous determination of the combined firm yield used the LCRA's RESPONSE model, which simulated the operation of Lakes Travis and Buchanan using a period of record from 1941-1965. Senate Bill1 (75th Legislature in 1997) funded the creation of new water availability models for the state of Texas. The TCEQ WAM for the Colorado River Basin was completed in December of 2001. LCRA used a modified version of the TCEQ WAM for the Colorado River Basin to determine the Combined Firm Yield of Lakes Buchanan and Travis.

LCRA's modifications to the WAM include a "no call" assumption with respect to upstream water rights in the Colorado River Basin, based on LCRA's agreements with certain upstream water rights. The model used to calculate the Combined Firm Yield also incorporates the settlement agreement between LCRA and the City of Austin related to treatment of the City's discharged return flows. LCRA proposes that the combined firm yield be reduced from 535,812 acre-feet (which includes 90,546 acre-feet of water associated with O.H. Ivie Reservoir) to 434,154 acre-feet (which does not include an amount for O.H. Ivie Reservoir). Therefore the actual reduction requested by LCRA is 11,112 acre-feet.

No Injury Analysis and Review of the Combined Firm Yield

Staff considered the 2014 WMP, including the information in the technical appendices, and comments received during the informal comment period to

perform the technical review of the 2014 WMP application. The 2014 WMP application does not request a new appropriation of water; therefore, the technical review focuses on impacts of the WMP on existing water rights and the environment. Staff must determine whether LCRA's requested amendment to the WMP would cause a greater impact to other water rights or available river flows than would exist if LCRA's water rights for Lakes Buchanan and Travis were fully exercised. Texas Water Code §11.122(b).

The instream flow targets and freshwater inflow criteria included in the WMP are based on the most recent scientific studies. These instream flow targets and freshwater inflow criteria are consistent with those recommended by the Colorado-Lavaca Senate Bill 3 science team and stakeholder groups and adopted as environmental flow standards by TCEQ on August 8, 2012. 30 TAC Chapter 298, Subchapter D.

For all of the analyses below, staff used a comparison of model results from the different simulations to evaluate the effects of the proposed changes on water rights in the Colorado River Basin. Volume reliability is defined as the percentage of the total demand that is actually supplied. Volume reliability is a measure of the annual quantity of water available to a water right under specified conditions. The impact on volume reliability is calculated by summing the percentage difference between the volume reliabilities for each individual water right authorization for the different simulations and calculating an average.

LCRA's WAMs

LCRA submitted Water Availability Models (WAM) for the Combined Firm Yield determination and the 2014 WMP on October 31, 2014 and November 7, 2014. Although LCRA's models are based on TCEQ's WAM for the Colorado River Basin, LCRA's WAMs include different assumptions:

1. LCRA's WAMs include a "no call" assumption whereby water rights above the Highland Lakes are modeled as senior to downstream rights and have access to river flows at their locations irrespective of the priority dates of downstream rights. LCRA's WMP states that this reflects LCRA's agreements with upstream reservoir owners and better represents actual operational conditions for existing water rights;

2. LCRA's WAM for the WMP represents LCRA's rights and those of their firm customers using projected demands instead of the full authorized amounts.

Regarding the "no call" assumption, some of LCRA's agreements with upstream water rights are included in specific water rights and some are not. In addition, pursuant to TWC, §11.027, all water rights in a river basin are subject to water rights that are senior to them. Although staff does not believe that use of the "no call" assumption is appropriate for permitting purposes, staff did perform an analysis to validate and confirm LCRA's calculations, as discussed further below. LCRA submitted an additional model on March 5, 2015 that incorporated LCRA's 2014 WMP application into TCEQ's

Full Authorization model.

Regarding LCRA's water use and demand projections, these water use and demand projections are taken from LCRA's Water Supply and Resource Plan (WSRP). The demands in the WSRP are based on the Lower Colorado Regional Water Planning Group (Region K) Regional Water Plan, as adjusted for more recent growth terms and based on LCRA's discussions with local entities. The demands used in this amendment to the WMP appear to be reasonable. The basis for these values is described in more detail in LCRA's WMP and technical appendices.

Combined Firm Yield Calculation

LCRA requests a change to the combined firm yield of Lakes Buchanan and Travis. Under the WMP, the LCRA's firm commitments shall not exceed the combined firm yield. In addition, the LCRA Board has reserved 50,000 acre-feet of the combined firm yield for future needs. When operated as a system, and incorporating LCRA's agreements with upstream water right holders, LCRA proposes that the combined firm yield be reduced from 535,812 acre-feet (which includes 90,546 acre-feet of water associated with O.H. Ivie Reservoir) to 434,154 acre-feet (which does not include an amount for O.H. Ivie Reservoir). Therefore the actual reduction requested by LCRA is 11,112 acre-feet.

LCRA's WMP Technical Paper A-6 describes the assumptions and calculations LCRA used to develop its Combined Firm Yield. The Combined Firm Yield model includes water rights at their fully authorized amounts, City of Austin return flows and does not include releases of interruptible stored water for downstream irrigation or curtailment of these releases. The determination of the Combined Firm Yield does not affect the amount of water LCRA proposes to deliver to downstream irrigation customers.

The combined firm yield calculation was determined through an iterative process so that all of the available supply in the reservoirs (inflows and storage) is completely used to meet firm demand during the drought of record, which is based on historic hydrology from 1940 through 2013. For purposes of this calculation, the drought or record was the drought of the 1950s. The critical drought period is defined based on the assumption that, at a system conservation storage of 99.9%, the system is assumed to be full for purposes of the calculation. Based on the 99.9% assumption, the critical drought period covers a 10.2 year period from May of 1947 through June of 1957. The Combined Firm Yield was calculated by adding the diversions and releases from Lakes Buchanan and Travis and dividing this quantity by the number of years in the critical drought period. The approximate yield of the remaining storage at its minimum level during the critical drought (1,832 acre-feet) divided by the total number of years in the critical period was added to the sum of the diversion and release components to generate the Combined Firm Yield.

As discussed above, LCRA'sfirm yield WAM includes the "no call" assumption, which

does not consider basin water rights according to their priority dates. Staff does not agree that this assumption provides a better representation of actual conditions with regard to operation of existing water rights. Under the prior appropriation doctrine, all water rights are subject to water rights senior to them. Because LCRA included the "no call" assumption in its Combined Firm Yield WAM, this version of the model cannot be used to determine reliability of other basin water rights or for purposes of determining whether other water rights are affected by an application.

However, the calculation method used by LCRA to determine the Combined Firm Yield for this application is consistent with that used to develop the previous estimate of the combined firm yield. Staff reviewed LCRA's Firm Yield model and identified a minor problem related to use of the ADD function on a Target Option (TO) record for subtraction purposes. Using this target may generate a negative target. Staff adjusted LCRA's model to replace the ADD function with the SUB function. This minor change did not affect the results of the firm yield calculation and staff confirmed that, as modeled by LCRA in the 2014 WMP application, the combined firm yield of Lakes Buchanan and Travis is 434,154 acre-feet per year.

Analysis of LCRA's 2014 WMP Application

Staff created a baseline simulation that does not include the provisions of the WMP and modeled LCRA's rights under Certificates 14-5482 and 14-5478 as a diversion of 1,500,000 acre-feet of water from the combined storage in Lakes Buchanan and Travis. Staff compared reliabilities for basin water rights generated from the baseline WAM to reliabilities of basin water rights generated from both TCEQ's Full Authorization model with LCRA's current WMP in place and TCEQ's Full Authorization model with LCRA's 2014 WMP application in place.

Staffs review indicates that volume reliabilities of basin rights were generally higher under both the 2010 WMP and the 2014 WMP application than they would be if LCRA's WMP was not in place. The increase in volume reliability was greater and the reduction was lower under the 2014 WMP. Staff also compared volume reliabilities between the 2010 WMP and the 2014 WMP application and found that there was a decrease in reliability of less than 2% under the 2014 WMP application. This is likely the result of differences in curtailment curves and environmental flow criteria between the two plans.

Based on the analysis described above, staffs opinion is that so long as LCRA operates its water rights in accordance with the basic goals and guidelines included in the 2014 WMP application, there would be no greater impact to water rights in the Colorado River Basin as a result of LCRA's requested amendments to its WMP than would exist if no WMP was in place.

Impacts to available river flows

With respect to flows downstream of Lakes Buchanan and Travis, staff compared the frequency of occurrence of modeled monthly WMP environmental flow requirements

at various control points under specific conditions, as shown in Tables 1. and 2. below, and found no impacts to available river flows beyond those that would be projected to occur with no WMP in place and all water rights fully utilized to the maximum extent of their authorizations.

Table 1. Average Frequency that Monthly Instream Flow Requirements are Equaled or Exceeded on an Annual Basis

Location	Natural	Baseline	TCEQ Run3 2010 WMP	TCEQ Run3 2014 WMP	LCRA 2014 WMP
Austin					
Subsistence	100%	90%	99%	99%	100%
Bastrop					
Subsistence	99%	77%	93%	99%	100%
Base-Dry	99%	67%	88%	91%	98%
Base-Average	91%	43%	74%	75%	81%
Columbus					
Subsistence	99%	81%	89%	89%	89%
Base-Dry	93%	63%	80%	83%	84%
Base-Average	81%	42%	61%	66%	67%
Wharton					
Subsistence	99%	72%	94%	99%	99%
Base-Dry	94%	43%	70%	68%	81%
Base-Average	83%	28%	47%	50%	63%

Table 2. Estimated Frequency that Annual Freshwater Inflows Equal or Exceed Natural Conditions

Annual Natural Flow	Baseline	TCEQ Run3 2010 WMP	TCEQ Run3 2014 WMP	LCRA 2014 WMP
25th Percentile (1,474,280 acre-feet)	5%	15%	17%	41%
50th Percentile (2,350,110 acre-feet)	2%	5%	5%	21%
75th Percentile (3,416,158 acre-feet)	1%	2%	2%	5%
90th Percentile (4,232,571 acre-feet)	1%	1%	1%	3%

Recommendations

Staff considered LCRA's application and supplemental materials and determined:

- The Combined Firm Yield calculation is reasonable;
- If LCRA operates its water rights in accordance with the basic goals and guidelines included in the 2014 WMP application, there will be no greater impact

to water rights in the Colorado River Basin as a result of LCRA's requested amendments to its WMP than would exist if no WMP was in place.

- LCRA's 2014 WMP application will not cause impacts to available river flows beyond those that would be projected to occur with no WMP in place and all water rights fully utilized to the maximum extent of their authorizations.

Staff also carefully considered LCRA's 2014WMP application and all of the comments received at the January 7, 2015 meeting and offers the following recommendation:

Look Ahead Test

Staff notes that although there are references to the Look Ahead test in the WMP, and a description of how a proxy for the test is incorporated into the WAM, the technical process used to determine whether the lake would drop below 600,000 acre-feet in the next twelve months or below 900,000 acre-feet in the upcoming crop season is not specified in the 2014 WMP. Section 4.3.2.4 refers to antecedent conditions, current storage, and forecasted conditions but provides no details on how these factors would be applied. Staff recognizes that research efforts are ongoing to enhance the capabilities of the stochastic and other models used in LCRA's requests for Emergency Orders to modify its WMP. Staff recommends that the order adopting the WMP require LCRA to use the 99% exceedance level to provide certainty in how the analysis will be conducted. This level is consistent with the modeling for the WMP. Staff also recognizes that a different trend for inflows and combined storage could be observed. In that case LCRA could use a different exceedance level; however, in no case should LCRA use less than a 95th percentile exceedance level in its Look Ahead Test.

Time Frames

Regarding the timelines and procedures for revising the WMP, the naturalized flows were updated through 2013 for the 2014 WMP. At this time Lakes Buchanan and Travis have not refilled. Updating the WAMs to include additional years could affect the trigger levels and curtailment curves included in the 2014 WMP amendment; however, the impact of the drought will not be known until the drought is over. Staff recommends that LCRA begin a process to update its WMP to take into account more recent conditions no later than one year from the date that Lakes Travis and Buchanan reach a combined capacity of 98% or greater or by December 31, 2018, whichever is earlier.

The models used to support LCRA's 2014 WMP assumed that LCRA's downstream water rights are operated the way they are today. Any changes to LCRA's operation of these water rights resulting from other amendments of these rights is not taken into account in the model used to develop the curtailment curves in the application. In addition to any updates that might be necessary to take into account recent drought conditions in the Colorado Basin, staff recommends that LCRA file an application to update its WMP if it changes its operations as a result of new permits or new amendments to its existing water rights prior to initiating such changes in its

operations.

Actual water use by firm customers could increase in the future above the levels considered in the 2014 WMP amendment. Should actual firm water use, as reported in LCRA's annual water use reports and annual WMP report filed with the TCEQ, reach a level that is 90% or greater than the demands considered in the modeling for the 2014 WMP amendment for a period of two consecutive years, staff recommends that LCRA begin a process to update its WMP to take into account increased firm demands within one year.

Staff also recommends that LCRA submit an application to amend its WMP no later than two years from the date it initiates a process to revise the WMP. If one or more of the events that could trigger an update to the WMP (the lakes refill, LCRA changes it operations, or firm use increases) occur after a revision process has been initiated, the time period to submit an application should be extended by six months to allow those changed circumstances to be included in the revision process.

Texas Commission on Environmental Quality

INTEROFFICE MEMORANDUM

To: Sarah Henderson, Project Manager **Date:** July 1, 2015
Water Rights Permits Team
Water Rights Permitting & Availability Section

Through: Chris Loft, Team Leader
Resource Protection Team
Water Rights Permitting & Availability Section

Robert Hansen, Senior Aquatic Scientist
Resource Protection Team
Water Rights Permitting & Availability Section

From: Leslie Patterson, Aquatic Scientist
Resource Protection Team
Water Rights Permitting & Availability Section

Subject: Lower Colorado River Authority-Management Plan
CN600253637
WRPERM 5838
Application No. 5838A to Amend Water Use Permit No. 5838
Lower Colorado River Basin
Llano, San Saba, Lampasas, Burnet, Blanco, Travis, Bastrop, Fayette, Colorado, Wharton, and Matagorda Counties

Non-Substantive Changes to Technical Memorandum

On June 26, 2015 the Lower Colorado River Authority (LCRA) provided comments on staff's June 11, 2015 technical review. Staff revised the environmental analysis memorandum accordingly. The revised memorandum is attached.

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Llano, San Saba, Lampasas, Burnet, Blanco, Travis, Bastrop, Fayette, Colorado, Wharton, and Matagorda Counties

Environmental reviews of water right applications are conducted in accordance with §11.042, §11.147, §11.1491, §11.150, and §11.152 of the Texas Water Code (TWC) and with Texas Commission on Environmental Quality (TCEQ) administrative rules which include 30 Texas Administrative Code (TAC) §297.53 through §297.56. These statutes and rules require the TCEQ to consider the possible impacts of the granting of a water right on fish and wildlife habitat, water quality, and instream uses associated with the affected body of water. Possible impacts to bays and estuaries are also addressed.

ENVIRONMENTAL ANALYSIS ADDENDUM

The Lower Colorado River Authority (LCRA) seeks to amend their existing Water Management Plan (WMP). The WMP for the Lower Colorado River Basin defines the LCRA's water management programs and policies in accordance with the Final Order of Adjudication of the water rights for the LCRA, the Enabling Act of the LCRA, General Law of the State of Texas, particularly the TWC, LCRA's Certificates of Adjudication Nos. 14-5478 and 14-5482, and the water policies of the LCRA's Board of Directors. Amendments to the WMP were last approved by the Commission in 2010.

The 2010 TCEQ Order approving the previous amendment to the WMP required LCRA to file another amendment to address various issues in its WMP including environmental flow needs. Specifically, the 2010 TCEQ Order required LCRA to revise its procedures for providing water for environmental flows using the best scientific data available including provisions to accommodate changing conditions occurring within a year, limiting intra-daily fluctuations in streamflows, and, to the maximum extent reasonable, specification of an overall instream flow regime.

LCRA's prior amendment to the WMP was filed in March 2012 and later supplemented in May 2012. A revised WMP was submitted to TCEQ in October 2014. The 2014 amendment to the WMP includes changes in the procedures for determining applicable instream flow needs downstream of Austin as well as development of environmental flow and freshwater inflow criteria based on the most recent and best available scientific studies. Under the revised WMP, water is made available to help meet varying environmental flow levels downstream of Austin based upon the Combined Storage in Lakes Buchanan and Travis consistent with the 2010 TCEQ Order. Specific details of the revised plan are summarized below:

Instream Flows in the Lower Colorado Basin

a. The revised WMP includes three levels of instream flows (Subsistence, Base-Dry, and Base-Average) for four streamflow gauging locations (Austin, Bastrop, Columbus and Wharton) and are presented in Table 4-3 of the WMP.

b. The amount of water provided for instream flows, (i.e., Subsistence, Base-Dry, or Base-Average), is based on the Combined Storage of Lakes Buchanan and Travis and will be determined on March 1st for March through June and on July 1st for July through February of the following year.

c. The specific trigger levels for determining which instream flow levels apply for gages other than the Austin gage can be found in Table 4-4 of the WMP and are summarized below:
    i. When the Combined Storage in Lakes Travis and Buchanan is above 1,960,000 acre-feet, Base-Average conditions apply;
    ii. When the Combined Storage in Lakes Travis and Buchanan is between 1,900,000 and 1,960,000 acre-feet, Base-Dry conditions apply; and
    iii. When the Combined Storage in Lakes Travis and Buchanan is less than 1,900,000 acre-feet, Subsistence conditions apply.

d. Under the 2010 WMP, LCRA committed 33,440 acre-feet of firm water to help meet environmental needs. LCRA does not propose to change this amount.

e. LCRA will make releases from Lakes Buchanan and Travis sufficient to meet applicable instream criteria, to the extent of Storable Inflows or for Subsistence, using previously stored water in addition to Storable Inflows, at the four streamflow gaging locations identified in Table 4-3 in the 2014 WMP.

f. In this amendment to the WMP, the Subsistence, Base-Dry, and Base-Average flow criteria for gages other than the Austin gage, are daily (or daily average) flow values. The Subsistence criteria at Austin represent minimum (or instantaneous) flow requirements.

g. For the Bastrop gage, the following minimum flow requirements apply:
   i. During those times when Base-Average criteria are in effect, the minimum flow requirements, subject to availability of Storable Inflows, shall be 70 percent of the Base-Average criteria for the given month.
   ii. During those times when Base-Dry criteria are in effect, the minimum (or instantaneous) flow requirements, subject to availability of Storable Inflows, shall be 70 percent of the Base-Dry criteria for the given month.
   iii. During those times that Subsistence criteria are in effect, releases shall be scheduled such that the minimum flow does not drop below:
      1. 90 percent of the Subsistence criteria when the Combined Storage in Lakes Travis and Buchanan is equal to or greater than 1,400,000 acre-feet; or
      2. 80 percent of the Subsistence criteria when the Combined Storage in Lakes Travis and Buchanan is less than 1,400,000 acre-feet.

h. LCRA's ability to meet the instream flow requirements in the 2014 WMP may, in rare instances, be impaired by certain unavoidable constraints such as unforeseen diversions, unforeseen changes in flow conditions downstream, unforeseen or unscheduled operations at Longhorn Dam, and adjustments to gages or flow ratings. Deviations from the instream flow criteria are subject to the requirements listed in Section 4.4.2 of the WMP.

i. In the event of a pro rata curtailment of firm supplies, the applicable instream flow criteria will be subject to the same percentage curtailment as imposed on LCRA's firm water customers.

j. LCRA is not required to manage water in the lower Colorado River to specifically provide for pulse flows under the WMP. However, LCRA will monitor pulse flows during the time period that this amendment to the

WMP is in effect to assess whether pulse flows are occurring at the frequency recommended in the 2008 instream flow study of the lower Colorado River.

Freshwater Inflows to Matagorda Bay

a. LCRA's revised freshwater inflow criteria are based upon the 2008 Matagorda Bay Health Evaluation (MBHE) study which used the latest science and data to assess bay health and freshwater inflow regimes.

b. The freshwater inflow criteria include five levels of inflow and a desired achievement guideline for each level. An explanation of the criteria (MBHE levels 1 through 4 and Threshold) and the specific numerical values can be found in Tables 2-4 and 2-5 of the WMP, respectively.

c. The WMP includes Operational Criteria (OP-1 through 4) to help meet the range of freshwater inflow needs associated with MBHE levels, as shown in Table 2-6 of the WMP.

d. Under this WMP, Storable Inflows available to help meet freshwater inflow criteria will be determined on a monthly basis and exclude any Storable Inflows that have already been released to help meet instream flow criteria.

e. The applicable freshwater inflow criteria are based on the Combined Storage of Lakes Buchanan and Travis and will be determined on March 1st for March through June and on July 1st for July through February of the following year.

f. The Combined Storage triggers at which specific freshwater inflow levels apply can be found in Table 4-7 of the WMP and are summarized below:
    i. When the Combined Storage in Lakes Travis and Buchanan is above 1,950,000 acre-feet, OP-4/MBHE-4 inflow conditions apply;
    ii. When the Combined Storage in Lakes Travis and Buchanan is less than 1,950,000 acre-feet, OP-3/MBHE-3 inflow conditions apply;
    iii. When the Combined Storage in Lakes Travis and Buchanan is less than 1,500,000 acre-feet, OP-2/MBHE-2 inflow conditions apply;
    iv. When the Combined Storage in Lakes Travis and Buchanan is less than 1,300,000 acre-feet, OP-1/MBHE-1 inflow conditions apply; and
    v. When the Combined Storage in Lakes Travis and Buchanan is less than 1,000,000 acre-feet, the only freshwater inflow criteria in effect is Threshold.

g. The monthly Threshold bay inflow need applies in every month, regardless of the season or inflow level sought to be achieved. In the event that the

Threshold criteria cannot be met using Storable Inflows from that month, and Remaining Storable Inflows were carried over from the previous month, LCRA will provide up to 5,000 acre-feet of the prior month's Remaining Storable Inflows to help meet the Threshold level of 15,000 acre-feet per month. The carry over provision applies when Combined Storage is greater than 1,000,000 acre-feet.

h. In this revision of the WMP, freshwater inflow criteria are subject to the following limitation as stated in Section 4.4.3 in the WMP, which may reduce the amount of stored water LCRA must provide to help meet freshwater inflow needs and additional limitations which may reduce the amount of water LCRA provides to help meet freshwater inflow needs as described on Pages 4-16 through 4-17 of the WMP.

a. In the event of a pro rata curtailment of Firm Water supplies, the applicable freshwater inflow criteria (including the Threshold criteria) will be subject to the same percentage reduction as imposed on LCRA's Firm Water customers.

Annual and Multi-year Caps on Water for Environmental Flows

a. The amounts of water made available for environmental flows are subject to annual and/or multi-year caps as outlined in Section 4.4.4 of the WMP to ensure the actual amounts made available do not exceed the amounts simulated in the development of the 2014 WMP revision for periods when Combined Storage is below 1.3 million acre-feet on the Evaluation Date for a given season.

b. In the event that the cumulative amounts made available in such periods equal or exceed the annual or multi-year caps, dedicated releases to help meet environmental flow needs, that are subject to these annual or multi-year caps, are suspended for the remainder of the year.

SUMMARY

LCRA seeks to amend their existing Water Management Plan. Amendments to the plan were last approved by the TCEQ in 2010. On August 30, 2012 the TCEQ adopted environmental flow standards for the Colorado and Lavaca River Basins, the Colorado-Lavaca and Lavaca-Guadalupe Coastal Basins, and Matagorda and Lavaca Bays. By rule, these environmental flow standards are considered adequate to support a sound ecological environment. LCRA's application to amend their WMP does not request a new appropriation of water and is therefore not subject to the adopted standards. However, LCRA's revised procedures incorporate the most recent scientific studies, accommodate changing conditions within a year, and limit intra-daily fluctuations in streamflows. In addition, the instream flow and freshwater inflow criteria are generally consistent with the flow regimes recommended by the Colorado and Lavaca Rivers and Matagorda and Lavaca Bays Senate Bill 3 Basin and Bay Expert Science Team and Stakeholder Committee and were adopted as environmental flow standards by TCEQ.

In staff's opinion, LCRA's amendment to its Water Management Plan should not result in a greater net adverse impact to the environment than would exist under the currently approved Water Management Plan.

This instream use assessment was conducted using current TCEQ operation procedures and policies and available data and information. Authorizations granted to the Permittee by the water rights permit shall comply with all rules of the TCEQ, and other applicable State and Federal authorizations.

Texas Commission on Environmental Quality
INTEROFFICE MEMORANDUM

To: Sarah Henderson, Project Manager
Water Rights Permits Team
Water Rights Permitting & Availability Section

Date: June 11, 2015

Thru: RH FOR
Chris Loft, Team Leader
Resource Protection Team
Water Rights Permitting & Availability Section

KW
6/11/15
Kristin Wang, Senior Water Conservation Specialist
Resource Protection Team
Water Rights Permitting & Availability Section

From JA
6/11/15
Jennifer Allis, Senior Water Conservation Specialist
Resource Protection Team
Water Rights Permitting & Availability Section

Subject: Lower Colorado River Authority
WRPERM 5838, ADJ 5478, and ADJ 5482
CN600253637
Application No. 5838A to Amend Water Use Permit No. 5838, and Certificates of Adjudication Nos. 14-5478 and 14-5482
Water Conservation Review

The Lower Colorado River Authority (LCRA) seeks to amend the LCRA's Water Management Plan (WMP), which is the reservoir operations plan for Lakes Buchanan and Travis. The WMP is mandated by the 1988 Final Judgment and Decree ("1988 Adjudication Order") that adjudicated the Highland Lakes water rights. The 1988 Adjudication Order specifically required LCRA to submit a reservoir operations plan for Lakes Buchanan and Travis, and this requirement is also incorporated into the water rights for these lakes.

As a retail public and wholesale water supplier, the water conservation and drought contingency plans for the Lower Colorado River Authority were reviewed by TCEQ staff and found to meet the requirements per 30 TAC Chapter 288.

In determining whether reasonable water conservation goals have been set and whether the proposed strategies can achieve the stated goals, a review of the 2014 LCRA Raw Water Conservation Plan identifies five and ten-year water conservation goals for firm and interruptible water supply.

LCRA goals for firm and interruptible water supply include:
Five-year goal:

- 4,500 acre-feet savings per year from firm water contract use

- 13,000 acre-feet savings per year from agricultural use in the irrigation division during a year with no curtailment of interruptible water supply

Ten-year goal:

- 6,500 acre-feet savings per year from firm water contract use
- 16,000 acre-feet savings per year from agricultural use in the irrigation division during a year with no curtailment of interruptible water supply

The five-year goal builds on water saved from 2009-2014. The firm water savings increase from 2,700 acre-feet in 2014 to 4,500 acre-feet in 2019 and are projected to come from expanding existing firm water programs and additional customer strategies. Savings in the irrigation division increase from 10,000 acre-feet in 2014 to 13,000 acre-feet in 2019, with projected saving coming from completion of the gate rehabilitation project in the Gulf Coast Irrigation Division. The ten-year goals were increased at the same yearly rate as the five-year goals. However, it was stated in the Water Conservation Plan that these goals will be reassessed once the drought ends and drought-related restrictions cease.

The Water Conservation Plan also lists a number of water conservation strategies that LCRA has implemented, such as educational programs and outreach, irrigation evaluation training to wholesale customers' staff, conservation incentive programs, customer cost-share program, monitoring and measuring water use, and non-promotional rates. The Plan also includes specific agricultural water conservation strategies, such as the Gulf Coast gate rehabilitation and control project, pilot project for canal lining, and a precision land levelling program. As such, from this review, TCEQ water conservation staff has deemed these conservation goals and strategies to be reasonable.

Following is additional information on several of the strategies and programs.

Landscape Irrigation Evaluations

- LCRA offers irrigation evaluation training to wholesale customers' staff. As a result, nine of LCRA's wholesale customers completed approximately 800 residential and 50 commercial irrigation evaluations between 2010 and 2013. In summer 2012, LCRA began offering evaluations to domestic users.

Customer Cost-share Program

- LCRA's Firm Water Conservation Cost-share Program provides funding for water efficiency projects and programs established by LCRA's firm water customers. Since 2012, LCRA has awarded $230,800 for seven projects with a total combined cost of $2.2 million. LCRA provides funding equal to 50 percent of the project cost or an annualized cost of $150 per acre-foot, whichever is less. Projects that have been funded in the past three years include converting irrigated areas from raw or potable use to recycled water; decreasing utility system water loss; and improving irrigation efficiency through irrigation technology upgrades or installation of soil moisture sensors.

End-User Conservation Incentives

- LCRA began its first large-scale conservation incentive program in 2010 with a residential indoor plumbing fixture replacement program. This program provided free toilet vouchers and showerheads to qualifying participants. LCRA wholesale customers administered the

program on a local level. LCRA partnered with 14 firm water customers to provide about 5,000 toilets and almost 3,000 showerheads to retail users.

- The Commercial, Industrial and Institutional (CII) Rebate Program helps businesses, industries, schools, churches and other institutions that directly or indirectly receive water from LCRA adopt new water-saving equipment and practices. The program provides rebates to replace inefficient plumbing, equipment or process change outs up to a fixed dollar amount or cost per acre-foot saved, based on recommendations from water audits.

According to the 2011 Region K Water Plan, LCRA holds water rights to over 2.1 million ac-ft of water in the Colorado River Basin. Combined, these water rights authorize every legal purpose of use, and also provide for protection of certain environmental flow needs. The LCRA is directed by the Texas Legislature to be the steward of this water in serving as the regional water supplier. The LCRA supplies water for municipal, irrigation, manufacturing, steam electric, mining, and other water uses. The LCRA currently supplies water to entities in Bastrop, Burnet, Colorado, Fayette, Hays, Lampasas (Region G), Llano, Matagorda, San Saba, Travis, Wharton, and Williamson (including the portion of Williamson in Region G) Counties.

LCRA's commitments across all water user groups (WUGs) are projected to decline from 810,268 ac-ft/year in 2010 to 739,872 ac-ft/year in 2060. The biggest declines will be in irrigation sectors for Colorado, Matagorda, and Wharton Counties, and municipal use for the City of Austin. However, water demand projections for Region K are expected to increase from 1,086,692 ac-ft/year in 2010 to 1,382,534 ac-ft/year in 2060. The sectors with the biggest increases in water demands between 2010 and 2060 are municipal, steam-electric power generation, and manufacturing.

The application is consistent with the approved 2012 State Water Plan and the approved January 2011 Region K Water Plan. The amendments to LCRA's Water Management Plan are extensively discussed as a water management strategy in the Region K Water Plan, for LCRA to meet increased firm customer demands, by adjusting the triggers at which it curtails the availability of interruptible water supply from Lakes Buchanan and Travis to meet irrigation, environmental and other needs.