Guadalupe County
Groundwater Conservation District

Jeff Walker
Executive Administrator
Texas Water Development Board
1700 North Congress Avenue
Suite 610B
Austin, TX 78701

Re: Guadalupe County GCD Adopted Management Plan October 14, 2022

Mr. Walker,

In a public meeting held October 13, 2022, the Board of Directors of the Guadalupe County Groundwater Conservation District adopted the attached GCGCD Management Plan to be effective December 29, 2022 – December 29, 2027, pending review and approval by the Texas Water Development Board.

GCGCD Resolution 10132022 is attached and has also been included in Appendix B of the Plan. Additionally, copies of the public notices for adoption of the Plan are included in Appendix A.

Thank you for your time.

Sincerely,

Kelley Cochran

Kelley Cochran
General Manager

Enclosed: Guadalupe County Groundwater Conservation District Management Plan December 29, 2022 – December 29, 2027; GCGCD Resolution 10132022

cc: Stephen Alan

GUADALUPE COUNTY GROUNDWATER CONSERVATION DISTRICT

MANAGEMENT PLAN

DECEMBER 29, 2022 –

DECEMBER 29, 2027

Effective: 12/29/2022 – 12/29/2027

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APPENDICES

1. District Mission

The Mission of the Guadalupe County Groundwater Conservation District (GCGCD, District) is to conserve, preserve, protect, and prevent waste of groundwater resources. It shall be the policy of the Board of Directors that the most efficient use of groundwater in the District is to provide for the needs of the citizens and ensure growth for future generations. The Board of Directors, with the cooperation of the citizens of the District, shall implement this management plan (Plan) and its accompanying rules to achieve this goal. GCGCD shall also establish, as part of this Plan, the policies of water conservation, public information dissemination and technical research by cooperation and coordination with the citizens of the District and equitable enforcement of the Plan and its accompanying rules.

2. Purpose of the Management Plan

The GCGCD recognizes that the groundwater resources of the region are of vital importance to the continued economic well-being of citizens, landowners, agriculture, economy, environment, groundwater owners, and long-term use of the resource within the District. The District will endeavor to evaluate the highest practicable level of groundwater production that can be achieved balanced along with conservation, preservation, and protection of the resource and private property rights. This Plan addresses the following management goals:

1) Providing the most efficient use of groundwater
2) Controlling and preventing waste of groundwater
3) Controlling and preventing subsidence
4) Addressing conjunctive surface water management issues
5) Addressing natural resource issues
6) Addressing drought conditions
7) Addressing conservation, recharge enhancement, rainwater harvesting, precipitation enhancement, or brush control where appropriate and cost effective
8) Addressing the desired future condition (DFC) of groundwater resources (as adopted by the District under TWC § 36.108)

This Plan is intended as a guide or blueprint for action of those individuals charged with the responsibility for the execution of District activities.

3. Background

The GCGCD was first created in 1997 by Acts of the 75th Legislature, Chapter 1066 and was then amended in 1999 by House Bill 3817 which established the District boundary, limited to only a portion of Guadalupe County outside of the boundaries of the Edwards Aquifer Authority in Guadalupe County, Texas (Figure 1).

A confirmation election was held in November of 1999 confirming the District and elected seven initial directors from single member districts. The District has adopted rules and held public hearings in accordance with Texas Water Code §36.001 et. Seq.
HB 1947 (81st Legislature, 2009) repealed Section 6(g) of Section 9, Chapter 1066 (75th Legislature, 1997 Regular session) to change the election date of the Board of Directors from May to November of odd years.

According to the Texas Legislature, groundwater conservations districts (GCDs) "are the state's preferred method of groundwater management". GCGCD is part of Regional Water Planning Area L (Figure 3) and Groundwater Management Area 13 (Figure 4).

Authority
GCGCD has all of the rights, powers, privileges, authority, functions, and duties provided by the general law of Texas and is governed by Chapters 36 & 49 of the Texas Water Code. GCGCD does not have the authority to tax.

Fees/Revenue
The District receives income from fees imposed on production amounts of non-exempt permitted wells and associated application fees. The majority of fees received are collected from municipal-public water supply permit holders, followed by industrial, agricultural/irrigation and other beneficial uses as outlined in TWC § 36.001.

Groundwater Resources
The GCGCD overlies the Carrizo and Wilcox aquifers and the Leona Gravels within its boundaries (Figure 1). The Carrizo and Wilcox aquifers have sufficient capacity for municipal, commercial, and irrigation type production. The Carrizo and Wilcox aquifers are recharged in Guadalupe County from rainfall and streams flowing over the outcrop areas (Figure 2.) Both water-table and artesian conditions are found within the boundaries of the District. A substantial amount of recharge to the Carrizo and Wilcox aquifers located in Gonzales County originates in Guadalupe County.
For additional information regarding the aquifers in Guadalupe County, District's website https://gcgcd.org/about.html and see TWDB Report 332 *Ground-Water Resources of the Carrizo-Wilcox Aquifer in the Central Texas Region,* September 1991, by Thorkildsen and Price. Report 332 - Ground-Water Resources of the Carrizo-Wilcox Aquifer in the Central Texas Region

4. Criteria for Plan Approval

A. Time Period of this Plan

This Plan will become effective, after notice and hearing, and upon adoption by the GCGCD Board of Directors, and approval as administratively complete by the Texas Water Development Board (TWDB). The Plan will remain in effect for five (5) years after the date of approval or until a revised Plan is adopted and certified.

B. Plan Adoption
Public notices demonstrating this Plan was adopted after the required public hearing and meeting of the Board of Directors are attached in Appendix A.

C. Board Resolution
A certified copy of the resolution of the Board of Directors of the District adopting this Management Plan is attached in Appendix B.

D. Coordination with Surface Water Management Entities
Letter transmitting a copy of this Management Plan to the Guadalupe-Blanco River Authority (GBRA) is attached in Appendix C.

5. Groundwater Management Plan Data 31 TAC 356.5(a)(5)(A-H) and TWC §36.1071(e)(4)

The Guadalupe County Groundwater Conservation District has considered the water supply needs and water management strategies included in the adopted 2022 State Water Plan. The District understands the water supply needs of the region and has received and reviewed the water management strategies data values supplied by the TWDB. The 2022 State Water Plan addresses the population projections (4.1, pgs. 47-52) and the importance of utility-based planning (4.1.2, pgs. 52-62). GCGCD recognizes that public water supply in the region is the most efficient way to provide water to the increasing population of the area (6.2, pgs. 84-86). In developing this Management Plan, the District reviewed the Estimated Historical Groundwater Use and 2022 State Water Plan datasets (Appendix G) provided by TWDB and considered each of the following, which are incorporated into the Plan.

- **Modeled Available Groundwater (MAG)** 31 TAC 356.5(a)(5)(A)

  Texas Water Code §36.108 requires joint planning among the groundwater conservation districts within GMA 13. A key component of joint planning is to determine the "desired future conditions" (DFCs) that are used to calculate the "modeled available groundwater" (MAG). For an estimate of the modeled available groundwater in the district based on the desired future conditions – refer to GAM RUN 21-018 MAG GAM Run 21-018 MAG (texas.gov). Refer to the MAG report included in Appendix H. To view a summary table of MAGs by GCD in GMA 13 refer to Appendix I.

  Modeled available groundwater is defined as "the amount of water that the executive administrator determines may be produced on an average annual basis to achieve a desired future condition established under Section 36.108". TWC §36.001(25)

Desired future condition means "a quantitative description, adopted in accordance with Section 36.108, of the desired condition of the groundwater resources in a management area at one or more specified future times". TWC §36.001(30).

Due to limitations of the Groundwater Availability Model for the Southern Portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers identified and discussed during 2016 (Hutchison, 2017a) and 2021 Joint Planning, Groundwater Management Area 13 adopted two desired future conditions for the Carrizo-Wilcox, Queen City, and Sparta aquifers as described below.

- The first desired future condition for the Carrizo-Wilcox, Queen City and Sparta aquifers in Groundwater Management Area 13 is that 75 percent of the saturated thickness in the outcrop at the end of 2012 remains at the end of 2080.

- In addition, a secondary desired future condition for the Carrizo-Wilcox, Queen City, and Sparta aquifers in Groundwater Management Area 13 is an average drawdown of 49 feet (+/- 5 feet) for all of GMA 13. The drawdown is calculated from the end of 2012 conditions to the year 2080. (See Appendix J)

**April 15, 2022, TWBD determined the desired future conditions explanatory report and other materials for Groundwater Management Area 13 required by TWC §36.108(d-3) are administratively complete in accordance with 31 TAC §356.33.*
See Appendix D.

- **Estimated Historical Groundwater Use and 2022 State Water Plan Datasets**
  31 TAC §356.52(a)(5)(B); §356.10(2) and TWC §36.1071(e)(3)(B)

  The TWDB Estimated Historical Water Use Survey (WUS) and 2022 State Water Plan Datasets for Guadalupe County charts by year and source the primary uses of both groundwater and surface water. The estimated historical groundwater use is for years 2004-2019. In 2019, the primary use of groundwater for Guadalupe County was municipal (8,137 AF), followed by steam electric (1,680 AF), irrigation (422 AF), livestock (321 AF), manufacturing (105 AF), and mining (1 AF).
  See Appendix G, page 3.
  See Appendix E for definitions.

- **Projected Surface Water Supplies** - 31 TAC §356.52(a)(5)(F) and TWC §36.1071(e)(3)(F)

  According to the TWDB Estimated Historical Water Use Survey and 2022 State Water Plan Datasets, Guadalupe County's projected surface water supplies for the Guadalupe and San Antonio Water Use Group (WUG) Basins are sourced primarily

from Canyon Lake Reservoir and the Guadalupe River Run-of-the River. See Appendix G, page 4.

- **Projected Total Demand for Water –** 31 TAC §356.52(a)(5)(G) and TWC §36.1071(e)(3)(G)

  According to the TWDB Estimated Historical Water Use Survey and 2022 State Water Plan Datasets, total projected water demands for Guadalupe County increase from 34,496 AF in year 2020 to 60,886 AF by year 2070. See Appendix G, page 6 for list of projected water demands by WUG and WUG Basin from 2020-2070.

- **Water Supply Needs** – TWC §36.1071(e)(4)

  According to the TWDB Estimated Historical Water Use Survey and 2022 State Water Plan Datasets, projected water supply needs for Guadalupe County indicate a need of 14,765 AF to meet demand needs of year 2070 (See Appendix G, page7). These projected water demands in excess of existing water supplies are primarily for municipal water use within the District. The majority of permits held within GCGCD are municipal/public water supply. Projected needs listed in the TWDB estimated historical water use/2022 state water plan data packet (Appendix G) are primarily municipal. Municipal needs in Guadalupe County exist for the following water use groups (WUGs): Cibolo, Crystal Clear WSC, Green Valley SUD, Luling, Marion, Martindale WSC, New Braunfels, Schertz, Seguin, Selma, and Water Services. Additional needs exist in one other WUG: Manufacturing. From 2020-2070, the total needs in Guadalupe County are projected to increase from 43 AF to 14,765 AF.

- **Water Management Strategies - From the 2022 Texas State Water Plan (SWP)** TWC §36.1071(e)(4)

  TWDB Estimated Historical Water Use Survey and 2022 State Water Plan Datasets lists the water management strategies by WUG and aquifer from 2020-2070 for Guadalupe County. Specific projects or actions to increase water supply or maximize existing supply to meet the needs of the growing population are identified. In Seguin, the SSLGC Expanded Carrizo Project is estimated to be the largest strategy at 3,000 AF (2020-2070). See Appendix G, pages 8-11 for a full list.
  Projected water management strategies listed in the TWDB estimated historical water use/2022 state water plan data packet and located within Guadalupe County are: Municipal Water Conservation (Cibolo, County - Other, Crystal Clear WSC, Gonzales County WSC, New Braunfels, Schertz, Seguin, Selma, and Water Services), Drought Management, (Crystal Clear WSC, Martindale, and Seguin), Carrizo-Wilcox Aquifer Wells (Canyon Regional Water Authority, and Schertz-Seguin Local Government Corporation). From 2020 to 2070, the total water management

strategies in Guadalupe County are projected to increase from 13,806 AF to 37,631 AF.

- **Groundwater Availability Model (GAM)**
  31 TAC §356.52(a)(5)(C); TWC §36.1071(e)(3)(C); 31 TAC §356.52(a)(5)(D); TWC §36.1071(e)(3)(D); 31 TAC §356.52(a)(5)(E); TWC §36.1071(e)(3)(E)

  The Groundwater Availability Model (GAM) is used to estimate the Modeled Available Groundwater (MAG) from the Desired Future Conditions (DFC). Estimates of the annual volume of recharge from precipitation, annual volume of water that discharges from the aquifer, annual volume of flow into the district within each aquifer, the annual volume of flow out of the aquifer within each aquifer, and the annual volume of flow between aquifers in the district is presented in the Groundwater Availability Model GAM Run 11-017 GR11-017.PDF (texas.gov) and is included in GAM report in Appendix K.

6. Actions, Procedures, Performance, and Avoidance Necessary to Effectuate the Management Plan, and Details on how the District will Manage Groundwater Supplies TWC §36.1071(e)(2), 31 TAC §356.52(a)(4)

The District will implement the provisions of this Plan and will utilize the provisions of this Plan as a guidepost for on-going evaluation determining the direction or priority for activities of the District. Operations and activities of the District will be performed in a manner that best encourages cooperation with the appropriate state, regional or local water authority. 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 District encourages public cooperation and shall treat all citizens equally. All meetings are noticed and open to the public and conducted in accordance with the Texas Open Meetings Act.

The District will manage groundwater resources consistent with the intent and mission of the District to conserve, preserve, protect, and prevent waste of groundwater resources so that the economy of the areas within the District will be ensured growth for future generations.

The District has installed a network of six groundwater monitoring wells across the outcrop region to aid in identifying the impacts of production in the Carrizo Aquifer as it relates to the desired future conditions. Additionally, the District collected hydrogeologic data (aquifer thickness, transmissivity, permeability, specific yield, and water quality) from these wells located in the outcrop of the Carrizo Aquifer and shared this data with TWDB.

The District will monitor water levels in selected observation wells across the District at least three times a year and maintain a database of water levels for comparison. Water

level changes will be calculated and shared with the Board and the public at open meetings and via the District website www.gcgcd.org and reported to TWDB.

The District has adopted Rules relating to the permitting of wells and the production of groundwater as provided under the authority of Texas Water Code §36.101. These Rules may be amended to reflect changes in TWC §36 and to ensure the best management of the groundwater within the District.

The District Rules are used in the exercise of the powers conferred on the District by law and in the accomplishment of the purposes of the law creating the District. These Rules may be used as guides in the exercise of discretion, where discretion is vested. However, under no circumstances and in no particular case will they or any part therein, be construed as a limitation or restriction upon the District to exercise powers, duties and jurisdiction conferred by law. These Rules create no rights or privileges in any person or water well and shall not be construed to bind the Board in any manner in its promulgation of the District Management Plan, or amendments to these Rules.

Public cooperation is essential for this plan to accomplish its objectives. The District will work with the public and local and state agencies to achieve the goals set forth in this plan. The District will coordinate with public water suppliers, private groundwater users, and industrial and agricultural users to help them conserve groundwater. The District will work with other groundwater conservation districts within GMA 13 to best achieve the desired future conditions set forth by TWC §36.108.

The District has been a member of the Texas Alliance of Groundwater Districts (TAGD) since 2005 and participates in regular business meetings and attends annual summits to learn more about the 'best available science' and updated legislative matters potentially impacting groundwater and surface water in the state.

Current Rules (Effective August 12, 2021) are available on District website www.gcgcd.org.

7. Management Goals, Methodology for Tracking Progress, Management Objectives & Performance Standards

In Accordance with 31 TAC §356.52(a)(4), the General Manager of the District will prepare and present an annual report to the Board of Directors on the performance of the District with respect to achieving the District's management goals and objectives. The Annual Manager's Report will be delivered to the Board on or before March 31st of each new year. A copy of the Annual Manager's Report will be kept on file at the District and made available to the public after adoption by the board.

GOALS:

1) **Providing the Most Efficient Use of Groundwater:** 31 TAC 356.52(a)(1)(A); TWC §36.1071(a)(1)

Practices, techniques, and technologies that a district determines will provide the least consumption of groundwater for each type of use balanced with the benefits of using groundwater.

Management Goal:

The District's goal is to provide the most efficient use of groundwater.

Management Objectives:

a. Each month, the District will compile a report of produced water as reported by municipal permit holders to be presented to the Board at each regularly scheduled board meeting and will be made available to the public on the District's website www.gcgcd.org at least quarterly.
b. The District will provide educational tools to the public relating to the most efficient uses of groundwater via a regularly scheduled board meeting, District newsletter and/or its website at least once a calendar year.

Performance Standards:

a. Maintain a database of produced water from public water supply permit holders within the District.
b. Record the number of times and the method(s) used to provide the educational tools relating to the most efficient uses of groundwater each year.

2) **Controlling and Preventing Waste of Groundwater:** 31 TAC 356.52(a)(1)(B); TWC §36.1071(a)(2)

Management Goal:

The District's goal is to prevent waste of groundwater as defined in TWC §36.001(8) within its District's boundaries.

Management Objective:

The District will provide educational resources to the public on ways to control and prevent waste of groundwater at least once a calendar year by presentations at a regular scheduled board meeting, District newsletter and/or on its website.

Performance Standard:

Record the number of times and the method(s) used to provide the educational resources relating to controlling and preventing waste of groundwater each year.

3) **Controlling and Preventing Subsidence:** 31 TAC 356.52(a)(1)(C); TWC §36.1071(a)(3)

Guadalupe County Groundwater Conservation District has reviewed TWDB subsidence risk report, *Identification of the Vulnerability of the Major and Minor Aquifers of Texas to Subsidence with Regard to Groundwater Pumping* – TWDB

Contract Number 1648302062, by LRE Water and agrees that the southern portion of the Carrizo-Wilcox has a lower risk factor [Figure 4.7] and therefore; goals, objectives, and performance standards are not applicable. GCGCD will investigate any reports of potential subsidence.

4) **Addressing Conjunctive Surface Water Management:** 31 TAC 356.52(a)(1)(D); TWC §36.1071(a)(4)

Management Goal:

The District's goal is to address the conjunctive use potential of groundwater and surface water sources for the benefit of the residents of the District.

Management Objectives:

a. The District will connect with staff of the Guadalupe-Blanco River Authority (GBRA) at least once a year to share information updates about conjunctive use potential.
b. The District will attend at least one Regional Water Planning Group (RWPG) meeting annually to share the information updates about potential conjunctive uses with its Board of Directors.
c. The District will publish in the District's newsletter updates from the RWPG at least once a year.

Performance Standards:

a. The District will record the date, number of meetings, and summary of discussion topic(s) between GCGCD and GBRA staff each year.
b. The District will record the date(s) and number of RWPGs meeting(s) attended by GCGCD each year.
c. The District will record the Newsletter edition featuring the RWPG update in the District's Annual Manager's Report.

5) **Addressing Natural Resource Issues:** 31 TAC 356.52(a)(1)(E); TWC §36.1071(a)(5)

Natural Resource Issues are 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.

Management Goal:

District's goal is to protect the natural resources of the GCGCD.

Management Objectives:

a. The District will connect with the Natural Resources Conservation Service (NRCS) representatives at least once a year to exchange information

regarding groundwater availability, irrigation demands, and NRCS programs relating to groundwater.

b. The District will connect with representatives of the Texas Railroad Commission (RRC) at least once a year to discuss abandoned oil/gas wells and plugging of such wells within the GCGCD boundary.

Performance Standards:

a. The District will record the date(s) of the meeting(s) and a summary of the discussion each year.
b. The District will record the date(s) of the meeting(s) and a summary of the discussion each year.

6) Addressing Drought Conditions: 31 TAC 356.52(a)(1)(F); TWC §36.1071(a)(6)

Management Goal:

The District's goal is to keep the public well informed of the drought conditions across the region. Links to TWDB drought page and GCGCD drought page can be found at: https://www.waterdatafortexas.org/drought and on the District's website http://gcgcd.org/drought.html

The District is a partner of the TWDB TexMesonet program TexMesoNet | Texas Water Development Board with seven stations a part of the GCGCD network.

Management Objectives:

a. The District will collect data from the TexMesonet sites within the District each month and present monthly rainfall totals to the Board and public at a regularly scheduled meeting.
b. The District will review the drought maps provided by TWDB at each regularly scheduled board meeting.
c. The District's manager will at least once a year review/discuss the District's Drought Management Plan.

Performance Standards:

a. The District will maintain a database of annual rainfall totals.
b. The Board will review the drought maps at regular monthly board meetings.
c. Record the date of the review of the Drought Management Plan.

7) Addressing, where appropriate and cost effective: 31 TAC 356.52(a)(1)(G); TWC §36.1071(a)(7)

a) Conservation

Management Objective:
The District, via its website and/or Newsletter, will provide educational resources on a variety of water conservation tools to the public at least once a year.
Performance Standard:
Record the topic, method of dissemination and number of times each year.

b) Recharge Enhancement – Increased recharge accomplished by the modification of the land surface, streams, or lakes to increase seepage or infiltration rates or by the direct injection of water into the subsurface through wells.
Management Objective:
The District, via its website and/or Newsletter, or a regular scheduled board meeting will provide to the public at least once a year, updated information on the subject of recharge enhancement.
Performance Standard:
Record the topic, method of dissemination and number of times each year.

c) Rainwater Harvesting
Management Objective:
The District, via its website and/or Newsletter, or a regular scheduled board meeting will provide to the public at least once a year, updated information on the subject of rainwater harvesting.
Performance Standard:
Record the topic, method of dissemination and number of times each year.

d) Precipitation Enhancement
Precipitation enhancement projects are not a cost-effective tool for GCGCD and therefore not applicable as a management goal.

e) Brush Control
Brush control projects are not a cost-effective tool for GCGCD and therefore not applicable as a management goal.

8) Addressing the Desired Future Conditions established under TWC §36.108 31TAC 356.52(a)(1)(H); TWC §36.1071(a)(8)

Management Goal:
The District's goal is to manage its aquifers within the established desired future conditions by participating in joint planning efforts and by obtaining water level measurements from the network of monitoring wells established throughout the

District in an effort to measure the health of the aquifers and assess the District's progress in achieving its desired future conditions.

Management Objectives:

a. The District's designated representative will attend at least one GMA 13 meeting a year to obtain updates, share information with the other Districts, and participate in the DFC planning process.
b. The District will obtain water level measurements in both the Carrizo and Wilcox aquifers three times a year and compile the data into a report posted on the District's website and/or Newsletter at least annually.
c. At the end of each DFC cycle, the District will compile the water level measurements obtained from the District's monitoring well network for that same five-year cycle into a summary report and calculate the water level averages over the five-year period to track the District's progress in achieving its desired future conditions.

Performance Standards:

a. Record the date of meeting(s) attended and update the Board at regular board meetings.
b. Record the date of the water level measurements and maintain a database of the water level measurements recorded.
c. Calculate the District's monitoring well water level averages annually and include in the District's annual Manager's Report for each DFC cycle.

Figure 1

GCGCD Boundary Map

Guadalupe County Groundwater Conservation District Boundary Map

N

Hays County

Edwards Aquifer Authority

Caldwell County

Comal County

GERONIMO

KINGSBURY

Hwy 90

MARION

SEGUIN

San Marcos River

Hwy 90A

FM 466

Guadalupe River

Cibolo Creek

Gonzales County

Bexar County

FM 775

Hwy 123

Wilson County

LEGEND

GCGCD Boundary

River/Creek

Figure 2

Carrizo-Wilcox Aquifer Recharge Zones

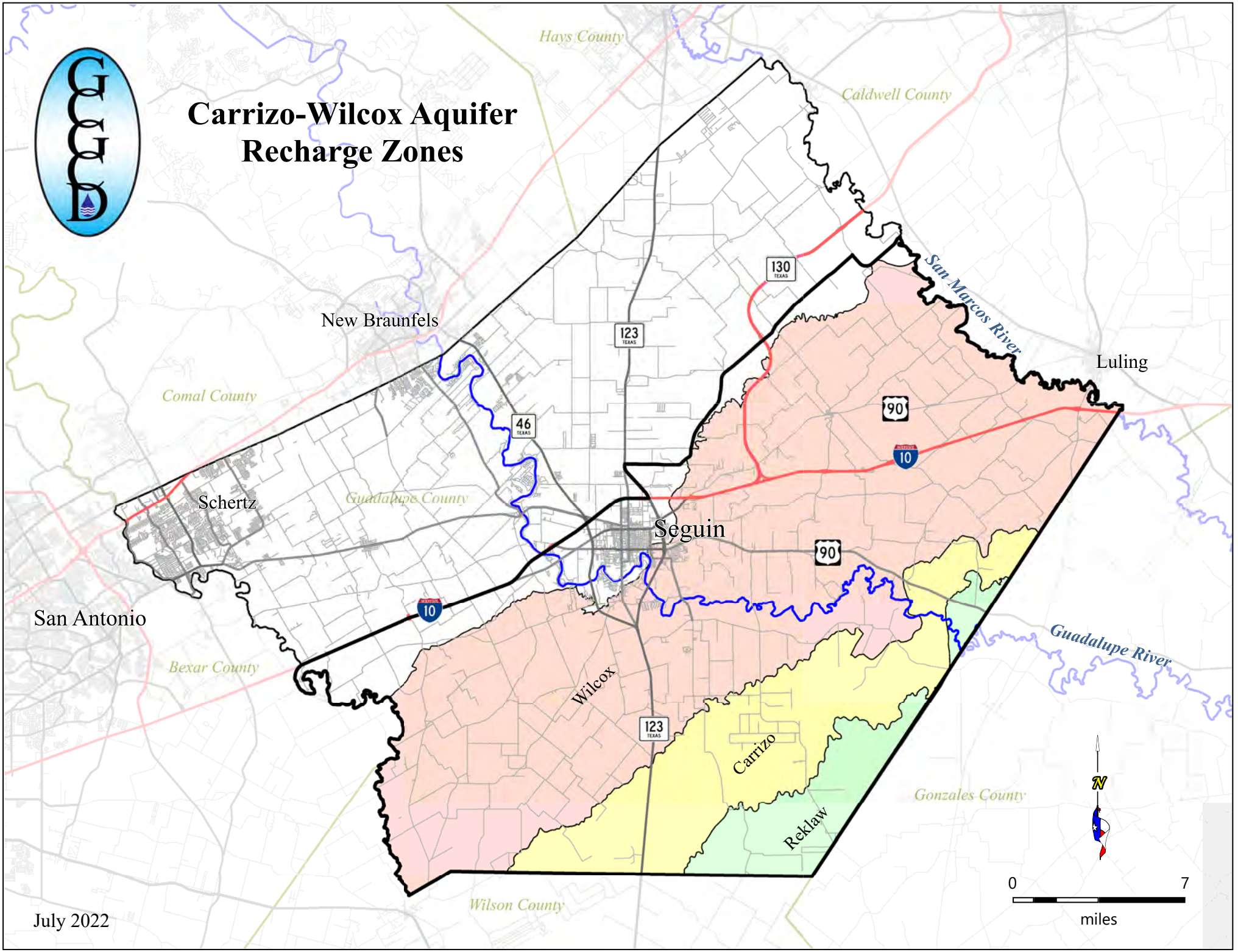
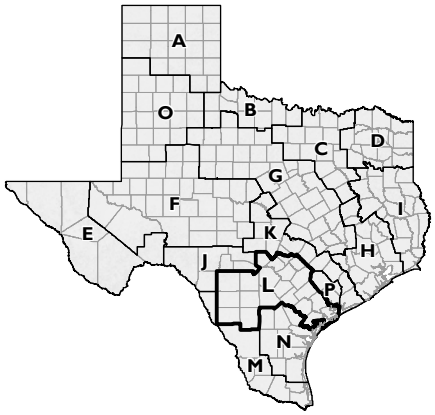

Carrizo-Wilcox Aquifer
Recharge Zones
Hays County
Caldwell County
New Braunfels
Comal County
Schertz
Guadalupe County
Seguin
San Antonio
Bexar County
Luling
San Marcos River
Guadalupe River
Wilcox
Carrizo
Reklaw
Gonzales County
Wilson County
130
123
46
90
10
N
0
7
miles
July 2022

Figure 3

Regional Water Planning Area L - South Central Texas

Regional Water Planning Area
L - South Central Texas



DISCLAIMER: This map was generated by the Texas Water Development Board using GIS (Geographical Information System) software. No claims are made to the accuracy or completeness of the information shown herein nor to its suitability for a particular use. The scale and location of all mapped data are approximate. Map date: 01/01/2019

County boundaries
Major river basin boundaries
Major roadways
Major reservoirs
Major rivers
County seats

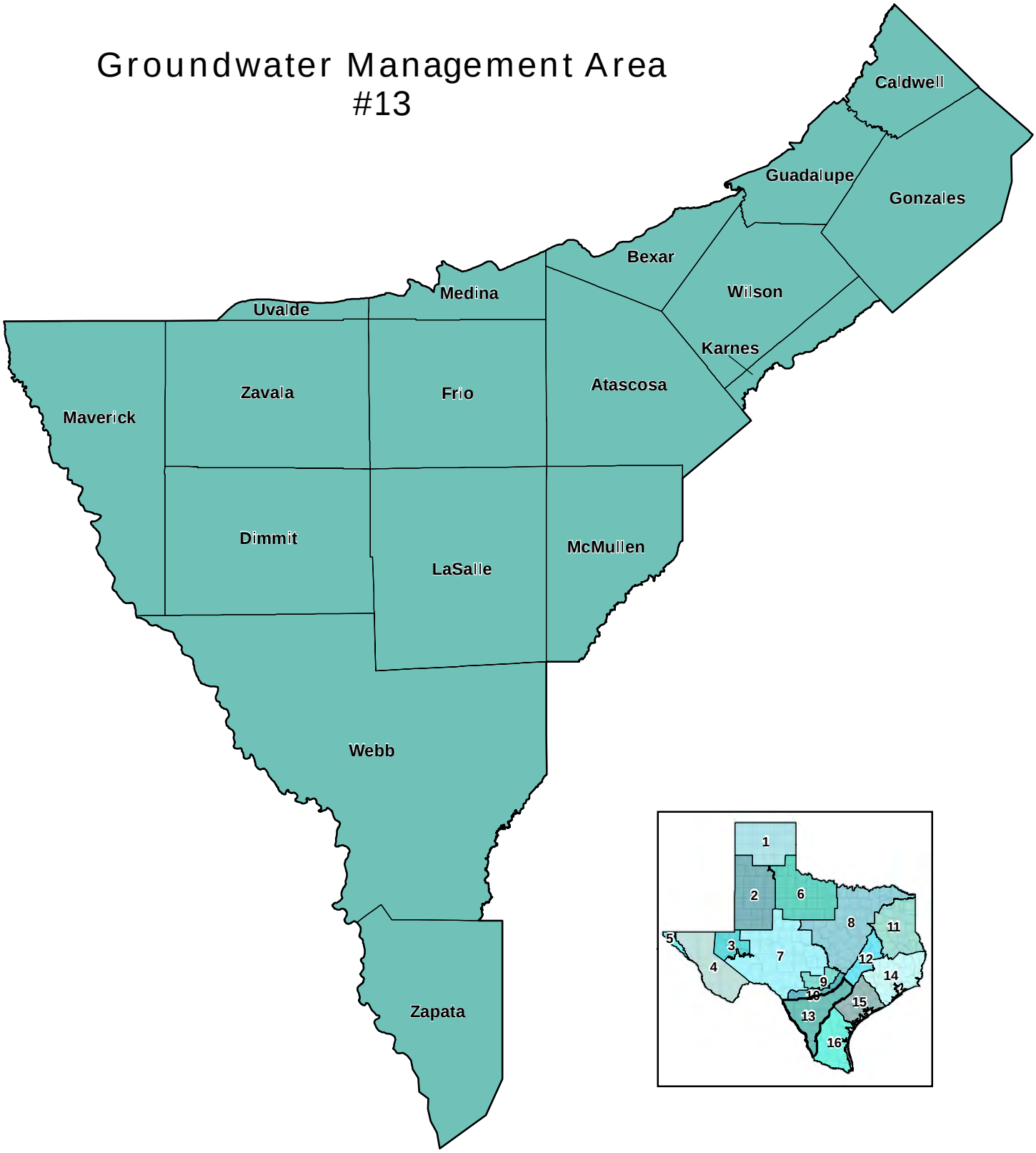
0 10 20
Miles

Texas Water Development Board
1700 North Congress Avenue, Austin, TX 78701
www.twdb.texas.gov - @twdb - facebook.com/twdboard

Figure 4

Groundwater Management Area 13
(by county, GCD, major aquifers & minor aquifers)

Groundwater Management Area #13

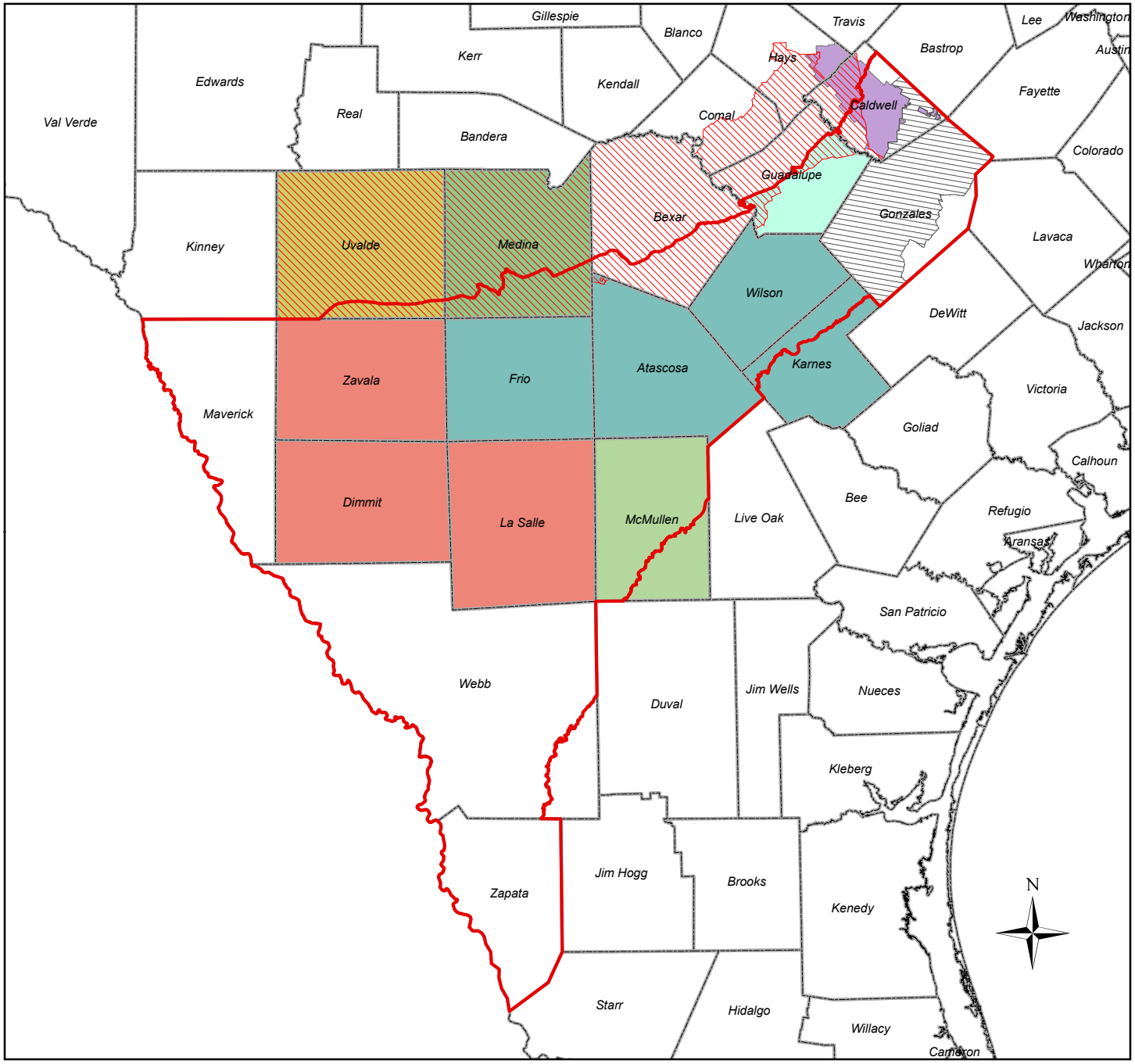


TEXAS WATER DEVELOPMENT BOARD
1700 North Congress Avenue | P.O. Box 13231
Austin, Texas 78711-3231
www.twdb.texas.gov

0 5 10 20
Miles

MISSION: The Texas Water Development Board's (TWDB) mission is to provide leadership, planning, financial assistance, information, and education for the conservation and responsible development of water for Texas.

Groundwater Management Area 13



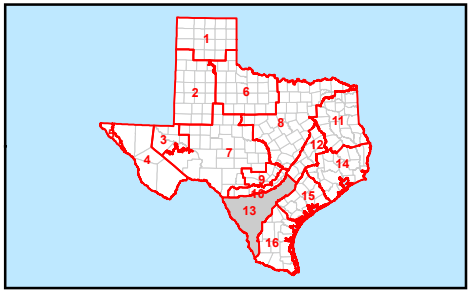
MAP LEGEND

- Groundwater Management Area 13
- Counties

Groundwater Conservation Districts

- Edwards Aquifer Authority
- Evergreen UWCD
- Gonzales County UWCD
- Guadalupe County GCD
- McMullen GCD
- Medina County GCD
- Plum Creek CD
- Uvalde County UWCD
- Wintergarden GCD

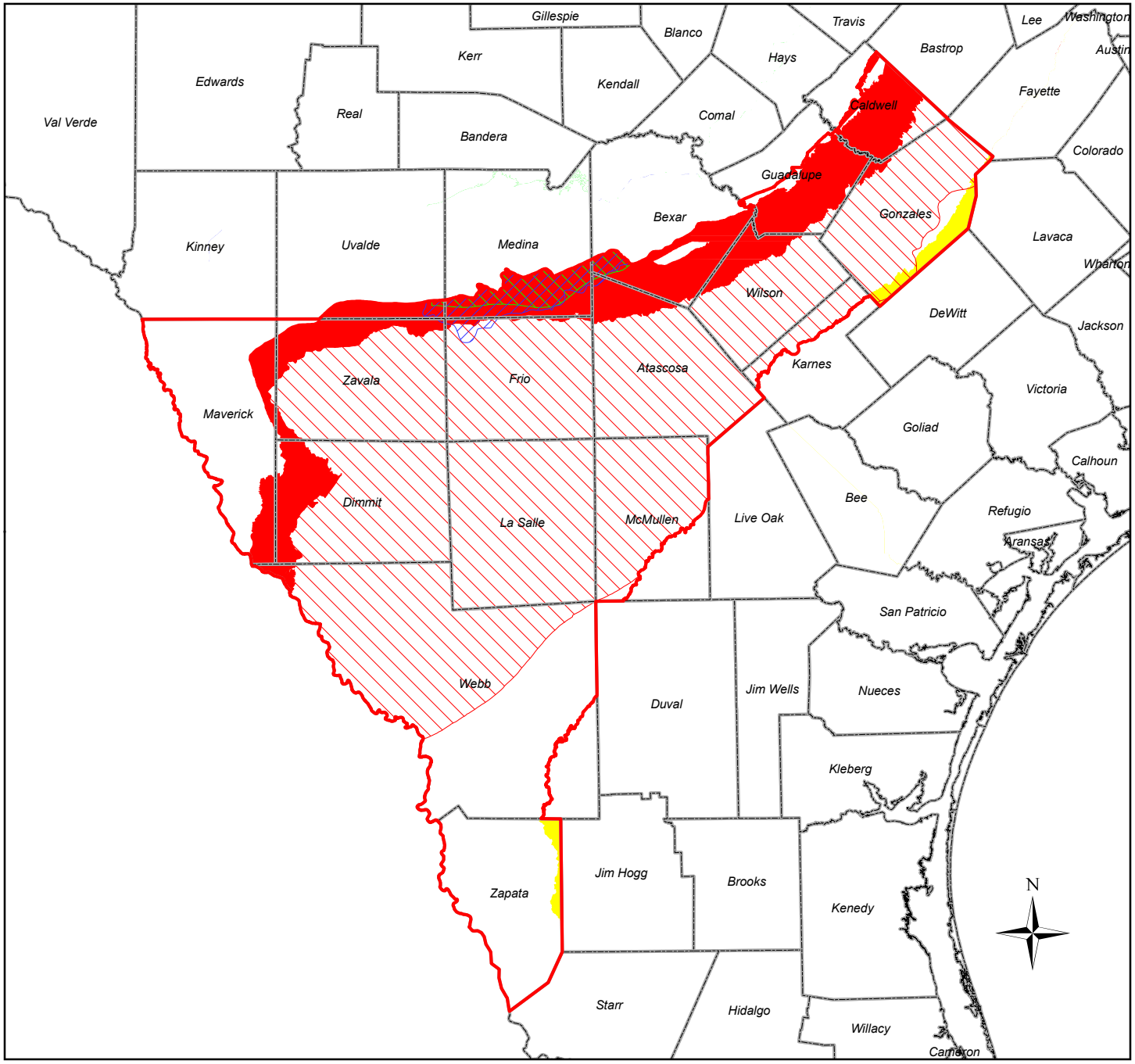
Updated 8/26/2015



0 5 10 20 30 40 Miles

1 in = 19 miles

Groundwater Management Area 13



MAP LEGEND

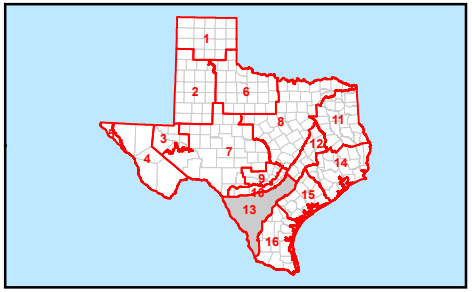
- Groundwater Management Area 13
- Counties

Major Aquifers

- Gulf Coast
- Carrizo - Wilcox (outcrop)
- Carrizo - Wilcox (subcrop)
- Edwards BFZ (subcrop)
- Trinity (subcrop)

DISCLAIMER
This map was generated by the Texas Water Development Board. No claims are made to the accuracy or completeness of the information shown herein nor to its suitability for a particular use. The scale and location of all mapped data are approximate. Boundaries for groundwater conservation districts are approximate and may not accurately depict legal descriptions.

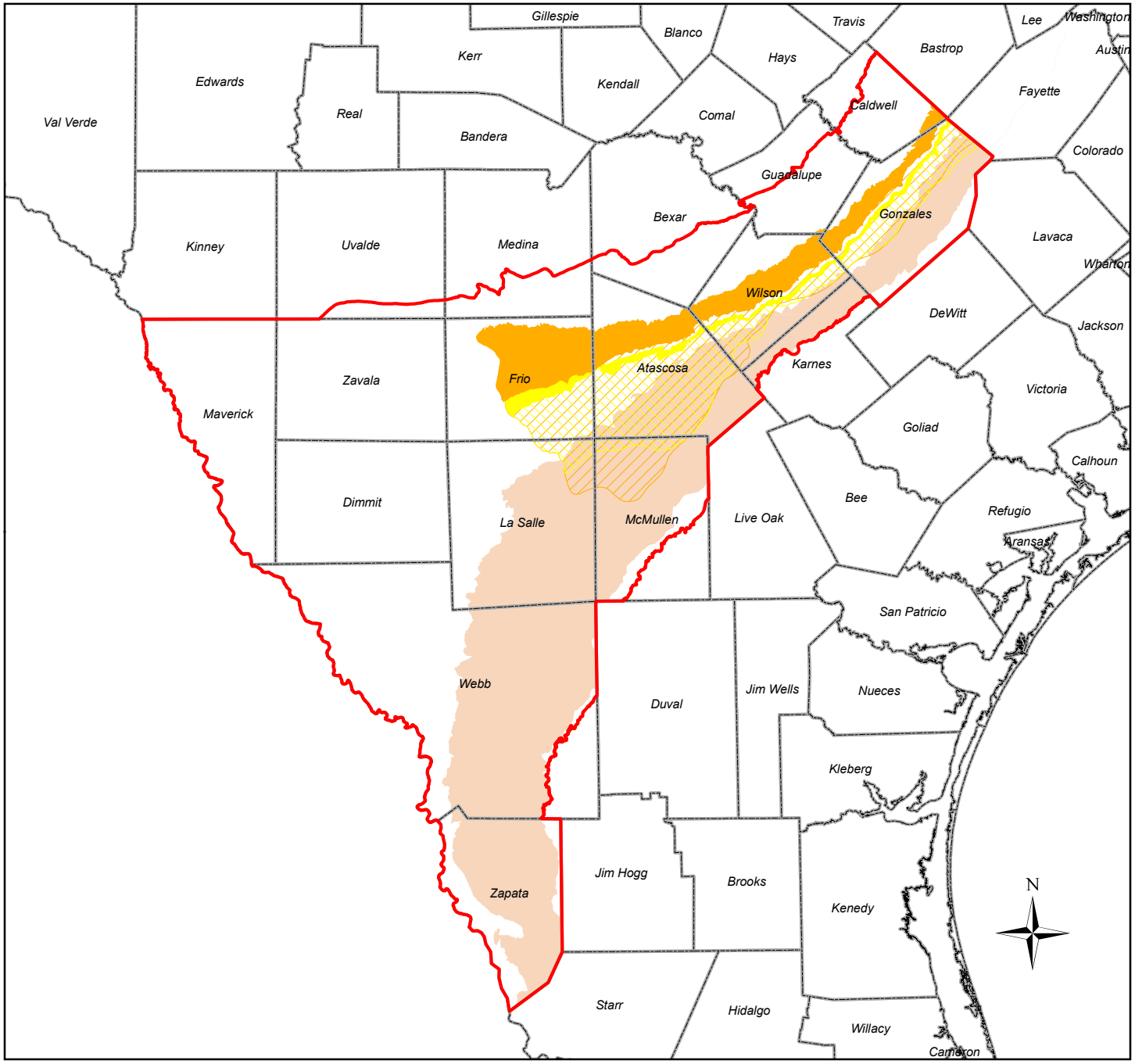
Updated 8/26/2015



0 5 10 20 30 40 Miles

1 in = 19 miles

Groundwater Management Area 13



MAP LEGEND

- Groundwater Management Area 13
- Counties

Minor Aquifers

- Yegua Jackson
- Sparta (outcrop)
- Sparta (subcrop)
- Queen City (outcrop)
- Queen City (subcrop)

DISCLAIMER
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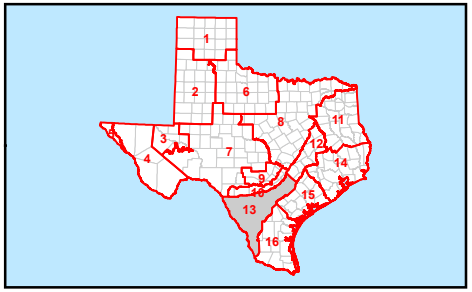

0 5 10 20 30 40 Miles

1 in = 19 miles

Appendix A

Public Notices for Adoption of Management Plan

NOTICE OF PUBLIC HEARING
GUADALUPE COUNTY GROUNDWATER CONSERVATION DISTRICT
ON PROPOSED ADOPTION OF
DISTRICT'S MANAGEMENT PLAN
Thursday, October 13, 2022 @ 4:30 PM
200 N. Austin St. Ste. # 301
Seguin, TX 78155

The Guadalupe County Groundwater Conservation District (GCGCD) will hold a public hearing for the purpose of receiving comments on the proposed adoption of the District's Management Plan.

Agenda is as follows:

1. Call to order
2. Discussion to consider the proposed Guadalupe County Groundwater Conservation District Management Plan as required by TWC 36.1071
3. Invitation for public comment
4. Adjourn

The Board of Directors will consider and possibly take action to adopt by resolution the proposed Management Plan at the regular meeting immediately following this public hearing.
Copies of the Management Plan are available at the GCGCD office at 200 N. Austin St. Ste #301, Seguin, Texas 78155, from 9:00 AM to 5:00 PM, Monday thru Friday.

Written comments should be submitted to the General Manager, PO Box 1221, Seguin, Texas 78156.

The deadline for submission of written comments is October 12, 2022, at 5:00 PM.

NOTE: The Board reserves the right to retire into executive session concerning any of the items listed on this Agenda whenever it is considered necessary and legally justified under the Opens Meeting Act (Chapter 551 of the Texas Government Code).
The District is committed to compliance with the Americans with Disabilities Act (ADA) and accommodations. Please contact the District office at (830) 379-5969 at least 48 hours in advance if special assistance is needed.

Appendix B

Certified Copy of GCGCD Resolution Adopting the Management Plan

Guadalupe County
Groundwater Conservation District

RESOLUTION 10132022

ADOPTING MANAGEMENT PLAN
FOR GUADALUPE COUNTY GROUNDWATER CONSERVATION DISTRICT

October 13, 2022

WHEREAS, the Guadalupe County Groundwater Conservation District ('District', GCGCD) is a political subdivision of the State of Texas, created under Section 59, Article XVI of the Texas Constitution by the 75th Legislature, Regular Session, Chapter 1066, 1997, and in accordance with Chapters 36 and 49 of the Texas Water Code;

WHEREAS, TWC §36.1072(e), states a district must review and readopt the plan with or without revisions at least once every five years;

WHEREAS, On October 3, 2022 Notice of Hearing was posted at the District office, District website, and the Guadalupe County clerk's office regarding a public hearing on the adoption of the Guadalupe County Groundwater Conservation District's Management Plan;

WHEREAS, a public hearing was held on October 13, 2022 to receive public comments regarding the adoption of the GCGCD Management Plan;

NOW THEREFORE, BE IT RESOLVED that the Board of the Guadalupe County Groundwater Conservation District does hereby APPROVE and ADOPT the Guadalupe County Groundwater Conservation District Management Plan and directs the submission of such Management Plan to the Executive Administrator of the Texas Water Development Board for review and approval.

Vote FOR 7 AGAINST 0
On this day, October 13, 2022.

Hilmar Blumberg

Hilmar Blumberg, Secretary GCGCD

Guadalupe County Groundwater Conservation District

830-379-5969 • gcgcd@gcgcd.org • www.gcgcd.org
PO Box 1221, Seguin, TX 78156 • 200 N. Austin Street Suite 301, Seguin, TX 78155

Appendix C

Proof of Notice to Surface Water Management Entities

From:	Kelley Cochran
To:	"Tramirez@gbra.org"
Subject:	GCGCD Management Plan
Date:	Thursday, October 13, 2022 6:12:00 PM
Attachments:	image001.png GCGCDMgmt Plan Letter_GBRA.pdf GCGCD Management Plan 2022-2027 - R - FINAL.pdf

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Ms. Ramirez,

Attached you will find the recently adopted Management Plan for the Guadalupe County Groundwater Conservation District for the period of December 2022 – 2027 for your review and comments.

Thank you for your time.

Sincerely,

Kelley Cochran

Kelley Cochran
General Manager
PO Box 1221
Seguin, TX 78156
www.gcgcd.org
830-379-5969

Guadalupe County
Groundwater Conservation District

Guadalupe-Blanco River Authority
ATTN: Kevin Patteson
933 E. Court Street
Seguin, TX 78155

October 14, 2022

Dear Mr. Patteson,

Attached to this letter you will find the recently adopted Management Plan for the Guadalupe County Groundwater Conservation District for the period of December 2022 – 2027 for your review and comments.

Thank you for your time.

Sincerely,

Kelley Cochran

Kelley Cochran
General Manager

830-379-5969 • gcgcd@gcgcd.org • www.gcgcd.org
PO Box 1221, Seguin, TX 78156 • 200 N. Austin Street Suite 301, Seguin, TX 78155

Appendix D

TWDB letter of Administratively Complete DFC Explanatory Report

Texas Water Development Board

P.O. Box 13231, 1700 N. Congress Ave.
Austin, TX 78711-3231, www.twdb.texas.gov
Phone (512) 463-7847, Fax (512) 475-2053

April 15, 2022

Ms. Kelley Cochran
Groundwater Management Area 13 Coordinator
c/o Guadalupe County Groundwater Conservation District
P.O. Box 1221
Seguin, TX 78156

Dear Ms. Cochran:

The purpose of this letter is to notify you that the desired future conditions explanatory report and other materials for Groundwater Management Area 13 required by Texas Water Code §36.108(d-3) are administratively complete in accordance with 31 Texas Administrative Code § 356.33.

On January 14, 2022, we received the final packet for desired future conditions adopted by groundwater conservation district representatives in Groundwater Management Area 13. Your submission included: (1) the explanatory report and the adopted desired future conditions for the relevant aquifers; (2) the signed resolution; (3) the postings, minutes, and voting record for the public meeting in which the desired future conditions were adopted; (4) model files; and (5) contact information for the groundwater management area consultant. On March 3 and March 7, 2022, we requested clarifications regarding items required to evaluate the materials for administrative completeness. We received final clarifications regarding these items on March 8, 2022.

We will provide you with modeled available groundwater values for these aquifers no later than 180 days after the date of this letter in accordance with 31 Texas Administrative Code § 356.35. Please contact Jean Perez of our Groundwater staff at 512-936-4017 or jean.perez@twdb.texas.gov if you have any questions or need any further information.

Respectfully,

Jeff Walker
Executive Administrator

c w/o enc: Matt Nelson, Deputy Executive Administrator of Planning
Temple McKinnon, Water Supply Planning Division
Sarah Backhouse, Water Supply Planning Division
Natalie Ballew, Groundwater Division

Appendix E

Water Planning Data Definitions

Data Definitions*

1. Projected Water Demands*

From the 2012 State Water Plan Glossary: "**WATER DEMAND** Quantity of water projected to meet the overall necessities of a water user group in a specific future year." (See 2012 State Water Plan Chapter 3 for more detail.)

Additional explanation: These are water demand volumes as projected for specific Water User Groups in the 2011 Regional Water Plans. This is NOT groundwater pumpage or demand based on any existing water source. This demand is how much water each Water User Group is projected to require in each decade over the planning horizon.

2. Projected Surface Water Supplies*

From the 2012 State Water Plan Glossary: "**EXISTING *[surface]* WATER SUPPLY -** Maximum amount of *[surface]* water available from existing sources for use during drought of record conditions that is physically and legally available for use." (See 2012 State Water Plan Chapter 5 for more detail.)

Additional explanation: These are the existing surface water supply volumes that, without implementing any recommended WMSs, could be used during a drought (in each planning decade) by Water User Groups located within the specified geographic area.

3. Projected Water Supply Needs*

From the 2012 State Water Plan Glossary: "**NEEDS -**Projected water demands in excess of existing water supplies for a water user group or a wholesale water provider." (See 2012 State Water Plan Chapter 6 for more detail.)

Additional explanation: These are the volumes of water that result from comparing each Water User Group's projected existing water supplies to its projected water demands. If the volume listed is a negative number, then the Water User Group shows a projected need during a drought if they do not implement any water management strategies. If the volume listed is a positive number, then the Water User Group shows a projected surplus. Note that if a Water User Group shows a need in any decade, then they are considered to have a potential need during the planning horizon, even if they show a surplus elsewhere.

4. Projected Water Management Strategies*

From the 2012 State Water Plan Glossary: "**RECOMMENDED WATER MANAGEMENT STRATEGY -** Specific project or action to increase water supply or maximize existing supply to meet a specific need." (See 2012 State Water Plan Chapter 7 for more detail.)

Additional explanation: These are the specific water management strategies (with associated water volumes) that were recommended in the 2011 Regional Water Plans.

**Terminology used by TWDB staff in providing data for 'Estimated Historical Water Use And 2012 State Water Plan Datasets' reports issued by TWDB.*

Appendix F

Texas Water Use Estimates – 2019 Summary

Texas Water Use Estimates

2019 Summary

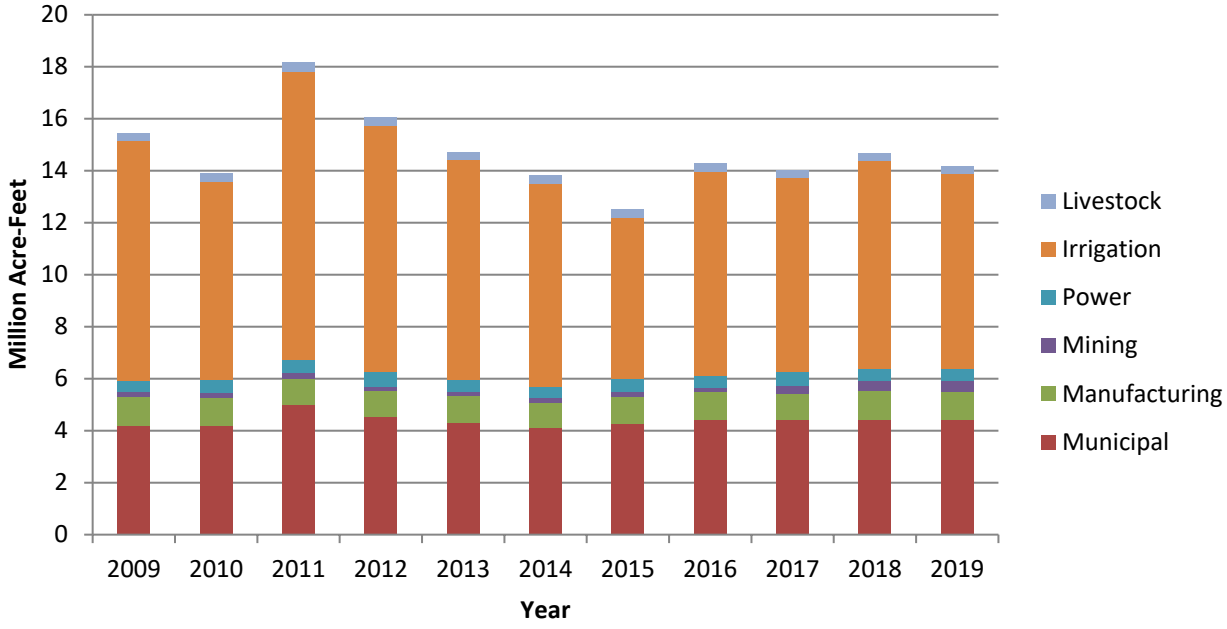
December 27, 2021

The Texas Water Development Board Water Use Survey program conducts an annual survey of about 4,600 public water systems and 2,600 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 7,200 systems/facilities surveyed, 78% submitted their water use survey for 2019 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.

2019 Estimated Annual Statewide Water Use

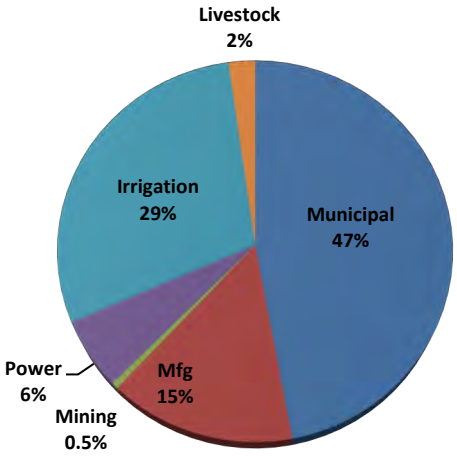
Total estimated water use for 2019 (including reported reuse) was about 14.17 million acre-feet *(1 acre-foot = 325,851 gallons)* and was down from 2018 which was estimated at about 14.66 million acre-feet. The total 2019 estimated municipal water use slightly decreased to 4.42 million acre-feet compared to 4.44 million acre-feet in 2018. Estimated irrigation water use decreased to 7.50 million acre-feet compared to 7.97 million acre-feet in 2018. Below is a breakdown of the categorical estimated uses for 2019. Irrigation water use **(53%)** topped the largest water use category in the State in 2019 with an estimated 7.50 million acre-feet. Municipal water use **(31%)**, similar to 2018, was the second largest water use category with an estimated 4.42 million acre-feet. Manufacturing **(8%)**, Power **(3%)**, Livestock **(2%)**, and Mining **(3%)** estimated water use collectively comprised about 2.25 million acre-feet.



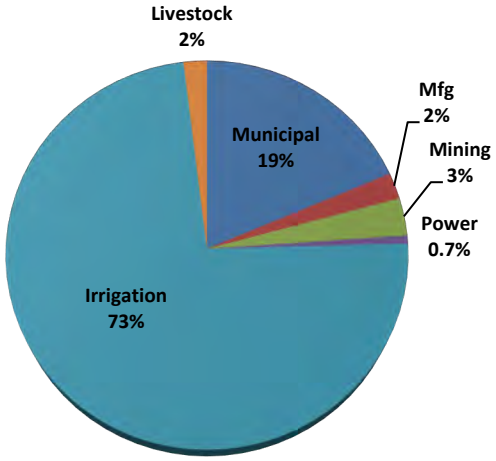
2019 Surface & Groundwater Use Estimates

Approximately **55%** of the 2019 estimated water use in Texas was from **groundwater** sources (about 7.74 million acre-feet) with **42%** from **surface water** sources (about 6.00 million acre-feet) and **3%** from reuse (almost a half million acre-feet). The two graphs below illustrate the categorical differences in use between surface water and groundwater sources.

2019 Surface Water Estimates by Category



2019 Groundwater Estimates by Category



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

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

http://www.twdb.texas.gov/waterplanning/waterusesurvey/historical-pumpage.asp

Appendix G

Estimated Historical Groundwater Use &
2022 State Water Plan Datasets

Estimated Historical Groundwater Use And 2022 State Water Plan Datasets:

Guadalupe County Groundwater Conservation District

Texas Water Development Board
Groundwater Division
Groundwater Technical Assistance Section
stephen.allen@twdb.texas.gov
(512) 463-7317
June 27, 2022

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 Groundwater 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 2022 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 2022 SWP data available as of 6/27/2022. 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 2022 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 2022 SWP dataset can be verified by contacting Sabrina Anderson (sabrina.anderson@twdb.texas.gov or 512-936-0886).

The values presented in the data tables of this report are county-based. In cases where groundwater conservation districts cover only a portion of one or more counties the data values are modified with an apportioning multiplier to create new values that more accurately represent conditions within district boundaries. The multiplier used in the following formula is a land area ratio: (data value * (land area of district in county / land area of county)). For two of the four SWP tables (Projected Surface Water Supplies and Projected Water Demands) only the county-wide water user group (WUG) data values (county other, manufacturing, steam electric power, irrigation, mining and livestock) are modified using the multiplier. WUG values for municipalities, water supply corporations, and utility districts are not apportioned; instead, their full values are retained when they are located within the district, and eliminated when they are located outside (we ask each district to identify these entity locations).

The remaining SWP tables (Projected Water Supply Needs and Projected Water Management Strategies) are not modified because district-specific values are not statutorily required. Each district needs only "consider" the county values in these tables.

In the WUS table every category of water use (including municipal) is apportioned. Staff determined that breaking down the annual municipal values into individual WUGs was too complex.

TWDB recognizes that the apportioning formula used is not perfect but it is the best available process with respect to time and staffing constraints. If a district believes it has data that is more accurate it can add those data to the plan with an explanation of how the data were derived. Apportioning percentages that the TWDB used are listed above each applicable table.

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 2020. TWDB staff anticipates the calculation and posting of these estimates at a later date.

GUADALUPE COUNTY

60.89% (multiplier)

All values are in acre-feet

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2019	GW	8,137	105	1	1,680	422	321	10,666
	SW	5,410	1,136	0	1,835	27	307	8,715
2018	GW	7,660	138	0	1,364	352	319	9,833
	SW	5,604	1,200	0	1,837	23	306	8,970
2017	GW	7,655	86	0	1,086	428	313	9,568
	SW	5,641	1,232	0	1,774	15	299	8,961
2016	GW	7,259	109	0	1,262	314	325	9,269
	SW	4,850	1,123	0	2,040	10	323	8,346
2015	GW	7,614	108	0	1,327	325	315	9,689
	SW	5,026	1,112	0	2,228	147	313	8,826
2014	GW	7,536	98	0	0	453	293	8,380
	SW	4,848	1,122	0	0	98	289	6,357
2013	GW	7,177	554	0	0	422	272	8,425
	SW	4,662	1,527	0	0	111	269	6,569
2012	GW	7,363	655	0	0	625	244	8,887
	SW	5,029	1,726	0	0	181	242	7,178
2011	GW	7,188	613	0	0	1,079	594	9,474
	SW	5,510	1,846	0	0	127	591	8,074
2010	GW	5,628	543	59	0	312	583	7,125
	SW	4,934	1,573	127	0	50	580	7,264
2009	GW	6,763	701	53	0	361	297	8,175
	SW	4,555	1,484	118	0	0	297	6,454
2008	GW	6,760	667	50	0	164	295	7,936
	SW	4,554	1,288	107	0	86	295	6,330
2007	GW	5,234	86	0	395	44	359	6,118
	SW	3,602	885	0	286	86	359	5,218
2006	GW	6,917	59	0	0	365	315	7,656
	SW	5,165	991	0	0	0	314	6,470
2005	GW	5,761	205	0	0	180	328	6,474
	SW	4,341	1,036	0	0	122	327	5,826
2004	GW	5,813	117	0	0	167	42	6,139
	SW	2,853	1,147	0	0	124	642	4,766

Projected Surface Water Supplies
TWDB 2022 State Water Plan Data

GUADALUPE COUNTY

60.89% (multiplier)

All values are in acre-feet

RWPG	WUG	WUG Basin	Source Name	2020	2030	2040	2050	2060	2070
L	Cibolo	San Antonio	Canyon Lake/Reservoir	1,350	1,350	1,350	1,350	1,350	1,350
L	County-Other, Guadalupe	Guadalupe	Canyon Lake/Reservoir	283	283	283	283	283	283
L	County-Other, Guadalupe	Guadalupe	Guadalupe Run-of-River	37	37	37	37	37	37
L	Crystal Clear WSC	Guadalupe	Canyon Lake/Reservoir	824	834	837	831	824	813
L	East Central SUD	San Antonio	Canyon Lake/Reservoir	47	48	42	51	46	54
L	Gonzales County WSC	Guadalupe	Canyon Lake/Reservoir	5	6	6	6	7	7
L	Green Valley SUD	Guadalupe	Canyon Lake/Reservoir	1,396	1,405	1,413	1,419	1,425	1,431
L	Green Valley SUD	San Antonio	Canyon Lake/Reservoir	1,019	1,025	1,032	1,036	1,041	1,045
L	Irrigation, Guadalupe	Guadalupe	Canyon Lake/Reservoir	189	189	189	189	189	189
L	Irrigation, Guadalupe	Guadalupe	Guadalupe Run-of-River	165	165	165	165	165	165
L	Livestock, Guadalupe	Guadalupe	Guadalupe Livestock Local Supply	396	396	396	396	396	396
L	Manufacturing, Guadalupe	Guadalupe	Canyon Lake/Reservoir	600	600	600	600	600	600
L	Manufacturing, Guadalupe	Guadalupe	Guadalupe Run-of-River	888	888	888	888	888	888
L	Marion	San Antonio	Canyon Lake/Reservoir	100	100	100	100	100	100
L	Martindale WSC	Guadalupe	Canyon Lake/Reservoir	12	14	16	18	20	20
L	Martindale WSC	Guadalupe	Guadalupe Run-of-River	1	1	1	1	1	1
L	New Braunfels	Guadalupe	Canyon Lake/Reservoir	1,648	1,596	1,562	1,532	1,513	1,502
L	New Braunfels	Guadalupe	Guadalupe Run-of-River	18	17	17	16	16	16
L	Seguin	Guadalupe	Canyon Lake/Reservoir	1,000	1,000	1,000	1,000	1,000	1,000
L	Springs Hill WSC	Guadalupe	Canyon Lake/Reservoir	3,443	3,002	3,002	3,002	3,002	3,002
L	Springs Hill WSC	San Antonio	Canyon Lake/Reservoir	463	404	404	404	404	404
L	Steam-Electric Power, Guadalupe	Guadalupe	Canyon Lake/Reservoir	4,165	4,165	4,165	4,165	4,165	4,165
L	Steam-Electric Power, Guadalupe	Guadalupe	Guadalupe Run-of-River	3,410	3,410	3,410	3,410	3,410	3,410
L	Tri Community WSC	Guadalupe	Guadalupe Run-of-River	8	10	10	9	10	10

Sum of Projected Surface Water Supplies (acre-feet)	**21,467**	**20,945**	**20,925**	**20,908**	**20,892**	**20,888**

Projected Water Demands
TWDB 2022 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.

GUADALUPE COUNTY

60.89% (multiplier)

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
L	Cibolo	San Antonio	2,374	3,251	3,695	3,915	4,024	4,077
L	County-Other, Guadalupe	Guadalupe	8	9	11	13	14	16
L	County-Other, Guadalupe	San Antonio	94	111	130	151	170	191
L	Crystal Clear WSC	Guadalupe	1,500	1,752	2,017	2,287	2,574	2,858
L	East Central SUD	San Antonio	70	78	74	97	95	119
L	Gonzales County WSC	Guadalupe	29	35	41	46	52	58
L	Green Valley SUD	Guadalupe	1,619	1,862	2,122	2,395	2,694	2,991
L	Green Valley SUD	San Antonio	2,343	3,232	3,790	4,594	5,570	6,591
L	Irrigation, Guadalupe	Guadalupe	578	578	578	578	578	578
L	Irrigation, Guadalupe	San Antonio	114	114	114	114	114	114
L	Livestock, Guadalupe	Guadalupe	712	712	712	712	712	712
L	Livestock, Guadalupe	San Antonio	79	79	79	79	79	79
L	Luling	Guadalupe	3	4	4	5	6	6
L	Manufacturing, Guadalupe	Guadalupe	2,517	2,753	2,753	2,753	2,753	2,753
L	Manufacturing, Guadalupe	San Antonio	1	1	1	1	1	1
L	Marion	San Antonio	234	271	309	350	394	437
L	Martindale WSC	Guadalupe	19	27	38	52	71	86
L	Mining, Guadalupe	Guadalupe	208	251	292	345	404	476
L	Mining, Guadalupe	San Antonio	69	84	97	115	135	159
L	New Braunfels	Guadalupe	2,569	2,976	3,526	4,014	4,521	5,022
L	Schertz	Guadalupe	485	636	742	848	957	1,064
L	Schertz	San Antonio	6,072	7,961	9,292	10,616	11,979	13,322
L	Seguin	Guadalupe	4,276	4,992	5,748	6,519	7,338	8,150
L	Selma	San Antonio	393	854	852	850	849	849
L	Springs Hill WSC	Guadalupe	2,050	2,265	2,622	2,996	3,415	3,819
L	Springs Hill WSC	San Antonio	276	305	353	403	460	514
L	Steam-Electric Power, Guadalupe	Guadalupe	5,727	5,727	5,727	5,727	5,727	5,727
L	Tri Community WSC	Guadalupe	3	4	5	5	6	7
L	Water Services	Guadalupe	74	81	87	95	103	110
	Sum of Projected Water Demands (acre-feet)		**34,496**	**41,005**	**45,811**	**50,675**	**55,795**	**60,886**

Projected Water Supply Needs
TWDB 2022 State Water Plan Data

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

GUADALUPE COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
L	Cibolo	San Antonio	1,578	-40	-484	-704	-813	-866
L	County-Other, Guadalupe	Guadalupe	525	525	525	525	525	525
L	County-Other, Guadalupe	San Antonio	0	0	0	0	0	0
L	Crystal Clear WSC	Guadalupe	-26	207	-52	-335	-640	-949
L	East Central SUD	San Antonio	35	30	21	18	9	3
L	Gonzales County WSC	Guadalupe	18	17	15	12	10	6
L	Green Valley SUD	Guadalupe	3,367	3,157	2,924	2,671	2,392	1,719
L	Green Valley SUD	San Antonio	1,297	428	-107	-896	-1,856	-2,469
L	Irrigation, Guadalupe	Guadalupe	31	31	31	31	31	31
L	Irrigation, Guadalupe	San Antonio	12	12	12	12	12	12
L	Livestock, Guadalupe	Guadalupe	0	0	0	0	0	0
L	Livestock, Guadalupe	San Antonio	0	0	0	0	0	0
L	Luling	Guadalupe	0	0	-1	-1	-2	-3
L	Manufacturing, Guadalupe	Guadalupe	0	-388	-388	-388	-388	-388
L	Manufacturing, Guadalupe	San Antonio	0	1	1	1	1	1
L	Marion	San Antonio	72	35	-3	-44	-88	-131
L	Martindale WSC	Guadalupe	-6	-12	-21	-33	-50	-65
L	Mining, Guadalupe	Guadalupe	0	0	0	0	0	0
L	Mining, Guadalupe	San Antonio	0	0	0	0	0	0
L	New Braunfels	Guadalupe	698	163	-430	-977	-1,521	-2,045
L	Schertz	Guadalupe	14	11	-60	-219	-383	-542
L	Schertz	San Antonio	181	148	-749	-2,739	-4,797	-6,786
L	Seguin	Guadalupe	-11	29	18	-93	-210	-331
L	Selma	San Antonio	161	-28	-69	-104	-134	-162
L	Springs Hill WSC	Guadalupe	3,196	1,734	1,377	1,003	584	180
L	Springs Hill WSC	San Antonio	430	234	186	136	79	25
L	Steam-Electric Power, Guadalupe	Guadalupe	3,915	3,915	3,915	3,915	3,915	3,915
L	Tri Community WSC	Guadalupe	5	6	5	4	4	3
L	Water Services	Guadalupe	0	-12	-15	-19	-24	-28
	Sum of Projected Water Supply Needs (acre-feet)		**-43**	**-480**	**-2,379**	**-6,552**	**-10,906**	**-14,765**

Projected Water Management Strategies
TWDB 2022 State Water Plan Data

GUADALUPE COUNTY

WUG, Basin (RWPG) All values are in acre-feet

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
Cibolo, San Antonio (L)							
CVLGC Carrizo Project	Carrizo-Wilcox Aquifer [Gonzales]	0	2,000	2,000	2,000	2,000	2,000
CVLGC Carrizo Project	Carrizo-Wilcox Aquifer [Wilson]	0	3,000	3,000	3,000	2,725	2,725
CVLGC Carrizo Project (GW Conversion)	Carrizo-Wilcox Aquifer [Wilson]	0	0	0	0	275	275
Municipal Water Conservation	DEMAND REDUCTION [Guadalupe]	0	0	43	267	545	875
		0	**5,000**	**5,043**	**5,267**	**5,545**	**5,875**
County-Other, Guadalupe, Guadalupe (L)							
Municipal Water Conservation	DEMAND REDUCTION [Guadalupe]	0	0	0	0	0	2
		0	**0**	**0**	**0**	**0**	**2**
County-Other, Guadalupe, San Antonio (L)							
Municipal Water Conservation	DEMAND REDUCTION [Guadalupe]	0	0	0	0	5	11
		0	**0**	**0**	**0**	**5**	**11**
Crystal Clear WSC, Guadalupe (L)							
ARWA - Phase 2	Carrizo-Wilcox Aquifer [Caldwell]	0	0	2,265	2,248	2,227	2,198
ARWA - Phase 3	Direct Reuse [Hays]	0	0	0	0	592	584
ARWA Shared Project (Phase 1)	Carrizo-Wilcox Aquifer [Caldwell]	1,593	1,613	1,618	1,606	1,590	1,570
Drought Management - Crystal Clear WSC	DEMAND REDUCTION [Guadalupe]	57	0	0	0	0	0
Municipal Water Conservation	DEMAND REDUCTION [Guadalupe]	0	0	0	0	0	47
		1,650	**1,613**	**3,883**	**3,854**	**4,409**	**4,399**
Gonzales County WSC, Guadalupe (L)							
Municipal Water Conservation	DEMAND REDUCTION [Guadalupe]	2	5	8	13	18	24
		2	**5**	**8**	**13**	**18**	**24**
Green Valley SUD, Guadalupe (L)							
ARWA - Phase 2	Carrizo-Wilcox Aquifer [Caldwell]	0	0	739	710	679	654
ARWA - Phase 3	Direct Reuse [Hays]	0	0	0	0	181	174
ARWA Shared Project (Phase 1)	Carrizo-Wilcox Aquifer [Caldwell]	590	535	528	508	486	467
		590	**535**	**1,267**	**1,218**	**1,346**	**1,295**

Green Valley SUD, San Antonio (L)							
ARWA - Phase 2	Carrizo-Wilcox Aquifer [Caldwell]	0	0	1,321	1,362	1,405	1,440
ARWA - Phase 3	Direct Reuse [Hays]	0	0	0	0	373	384
ARWA Shared Project (Phase 1)	Carrizo-Wilcox Aquifer [Caldwell]	855	930	944	972	1,004	1,029
		855	**930**	**2,265**	**2,334**	**2,782**	**2,853**
Luling, Guadalupe (L)							
Local Carrizo Aquifer Development	Carrizo-Wilcox Aquifer [Caldwell]	0	4	3	4	4	3
		0	**4**	**3**	**4**	**4**	**3**
Manufacturing, Guadalupe, Guadalupe (L)							
GBRA - MBWSP - Surface Water w/ASR	Carrizo-Wilcox Aquifer ASR [Gonzales]	0	402	402	402	402	402
		0	**402**	**402**	**402**	**402**	**402**
Manufacturing, Guadalupe, San Antonio (L)							
GBRA - MBWSP - Surface Water w/ASR	Carrizo-Wilcox Aquifer ASR [Gonzales]	0	0	0	0	0	0
		0	**0**	**0**	**0**	**0**	**0**
Marion, San Antonio (L)							
CRWA - Wells Ranch (Phase 3)	Carrizo-Wilcox Aquifer [Guadalupe]	0	0	18	59	103	146
		0	**0**	**18**	**59**	**103**	**146**
Martindale WSC, Guadalupe (L)							
CRWA - Wells Ranch (Phase 3)	Carrizo-Wilcox Aquifer [Guadalupe]	0	4	9	19	46	75
Drought Management - Martindale	DEMAND REDUCTION [Guadalupe]	1	0	0	0	0	0
FE - CRWA Hays Caldwell WTP Expansion	Guadalupe Run-of-River [Hays]	13	14	17	20	22	22
Martindale WSC - Alluvial Well	San Marcos River Alluvium Aquifer [Caldwell]	0	14	16	18	21	21
		14	**32**	**42**	**57**	**89**	**118**
New Braunfels, Guadalupe (L)							
FE - NBU Seguin Interconnect	Carrizo-Wilcox Aquifer [Gonzales]	346	322	320	312	307	304
GBRA Shared Project (Phase 1)	Carrizo-Wilcox Aquifer [Caldwell]	549	512	508	494	488	483
GBRA Shared Project (Phase 1)	Carrizo-Wilcox Aquifer [Gonzales]	557	520	516	503	496	491
Municipal Water Conservation	DEMAND REDUCTION [Guadalupe]	92	289	561	725	881	1,050
NBU - ASR	Trinity and/or Brackish Edwards Aquifer ASR [Comal]	1,495	1,395	1,385	1,349	1,330	1,317
NBU - Trinity Development	Trinity Aquifer [Comal]	0	433	430	419	413	409
		3,039	**3,471**	**3,720**	**3,802**	**3,915**	**4,054**
Schertz, Guadalupe (L)							
CVLGC Carrizo Project	Carrizo-Wilcox Aquifer [Gonzales]	0	137	135	133	131	129

CVLGC Carrizo Project	Carrizo-Wilcox Aquifer [Wilson]	0	205	202	199	178	176
CVLGC Carrizo Project (GW Conversion)	Carrizo-Wilcox Aquifer [Wilson]	0	0	0	0	18	18
Municipal Water Conservation	DEMAND REDUCTION [Guadalupe]	17	26	42	64	93	127
SSLGC Expanded Brackish Wilcox Groundwater	Carrizo-Wilcox Aquifer [Gonzales]	0	0	168	166	164	162
SSLGC Expanded Carrizo Project	Carrizo-Wilcox Aquifer [Guadalupe]	206	205	202	199	196	194
		223	**573**	**749**	**761**	**780**	**806**
Schertz, San Antonio (L)							
CVLGC Carrizo Project	Carrizo-Wilcox Aquifer [Gonzales]	0	1,711	1,686	1,664	1,638	1,619
CVLGC Carrizo Project	Carrizo-Wilcox Aquifer [Wilson]	0	2,566	2,530	2,495	2,232	2,205
CVLGC Carrizo Project (GW Conversion)	Carrizo-Wilcox Aquifer [Wilson]	0	0	0	0	225	222
Municipal Water Conservation	DEMAND REDUCTION [Guadalupe]	208	321	524	807	1,170	1,592
SSLGC Expanded Brackish Wilcox Groundwater	Carrizo-Wilcox Aquifer [Gonzales]	0	0	2,109	2,079	2,047	2,023
SSLGC Expanded Carrizo Project	Carrizo-Wilcox Aquifer [Guadalupe]	2,581	2,566	2,530	2,495	2,457	2,429
		2,789	**7,164**	**9,379**	**9,540**	**9,769**	**10,090**
Seguin, Guadalupe (L)							
Drought Management - Seguin	DEMAND REDUCTION [Guadalupe]	228	0	0	0	0	0
Municipal Water Conservation	DEMAND REDUCTION [Guadalupe]	0	0	0	59	232	448
SSLGC Expanded Brackish Wilcox Groundwater	Carrizo-Wilcox Aquifer [Gonzales]	0	0	2,500	2,500	2,500	2,500
SSLGC Expanded Carrizo Project	Carrizo-Wilcox Aquifer [Guadalupe]	3,000	3,000	3,000	3,000	3,000	3,000
		3,228	**3,000**	**5,500**	**5,559**	**5,732**	**5,948**
Selma, San Antonio (L)							
Municipal Water Conservation	DEMAND REDUCTION [Guadalupe]	20	52	70	108	140	169
		20	**52**	**70**	**108**	**140**	**169**
Springs Hill WSC, Guadalupe (L)							
FE - SHWSC Lake Placid WTP Expansion	Canyon Lake/Reservoir [Reservoir]	1,229	1,229	1,229	1,229	1,229	1,229
		1,229	**1,229**	**1,229**	**1,229**	**1,229**	**1,229**
Springs Hill WSC, San Antonio (L)							
FE - SHWSC Lake Placid WTP Expansion	Canyon Lake/Reservoir [Reservoir]	165	165	165	165	165	165
		165	**165**	**165**	**165**	**165**	**165**
Water Services, Guadalupe (L)							
Local Trinity Aquifer Development	Trinity Aquifer [Bexar]	0	16	16	21	25	33
Municipal Water Conservation	DEMAND REDUCTION [Guadalupe]	2	2	2	4	6	9
		2	**18**	**18**	**25**	**31**	**42**

Sum of Projected Water Management Strategies (acre-feet)	**13,806**	**24,193**	**33,761**	**34,397**	**36,464**	**37,631**

Appendix H

TWDB GAM RUN 21-018 MAG

GAM RUN 21-018 MAG:
MODELED AVAILABLE GROUNDWATER FOR THE CARRIZO-WILCOX, QUEEN CITY, SPARTA, AND YEGUA-JACKSON AQUIFERS IN GROUNDWATER MANAGEMENT AREA 13

Shirley C. Wade, Ph.D., P.G.
Texas Water Development Board
Groundwater Division
Groundwater Availability Modeling Department
(512) 936-0883
July 25, 2022

Shirley C. Wade
7/25/22

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GAM RUN 21-018 MAG: MODELED AVAILABLE GROUNDWATER FOR THE CARRIZO-WILCOX, QUEEN CITY, SPARTA, AND YEGUA-JACKSON AQUIFERS IN GROUNDWATER MANAGEMENT AREA 13

Shirley C. Wade, Ph.D., P.G.
Texas Water Development Board
Groundwater Division
Groundwater Availability Modeling Department
(512) 936-0883
July 25, 2022

EXECUTIVE SUMMARY:

The modeled available groundwater for Groundwater Management Area 13 for the Carrizo-Wilcox, Queen City, Sparta, and Yegua-Jackson aquifers is summarized by decade for the groundwater conservation districts (Tables 1 through 4 respectively) and for use in the regional water planning process (Tables 5 through 8 respectively). The modeled available groundwater estimates for the Carrizo-Wilcox Aquifer range from approximately 470,000 acre-feet per year in 2020 to approximately 575,000 acre-feet per year in 2080 (Table 1). The modeled available groundwater estimates for the Queen City Aquifer range from approximately 23,000 acre-feet per year in 2020 to approximately 18,000 acre-feet per year in 2080 (Table 2). The modeled available groundwater estimates for the Sparta Aquifer range from approximately 6,000 acre-feet per year in 2020 to approximately 4,000 acre-feet per year in 2080 (Table 3). The estimates for the Carrizo-Wilcox, Queen City, and Sparta Aquifers were extracted from the results of a model run using the groundwater availability model for the southern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers (version 2.01). The modeled available groundwater estimates for the Yegua-Jackson Aquifer are approximately 6,700 acre-feet per year from 2020 to 2080 (Table 4). The estimates for the Yegua-Jackson Aquifer were extracted from the results of a model run using the groundwater availability model for the Yegua-Jackson Aquifer (version 1.01). The explanatory report and other materials submitted to the TWDB were determined to be administratively complete on April 15, 2022.

REQUESTOR:

Ms. Kelley Cochran, coordinator of Groundwater Management Area 13.

DESCRIPTION OF REQUEST:

The desired future conditions for the Carrizo-Wilcox, Queen City, and Sparta aquifers described in Resolution 21-02 from Groundwater Management Area 13, adopted November 19, 2021, are:

- *"The first desired future condition for the Carrizo-Wilcox, Queen City and Sparta aquifers in Groundwater Management Area 13 is that 75 percent of the saturated thickness in the outcrop at the end of 2012 remains in 2080. Due to the limitations of the current Groundwater Availability Model, this desired future condition cannot be simulated as documented during 2016 Joint Planning in GMA 13 Technical Memorandum 16-08 (Hutchison, 2017a)."*
- *"In addition, a secondary proposed desired future condition for the Carrizo-Wilcox, Queen City, and Sparta aquifers in Groundwater Management Area 13 is an average drawdown of 49 feet (+/- 5 feet) for all of GMA 13. The drawdown is calculated from the end of 2012 conditions to the year 2080. This desired future condition is consistent with simulation "GMA13_2019_001" summarized during a meeting of Groundwater Management Area 13 members on March 19, 2021."*

The desired future conditions for the Yegua-Jackson Aquifer described in Resolution 21-03 from Groundwater Management Area 13, adopted November 19, 2021 are:

- *"For Gonzales County, the average drawdown from 2010 to 2080 is 3 feet (+/- 1 foot)."*
- *"For Karnes County, the average drawdown from 2010 to 2080 is 1 foot (+/- 1 foot)."*
- *"For all other counties in GMA 13, the Yegua-Jackson is classified as not relevant for purposes of joint planning."*

The Edwards (Balcones Fault Zone), Gulf Coast, and Trinity aquifers were declared not relevant for purposes of joint planning by Groundwater Management Area 13 in Resolution 21-01 (Groundwater Management Area 13 Joint Planning Committee and others, 2022; Appendix B).

On January 14, 2022, Dr. Jordan Furnans, on behalf of Groundwater Management Area 13, submitted the Desired Future Conditions Packet to the TWDB. TWDB staff reviewed the model files associated with the desired future conditions and received clarifications on procedures and assumptions from the Groundwater Management Area 13 Technical Coordinator on March 3, 2022, and on March 7, 2022. Groundwater Management Area 13 adopted two desired future conditions for the Carrizo-Wilcox, Queen City, and Sparta Aquifers and they were not mutually compatible in the groundwater availability model. The

technical coordinator for the groundwater management area confirmed that their intention was for the modeled available groundwater values to be based on the secondary desired future condition and MODFLOW pumping simulation GMA13_2019_001 (Groundwater Management Area 13 Joint Planning Committee and others, 2022; Appendix 2). The first proposed desired future condition was not intended for the calculation of modeled available groundwater.

The model run pumping file, which meets the secondary desired future condition adopted by district representatives of Groundwater Management Area 13 for the Carrizo-Wilcox, Queen City, and Sparta Aquifers, was submitted to the TWDB as supplemental information for the original submittal on February 9, 2022. The model run files, which meet the desired future conditions adopted by district representatives of Groundwater Management Area 13 for the Yegua-Jackson Aquifer, were submitted to the TWDB on January 14, 2022, as part of the Desired Future Conditions Explanatory Report for Groundwater Management Area 13.

In an email dated March 3, 2022, the Technical Coordinator and consultant for Groundwater Management Area 13 confirmed that they intended to use the end of 2011 as the reference year for the drawdown calculations for the Carrizo-Wilcox, Queen City, and Sparta aquifers and they intended to use the end of 2009 as the reference year for the Yegua-Jackson Aquifer. In an email dated March 7, 2022, they also confirmed that the confining unit model layers representing the Reklaw and Weches formations should be included in the desired future condition calculation of average drawdown for the combined Carrizo-Wilcox, Queen City, and Sparta aquifers.

All clarifications are included in the Parameters and Assumptions Section of this report.

METHODS:

The groundwater availability model for the southern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers (Figures 1 through 3) was run using the model files submitted with the explanatory reports (Groundwater Management Area 13 Joint Planning Committee and others, 2022) on January 14 and February 9, 2022. Model-calculated water levels were extracted for the years 2011 (stress period 12) and 2080 (stress period 81). An overall drawdown average was calculated for the entire Groundwater Management Area 13 using all model layers in the average. As described in the Technical Memorandum submitted with the Explanatory Report on January 14, 2022 (Furnans, 2022) drawdowns for cells that became dry during the simulation (water level dropped below the base of the cell) were calculated as the reference year water level elevation minus the elevation of the model cell bottom. The calculated drawdown average was compared with the desired future condition of 49 feet to verify that the pumping scenario achieved the desired future conditions within the stated tolerance of five feet.

The groundwater availability model for the Yegua-Jackson Aquifer (Figure 4) was run using the model files submitted on January 14, 2022. Model-calculated water levels were extracted for the years 2009 (stress period 39) and 2080 (stress period 110). County-wide average drawdowns were calculated for Gonzales and Karnes counties within Groundwater Management Area 13 by averaging the drawdown values for all model layers. There were no dry cells in Karnes County or Gonzales County, so no additional dry cell calculations were needed. The calculated drawdown averages were compared with the desired future conditions for Gonzales and Karnes counties to verify that the pumping scenario achieved the desired future conditions within the stated tolerance of one foot.

The modeled available groundwater values were determined by extracting pumping rates by decade from the model results using ZONEBUDGET Version 3.01 (Harbaugh, 2009). Annual pumping rates by aquifer are presented by county and groundwater conservation district, subtotaled by groundwater conservation district, and then summed for Groundwater Management Area 13 (Tables 1 through 4). Annual pumping rates by aquifer are also presented by county, river basin, and regional water planning area within Groundwater Management Area 13 (Tables 5 through 8) in order to be consistent with the format used in the regional water planning process.

Modeled Available Groundwater and Permitting

As defined in Chapter 36 of the Texas Water Code (2011), "modeled available groundwater" is the estimated average amount of water that may be produced annually to achieve a desired future condition. Groundwater conservation districts are required to consider modeled available groundwater, along with several other factors, when issuing permits in order to manage groundwater production to achieve the desired future condition(s). The other factors districts must consider include 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 modeled available groundwater estimates are described below:

Carrizo-Wilcox, Queen City, and Sparta aquifers

- 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 (Layer 5), the Upper Wilcox (Layer 6), the Middle Wilcox (Layer 7), and the Lower Wilcox (Layer 8). Since the model extends beyond the official TWDB aquifer extents, please note that model layers 1 and 3 instead represent geologic units equivalent to the Sparta and Queen City aquifers, respectively, in those areas falling outside of the official aquifer extents.
- The model was run with MODFLOW-96 (Harbaugh and McDonald, 1996).
- Although the original groundwater availability model was only calibrated to 1999, an analysis during the second round of joint planning (Hutchison, 2017b) verified that the model satisfactorily matched measured water levels for the period from 1999 to 2011. For this reason, TWDB considers it acceptable to use the end of 2011 as the reference year for drawdown calculations.
- Drawdown averages and modeled available groundwater values were based on the TWDB defined aquifer boundaries rather than the model extent.
- Drawdowns for cells that became dry during the simulation (water level dropped below the base of the cell) were calculated as the reference year water level elevation minus the elevation of the model cell bottom. Pumping in dry cells was excluded from the modeled available groundwater calculations for the decades after the cell went dry.
- A tolerance of five feet was assumed when comparing desired future conditions to modeled drawdown results. This tolerance was specified by the GMA in their definition of the desired future conditions.
- Estimates of modeled available groundwater from the model simulation were rounded to the nearest whole number.
- The verification calculation for the desired future conditions is based on an average of all model layers (Layers 1 through 8). The modeled available groundwater

calculations are based on Layer 1 for the Sparta Aquifer, Layer 3 for the Queen City Aquifer, and the sum of Layers 5 through 8 for the Carrizo-Wilcox Aquifer.

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 of the Yegua-Jackson Aquifer and younger overlying units—the Catahoula Formation (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).
- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).
- Although the original groundwater availability model was only calibrated to 1997, a TWDB analysis (Oliver, 2010) verified that the model satisfactorily matched measured water levels for the period from 1997 to 2009. For this reason, TWDB considers it acceptable to use the end of 2009 as the reference year for drawdown calculations.
- Drawdown averages and modeled available groundwater values were based on the TWDB-defined aquifer boundaries rather than the model extent.
- No dry cells occurred in the simulation in Gonzales County or Karnes County. As these were the only counties with defined desired future conditions, no dry cell considerations were required during the verification calculation for the desired future conditions. Pumping in dry cells was excluded from the modeled available groundwater calculations for the decades after the cell went dry.
- A tolerance of one foot was assumed when comparing desired future conditions to modeled drawdown results. This tolerance was specified by the GMA in their definition of the desired future conditions.
- Estimates of modeled available groundwater from the model simulation were rounded to the nearest whole number.
- The verification calculation for the desired future conditions is based on an average of all model layers representing the Yegua or Jackson formations (Layers 1 through 5). The modeled available groundwater calculations are the sum of all model layers representing the Yegua or Jackson formations (Layers 1 through 5).

RESULTS:

The modeled available groundwater estimates for the Carrizo-Wilcox Aquifer range from approximately 470,000 acre-feet per year in 2020 to approximately 575,000 acre-feet per year in 2080 (Table 1). The modeled available groundwater estimates for the Queen City Aquifer range from approximately 23,000 acre-feet per year in 2020 to approximately 18,000 acre-feet per year in 2080 (Table 2). The modeled available groundwater estimate for the Sparta Aquifer ranges from approximately 6,000 acre-feet per year in 2020 to approximately 4,000 acre-feet per year in 2080 (Table 3). The modeled available groundwater is summarized by groundwater conservation district and county for the Carrizo-Wilcox, Queen City, and Sparta aquifers (Tables 1, 2, and 3 respectively). The modeled available groundwater has also been summarized by county, river basin, and regional water planning area for use in the regional water planning process for the Carrizo-Wilcox, Queen City, and Sparta aquifers (Tables 5, 6, and 7 respectively). Small differences in values between table summaries are due to rounding.

The modeled available groundwater estimate for the Yegua-Jackson Aquifer is approximately 7,000 acre-feet per year from 2020 to 2080 (Table 4). The modeled available groundwater for the Yegua-Jackson Aquifer is summarized by groundwater conservation district and county (Table 4) and by county, river basin, and regional water planning area for use in the regional water planning process (Table 8). Small differences of values between table summaries are due to rounding.

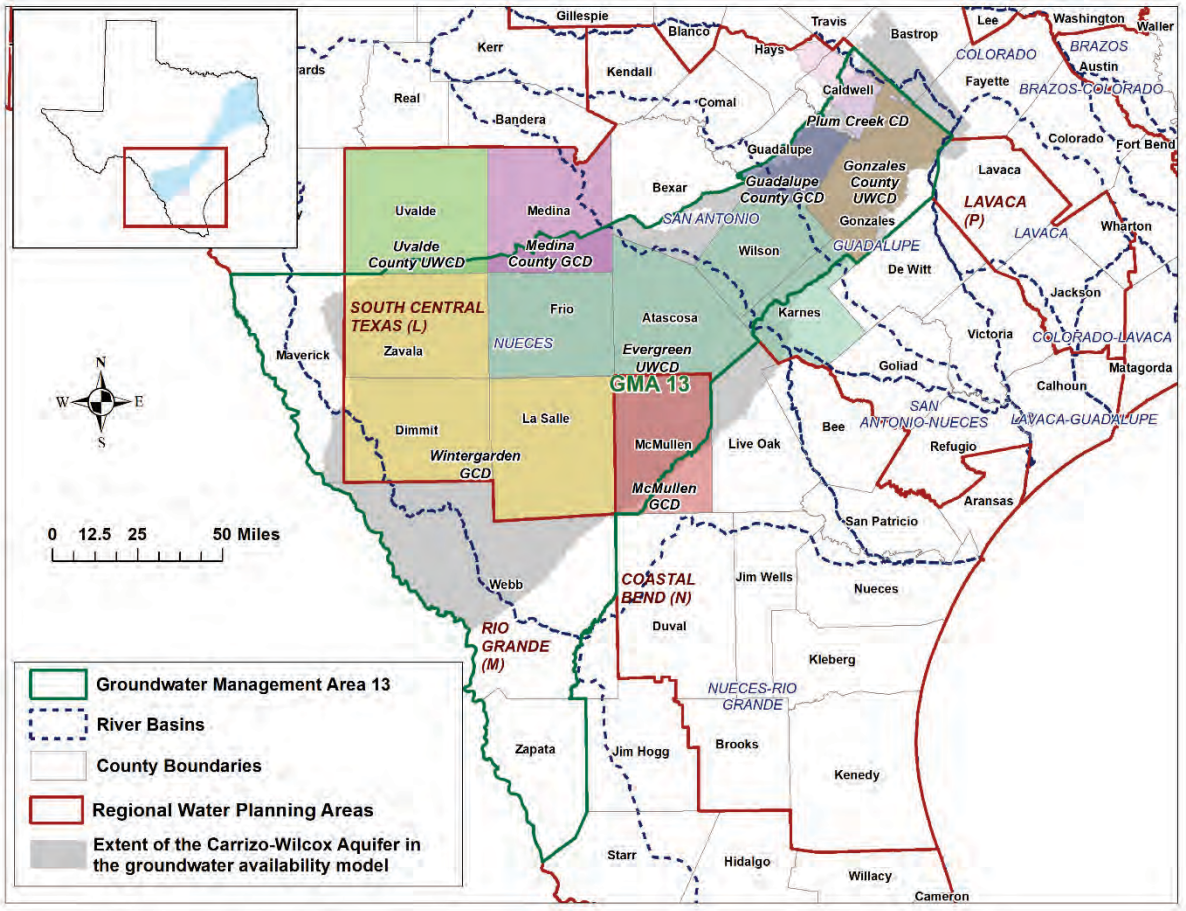

FIGURE 1. GROUNDWATER MANAGEMENT AREA (GMA) 13 BOUNDARY, REGIONAL WATER PLANNING AREAS (RWPAS), RIVER BASINS, GROUNDWATER CONSERVATION DISTRICTS (GCDS), AND COUNTIES OVERLAIN ON THE EXTENT OF THE CARRIZO-WILCOX AQUIFER.

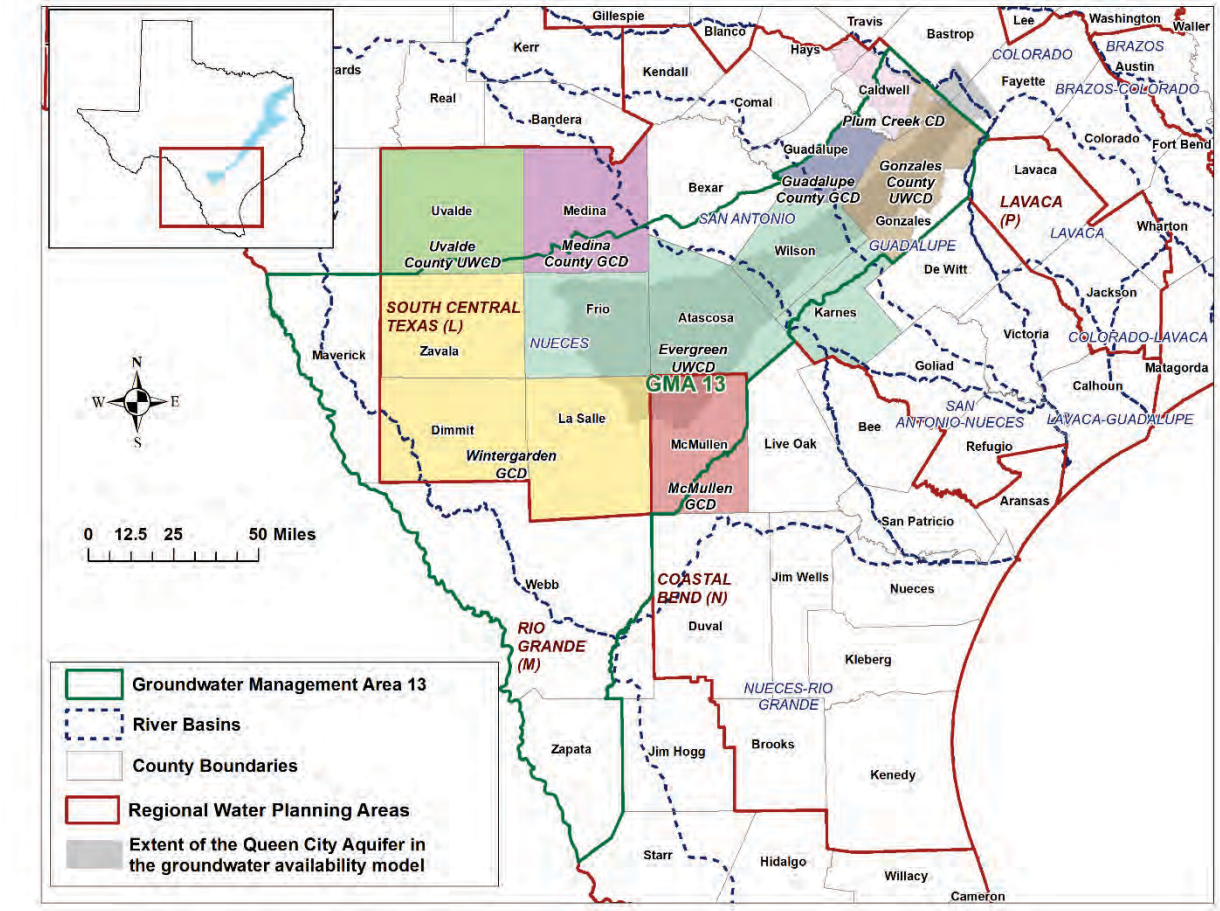

FIGURE 2. GROUNDWATER MANAGEMENT AREA (GMA) 13 BOUNDARY, REGIONAL WATER PLANNING AREAS (RWPAS), RIVER BASINS, GROUNDWATER CONSERVATION DISTRICTS (GCDS), AND COUNTIES OVERLAIN ON THE EXTENT OF THE QUEEN CITY AQUIFER.

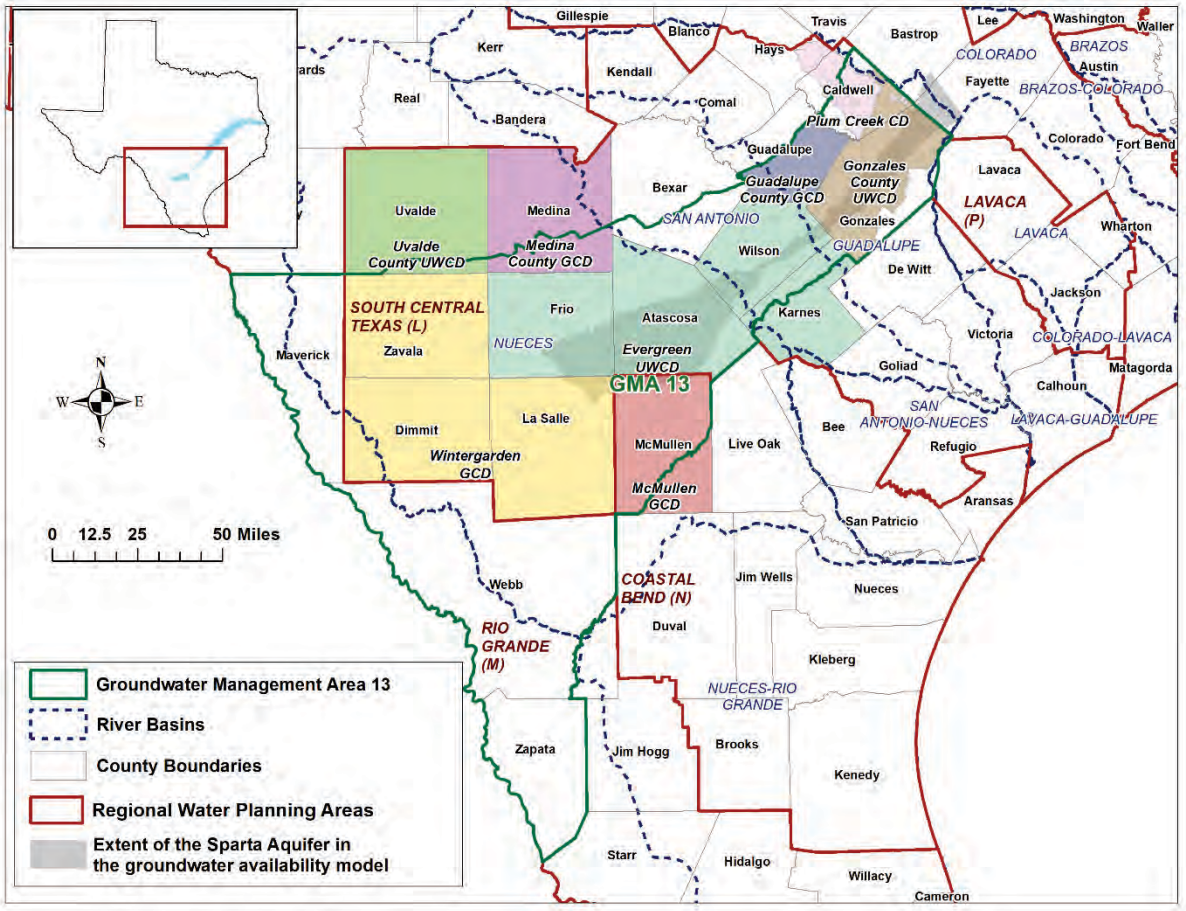

FIGURE 3. GROUNDWATER MANAGEMENT AREA (GMA) 13 BOUNDARY, REGIONAL WATER PLANNING AREAS (RWPAS), RIVER BASINS, GROUNDWATER CONSERVATION DISTRICTS (GCDS), AND COUNTIES OVERLAIN ON THE EXTENT OF THE SPARTA AQUIFER.

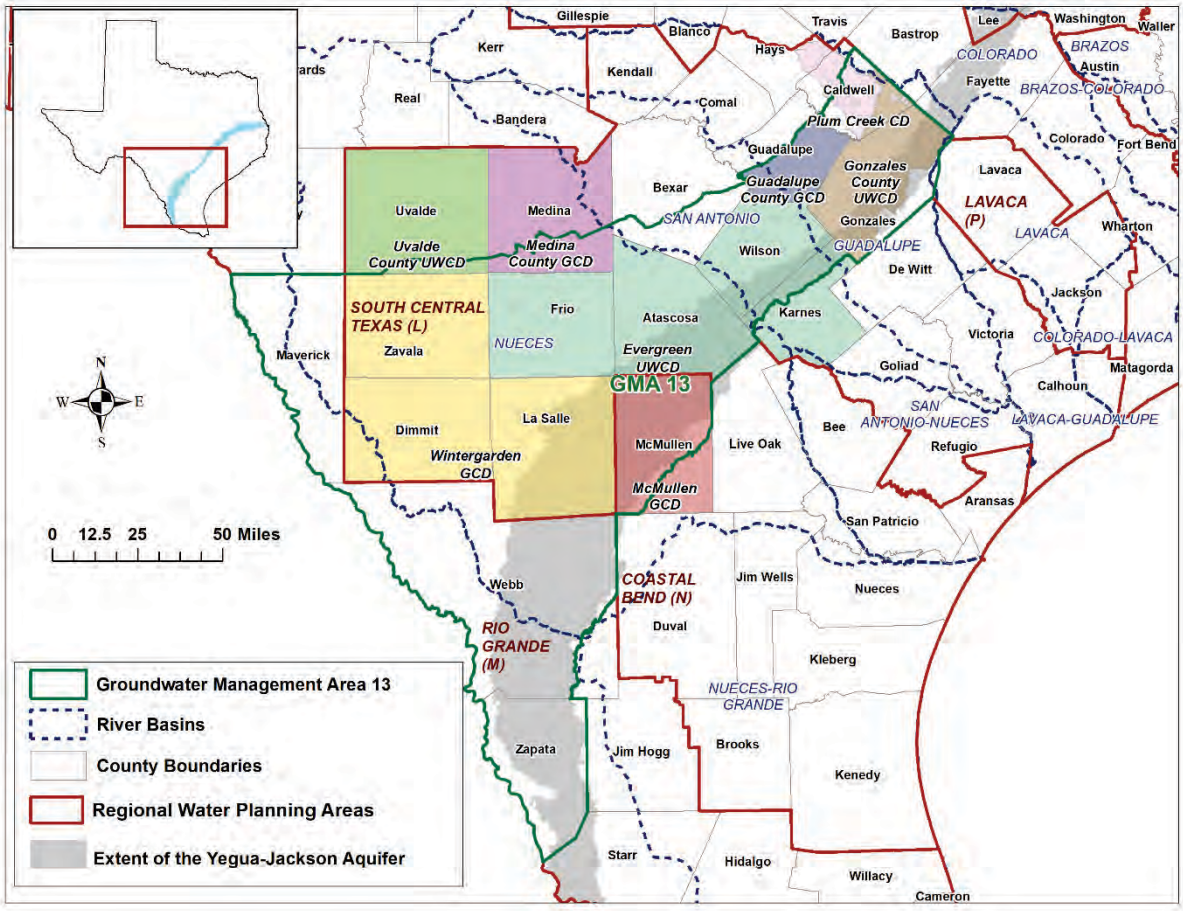

FIGURE 4. GROUNDWATER MANAGEMENT AREA (GMA) 13 BOUNDARY, REGIONAL WATER PLANNING AREAS (RWPAS), RIVER BASINS, GROUNDWATER CONSERVATION DISTRICTS (GCDS), AND COUNTIES OVERLAIN ON THE EXTENT OF THE YEGUA-JACKSON AQUIFER.

TABLE 1. MODELED AVAILABLE GROUNDWATER FOR THE CARRIZO-WILCOX AQUIFER IN GROUNDWATER MANAGEMENT AREA 13 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2080. VALUES ARE IN ACRE-FEET PER YEAR.

Groundwater Conservation District	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
Evergreen UWCD	Atascosa	Carrizo-Wilcox	51,924	54,397	55,329	56,828	58,406	59,982	59,982
Evergreen UWCD	Frio	Carrizo-Wilcox	114,827	86,995	85,143	82,950	81,018	79,131	79,131
Evergreen UWCD	Karnes	Carrizo-Wilcox	693	758	843	931	1,001	1,043	1,043
Evergreen UWCD	Wilson	Carrizo-Wilcox	38,229	38,284	43,604	68,609	105,947	125,670	125,670
Evergreen UWCD Total		**Carrizo-Wilcox**	**205,673**	**180,434**	**184,919**	**209,318**	**246,372**	**265,826**	**265,826**
Gonzales County UWCD	Caldwell	Carrizo-Wilcox	468	9,472	16,401	25,510	30,087	30,087	30,087
Gonzales County UWCD	Gonzales	Carrizo-Wilcox	60,431	76,265	90,788	102,373	102,747	103,707	96,161
Gonzales County UWCD Total		**Carrizo-Wilcox**	**60,899**	**85,737**	**107,189**	**127,883**	**132,834**	**133,794**	**126,248**
Guadalupe County GCD	**Guadalupe**	**Carrizo-Wilcox**	**55,637**	**39,563**	**41,668**	**43,315**	**42,118**	**42,199**	**41,659**
McMullen GCD	**McMullen**	**Carrizo-Wilcox**	**7,789**	**7,768**	**4,867**	**4,854**	**4,854**	**4,854**	**4,854**
Medina County GCD	**Medina**	**Carrizo-Wilcox**	**2,635**	**2,628**	**2,635**	**2,628**	**2,628**	**2,628**	**2,628**
Plum Creek CD	**Caldwell**	**Carrizo-Wilcox**	**17,673**	**15,366**	**16,335**	**16,965**	**15,562**	**19,509**	**19,468**
Uvalde County UWCD	**Uvalde**	**Carrizo-Wilcox**	**0**[1]	**0**	**0**	**0**	**0**	**0**	**0**

[1] A zero value indicates the groundwater availability model pumping scenario did not include any pumping in the aquifer.

TABLE 1 (CONTINUED)

Groundwater Conservation District	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
Wintergarden GCD	Dimmit	Carrizo-Wilcox	**3,895**	**3,885**	**3,895**	**3,885**	**3,885**	**3,885**	**3,885**
Wintergarden GCD	La Salle	Carrizo-Wilcox	**6,554**	**6,536**	**6,554**	**6,536**	**6,536**	**6,536**	**6,536**
Wintergarden GCD	Zavala	Carrizo-Wilcox	**38,303**	**36,675**	**35,399**	**35,204**	**35,006**	**34,831**	**34,540**
Wintergarden GCD Total		**Carrizo-Wilcox**	**48,752**	**47,096**	**45,848**	**45,625**	**45,427**	**45,252**	**44,961**
No District-County	Bexar	Carrizo-Wilcox	69,727	68,451	68,928	68,739	67,653	67,849	67,849
No District-County	Caldwell	Carrizo-Wilcox	39	39	39	39	39	39	39
No District-County	Gonzales	Carrizo-Wilcox	0[2]	0	0	0	0	0	0
No District-County	Maverick	Carrizo-Wilcox	547	545	547	545	545	276	276
No District-County	Webb	Carrizo-Wilcox	912	910	912	910	910	910	910
No District-County Total		**Carrizo-Wilcox**	**71,225**	**69,945**	**70,426**	**70,233**	**69,147**	**69,074**	**69,074**
Total for GMA 13		**Carrizo-Wilcox**	**470,283**	**448,537**	**473,887**	**520,821**	**558,942**	**583,136**	**574,718**

[2] A zero value indicates the groundwater availability model pumping scenario did not include any pumping in the aquifer.

TABLE 2. MODELED AVAILABLE GROUNDWATER FOR THE QUEEN CITY AQUIFER IN GROUNDWATER MANAGEMENT AREA 13 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2080. VALUES ARE IN ACRE-FEET PER YEAR.

Groundwater Conservation District	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
Evergreen UWCD	Atascosa	Queen City	4,070	4,525	4,537	4,495	4,390	4,285	4,285
Evergreen UWCD	Frio	Queen City	6,702	4,533	4,380	4,231	4,066	3,927	3,927
Evergreen UWCD	Wilson	Queen City	2,631	1,423	1,267	1,123	1,000	892	892
Evergreen UWCD Total		**Queen City**	**13,403**	**10,481**	**10,184**	**9,849**	**9,456**	**9,104**	**9,104**
Gonzales County UWCD	Caldwell	Queen City	4,842	4,829	4,557	4,545	4,545	3,977	3,977
Gonzales County UWCD	Gonzales	Queen City	4,973	4,960	4,973	4,960	4,960	4,500	4,500
Gonzales County UWCD Total		**Queen City**	**9,815**	**9,789**	**9,530**	**9,505**	**9,505**	**8,477**	**8,477**
Guadalupe County GCD	**Guadalupe**	**Queen City**	**0**[3]	**0**	**0**	**0**	**0**	**0**	**0**
McMullen GCD	**McMullen**	**Queen City**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
Plum Creek CD	**Caldwell**	**Queen City**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Wintergarden GCD	**La Salle**	**Queen City**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Total for GMA 13		**Queen City**	**23,222**	**20,274**	**19,718**	**19,358**	**18,965**	**17,585**	**17,585**

[3] A zero value indicates the groundwater availability model pumping scenario did not include any pumping in the aquifer.

TABLE 3. MODELED AVAILABLE GROUNDWATER FOR THE SPARTA AQUIFER IN GROUNDWATER MANAGEMENT AREA 13 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2080. VALUES ARE IN ACRE-FEET PER YEAR.

Groundwater Conservation District	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
Evergreen UWCD	Atascosa	Sparta	1,218	1,187	1,043	998	961	932	932
Evergreen UWCD	Frio	Sparta	897	623	603	576	557	534	534
Evergreen UWCD	Wilson	Sparta	335	182	163	144	128	114	114
Evergreen UWCD Total		**Sparta**	**2,450**	**1,992**	**1,809**	**1,718**	**1,646**	**1,580**	**1,580**
Gonzales County UWCD	**Gonzales**	**Sparta**	**3,524**	**2,451**	**2,457**	**2,451**	**2,451**	**2,451**	**2,451**
McMullen GCD	**McMullen**	**Sparta**	**0**[4]	**0**	**0**	**0**	**0**	**0**	**0**
Wintergarden GCD	**La Salle**	**Sparta**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total for GMA 13		**Sparta**	**5,974**	**4,443**	**4,266**	**4,169**	**4,097**	**4,031**	**4,031**

TABLE 4. MODELED AVAILABLE GROUNDWATER FOR THE YEGUA-JACKSON AQUIFER IN GROUNDWATER MANAGEMENT AREA 13 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2080. VALUES ARE IN ACRE-FEET PER YEAR.

Groundwater Conservation District	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
Evergreen UWCD	Karnes	Yegua-Jackson	2,013	2,013	2,013	2,013	2,013	2,013	2,013
Gonzales County UWCD	Gonzales	Yegua-Jackson	4,155	4,155	4,155	4,155	4,155	4,155	4,155
No District-County	Gonzales	Yegua-Jackson	573	573	573	573	573	573	573
Total for GMA 13		**Yegua-Jackson**	**6,741**	**6,741**	**6,741**	**6,741**	**6,741**	**6,741**	**6,741**

[4] A zero value indicates the groundwater availability model pumping scenario did not include any pumping in the aquifer.

TABLE 5. MODELED AVAILABLE GROUNDWATER BY DECADE FOR THE CARRIZO-WILCOX AQUIFER IN GROUNDWATER MANAGEMENT AREA 13. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), RIVER BASIN, AND AQUIFER.

County	RWPA	River Basin	Aquifer	2030	2040	2050	2060	2070	2080
Atascosa	L	Nueces	Carrizo-Wilcox	54,310	55,241	56,739	58,316	59,890	59,890
Atascosa	L	San Antonio	Carrizo-Wilcox	87	88	89	90	92	92
Bexar	L	Nueces	Carrizo-Wilcox	38,762	38,993	39,134	39,134	39,287	39,287
Bexar	L	San Antonio	Carrizo-Wilcox	29,689	29,935	29,605	28,519	28,562	28,562
Caldwell	L	Colorado	Carrizo-Wilcox	0[5]	0	0	0	0	0
Caldwell	L	Guadalupe	Carrizo-Wilcox	24,877	32,775	42,514	45,688	49,635	49,594
Dimmit	L	Nueces	Carrizo-Wilcox	3,765	3,775	3,765	3,765	3,765	3,765
Dimmit	L	Rio Grande	Carrizo-Wilcox	120	120	120	120	120	120
Frio	L	Nueces	Carrizo-Wilcox	86,995	85,143	82,950	81,018	79,131	79,131
Gonzales	L	Guadalupe	Carrizo-Wilcox	76,265	90,788	102,373	102,747	103,707	96,161
Gonzales	L	Lavaca	Carrizo-Wilcox	0	0	0	0	0	0
Guadalupe	L	Guadalupe	Carrizo-Wilcox	32,400	34,200	35,631	34,655	34,736	34,345
Guadalupe	L	San Antonio	Carrizo-Wilcox	7,163	7,468	7,684	7,463	7,463	7,314
Karnes	L	Guadalupe	Carrizo-Wilcox	0	0	0	0	0	0
Karnes	L	Nueces	Carrizo-Wilcox	0	0	0	0	0	0
Karnes	L	San Antonio	Carrizo-Wilcox	758	843	931	1,001	1,043	1,043
La Salle	L	Nueces	Carrizo-Wilcox	6,536	6,554	6,536	6,536	6,536	6,536
Medina	L	Nueces	Carrizo-Wilcox	2,623	2,630	2,623	2,623	2,623	2,623

[5] A zero value indicates the groundwater availability model pumping scenario did not include any pumping in the aquifer.

TABLE 5 (CONTINUED)

County	RWPA	River Basin	Aquifer	2030	2040	2050	2060	2070	2080
Medina	L	San Antonio	Carrizo-Wilcox	5	5	5	5	5	5
Uvalde	L	Nueces	Carrizo-Wilcox	0[6]	0	0	0	0	0
Wilson	L	Guadalupe	Carrizo-Wilcox	443	653	762	3,870	3,982	3,982
Wilson	L	Nueces	Carrizo-Wilcox	10,774	11,171	11,578	12,027	12,546	12,546
Wilson	L	San Antonio	Carrizo-Wilcox	27,067	31,780	56,269	90,050	109,142	109,142
Zavala	L	Nueces	Carrizo-Wilcox	36,675	35,399	35,204	35,006	34,831	34,540
Maverick	M	Nueces	Carrizo-Wilcox	542	544	542	542	273	273
Maverick	M	Rio Grande	Carrizo-Wilcox	3	3	3	3	3	3
Webb	M	Nueces	Carrizo-Wilcox	890	892	890	890	890	890
Webb	M	Rio Grande	Carrizo-Wilcox	20	20	20	20	20	20
McMullen	N	Nueces	Carrizo-Wilcox	7,768	4,867	4,854	4,854	4,854	4,854
GMA 13 Total			**Carrizo-Wilcox**	**448,537**	**473,887**	**520,821**	**558,942**	**583,136**	**574,718**

[6] A zero value indicates the groundwater availability model pumping scenario did not include any pumping in the aquifer.

TABLE 6. MODELED AVAILABLE GROUNDWATER BY DECADE FOR THE QUEEN CITY AQUIFER IN GROUNDWATER MANAGEMENT AREA 13. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), RIVER BASIN, AND AQUIFER.

County	RWPA	River Basin	Aquifer	2030	2040	2050	2060	2070	2080
Atascosa	L	Nueces	Queen City	4,525	4,537	4,495	4,390	4,285	4,285
Caldwell	L	Guadalupe	Queen City	4,829	4,557	4,545	4,545	3,977	3,977
Frio	L	Nueces	Queen City	4,533	4,380	4,231	4,066	3,927	3,927
Gonzales	L	Guadalupe	Queen City	4,960	4,973	4,960	4,960	4,500	4,500
Guadalupe	L	Guadalupe	Queen City	0[7]	0	0	0	0	0
La Salle	L	Nueces	Queen City	1	1	1	1	1	1
Wilson	L	Guadalupe	Queen City	106	95	84	75	67	67
Wilson	L	Nueces	Queen City	181	161	143	127	114	114
Wilson	L	San Antonio	Queen City	1,136	1,011	896	798	711	711
McMullen	N	Nueces	Queen City	3	3	3	3	3	3
GMA 13 Total			**Queen City**	**20,274**	**19,718**	**19,358**	**18,965**	**17,585**	**17,585**

[7] A zero value indicates the groundwater availability model pumping scenario did not include any pumping in the aquifer.

TABLE 7. MODELED AVAILABLE GROUNDWATER BY DECADE FOR THE SPARTA AQUIFER IN GROUNDWATER MANAGEMENT AREA 13. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), RIVER BASIN, AND AQUIFER.

County	RWPA	River Basin	Aquifer	2030	2040	2050	2060	2070	2080
Atascosa	L	Nueces	Sparta	1,187	1,043	998	961	932	932
Frio	L	Nueces	Sparta	623	603	576	557	534	534
Gonzales	L	Guadalupe	Sparta	2,451	2,457	2,451	2,451	2,451	2,451
La Salle	L	Nueces	Sparta	0[8]	0	0	0	0	0
Wilson	L	Guadalupe	Sparta	12	11	10	9	8	8
Wilson	L	Nueces	Sparta	19	17	15	13	12	12
Wilson	L	San Antonio	Sparta	151	135	119	106	94	94
McMullen	N	Nueces	Sparta	0	0	0	0	0	0
GMA 13 Total			**Sparta**	**4,443**	**4,266**	**4,169**	**4,097**	**4,031**	**4,031**

[8] A zero value indicates the groundwater availability model pumping scenario did not include any pumping in the aquifer.

TABLE 8. MODELED AVAILABLE GROUNDWATER BY DECADE FOR THE YEGUA-JACKSON AQUIFER IN GROUNDWATER MANAGEMENT AREA 13. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), RIVER BASIN, AND AQUIFER.

County	RWPA	River Basin	Aquifer	2030	2040	2050	2060	2070	2080
Atascosa	L	Nueces	Yegua-Jackson	NR	NR	NR	NR	NR	NR
Frio	L	Nueces	Yegua-Jackson	NR	NR	NR	NR	NR	NR
Gonzales	L	Guadalupe	Yegua-Jackson	4,709	4,709	4,709	4,709	4,709	4,709
Gonzales	L	Lavaca	Yegua-Jackson	19	19	19	19	19	19
Karnes	L	Guadalupe	Yegua-Jackson	292	292	292	292	292	292
Karnes	L	Nueces	Yegua-Jackson	91	91	91	91	91	91
Karnes	L	San Antonio	Yegua-Jackson	1,630	1,630	1,630	1,630	1,630	1,630
La Salle	L	Nueces	Yegua-Jackson	NR	NR	NR	NR	NR	NR
Wilson	L	Guadalupe	Yegua-Jackson	NR	NR	NR	NR	NR	NR
Wilson	L	Nueces	Yegua-Jackson	NR	NR	NR	NR	NR	NR
Wilson	L	San Antonio	Yegua-Jackson	NR	NR	NR	NR	NR	NR
Webb	M	Nueces	Yegua-Jackson	NR	NR	NR	NR	NR	NR
Webb	M	Rio Grande	Yegua-Jackson	NR	NR	NR	NR	NR	NR
Zapata	M	Rio Grande	Yegua-Jackson	NR	NR	NR	NR	NR	NR
McMullen	N	Nueces	Yegua-Jackson	NR	NR	NR	NR	NR	NR
GMA 13 Total			**Yegua-Jackson**	**6,741**	**6,741**	**6,741**	**6,741**	**6,741**	**6,741**

NR: Groundwater Management Area 13 declared the Yegua-Jackson Aquifer not relevant in these areas.

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.

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APPENDIX A

Total Pumping Associated with Modeled Available Groundwater Run for the Carrizo-Wilcox Aquifer Split by Model Layers for Groundwater Management Area 13

TABLE A.1. TOTAL PUMPING SPLIT BY MODEL LAYERS FROM THE MODELED AVAILABLE GROUNDWATER RUN FOR THE CARRIZO-WILCOX AQUIFER IN GROUNDWATER MANAGEMENT AREA 13. THE VALUES ARE SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2080. VALUES ARE IN ACRE-FEET PER YEAR.

GCD	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
Evergreen UWCD	Atascosa	Carrizo	50,266	52,745	53,671	55,176	56,754	58,330	58,330
Evergreen UWCD	Atascosa	Upper Wilcox	250	249	250	249	249	249	249
Evergreen UWCD	Atascosa	Middle Wilcox	224	223	224	223	223	223	223
Evergreen UWCD	Atascosa	Lower Wilcox	1,184	1,180	1,184	1,180	1,180	1,180	1,180
Evergreen UWCD	Frio	Carrizo	114,827	86,995	85,143	82,950	81,018	79,131	79,131
Evergreen UWCD	Frio	Upper Wilcox	0[9]	0	0	0	0	0	0
Evergreen UWCD	Frio	Middle Wilcox	0	0	0	0	0	0	0
Evergreen UWCD	Frio	Lower Wilcox	0	0	0	0	0	0	0
Evergreen UWCD	Karnes	Carrizo	693	758	843	931	1,001	1,043	1,043
Evergreen UWCD	Karnes	Upper Wilcox	0	0	0	0	0	0	0
Evergreen UWCD	Karnes	Middle Wilcox	0	0	0	0	0	0	0
Evergreen UWCD	Karnes	Lower Wilcox	0	0	0	0	0	0	0
Evergreen UWCD	Wilson	Carrizo	36,086	32,648	34,096	35,482	36,994	38,730	38,730
Evergreen UWCD	Wilson	Upper Wilcox	125	125	125	125	125	125	125
Evergreen UWCD	Wilson	Middle Wilcox	125	125	125	125	125	125	125
Evergreen UWCD	Wilson	Lower Wilcox	1,893	5,386	9,258	32,877	68,703	86,690	86,690
Evergreen UWCD Total		**Carrizo-Wilcox**	**205,673**	**180,434**	**184,919**	**209,318**	**246,372**	**265,826**	**265,826**

[9] A zero value indicates the groundwater availability model pumping scenario did not include any pumping in the aquifer.

TABLE A.1. (CONTINUED)

GCD	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
Gonzales County UWCD	Caldwell	Carrizo	453	9,457	16,386	25,495	30,072	30,072	30,072
Gonzales County UWCD	Caldwell	Upper Wilcox	15	15	15	15	15	15	15
Gonzales County UWCD	Caldwell	Middle Wilcox	0[10]	0	0	0	0	0	0
Gonzales County UWCD	Caldwell	Lower Wilcox	0	0	0	0	0	0	0
Gonzales County UWCD	Gonzales	Carrizo	47,131	51,908	55,242	55,832	56,206	57,166	49,620
Gonzales County UWCD	Gonzales	Upper Wilcox	0	0	0	0	0	0	0
Gonzales County UWCD	Gonzales	Middle Wilcox	11,096	15,563	20,114	24,556	24,556	24,556	24,556
Gonzales County UWCD	Gonzales	Lower Wilcox	2,204	8,794	15,432	21,985	21,985	21,985	21,985
Gonzales County UWCD Total		**Carrizo-Wilcox**	**60,899**	**85,737**	**107,189**	**127,883**	**132,834**	**133,794**	**126,248**
Guadalupe County GCD	Guadalupe	Carrizo	28,943	14,834	14,627	14,532	14,224	14,624	14,624
Guadalupe County GCD	Guadalupe	Upper Wilcox	0	0	0	0	0	0	0

[10] A zero value indicates the groundwater availability model pumping scenario did not include any pumping in the aquifer.

TABLE A.1 (CONTINUED)

GCD	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
Guadalupe County GCD	Guadalupe	Middle Wilcox	6,609	6,373	7,926	9,428	9,207	9,075	8,986
Guadalupe County GCD	Guadalupe	Lower Wilcox	20,085	18,356	19,115	19,355	18,687	18,500	18,049
Guadalupe County GCD Total		**Carrizo-Wilcox**	**55,637**	**39,563**	**41,668**	**43,315**	**42,118**	**42,199**	**41,659**
McMullen County GCD	McMullen	Carrizo	7,789	7,768	4,867	4,854	4,854	4,854	4,854
McMullen County GCD	McMullen	Upper Wilcox	0[11]	0	0	0	0	0	0
McMullen County GCD	McMullen	Middle Wilcox	0	0	0	0	0	0	0
McMullen County GCD	McMullen	Lower Wilcox	0	0	0	0	0	0	0
McMullen County GCD Total		**Carrizo-Wilcox**	**7,789**	**7,768**	**4,867**	**4,854**	**4,854**	**4,854**	**4,854**
Medina County GCD	Medina	Carrizo	517	515	517	515	515	515	515
Medina County GCD	Medina	Upper Wilcox	0	0	0	0	0	0	0
Medina County GCD	Medina	Middle Wilcox	1,252	1,249	1,252	1,249	1,249	1,249	1,249
Medina County GCD	Medina	Lower Wilcox	866	864	866	864	864	864	864
Medina County GCD Total		**Carrizo-Wilcox**	**2,635**	**2,628**	**2,635**	**2,628**	**2,628**	**2,628**	**2,628**
Plum Creek CD	Caldwell	Carrizo	0	1,990	5,048	5,709	6,046	9,993	9,993
Plum Creek CD	Caldwell	Upper Wilcox	0	0	0	0	0	0	0
Plum Creek CD	Caldwell	Middle Wilcox	5,733	5,717	5,733	5,717	3,977	3,977	3,936
Plum Creek CD	Caldwell	Lower Wilcox	11,940	7,659	5,554	5,539	5,539	5,539	5,539
Plum Creek CD Total		**Carrizo-Wilcox**	**17,673**	**15,366**	**16,335**	**16,965**	**15,562**	**19,509**	**19,468**

[11] A zero value indicates the groundwater availability model pumping scenario did not include any pumping in the aquifer.

TABLE A.1 (CONTINUED)

GCD	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
Uvalde County GCD	Uvalde	Carrizo	0[12]	0	0	0	0	0	0
Uvalde County GCD	Uvalde	Upper Wilcox	0	0	0	0	0	0	0
Uvalde County GCD	Uvalde	Middle Wilcox	0	0	0	0	0	0	0
Uvalde County GCD	Uvalde	Lower Wilcox	0	0	0	0	0	0	0
Uvalde County GCD Total		**Carrizo-Wilcox**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Wintergarden GCD	Dimmit	Carrizo	2,722	2,715	2,722	2,715	2,715	2,715	2,715
Wintergarden GCD	Dimmit	Upper Wilcox	993	990	993	990	990	990	990
Wintergarden GCD	Dimmit	Middle Wilcox	142	142	142	142	142	142	142
Wintergarden GCD	Dimmit	Lower Wilcox	38	38	38	38	38	38	38
Wintergarden GCD	La Salle	Carrizo	4,597	4,584	4,597	4,584	4,584	4,584	4,584
Wintergarden GCD	La Salle	Upper Wilcox	1,957	1,952	1,957	1,952	1,952	1,952	1,952
Wintergarden GCD	La Salle	Middle Wilcox	0	0	0	0	0	0	0
Wintergarden GCD	La Salle	Lower Wilcox	0	0	0	0	0	0	0
Wintergarden GCD	Zavala	Carrizo	27,969	26,368	25,065	24,897	24,699	24,524	24,233
Wintergarden GCD	Zavala	Upper Wilcox	6,329	6,312	6,329	6,312	6,312	6,312	6,312
Wintergarden GCD	Zavala	Middle Wilcox	3,683	3,673	3,683	3,673	3,673	3,673	3,673
Wintergarden GCD	Zavala	Lower Wilcox	322	322	322	322	322	322	322
Wintergarden GCD Total		**Carrizo-Wilcox**	**48,752**	**47,096**	**45,848**	**45,625**	**45,427**	**45,252**	**44,961**
No District-County	Bexar	Carrizo	43,057	42,939	43,346	43,227	43,227	43,423	43,423
No District-County	Bexar	Upper Wilcox	10	10	10	10	10	10	10
No District-County	Bexar	Middle Wilcox	58	58	58	58	58	58	58
No District-County	Bexar	Lower Wilcox	26,602	25,444	25,514	25,444	24,358	24,358	24,358

[12] A zero value indicates the groundwater availability model pumping scenario did not include any pumping in the aquifer.

TABLE A.1 (CONTINUED)

GCD	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
No District-County	Caldwell	Carrizo	NP[13]	NP	NP	NP	NP	NP	NP
No District-County	Caldwell	Upper Wilcox	NP	NP	NP	NP	NP	NP	NP
No District-County	Caldwell	Middle Wilcox	39	39	39	39	39	39	39
No District-County	Caldwell	Lower Wilcox	0[14]	0	0	0	0	0	0
No District-County	Gonzales	Carrizo	0	0	0	0	0	0	0
No District-County	Gonzales	Upper Wilcox	0	0	0	0	0	0	0
No District-County	Gonzales	Middle Wilcox	0	0	0	0	0	0	0
No District-County	Gonzales	Lower Wilcox	0	0	0	0	0	0	0
No District-County	Maverick	Carrizo	543	541	543	541	541	272	272
No District-County	Maverick	Upper Wilcox	0	0	0	0	0	0	0
No District-County	Maverick	Middle Wilcox	2	2	2	2	2	2	2
No District-County	Maverick	Lower Wilcox	2	2	2	2	2	2	2
No District-County	Web	Carrizo	898	896	898	896	896	896	896
No District-County	Web	Upper Wilcox	13	13	13	13	13	13	13
No District-County	Web	Middle Wilcox	1	1	1	1	1	1	1
No District-County	Web	Lower Wilcox	0	0	0	0	0	0	0
No District-County Total		**Carrizo-Wilcox**	**71,225**	**69,945**	**70,426**	**70,233**	**69,147**	**69,074**	**69,074**
Total for GMA 13		**Carrizo-Wilcox**	**470,283**	**448,537**	**473,887**	**520,821**	**558,942**	**583,136**	**574,718**

[13] NP: The aquifer is not present in this part of the county.
[14] A zero value indicates the groundwater availability model pumping scenario did not include any pumping in the aquifer.

Appendix I

Summary Table of MAGs
by GCD in GMA 13

Groundwater Management Area (GMA) 13
Modeled Available Groundwater for Relevant Aquifers by Groundwater Conservation District (GCD)
2021 Joint Planning

Evergreen UWCD								
GCD	Aquifer	County	Modeled Available Groundwater (acre-feet per year)					
			2020	2030	2040	2050	2060	2070	2080
Evergreen UWCD	Carrizo-Wilcox	Atascosa	51,924	54,397	55,329	56,828	58,406	59,982	59,982
Evergreen UWCD	Carrizo-Wilcox	Frio	114,827	86,995	85,143	82,950	81,018	79,131	79,131
Evergreen UWCD	Carrizo-Wilcox	Karnes	693	758	843	931	1,001	1,043	1,043
Evergreen UWCD	Carrizo-Wilcox	Wilson	38,229	38,284	43,604	68,609	105,947	125,670	125,670
Evergreen UWCD	Queen City	Atascosa	4,070	4,525	4,537	4,495	4,390	4,285	4,285
Evergreen UWCD	Queen City	Frio	6,702	4,533	4,380	4,231	4,066	3,927	3,927
Evergreen UWCD	Queen City	Wilson	2,631	1,423	1,267	1,123	1,000	892	892
Evergreen UWCD	Sparta	Atascosa	1,218	1,187	1,043	998	961	932	932
Evergreen UWCD	Sparta	Frio	897	623	603	576	557	534	534
Evergreen UWCD	Sparta	Wilson	335	182	163	144	128	114	114
Evergreen UWCD	Yegua-Jackson	Karnes	2,013	2,013	2,013	2,013	2,013	2,013	2,013
Evergreen UWCD Totals									
	Carrizo-Wilcox Aquifer		**205,673**	**180,434**	**184,919**	**209,318**	**246,372**	**265,826**	**265,826**
	Queen City Aquifer		**13,403**	**10,481**	**10,184**	**9,849**	**9,456**	**9,104**	**9,104**
	Sparta Aquifer		**2,450**	**1,992**	**1,809**	**1,718**	**1,646**	**1,580**	**1,580**
	Yegua-Jackson Aquifer		**2,013**	**2,013**	**2,013**	**2,013**	**2,013**	**2,013**	**2,013**

Values from GAM Run 21-018 MAG: Modeled Available Groundwater for the Carrizo-Wilcox, Queen City, Sparta, and Yegua-Jackson aquifers in Groundwater Management Area 13
Total pumping split by model layers for the Carrizo-Wilcox Aquifer are included in Appendix A of GAM Run 21-018 MAG.

Groundwater Management Area (GMA) 13
Modeled Available Groundwater for Relevant Aquifers by Groundwater Conservation District (GCD)
2021 Joint Planning

Gonzales County UWCD								
GCD	Aquifer	County	Modeled Available Groundwater (acre-feet per year)					
			2020	2030	2040	2050	2060	2070	2080
Gonzales County UWCD	Carrizo-Wilcox	Caldwell	468	9,472	16,401	25,510	30,087	30,087	30,087
Gonzales County UWCD	Carrizo-Wilcox	Gonzales	60,431	76,265	90,788	102,373	102,747	103,707	96,161
Gonzales County UWCD	Queen City	Caldwell	4,842	4,829	4,557	4,545	4,545	3,977	3,977
Gonzales County UWCD	Queen City	Gonzales	4,973	4,960	4,973	4,960	4,960	4,500	4,500
Gonzales County UWCD	Sparta	Gonzales	3,524	2,451	2,457	2,451	2,451	2,451	2,451
Gonzales County UWCD	Yegua-Jackson	Gonzales	4,155	4,155	4,155	4,155	4,155	4,155	4,155
Gonzales County UWCD Totals									
	Carrizo-Wilcox Aquifer		**60,899**	**85,737**	**107,189**	**127,883**	**132,834**	**133,794**	**126,248**
	Queen City Aquifer		**9,815**	**9,789**	**9,530**	**9,505**	**9,505**	**8,477**	**8,477**
	Sparta Aquifer		**3,524**	**2,451**	**2,457**	**2,451**	**2,451**	**2,451**	**2,451**
	Yegua-Jackson Aquifer		**4,155**	**4,155**	**4,155**	**4,155**	**4,155**	**4,155**	**4,155**

Values from GAM Run 21-018 MAG: Modeled Available Groundwater for the Carrizo-Wilcox, Queen City, Sparta, and Yegua-Jackson aquifers in Groundwater Management Area 13
Total pumping split by model layers for the Carrizo-Wilcox Aquifer are included in Appendix A of GAM Run 21-018 MAG.

Groundwater Management Area (GMA) 13
Modeled Available Groundwater for Relevant Aquifers by Groundwater Conservation District (GCD)
2021 Joint Planning

Guadalupe County GCD									
GCD	Aquifer	County	Modeled Available Groundwater (acre-feet per year)						
			2020	2030	2040	2050	2060	2070	2080
Guadalupe County GCD	Carrizo-Wilcox	Guadalupe	55,637	39,563	41,668	43,315	42,118	42,199	41,659
Guadalupe County GCD	Queen City	Guadalupe	0	0	0	0	0	0	0

Values from GAM Run 21-018 MAG: Modeled Available Groundwater for the Carrizo-Wilcox, Queen City, Sparta, and Yegua-Jackson aquifers in Groundwater Management Area 13
Total pumping split by model layers for the Carrizo-Wilcox Aquifer are included in Appendix A of GAM Run 21-018 MAG.

Groundwater Management Area (GMA) 13
Modeled Available Groundwater for Relevant Aquifers by Groundwater Conservation District (GCD)
2021 Joint Planning

McMullen GCD									
GCD	Aquifer	County	Modeled Available Groundwater (acre-feet per year)						
			2020	2030	2040	2050	2060	2070	2080
McMullen GCD	Carrizo-Wilcox	McMullen	7,789	7,768	4,867	4,854	4,854	4,854	4,854
McMullen GCD	Queen City	McMullen	3	3	3	3	3	3	3
McMullen GCD	Sparta	McMullen	0	0	0	0	0	0	0

Values from GAM Run 21-018 MAG: Modeled Available Groundwater for the Carrizo-Wilcox, Queen City, Sparta, and Yegua-Jackson aquifers in Groundwater Management Area 13
Total pumping split by model layers for the Carrizo-Wilcox Aquifer are included in Appendix A of GAM Run 21-018 MAG.

Groundwater Management Area (GMA) 13
Modeled Available Groundwater for Relevant Aquifers by Groundwater Conservation District (GCD)
2021 Joint Planning

Medina County GCD									
GCD	Aquifer	County	Modeled Available Groundwater (acre-feet per year)						
			2020	2030	2040	2050	2060	2070	2080
Medina County GCD	Carrizo-Wilcox	Medina	2,635	2,628	2,635	2,628	2,628	2,628	2,628

Values from GAM Run 21-018 MAG: Modeled Available Groundwater for the Carrizo-Wilcox, Queen City, Sparta, and Yegua-Jackson aquifers in Groundwater Management Area 13
Total pumping split by model layers for the Carrizo-Wilcox Aquifer are included in Appendix A of GAM Run 21-018 MAG.

Groundwater Management Area (GMA) 13
Modeled Available Groundwater for Relevant Aquifers by Groundwater Conservation District (GCD)
2021 Joint Planning

Plum Creek CD									
GCD	Aquifer	County	Modeled Available Groundwater (acre-feet per year)						
			2020	2030	2040	2050	2060	2070	2080
Plum Creek CD	Carrizo-Wilcox	Caldwell	17,673	15,366	16,335	16,965	15,562	19,509	19,468
Plum Creek CD	Queen City	Caldwell	0	0	0	0	0	0	0

Values from GAM Run 21-018 MAG: Modeled Available Groundwater for the Carrizo-Wilcox, Queen City, Sparta, and Yegua-Jackson aquifers in Groundwater Management Area 13
Total pumping split by model layers for the Carrizo-Wilcox Aquifer are included in Appendix A of GAM Run 21-018 MAG.

Groundwater Management Area (GMA) 13
Modeled Available Groundwater for Relevant Aquifers by Groundwater Conservation District (GCD)
2021 Joint Planning

Uvalde County UWCD									
GCD	Aquifer	County	Modeled Available Groundwater (acre-feet per year)						
			2020	2030	2040	2050	2060	2070	2080
Uvalde County UWCD	Carrizo-Wilcox	Uvalde	0	0	0	0	0	0	0

Values from GAM Run 21-018 MAG: Modeled Available Groundwater for the Carrizo-Wilcox, Queen City, Sparta, and Yegua-Jackson aquifers in Groundwater Management Area 13
Total pumping split by model layers for the Carrizo-Wilcox Aquifer are included in Appendix A of GAM Run 21-018 MAG.

Groundwater Management Area (GMA) 13
Modeled Available Groundwater for Relevant Aquifers by Groundwater Conservation District (GCD)
2021 Joint Planning

Wintergarden GCD									
GCD	Aquifer	County	Modeled Available Groundwater (acre-feet per year)						
			2020	2030	2040	2050	2060	2070	2080
Wintergarden GCD	Carrizo-Wilcox	Dimmit	3,895	3,885	3,895	3,885	3,885	3,885	3,885
Wintergarden GCD	Carrizo-Wilcox	La Salle	6,554	6,536	6,554	6,536	6,536	6,536	6,536
Wintergarden GCD	Carrizo-Wilcox	Zavala	38,303	36,675	35,399	35,204	35,006	34,831	34,540
Wintergarden GCD	Queen City	La Salle	1	1	1	1	1	1	1
Wintergarden GCD	Sparta	La Salle	0	0	0	0	0	0	0
McMullen GCD Totals									
	Carrizo-Wilcox Aquifer		**48,752**	**48,752**	**48,752**	**48,752**	**48,752**	**48,752**	**48,752**
	Queen City Aquifer		**1**	**1**	**1**	**1**	**1**	**1**	**1**
	Sparta Aquifer		**0**	**0**	**0**	**0**	**0**	**0**	**0**

Values from GAM Run 21-018 MAG: Modeled Available Groundwater for the Carrizo-Wilcox, Queen City, Sparta, and Yegua-Jackson aquifers in Groundwater Management Area 13
Total pumping split by model layers for the Carrizo-Wilcox Aquifer are included in Appendix A of GAM Run 21-018 MAG.

Groundwater Management Area (GMA) 13
Modeled Available Groundwater for Relevant Aquifers by Groundwater Conservation District (GCD)
2021 Joint Planning

No District – County									
GCD	Aquifer	County	Modeled Available Groundwater (acre-feet per year)						
			2020	2030	2040	2050	2060	2070	2080
No District-County	Carrizo-Wilcox	Bexar	69,727	68,451	68,928	68,739	67,653	67,849	67,849
No District-County	Carrizo-Wilcox	Caldwell	39	39	39	39	39	39	39
No District-County	Carrizo-Wilcox	Gonzales	0	0	0	0	0	0	0
No District-County	Carrizo-Wilcox	Maverick	547	545	547	545	545	276	276
No District-County	Carrizo-Wilcox	Webb	912	910	912	910	910	910	910
No District-County	Yegua-Jackson	Gonzales	573	573	573	573	573	573	573
No District-County Totals									
	Carrizo-Wilcox Aquifer		**71,225**	**71,225**	**71,225**	**71,225**	**71,225**	**71,225**	**71,225**
	Yegua-Jackson Aquifer		**573**	**573**	**573**	**573**	**573**	**573**	**573**

Values from GAM Run 21-018 MAG: Modeled Available Groundwater for the Carrizo-Wilcox, Queen City, Sparta, and Yegua-Jackson aquifers in Groundwater Management Area 13
Total pumping split by model layers for the Carrizo-Wilcox Aquifer are included in Appendix A of GAM Run 21-018 MAG.

Appendix J

GMA 13 Desired Future Conditions
2021 Joint Planning

Groundwater Management Area (GMA) 13
Desired Future Conditions
2021 Joint Planning

Adopted Desired Future Conditions for Relevant Aquifers		
Aquifer	**Desired Future Condition (DFC)**	**Date DFC Adopted**
Carrizo-Wilcox, Queen City, and Sparta (outcrop)	75 percent of saturated thickness in the outcrop at the end of 2012 remains at the end of 2080.	11/19/2021
Carrizo-Wilcox, Queen City, and Sparta	Average drawdown of 48 feet (+/- 5 feet) for all of GMA 13 calculated from the end of 2012 conditions through the year 2080	11/19/2021
Yegua-Jackson	For Gonzales County, the average drawdown from the end of 2010 through 2080 is 3 feet (+/- 1 foot). For Karnes County, the average drawdown from the end of 2010 through 2080 is 1 foot (+/- 1 foot).	11/19/2021

Non-Relevant Aquifers *		
Aquifer	**Location**	**Justification**
Edwards (BFZ)	GMA 13 (Atascosa, Bexar, Frio, Medina, Uvalde, and Zavala counties)	Limited extent and use, hydraulic separation from the relevant aquifer system, managed by the Edwards Aquifer Authority
Gulf Coast	GMA 13 (Gonzales and Zapata counties)	Limited extent and use, hydraulic separation from the relevant aquifer system, planning for portions of the aquifer within other groundwater management areas
Trinity	GMA 13 (Atascosa, Bexar, Medina, and Medina counties)	Limited extent and use, hydraulic separation from the relevant aquifer system, planning for portions of the aquifer within other groundwater management areas
Yegua-Jackson	Atascosa, Frio, La Salle, McMullen, Webb, Wilson, and Zapata counties	Limited use, hydraulic separation from the relevant aquifer system

* Districts in a groundwater management area may, as part of the process for adopting and submitting desired future conditions, propose classification of a portion or portions of a relevant aquifer as non-relevant if the districts determine that aquifer characteristics, groundwater demands, and current groundwater uses do not warrant adoption of a desired future condition (Texas Administrative Code § 356.31(b)). Declaring an aquifer as non-relevant for the purposes of joint planning does not necessarily mean that the aquifer will not be managed by a local groundwater conservation district.

Appendix K

TWDB GAM Run 11-017

GAM Run 11-017: Guadalupe County Groundwater Conservation District Management Plan

by Ian C. Jones, Ph.D., P.G.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-6641
November 29, 2011

The seal appearing on this document was authorized by Ian C. Jones, Ph.D., P.G. 477 on November 29, 2011.

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GAM RUN 11-017: GUADALUPE COUNTY GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN

by Ian C. Jones, Ph.D., P.G.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-6641
November 29, 2011

EXECUTIVE SUMMARY:

Texas State Water Code, Section 36.1071, Subsection (h), states that, in developing its groundwater management plan, groundwater conservation districts shall use groundwater availability modeling information provided by the Executive Administrator of the Texas Water Development Board in conjunction with any available site-specific information provided by the district for review and comment to the Executive Administrator. Information derived from groundwater availability models that shall be included in the groundwater management plan includes:

- the annual amount of recharge from precipitation to the groundwater resources within the district, if any;
- 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
- the annual volume of flow into and out of the district within each aquifer and between aquifers in the district.

The purpose of this report is to provide Part 2 of a two-part package of information from the Texas Water Development Board to Guadalupe County Groundwater Conservation District for its groundwater management plan. The groundwater management plan for Guadalupe County Groundwater Conservation District is due for approval by the Executive Administrator of the Texas Water Development Board before January 16, 2013.

This report discusses the method, assumptions, and results from model runs using the groundwater availability model for the southern part of the Carrizo-Wilcox and Queen City aquifers. Tables 1 and 2 summarize the groundwater availability model data

required by the statute, and Figures 1 and 2 show the area of each model from which the values in the respective tables were extracted. This model run replaces the results of GAM Run 07-25. GAM Run 11-017 meets current standards set after GAM Run 07-25. Slight differences in the results of the two model runs are due to differences in the method of extracting data from the model. The Guadalupe County Groundwater Conservation District can use either GAM Run 07-25 or GAM Run 11-017 in their groundwater management plan. If after review of the figures, Guadalupe County Groundwater Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the Texas Water Development Board immediately.

METHODS:

The groundwater availability model for the southern part of the Carrizo-Wilcox and Queen City aquifers (1980 through 1999) was run for this analysis. Water budgets for each year of the transient model period were extracted and the average annual water budget values for recharge, surface water outflow, inflow to the district, outflow from the district, net inter-aquifer flow (upper), and net inter-aquifer flow (lower) for the portions of the aquifers located within the district are summarized in this report.

PARAMETERS AND ASSUMPTIONS:

Carrizo-Wilcox and Queen City Aquifers

- Version 2.01 of the groundwater availability model for the southern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers was used for this analysis. 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 correspond to (from top to bottom):
    1. the Sparta Aquifer,
    2. the Weches Confining Unit,
    3. the Queen City Aquifer,

4. the Reklaw Confining Unit,
5. the Carrizo Aquifer,
6. the Upper Wilcox Aquifer,
7. the Middle Wilcox Aquifer, and
8. the Lower Wilcox Aquifer.

- Of the eight layers listed above, individual water budgets for the district were determined for the Queen City Aquifer (Layer 3), and the combined layers of the Carrizo-Wilcox Aquifer (Layers 5 through 8).
- The root mean square error (a measure of the difference between simulated and actual water levels during model calibration) in the groundwater availability model is 23 feet for the Sparta Aquifer, 18 feet for the Queen City Aquifer, and 33 feet for the Carrizo Aquifer for the calibration period (1980 to 1990) and 19, 22, and 48 feet for the same aquifers, respectively, in the verification period (1991 to 1999) (Kelley and others, 2004). These root mean square errors are between seven and ten percent of the range of measured water levels (Kelley and others, 2004).
- 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.
- Groundwater Vistas Version 5 (Environmental Simulations, Inc. 2007) was used as the interface to process model output.

RESULTS:

A groundwater budget summarizes the amount of water entering and leaving the aquifer according to the groundwater availability model. Selected components were extracted from the groundwater budget for the aquifers located within the district and averaged over the duration of the calibration and verification portion of the model runs in the district, as shown in Tables 1 and 2. The components of the modified budget shown in Tables 1 and 2 include:

- 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.
- Surface water outflow—The total water discharging from the aquifer (outflow) to surface water features such as streams, reservoirs, and drains (springs).
- Flow into and out of district—The lateral flow within the aquifer between the district and adjacent counties.
- Flow between aquifers—The net vertical flow between aquifers or confining units. This flow is controlled by the relative water levels in each aquifer or confining unit and aquifer properties of each aquifer or confining unit that define the amount of leakage that occurs. "Inflow" to an aquifer from an overlying or underlying aquifer will always equal the "Outflow" from the other aquifer.

The information needed for the District's management plan is summarized in Tables 1 and 2. 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 (see Figures 1 and 2).

TABLE 1: SUMMARIZED INFORMATION FOR THE QUEEN CITY AQUIFER THAT IS NEEDED FOR GUADALUPE COUNTY GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT. THESE FLOWS INCLUDE BRACKISH WATERS.

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Queen City Aquifer	39
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Queen City Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Queen City Aquifer	3
Estimated annual volume of flow out of the district within each aquifer in the district	Queen City Aquifer	2
Estimated net annual volume of flow between each aquifer in the district	From Queen City Aquifer into the underlying Reklaw Formation confining unit	3

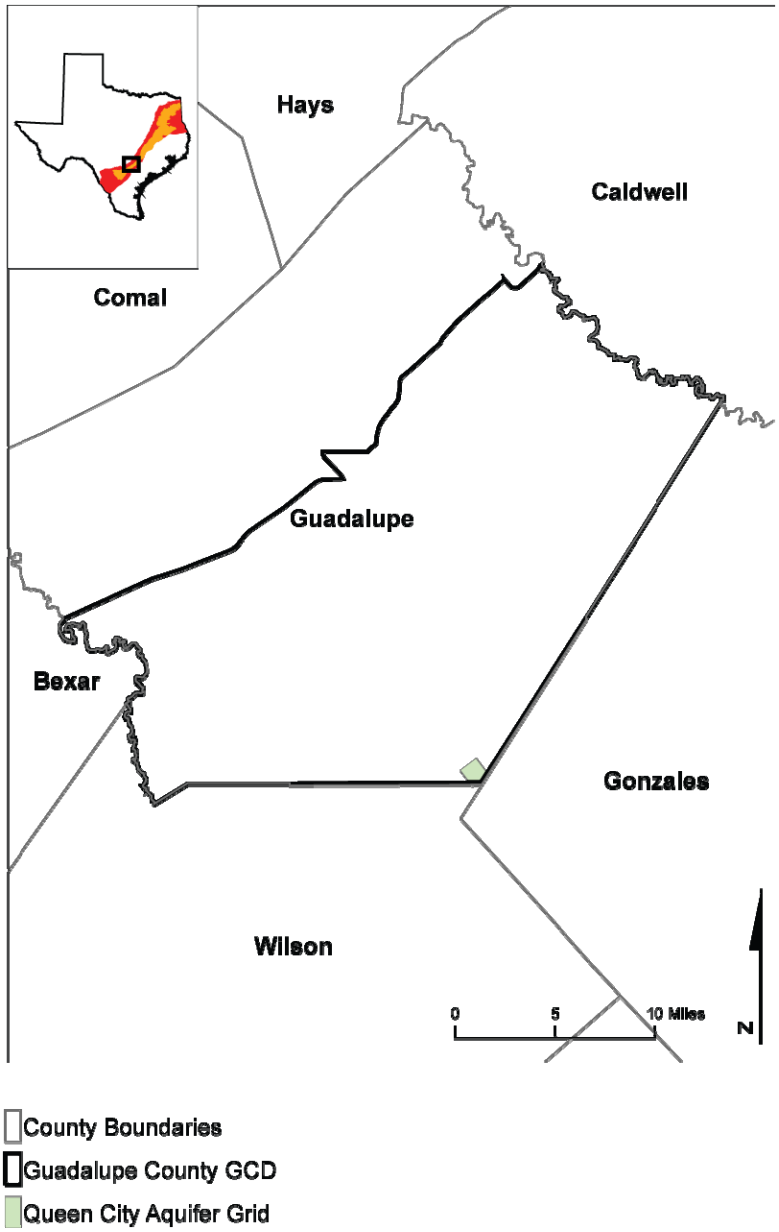

FIGURE 1: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE SOUTHERN PORTION OF THE QUEEN CITY AQUIFER FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED (THE AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 2: SUMMARIZED INFORMATION FOR THE CARRIZO-WILCOX AQUIFER THAT IS NEEDED FOR GUADALUPE COUNTY GROUNDWATERCONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT. THESE FLOWS MAY INCLUDE FRESH AND BRACKISH WATERS.

Management Plan requirement	*Aquifer*	*Results*
Estimated annual amount of recharge from precipitation to the district	Carrizo-Wilcox Aquifer	17,610
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Carrizo-Wilcox Aquifer	4,854
Estimated annual volume of flow into the district within each aquifer in the district	Carrizo-Wilcox Aquifer	1,259
Estimated annual volume of flow out of the district within each aquifer in the district	Carrizo-Wilcox Aquifer	15,967
Estimated net annual volume of flow between each aquifer in the district	From the Reklaw Formation confining unit into the Carrizo-Wilcox Aquifer	382

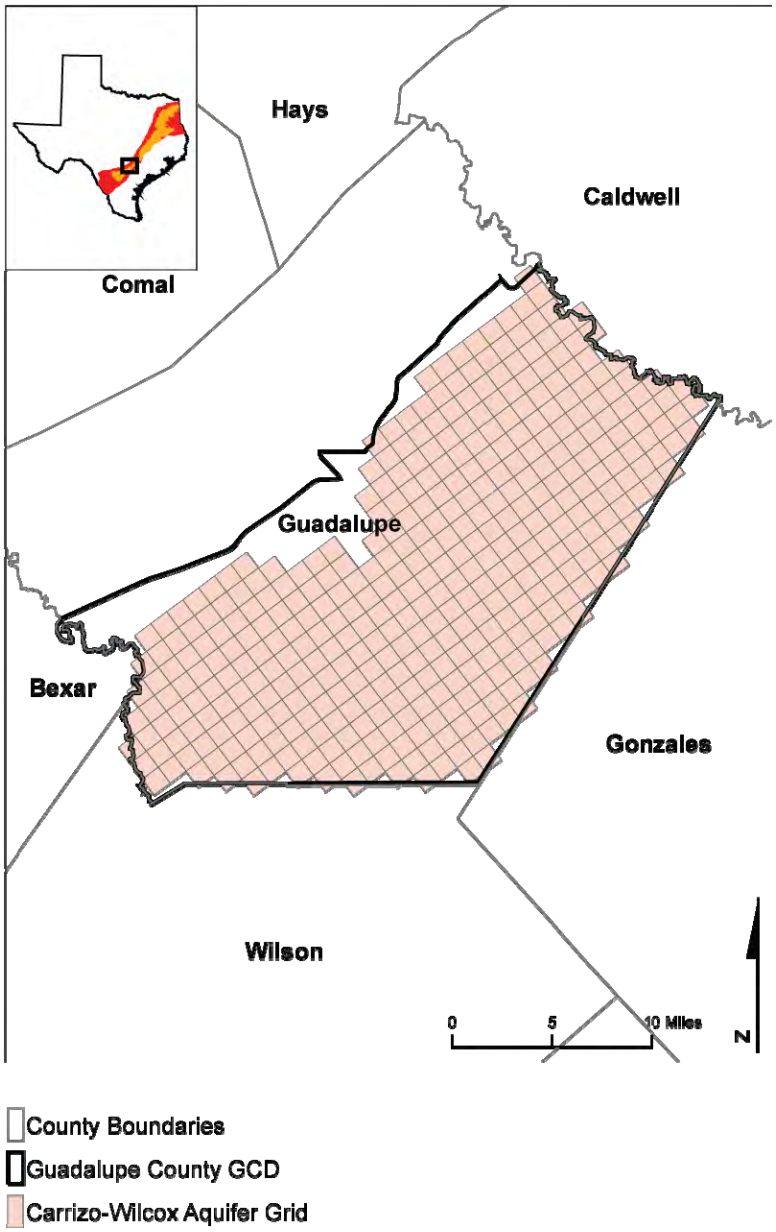

FIGURE 2: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE SOUTHERN CARRIZO-WILCOX AQUIFER FROM WHICH THE INFORMATION IN TABLE 2 WAS EXTRACTED (THE AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

LIMITATIONS

The groundwater model(s) used in completing this analysis is the best available scientific tool that can be used to meet the stated objective(s). 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 model 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:

Deeds, N., Kelley, V., Fryar, D., Jones, T., Whallon, A.J., and Dean, K.E., 2003, Groundwater Availability Model for the Southern Carrizo-Wilcox Aquifer: Contract report to the Texas Water Development Board, 451 p., http://www.twdb.state.tx.us/gam/czwx_s/CZWX_s_Full_Report.pdf .

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