Mr. Jeff Walker  
Executive Administrator  
Texas Water Development Board  
1700 N. Congress  
PO Box 13231  
Austin, Texas  78711-3231

Dear Mr. Walker,

The Live Oak Underground Water Conservation District (LOUWCD) is pleased to submit to the Texas Water Development Board (TWDB) a copy of our adopted Management Plan in accordance with chapter 36.1073. The Live Oak Underground Water Conservation District Management Plan (LOUWCDMP) was adopted by the LOUWCD Board of Directors at their quarterly meeting on August 19, 2020, by unanimous consent. In addition, a certified copy of the LOUWCD Board of Directors resolution adopting the plan is also attached. This plan was adopted at the regular meeting of the LOUWCD August 19, 2020, by unanimous vote of all directors.

The LOUWCD, established in 1991, has historically had an excellent working relationship with the TWDB and it is our hope that we can count on your support as we implement the enclosed plan, it is the intent of our Board of Directors that we will begin implementation of this plan immediately to facilitate the success of our efforts.

The LOUWCDMP was developed during open meetings of the Board of Directors in accordance with all notice and hearing requirements stated in the District’s procedures. Documentation that notice and hearing requirements were followed is presented in a separate attachment.

During preparation of the LOUWCD Management Plan, (LOUWCD MP) all planning efforts were coordinated with the Nueces River Authority, as mandated by TWC 36.1071 (a) and 31 TAC 356. Documentation of this coordinated effort is included in the packet for your review.

The rules of LOUWCD are available at our website which is www.louwcd.org. The LOUWCDMP will be in force for 5 years from the date of approval. If there is any other documentation we can provide to the TWDB that will ensure the prompt approval of the Live Oak Underground Water Conservation District Management Plan, please do not hesitate to call me or my staff. I look forward to working with you and your staff throughout the process.

Sincerely,

Scott Bledsoe III, President
DISTRICT MISSION
The Live Oak Underground Water Conservation District will strive to develop, promote, and implement water conservation, augmentation, and management strategies to protect water resources for the benefit of the citizens, economy, and environment of the district.

TIME PERIOD FOR THIS PLAN
This plan becomes effective upon approval by the Texas Water Development Board and remains in effect until a revised plan is approved or five years, whichever is earlier.

STATEMENT OF GUIDING PRINCIPLES
The district recognizes that the groundwater resources of the region are of vital importance. The preservation of this most valuable resource can be managed in a prudent and cost effective manner through regulation and permitting. This management document is intended as a tool to focus the thoughts and actions of those given the responsibility for the execution of district activities.

General Description
The District was created by the citizens of Live Oak County through election, November, 1989. The current Board of Directors are Scott Bledsoe III - Chairman, Mark Katzfey - Vice-Chairman, Harriet Lamm, Stanley Schilling, and James Pawlik, Live Oak Underground Water Conservation District (LOUWCD) has the same areal extent as that of Live Oak County. The county has a vibrant economy dominated by agriculture and petroleum. The agriculture income is derived primarily from beef cattle production, wheat, corn, sorghum, and cotton, with some sheep and goat ranching.

Location and Extent
Live Oak County, consisting of 1,072 square miles, is located in South Texas. The county is bounded on the east by Bee, San Patricio, and Karnes counties, on the north by Atascosa county, on the west by McMullen County, and on the south by Jim Wells and Duval County. George West, which is centrally located in the county, is the county seat. Three Rivers, the only other municipality in the county, is located in the northern portion of the county.
Topography, Drainage and Groundwater Resources of Live Oak County

Live Oak County is on the Gulf Coastal Plain in southern Texas. Most the 1,072 square miles of the county are devoted to farming and ranching which provide the principal income for the 9,000 inhabitants. The production of oil is also an important industry.

The principal water-bearing formations underlying the county are the Carrizo Sand, Oakville Sandstone, Lagarto Clay, and Goliad Sand, and range in age from Eocene to Pliocene. The formations dip toward the coast at rates ranging from less than 20 to about 140 feet to the mile.

Some irrigation, municipal, and stock supplies are obtained from surface-water sources. In Live Oak County the water-bearing sands above a depth of 2,000 feet contain approximately 20 million acre-feet of fresh and slightly saline water. Even though it may be impractical to recover much of the stored water, the rate of withdrawal could be increased several times more than the 1999 rate without appreciably depleting the water available from storage for many decades. A large but not estimated amount of fresh to slightly saline water occurs in the Carrizo Sand in the northern and northwestern parts of the county at depths as much as 6,000 feet. Most of the water in the Carrizo Sand in Live Oak County is more than 4,000 feet below land surface and therefore is too deeply buried to be economically developed for most uses.

Most of the ground water in Live Oak County is brackish in quality for municipal, industrial, and irrigation uses. However, because better water is not available in most areas in the county, brackish water has been used successfully by users of all three categories. Generally the Goliad Sand contains water of better quality than that in any formation except the Carrizo Sand. In favorable areas properly constructed wells in the Carrizo, Oakville, Lagarto, and Goliad may yield 1,000 gallons per minute or more. Yields from wells tapping the other water-bearing formations generally are small and the water commonly is suitable only for stock.

Most of Live Oak County is rolling to moderately hilly, although some areas are nearly flat. The altitude ranges from about 460 feet in the southwestern part of the county to about 90 feet near Lake Corpus Christi. The county is drained by the Nueces River and its tributaries, the Frio and Atascosa Rivers, with the exception of a small, elongated area near the Bee County line which is drained by tributaries of the Aransas River.
The water-bearing formations in Live Oak County are continually recharged by the infiltration of a small part of the precipitation, which falls on the more permeable strata. However, most of the precipitation that falls in the county runs off in streams, evaporates, or is transpired by plants. The remaining water, probably less than five percent, may reach the zone of saturation where it moves slowly toward an area of discharge such as a well, natural outlet, or, under artesian pressure, it may seep or percolate slowly upward into overlying beds. Recharge could be enhanced by several methods: brush control, additional precipitation, and additional tanks to catch runoff from excessive precipitation.

**Surface Water Resource of Live Oak County**

There are two surface impoundments used to supply water other than for livestock consumption, the Choke Canyon reservoir and Lake Corpus Christi. The average annual supply from these impoundments is 241,000 acre-feet, however, the calculated firm yield is 206,000 acre-feet. For planning calculations the impoundments will be assumed to supply 162,500 acre-feet per year by the year 2050. These figures came from the City of Corpus Christi. The owners and operators are the Nueces River Authority and the City of Corpus Christi within all reaches of the Nueces River in Live Oak County. The City of Corpus Christi is the major user of surface water in Live Oak County along with the City of Three Rivers and the petrochemical plant, Valero.

For additional information see Appendix A

**Estimate of the amount of groundwater used from the latest version of the TWDB Estimated Historical Water Use/2017 State Water Plan, estimates of the projected total demand, projected surface water supply, water supply needs, and water management strategies from the 2017 State Water Plan.** (See Appendix A) The District considered the water supply needs and water management strategies included in the state water plan. There are not any projected water supply needs identified for Live Oak County. The District considered the demand reduction for the municipalities. For additional information see Appendix A

**Groundwater Availability Modeling Information**

This information came from the TWDB GAM run 19-019. The TWDB GAM run 19-019 report is included in Appendix A and presents estimated data values for recharge, discharge, and volume of flow into the district, out of the district, and between aquifers.
Actions, Procedures, Performance and Avoidance for Plan Implementation

The District will implement the provisions of this plan and will utilize the provisions of this plan as a guidepost for determining the direction or priority for all District activities. All operations of the District, all agreements entered into by the District and any additional planning efforts in which the District may participate will be consistent with the provisions of this plan. The rules adopted by the District shall be pursuant to Texas Water Code Chapter 36 and the provisions of this plan. All rules will be adhered to and enforced. The promulgation and enforcement of the rules will be based on the best technical evidence available. The rules can be downloaded at http://www.louwcd.org/approved-rules.html under the tab “District Rules”.

Methodology for Tracking the District’s Progress in Achieving Management Goals

The District manager will prepare and present an annual report to the Board of Directors on District performance in regards to achieving management goals and objectives. The presentation of the report will occur during the last monthly Board meeting each fiscal year, beginning December 31, 2020. The report will include the number of instances in which each of the activities specified in the District’s management objectives was engaged in during the fiscal year. The Board will maintain the report on file, for public inspection at the District’s offices upon adoption. This methodology will apply to all management goals contained within this plan.

Management of Groundwater Supplies

The District will manage the supply of groundwater within the District in order to conserve the resource while seeking to maintain the economic viability of all resource user groups, public and private. In consideration of the economic and cultural activities occurring within the District, the District will identify and engage in such activities and practices that, if implemented, would result in a reduction of groundwater use. A monitor well observation network shall be established and maintained in order to evaluate changing conditions of groundwater supplies (water in storage) within the District. The District will make a regular assessment of water supply and groundwater storage conditions and will report those conditions to the Board and to the public.
The District will undertake, as necessary and cooperate with investigations of the groundwater resources within the District and will make the results of investigations available to the public upon adoption by the Board. The District has adopted rules to regulate groundwater withdrawals by means of well spacing and production limits. The District may deny a well construction permit or limit groundwater withdrawals in accordance with the guidelines stated in the rules of the District. In making a determination to deny a permit or limit groundwater withdrawals, the District will consider the public benefit against individual hardship after considering all appropriate testimony.

In pursuit of the Districts mission of protecting the resource, the District may require reduction of groundwater withdrawals to amounts, which will not cause harm to the aquifer. To achieve this purpose, the District may, at the Boards discretion, amend or revoke any permits after notice and hearing. The determination to seek the amendment or revocation of a permit by the District will be based on aquifer conditions observed by the District. The District will enforce the terms and conditions of permits and the rules of the District by enjoining the permit holder in a court of competent jurisdiction as provided for in Texas Water Code (TWC) 36.102.

 Desired Future Condition and Modeled Available Groundwater

GMA 16 adopted a desired future condition for the Gulf Coast Aquifer on January 17, 2017, and declared all of the other aquifers non-relevant. The desired future condition is 62 feet of drawdown as an average for the entire GMA 16. The desired future condition for Live Oak UWCD is 34 feet of drawdown within the district. The modeled available groundwater, GAM Run 17-025 MAG, is in Appendix A.
MISSION STATEMENT
The mission of the Live Oak Underground Water Conservation District is to protect and assure a sufficient quantity and quality of groundwater for our constituents use. We value:

*Collection and maintenance of data on water quantity and quality
*Efficient use of groundwater
*Conjunctive water management issues
*Development and enforcement of water district rules concerning conservation of ground water.

Management Goals, Objectives, and Performance Standards

Resource Goals

Goal 1.0: Providing the most efficient use of groundwater

Management Objective:
Each year the District will provide education materials concerning the efficient use of groundwater.

Performance standard:
Provide educational materials to at least one school annually.

Goal 2.0: Controlling and preventing waste of groundwater

Management Objective:
Measure water levels from the land surface on strategic wells on an annual basis and report waste to the District Board.

Performance standard:
(a) Report to the District Board annually the water level measurements for three wells.
(b) The District will investigate all reports of waste within 7 working days. The number of reports of waste as well as the investigation findings will be reported to the District Board annually.
Goal 3.0: Controlling and preventing subsidence

The District has reviewed the report: Identification of the Vulnerability of the Major and Minor Aquifers in Texas to Subsidence with regard to Groundwater Pumping – TWDB Contract Number 1648302062 by LRE Water: http://www.twdb.texas.gov/groundwater/models/research/subsidence/subsidence.asp. Due to the amount of current pumping, subsidence is not expected to occur. This management goal is not applicable to the operations of the District.

Goal 4.0: Addressing Conjunctive surface water management issues

Management Objective:

The District will participate in the regional planning process by attending the Region N regional water planning group meetings to encourage the development of surface water supplies to meet the needs of water user groups within the District. A representative of the District will attend, at least, one meeting of the Region N regional water planning group.

Performance Standard:

The District will attend one meeting of the Region N regional water planning group in , and include the attendee’s name in the Annual Report to the Board.

Goal 5.0: Addressing Natural Resource Issues

Management Objective:

The District will investigate issues related to environmental and other concerns that may be affected by a district’s groundwater management plan and rules, such as impacts on endangered species, soils, oil and gas production, mining, air and water quality degradation, agriculture, and plant and animal life.

Performance Standard:

The District will discuss any issues concerning the above in the Annual Report to the Board once per year.
Goal 6.0: Addressing Drought Conditions

Management Objective:

The District will monitor the Palmer Drought Severity Index (PDSI). The link to the Drought index is www.waterdatafortexas.org/drought

Performance Standard:

A report of the Palmer Drought Severity Index will be presented to the District board on an annual basis. The link to the Drought index is www.waterdatafortexas.org/drought

Goal 7.0: Addressing Conservation

Management Objective:

Each year the District will provide educational material to the public promoting conservation methods and concepts.

Performance Standard:

The District will make at least one educational brochure available per year through service organizations, and on a continuing basis at the District office.

Goal 8.0: Addressing Precipitation Enhancement

The District has determined that this goal is not financially feasible at this time.

Goal 9.0: Recharge Enhancement

This goal is not applicable to the District because, at the current time, it is cost prohibitive.

Goal 10.0: Addressing Rainwater Harvesting

This goal is not applicable to the District because, at the current time, it is cost prohibitive.

Goal 11.0: Addressing Brush Control

This goal is not applicable to the District because, at the current time, it is cost prohibitive.
Goal 12.0: Addressing the Desired Future Conditions of the groundwater resource in the District.

Management Objective:

The District will annually measure the water levels in at least three monitoring wells within the District and will determine the five-year water level averages based on the measurements are taken. The District will compare the five-year water level averages to the corresponding five-year increment of its Desired Future Conditions in order to track its progress in achieving the Desired Future Conditions.

Performance Standard:

The District’s Annual Report will include the water level measured taken each year for the purpose of measuring water levels to assess the District’s progress towards achieving its Desired Future Conditions. Once the District has obtained water level measurements for five consecutive years and is able to calculate water level averages over five-year periods thereafter, the District will include a discussion of its comparison of water level averages to the corresponding five-year increment of its Desired Future Conditions in order to track its progress in achieving its Desired Future Conditions.

Management Objective:

The District will review and calculate its permit and well registration totals in light of the Desired Future Conditions of the groundwater resources within the boundaries of the District to assess whether the District is on target to meet the Desired Future Conditions estimates submitted to the TWDB.

Performance Standard:

The District’s Annual Report will include a discussion of the District’s permit and well registration totals and will evaluate the District’s progress in achieving the Desired Future Conditions of the groundwater resources within the boundaries of the District and whether the District is on track to maintain the Desired Future Conditions estimates over the 50-year planning period.
RESOLUTION NO. 001-2020

Whereas, the Live Oak Underground Water Conservation District has held the appropriate public hearings, and;

Whereas, the District has presented the management plan to the county officials and the Nueces River Authority.

Whereas, the District has followed the rules set forth by SB 1 and the TWDB.

Now, Therefore be it Resolved, that the Live Oak Underground Water Conservation District voted to pass the District management plan.

In favor________________               Against________________

Passed and Approved this the 19 day of August, 2020.

________________________       Attest by:________________________
Scott Bledsoe III, President            Lonnie Stewart, Secretary
Appendix A
Texas Water Use Estimates
2017 Summary
July 9, 2019

The Texas Water Development Board Water Use Survey program conducts an annual survey of about 4,200 public water systems and 2,000 industrial facilities. The water use survey collects the volume of both ground and surface water used, the source of the water, water sales, and other pertinent data from the users. This data provides an important source of information in helping guide water supply studies as well as regional and state water planning that is dependent upon the accuracy and completeness of the information water users provide.

Of the approximately 6,700 systems/facilities surveyed, 80% submitted their water use survey for 2017 water use. This represents about 98% of the total surveyed water use in the state. For those systems/facilities that did not submit their survey, estimates were carried-over from the most current available year. Estimates are also revised as additional or more accurate data becomes available through survey responses.

**2017 Estimated Annual Statewide Water Use**

Total estimated water use for 2017 (including reported reuse) was about 13.75 million acre-feet (1 acre-foot = 325,851 gallons) and was down from 2016 which was estimated at about 14.23 million acre-feet. The total 2017 estimated municipal water use slightly decreased to 4.17 million acre-feet compared to 4.41 million acre-feet in 2016. Estimated irrigation water use slightly decreased to 7.49 million acre-feet compared to 7.83 million acre-feet in 2016. Below is a breakdown of the categorical estimated uses for 2017. Irrigation water use (54%) topped the largest water use category in the State in 2017 with an estimated 7.49 million acre-feet. Municipal water use (30%), same as 2016, was the second largest water use category with an estimated 4.17 million acre-feet. Manufacturing (7%), Power (3%), Livestock (2%), and Mining (1%) estimated water use collectively comprised about 2.1 million acre-feet.
2017 Surface & Groundwater Use Estimates

Approximately 54% of the 2017 estimated water use in Texas was from groundwater sources (about 7.40 million acre-feet) with 43% from surface water sources (about 5.93 million acre-feet) and 3% from reuse (a little over a quarter million acre-feet). The two graphs below illustrate the categorical differences in use between surface water and groundwater sources.

2017 Surface Water Estimates by Category

- Irrigation: 33%
- Municipal: 44%
- Power: 7%
- Mfg: 14%
- Mining: 0.3%
- Livestock: 2%

2017 Groundwater Estimates by Category

- Irrigation: 74%
- Municipal: 19%
- Mfg: 2%
- Mining: 2%
- Power: 0.7%
- Livestock: 2%

Detailed reports of historical water use estimates and historical groundwater pumpage in Texas can be found at:


http://www.twdb.texas.gov/waterplanning/waterusesurvey/historical-pumpage.asp
GAM RUN 17-025 MAG: MODELED AVAILABLE GROUNDWATER FOR THE GULF COAST AQUIFER SYSTEM IN GROUNDWATER MANAGEMENT AREA 16

Rohit Raj Goswami, Ph.D., P.E.
Texas Water Development Board
Groundwater Division
Groundwater Availability Modeling Section
(512) 463-0495
May 19, 2017
EXECUTIVE SUMMARY:

The modeled available groundwater for Groundwater Management Area 16 (Figure 1) for the Gulf Coast Aquifer System is summarized by decade for the groundwater conservation districts and counties (Table 1) and for use in the regional water planning process (Table 2). The modeled available groundwater estimates range from approximately 233,000 acre-feet per year in 2020 to 312,000 acre-feet per year in 2060 (Tables 1 and 2). The estimates were extracted from results of a model run using the alternative groundwater availability model for Groundwater Management Area 16 (version 1.01). The model run files, which meet the desired future conditions of Groundwater Management Area 16, were submitted to the Texas Water Development Board (TWDB) as part of the Desired Future Conditions Explanatory Report for Groundwater Management Area 16. The explanatory report and other materials submitted to the TWDB were determined to be administratively complete on April 19, 2017.

REQUESTOR:

Mr. David O’Rourke, consultant for Groundwater Management Area 16.

DESCRIPTION OF REQUEST:

In a letter dated January 25, 2017, Mr. David O’Rourke, consultant for Groundwater Management Area 16, provided the TWDB with the desired future conditions of the Gulf Coast Aquifer System adopted by the groundwater conservation district representatives in Groundwater Management Area 16. All other aquifers in Groundwater Management Area 16 (Carrizo-Wilcox and Yegua-Jackson) were declared non-relevant for joint planning purposes. The Gulf Coast Aquifer System includes the Chicot Aquifer, Evangeline Aquifer, and the Jasper Aquifer. Clarifications to the submitted materials were received by TWDB on April 4, 2017. The desired future conditions for the Gulf Coast Aquifer System, as described
in Resolution No. 2017-01 and adopted January 17, 2017, by the groundwater conservation districts within Groundwater Management Area 16, are described below:

**Groundwater Management Area 16 [all counties]**

Drawdown of the Gulf Coast Aquifer System shall not exceed an average of 62 feet in December 2060 from estimated year 2010 conditions.

**Bee Groundwater Conservation District**

Drawdown of the Gulf Coast Aquifer System shall not exceed an average of 76 feet in December 2060 from estimated year 2010 conditions.

**Live Oak Underground Water Conservation District**

Drawdown of the Gulf Coast Aquifer System shall not exceed an average of 34 feet in December 2060 from estimated year 2010 conditions.

**McMullen Groundwater Conservation District**

Drawdown of the Gulf Coast Aquifer System shall not exceed an average of 9 feet in December 2060 from estimated year 2010 conditions.

**Red Sands Groundwater Conservation District**

Drawdown of the Gulf Coast Aquifer System shall not exceed an average of 40 feet in December 2060 from estimated year 2010 conditions.

**Kenedy County Groundwater Conservation District**

Drawdown of the Gulf Coast Aquifer System shall not exceed an average of 40 feet in December 2060 from estimated year 2010 conditions.

**Brush Country Groundwater Conservation District**

Drawdown of the Gulf Coast Aquifer System shall not exceed an average of 69 feet in December 2060 from estimated year 2010 conditions.

**Duval County Groundwater Conservation District**

Drawdown of the Gulf Coast Aquifer System shall not exceed an average of 104 feet in December 2060 from estimated year 2010 conditions.
San Patricio County Groundwater Conservation District
Drawdown of the Gulf Coast Aquifer System shall not exceed an average of 48 feet in December 2060 from estimated year 2010 conditions.

Starr County Groundwater Conservation District
Drawdown of the Gulf Coast Aquifer System shall not exceed an average of 69 feet in December 2060 from estimated year 2010 conditions.

No District - Cameron County
Drawdown of the Gulf Coast Aquifer System shall not exceed an average of 70 feet in December 2060 from estimated year 2010 conditions.

No District - Hidalgo County
Drawdown of the Gulf Coast Aquifer System shall not exceed an average of 118 feet in December 2060 from estimated year 2010 conditions.

No District - Kleberg County
Drawdown of the Gulf Coast Aquifer System shall not exceed an average of 28 feet in December 2060 from estimated year 2010 conditions.

No District - Nueces County
Drawdown of the Gulf Coast Aquifer System shall not exceed an average of 21 feet in December 2060 from estimated year 2010 conditions.

No District - Webb County
Drawdown of the Gulf Coast Aquifer System shall not exceed an average of 113 feet in December 2060 from estimated year 2010 conditions.

No District - Willacy County
Drawdown of the Gulf Coast Aquifer System shall not exceed an average of 40 feet in December 2060 from estimated year 2010 conditions.

METHODS:
The alternative groundwater availability model for Groundwater Management Area 16 (Hutchison and others, 2011) was run using the model files submitted with the explanatory report (O’Rourke, 2017). Model-calculated water levels were extracted for the years 2010
and 2060, and drawdown was calculated as the difference between water levels at the beginning of 2010 and water levels at the end of 2060. Drawdown averages were calculated for the Gulf Coast Aquifer System by county, groundwater conservation districts, and the entire groundwater management area. As specified in the explanatory report (O’Rourke, 2017), drawdown for model cells that became dry during the simulation (water level dropped below the base of the cell) were excluded from the averaging. The calculated drawdown averages were compared with the desired future conditions to verify that the pumping scenario specified by the district representatives achieved the desired future conditions within a one-foot variance.

The modeled available groundwater values were determined by extracting pumping rates by decade from the model results using ZONEBUDGET Version 3.01 (Harbaugh, 2009). Table 1 presents the annual pumping rates by county and groundwater conservation district, subtotaled by groundwater conservation district, and then summed for Groundwater Management Area 16. Table 2 presents the annual pumping rates by county, river basin, regional water planning area, and groundwater conservation district within Groundwater Management Area 16.

**Modeled Available Groundwater and Permitting**

As defined in Chapter 36 of the Texas Water Code, “modeled available groundwater” is the estimated average amount of water that may be produced annually to achieve a desired future condition. Groundwater conservation districts must consider modeled available groundwater when issuing permits in order to manage groundwater production to achieve the desired future condition(s). Districts must also consider annual precipitation and production patterns, the estimated amount of pumping exempt from permitting, existing permits, and a reasonable estimate of actual groundwater production under existing permits.

**PARAMETERS AND ASSUMPTIONS:**

The parameters and assumptions for the groundwater availability are described below:

- The analysis used version 1.01 of the alternate groundwater availability model for Groundwater Management Area 16. See Hutchison and others (2011) for assumptions and limitations of the model.

- The model has six layers that represent the Chicot Aquifer (Layer 1), the Evangeline Aquifer (Layer 2), the Burkeville Confining Unit (Layer 3), the Jasper Aquifer (Layer 4), the Yegua-Jackson Aquifer (Layer 5), and the Queen-City, Sparta and Carrizo-Wilcox Aquifer System (Layer 6).

- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).
Groundwater Division checked the validity of the assertion that starting water levels in the model were comparable to the measured water-level conditions at the end of year 2010. Water-level values were averaged over the entire area of Groundwater Management Area 16 for the measured and modeled conditions between the years 2000 and 2010. These averaged water-level values are reported in Table 3. As presented in Table 3, the average water-levels indicate that conditions in the field did not change significantly, however, model estimated values differ significantly (by over 12 feet). Such a difference in the model estimates can be explained by the difference in values of pumping and recharge used in the model and those occurring in the field for the period between the years 2000 and 2010. It is important to note here that the groundwater availability model for Groundwater Management Area 16 was constructed using the confined aquifer assumption (and LAYCON=0 option) available within MODFLOW-96. Such an assumption leads to an almost linear response between pumping and drawdown. The Groundwater Division checked and verified the validity of the assumption by taking out the pumping input in the model from the years 2000 to 2010 and obtaining equivalent drawdown values in the year 2060. Based on the analysis, we conclude that the submitted model files are acceptable for developing estimates of modeled available groundwater. Please note that the confined aquifer assumption may also lead to physically unrealistic conditions with pumping in a model cell continuing even when water levels have dropped below the base of the model cell.

Drawdown averages and modeled available groundwater values are based on official aquifer boundaries (Figures 1 and 2).

Drawdown values for cells with water levels below the base elevation of the cell (“dry” cells) were excluded from the averaging. However, pumping values from those cells were included in the calculation of modeled available groundwater.

Estimates of modeled available groundwater from the model simulation were rounded to whole numbers.

Average drawdown per county may include some model cells that represent portions of surface water such as bays, reservoirs, and the Gulf of Mexico.

**RESULTS:**

The modeled available groundwater for the Gulf Coast Aquifer System that achieves the desired future conditions adopted by Groundwater Management Area 16 increases from approximately 233,000 acre-feet per year in 2020 to 312,000 acre-feet per year in 2060 (Tables 1 and 2). The modeled available groundwater is summarized by groundwater conservation district and county (Table 1) and by county, river basin, and regional water.
planning area for use in the regional water planning process (Table 2). Small differences of values between table summaries are due to rounding errors.
FIGURE 1. MAP SHOWING GROUNDWATER CONSERVATION DISTRICTS (GCDS), COUNTIES, AND GULF COAST AQUIFER SYSTEM EXTENT IN GROUNDWATER MANAGEMENT AREA 16 OVERLAIN ON THE EXTENT OF THE ALTERNATIVE GROUNDWATER AVAILABILITY MODEL FOR GROUNDWATER MANAGEMENT AREA 16.
FIGURE 2. MAP SHOWING THE EXTENT OF THE GULF COAST AQUIFER SYSTEM, REGIONAL WATER PLANNING AREAS, COUNTIES, AND RIVER BASINS IN GROUNDWATER MANAGEMENT AREA 16 OVERLAIN ON THE EXTENT OF THE ALTERNATIVE GROUNDWATER AVAILABILITY MODEL FOR GROUNDWATER MANAGEMENT AREA 16.
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<td>Gulf Coast Aquifer System</td>
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<td>6,688</td>
<td>7,999</td>
<td>9,311</td>
<td>10,620</td>
<td>11,932</td>
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<td>2020</td>
<td>2030</td>
<td>2040</td>
<td>2050</td>
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<td>959</td>
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<td>No District-Willacy</td>
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<td>785</td>
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<td><strong>118,273</strong></td>
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<tr>
<td><strong>GMA 16 Total</strong></td>
<td></td>
<td><strong>Gulf Coast Aquifer System</strong></td>
<td><strong>112,428</strong></td>
<td><strong>233,371</strong></td>
<td><strong>257,092</strong></td>
<td><strong>278,239</strong></td>
<td><strong>299,737</strong></td>
<td><strong>311,830</strong></td>
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TABLE 2. MODELED AVAILABLE GROUNDWATER BY DECADE FOR THE GULF COAST AQUIFER SYSTEM IN GROUNDWATER MANAGEMENT AREA 16. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), RIVER BASIN, AND AQUIFER.

<table>
<thead>
<tr>
<th>County</th>
<th>RWPA</th>
<th>River Basin</th>
<th>Aquifer</th>
<th>2020</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
<th>2060</th>
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<td>Bee</td>
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<td>Nueces</td>
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<td>978</td>
<td>995</td>
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<td>Gulf Coast Aquifer System</td>
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<td>9,503</td>
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<td>10,414</td>
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<td>N</td>
<td>Nueces-Rio Grande</td>
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<td>M</td>
<td>Nueces-Rio Grande</td>
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<td>7,536</td>
<td>8,771</td>
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<td>615</td>
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<td>938</td>
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<td>Gulf Coast Aquifer System</td>
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<td>23,941</td>
<td>29,261</td>
<td>29,261</td>
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<td>0</td>
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<td>2040</td>
<td>2050</td>
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<td><strong>GMA 16-Total</strong></td>
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<td><strong>Gulf Coast Aquifer System</strong></td>
<td><strong>233,371</strong></td>
<td><strong>257,092</strong></td>
<td><strong>278,239</strong></td>
<td><strong>299,737</strong></td>
<td><strong>311,830</strong></td>
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</table>
### Table 3.
Comparison of Measured and Modeled Water-Levels Averaged Over Groundwater Management Area 16 from the Decadal Years 2000 and 2010. Values of Field Measured Water-Levels Were Obtained from the TWDB Groundwater Database (GWDB).

<table>
<thead>
<tr>
<th>Average water levels in Groundwater Management Area 16 (in feet above mean sea level)</th>
<th>Year 2000</th>
<th>Year 2010</th>
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<td>Field measurements (GWDB)</td>
<td>114.1</td>
<td>114.4</td>
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<tr>
<td>Model estimated</td>
<td>119.5</td>
<td>107.1</td>
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</table>
LIMITATIONS:

The groundwater model used in completing this analysis is the best available scientific tool that can be used to meet the stated objectives. To the extent that this analysis will be used for planning purposes and/or regulatory purposes related to pumping in the past and into the future, it is important to recognize the assumptions and limitations associated with the use of the results. In reviewing the use of models in environmental regulatory decision making, the National Research Council (2007) noted:

“Models will always be constrained by computational limitations, assumptions, and knowledge gaps. They can best be viewed as tools to help inform decisions rather than as machines to generate truth or make decisions. Scientific advances will never make it possible to build a perfect model that accounts for every aspect of reality or to prove that a given model is correct in all respects for a particular regulatory application. These characteristics make evaluation of a regulatory model more complex than solely a comparison of measurement data with model results.”

A key aspect of using the groundwater model to evaluate historic groundwater flow conditions includes the assumptions about the location in the aquifer where historic pumping was placed. Understanding the amount and location of historic pumping is as important as evaluating the volume of groundwater flow into and out of the district, between aquifers within the district (as applicable), interactions with surface water (as applicable), recharge to the aquifer system (as applicable), and other metrics that describe the impacts of that pumping. In addition, assumptions regarding precipitation, recharge, and streamflow are specific to a particular historic time period.

Because the application of the groundwater model was designed to address regional scale questions, the results are most effective on a regional scale. The TWDB makes no warranties or representations relating to the actual conditions of any aquifer at a particular location or at a particular time.

It is important for groundwater conservation districts to monitor groundwater pumping and groundwater levels in the aquifer. Because of the limitations of the groundwater model and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine this analysis in the future given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future. Historic precipitation patterns also need to be placed in context as future climatic conditions, such as dry and wet year precipitation patterns, may differ and affect groundwater flow conditions.
REFERENCES:


GAM Run 19-019: Live Oak Underground Water Conservation District Management Plan

By Andrew Denham and Shirley C. Wade, Ph.D., P.G.
Texas Water Development Board
Groundwater Division
Groundwater Availability Modeling Department
(512) 936-0883
September 4, 2019

Cynthia K. Ridgeway is the manager of the Groundwater Availability Department and is responsible for the oversight of work performed by Andrew Denham under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G. 471 on September 4, 2019.
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GAM Run 19-019: Live Oak Underground Water Conservation District Management Plan

By Andrew Denham and Shirley C. Wade, Ph.D., P.G.
Texas Water Development Board
Groundwater Division
Groundwater Availability Modeling Department
(512) 936-0883
September 4, 2019

EXECUTIVE SUMMARY:

Texas State Water Code, Section 36.1071, Subsection (h) (Texas Water Code, 2011), states that, in developing its groundwater management plan, a groundwater conservation district shall use groundwater availability modeling information provided by the Executive Administrator of the Texas Water Development Board (TWDB) in conjunction with any available site-specific information provided by the district for review and comment to the Executive Administrator.

The TWDB provides data and information to the Live Oak Underground Water Conservation District in two parts. Part 1 is the Estimated Historical Water Use/State Water Plan dataset report, which will be provided to you separately by the TWDB Groundwater Technical Assistance Department. Please direct questions about the water data report to Mr. Stephen Allen at 512-463-7317 or stephen.allen@twdb.texas.gov. Part 2 is the required groundwater availability modeling information and this information includes:

1. the annual amount of recharge from precipitation, if any, to the groundwater resources within the district;

2. for each aquifer within the district, the annual volume of water that discharges from the aquifer to springs and any surface-water bodies, including lakes, streams, and rivers; and

3. the annual volume of flow into and out of the district within each aquifer and between aquifers in the district.
The groundwater management plan for the Live Oak Underground Water Conservation District should be adopted by the district on or before June 17, 2020 and submitted to the executive administrator of the TWDB on or before July 17, 2020. The current management plan for the Live Oak Underground Water Conservation District expires on September 15, 2020.

We used three groundwater availability models to estimate the management plan information for the aquifers within the Live Oak Underground Water Conservation District. Information for the Carrizo-Wilcox Aquifer is from version 2.01 of the groundwater availability model for the southern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers (Kelley and others, 2004). Information for the Yegua-Jackson Aquifer is from version 1.01 of the groundwater availability model for the Yegua-Jackson Aquifer (Deeds and others, 2010). Information for the Gulf Coast Aquifer System is from version 1.01 of the groundwater availability model for the central portion of the Gulf Coast Aquifer System (Chowdhury and others, 2004).

This report replaces the results of GAM Run 14-014 (Wade, 2014), as the approach used for analyzing model results has been since refined to more accurately delineate flows between hydraulically connected units. Tables 1, 2, and 3 summarize the groundwater availability model data required by statute and Figures 1, 2, and 3 show the area of the models from which the values in the tables were extracted. If, after review of the figures, the Live Oak Underground Water Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the TWDB at your earliest convenience.

**METHODS:**

In accordance with the provisions of the Texas State Water Code, Section 36.1071, Subsection (h), the groundwater availability models mentioned above were used to estimate information for the Live Oak Underground Water Conservation District management plan. Water budgets were extracted for the Carrizo-Wilcox Aquifer (1980-1999), Yegua-Jackson Aquifer (1980-1997), and Gulf Coast Aquifer System (1981-1999). We used ZONEBUDGET Version 3.01 (Harbaugh, 2009) to extract water budgets from the model results. The average annual water budget values for recharge, surface-water outflow, inflow to the district, and outflow from the district for the aquifers within the district are summarized in this report.
PARAMETERS AND ASSUMPTIONS:

Carrizo-Wilcox Aquifer

- We used version 2.01 of the groundwater availability model for the southern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers. See Deeds and others (2003) and Kelley and others (2004) for assumptions and limitations of the groundwater availability model for the southern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers.

- This groundwater availability model includes eight layers which generally represent the Sparta Aquifer (Layer 1), the Weches Confining Unit (Layer 2), the Queen City Aquifer (Layer 3), the Reklaw Confining Unit (Layer 4), the Carrizo Aquifer (Layer 5), the Upper Wilcox (Layer 6), the Middle Wilcox (Layer 7), and the Lower Wilcox (Layer 8). The Sparta Aquifer (Layer 1), and Queen City Aquifer (Layer 3) are not present in Live Oak Underground Water Conservation District. Water budgets were extracted collectively for the Carrizo-Wilcox Aquifer (Layer 5 through Layer 8).

- Groundwater in the Carrizo-Wilcox, Queen City, and Sparta aquifers ranges from fresh to brackish in composition (Kelley and others, 2004). Groundwater with total dissolved solids of less than 1,000 milligrams per liter are considered fresh and total dissolved solids of 1,000 to 10,000 milligrams per liter are considered brackish.

- The model was run with MODFLOW-96 (Harbaugh and McDonald, 1996).

Yegua-Jackson Aquifer

- We used version 1.01 of the groundwater availability model for the Yegua-Jackson Aquifer. See Deeds and others (2010) for assumptions and limitations of the groundwater availability model.

- This groundwater availability model includes five layers which represent the outcrop section for the Yegua-Jackson Aquifer and younger overlying units (Layer 1), the upper portion of the Jackson Group (Layer 2), the lower portion of the Jackson Group (Layer 3), the upper portion of the Yegua Group (Layer 4), and the lower portion of the Yegua Group (Layer 5).

- An overall water budget for the District was determined for the Yegua-Jackson Aquifer (Layer 1 through Layer 5 collectively for the portions of the model that
represent the Yegua-Jackson Aquifer). The net flow between aquifers within the
district were determined by separating Layer 1 from the combined Layers of 2
through 5 from portions outside of the Yegua-Jackson Aquifer outcrop areas.

- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).

**Gulf Coast Aquifer System**

- We used version 1.01 of the groundwater availability model for the central
  portion of the Gulf Coast Aquifer for this analysis. See Chowdhury and others
  (2004) and Waterstone and others (2003) for assumptions and limitations of the
groundwater availability model.

- The model for the central portion of the Gulf Coast Aquifer assumes partially
  penetrating wells in the Evangeline Aquifer due to a lack of data for aquifer
  properties in the deeper section of the aquifer located closer to the Gulf of
  Mexico.

- This groundwater availability model includes four layers, which generally
  represent the Chicot Aquifer (Layer 1), the Evangeline Aquifer (Layer 2), the
  Burkeville Confining Unit (Layer 3), and the Jasper Aquifer including parts of the
  Catahoula Formation (Layer 4).

- The model was run with MODFLOW-96 (Harbaugh and McDonald, 1996).

- Because this model assumes a no-flow boundary condition at the base of the Gulf
  Coast Aquifer System, we used version 1.01 of the groundwater availability
  model for the Yegua-Jackson Aquifer to investigate groundwater flows between
  parts of the Catahoula Formation in direct hydrologic communication with the
  Gulf Coast Aquifer System and the Yegua-Jackson Aquifer and its equivalent
downdip Yegua-Jackson confined units. See Deeds and others (2010) for
assumptions and limitations of the groundwater availability model for the
Yegua-Jackson Aquifer.
RESULTS:

A groundwater budget summarizes the amount of water entering and leaving the aquifer according to the groundwater availability model. Selected groundwater budget components listed below were extracted from the model results for the aquifers located within the district and averaged over the historical calibration periods, as shown in Tables 1, 2, and 3.

1. Precipitation recharge—the areally distributed recharge sourced from precipitation falling on the outcrop areas of the aquifers (where the aquifer is exposed at land surface) within the district.

2. Surface-water outflow—the total water discharging from the aquifer (outflow) to surface-water features such as streams, reservoirs, and springs.

3. Flow into and out of district—the lateral flow within the aquifer between the district and adjacent counties.

4. Flow between aquifers—the net vertical flow between the aquifer and adjacent aquifers or confining units. This flow is controlled by the relative water levels in each aquifer and aquifer properties of each aquifer or confining unit that define the amount of leakage that occurs.

The information needed for the district’s management plan is summarized in Tables 1, 2, and 3. It is important to note that sub-regional water budgets are not exact. This is due to the size of the model cells and the approach used to extract data from the model. To avoid double accounting, a model cell that straddles a political boundary, such as a district or county boundary, is assigned to one side of the boundary based on the location of the centroid of the model cell. For example, if a cell contains two counties, the cell is assigned to the county where the centroid of the cell is located.
**TABLE 1: SUMMARIZED INFORMATION FOR THE CARRIZO-WILCOX AQUIFER THAT IS NEEDED FOR THE LIVE OAK UNDERGROUND WATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE- FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.**

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<tr>
<th>Management Plan requirement</th>
<th>Aquifer or confining unit</th>
<th>Results</th>
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<td>Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers.</td>
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<tr>
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<td>To the Reklaw confining unit from the Carrizo-Wilcox Aquifer</td>
<td>70</td>
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</table>
TABLE 2: SUMMARIZED INFORMATION FOR THE YEGUA-JACKSON AQUIFER THAT IS NEEDED FOR THE LIVE OAK UNDERGROUND WATER CONSERVATION DISTRICT’S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

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<th>Aquifer or confining unit</th>
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<td>Estimated annual volume of flow out of the district within each aquifer in the district</td>
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<td>Into Yegua-Jackson Aquifer from the Catahoula Formation(^1)</td>
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<tr>
<td></td>
<td>Into the Catahoula Formation from the confined Yegua-Jackson units(^2)</td>
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\(^1\) The Catahoula Formation within and near its outcrop is considered part of the Gulf Coast Aquifer System by the TWDB. Flow values from the Catahoula Formation outcrop portion of the Gulf Coast Aquifer System into the Yegua-Jackson Aquifer were extracted from the groundwater availability model for the Yegua-Jackson Aquifer.

\(^2\) Deeper parts of the Catahoula Formation in direct hydrologic communication with the Gulf Coast Aquifer System provide a semi-confined boundary between the Gulf Coast Aquifer system and the underlying confined Yegua-Jackson units (not considered part of the Yegua-Jackson Aquifer by the TWDB). Flow values from the Catahoula Formation in direct hydrologic communication with the Gulf Coast Aquifer System and into the confined Yegua-Jackson units were extracted from the groundwater availability model for the Yegua-Jackson Aquifer.
### TABLE 3: SUMMARIZED INFORMATION FOR THE GULF COAST AQUIFER SYSTEM THAT IS NEEDED FOR THE LIVE OAK UNDERGROUND WATER CONSERVATION DISTRICT’S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

<table>
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<td>Estimated net annual volume of flow between each aquifer in the district</td>
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<tr>
<td></td>
<td>From the confined Yegua-Jackson units into the Catahoula Formation²</td>
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</table>

¹The Catahoula Formation within and near its outcrop is considered part of the Gulf Coast Aquifer System by the TWDB. Flow values from the Catahoula Formation outcrop portion of the Gulf Coast Aquifer System into the Yegua-Jackson Aquifer were extracted from the groundwater availability model for the Yegua-Jackson Aquifer.

²Deeper parts of the Catahoula Formation in direct hydrologic communication with the Gulf Coast Aquifer System provide a semi-confined boundary between the Gulf Coast Aquifer System and the underlying confined Yegua-Jackson units (not considered part of the Yegua-Jackson Aquifer by the TWDB). Flow values from the Catahoula Formation in direct hydrologic communication with the Gulf Coast Aquifer System and into the confined Yegua-Jackson units were extracted from the groundwater availability model for the Yegua-Jackson Aquifer.
LIMITATIONS:

The groundwater models used in completing this analysis is the best available scientific tool that can be used to meet the stated objectives. To the extent that this analysis will be used for planning purposes and/or regulatory purposes related to pumping in the past and into the future, it is important to recognize the assumptions and limitations associated with the use of the results. In reviewing the use of models in environmental regulatory decision making, the National Research Council (2007) noted:

“Models will always be constrained by computational limitations, assumptions, and knowledge gaps. They can best be viewed as tools to help inform decisions rather than as machines to generate truth or make decisions. Scientific advances will never make it possible to build a perfect model that accounts for every aspect of reality or to prove that a given model is correct in all respects for a particular regulatory application. These characteristics make evaluation of a regulatory model more complex than solely a comparison of measurement data with model results.”

A key aspect of using the groundwater model to evaluate historic groundwater flow conditions includes the assumptions about the location in the aquifer where historic pumping was placed. Understanding the amount and location of historic pumping is as important as evaluating the volume of groundwater flow into and out of the district, between aquifers within the district (as applicable), interactions with surface water (as applicable), recharge to the aquifer system (as applicable), and other metrics that describe the impacts of that pumping. In addition, assumptions regarding precipitation, recharge, and interaction with streams are specific to particular historic time periods.

Because the application of the groundwater models was designed to address regional scale questions, the results are most effective on a regional scale. The TWDB makes no warranties or representations related to the actual conditions of any aquifer at a particular location or at a particular time.

It is important for groundwater conservation districts to monitor groundwater pumping and overall conditions of the aquifer. Because of the limitations of the groundwater model and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine this analysis in the future given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future. Historic precipitation patterns also need to be placed in context as future climatic conditions, such as dry and wet year precipitation patterns, may differ and affect groundwater flow conditions.
REFERENCES:


GROUNDWATER MANAGEMENT PLAN DATA:

This package of water data reports (part 1 of a 2-part package of information) is being provided to groundwater conservation districts to help them meet the requirements for approval of their five-year groundwater management plan. Each report in the package addresses a specific numbered requirement in the Texas Water Development Board's groundwater management plan checklist. The checklist can be viewed and downloaded from this web address:

http://www.twdb.texas.gov/groundwater/docs/GCD/GMPChecklist0113.pdf

The five reports included in this part are:

1. Estimated Historical Water Use (checklist item 2)  
   from the TWDB Historical Water Use Survey (WUS)
2. Projected Surface Water Supplies (checklist item 6)
3. Projected Water Demands (checklist item 7)
4. Projected Water Supply Needs (checklist item 8)
5. Projected Water Management Strategies (checklist item 9)  
   from the 2017 Texas State Water Plan (SWP)

Part 2 of the 2-part package is the groundwater availability model (GAM) report for the District (checklist items 3 through 5). The District should have received, or will receive, this report from the Groundwater Availability Modeling Section. Questions about the GAM can be directed to Dr. Shirley Wade, shirley.wade@twdb.texas.gov, (512) 936-0883.
**DISCLAIMER:**

The data presented in this report represents the most up-to-date WUS and 2017 SWP data available as of 5/15/2020. Although it does not happen frequently, either of these datasets are subject to change pending the availability of more accurate WUS data or an amendment to the 2017 SWP. District personnel must review these datasets and correct any discrepancies in order to ensure approval of their groundwater management plan.

The WUS dataset can be verified at this web address:

http://www.twdb.texas.gov/waterplanning/waterusesurvey/estimates/

The 2017 SWP dataset can be verified by contacting Sabrina Anderson (sabrina.anderson@twdb.texas.gov or 512-936-0886).

For additional questions regarding this data, please contact Stephen Allen (stephen.allen@twdb.texas.gov or 512-463-7317).
### Estimated Historical Water Use

**TWDB Historical Water Use Survey (WUS) Data**

Groundwater and surface water historical use estimates are currently unavailable for calendar year 2018. TWDB staff anticipates the calculation and posting of these estimates at a later date.

#### LIVE OAK COUNTY

All values are in acre-feet

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## Projected Surface Water Supplies
### TWDB 2017 State Water Plan Data

### LIVE OAK COUNTY

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**Sum of Projected Surface Water Supplies (acre-feet)**

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All values are in acre-feet
Projected Water Demands  
TWDB 2017 State Water Plan Data

Please note that the demand numbers presented here include the plumbing code savings found in the Regional and State Water Plans.

### LIVE OAK COUNTY

<table>
<thead>
<tr>
<th>RWPG</th>
<th>WUG</th>
<th>WUG Basin</th>
<th>2020</th>
<th>2030</th>
<th>2040</th>
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<th>2070</th>
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<tbody>
<tr>
<td>N</td>
<td>COUNTY-OTHER, LIVE OAK</td>
<td>NUECES</td>
<td>802</td>
<td>783</td>
<td>768</td>
<td>760</td>
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<td>2,547</td>
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<td>933</td>
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<td>2,058</td>
<td>2,089</td>
<td>2,114</td>
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<td>MINING, LIVE OAK</td>
<td>NUECES</td>
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<td>917</td>
<td>907</td>
<td>729</td>
<td>492</td>
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<tr>
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<td>NUECES</td>
<td>325</td>
<td>316</td>
<td>309</td>
<td>305</td>
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</table>

| Sum of Projected Water Demands (acre-feet) | 7,717 | 7,920 | 8,023 | 7,972 | 7,960 | 8,046 |

All values are in acre-feet.
## Projected Water Supply Needs

**TWDB 2017 State Water Plan Data**

Negative values (in red) reflect a projected water supply need, positive values a surplus.

### LIVE OAK COUNTY

<table>
<thead>
<tr>
<th>RWPG</th>
<th>WUG</th>
<th>WUG Basin</th>
<th>2020</th>
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### Live Oak County - Other, Live Oak

<table>
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<th>2040</th>
<th>2050</th>
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<th>2070</th>
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</thead>
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<tr>
<td>NUECES</td>
<td>200</td>
<td>219</td>
<td>234</td>
<td>242</td>
<td>244</td>
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### George West

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<th>2040</th>
<th>2050</th>
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</thead>
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<td>312</td>
<td>314</td>
<td>316</td>
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<td>322</td>
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### Irrigation, Live Oak

<table>
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<tr>
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<th>2020</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
<th>2060</th>
<th>2070</th>
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</thead>
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<tr>
<td>NUECES</td>
<td>423</td>
<td>434</td>
<td>444</td>
<td>448</td>
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### Livestock, Live Oak

<table>
<thead>
<tr>
<th>WUG Basin</th>
<th>2020</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
<th>2060</th>
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<tr>
<td>NUECES</td>
<td>700</td>
<td>590</td>
<td>474</td>
<td>353</td>
<td>226</td>
<td>92</td>
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### Manufacturing, Live Oak

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<th>2030</th>
<th>2040</th>
<th>2050</th>
<th>2060</th>
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</thead>
<tbody>
<tr>
<td>NUECES</td>
<td>0</td>
<td>0</td>
<td>0</td>
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### McCoy WSC

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<td>NUECES</td>
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<td>2,965</td>
<td>2,940</td>
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### Mining, Live Oak

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<th>2030</th>
<th>2040</th>
<th>2050</th>
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<td>NUECES</td>
<td>106</td>
<td>3</td>
<td>13</td>
<td>191</td>
<td>428</td>
<td>588</td>
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### Three Rivers

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<tr>
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**Sum of Projected Water Supply Needs (acre-feet)**

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<th>All values are in acre-feet</th>
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<tbody>
<tr>
<td>0</td>
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## Projected Water Management Strategies

**TWDB 2017 State Water Plan Data**

### LIVE OAK COUNTY

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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EL OSO WSC, NUECES (N)</td>
<td>MUNICIPAL WATER CONSERVATION (RURAL)</td>
<td>DEMAND REDUCTION [LIVE OAK]</td>
<td>11</td>
<td>21</td>
<td>28</td>
<td>29</td>
<td>26</td>
<td>28</td>
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<tr>
<td></td>
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<td>11</td>
<td>21</td>
<td>28</td>
<td>29</td>
<td>26</td>
<td>28</td>
</tr>
</tbody>
</table>

| GEORGE WEST, NUECES (N) | MUNICIPAL WATER CONSERVATION (RURAL) | DEMAND REDUCTION [LIVE OAK] | 15   | 46   | 44   | 40   | 39   | 39   |
| IDENTICAL ROW AS ABOVE |

| THREE RIVERS, NUECES (N) | MUNICIPAL WATER CONSERVATION (RURAL) | DEMAND REDUCTION [LIVE OAK] | 11   | 22   | 15   | 15   | 14   | 15   |
| IDENTICAL ROW AS ABOVE |

| Sum of Projected Water Management Strategies (acre-feet) | 37   | 89   | 87   | 84   | 79   | 82   |

All values are in acre-feet.
RESOLUTION NO. 001-2020

Whereas, the Live Oak Underground Water Conservation District has held the appropriate public hearings, and;

Whereas, the District has presented the management plan to the county officials and the Nueces River Authority.

Whereas, the District has followed the rules set forth by SB 1 and the TWDB.

Now, Therefore be it Resolved, that the Live Oak Underground Water Conservation District voted to pass the District management plan.

In favor 4

Against 0

Passed and Approved this the 19 day of August, 2020.

Scott Bledsoe III, President

Attest by: Lonnie Stewart, Secretary
LIVE OAK UNDERGROUND
WATER CONSERVATION DISTRICT
REGULAR MEETING
AUGUST 19, 2020
8:00 AM

BLEDSOE DECLARED A QUORUM AND CALLED MEETING TO ORDER @ 8:00 AM.
MEMBERS PRESENT: KATZFHEY, LAMM, PAWLIK, BLEDSOE
GUEST PRESENT: STEWART
PUBLIC COMMENTS: BLED SOE OPENED THE PUBLIC HEARING CONCERNING THE
DISTRICT MANAGEMENT PLAN. NO COMMENTS WERE RECEIVED SO BLEDSOE
CLOSED THE HEARING.

LAMM MOVED TO APPROVE THE MINUTES OF THE PREVIOUS REGULAR
MEETINGS. PAWLIK SECONDED. MOTION CARRIED UNANIMOUSLY.

FINANCIAL REPORT: REG. ACCT: $18,421.69 SAVINGS ACCT: $312,049.58
PAWLIK MOVED TO APPROVE THE FINANCIAL REPORT UNTIL AUDITED. LAMM
SECONDED. MOTION CARRIED UNANIMOUSLY.

THE BOARD DISCUSSED THE 2019 AUDIT PERFORMED BY NOEL SNECKDER.
KATZFHEY MOVED TO APPROVE THE AUDIT REPORT. LAMM SECONDED. MOTION
CARRIED UNANIMOUSLY.

STEWART DISCUSSED THE 2019 ANNUAL MANAGEMENT REPORT. THE BOARD
DISCUSSED THE DESIRED FUTURE CONDITION AND DETERMINED THE
DESIRED FUTURE CONDITION WAS ACHIEVED FOR 2019. PAWLIK MOVED TO
APPROVE THE REPORT. LAMM SECONDED. MOTION CARRIED UNANIMOUSLY.
(COPY ATTACHED)

THE BOARD DISCUSSED THE DISTRICT MANAGEMENT PLAN. KATZFHEY MOVED
TO APPROVE THE DISTRICT MANAGEMENT PLAN AND RESOLUTION #001-2020.
PAWLIK SECONDED. MOTION CARRIED UNANIMOUSLY. (COPY ATTACHED)

THE BOARD DISCUSSED THE 2021 BUDGET AND THERE WAS NOT ANY ACTION
TAKEN.

THE BOARD DISCUSSED THE 20120 TAX RATE. LAMM MOVED TO APPROVE A
TAX RATE OF $0.00180 PER $100 VALUATION. KATZFHEY SECONDED. MOTION
CARRIED UNANIMOUSLY.

NO REPORT ON THE GMA 16 UPDATE.

STEWART REPORTED NO NEW WELLS WE DRILLED SINCE THE LAST MEETING.

STEWART DISCUSSED A WELL IN PERNITAS POINT THAT THERE WAS A
DISPUTE OVER WHO OWNED THE WELL. NO ACTION TAKEN.

NEXT MEETING WILL BE SCHEDULED FOR SEPTEMBER 3 AT 8:00 AM.
LAMM MOVED TO ADJOURN AT 9:01 AM. KATZFHEY SECONDED. MOTION
CARRIED UNANIMOUSLY.

____________________________  ______________________________
SCOTT BLEDSOE III          LONNIE STEWART
PRESIDENT                  SECR. - TREAS.
Coastal Bend Publishing
BEEVILLE GOLIAD THE PROGRESS KARNES SAN PATRICIO REFUGIO
League City
111 N. Washington • PO Box 10 • Beeville TX 78104
361.358.2550 office@mysoutex.com

AFFIDAVIT of PUBLICATION

THE STATE OF TEXAS

COUNTY OF BEE

Before me, the undersigned authority, on this day personally appeared Dennis Wade known to me, who, by me duly sworn, on his oath deposes and says that he is the Publisher of the Progress, having general circulation in Live Oak & McMullen Counties, who being by me duly sworn, deposes and says that the foregoing attached notice was published in said newspaper on the following date(s), to wit:
August 6, 2020

[Signature]
Dennis Wade, Publisher

Sworn to and subscribed before me by Dennis Wade this the 06 day of August 2020 AD to certify which witness my hand and official seal.

[Signature]
Mary Virginia Massey
Mary Virginia Massey, Notary Public in and for the State of Texas
Live Oak UWCD
3460 Hwy 281
GEORGE WEST, TX 78022

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Order Detail:

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</table>
LIVE OAK UNDERGROUND WATER CONSERVATION DISTRICT
NOTICE OF PUBLIC HEARING

Notice is hereby given that a Public Hearing concerning the proposed District Management Plan by the Board of Directors of the Live Oak Underground Water Conservation District (LOUWCD) will be held on Wednesday, August 19, 2020 at 8:00 AM at the Live Oak County Farm Bureau Office. Information is available by calling Lonnie Stewart (361) 449-7017 or by emailing louwcd@yahoo.com.
LIVE OAK
UNDERGROUND WATER CONSERVATION DISTRICT
NOTICE OF MEETING
Notice is hereby given that a Regular Meeting of the Board of Directors of the Live Oak Underground Water Conservation District (LOUWCD) will be held on WEDNESDAY AUGUST 19, 2020 AT 8:00 a.m. at the Live Oak County Farm Bureau office.

Lonnie Stewart - Secr. - Treas.

Agenda

Consider and/or Action On:

1. Declaration of Quorum and call meeting to order
3. Minutes of previous meeting
5. 2019 Audit
6. Annual Management Report
7. Approve District Management Plan
8. 2021 Proposed Budget
9. 2020 Proposed Tax Rate
10. GMA 16 Update
11. Management Report, Water Well in Pernitas Point
12. Directors Discussion
13. Next meeting date and agenda items
14. Adjourn

3460A HWY 281 • GEORGE WEST, TEXAS 78022
361-449-1151
Live Oak UWCD - District Management plan

From: Lonnie Stewart (louwcd@yahoo.com)
To: jbyrum@nueces-ra.org
Cc: stephen.allen@twdb.texas.gov
Date: Wednesday, August 19, 2020, 10:48 AM CDT

John, I am attaching the approved District Management Plan for Live Oak UWCD. Let me know if you have any questions.

Thanks,
Lonnie Stewart
LOUWCD: 361-449-1151
BGCD: 361-358-2244
Mobile Phone: 361-449-7017

DMP2020Final.pdf
2.4MB
Live Oak UWCD District Management Plan

Lonnie Stewart <louwcd@yahoo.com>
To ○ Esteban Ramos; ○ Thomas Salazar
Cc ○ Stephen Allen
Retention Policy  Default 2 Year permanent Delete (2 years)  Expires 8/27/2022

DMP2020Final(1).pdf  2 MB

External: Beware of links/attachments.

Steve and Thomas, I am attaching the approved District Management Plan for 2020. The TWDB said I needed to send to the City of Corpus Christi and the City of Three Rivers.
Let me know if you need anything else.

Thanks,
Lonnie Stewart
LOUWCD: 361-449-1151
BGCD: 361-358-2244
Mobile Phone: 361-449-7017
Dan, I am attaching the approved District Management Plan for 2020. The TWDB said I needed to send to the City of Corpus Christi. Let me know if you need anything else.

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Lonnie Stewart
LOUWCD: 361-449-1151
BGCD: 361-358-2244
Mobile Phone: 361-449-7017