

Santa Rita Underground Water Conservation District

Groundwater Management Plan 2025-2030

Adopted:

March 18, 2025

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Santa Rita Underground Water Conservation District

Groundwater Management Plan 2025-2030

The Santa Rita Underground Water Conservation District (the "District") was created by the 71st Legislature under the authority of Section 59, Article XVI, of the Texas Constitution and in accordance with Chapter 36 of the Texas Water Code ("Water Code"), by the District Act, Act of May 24, 1989, 71st Legislature, Regular Session, Chapter 653 (Senate Bill 1634).

The District is a governmental agency and a body politic and corporate. The District was created to serve a public use and benefit, and is essential to accomplish the objectives set forth in Section 59, Article XVI, of the Texas Constitution and Chapter 36, Water Code. The District's boundaries are coextensive with the boundaries of Reagan County, Texas, and all lands and property within these boundaries will benefit from the works and projects that will be accomplished by the District.

District Mission

The mission of the District is to develop, promote and implement water conservation and management strategies to

1. Conserve, preserve, and protect the groundwater supplies of the District
2. Protect and enhance recharge
3. Prevent waste and pollution, and
4. To effect the efficient, beneficial and wise use of water for the benefit of the current and future citizens and economy of the District

The District is committed to protect the groundwater quality and quantity within the District pursuant to the powers and duties granted under Chapter 36, Subchapter D of the Texas Water Code. Any action taken by the District shall only be after full consideration and respect has been afforded to the individual property rights of all citizens of the District.

The District also seems to maintain groundwater ownership and rights of the landowners and their lessees as provided in the Texas Water Code §36.002.

Purpose of Management Plan

The 75th Texas Legislature in 1997 enacted Senate Bill 1 ("SB 1") to establish a comprehensive statewide water planning process. In particular, SB 1 contained provisions that required groundwater conservation districts to prepare management plans to identify the water supply resources and water demands that will shape the decisions of each district. SB 1 designed the management plans to include management goals for each district to manage and conserve the groundwater resources within their boundaries. In 2001, the Texas Legislature enacted Senate Bill 2 ("SB 2") to build on the planning requirements of SB 1 and to further clarify the actions necessary for districts to manage and conserve the groundwater resources of the state of Texas.

The Texas Legislature enacted significant changes to the management of groundwater resources in Texas with the passage of House Bill 1763 (HB 1763) in 2005. HB 1763 created a long-term planning process in which groundwater conservation districts (GCDs) in each groundwater management area (GMA) are required to meet and determine the Desired Future Conditions (DFCs) for the groundwater resources within their boundaries by September 1, 2010 and every five years thereafter. In addition, HB 1763 required GCDs, to share management plans with other GCDs in the GMA for review by the other GCDs.

The Santa Rita Underground Water Conservation District's management plan satisfies the requirements of SB 1, SB 2, HB 1763, the statutory requirements of Chapter 36 of the Texas Water Code, and the administrative requirements of the Texas Water Development Board's (TWDB) rules.

Time Period for this Plan

This plan becomes effective upon adoption by the Board of Directors. The plan remains in effect for five years or until amendment or adoption of a new plan.

Statement of Guiding Principles

The District recognizes that groundwater resources are of the utmost importance for the economy for all groundwater users, first for the residents of the District, and then the region. Also recognized is the importance of understanding the aquifers and aquifer characteristics for proper management of these resources. Integrity and ownership of groundwater are also recognized as important for the management of this precious resource.

The primary goal of the District is to preserve the integrity of the groundwater in the district from all potential contamination sources, mainly oil and gas production and related activities. This is accomplished as the District sets objectives to provide for the conservation, preservation, protection, recharge, prevention of waste and pollution, and efficient use of water including:

- a) acquiring additional hydrogeologic data for the aquifers within the District;
- b) protecting the landowner's right to the beneficial use of groundwater resources beneath his land;
- c) promulgating rules for the protection of all users while maintaining adequate future supplies and;
- d) cooperation with other local GCD's to manage shared groundwater resources.

These objectives are best achieved through guidance from the locally elected board members who understand the local conditions and can manage the resource for the benefit of the residents of the district and region. The District shall seek to ensure that maximum

groundwater withdrawals do not exceed amounts that would be significantly detrimental for future residents of the District. The District rules can be found at [Santa+Rita+UWCD+Rules+as+of+November+28,+2023.pdf](#) or by visiting our website at www.santaritauwcd.org and finding the Governance tab.

General Description

History

The Santa Rita Underground Water Conservation District was created by the 71st Legislature under the authority of Section 59, Article XVI, of the Texas Constitution and in accordance with Chapter 36 of the Texas Water Code (“Water Code”), by the District Act, Act of May 24, 1989, 71st Legislature, Regular Session, Chapter 653 (Senate Bill 1634). The District is governed by a five member, locally elected board serving staggered four-year terms.

Demographics

The District boundaries are contiguous with that of Reagan County, Texas. It has an aerial extent of approximately 1,175 miles, or 751,866 acres of land, minus 65,350 acres of Reagan County, which was annexed into the Glasscock Groundwater Conservation District in 1988. Thus, the northern portion of Reagan County is now a patch work of two conservation districts.

The total population of Reagan County is approximately 2,936 persons. The City of Big Lake is the county seat of Reagan County. Other communities within the District, mostly in name only, are Stiles, Best, and Texon. The economy of the District is primarily oil and gas production and agricultural income, derived primarily from cotton and grain sorghum, as well as sheep, meat goats, and beef cattle production. Recreational hunting leases contribute to the economy also.

The District lands are within the Concho River Basin of the Colorado River with the southern and southwestern portions of the District draining into the Pecos River (Rio Grande) Basin. Topographically, the area within the District ranges in altitude from 2,380 feet above sea level in the northwestern part of the District, to 2,860 feet above sea level in the southwestern part of the District. The District is included in the Region F Water Planning Group and Groundwater Management Area 7.

Regional Cooperation and Coordination

West Texas Regional Groundwater Alliance

Since 1989 the District has been involved in coordination of district activities with other GCDs managing the Edwards-Trinity (Plateau) Aquifer. In 1988 four groundwater conservation districts; Coke County UWCD, Glasscock County UWCD, Irion County WCD and Sterling County UWCD signed an original Cooperative Agreement. As new districts were created, they too

signed the Cooperative Agreement. In fall of 1996, the original Cooperative Agreement was redrafted and the West Texas Regional Groundwater Alliance was created. Today, the regional alliance consists of eighteen locally created and locally funded groundwater conservation districts covering all or part of twenty-six counties, that encompass approximately 18.2 million acres or 28,368 square miles of West Central Texas. This West Texas region is as diverse as the State of Texas. Due to the diversity of the region, each member district provides its own unique programs to best serve its constituents. Current member districts are:

Coke Co. UWCD	Crockett Co. GCD	Glasscock GCD
Hickory UWCD # 1	Hill Country UWCD	Irion Co. WCD
Kimble Co. GCD	Lipan-Kickapoo WCD	Lone Wolf GCD
Menard Co. UWD	Middle Pecos GCD	Permian Basin UWCD
Plateau UWC & SD	Reeves Co. GCD	Santa Rita UWCD
Sterling Co. UWCD	Sutton Co. UWCD	Wes-Tex GCD

This regional alliance was created because the local districts have a common objective: to facilitate the conservation, preservation and protection of groundwater supplies, protection and enhancement of recharge, prevention of waste and pollution, and beneficial use of water and related resources. Local districts monitor water-related activities which include but are not limited to the State’s largest industries of farming, ranching and oil and gas production. The regional alliance provides coordination essential to the activities of these member districts as they monitor these activities in order to accomplish their objectives.

Regional Water Planning

The District has been active in the Region F, Regional Water Planning Group meetings to provide input in developing and adopting the 2001, 2006, 2011, 2016 and 2021 regional plans. As the regional planning group moves toward adopting future Regional Plans the District will continue to participate in the planning process.

Groundwater Management Area

Groundwater Management Area 7 covers all or part of thirty-three counties and includes twenty groundwater conservation districts. These GCDs manage groundwater resources at the local level in all or part of twenty four counties within GMA 7 and surrounding areas. The District continues to actively participate in meetings and discussions to determine a feasible future desired condition of the aquifers within the management area and district.

Groundwater Resources of the Santa Rita UWCD

The Edwards-Trinity (Plateau) Aquifer is the main source of groundwater in Reagan County. This aquifer is located in the entire District, with approximate altitude of the base from 1,900 feet to 2,300 feet above sea level. Water from this aquifer is used primarily for irrigation, human consumption and livestock needs. This aquifer consists of saturated sediments of lower Cretaceous Period Trinity Group formations and overlying limestone of the Washita, Fredericksburg, and Trinity groups. The Antlers sand and Dockum sand are used extensively in the southern and southeastern portions of the District for rural domestic and livestock water. The lower sand unit of the Dockum Group, often referred to as the Santa Rosa Sandstone, is an artesian aquifer in which the water is confined by overlying shale. Wells completed in this zone produce fresh to saline water which has been used mostly for secondary recovery purposes by the oil industry. Reported well yields range from 20 gal/min, where saturated thickness is thin, to more than 100 gal/min within the District.

The Dockum Aquifer also occurs in the District. It does not crop out at the surface within the District; therefore, no recharge from precipitation to the aquifer occurs within the District. Additionally, no water discharges to springs, lakes, streams or rivers within the District.

Chemical quality of Edwards-Trinity (Plateau) water ranges from fresh to slightly saline. The water is typically hard and may vary widely in concentration of dissolved solids; made up of mostly calcium and bicarbonate. Salinity levels are highest in areas of older oil and gas production in the north and west parts of the District. Other areas have unacceptable levels of boron, fluoride, and sulfates. Water levels in the northwestern part of the District continue to decline due to irrigation, however none of this area has experienced declines greater than 60 feet since 1980. Recently, many water wells drilled to supply the drilling of oil wells and the fracking process in some areas of the District has caused older, shallower wells to run dry. The District, through programs and its Rules, strives to ensure the most efficient use of groundwater in order to sustain available resources for the future while maintaining the economic growth and respecting private property rights of the District.

Surface Water Resources

No surface water management entities exist within the District. There are no surface water impoundments within the District except for those using local groundwater supplies for livestock consumption. There are no surface water entities located within the District to coordinate the development of this plan.

Technical District Information Required by the Texas Administrative Code

Texas Water Code 36.001 defines modeled available groundwater 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”.

The joint planning process set forth in Texas Water Code § 36.108 must be collectively conducted by all groundwater conservation districts within the same GMA. The District is a member of GMA 7. GMA 7 adopted DFCs for the Edwards/Trinity (Plateau) Aquifer on August 19, 2021. The adopted DFCs were forwarded to the TWDB for development of the MAG calculations. The submittal package for the DFCs can be found here:

https://www.twdb.texas.gov/groundwater/management_areas/gma7.asp

A summary of the desired future conditions and the modeled available groundwater are summarized below.

Edwards-Trinity (Plateau) Aquifer: An average drawdown of 42 feet for the Edwards-Trinity (Plateau) Aquifer based on the GMA 7 Technical Memorandum 18-01.

Dockum Aquifer: An average drawdown of 14 feet for the Dockum Aquifer based on the Scenario 17, GMA 7 Technical Memorandum 16-01.

Estimated Modeled Available Groundwater in ac/ft for the Edwards-Trinity (Plateau) Aquifer by district from GAM Run 21-012 MAG.

	Year					
	2020	2030	2040	2050	2060	2070
Santa Rita UWCD	27,398	27,398	27,398	27,398	27,398	27,398

Estimated Modeled Available Groundwater in ac/ft for the Dockum Aquifer by district from GAM Run 21-012 MAG.

	Year					
	2020	2030	2040	2050	2060	2070
Santa Rita UWCD	302	302	302	302	302	302

Modeled Available Groundwater in the District.

Please refer to Appendix A-GAM Run 21-012 MAG

Amount of Groundwater being used within the District on an Annual Basis

Please refer to Appendix B-Estimated Historical Groundwater Use and 2022 State Water Plan Datasets: Santa Rita Underground Water Conservation District

Annual Amount of Recharge from Precipitation to the Groundwater Resources within the District

Please refer to Appendix C

Annual Volume of Water that Discharges from the Aquifer to Springs and Surface Water Bodies

Please refer to Appendix C

Estimate of the Annual Volume of Flow into the District, out of the District and Between Aquifers in the District

Please refer to Appendix C

Projected Surface Water Supplies within the District

Please refer to Appendix B

Projected Total Demand for Water within the District

Please refer to Appendix B

Water Supply Needs

Based on supply and demand calculations and projections, it is obvious that there will be times that demand exceeds supply. In this area of the state, and with the type of aquifer that serves the area, this is a normal occurrence that is recognized by the local residents. Efforts are being made by the residents of the District to use the available groundwater resources with maximum efficiency, while monitoring the quality of the groundwater to protect this resource for years to come. The 2022 Texas State Water Plan, in Appendix A, predicts that there will be no groundwater needs between the years 2020 and 2070.

Please refer to Appendix B

Water Management Strategies

The District continues to encourage water conservation and reuse to meet the projected strategies in the 2021 Region F Water Plan.

Projected water management strategies for Reagan County listed in the TWDB 2022 State Water Plan Data packet (Appendix B) are:

- Demand reduction in municipal conservation for Big Lake

- Demand reduction in mining conservation in Reagan County
- Demand reduction in irrigation conservation in Reagan County
- Atmospheric weather modification for Reagan County

Management of Groundwater Supplies, and Actions, Procedures, Performance, and Avoidance Necessary to Effectuate the Management Plan

The District will implement and utilize the provisions of this plan as a guide for determining the direction and/or priority for District activities. Operations of the District and all agreements entered into by the District will be consistent with the provisions of this plan. The District has adopted rules for the management of groundwater resources and will amend those rules as necessary pursuant to TWC Chapter 36 and the provisions of this plan. The promulgation of the rules will be based on the best technical evidence available. Current rules are available at <https://www.santaritauwcd.org/files/1a02fd570/Santa+Rita+UWCD+Rules+as+of+November+28%2C+2023.pdf>. The District shall treat all residents with equality. Residents may apply to the District for discretion in enforcement of the rules on grounds of adverse economic effect or unique local character. In granting discretion to any rule, the Board shall consider the potential for adverse effect on adjacent landowners. The exercise of said discretion by the Board shall not be construed as limiting the power of the Board. The District will seek cooperation in the implementation of this plan and the management of groundwater supplies within the District.

Methodology for Tracking Progress

The methodology the District will use to track the progress in achieving the management goals will be as follows: the District holds a regular monthly Board Meeting for the purpose of conducting District Business. Each month the Managers Report will reflect meetings attended, water samples collected and analyzed, water levels monitored, reports on any school or civic group programs, resulting action regarding potential contamination or remediation of actual contamination, and other matters of District importance. Additionally, the District General Manager will prepare and present an annual report to the Board regarding achievement of management plan goals and objectives for the preceding fiscal year.

Goals, Management Objectives and Performance Standards

Goal 1.0 - §36.1071(a)(1) Providing the Efficient Use of Groundwater

The District strives to gather groundwater data both to improve the understanding of the aquifers and their hydrogeologic properties and to quantify this resource for prudent planning and efficient use.

1.1. Management Objective

The District will measure, record, and accumulate a historic record of static water levels in the monitoring network quarterly.

1.1a. Performance Standard

Monitor network water level measurements will be reported quarterly at regularly scheduled board meetings.

Goal 2.0 - §36.1071(a)(2) Controlling and Preventing Waste of Groundwater

The District strives to minimize potential waste and contamination of the groundwater by monitoring the drilling, spacing, and completion of wells.

2.1. Management Objective

The District will register new wells drilled within the district in accordance with District Rules.

2.1a. Performance Standard

The District will maintain files including information on the drilling, spacing, and completion of all new wells drilled within the District. Newly registered wells will be reported at regularly scheduled board meetings.

Goal 3.0 - §36.1071(a)(5) Addressing Natural Resource Issues

The District recognizes the reliance of other natural resources on groundwater supplies.

3.1 Management Objective

The District will monitor one or more selected wells within areas of the District where there is oil and gas production, for possible contamination problems which would jeopardize the integrity of the groundwater resource.

3.1a. Performance Standard

The District will once a year, at least one well sample will be collected and analyzed for petroleum related contamination in areas of the District where there is oil production. The number of wells monitored and the water quality results from each sample will be included in the annual report. District rules require any and all water wells drilled associated with oil and gas drilling or production be registered with the District and are required to comply with District construction standards and reporting

3.2 Management Objective

There is the opportunity to participate in discussions, planning, and education concerning the interrelationship of groundwater with other natural resource issues through GMA 7 and the water planning process.

3.2a. Performance Standard

A representative of the District will attend a minimum of 50% of the GMA 7 meetings annually.

Goal 4.0 - §36.1071(a)(6) Addressing Drought Conditions

The District's lack of surface water supplies and semi-arid climate conditions results in drought monitoring being an important component of informed management. The District strives to remain aware of ever changing climatic conditions.

4.1. Management Objective

The District will monitor the NOAA Climate Prediction Center, <http://www.cpc.ncep.noaa.gov/> and the TWDB drought page, <https://waterdatafortexas.org/drought/>.

4.1a. Performance Standard

The drought index will be reported quarterly at regularly scheduled board meetings.

Goal 5.0 - §36.1071(a)(7) Addressing Conservation

The District strives to promote water management strategies recommended in the 2021 Region F Regional Water Plan that have the potential to promote local groundwater supplies and maintain financial responsibility.

5.1 Management Objective - Conservation

The District will continue to be a source for available informational materials and programs to improve public awareness of efficient use, wasteful practices and conservation measures.

5.1a. Performance Standard

The District will provide information to the public annually by participating in a show, demonstration, educational talk, other community event or publishing articles on the District's website.

www.santaritauwcd.org

Goal 6.0 - §36.1071(a)(8) Addressing the Desired Future Conditions established under §36.108

The District strives to gather groundwater data both to improve the understanding of the aquifers and their hydrogeologic properties and in the establishment and monitoring of achievement of desired future conditions.

6.1 Management Objective

The District will at least quarterly will measure wells within the water level monitoring network through steel tape and electronic sensors.

6.1a. Performance Standard

Report at least quarterly to the Board of Directors the measurement of water levels from at least 9 wells monitored in the District's water level monitoring network. Each year the District will compare the average annual change of water levels and compare them to the DFCs.

Management Goals Determined Not-Applicable

Goal 7.0 - §36.1071(a)(3) Controlling and Preventing Subsidence

The rigid geologic framework of the region precludes significant subsidence from occurring, as identified in the *Identification of the Vulnerability of the Major and Minor Aquifers of Texas to Subsidence with Regard to Groundwater Pumping – TWDB Contract Number 1648302062* report. Table 1.4 on page 1-6 (pdf 28 of 434) summarizes the risk as low for the aquifer as a whole. The subsidence risk at well locations figure on page 4-32 (pdf 81 of 434) visually identifies the risk for Reagan County ranging from insufficient data to low subsidence risk, recognizing that risk is likely skewed due to drillers log descriptions of clay (page 4-31 or pdf 80 of 434). As a result, this management goal is not applicable to the operations of the District.

Goal 8.0 - §36.1071(a)(4) Addressing Conjunctive Surface Water Management Issues

There are no surface water management entities within the District. As recorded by the TCEQ Water Rights Viewer, there are zero water rights within the boundaries of the SRUWCD. This management goal is not applicable to the operations of the District.

Goal 9.0- Addressing Precipitation Enhancement (36.1071(A)(7))

The management goal is not applicable to the District as there is not a precipitation enhancement program unique to the District. The District recognizes the benefits of precipitation enhancement, and can find educational materials with the West Texas Weather Modification Association.

Goal 10.0 §36.1071(a)(7) Addressing Rainwater Harvesting

The semiarid nature of the area within the District makes the cost of large-scale rainwater harvesting projects economically unfeasible. Educational material and programs on rainwater harvesting are provided by the experts at the Texas AgriLife Extension Service. This management goal is not applicable to the operations of the District.

Goal 11.0-§36.1071(a)(7) Addressing Brush Control

The District recognizes the benefits of brush control through increased spring flows and the enhancement of native turf which limits runoff. However, most brush control projects within the District are carried out and funded through the experts at the Natural Resources Conservation Service (NRCS) and ample educational material and programs on brush control are provided by the Texas AgriLife Extension Service. This management goal is not applicable to the operations of the District.

Goal 12.0-§36.1071(a)(7) Addressing Recharge Enhancement

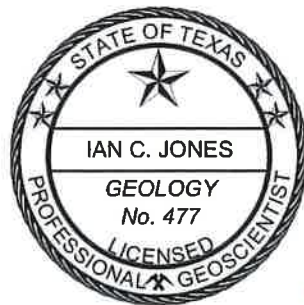
The District recognizes the benefits of Recharge Enhancement using various methods to increase the amount of water naturally replenishing groundwater supplies such as storm water or treated wastewater. However at this time, the District doesn't have anything other than natural precipitation to increase these supplies. This management goal is not applicable to the operations of the District at this time.

Appendix A

GAM Run 21-012 MAG

**GAM RUN 21-012 MAG:
MODELED AVAILABLE GROUNDWATER FOR
THE AQUIFERS IN GROUNDWATER
MANAGEMENT AREA 7**

Ian C. Jones, Ph.D., P.G.
Texas Water Development Board
Groundwater Division
Groundwater Modeling Department
512-463-6641
August 12, 2022



A handwritten signature in blue ink, appearing to read "I. C. Jones", positioned to the right of the professional seal.

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GAM RUN 21-012 MAG: MODELED AVAILABLE GROUNDWATER FOR THE AQUIFERS IN GROUNDWATER MANAGEMENT AREA 7

Ian C. Jones, Ph.D., P.G.
Texas Water Development Board
Groundwater Division
Groundwater Modeling Department
512-463-6641
August 12, 2022

EXECUTIVE SUMMARY:

The Texas Water Development Board (TWDB) has prepared estimates of the modeled available groundwater for the relevant aquifers of Groundwater Management Area 7—the Capitan Reef Complex, Dockum, Edwards-Trinity (Plateau), Ellenburger-San Saba, Hickory, Ogallala, Pecos Valley, Rustler, and Trinity aquifers. The estimates are based on the desired future conditions for these aquifers adopted by the groundwater conservation districts in Groundwater Management Area 7 on August 19, 2021. The explanatory reports and other materials submitted to the TWDB were determined to be administratively complete on February 23, 2022.

The modeled available groundwater values are summarized by decade for the groundwater conservation districts (Tables 1, 3, 5, 7, 9, 11, 13) and for use in the regional water planning process (Tables 2, 4, 6, 8, 10, 12, 14). The modeled available groundwater estimates for each decade from 2020 through 2070 are:

- 26,164 acre-feet per year in the Capitan Reef Complex Aquifer,
- 2,324 acre-feet per year in the Dockum Aquifer,
- 6,570 to 7,925 acre-feet per year in the Ogallala Aquifer,
- 479,063 acre-feet per year in the undifferentiated Edwards-Trinity (Plateau), Pecos Valley, and Trinity aquifers,
- 22,616 acre-feet per year in the Ellenburger-San Saba Aquifer,
- 49,936 acre-feet per year in the Hickory Aquifer, and
- 7,040 acre-feet per year in the Rustler Aquifer.

The modeled available groundwater estimates were extracted from results of model runs using the groundwater availability models for the Capitan Reef Complex Aquifer [Version

1.01] (Jones, 2016) for the Capitan Reef Complex Aquifer; the High Plains Aquifer System [Version 1.01] (Deeds and Jigmond, 2015) for the Dockum and Ogallala aquifers; the minor aquifers of the Llano Uplift Area [Version 1.01] (Shi and others, 2016) for the Ellenburger-San Saba and Hickory aquifers, and the Rustler Aquifer [Version 1.01] (Ewing and others, 2012) for the Rustler Aquifer. In addition, the alternative 1-layer model for the Edwards-Trinity (Plateau), Pecos Valley, and Trinity aquifers (Hutchison and others, 2011a) was used for the Edwards-Trinity (Plateau), Pecos Valley, and Trinity aquifers, except for Kinney and Val Verde counties. In these two counties, the alternative Kinney County model (Hutchison and others, 2011b) and the model associated with a hydrogeological study for Val Verde County and the City of Del Rio (EcoKai and Hutchison, 2014), respectively, were used to estimate modeled available groundwater.

REQUESTOR:

Ms. Meredith Allen, coordinator of Groundwater Management Area 7 districts.

DESCRIPTION OF REQUEST:

In an email dated August 28, 2021, Dr. William Hutchison on behalf of Groundwater Management Area 7 provided the TWDB with the desired future conditions for the Capitan, Dockum, Ellenburger-San Saba, Hickory, Ogallala, and Rustler aquifers, as well as for the undifferentiated Edwards-Trinity (Plateau), Pecos Valley and Trinity aquifers, in Groundwater Management Area 7. Groundwater Management Area 7 provided additional clarifications through an email to the TWDB on November 12, 2021, for the assumptions and model files to be used to calculate modeled available groundwater.

The final adopted desired future conditions as stated in signed resolutions for the aquifers in Groundwater Management Area 7 are as follows:

Capitan Reef Complex Aquifer (Resolution #08-19-2021-2)

- | |
|---|
| <ul style="list-style-type: none">a) Total net drawdown of the Capitan Reef Complex Aquifer not to exceed 56 feet in Pecos County (Middle Pecos GCD) in 2070 as compared with 2006 aquifer levels.
<i>*(Reference: Scenario 4, GMA 7 Technical Memorandum 16-03)</i>b) The Capitan Reef Complex Aquifer is not relevant for joint planning purposes in all other areas of GMA 7. |
|---|

Dockum and Ogallala aquifers (Resolution #08-19-2021-5)

Ogallala Aquifer:

- a) Total net drawdown of the Ogallala Aquifer not to exceed **6 feet in Glasscock County** in 2070 as compared with 2010 aquifer levels.

Dockum Aquifer:

- b) Total net drawdown of the Dockum Aquifer not to exceed **52 feet in Pecos County** in 2070 as compared with 2010 aquifer levels.
- c) Total net drawdown of the Dockum Aquifer not to exceed **14 feet in Reagan County** in 2070 as compared with 2010 aquifer levels.

**(Reference items a) through c): Scenario 17, GMA 7 Technical Memorandum 16-01)*

- d) The Ogallala and Dockum Aquifers are not relevant for joint planning purposes in all other areas of GMA 7.

Edwards-Trinity (Plateau), Pecos Valley, and Trinity aquifers (Resolution #08-19-2021-3)

- a) Total net drawdown of the Edwards-Trinity (Plateau), Pecos Valley, and Trinity Aquifers not to exceed **0 feet in Coke County** in 2070 as compared with 2010 aquifer levels.
- b) Total net drawdown of the Edwards-Trinity (Plateau), Pecos Valley, and Trinity Aquifers not to exceed **10 feet in Crockett County** in 2070 as compared with 2010 aquifer levels.
- c) Total net drawdown of the Edwards-Trinity (Plateau), Pecos Valley, and Trinity Aquifers not to exceed **4 feet in Ector County** in 2070 as compared with 2010 aquifer levels.
- d) Total net drawdown of the Edwards-Trinity (Plateau), Pecos Valley, and Trinity Aquifers not to exceed **2 feet in Edwards County** in 2070 as compared with 2010 aquifer levels.
- e) Total net drawdown of the Edwards-Trinity (Plateau), Pecos Valley, and Trinity Aquifers not to exceed **5 feet in Gillespie County** in 2070 as compared with 2010 aquifer levels.
- f) Total net drawdown of the Edwards-Trinity (Plateau), Pecos Valley, and Trinity Aquifers not to exceed **42 feet in Glasscock County** in 2070 as compared with 2010 aquifer levels.
- g) Total net drawdown of the Edwards-Trinity (Plateau), Pecos Valley, and Trinity Aquifers not to exceed **10 feet in Irion County** in 2070 as compared with 2010 aquifer levels.
- h) Total net drawdown of the Edwards-Trinity (Plateau), Pecos Valley, and Trinity Aquifers not to exceed **1 foot in Kimble County** in 2070 as compared with 2010 aquifer levels.
- i) Total net drawdown of the Edwards-Trinity (Plateau), Pecos Valley, and Trinity Aquifers not to exceed **1 foot in Menard County** in 2070 as compared with 2010 aquifer levels.
- j) Total net drawdown of the Edwards-Trinity (Plateau), Pecos Valley, and Trinity Aquifers not to exceed **12 feet in Midland County** in 2070 as compared with 2010 aquifer levels.
- k) Total net drawdown of the Edwards-Trinity (Plateau), Pecos Valley, and Trinity Aquifers not to exceed **14 feet in Pecos County** in 2070 as compared with 2010 aquifer levels.
- l) Total net drawdown of the Edwards-Trinity (Plateau), Pecos Valley, and Trinity Aquifers not to exceed **42 feet in Reagan County** in 2070 as compared with 2010 aquifer levels.
- m) Total net drawdown of the Edwards-Trinity (Plateau), Pecos Valley, and Trinity Aquifers not to exceed **4 feet in Real County** in 2070 as compared with 2010 aquifer levels.
- n) Total net drawdown of the Edwards-Trinity (Plateau), Pecos Valley, and Trinity Aquifers not to exceed **8 feet in Schleicher County** in 2070 as compared with 2010 aquifer levels.
- o) Total net drawdown of the Edwards-Trinity (Plateau), Pecos Valley, and Trinity Aquifers not to exceed **7 feet in Sterling County** in 2070 as compared with 2010 aquifer levels.
- p) Total net drawdown of the Edwards-Trinity (Plateau), Pecos Valley, and Trinity Aquifers not to exceed **6 feet in Sutton County** in 2070 as compared with 2010 aquifer levels.
- q) Total net drawdown of the Edwards-Trinity (Plateau), Pecos Valley, and Trinity Aquifers not to exceed **0 feet in Taylor County** in 2070 as compared with 2010 aquifer levels.
- r) Total net drawdown of the Edwards-Trinity (Plateau), Pecos Valley, and Trinity Aquifers not to exceed **2 feet in Terrell County** in 2070 as compared with 2010 aquifer levels.
- s) Total net drawdown of the Edwards-Trinity (Plateau), Pecos Valley, and Trinity Aquifers not to exceed **20 feet in Upton County** in 2070 as compared with 2010 aquifer levels.
- t) Total net drawdown of the Edwards-Trinity (Plateau), Pecos Valley, and Trinity Aquifers not to exceed **2 feet in Uvalde County** in 2070 as compared with 2010 aquifer levels.

*(Reference items a) through t): GMA 7 Technical Memorandum 18-01)

Edwards-Trinity (Plateau), Pecos Valley, and Trinity aquifers (continued)

- u) Total net drawdown in **Kinney County** in 2070, as compared with 2010 aquifer levels, shall be consistent with maintenance of an annual average flow of 23.9 cfs and an annual median flow of **23.9 cfs at Las Moras Springs**.
**(Reference: Groundwater Flow Model of the Kinney County Area by W.R. Hutchison and others, 2011).*
- v) Total net drawdown in **Val Verde County** in 2070, as compared with 2010 aquifer levels, shall be consistent with maintenance of an average annual flow of **73-75 mgd at San Felipe Springs**.
**(Reference: EcoKai, 2014)*
- w) The Edwards-Trinity (Plateau), Pecos Valley, and Trinity Aquifers are not relevant for joint planning purposes in all other areas of GMA 7.

Minor Aquifers of the Llano Uplift Area (Resolution #08-19-2021-4)

Ellenburger-San Saba Aquifer:

- a) Total net drawdown of the Ellenburger-San Saba Aquifer not to exceed **8 feet in Gillespie County** in 2070 as compared with 2010 aquifer levels.
- b) Total net drawdown of the Ellenburger-San Saba Aquifer not to exceed **18 foot in Kimble County** in 2070 as compared with 2010 aquifer levels.
- c) Total net drawdown of the Ellenburger-San Saba Aquifer not to exceed **14 foot in Mason County** in 2070 as compared with 2010 aquifer levels.
- d) Total net drawdown of the Ellenburger-San Saba Aquifer not to exceed **29 feet in McCulloch County** in 2070 as compared with 2010 aquifer levels.
- e) Total net drawdown of the Ellenburger-San Saba Aquifer not to exceed **46 feet in Menard County** in 2070 as compared with 2010 aquifer levels.
- f) Total net drawdown of the Ellenburger-San Saba Aquifer not to exceed **5 feet in San Saba County** in 2070 as compared with 2010 aquifer levels.

Hickory Aquifer:

- g) Total net drawdown of the Hickory Aquifer not to exceed **53 feet in Concho County** in 2070 as compared with 2010 aquifer levels.
- h) Total net drawdown of the Hickory Aquifer not to exceed **9 feet in Gillespie County** in 2070 as compared with 2010 aquifer levels.
- i) Total net drawdown of the Hickory Aquifer not to exceed **18 feet in Kimble County** in 2070 as compared with 2010 aquifer levels.
- j) Total net drawdown of the Hickory Aquifer not to exceed **17 feet in Mason County** in 2070 as compared with 2010 aquifer levels.

Minor Aquifers of the Llano Uplift Area (continued)

- k) Total net drawdown of the Hickory Aquifer not to exceed **29 feet in McCulloch County** in 2070 as compared with 2010 aquifer levels.
- l) Total net drawdown of the Hickory Aquifer not to exceed **46 feet in Menard County** in 2070 as compared with 2010 aquifer levels.
- m) Total net drawdown of the Hickory Aquifer not to exceed **6 feet in San Saba County** in 2070 as compared with 2010 aquifer levels.
**(Reference items a) through m): Scenario 3, GMA 7 Technical Memorandum 16-02)*
- n) The Llano Uplift Region (Ellenburger-San Saba, Hickory, Marble Falls) Aquifers are not relevant for joint planning purposes in all other areas of GMA 7.

Rustler Aquifer (Resolution #08-19-2021-6)

- a) Total net drawdown of the Rustler Aquifer not to exceed **94 feet in Pecos County** in 2070 as compared with 2010 aquifer levels.
**(Reference: Scenario 4, GMA 7 Technical Memorandum 15-05)*
- b) The Rustler Aquifer not relevant for joint planning purposes in all other areas of GMA 7.

In addition to the non-relevant statements provided above in the individual resolutions, Groundwater Management Area 7 also provided additional non-relevant documentation dated August 27, 2021 and January 20, 2022 as part of their submittal to TWDB. The following aquifers or parts of aquifers are non-relevant for the purposes of joint planning:

- The entirety of the Blaine, Cross Timbers, Igneous, Lipan, Marble Falls, and Seymour aquifers.
- The Capitan Reef Complex Aquifer outside of the boundaries of the Middle Pecos Groundwater Conservation District.
- The Edwards-Trinity (Plateau) Aquifer in Concho, Mason, McCulloch, Nolan, and Tom Green counties.
- The Ellenburger-San Saba Aquifer in Coleman, Concho, and Mason counties.
- The Hickory Aquifer in Coleman and Llano counties.
- The Dockum Aquifer outside of Reagan and Pecos counties.
- The Ogallala Aquifer outside of Glasscock County.

CLARIFICATIONS:

In response to a request for clarifications from the TWDB in 2021, the Groundwater Management Area 7 Chair, Ms. Meredith Allen, and Groundwater Management Area 7 consultant, Dr. William R. Hutchison, provided the following clarifications regarding the definition of the desired future conditions. These clarifications were necessary for verifying that the desired future conditions of the aquifers were attainable and for confirming approval of the TWDB methodology to calculate modeled available groundwater volumes in Groundwater Management Area 7:

Capitan Reef Complex Aquifer

- The calculated modeled available groundwater values are based on the official TWDB aquifer boundary.
- The modeled available groundwater calculations are based on the desired future conditions with a one-foot tolerance (that is, modeled drawdown verifications within one foot of the desired future conditions are acceptable).
- Drawdown calculations used to define the desired future conditions value take into consideration the occurrence of “dry” cells, where water levels are below the base of the aquifer.

Dockum Aquifer

- The calculated modeled available groundwater values are based on the spatial extent of the Dockum Formation, as represented in the groundwater availability model for the High Plains Aquifer System, rather than the official TWDB aquifer boundary.
- Modeled available groundwater analysis excludes model pass-through cells.
- The modeled available groundwater calculations are based on the desired future conditions with a one-foot tolerance (that is, modeled drawdown verifications within one foot of the desired future conditions are acceptable).

Ogallala Aquifer

- The calculated modeled available groundwater values are based on the official TWDB aquifer boundary and use the same model assumptions used in Groundwater Management Area 7 Technical Memorandum 16-01 (Hutchison, 2016c).
- Drawdown calculations used to define the desired future conditions do not take into consideration the occurrence of “dry” cells, where water levels are below the base of the aquifer.

- The modeled available groundwater calculations are based on the desired future conditions with a one-foot tolerance (that is, modeled drawdown verifications within one foot of the desired future conditions are acceptable).

Edwards-Trinity (Plateau), Pecos Valley, and Trinity aquifers

- The calculated modeled available groundwater values are based on the official TWDB aquifer boundaries.
- The modeled available groundwater calculations are based on the desired future conditions with a one-foot tolerance (that is, modeled drawdown verifications within one foot of the desired future conditions value are acceptable).
- Drawdown calculations used to define the desired future conditions include drawdowns for cells with water levels below the base elevation of the cell (“dry” cells).

Kinney County

- The modeled available groundwater values, model assumptions, and simulated springflow are from GAM Run 10-043 MAG Version 2 (Shi, 2012).

Val Verde County

- There is no associated drawdown as a desired future condition. The desired future condition is based solely on simulated spring flow conditions at San Felipe Spring of 73 to 75 million gallons per day. Pumping scenarios—50,000 acre-feet per year—in three well field locations and monthly hydrologic conditions for the historic period 1969 to 2012 meet the desired future conditions set by Groundwater Management Area 7 (EcoKai and Hutchison, 2014; Hutchison 2021).

Minor Aquifers of the Llano Uplift Area

- The calculated modeled available groundwater values are based on the full spatial extent of the Ellenburger-San Saba and Hickory formations in the groundwater availability model for the aquifers of the Llano Uplift Area rather than the official TWDB aquifer boundaries and use the same model assumptions used in Groundwater Management Area 7 Technical Memorandum 16-02 (Hutchison 2016b).
- The modeled available groundwater calculations are based on the desired future conditions with a one-foot tolerance (that is, modeled drawdown verifications within one foot of the desired future conditions value are acceptable).

- The drawdown calculations used to define desired future conditions did not include “dry” cells, where water levels are below the base of the aquifer.

Rustler Aquifer

- The model used to define desired future conditions and calculate modeled available groundwater assumes that the initial model heads represent the heads at the end of 2008 (the baseline for calculating desired future conditions drawdown values).
- Calculated modeled available groundwater values are based on the full spatial extent of the Rustler Formation, as represented in the groundwater availability model for the Rustler Aquifer, rather than the official TWDB aquifer boundary.
- The predictive model used to define desired future conditions and calculate modeled available groundwater uses the same model assumptions used in Groundwater Management Area 7 Technical Memorandum 15-05 (Hutchison, 2016d).
- The modeled available groundwater calculations are based on the desired future conditions with a one-foot tolerance (that is, modeled drawdown verifications within one foot of the desired future conditions value are acceptable).

METHODS:

As defined in Chapter 36 of the Texas Water Code (TWC, 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 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.

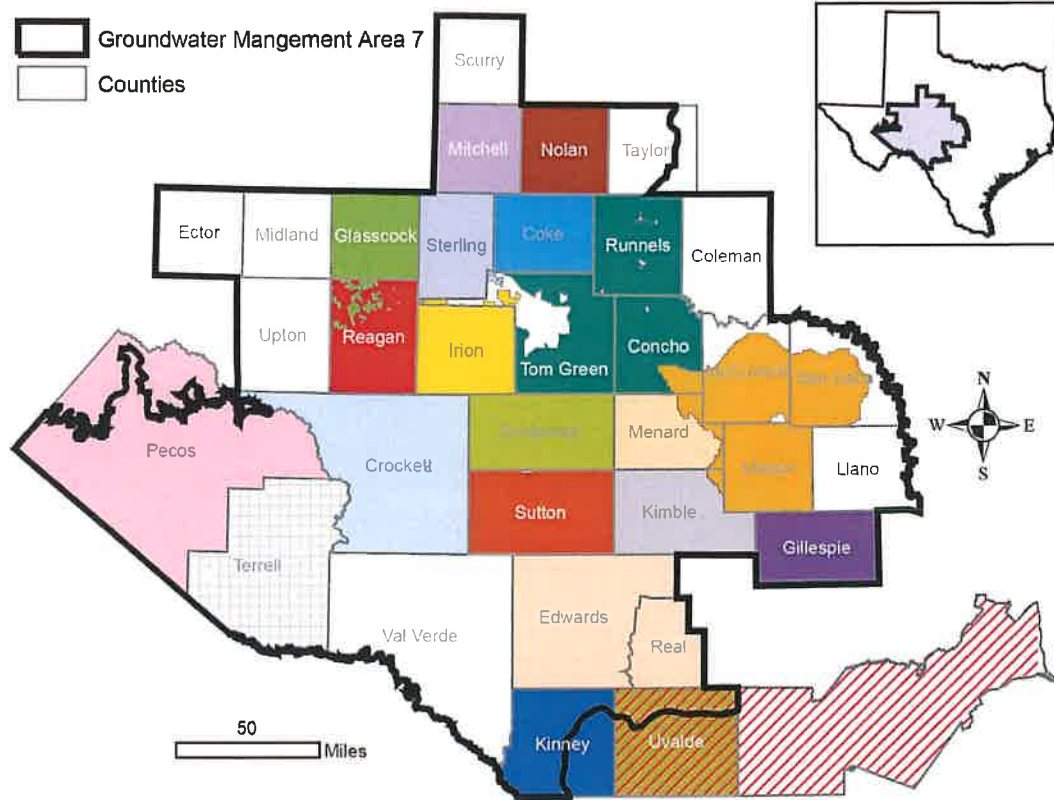
For relevant aquifers with desired future conditions based on water-level drawdown, water levels simulated at the end of the predictive simulations were compared to the water levels in the baseline year. These baseline years are 2005 in the groundwater availability model for the Capitan Reef Complex Aquifer and the alternative model for the Edwards-Trinity (Plateau) and Pecos Valley aquifers, 2012 in the groundwater availability model for the High Plains Aquifer System, 2010 in the groundwater availability model for the minor aquifers of the Llano Uplift Area, and 2008 in the groundwater availability model for the Rustler Aquifer. The predictive model runs used average pumping rates from the historical period for the respective model except in the aquifer or area of interest. In those areas, pumping rates are varied until they produce drawdowns consistent with the adopted desired future conditions. In most cases, these model runs were supplied by Groundwater Management Area 7 for review by TWDB staff before they were used to calculate the modeled available groundwater. Pumping rates or modeled available groundwater are reported in 10-year intervals.

Water-level drawdown averages were calculated for the relevant portions of each aquifer. Drawdown for model cells that became dry during the simulation—when the water level dropped below the base of the cell—were excluded from the averaging. In Groundwater Management Area 7, dry cells only occur during the predictive period in the Ogallala Aquifer of Glasscock County. Consequently, estimates of modeled available groundwater decrease over time as continued simulated pumping predicts the development of increasing numbers of dry model cells in areas of the Ogallala Aquifer in Glasscock County. The calculated water-level drawdown averages for all aquifers were compared with the desired future conditions to verify that the pumping scenario achieved the desired future conditions.

In Kinney and Val Verde counties, the desired future conditions are based on discharge from selected springs. In these cases, spring discharge was estimated based on simulated average spring discharge over a historical period, maintaining all historical hydrologic conditions—such as recharge and river stage—except pumping. In other words, we

assume that past average hydrologic conditions—the range of fluctuation—will continue in the future. In the cases of Kinney and Val Verde counties, simulated spring discharge was based on hydrologic variations that took place over the periods 1950 through 2005 and 1968 through 2013, respectively. The desired future condition for the Edwards-Trinity (Plateau) Aquifer in Kinney County is similar to the one adopted in 2010 and the associated modeled available groundwater is based on a specific model run—GAM Run 10-043 (Shi, 2012).

Modeled available groundwater values for the Ellenburger-San Saba and Hickory aquifers were determined by extracting pumping rates by decade from the model results using ZONBUDUSG Version 1.01 (Panday and others, 2013). For the remaining relevant aquifers in Groundwater Management Area 7 modeled available groundwater values were determined by extracting pumping rates by decade from the model results using ZONEBUDGET Version 3.01 (Harbaugh, 2009). Decadal modeled available groundwater for the relevant aquifers is reported by groundwater conservation district and county (Figure 1; Tables 1, 3, 5, 7, 9, 11, 13), and by county, regional water planning area, and river basin (Figures 2 and 3; Tables 2, 4, 6, 8, 10, 12, 14).



Groundwater Conservation Districts

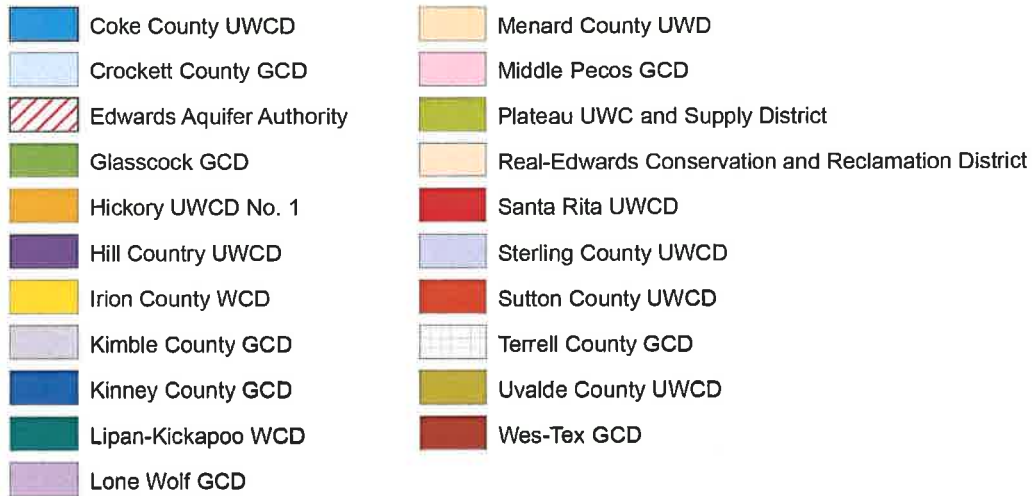


FIGURE 1. MAP SHOWING THE GROUNDWATER CONSERVATION DISTRICTS (GCD) IN GROUNDWATER MANAGEMENT AREA 7. NOTE: THE BOUNDARIES OF THE EDWARDS AQUIFER AUTHORITY OVERLAP WITH THE UVALDE COUNTY UNDERGROUND WATER CONSERVATION DISTRICT (UWCD).

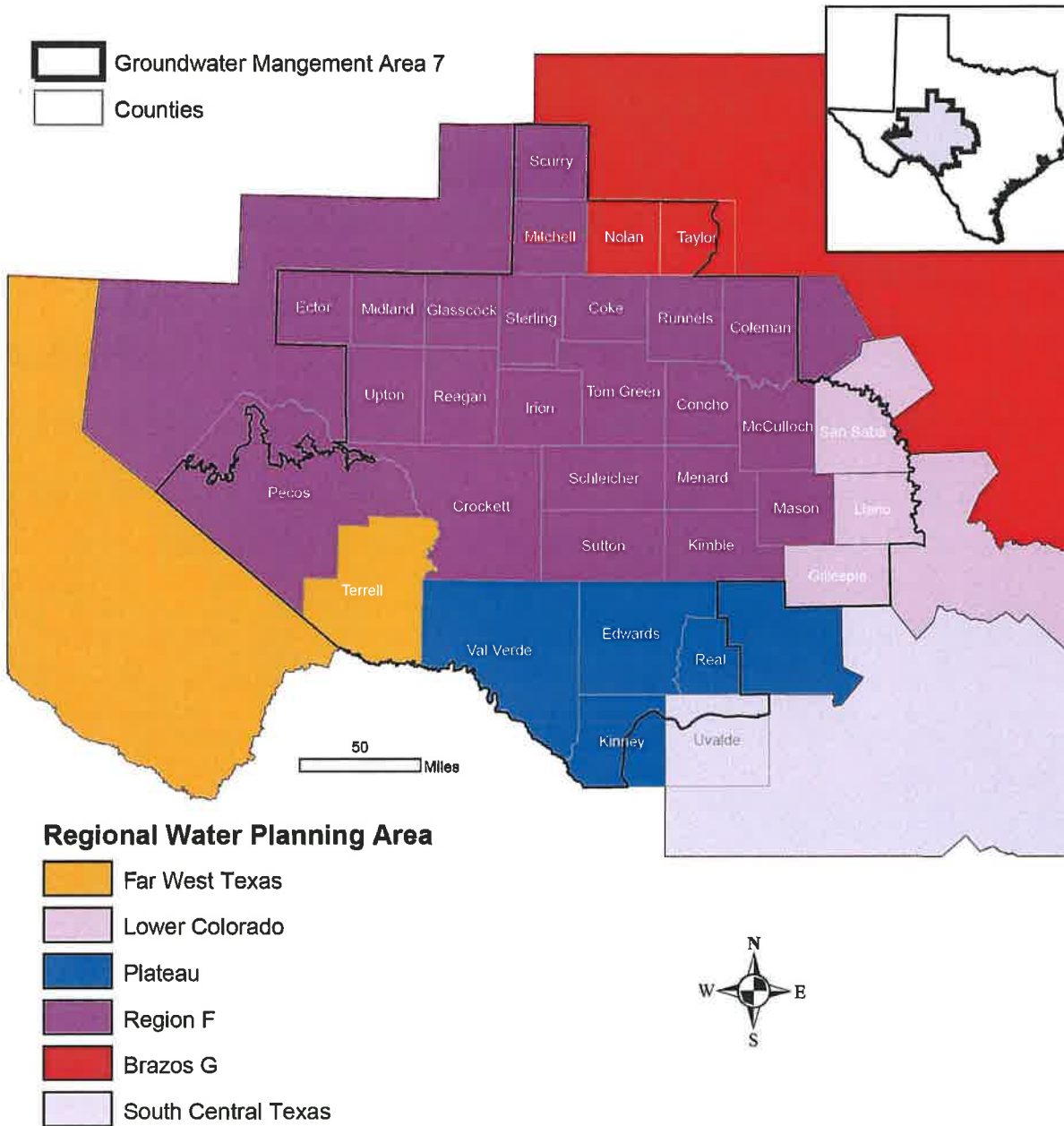


FIGURE 2. MAP SHOWING REGIONAL WATER PLANNING AREAS IN GROUNDWATER MANAGEMENT AREA 7.

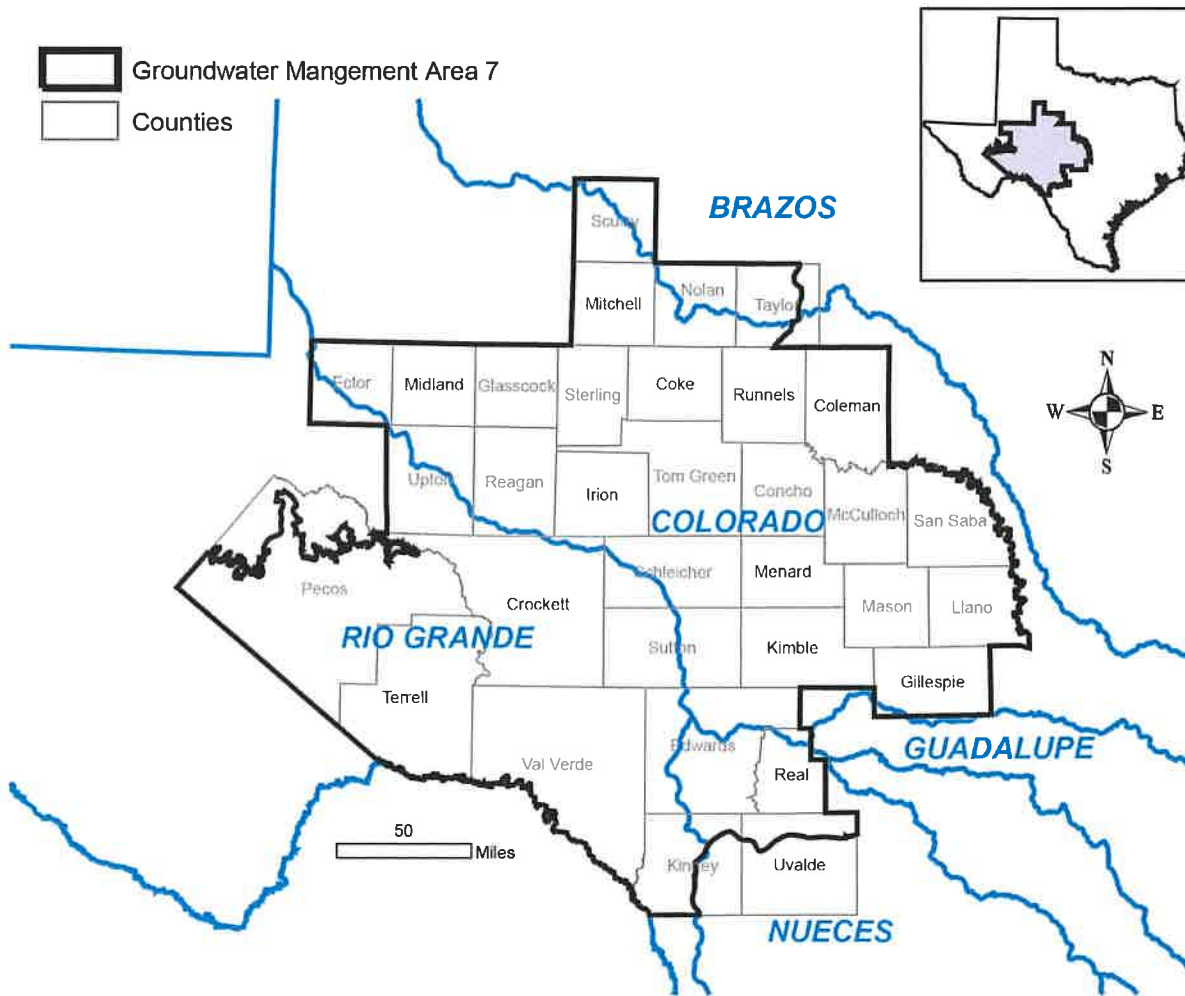


FIGURE 3. MAP SHOWING RIVER BASINS IN GROUNDWATER MANAGEMENT AREA 7. THESE INCLUDE PARTS OF THE BRAZOS, COLORADO, GUADALUPE, NUECES, AND RIO GRANDE RIVER BASINS.

PARAMETERS AND ASSUMPTIONS:

Capitan Reef Complex Aquifer

- Version 1.01 of the groundwater availability model of the eastern arm of the Capitan Reef Complex Aquifer was used. See Jones (2016) for assumptions and limitations of the groundwater availability model. See Hutchison (2016a) for details on the assumptions used for predictive simulations.
- The model has five layers: Layer 1, the Edwards-Trinity (Plateau) and Pecos Valley aquifers; Layer 2, the Dockum Aquifer and the Dewey Lake Formation; Layer 3, the Rustler Aquifer; Layer 4, a confining unit made up of the Salado and Castile formations, and the overlying portion of the Artesia Group; and Layer 5, the Capitan Reef Complex Aquifer, part of the Artesia Group, and the Delaware Mountain Group. Layers 1 through 4 are intended to act solely as boundary conditions facilitating groundwater inflow and outflow relative to the Capitan Reef Complex Aquifer (Layer 5).
- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).
- The model was run for the interval 2006 through 2070 for a 64-year predictive simulation. Drawdowns were calculated by subtracting 2006 simulated water levels from 2070 simulated water levels, which were then averaged over the portion of the aquifer in Groundwater Management Area 7.
- During predictive simulations, there were no cells where water levels were below the base elevation of the cell ("dry" cells). Therefore, all drawdowns were included in the averaging.
- Drawdown averages and modeled available groundwater volumes are based on the official TWDB aquifer boundary within Groundwater Management Area 7.

Dockum and Ogallala Aquifers

- Version 1.01 of the groundwater availability model for the High Plains Aquifer System by Deeds and Jigmond (2015) was used to construct the predictive model simulation for this analysis. See Hutchison (2016c) for details of the initial assumptions.
- The model has four layers which represent the Ogallala and Pecos Valley Alluvium aquifers (Layer 1), the Edwards-Trinity (High Plains) and Edwards-Trinity (Plateau) aquifers (Layer 2), the Upper Dockum Aquifer (Layer 3), and the Lower Dockum Aquifer (Layer 4). Pass-through cells exist in layers 2 and 3 to hydraulically connect the Ogallala Aquifer to the Lower Dockum where the Edwards-Trinity (High Plains)

and Upper Dockum aquifers are absent. These pass-through cells were excluded from the calculations of drawdowns and modeled available groundwater.

- The model was run with MODFLOW-NWT (Niswonger and others, 2011). The model uses the Newton formulation and the upstream weighting package, which automatically reduces pumping as heads drop in a particular cell, as defined by the user. This feature may simulate the declining production of a well as saturated thickness decreases. Deeds and Jigmond (2015) modified the MODFLOW-NWT code to use a saturated thickness of 30 feet as the threshold—instead of percent of the saturated thickness—when pumping reductions occur during a simulation. Therefore, the groundwater management area should be aware that the modeled available groundwater values will be less than pumping input values if the modeled saturated thickness drops below that threshold.
- The model was run for the interval 2013 through 2070 for a 58-year predictive simulation. Drawdowns were calculated by subtracting initial water levels from 2070 simulated water levels, which were then averaged over the portion of the aquifer in Groundwater Management Area 7.
- During predictive simulations, there were no cells in the Dockum Aquifer where water levels were below the base elevation of the cell (“dry” cells). Therefore, all drawdowns were included in the averaging. However, in the Ogallala Aquifer, dry cells occurred during the predictive simulation. These dry cells were excluded from the modeled available groundwater calculations.
- Drawdown averages and modeled available groundwater volumes are based on the model boundary within Groundwater Management Area 7 for the Dockum Aquifer and the official TWDB aquifer boundary for the Ogallala Aquifer.

Pecos Valley, Edwards-Trinity (Plateau) and Trinity Aquifers

- The single-layer alternative groundwater flow model for the Edwards-Trinity (Plateau) and Pecos Valley aquifers was used for this analysis. This model is an update to the previously developed groundwater availability model documented in Anaya and Jones (2009). See Hutchison and others (2011a) and Anaya and Jones (2009) for assumptions and limitations of the model. See Hutchison (2016e; 2018) for details on the assumptions used for predictive simulations.
- The groundwater model has one layer representing the Pecos Valley Aquifer and the Edwards-Trinity (Plateau) Aquifer. In the relatively narrow area where both aquifers are present, the model is a lumped representation of both aquifers.
- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).

- The model was run for the interval 2006 through 2070 for a 65-year predictive simulation. Drawdowns were calculated by subtracting 2010 simulated water levels from 2070 simulated water levels, which were then averaged over the portion of the aquifer in Groundwater Management Area 7.
- Because simulated water levels for the baseline year (2010) are not included in the original calibrated historical model, these water levels had to be verified against measured water levels to confirm that the predictive model satisfactorily matched real-world conditions. Comparison of 2010 simulated and measured water levels indicated a root mean squared error of 100 feet or 4 percent of the range in water-level elevations, which is within acceptable limits. Based on these results, we consider the predictive model an appropriate tool for evaluating the attainability of desired future conditions and for calculating modeled available groundwater.
- Drawdowns for cells with water levels below the base elevation of the cell (“dry” cells) were included in the averaging.
- Drawdown averages and modeled available groundwater volumes are based on the official TWDB aquifer boundaries within Groundwater Management Area 7.

Edwards-Trinity (Plateau) Aquifer of Kinney County

- All parameters and assumptions for the Edwards-Trinity (Plateau) Aquifer of Kinney County in Groundwater Management Area 7 are described in GAM Run 10-043 MAG Version 2 (Shi, 2012). This report assumes a planning period from 2010 to 2070.
- The Kinney County Groundwater Conservation District model developed by Hutchison and others (2011b) was used for this analysis. The model was calibrated to water level and spring flux collected from 1950 to 2005.
- The model has four layers representing the following hydrogeologic units (from top to bottom): Carrizo-Wilcox Aquifer (Layer 1), Upper Cretaceous Unit (Layer 2), Edwards (Balcones Fault Zone) Aquifer/Edwards portion of the Edwards-Trinity (Plateau) Aquifer (Layer 3), and Trinity portion of the Edwards-Trinity (Plateau) Aquifer (Layer 4).
- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).
- The model was run for 56 annual stress periods under the conditions set in Scenario 3 in Task 10-027 (Hutchison, 2011).
- Modeled available groundwater volumes are based on the official TWDB aquifer boundary within Groundwater Management Area 7 in Kinney County.

Edwards-Trinity (Plateau) Aquifer of Val Verde County

- The single-layer numerical groundwater flow model for the Edwards-Trinity (Plateau) Aquifer of Val Verde County was used for this analysis. This model is based on the previously developed alternative groundwater model of the Kinney County area documented in Hutchison and others (2011b). See EcoKai and Hutchison (2014) for assumptions and limitations of the model. See Hutchison (2016e; 2021) for details on the assumptions used for predictive simulations, including recharge and pumping assumptions.
- The groundwater model has one layer representing the Edwards-Trinity (Plateau) Aquifer of Val Verde County.
- The model was run with MODFLOW-2005 (Harbaugh, 2005).
- The model was run for a 45-year predictive simulation representing hydrologic conditions of the interval 1968 through 2013. Simulated spring discharge from San Felipe Springs was averaged over duration of the simulation. The resultant pumping rate that met the desired future conditions was applied to the predictive period—2010 through 2070—based on the assumption that average conditions over the predictive period are the same as those over the historic period represented by the model run.
- Modeled available groundwater volumes are based on the official TWDB aquifer boundary within Groundwater Management Area 7 in Val Verde County.

Minor aquifers of the Llano Uplift Area

- We used version 1.01 of the groundwater availability model for the minor aquifers in the Llano Uplift Area. See Shi and others (2016) for assumptions and limitations of the model. See Hutchison (2016b) for details of the initial assumptions.
- The model contains eight layers: Trinity Aquifer, Edwards-Trinity (Plateau) Aquifer, and younger alluvium deposits (Layer 1), confining units (Layer 2), Marble Falls Aquifer and equivalent units (Layer 3), confining units (Layer 4), Ellenburger-San Saba Aquifer and equivalent units (Layer 5), confining units (Layer 6), Hickory Aquifer and equivalent units (Layer 7), and Precambrian units (Layer 8).
- The model was run with MODFLOW-USG beta (development) version (Panday and others, 2013). Perennial rivers and reservoirs were simulated using the MODFLOW-USG river package. Springs were simulated using the MODFLOW-USG drain package.
- The model was run for the interval 2011 through 2070 for a 60-year predictive simulation. Drawdowns were calculated by subtracting initial water levels from 2070 simulated water levels, which were then averaged over the portion of the

aquifer in Groundwater Management Area 7. During predictive simulations, there were no cells where water levels were below the base elevation of the cell (“dry” cells). Therefore, all drawdowns were included in the averaging.

- Drawdown averages and modeled available groundwater volumes are based on the model boundaries within Groundwater Management Area 7.

Rustler Aquifer

- Version 1.01 of the groundwater availability model for the Rustler Aquifer by Ewing and others (2012) was used to construct the predictive model simulation for this analysis. See Hutchison (2016d) for details of the initial assumptions, including recharge conditions.
- The model has two layers, the top one representing the Rustler Aquifer, and the other representing the Dewey Lake Formation and the Dockum Aquifer.
- The model was run with MODFLOW-NWT (Niswonger and others, 2011).
- The model was run for the interval 2009 through 2070 for a 61-year predictive simulation. Drawdowns were calculated by subtracting 2009 simulated water levels from 2070 simulated water levels, which were then averaged over the portion of the aquifer in Groundwater Management Area 7.
- The predictive model used to define desired future conditions uses 2008 recharge conditions throughout the predictive period.
- The predictive model used to define desired future conditions has general-head boundary heads that decline at a rate of 1.5 feet per year.
- During predictive simulations, there were no cells where water levels were below the base elevation of the cell (“dry” cells). Therefore, all drawdowns were included in the averaging.
- Drawdown averages and modeled available groundwater volumes are based on the model boundaries within Groundwater Management Area 7.

RESULTS:

The modeled available groundwater estimates for each decade from 2020 through 2070 are:

- 26,164 acre-feet per year in the Capitan Reef Complex Aquifer,
- 2,324 acre-feet per year in the Dockum Aquifer,
- 6,570 to 7,925 acre-feet per year in the Ogallala Aquifer,

- 479,063 acre-feet per year in the undifferentiated Edwards-Trinity (Plateau), Pecos Valley, and Trinity aquifers,
- 22,616 acre-feet per year in the Ellenburger-San Saba Aquifer,
- 49,936 acre-feet per year in the Hickory Aquifer, and
- 7,040 acre-feet per year in the Rustler Aquifer.

The modeled available groundwater for the respective aquifers has been summarized by aquifer, county, and groundwater conservation district (Tables 1, 3, 5, 7, 9, 11, and 13). The modeled available groundwater is also summarized by county, regional water planning area, river basin, and aquifer for use in the regional water planning process (Tables 2, 4, 6, 8, 10, 12, and 14). The modeled available groundwater for the Ogallala Aquifer that achieves the desired future conditions adopted by districts in Groundwater Management Area 7 decreases from 7,925 to 6,570 acre-feet per year between 2020 and 2070 (Tables 5 and 6). This decline is attributable to the occurrence of increasing numbers of cells where water levels were below the base elevation of the cell ("dry" cells) in parts of Glasscock County. Please note that MODFLOW-NWT automatically reduces pumping as water levels decline.

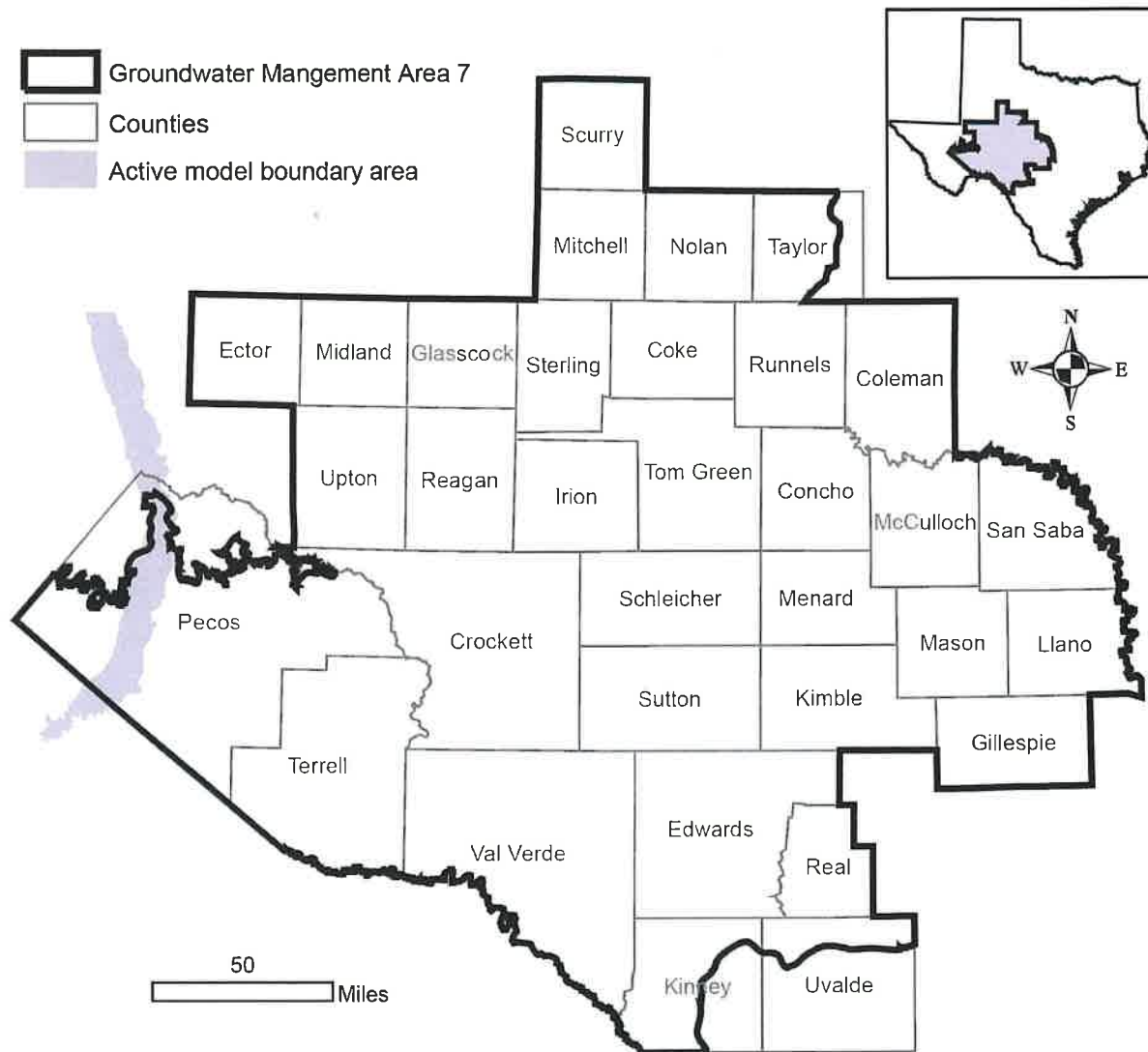


FIGURE 4. MAP SHOWING THE AREAS COVERED BY THE CAPITAN REEF COMPLEX AQUIFER IN THE GROUNDWATER AVAILABILITY MODEL FOR THE EASTERN ARM OF THE CAPITAN REEF COMPLEX AQUIFER IN GROUNDWATER MANAGEMENT AREA 7.

TABLE 2. MODELED AVAILABLE GROUNDWATER FOR THE CAPITAN REEF COMPLEX AQUIFER IN GROUNDWATER MANAGEMENT AREA 7 SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), AND RIVER BASIN FOR EACH DECADE BETWEEN 2030 AND 2070. RESULTS ARE IN ACRE-FEET PER YEAR.

County	RWPA	River Basin	Year				
			2030	2040	2050	2060	2070
Pecos	F	Rio Grande	26,164	26,164	26,164	26,164	26,164
		Total	26,164	26,164	26,164	26,164	26,164
GMA 7			26,164	26,164	26,164	26,164	26,164

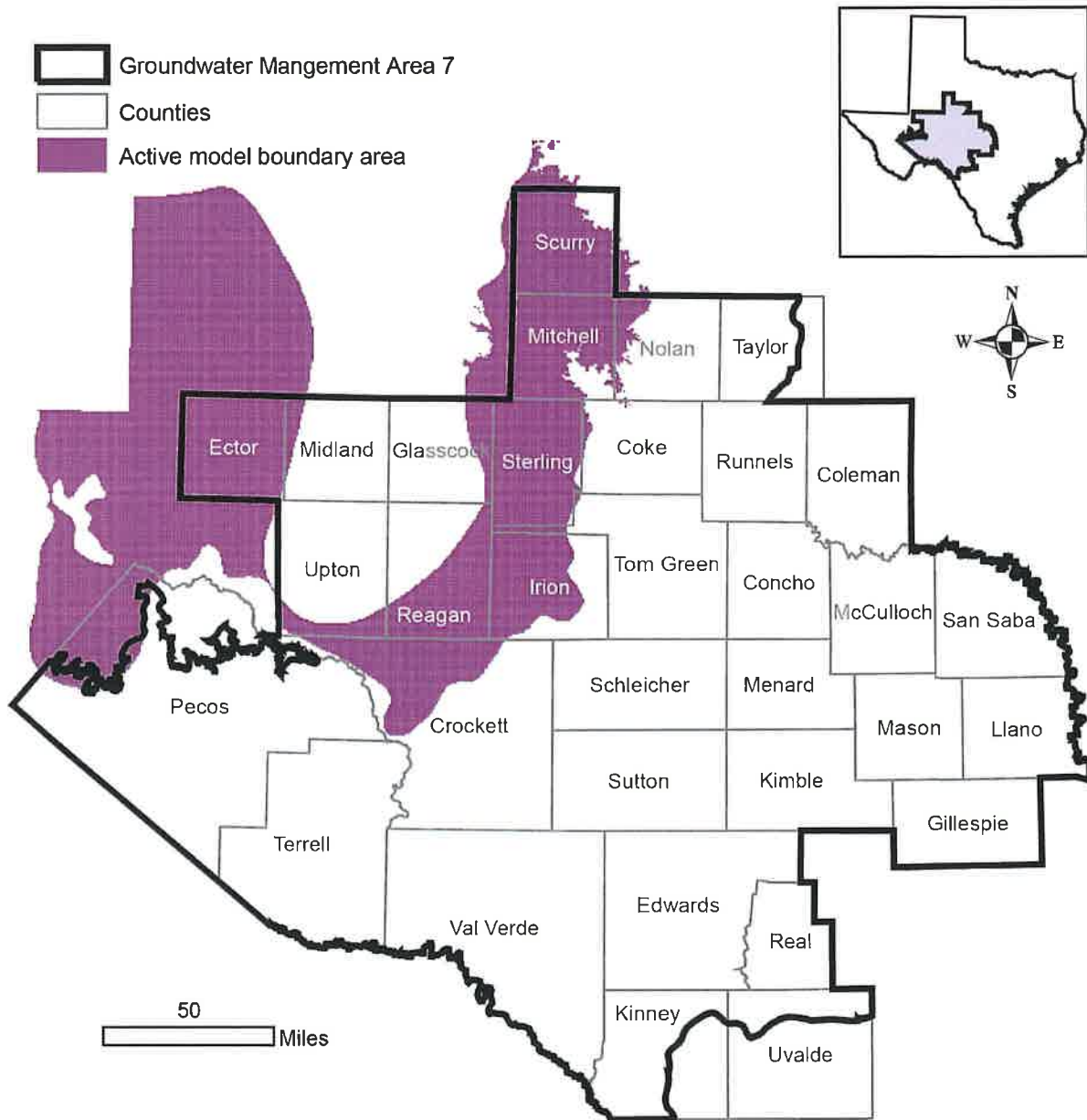


FIGURE 5. MAP SHOWING AREAS COVERED BY THE DOCKUM AQUIFER IN THE GROUNDWATER AVAILABILITY MODEL FOR THE HIGH PLAINS AQUIFER SYSTEM IN GROUNDWATER MANAGEMENT AREA 7.

TABLE 3. MODELED AVAILABLE GROUNDWATER FOR THE DOCKUM AQUIFER IN GROUNDWATER MANAGEMENT AREA 7 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2070. RESULTS ARE IN ACRE-FEET PER YEAR. GCD AND UWCD ARE THE ABBREVIATIONS FOR GROUNDWATER CONSERVATION DISTRICT AND UNDERGROUND WATER CONSERVATION DISTRICT, RESPECTIVELY.

District	County	Year					
		2020	2030	2040	2050	2060	2070
Middle Pecos GCD	Pecos	2,022	2,022	2,022	2,022	2,022	2,022
	Total	2,022	2,022	2,022	2,022	2,022	2,022
Santa Rita UWCD	Reagan	302	302	302	302	302	302
	Total	302	302	302	302	302	302
GMA 7		2,324	2,324	2,324	2,324	2,324	2,324
Note: The modeled available groundwater for Santa Rita Underground Water Conservation District excludes parts of Reagan County that fall within Glasscock Groundwater Conservation District.							

TABLE 4. MODELED AVAILABLE GROUNDWATER FOR THE DOCKUM AQUIFER IN GROUNDWATER MANAGEMENT AREA 7 SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), AND RIVER BASIN FOR EACH DECADE BETWEEN 2030 AND 2070. RESULTS ARE IN ACRE-FEET PER YEAR.

County	RWPA	River Basin	Year				
			2030	2040	2050	2060	2070
Pecos	F	Rio Grande	2,022	2,022	2,022	2,022	2,022
		Total	2,022	2,022	2,022	2,022	2,022
Reagan	F	Colorado	302	302	302	302	302
		Rio Grande	0	0	0	0	0
		Total	302	302	302	302	302
GMA 7			2,324	2,324	2,324	2,324	2,324
Note: The modeled available groundwater for Reagan County excludes parts of Reagan County that fall outside of Santa Rita Underground Water Conservation District.							

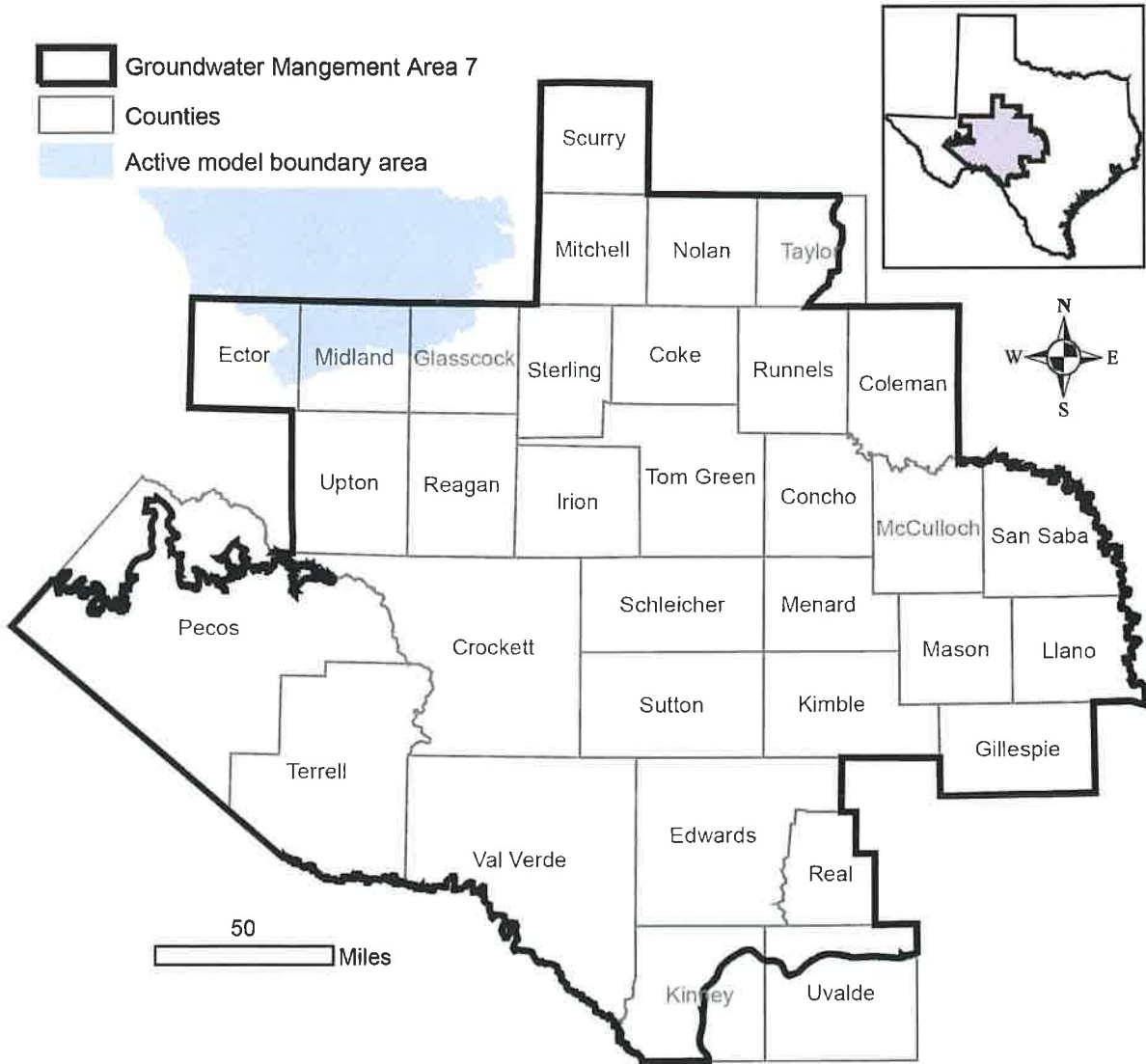


FIGURE 6. MAP SHOWING THE AREAS COVERED BY THE OGALLALA AQUIFER IN THE GROUNDWATER AVAILABILITY MODEL FOR THE HIGH PLAINS AQUIFER SYSTEM IN GROUNDWATER MANAGEMENT AREA 7.

TABLE 5. MODELED AVAILABLE GROUNDWATER FOR THE OGALLALA AQUIFER IN GROUNDWATER MANAGEMENT AREA 7 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2070. RESULTS ARE IN ACRE-FEET PER YEAR.

District	County	Year					
		2020	2030	2040	2050	2060	2070
Glasscock GCD	Glasscock	7,925	7,673	7,372	7,058	6,803	6,570
	Total	7,925	7,673	7,372	7,058	6,803	6,570
GMA 7		7,925	7,673	7,372	7,058	6,803	6,570

TABLE 6. MODELED AVAILABLE GROUNDWATER FOR THE OGALLALA AQUIFER IN GROUNDWATER MANAGEMENT AREA 7 SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), AND RIVER BASIN FOR EACH DECADE BETWEEN 2030 AND 2070. RESULTS ARE IN ACRE-FEET PER YEAR.

County	RWPA	River Basin	Year				
			2030	2040	2050	2060	2070
Glasscock	F	Colorado	7,673	7,372	7,058	6,803	6,570
		Total	7,673	7,372	7,058	6,803	6,570
GMA 7			7,673	7,372	7,058	6,803	6,570

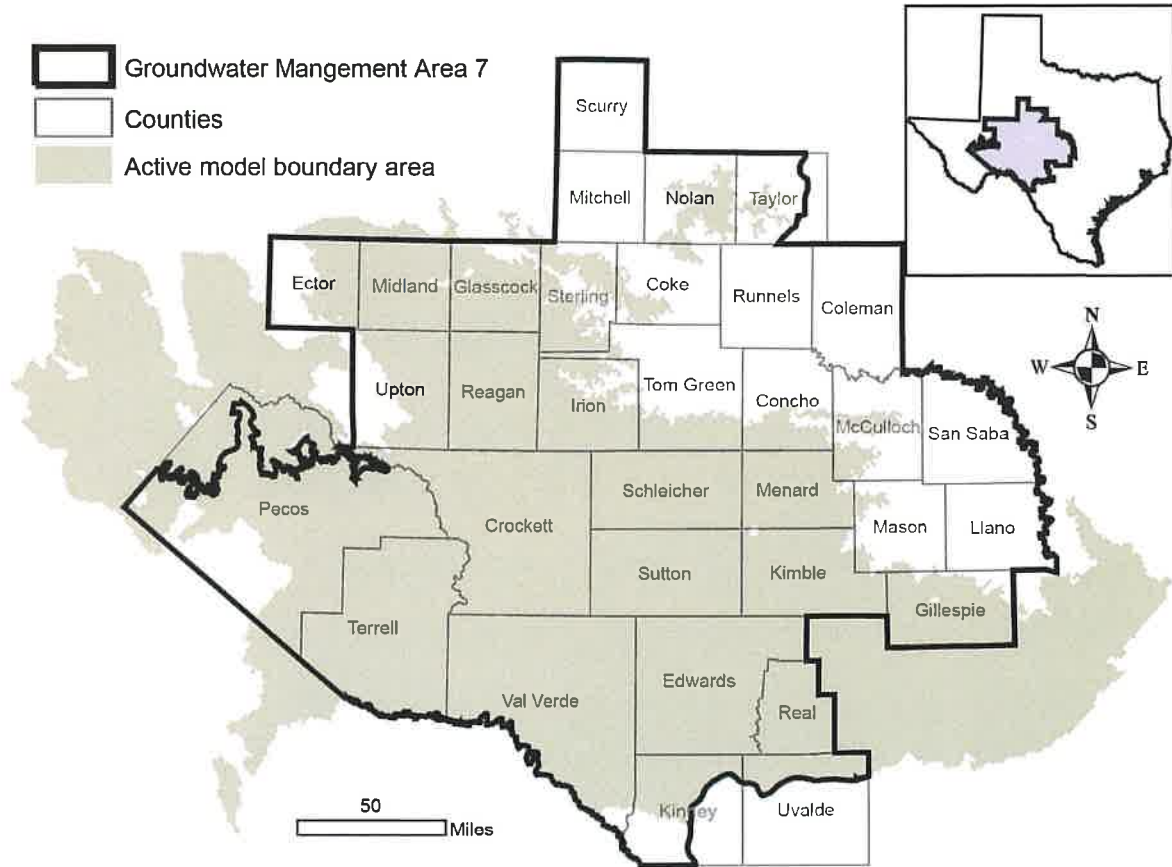


FIGURE 7. MAP SHOWING THE AREAS COVERED BY THE UNDIFFERENTIATED EDWARDS-TRINITY (PLATEAU), PECOS VALLEY, AND TRINITY AQUIFERS IN THE GROUNDWATER AVAILABILITY MODEL FOR THE EDWARDS-TRINITY (PLATEAU) AND PECOS VALLEY AQUIFERS IN GROUNDWATER MANAGEMENT AREA 7.

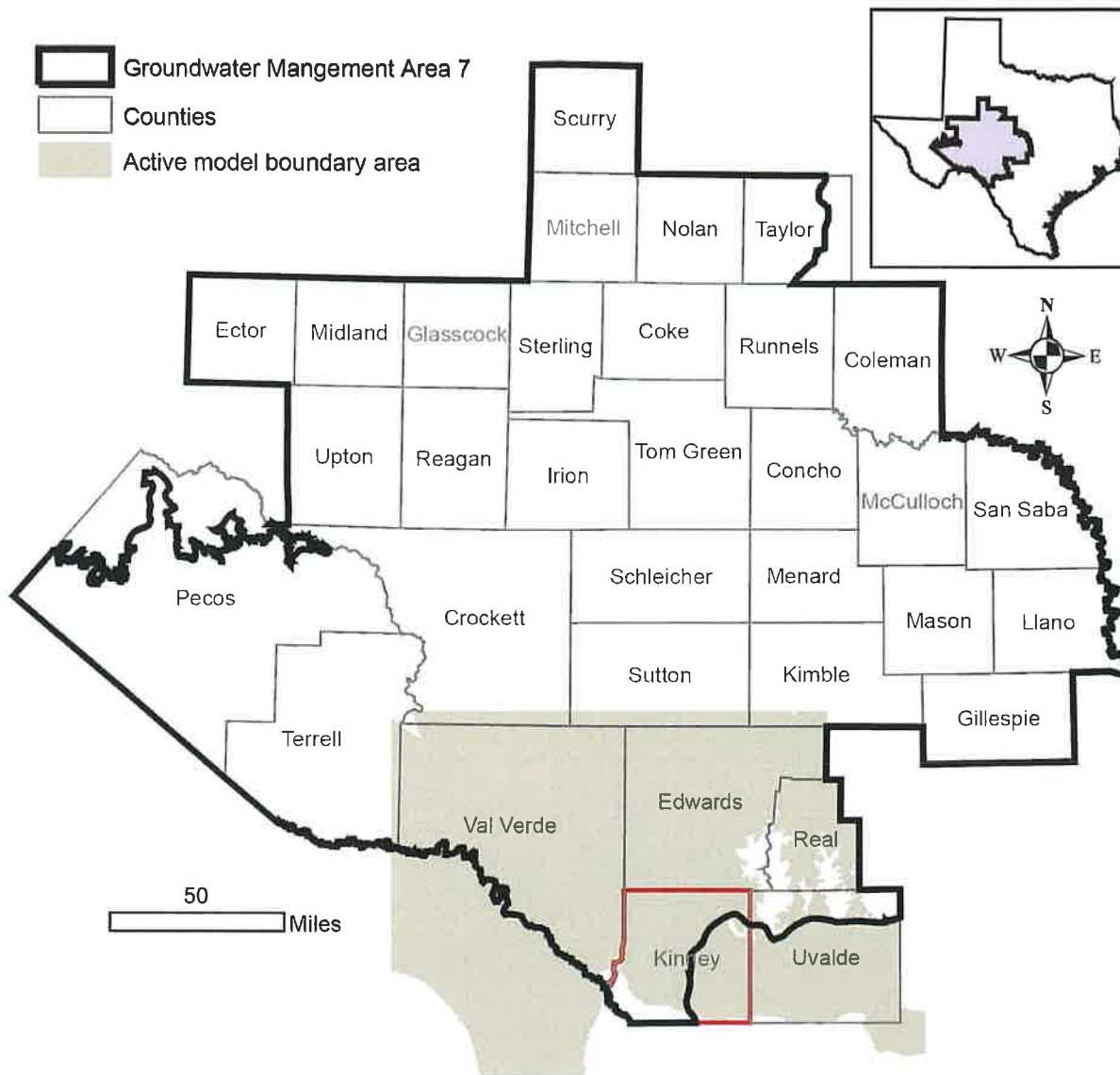


FIGURE 8. MAP SHOWING THE AREAS COVERED BY THE EDWARDS-TRINITY (PLATEAU) AQUIFER IN THE ALTERNATIVE MODEL FOR THE EDWARDS-TRINITY (PLATEAU) AQUIFER IN KINNEY COUNTY [HIGHLIGHTED IN RED].

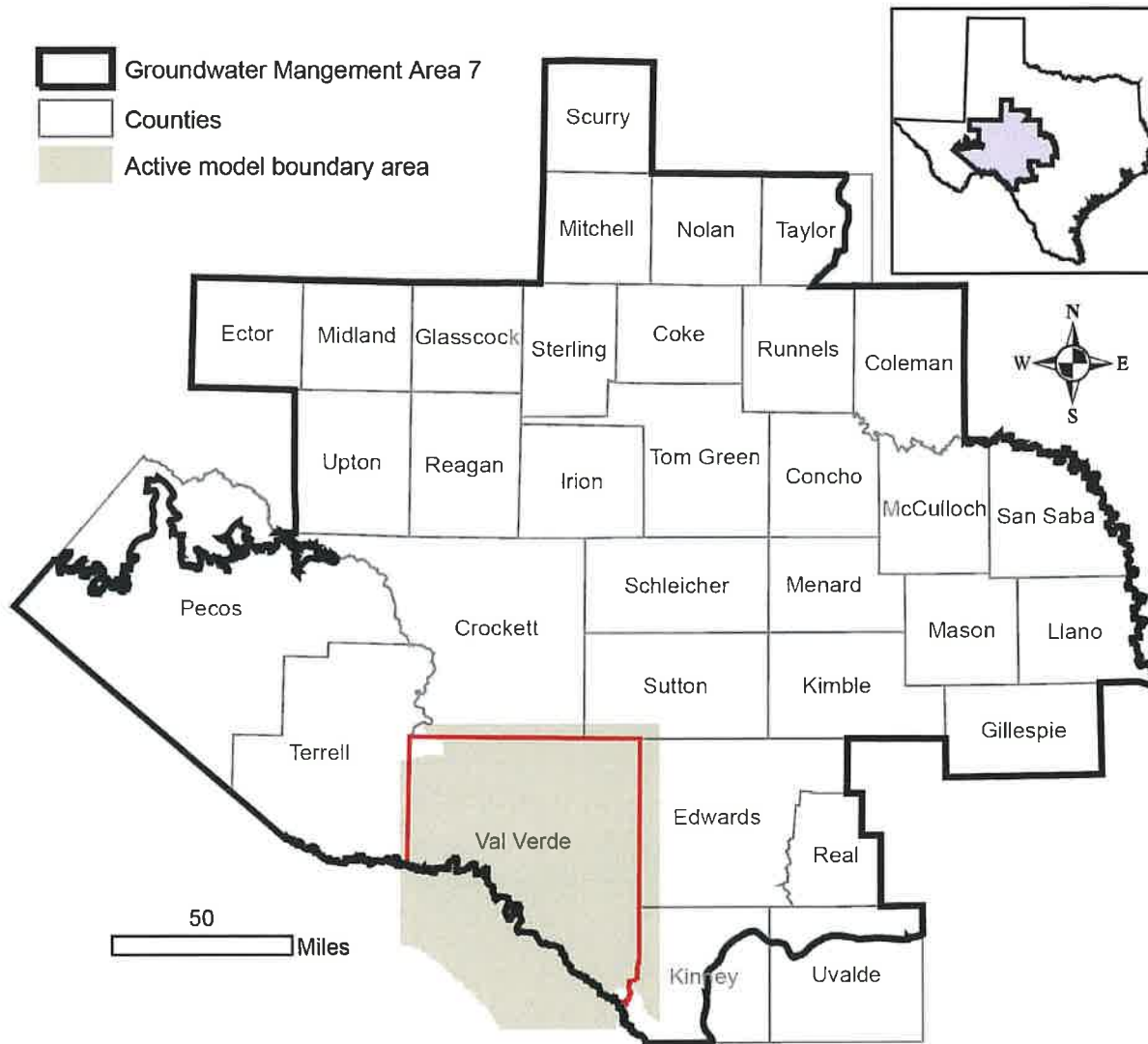


FIGURE 9. MAP SHOWING THE AREAS COVERED BY THE EDWARDS-TRINITY (PLATEAU) AQUIFER IN THE GROUNDWATER FLOW MODEL FOR THE EDWARDS-TRINITY (PLATEAU) AQUIFER IN VAL VERDE COUNTY [HIGHLIGHTED IN RED].

TABLE 8. MODELED AVAILABLE GROUNDWATER BY DECADE FOR THE UNDIFFERENTIATED EDWARDS-TRINITY (PLATEAU), PECOS VALLEY, AND TRINITY AQUIFERS IN GROUNDWATER MANAGEMENT AREA 7 SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), AND RIVER BASIN FOR EACH DECADE BETWEEN 2030 AND 2070. RESULTS ARE IN ACRE-FEET PER YEAR.

County	RWPA	River Basin	Year				
			2030	2040	2050	2060	2070
Coke	F	Colorado	997	997	997	997	997
		Total	997	997	997	997	997
Crockett	F	Colorado	20	20	20	20	20
		Rio Grande	5,427	5,427	5,427	5,427	5,427
		Total	5,447	5,447	5,447	5,447	5,447
Ector	F	Colorado	4,925	4,925	4,925	4,925	4,925
		Rio Grande	617	617	617	617	617
		Total	5,542	5,542	5,542	5,542	5,542
Edwards	J	Colorado	2,305	2,305	2,305	2,305	2,305
		Nueces	1,631	1,631	1,631	1,631	1,631
		Rio Grande	1,740	1,740	1,740	1,740	1,740
		Total	5,676	5,676	5,676	5,676	5,676
Gillespie	K	Colorado	4,843	4,843	4,843	4,843	4,843
		Guadalupe	136	136	136	136	136
		Total	4,979	4,979	4,979	4,979	4,979
Glasscock	F	Colorado	65,186	65,186	65,186	65,186	65,186
		Total	65,186	65,186	65,186	65,186	65,186

TABLE 8. (CONTINUED).

County	RWPA	River Basin	Year				
			2030	2040	2050	2060	2070
Irion	F	Colorado	3,289	3,289	3,289	3,289	3,289
		Total	3,289	3,289	3,289	3,289	3,289
Kimble	F	Colorado	1,386	1,386	1,386	1,386	1,386
		Total	1,386	1,386	1,386	1,386	1,386
Kinney	J	Nueces	12	12	12	12	12
		Rio Grande	70,329	70,329	70,329	70,329	70,329
		Total	70,341	70,341	70,341	70,341	70,341
Menard	F	Colorado	2,597	2,597	2,597	2,597	2,597
		Total	2,597	2,597	2,597	2,597	2,597
Midland	F	Colorado	23,233	23,233	23,233	23,233	23,233
		Total	23,233	23,233	23,233	23,233	23,233
Pecos	F	Rio Grande	117,309	117,309	117,309	117,309	117,309
		Total	117,309	117,309	117,309	117,309	117,309

TABLE 8. (CONTINUED).

County	RWPA	River Basin	Year				
			2030	2040	2050	2060	2070
Reagan	F	Colorado	68,205	68,205	68,205	68,205	68,205
		Rio Grande	28	28	28	28	28
		Total	68,233	68,233	68,233	68,233	68,233
Real	J	Colorado	277	277	277	277	277
		Guadalupe	3	3	3	3	3
		Nueces	7,243	7,243	7,243	7,243	7,243
		Total	7,523	7,523	7,523	7,523	7,523
Schleicher	F	Colorado	6,403	6,403	6,403	6,403	6,403
		Rio Grande	1,631	1,631	1,631	1,631	1,631
		Total	8,034	8,034	8,034	8,034	8,034
Sterling	F	Colorado	2,495	2,495	2,495	2,495	2,495
		Total	2,495	2,495	2,495	2,495	2,495
Sutton	F	Colorado	388	388	388	388	388
		Rio Grande	6,022	6,022	6,022	6,022	6,022
		Total	6,410	6,410	6,410	6,410	6,410
Taylor	G	Brazos	331	331	331	331	331
		Colorado	158	158	158	158	158
		Total	489	489	489	489	489
Terrell	E	Rio Grande	1,420	1,420	1,420	1,420	1,420
		Total	1,420	1,420	1,420	1,420	1,420

TABLE 8. (CONTINUED).

County	RWPA	River Basin	Year				
			2030	2040	2050	2060	2070
Upton	F	Colorado	21,243	21,243	21,243	21,243	21,243
		Rio Grande	1,126	1,126	1,126	1,126	1,126
		Total	22,369	22,369	22,369	22,369	22,369
Uvalde	L	Nueces	1,993	1,993	1,993	1,993	1,993
		Total	1,993	1,993	1,993	1,993	1,993
Val Verde	J	Rio Grande	50,000	50,000	50,000	50,000	50,000
		Total	50,000	50,000	50,000	50,000	50,000
GMA 7			479,063	479,063	479,063	479,063	479,063

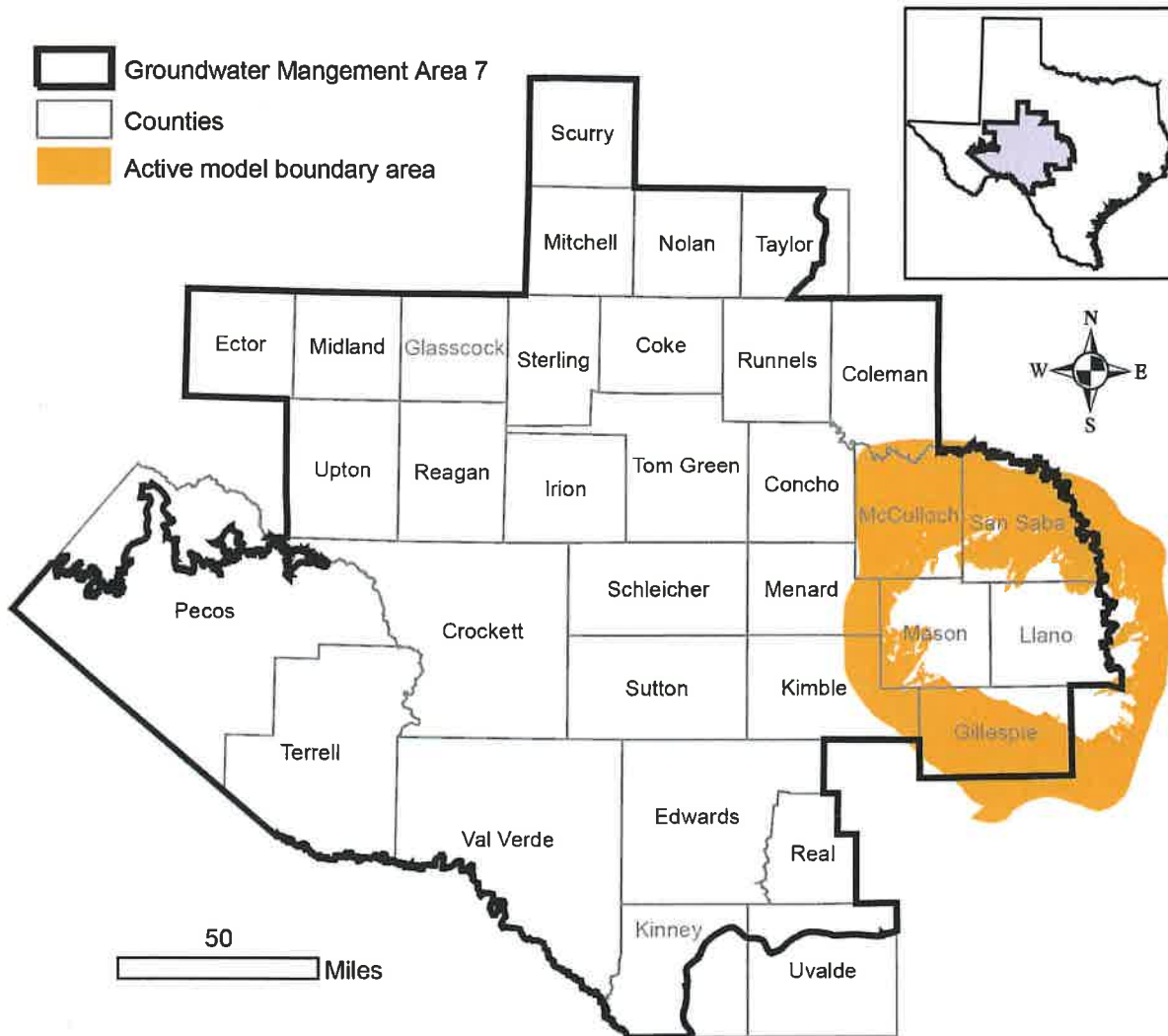


FIGURE 10. MAP SHOWING THE AREAS COVERED BY THE ELLENBURGER-SAN SABA AQUIFER IN THE GROUNDWATER AVAILABILITY MODEL FOR THE MINOR AQUIFERS OF THE LLANO UPLIFT AREA IN GROUNDWATER MANAGEMENT AREA 7.

TABLE 10. MODELED AVAILABLE GROUNDWATER FOR THE ELLENBURGER-SAN SABA AQUIFER IN GROUNDWATER MANAGEMENT AREA 7 SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), AND RIVER BASIN FOR EACH DECADE BETWEEN 2030 AND 2070. RESULTS ARE IN ACRE-FEET PER YEAR.

County	RWPA	River Basin	Year				
			2030	2040	2050	2060	2070
Gillespie	K	Colorado	6,294	6,294	6,294	6,294	6,294
		Total	6,294	6,294	6,294	6,294	6,294
Kimble	F	Colorado	521	521	521	521	521
		Total	521	521	521	521	521
Mason	F	Colorado	3,237	3,237	3,237	3,237	3,237
		Total	3,237	3,237	3,237	3,237	3,237
McCulloch	F	Colorado	4,364	4,364	4,364	4,364	4,364
		Total	4,364	4,364	4,364	4,364	4,364
Menard	F	Colorado	309	309	309	309	309
		Total	309	309	309	309	309
San Saba	K	Colorado	7,890	7,890	7,890	7,890	7,890
		Total	7,890	7,890	7,890	7,890	7,890
GMA 7			22,615	22,615	22,615	22,615	22,615

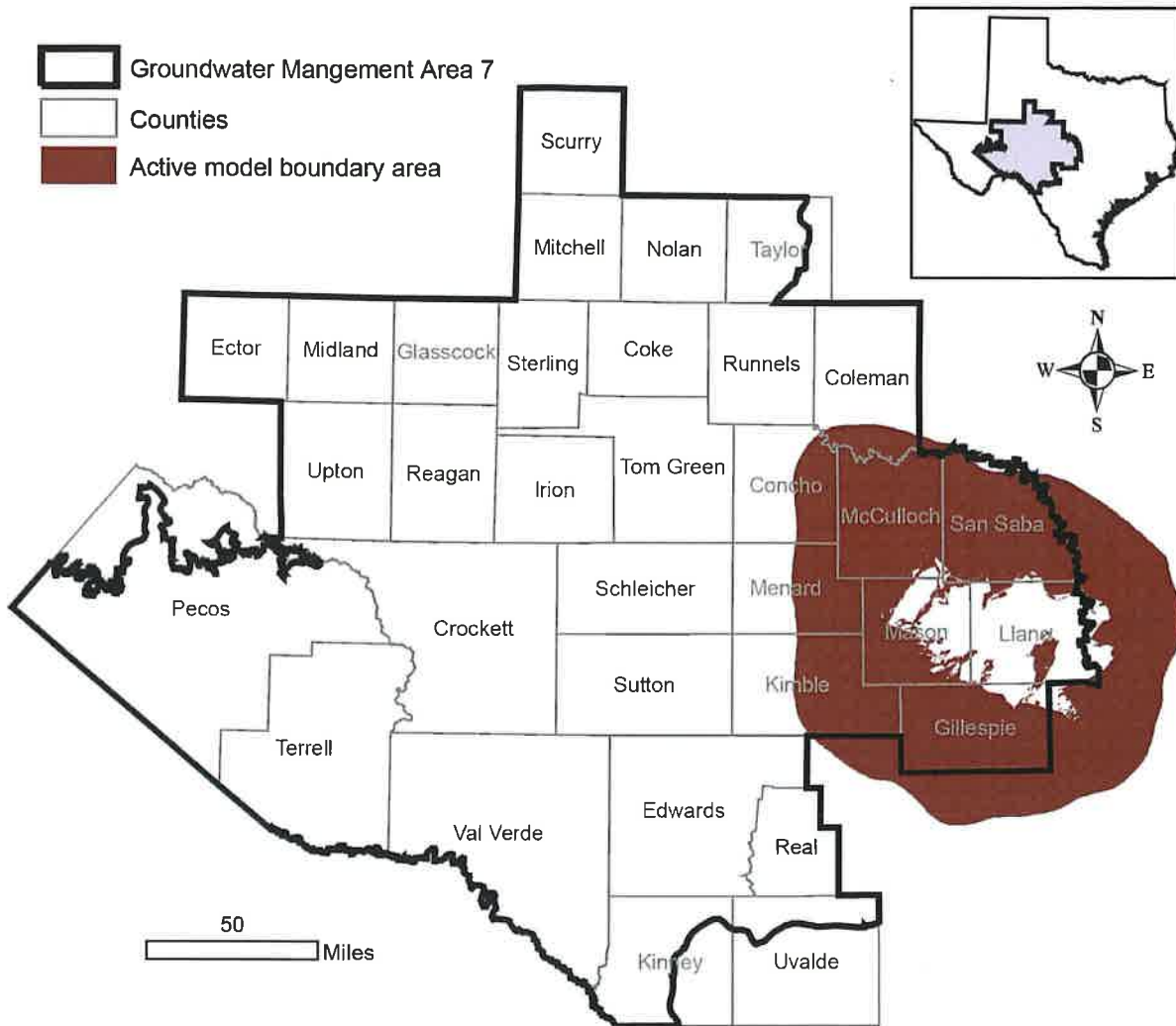


FIGURE 11. MAP SHOWING AREAS COVERED BY THE HICKORY AQUIFER IN THE GROUNDWATER AVAILABILITY MODEL FOR THE MINOR AQUIFERS OF THE LLANO UPLIFT AREA IN GROUNDWATER MANAGEMENT AREA 7.

TABLE 12. MODELED AVAILABLE GROUNDWATER FOR THE HICKORY AQUIFER IN GROUNDWATER MANAGEMENT AREA 7 SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), AND RIVER BASIN FOR EACH DECADE BETWEEN 2030 AND 2070. RESULTS ARE IN ACRE-FEET PER YEAR.

County	RWPA	River Basin	Year				
			2030	2040	2050	2060	2070
Concho	F	Colorado	27	27	27	27	27
		Total	27	27	27	27	27
Gillespie	K	Colorado	1,751	1,751	1,751	1,751	1,751
		Total	1,751	1,751	1,751	1,751	1,751
Kimble	F	Colorado	165	165	165	165	165
		Total	165	165	165	165	165
Mason	F	Colorado	13,212	13,212	13,212	13,212	13,212
		Total	13,212	13,212	13,212	13,212	13,212
McCulloch	F	Colorado	24,377	24,377	24,377	24,377	24,377
		Total	24,377	24,377	24,377	24,377	24,377
Menard	F	Colorado	2,725	2,725	2,725	2,725	2,725
		Total	2,725	2,725	2,725	2,725	2,725
San Saba	K	Colorado	7,680	7,680	7,680	7,680	7,680
		Total	7,680	7,680	7,680	7,680	7,680
GMA 7			49,937	49,937	49,937	49,937	49,937

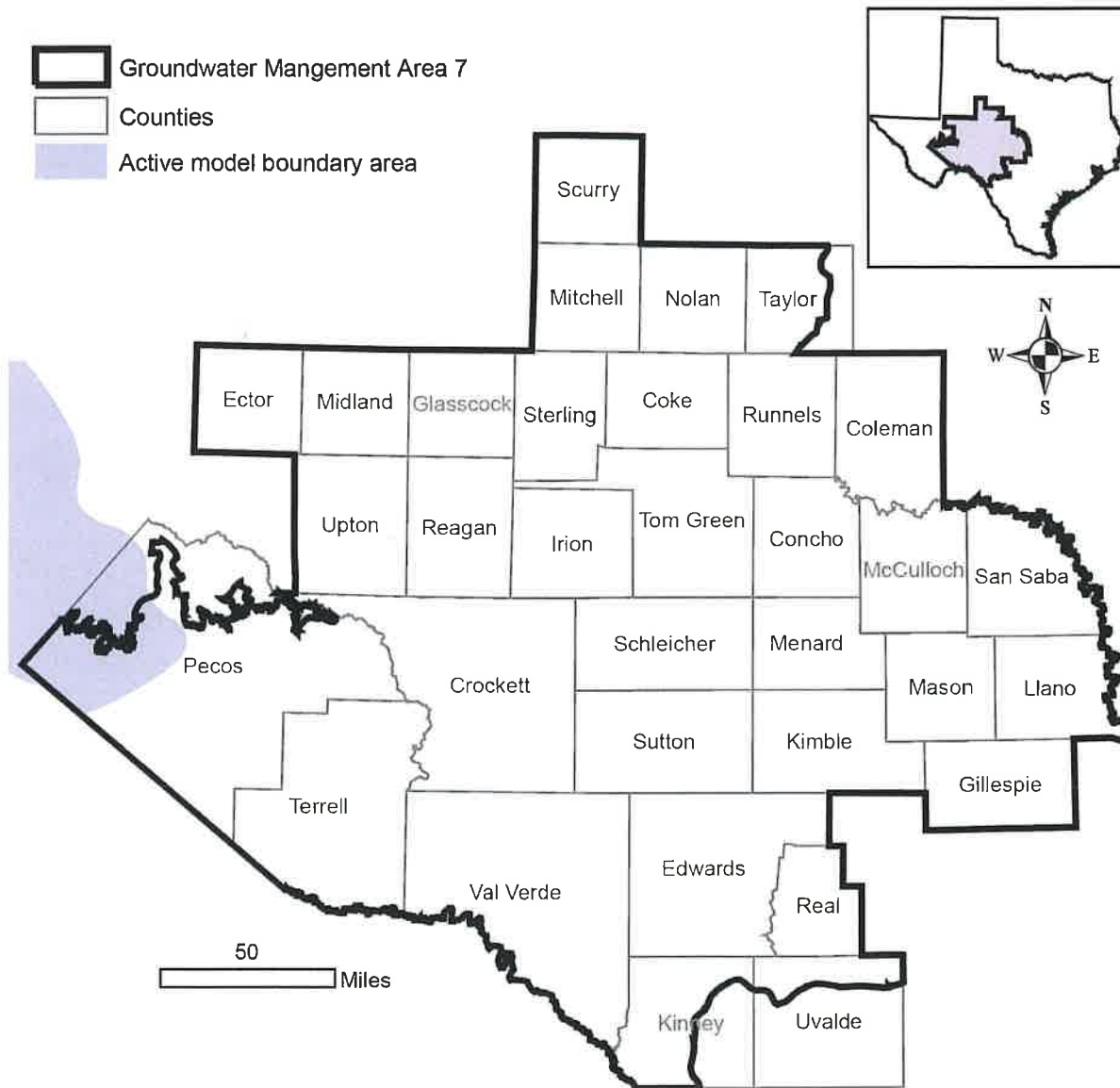


FIGURE 13. MAP SHOWING AREAS COVERED BY THE RUSTLER AQUIFER IN THE GROUNDWATER AVAILABILITY MODEL FOR THE RUSTLER AQUIFER IN GROUNDWATER MANAGEMENT AREA 7.

TABLE 13. MODELED AVAILABLE GROUNDWATER FOR THE RUSTLER AQUIFER IN GROUNDWATER MANAGEMENT AREA 7 SUMMARIZED BY DISTRICT AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2070. RESULTS ARE IN ACRE-FEET PER YEAR.

District	County	Year					
		2020	2030	2040	2050	2060	2070
Middle Pecos GCD	Pecos	7,040	7,040	7,040	7,040	7,040	7,040
	Total	7,040	7,040	7,040	7,040	7,040	7,040

TABLE 14. MODELED AVAILABLE GROUNDWATER FOR THE RUSTLER AQUIFER IN GROUNDWATER MANAGEMENT AREA 7 SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), AND RIVER BASIN FOR EACH DECADE BETWEEN 2030 AND 2070. RESULTS ARE IN ACRE-FEET PER YEAR.

County	RWPA	River Basin	Year				
			2030	2040	2050	2060	2070
Pecos	F	Rio Grande	7,040	7,040	7,040	7,040	7,040
		Rio Grande	7,040	7,040	7,040	7,040	7,040

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 historical groundwater flow conditions includes the assumptions about the location in the aquifer where historic pumping was placed. Understanding the amount and location of historical 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 historical 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.

Model “Dry” Cells

In some cases, the predictive model run for this analysis could result in water levels in some model cells dropping below the base elevation of the cell during the simulation. In terms of water level, the cells have gone dry. However, as noted in the model assumptions the transmissivity of the cell remains constant and will produce water. This would mean that the modeled available groundwater would include imaginary “pumping” values that are coming from cells that are actually dry.

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Appendix B

Estimated Historical Groundwater Use and 2022 State Water Plan Datasets: Santa Rita Underground Water Conservation District

TWDB Estimated Historical Groundwater Use and 2022 State Water Plan Datasets

Santa Rita Underground Water Conservation District

Texas Water Development Board
Groundwater Division
Groundwater Technical Assistance Department
stephen.allen@twdb.texas.gov
(512) 463-7317
January 2, 2025

GROUNDWATER MANAGEMENT PLAN DATA

This set of water data tables (part one of a two-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 table addresses a specific numbered requirement in the Texas Water Development Board's groundwater management plan review checklist. The checklist can be found at this web address:

<https://www.twdb.texas.gov/groundwater/docs/GCD/GMPChecklist0113.pdf>

The five tables included in part one of this data package are:

TWDB Historical Water Use Survey (WUS)

- Estimated Historical Water Use (checklist item 2)

State Water Plan (SWP)

- Projected Surface Water Supplies (checklist item 6),
- Projected Water Demands (checklist item 7),
- Projected Water Supply Needs (checklist item 8),
- Projected Water Management Strategies (checklist item 9)

Part two of the two-part package is the groundwater availability model (GAM) run report for the district (checklist items 3 through 5). The district should have received, or will receive, this report from the TWDB Groundwater Modeling Department. Questions about the GAM can be directed to Grayson Dowlearn, grayson.dowlearn@twdb.texas.gov, (512) 475-1552.

DISCLAIMER:

Data presented in these tables are the most up to date WUS and SWP data available as of 1/2/2025. Although it does not happen often, these data are subject to change pending the availability of more accurate WUS data or an amendment to the 2022 SWP. District personnel should review the data table values and correct any discrepancies to ensure approval of their groundwater management plan.

The WUS data can be verified at this web address:

<https://www.twdb.texas.gov/waterplanning/waterusesurvey/estimates/>

The 2022 SWP data can be verified by contacting Sabrina Anderson, (sabrina.anderson@twdb.texas.gov or 512-936-0886).

The values presented in the data tables 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 offer districts the opportunity to review this determination).

The county values in two of the SWP tables (Projected Water Supply Needs and Projected Water Management Strategies) are not apportioned because district-specific values are not required to be presented in the groundwater management plan. However, a district is required to “consider” the county values in these two tables by drafting a short summary of the needs and strategies values in the groundwater management plan.

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 ideal but it is the best available process with respect to time and staffing constraints. If a district believes it has data that are more accurate, they 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

REAGAN COUNTY

91.77% (multiplier)

All values are in acre-feet

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2021	GW	465	0	2,092	0	20,693	319	23,569
	SW	0	0	0	0	0	35	35
2020	GW	589	0	4,524	0	23,315	327	28,755
	SW	0	0	0	0	0	36	36
2019	GW	634	0	9,792	0	19,505	327	30,258
	SW	0	0	0	0	0	36	36
2018	GW	683	0	10,278	0	19,345	327	30,633
	SW	0	0	0	0	0	36	36
2017	GW	659	0	8,296	0	20,324	315	29,594
	SW	0	0	0	0	0	34	34
2016	GW	572	0	3,349	0	18,578	124	22,623
	SW	0	0	0	0	0	14	14
2015	GW	761	0	4,462	0	18,482	123	23,828
	SW	0	0	0	0	0	14	14
2014	GW	737	0	5,547	0	22,377	122	28,783
	SW	0	0	0	0	0	14	14
2013	GW	683	0	2,968	0	18,529	122	22,302
	SW	0	0	0	0	0	14	14
2012	GW	595	0	251	0	18,200	157	19,203
	SW	0	0	0	0	0	18	18

Projected Surface Water Supplies

TWDB 2022 State Water Plan Data

REAGAN COUNTY

91.77% (multiplier)

All values are in acre-feet

RWPG	WUG	WUG Basin	Source Name	2020	2030	2040	2050	2060	2070
F	Livestock, Reagan	Colorado	Colorado Livestock Local Supply	55	55	55	55	55	55
F	Mining, Reagan	Colorado	Colorado Other Local Supply	163	163	163	163	163	163
Sum of Projected Surface Water Supplies (acre-feet)				218	218	218	218	218	218

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.

REAGAN COUNTY

91.77% (multiplier)

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
F	Big Lake	Colorado	730	795	834	877	906	928
F	County-Other, Reagan	Colorado	64	70	72	75	78	80
F	Irrigation, Reagan	Colorado	20,218	20,218	20,218	20,218	20,218	20,218
F	Livestock, Reagan	Colorado	161	161	161	161	161	161
F	Livestock, Reagan	Rio Grande	7	7	7	7	7	7
F	Mining, Reagan	Colorado	9,046	9,046	6,572	3,755	1,451	512
F	Mining, Reagan	Rio Grande	682	682	495	283	109	39
Sum of Projected Water Demands (acre-feet)			30,908	30,979	28,359	25,376	22,930	21,945

Projected Water Supply Needs

TWDB 2022 State Water Plan Data

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

REAGAN COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
F	Big Lake	Colorado	0	0	0	0	0	0
F	County-Other, Reagan	Colorado	0	0	0	0	0	0
F	Irrigation, Reagan	Colorado	0	0	0	0	0	0
F	Livestock, Reagan	Colorado	0	0	0	0	0	0
F	Livestock, Reagan	Rio Grande	0	0	0	0	0	0
F	Mining, Reagan	Colorado	0	0	0	263	2,963	4,063
F	Mining, Reagan	Rio Grande	0	0	0	0	0	0
Sum of Projected Water Supply Needs (acre-feet)			0	0	0	0	0	0

Projected Water Management Strategies

TWDB 2022 State Water Plan Data

REAGAN COUNTY

WUG, Basin (RWPG)

All values are in acre-feet

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
Big Lake, Colorado (F)							
Municipal Conservation - Big Lake	DEMAND REDUCTION [Reagan]	10	12	12	13	13	14
		10	12	12	13	13	14
Irrigation, Reagan, Colorado (F)							
Irrigation Conservation - Reagan County	DEMAND REDUCTION [Reagan]	1,102	2,203	3,305	3,305	3,305	3,305
Weather Modification	Weather Modification [Atmosphere]	1,869	1,869	1,869	1,869	1,869	1,869
		2,971	4,072	5,174	5,174	5,174	5,174
Mining, Reagan, Colorado (F)							
Mining Conservation - Reagan County	DEMAND REDUCTION [Reagan]	414	414	300	58	22	7
		414	414	300	58	22	7
Mining, Reagan, Rio Grande (F)							
Mining Conservation - Reagan County	DEMAND REDUCTION [Reagan]	31	31	23	4	2	1
		31	31	23	4	2	1
Sum of Projected Water Management Strategies (acre-feet)		3,426	4,529	5,509	5,249	5,211	5,196

Appendix C

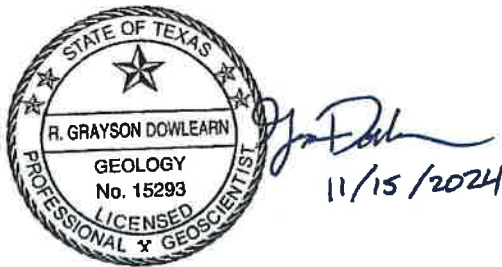
GAM Run 24-011: Santa Rita Underground Water Conservation District Management Plan

Santa Rita Underground Water Conservation District

Part 2 – Data Required for Management Plan GAM Run 24-011



Zedric Capus, G.I.T. and Grayson Dowlearn, P.G.
Texas Water Development Board
Groundwater Modeling Department
November 15, 2024



INTRODUCTION

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

The TWDB provides data and information to the Santa Rita Underground Water Conservation District in two parts. This report constitutes part 2, the required groundwater availability modeling information, which includes:

1. the annual amount of recharge from precipitation, if any, to the groundwater resources within the district;
2. the annual volume of water that discharges from the aquifer to springs and any surface-water bodies, including lakes, streams, and rivers, for each aquifer within the district; and
3. the annual volume of flow into and out of the district within each aquifer and between aquifers in the district.

This report replaces the results of GAM Run 17-002 (Jones, 2017). We used two groundwater availability models for the Santa Rita Underground Water Conservation District. Information for the [Edwards-Trinity \(Plateau\) Aquifer](#) is from version 1.01 of the groundwater availability model for the Edwards-Trinity (Plateau) and Pecos Valley aquifers (Anaya and Jones, 2009). Information for the [Dockum Aquifer](#) is from version 1.01 of the groundwater availability model for High Plains Aquifer System (Deeds and Jigmond, 2015).

The groundwater management plan for the Santa Rita Underground Water Conservation District should be adopted by the district on or before February 5, 2025, and submitted to the Executive Administrator of the TWDB on or before March 7, 2025. The current management plan for the Santa Rita Underground Water Conservation District expires on May 6, 2025.

METHODS

In accordance with the provisions of the Texas Water Code § 36.1071 (h), the groundwater availability models mentioned above were used to estimate information for the Santa Rita Underground Water Conservation District management plan. The average annual water budget values for recharge, surface-water outflow, inflow to the district, outflow from the district, and the flow between aquifers within the district are summarized in this report.

Values may differ from the previous report as a result of routine updates to the spatial grid file used to define county, groundwater conservation district, and aquifer boundaries, which can impact the calculated water budget values. Additionally, the approach used for analyzing model results is reviewed during each update and may have been refined to better delineate groundwater flows. Finally, results may differ due to the use of more recent models or techniques.

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.

If the Santa Rita Underground Water Conservation District determines that the district boundaries used in the assessment do not reflect current conditions after reviewing the figures, please notify the TWDB Groundwater Modeling Department at your earliest convenience.

The flow components presented in this report do not represent the full groundwater budget. If additional inflow and outflow information would be helpful for planning purposes, the district may submit a request in writing to the [TWDB Groundwater Modeling Department](#) for the full groundwater budget.

Models and Aquifers

Groundwater availability model for the Edwards-Trinity (Plateau) and Pecos Valley aquifers

- Version 1.01 (Anaya and Jones, 2009)
- The model was run with MODFLOW-96 (Harbaugh and McDonald, 1996).
- Water budgets were extracted for the historical calibration period (1981 through 2000) using ZONEBUDGET Version 3.01 (Harbaugh, 2009).
- This model was used to analyze the following aquifer:
 - [Edwards-Trinity \(Plateau\) Aquifer](#)

Groundwater availability model for the High Plains Aquifer System

- Version 1.01 (Deeds and Jigmond, 2015)
- The model was run with MODFLOW-NWT (Niswonger and others, 2011).
- Water budgets were extracted for the historical calibration period (1980 through 2012) using ZONEBUDGET Version 3.01 (Harbaugh, 2009).
- This model was used to analyze the following aquifer:
 - [Dockum Aquifer](#)

For more information on model parameters, packages used to simulate groundwater flow, other model layers, or model assumptions, please see the associated model reports linked in the References section.

RESULTS

A groundwater budget summarizes the amount of water entering and leaving the aquifer according to the groundwater availability model. Selected groundwater budget components listed below were extracted from the groundwater availability model results for the [Edwards-Trinity \(Plateau\) and Dockum aquifers](#) located within Santa Rita Underground Water Conservation District:

1. [Precipitation recharge](#) - the areally distributed recharge sourced from precipitation falling on the outcrop areas of the aquifers (where the aquifer is exposed at land surface) within the district.
2. [Surface-water outflow](#) - the total water discharging from the aquifer (outflow) to surface-water features such as streams, reservoirs, and springs.
3. [Flow into and out of district](#) - the lateral flow within the aquifer between the district and adjacent counties.
4. [Flow between aquifers](#) - the net vertical flow between the aquifer and adjacent aquifers or confining units. This flow is controlled by the relative water levels in each aquifer and aquifer properties of each aquifer or confining unit that define the amount of leakage that occurs.

The information needed for the district's management plan is summarized in Tables 1 and 2. Figures 1 and 3 show the area of the model from which the values in Tables 1 and 2 were extracted. Figures 2 and 4 provide a generalized diagram of the groundwater flow components provided in Tables 1 and 2.

Table 1: Summarized information for the Edwards-Trinity (Plateau) Aquifer. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot.

Management plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Edwards-Trinity (Plateau) Aquifer	17,971
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Edwards-Trinity (Plateau) Aquifer	803
Estimated annual volume of flow into the district within each aquifer in the district	Edwards-Trinity (Plateau) Aquifer	31,327
Estimated annual volume of flow out of the district within each aquifer in the district	Edwards-Trinity (Plateau) Aquifer	42,547
Estimated net annual volume of flow between each aquifer in the district	To Edwards-Trinity (Plateau) from Dockum Aquifer	271*

* Value from the groundwater availability model for the High Plains Aquifer System.

Santa Rita Underground Water Conservation District
Part 2 – Data Required for Management Plan
November 15, 2024

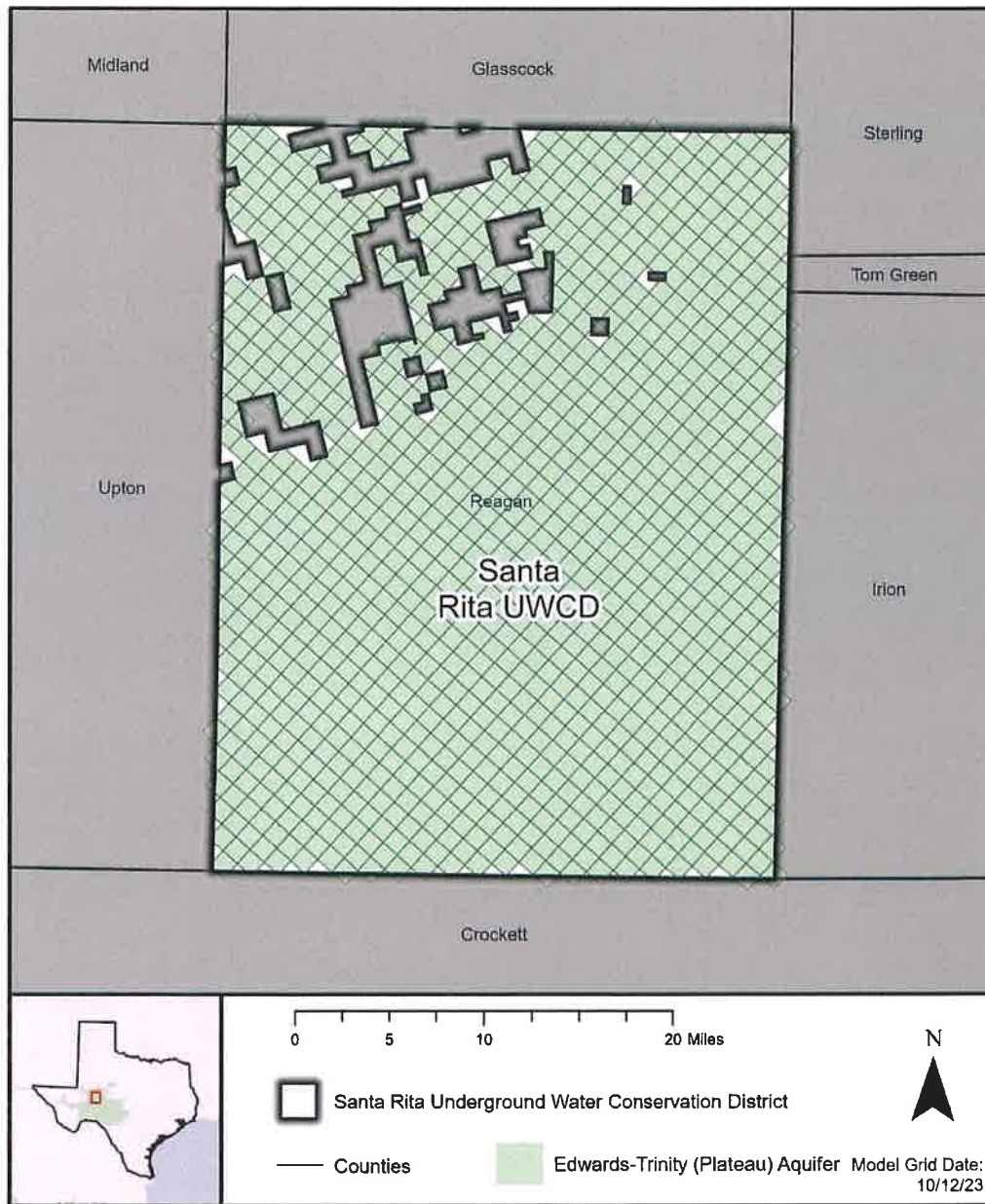
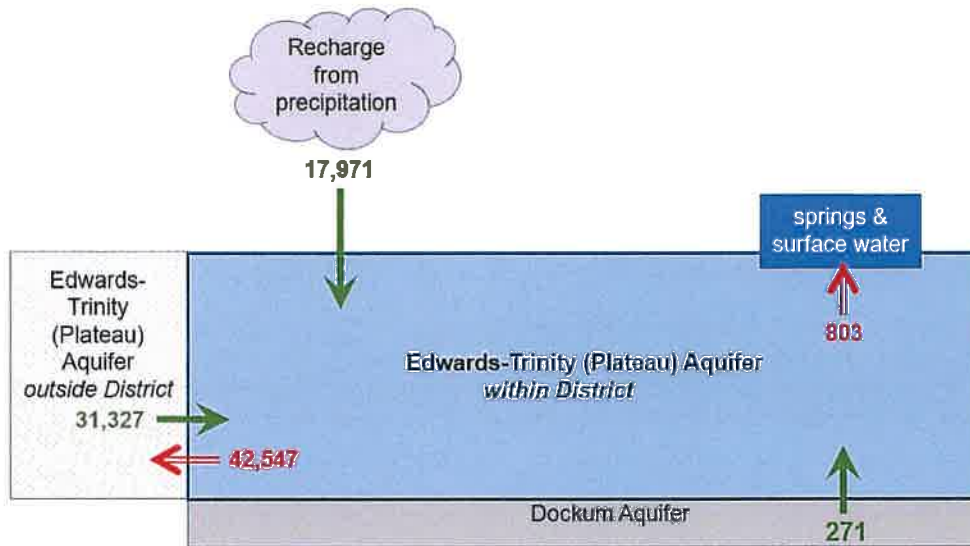


Figure 1: Area of the groundwater availability model for the Edwards-Trinity (Plateau) and Pecos Valley aquifers from which the information in Table 1 was extracted (the Edwards-Trinity [Plateau] Aquifer extent within the district boundary).

Santa Rita Underground Water Conservation District
 Part 2 – Data Required for Management Plan
 November 15, 2024



Caveat: This diagram only includes the water budget items provided in Table 1. A complete water budget would include additional inflows and outflows. For a full groundwater budget, please submit a request in writing to the Groundwater Modeling Department.

Figure 2: Generalized diagram of the summarized budget information from Table 1, representing directions of flow for the Edwards-Trinity (Plateau) Aquifer within the Santa Rita Underground Water Conservation District. Flow values are expressed in acre-feet per year.

Table 2: Summarized information for the Dockum Aquifer. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot.

Management plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Dockum Aquifer	0
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Dockum Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Dockum Aquifer	11
Estimated annual volume of flow out of the district within each aquifer in the district	Dockum Aquifer	161
Estimated net annual volume of flow between each aquifer in the district	From Dockum Aquifer to Edwards-Trinity (Plateau) Aquifer	271
	To Dockum Aquifer from Dockum equivalent units	196

Santa Rita Underground Water Conservation District
Part 2 – Data Required for Management Plan
November 15, 2024

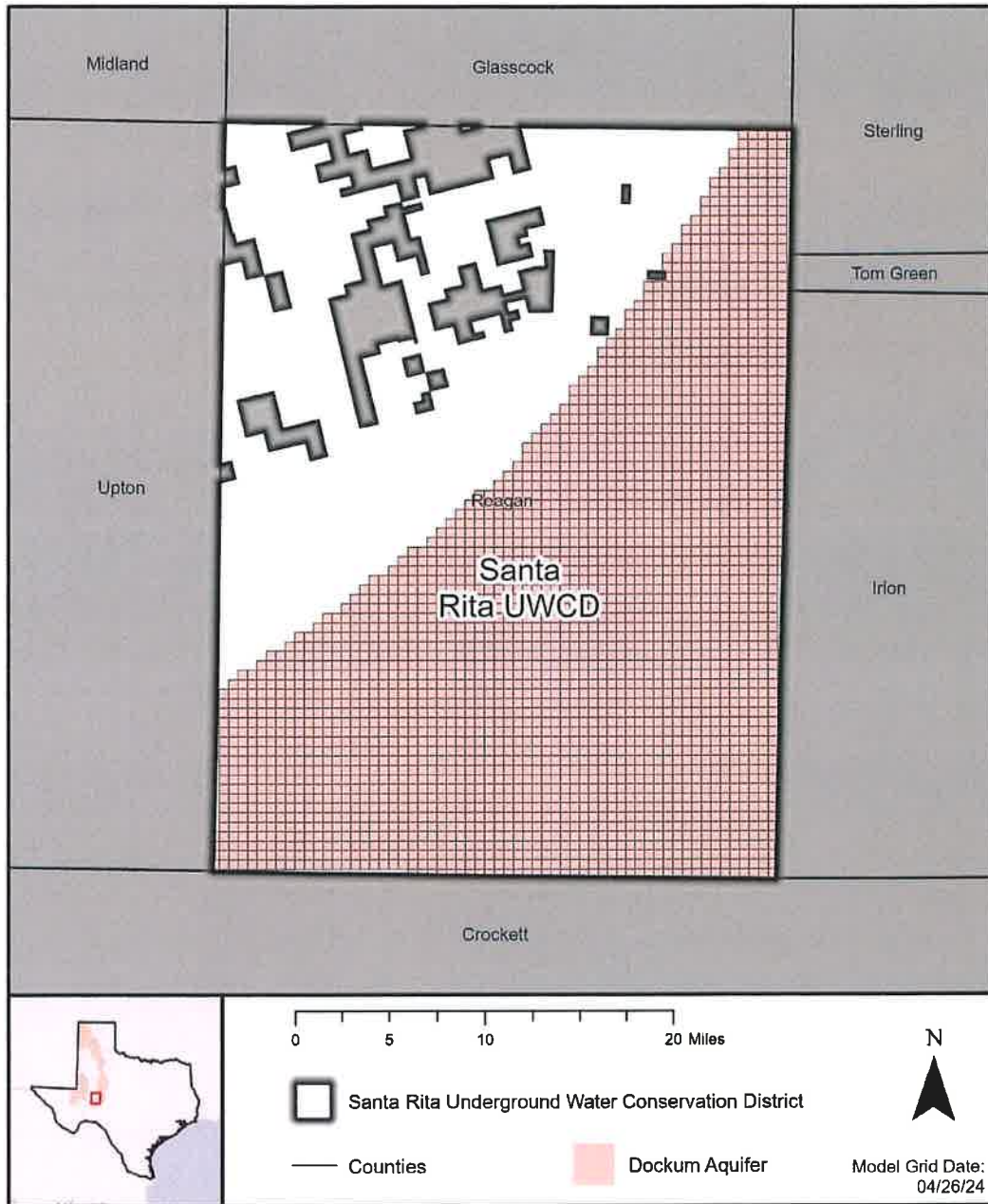
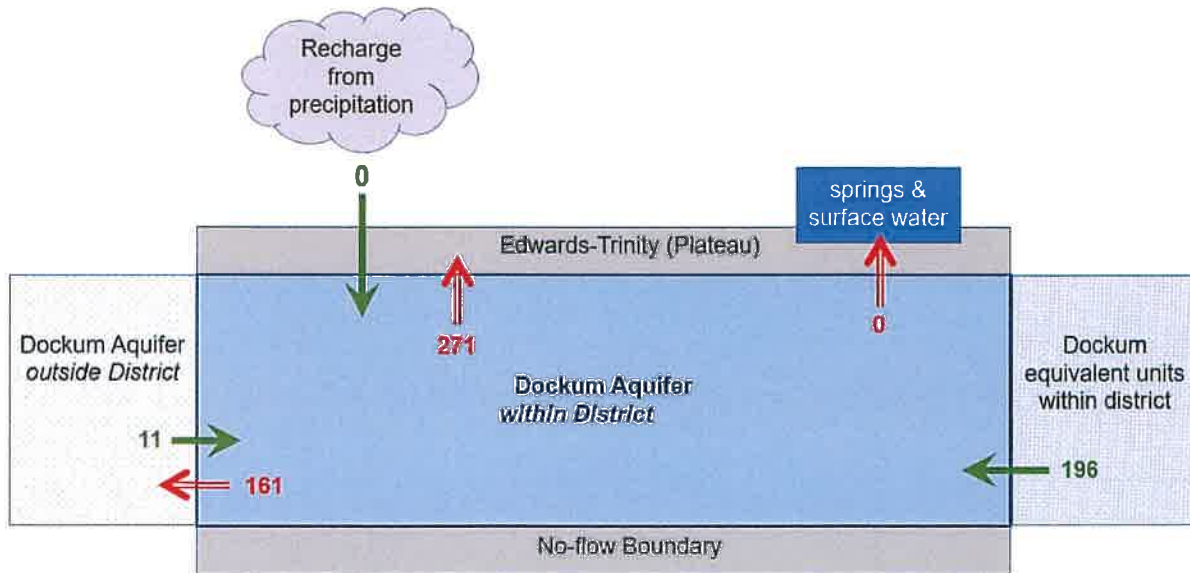


Figure 3: Area of the groundwater availability model for the High Plains Aquifer System from which the information in Table 2 was extracted (the Dockum Aquifer extent within the district boundary).

Santa Rita Underground Water Conservation District
 Part 2 – Data Required for Management Plan
 November 15, 2024



Caveat: This diagram only includes the water budget items provided in Table 2. A complete water budget would include additional inflows and outflows. For a full groundwater budget, please submit a request in writing to the Groundwater Modeling Department.

Figure 4: Generalized diagram of the summarized budget information from Table 2, representing directions of flow for Dockum Aquifer within the Santa Rita Underground Water Conservation District. Flow values are expressed in acre-feet per year.

LIMITATIONS

The groundwater models used in completing this analysis are the best available scientific tools 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 historical pumping is as important as evaluating the volume of groundwater flow into and out of the district, between aquifers within the district (as applicable), interactions with surface water (as applicable), recharge to the aquifer system (as applicable), and other metrics that describe the impacts of that pumping. In addition, assumptions regarding precipitation, recharge, and interaction with streams are specific to particular historic time periods.

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

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

REFERENCES

- Anaya, R., and Jones, I., 2009, Groundwater Availability Model for the Edwards-Trinity (Plateau) and Pecos Valley Aquifers of Texas: Texas Water Development Board Report 373, 103 p., www.twdb.texas.gov/groundwater/models/gam/eddt_p/ET-Plateau_Full.pdf.
- Deeds, N.E., and Jigmond, M., 2015, Numerical model report for the High Plains Aquifer System groundwater availability model, 640 p., http://www.twdb.texas.gov/groundwater/models/gam/hpas/HPAS_GAM_Numerical_Report.pdf.
- Jones, I., 2017, GAM Run 17-002: Santa Rita Underground Water Conservation, Management Plan 13 p., www.twdb.texas.gov/groundwater/docs/GAMruns/GR17-002.pdf.
- Harbaugh, A. W., and McDonald, M.G., 1996, User's documentation for MODFLOW-96, an update to the U.S. Geological Survey modular finite-difference ground-water flow model: U.S. Geological Survey Open-File Report 96-485, 56 p., water.usgs.gov/software/MODFLOW-96/
- Harbaugh, A. W., 2009, Zonebudget Version 3.01, A computer program for computing subregional water budgets for MODFLOW ground-water flow models, U.S. Geological Survey Groundwater Software., water.usgs.gov/nrp/gwsoftware/zonebud3/zonebudget3.html.
- National Research Council, 2007, Models in Environmental Regulatory Decision Making Committee on Models in the Regulatory Decision Process, National Academies Press, Washington D.C., 287 p., www.nap.edu/catalog/11972/models-in-environmental-regulatory-decision-making.
- Niswonger, R. G., Panday, S., and Ibaraki, M., 2011, MODFLOW-NWT, A Newtonian formulation for MODFLOW-2005: U.S. Geological Survey Techniques and Methods 6-A37, 44 p.
- Texas Water Code § 36.1071

Appendix D

Resolutions Adopting the Management Plan

Santa Rita Underground Water Conservation District

P.O. Box 849

Big Lake, TX 76932

Phone: 325-884-2893

Fax: 325-884-2445

Email: srwcdist@verizon.net

Adoption of 2025-2030 SRUWCD Management Plan

WHEREAS, the Santa Rita Underground Water Conservation District (the District) was created by Acts of the 71st Legislature under the authority of Section 59, Article XVI, of the Texas Constitution and in accordance with Chapter 36 of the Texas Water Code (Water Code), by the District Act of May 24, 1989, 71st Legislature, Regular Session, Chapter 653 (Senate Bill 1634).

WHEREAS, the District is required by Chapter 36, §36.1071 of the Texas Water Code to develop and adopt a Management Plan; and

WHEREAS, the District is required by Chapter 36, §36.1072 of the Texas Water Code to review and re-adopt the plan with or without revisions at least once every five years and to submit the adopted Management Plan to the Executive Administrator of the Texas Water Development Board for review and approval; and

WHEREAS, the District's readopted revised Management Plan shall be approved by the Executive Administrator if the plan is administratively complete; and

WHEREAS, the District Board of Directors, after reviewing the existing Management Plan, has determined that this plan should be revised and replaced with a new 5-Year Management Plan expiring in 2030; and

WHEREAS, the District Board of Directors has determined that the 5-Year Management Plan addresses the requirements of Chapter 36, §36.1071.

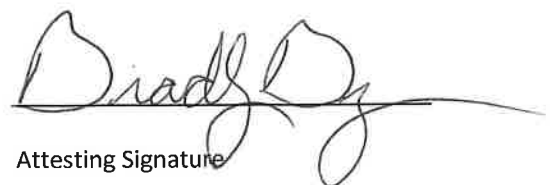
NOW, THEREFORE, be it resolved that the Board of Directors of the Santa Rita Underground Water Conservation District, following notice and hearing, hereby adopts this 5-Year Management Plan; and

FURTHER, be it resolved, that this new Management Plan shall become effective immediately upon adoption

Adopted this 18th day of March, 2025 by the Board of Directors of the Santa Rita Underground Water Conservation District.



Presiding Officer



Attesting Signature

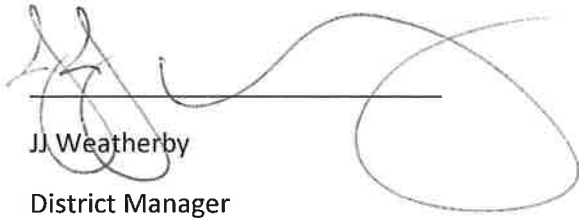
Appendix E

EVIDENCE OF NOTICE AND HEARING

**NOTICE OF PUBLIC HEARING AND MEETING OF THE SANTA RITA UNDERGROUND WATER
CONSERVATION DISTRICT (SRUWCD)**

A **PUBLIC HEARING and MEETING** of the Board of Directors will be held at **5:00PM** on the **18th** day of **March, 2025**, in the Santa Rita Underground Water Conservation District Office, **108 Hwy 67 West, Big Lake, TX 76932**. The purpose of this hearing is to accept public comments on the proposed 2025-2030 SRUWCD Management Plan. Copies of the proposed 2025-2030 SRUWCD Management Plan can be found on the District homepage at <https://www.santaritauwcd.org/> or can be obtained by contacting the District office at 325-884-2893 or srwcdist@verizon.net. Written comments will be accepted through March 17, 2025 by mail, email or hand delivery. The mailing address is PO Box 849, Big Lake, TX 76932. The public may provide oral comments at the March 18, 2025 public hearing.

The **REGULAR** meeting of the Santa Rita Underground Water Conservation District meeting will convene following the **PUBLIC HEARING** on the **18th** day of **March, 2025** at the SRUWCD Office at 108 HWY 67 West, Big Lake, TX 76932



JJ Weatherby
District Manager

FILED at 12:57 PM
Reagan County

MAR 11 2025

Tammy Hodge
County and District Clerk
By [Signature] Dep

PUBLIC NOTICE

NOTICE OF PUBLIC HEARING AND MEETING OF THE SANTA RITA UNDERGROUND WATER CONSERVATION DISTRICT (SRUWCD)

A PUBLIC HEARING and MEETING of the Board of Directors will be held at 5:00PM on the 18th day of March, 2025, in the Santa Rita Underground Water Conservation District Office, 108 Hwy 67 West, Big Lake, TX 76932. The purpose of this hearing is to accept public comments on the proposed 2025-2030 SRUWCD Management Plan. Copies of the proposed 2025-2030 SRUWCD Management Plan can be found on the District homepage at <https://www.santaritauwcd.org/> or can be obtained by contacting the District office at 325-884-2893 or snwcdist@verizon.net. Written comments will be accepted through March 17, 2025 by mail, email or hand delivery. The mailing address is PO Box 849, Big Lake, TX 76932. The public may provide oral comments at the March 18, 2025 public hearing.

The REGULAR meeting of the Santa Rita Underground Water Conservation District meeting will convene following the PUBLIC HEARING on the 18th day of March, 2025 at the SRUWCD Office at 108 HWY 67 West, Big Lake, TX 76932

J.J. Weatherby
District Manager

Appendix F

District Boundaries

