TEXAS WATER DEVELOPMENT BOARD

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

December 18, 2024

Kathy Nelson
Secretary
Garza County Underground Water Conservation District
300 West Main Street
Post, TX 79356

Dear Ms. Nelson:

The purpose of this letter is to notify you that the groundwater management plan for the Garza County Underground Water Conservation District required by Texas Water Code § 36.1072 is administratively complete in accordance with Texas Water Code § 36.1071(a) and (e). The policies, plans, and opinions in the groundwater management plan represent those of the District and not those of the Texas Water Development Board.

We received the groundwater management plan for the administrative completeness review on November 20, 2024, and it was approved on December 18, 2024. Included with this letter is your District Groundwater Management Plan Certificate of Administrative Completeness.

Thank you for participating in this effort and contributing to the future of groundwater conservation and management in the state of Texas. Your next five-year management plan is due on December 18, 2029.

If you have any questions or concerns, please contact Stephen Allen of our Groundwater Technical Assistance Department at 512-463-7317 or stephen.allen@twdb.texas.gov.

Sincerely,

Kathleen Ligon (Dec 20, 2024 09:46 CST)

Bryan McMath
Executive Administrator

Enclosure

c w/o enc.: Stephen Allen, P.G., Groundwater
Robert Bradley, P.G., Groundwater
Abiy Berehe, P.G., Texas Commission on Environmental Quality
Peggy Hunka, P.G., Texas Commission on Environmental Quality
Kory Talcott, Texas Commission on Environmental Quality

GARZA COUNTY UNDERGROUND WATER CONSERVATION DISTRICT

GROUNDWATER MANAGEMENT PLAN

2024-2029

INDEX

PERIOD FOR THIS PLAN 2024-2029

This plan becomes effective upon approval by the Texas Water Development Board after Adoption by the District Board of Directors and remains in effect until 2029, or for a period of five years, whichever is later. This plan may be revised at any time, or after five years when the plan will be reviewed to ensure that it is consistent with the applicable Regional Water Plan and the State Water Plan.

GARZA COUNTY UNDERGROUND WATER CONSERVATION DISTRICT DISTRICT MISSION

The overall objective of the District is the conservation, preservation, recharge and enhancement of the ground water supplies with the boundaries of the District; also to make wise and beneficial use of the resource for the benefit of the citizens and economy of the District. To accomplish these goals, the District plans to implement a program to monitor both the quantity & quality of these water supplies and also to promote a brush control program for the District.

STATEMENT OF GUIDING PRINCIPLES

The Garza County Underground Water Conservation District is created and organized under the term and provisions of Section 59, Article XVI, Texas Constitution, and Chapter 188 of the House Bill 846, including all amendments and additions, of the 74th Legislature. The District has all the rights, powers, privileges, authority, functions and duties provided by the general law of the state, including Chapter 36 (formerly Chapter 52) of the Texas Water Code, Vernon's Texas Codes Annotated, applicable to underground water conservation districts created under Section 59, Article XVI, Texas Constitution.

The District recognizes that the groundwater resources of the region are of vital importance to the residents of the District and that this resource must be managed and protected from contamination and waste. The rules and regulations of the District will be implemented and enforced to accomplish these objectives.

LOCATION AND EXTENT

The boundaries of the Garza County UWCD are coextensive with the boundaries of Garza County, Texas, which lies in the southern part of the High Plains of Texas. About one fourth of the District lies above the Caprock escarpment while the rest of the District, including the principal city of Post, lies below the Caprock.

GROUNDWATER RESOURCE

The Ogallala Aquifer is located in the western part of the District, extending from the northwestern corner to the southwest corner, mainly being in the area above the Caprock. Water from the aquifer is principally used for irrigation and rural domestic and livestock needs.

The Dockum Aquifer is located in the northern and northeastern parts of the District and extends along the eastern edge to the southeast corner. Water from the aquifer is used for mining, irrigation, livestock and household use.

The Edwards-Trinity High Plains Aquifer lies along the western edge of the District, extending from the northwest corner to the southwest corner. Water from the aquifer is used namely for irrigation and domestic household needs.

SURFACE WATER RESOURCES OF GARZA COUNTY UWCD

There are no surface water impoundments in the District, except for livestock consumption, which could possibly require conjunctive management. At the present time, Garza County UWCD has no jurisdiction over any surface water projects. Likewise, no agency which regulates surface water, has the authority to manage groundwater within the territory of this District.

Lake Alan Henry and proposed Post Reservoir are within the boundaries of Garza County UWCD, but the District has no jurisdiction over these lakes.

Lake Alan Henry Water District was formed during the Texas 78th Legislature to manage the surface water of Lake Alan Henry.

Estimate of Modeled Available Groundwater Based on Desired Future Conditions

Refer to: GAM Run – 21-008 MAG Appendix C
GAM Run – 21-008 MAG Addendum Appendix C

Estimate of amount of groundwater being used annually

Refer to: TWDB Estimated Historical Water Use and 2022 Texas State Water Plan Datasets
Appendix A

Estimated annual amount of recharge from precipitation to groundwater resource.

Refer to: GAM Run 24-004 Table 1-3 Appendix B

Estimated annual volume of water that discharges from the aquifer to springs and any surface water bodies.

Estimate of annual volume of flow:

a) Into the District within each aquifer
b) Out of the District within each aquifer
c) Between aquifers in the District

Refer to: GAM Run 24-004 Table 1-3 Appendix B

Estimate of projected surface water supplies within the District according to the most recently adopted State Water Plan.

Refer to: TWDB Estimate Historical Water Use and 2022 State Water Plan Datasets
Appendix A

Estimate of projected total demand for water within the District according to the most recently adopted State Water Plan

Refer to: TWDB Estimated Historical Water Use and 2022 State Water Plan Datasets
Appendix A

Water supply needs for the adopted State Water Plan.

There are no water supply needs.
Refer to: TWDB Estimated Historical Water Use and 2022 State Water Plan Datasets
Appendix A

Water management strategies from the adopted State Water Plan

There are no water management strategies.

Refer to: TWDB Estimated Historical Water Use and 2022 State Water Plan Datasets
Appendix A

Enhancement of Recharge and Availability

The District supports brush control as a management practice to maintain and improve ground water supplies in the District and region. Recharge of aquifers is achieved through rainfall and can be enhanced by the control of brush, mainly Mesquite and Juniper, which would decrease the demand of groundwater in the District and region. Benefits would include more groundwater availability, increase productivity of rangeland, increased spring flow and increased amount of moisture available to infiltrate as recharge.

Mesquite

There are approximately 430,000 acres in Garza County which are infested with Mesquite. There are a total of 440,000 acres of rangeland in this county. Researchers estimate that a Mesquite tree uses up to 15 gallons/day/tree during the growing season. This rate will vary based on the size of tree. Our counts have ranged from approximately 50 trees to 450 trees per acre where producers have signed up to control Mesquite. This is a perpetual management problem and an ongoing project.

Redberry Juniper

There are approximately 72,000 acres in Garza County which are infested with Juniper. This estimate is based on the acres of Rough Breaks and Mobeeti-Potter(very shallow) soil types.

Researchers estimate that a large Redberry Juniper uses up to 32 gallons of water per day. This also will vary based on the size of the tree.

Salt Cedar

There are approximately 3,000 acres in Garza County which are infested with Salt Cedar. This estimate is based on measuring the lengths of the five major streams in the county and 100 feet on each side of the streams. Researchers estimate that a large Salt Cedar uses up to 200 gallons of water per day during the growing season. This is a perpetual management problem and an ongoing project.

Source of this data: Natural Resources Conservation Services (NRCS)

Desired Future Conditions

In a joint planning session with other members of the Groundwater Management Area #2, the Garza County UWCD adopted Desired Future Conditions (DFC), for the District for relevant aquifers: Ogallala, Edwards-Trinity (High Plains) and the Dockum. Based on the 50-year planning horizon, the average allowable drawdown for Garza County UWCD would be 40 feet. This would be an average of 0.8 feet per year. The District proposes to calculate the cumulative drawdown every 5 years and make any changes necessary to conform to allowable drawdown of DFCs.

Refer to GAM Run 21-008 Addendum Table 1 Appendix C

MANAGEMENT OF GROUNDWATER SUPPLIES

The District will manage the supply of groundwater within the District in order to conserve the resource while seeking to maintain the economic viability of all resource user groups, public and private. In consideration of the economic and cultural activities occurring within the District, the District will identify and engage in such activities and practices, that if implemented would result in a reduction of groundwater use. The District will make a regular assessment of water supply and groundwater storage conditions and will report those conditions to the Board and to the public. The District will undertake, as necessary, and co-operate with investigations of the groundwater resources within the District and will make the results of investigations available to the public upon adoption by the Board.

The District will adopt rules to regulate groundwater withdrawals by means of well spacing and production limits. The district may deny a well construction permit or limit groundwater withdrawals in accordance with the guidelines stated in the rules of the District. In making a determination to deny a permit or limit groundwater withdrawals, the District will consider the public benefit against individual hardship after considering all appropriate testimony.

The relevant factors to be considered in making a determination to deny a permit or limit groundwater withdrawals will include:

(1) The purpose of the rules of the District
(2) The equitable distribution of the resource
(3) The economic hardship resulting from grant or denial of a permit or the terms prescribed by the permit

ACTIONS, PROCEDURES, PERFORMANCE AND AVOIDANCE FOR PLAN IMPLEMENTATION

The District will implement the provisions of this plan and will utilize the provisions of this plan TRACKING METHODOLOGY of the District, all agreements entered into by the District and any additional planning efforts in which the District may participate, will be consistent with the provision of this plan.

The District will adopt and amend as necessary rules relating to the permitting of wells and the production of groundwater. The rules adopted by the District shall be pursuant to Texas Water Code (TWC) Chapter 36 and the provisions of this plan. All rules will be adhered to and enforced The promulgation and enforcement of the rules will be based on the best technical evidence available.

The District shall treat all citizens with equality. Citizens may apply to the District for discretion in enforcement of the rules on grounds of adverse economic effect or unique local character. In granting of discretion to any rules, 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. All activities of the District will be undertaken in cooperation and coordination with the appropriate state, regional or local water management entity.

COORDINATION WITH REGIONAL WATER PLAN

The Garza County Underground Water Conservation District Groundwater Management Plan will coordinate with both the Regional and State Water Plans.

TRACKING METHODOLOGY

The District manager will prepare an annual report on District performance to ensure that management goals and objectives are being achieved. This report will be presented yearly, to

the Board of Directors during their regular business meeting in October and this report will be maintained on file at the District office.

Rules for Garza County UWCD can be found at this link:
https://www.garzacounty.net/page/uwcd.county.programs

GOALS, MANAGEMENT OBJECTIVES AND PERFORMANCE STANDARDS

Goal 1.0 -Providing for the most efficient use of groundwater within the District

Management Objective: Each year, the District will provide available educational information on water conservation to the public within the District by at least one of the following methods: articles in the District newsletter, local newspaper articles, NRCS and FSA newsletters, Extension Service newsletters or any other publications available.

Performance Standard: The number of articles, newsletters or other publications on the efficient use of groundwater in various publications within the District, as information becomes available, will be reported in the annual report to the District Board.

Goal 2.0-Controlling and Preventing the Waste of Groundwater within the District

Management Objective: Each year, the District will investigate 100 percent of reported wasteful irrigation practices with the District. The District will seek remediation on 100 percent of sites deemed a wasteful practice. The District will make diligent searches to identify wasteful irrigation practice within the district annually.

Performance Standards:

(A) The District will investigate 100 percent of reported wasteful irrigation practices and seek remediation on 100 percent of wasteful practice sites occurring within the district.

(B) The number of wasteful irrigation practices reported to the district and the number of investigations by the District will be included in the annual report to the District Board.

(C) The number of diligent searches for wasteful irrigation practice in the District that were carried out by District personnel will be reported in the annual report to the District Board.

Goal 3.0-Addressing Drought conditions

Management Objective: Addressing the effects of drought due to climatic or other conditions upon all water resource user groups.

Performance Standards:

(A) The District will check water table levels in twenty (20) wells in January of each year, and report those findings to the board in April of each year. The District will monitor pumping rates to determine water supply availability.

(B) Publish change in water levels in at least one newsletter or at least one newspaper each year.

(C) Inform the public about water shortages and stress water saving techniques during peak water usage periods each year through at least one newspaper article or at least one newsletter.

For more information on Drought Conditions click on
http://waterdatafortexas.org/drought

Goal 4.0- Addressing Conservation

Management Objective: Each year, at the beginning of the irrigation season, and during the heavy irrigation period, the District will provide information to the producers through NRCS newsletters and local media.

Performance Standards: The District will publish at least one article each year about water conservation techniques.

Goal 5.0- Addressing Rainwater Harvesting

Management Objective: The District will publish at least one article each year about rainwater harvesting.

Performance Standard: The number of rainwater harvesting information articles published each year in the local newspaper or newsletters.

Goal 6.0- Brush Control

Management Objective: The District will publish at least one article each year on the benefits of brush control.

Performance Standard: the number of brush control information articles published each year in the local newspaper or newsletters.

Goal 7.0- Addressing the Desired Future Conditions of the Groundwater Resources in the District.

Desired Future Conditions (DFCs) were adopted for the District in August, 2010. Based on the 50-year planning horizon, the allowable drawdown for the District would be 40 feet, or an average of 0.8 feet per year.

Management Objective: the District will publish at least one article each year on the status of Desired Future Conditions.

Performance Standards:

(A) The District will check water table levels in 20 wells in January of each year and monitor pumping rates to determine water supply availability. In addition, the District will check water table levels every five (5) years for cumulative drawdown to determine if DFCs are met.

(B) Publish results of water table level checks in at least one newsletter or one newspaper each year on the results.

Goal 8 .0- Addressing natural resource issues that impact the use and availability of groundwater and which are impacted by the use of groundwater.

Management Objective:

Prevent contamination/pollution of the aquifers from other natural resources being produced within the District.

Performance Standard:

A. The District will post advisements annually advising how to plug or cap abandoned wells to prevent natural resources from being contaminated or polluted. The District will refer to TCEQ's Regulatory Guidance for Landowner's Guide to Plugging Abandoned Water Wells.

There are no endangered species in our District effected by the pumping of ground water. The Districts' oil & gas and limited mining use reprocessed water or surface water. Plants and animal life are not affected by groundwater pumping.

MANAGEMENT GOALS DETERMINED NOT APPLICABLE

Goal 1.0- Controlling and preventing subsidence

This management goal is not applicable to the operations of the District. In the Garza County Underground Water District, there is no evidence of subsidence according to the definition we have. Such as, damage occurring to buildings, roads, canals and other infrastructures. Also, there is no evidence of ground leveling, surface elevation changes or increased flood risk due to elevation changes. Subsidence due to ground pumping is not evident. The vulnerability to subsidence of the major and minor aquifers in Garza County is very low. Review of map Figure 4.33, Figure 4.80 and Figure 4.86, show a medium risk for subsidence. Garza County UWCD will keep this in mind for the future.

Refer to pages 4-55, 4-126 and 4-133 found on pages 14-16 of the groundwater management plan.

Goal 2.0- Addressing conjunctive surface water management issues

This management goal is not applicable to the operations of the District. This District has no involvement with surface water.

Goal 3.0- Addressing recharge enhancement

This management is not cost effective to the District.
This goal is not applicable to the operations of the District.

Goal 4.0-Addressing precipitation enhancement

This management is not cost effective to the District.
This goal is not applicable to the operation of the District.

SUMMARY DEFINITIONS:

"Abandoned Well" shall mean:

1) A well or borehole, the condition of which is causing or is likely to cause pollution of groundwater in the District.

A well is considered to be in use in the following cases:

A) A well which contains the casing, pump and pump column in good condition, or
B) A well in good condition which has been capped.

2) A well or borehole which is not in compliance with the applicable law, including the Rules and Regulations of the District, the Texas Water Driller's Act, Texas Commission on Environmental Quality or any other state or federal agency, or political subdivision having jurisdiction, if presumed to be an abandoned or deteriorated well.

"Board"- The Board of Directors of the Garza County Underground Water Conservation District

"District"- The Garza County Underground Water Conservation District

"TCEQ"- Texas Commission on Environmental Quality

"TWDB"- Texas Water Development Board

"Waste" as defined by Chapter 36 of the Texas Water Code

Means any one or more of the following:

(1) Withdrawal of ground water from a ground water reservoir at a rate and in an amount that causes or threatens to cause intrusion into the reservoir of water unsuitable for agricultural, gardening, domestic or stock raising purposes;
(2) The flowing or producing of wells from a groundwater reservoir if the water produced is not used for a beneficial purpose:
(3) Escape of groundwater from groundwater reservoir to any other reservoir or geologic strata that does not contain groundwater;
(4) Pollution or harmful alteration of groundwater in a groundwater reservoir by saltwater or by other deleterious matter admitted from another stratum or from the surface of the ground;
(5) Willfully or negligently causing suffering, or allowing groundwater to escape into any river, creek, natural watercourse, depression, lake, reservoir, drain, sewer, street, highway, road or road ditch, or into any land other than that of the owner of the well, unless such discharge is authorized by permit, rule or order issued by the Commission under Chapter 26.
(6) Groundwater pumped for irrigation that escapes as irrigation tailwater into land other than that of the owner of the well, unless permission has been granted by the occupant of the land receiving the discharge; or
(7) For water produced from an artesian well, "waste" has the meaning assigned by Section 11.205.

APPENDIX

A

Estimated Historical Groundwater Use And 2022 State Water Plan Datasets:

Garza County Underground Water Conservation District

Texas Water Development Board
Groundwater Division
Groundwater Technical Assistance Section
stephen.allen@twdb.texas.gov
(512) 463-7317
June 22, 2024

GROUNDWATER MANAGEMENT PLAN DATA:

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

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

The five reports included in this part are:

1. Estimated Historical Groundwater Use (checklist item 2)

   from the TWDB Historical Water Use Survey (WUS)

2. Projected Surface Water Supplies (checklist item 6)
3. Projected Water Demands (checklist item 7)
4. Projected Water Supply Needs (checklist item 8)
5. Projected Water Management Strategies (checklist item 9)

   from the 2022 Texas State Water Plan (SWP)

Part 2 of the 2-part package is the groundwater availability model (GAM) report for the District (checklist items 3 through 5). The District should have received, or will receive, this report from the Groundwater Availability Modeling Section. Questions about the GAM can be directed to Grayson Dowlearn, grayson.dowlearn@twdb.texas.gov, (512) 475-1552.

DISCLAIMER:

The data presented in this report represents the most up to date WUS and 2022 SWP data available as of 6/22/2024. Although it does not happen frequently, either of these datasets are subject to change pending the availability of more accurate WUS data or an amendment to the 2022 SWP. District personnel must review these datasets and correct any discrepancies to ensure approval of their groundwater management plan.

The WUS dataset can be verified at this web address:

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

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

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

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

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

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

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

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

Groundwater and surface water historical use estimates are currently unavailable for calendar year 2020. TWDB staff anticipates the calculation and posting of these estimates at a later date.

GARZA COUNTY

100% (multiplier)

All values are in acre-feet

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2019	GW	62	0	2	0	11,407	44	11,515
	SW	623	0	0	0	75	177	875
2018	GW	91	0	8	0	11,922	44	12,065
	SW	521	0	0	0	75	177	773
2017	GW	101	0	0	0	10,730	43	10,874
	SW	603	0	0	0	0	172	775
2016	GW	105	0	0	0	11,801	26	11,932
	SW	610	0	0	0	0	104	714
2015	GW	118	0	0	0	8,984	26	9,128
	SW	626	0	0	0	0	102	728
2014	GW	86	0	10	0	9,832	25	9,953
	SW	516	0	0	0	0	102	618
2013	GW	128	0	11	0	11,384	30	11,553
	SW	0	0	0	0	0	121	121
2012	GW	174	0	0	0	11,659	41	11,874
	SW	0	2	0	0	0	163	165
2011	GW	185	0	0	0	11,535	63	11,783
	SW	767	2	0	0	0	252	1,021
2010	GW	149	0	95	0	7,354	60	7,658
	SW	599	2	22	0	0	242	865
2009	GW	145	0	138	0	15,028	60	15,371
	SW	589	2	32	0	0	238	861
2008	GW	142	0	181	0	8,883	53	9,259
	SW	588	2	42	0	0	210	842
2007	GW	127	0	0	0	14,502	53	14,682
	SW	559	2	0	0	0	210	771
2006	GW	140	0	0	0	11,515	49	11,704
	SW	614	2	0	0	0	197	813
2005	GW	129	0	0	0	11,784	43	11,956
	SW	874	2	0	0	0	170	1,046
2004	GW	123	0	0	0	13,257	22	13,402
	SW	664	2	0	0	0	198	864

Projected Surface Water Supplies
TWDB 2022 State Water Plan Data

GARZA COUNTY

100% (multiplier)

All values are in acre-feet

RWPG	WUG	WUG Basin	Source Name	2020	2030	2040	2050	2060	2070
O	County-Other, Garza	Brazos	Alan Henry Lake/Reservoir	25	25	25	25	25	25
O	Post	Brazos	Brazos Run-of-River	0	0	0	0	0	0
	Sum of Projected Surface Water Supplies (acre-feet)			**25**	**25**	**25**	**25**	**25**	**25**

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.

GARZA COUNTY

100% (multiplier)

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
O	County-Other, Garza	Brazos	135	128	125	126	129	133
O	Irrigation, Garza	Brazos	10,353	10,353	10,353	10,353	10,353	10,353
O	Livestock, Garza	Brazos	148	155	162	170	179	181
O	Manufacturing, Garza	Brazos	2	2	2	2	2	2
O	Mining, Garza	Brazos	395	544	438	334	234	164
O	Post	Brazos	792	827	860	884	927	964
	Sum of Projected Water Demands (acre-feet)		**11,825**	**12,009**	**11,940**	**11,869**	**11,824**	**11,797**

Projected Water Supply Needs
TWDB 2022 State Water Plan Data

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

GARZA COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
O	County-Other, Garza	Brazos	36	43	46	45	42	38
O	Irrigation, Garza	Brazos	4,675	4,267	3,014	2,276	1,799	1,474
O	Livestock, Garza	Brazos	36	29	22	14	5	3
O	Manufacturing, Garza	Brazos	0	0	0	0	0	0
O	Mining, Garza	Brazos	149	0	106	210	310	380
O	Post	Brazos	172	137	104	80	37	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

APPENDIX

B

GAM Run 24-004: Garza County Underground Water Conservation District Groundwater Management Plan

Saheli Majumdar, Ph.D. and Shirley Wade, Ph.D., P.G.
Texas Water Development Board
Groundwater Division
Groundwater Modeling Department
512-936-6079
March 14, 2024

Shirley C. Wade
3/14/2024

GAM Run 24-004: Garza County Underground Water Conservation District Groundwater Management Plan

Saheli Majumdar, Ph.D. and Shirley Wade, Ph.D., P.G.
Texas Water Development Board
Groundwater Division
Groundwater Modeling Department
512-936-6079
March 14, 2024

EXECUTIVE SUMMARY

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

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

The groundwater management plan for the Garza County Underground Water Conservation District should be adopted by the district on or before June 20, 2024 and submitted to the Executive Administrator of the TWDB on or before July 20, 2024. The current management plan for the Garza County Underground Water Conservation District expires on September 18, 2024.

The management plan information for the aquifers within Garza County Underground Water Conservation District was extracted from the groundwater availability model for the High Plains Aquifer System (Deeds and Jigmond, 2015).

This report replaces the results of GAM Run 19-001 (Anaya, 2019). 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.

Tables 1 through 3 summarize the groundwater availability model data required by statute. Figures 1, 3, and 5 show the area of the models from which the values in Tables 1 through 3 were extracted. Figures 2, 4, and 6 provide a generalized diagram of the groundwater flow components provided in Tables 1 through 3. If the Garza County 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.

METHODS

In accordance with the provisions of the Texas Water Code, Section 36.1071(h), the groundwater availability model of the High Plains Aquifer System was used to estimate information for the Garza County Underground Water Conservation District management plan. Water budgets were extracted for the historical model period (1980 through 2012) using ZONEBUDGET Version 3.01 (Harbaugh, 2009). The average annual water budget values for recharge, surface-water outflow, inflow to the district, and outflow from the district for the aquifers within the district are summarized in this report.

PARAMETERS AND ASSUMPTIONS

Groundwater availability model for the High Plains Aquifer System

- We used version 1.01 of the groundwater availability model for the High Plains Aquifer System to analyze the Ogallala, Edwards-Trinity (High Plains), and Dockum aquifers. See Deeds and Jigmond (2015) for assumptions and limitations of the model.
- The groundwater availability model for the High Plains Aquifer System contains the following four layers:
    - Layer 1 represents the Ogallala and Pecos Valley aquifers
    - Layer 2 represents the Rita Blanca Aquifer and Edwards-Trinity (High Plains & Plateau) aquifers
    - Layer 3 represents the upper Dockum Aquifer
    - Layer 4 represents the lower Dockum Aquifer

- The model was run with MODFLOW-NWT (Niswonger and others, 2011).
- Water budgets for the district were determined for the Ogallala Aquifer (Layer 1), the Edwards-Trinity (High Plains) Aquifer (Layer 2) and the Dockum Aquifer (Layers 3 and 4).
- Water budget terms were averaged for the period from 1980 through 2012.

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 aquifers located within the Garza County Underground Water Conservation District and averaged over the historical calibration period, as shown in Tables 1 through 3.

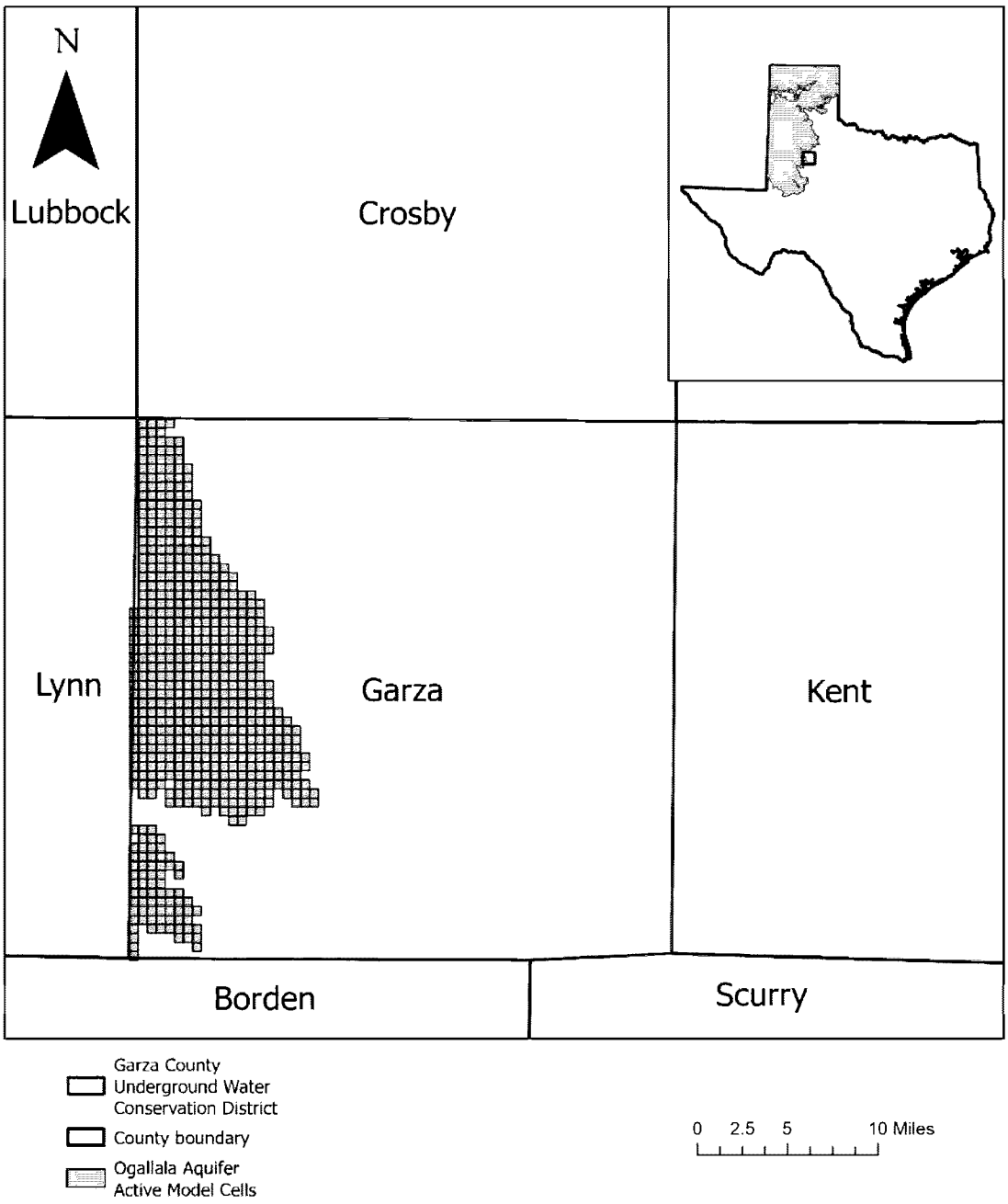
1. Precipitation recharge—the areally distributed recharge sourced from precipitation falling on the outcrop areas of the aquifers (where the aquifer is exposed at land surface) within the district.
2. Surface-water outflow—the total water discharging from the aquifer (outflow) to surface-water features such as streams, reservoirs, and springs.
3. Flow into and out of the 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 through 3. Figures 1, 3, and 5 show the area of the model from which the values in Tables 1 through 3 were extracted. Figures 2, 4, and 6 provide a generalized diagram of the groundwater flow components provided in Tables 1 through 3. It is important to note that sub-regional water budgets are not exact. This is due to the size of the model cells and the approach used to extract data from the model.

To avoid double accounting, a model cell that straddles a political boundary, such as a district or county boundary, is assigned to one side of the boundary based on the location of the centroid of the model cell. For example, if a cell contains two counties, the cell is assigned to the county where the centroid of the cell is located.

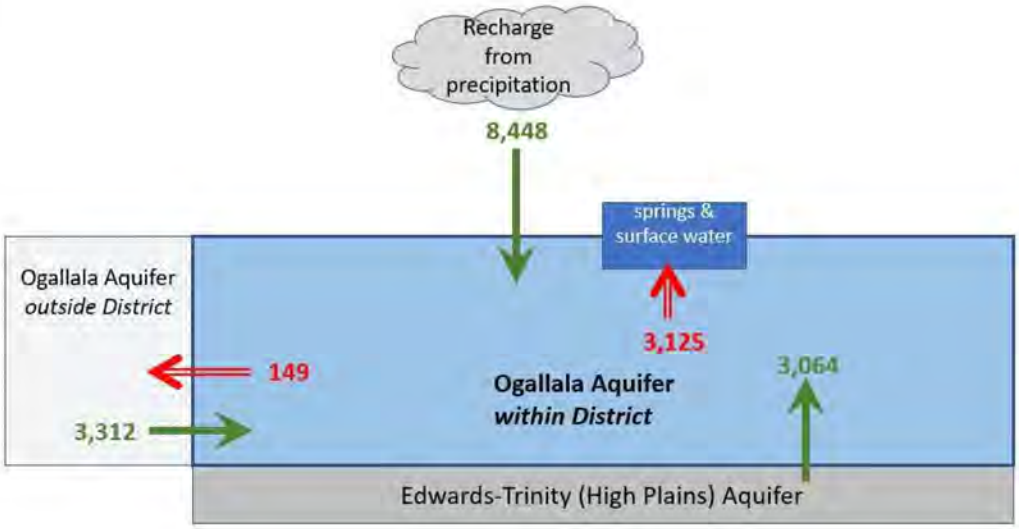
Table 1: Summarized information for the Ogallala Aquifer that is needed for the Garza County Underground Water Conservation District's groundwater management plan. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot.

Management plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Ogallala Aquifer	8,448
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams and rivers	Ogallala Aquifer	3,125
Estimated annual volume of flow into the district within each aquifer in the district	Ogallala Aquifer	3,312
Estimated annual volume of flow out of the district within each aquifer in the district	Ogallala Aquifer	149
Estimated net annual volume of flow between each aquifer in the district	To Ogallala Aquifer from Edwards-Trinity (High Plains) Aquifer	3,064



county boundary date: 01/19/2024, gcd boundary date: 01/26/2024, hpas grid date: 10/31/2023

Figure 1: Area of the groundwater availability model for the High Plains Aquifer System from which the information in Table 1 was extracted (the Ogallala Aquifer extent within the district boundary).



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 Ogallala Aquifer within Garza County Underground Water Conservation District. Flow values are expressed in acre-feet per year.

Table 2: Summarized information for the Edwards Trinity (High Plains) Aquifer that is needed for the Garza County Underground Water Conservation District's groundwater management plan. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot.

Management plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Edwards-Trinity (High Plains) Aquifer	0
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams and rivers	Edwards-Trinity (High Plains) Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Edwards-Trinity (High Plains) Aquifer	3,700
Estimated annual volume of flow out of the district within each aquifer in the district	Edwards-Trinity (High Plains) Aquifer	45
Estimated net annual volume of flow between each aquifer in the district	From Edwards-Trinity (High Plains) Aquifer to Ogallala Aquifer	3,064
	From Edwards-Trinity (High Plains) Aquifer to Dockum equivalent units	264

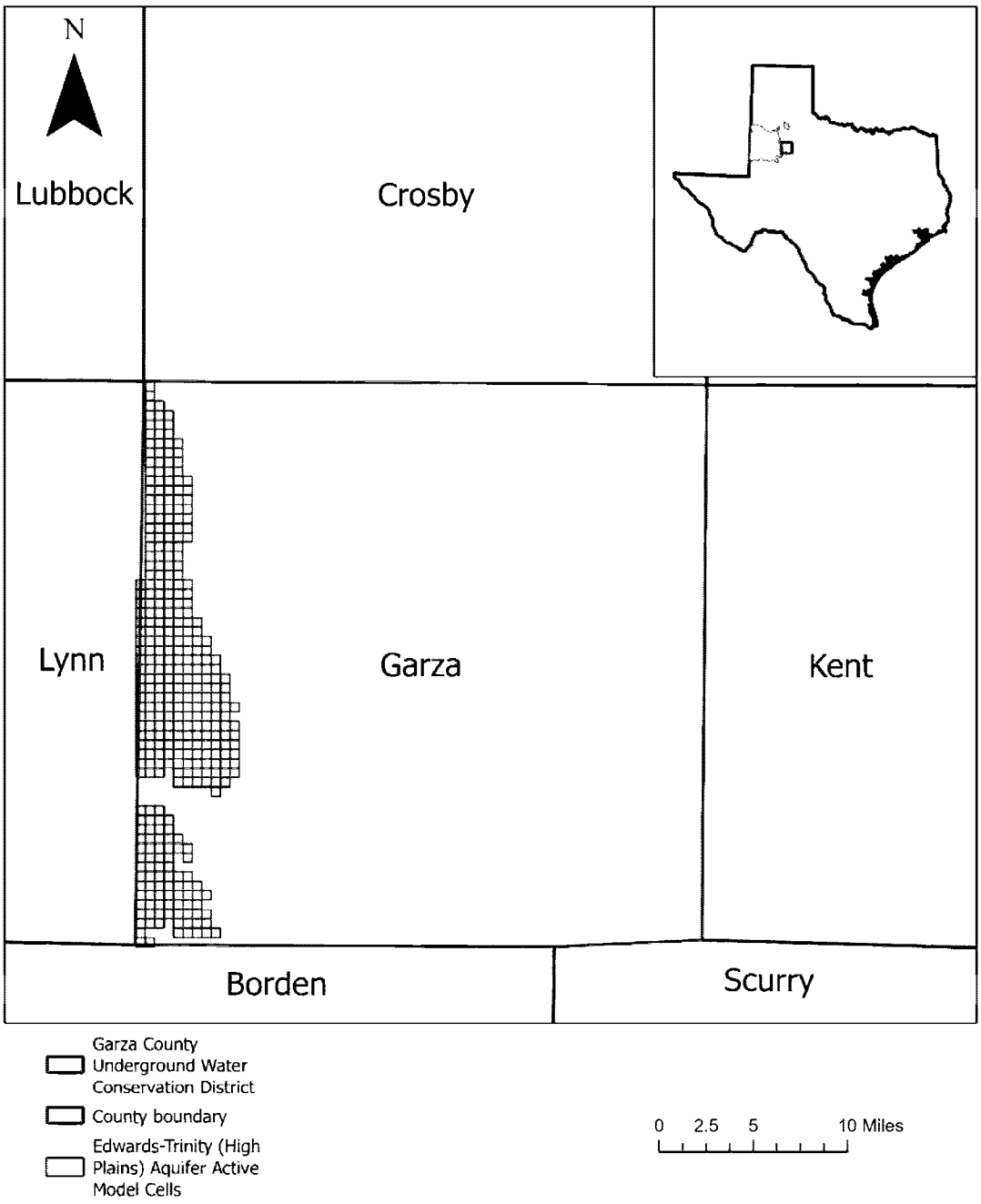
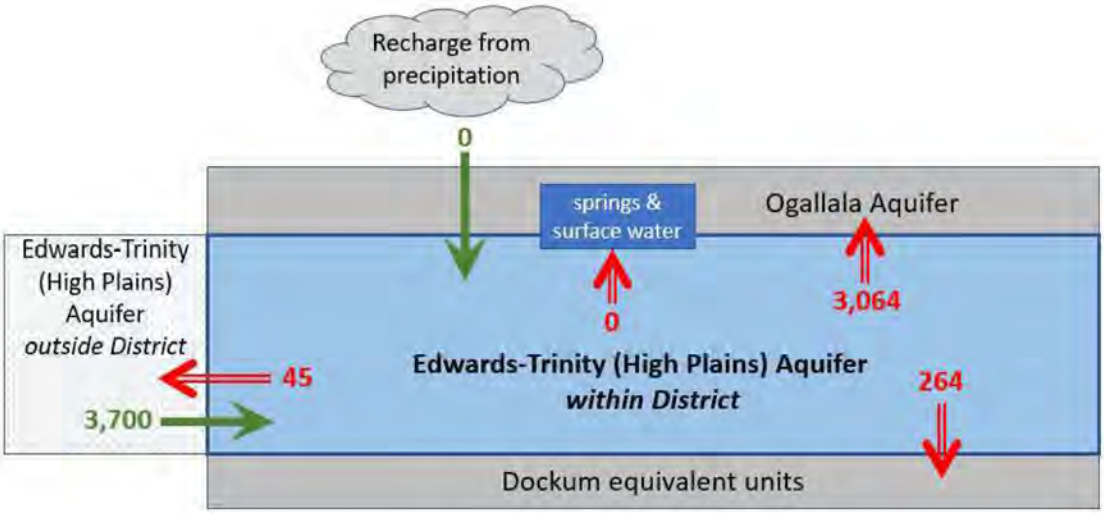


Figure 3: Area of the groundwater availability model for the High Plains Aquifer System from which the information in Table 2 was extracted (the Edwards-Trinity [High Plains] Aquifer extent within the district boundary).

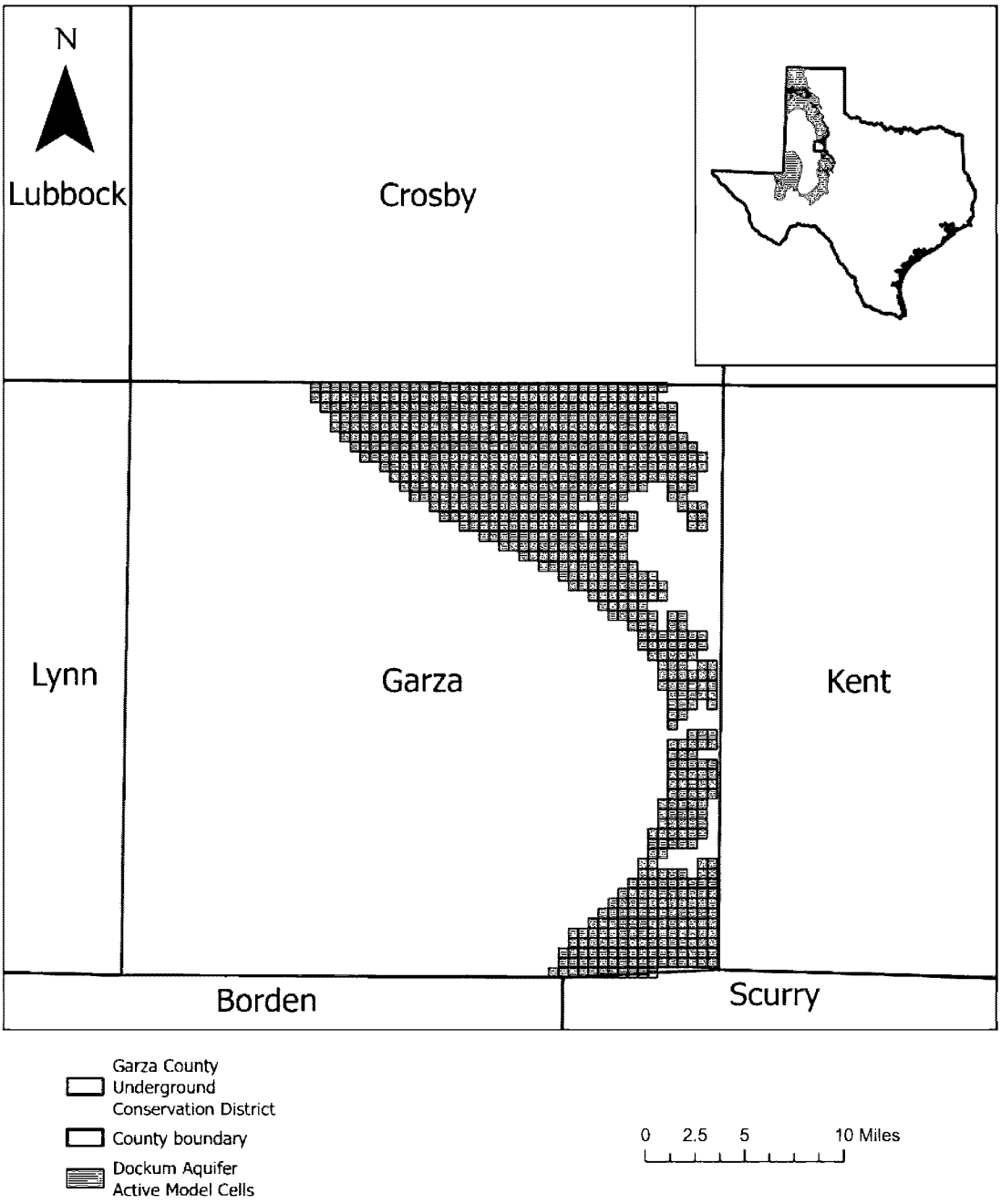


Caveat: This diagram only includes the water budget items provided in Table 2. A complete water budget would include additional inflows and outflows. For a full groundwater budget, please submit a request in writing to the Groundwater Modeling Department.

Figure 4: Generalized diagram of the summarized budget information from Table 2, representing directions of flow for the Edwards-Trinity (High Plains) Aquifer within Garza County Underground Water Conservation District. Flow values are expressed in acre-feet per year.

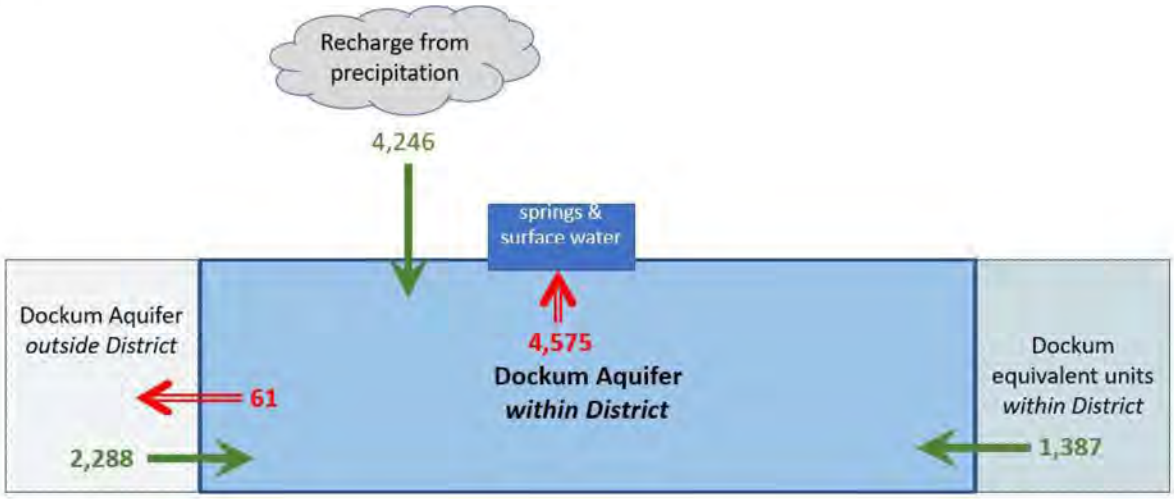
Table 3: Summarized information for the Dockum Aquifer that is needed for the Garza County Underground Water Conservation District's groundwater management plan. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot.

Management plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Dockum Aquifer	4,246
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams and rivers	Dockum Aquifer	4,575
Estimated annual volume of flow into the district within each aquifer in the district	Dockum Aquifer	2,288
Estimated annual volume of flow out of the district within each aquifer in the district	Dockum Aquifer	61
Estimated net annual volume of flow between each aquifer in the district	To Dockum Aquifer from Dockum equivalent units	1,387



county boundary date: 01/19/2024, gcd boundary date: 01/26/2024, hpas grid date: 10/31/2023

Figure 5: Area of the groundwater availability model for the High Plains Aquifer System from which the information in Table 3 was extracted (the Dockum Aquifer extent within the district boundary).



Caveat: This diagram only includes the water budget items provided in Table 3. 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 6: Generalized diagram of the summarized budget information from Table 3, representing directions of flow for the Dockum Aquifer within Garza County 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 historic pumping is as important as evaluating the volume of groundwater flow into and out of the district, between aquifers within the district (as applicable), interactions with surface water (as applicable), recharge to the aquifer system (as applicable), and other metrics that describe the impacts of that pumping. In addition, assumptions regarding precipitation, recharge, and interaction with streams are specific to particular historic time periods.

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

It is important for groundwater conservation districts to monitor groundwater pumping and overall conditions of the aquifer. Because of the limitations of the groundwater model and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine this analysis in the future given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future.

Historic precipitation patterns also need to be placed in context as future climatic conditions, such as dry and wet year precipitation patterns, may differ and affect groundwater flow conditions.

REFERENCES

Anaya, R., 2019, GAM Run 19-001: Garza County Underground Water Conservation District Management Plan, 13 p., http://www.twdb.texas.gov/groundwater/docs/GAMruns/GR19-001.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

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.

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., http://www.nap.edu/catalog.php?record_id=11972.

Niswonger, R. G., Panday, S., and Ibaraki, M., 2011, MODFLOW-NWT, A Newtonian formulation for MODFLOW-2005: U.S. Geological Survey Survey Techniques and Methods 6-A37, 44 p.

Texas Water Code § 36.1071

APPENDIX

C

GAM RUN 21-008 ADDENDUM: MODELED AVAILABLE GROUNDWATER FOR THE HIGH PLAINS AQUIFER SYSTEM (OGALLALA, EDWARDS-TRINITY (HIGH PLAINS), AND DOCKUM AQUIFERS) IN GROUNDWATER MANAGEMENT AREA 2

Grayson Dowlearn, P.G.
Texas Water Development Board
Groundwater Division
Groundwater Modeling Department
512 475-1552
June 3, 2022

ADDENDUM SUMMARY:

Modeled available groundwater for the Ogallala, Edwards-Trinity (High Plains), and Dockum aquifers in Groundwater Management Area 2 was provided on May 2, 2022 in GAM Run 22-008 (Bond and Dowlearn, 2022). However, after the report was released, errors were identified in Tables 1 and 2. The identified errors are listed below:

1) Tables 1 and 2 were missing a column with the modeled available groundwater for the year 2020, and

2) Table 2 incorrectly included Gaines County and its modeled available groundwater values within the High Plains UWCD No. 1 modeled available groundwater totals.

The errors were addressed with the following corrections:

1) A column with modeled available groundwater values for the year 2020 was added to Tables 1 and 2,

2) Gaines County was removed from the High Plains UWCD No. 1 and the modeled available groundwater values were subtracted from the total for the High Plains UWCD No. 1, and

3) Llano Estacado UWCD, which coincides with Gaines County, was added as a separate groundwater conservation district to Table 2.

This addendum contains the corrected Tables 1 and 2.

TABLE 1: MODELED AVAILABLE GROUNDWATER FOR THE OGALLALA AND EDWARDS-TRINITY (HIGH PLAINS) AQUIFERS IN GROUNDWATER MANAGEMENT AREA 2 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2080. VALUES ARE IN ACRE-FEET PER YEAR. (UWCD = UNDERGROUND WATER CONSERVATION DISTRICT)

Groundwater Conservation District	County	2020	2030	2040	2050	2060	2070	2080
Garza County UWCD Total	**Garza**	**15,519**	**13,508**	**12,402**	**11,717**	**11,263**	**10,948**	**10,721**
High Plains UWCD No.1	Bailey	88,271	65,138	50,725	42,532	37,743	34,724	32,675
	Castro	228,996	176,186	116,578	68,325	42,856	30,477	23,914
	Cochran	87,584	73,991	62,095	54,265	48,561	43,632	40,036
	Crosby	145,637	105,559	73,026	51,628	39,354	32,169	27,680
	Deaf Smith	162,070	117,359	80,488	56,872	43,574	35,948	31,405
	Floyd	157,164	93,953	65,087	52,305	44,155	39,232	35,987
	Hale	217,265	116,615	75,108	53,298	41,142	34,308	30,298
	Hockley	141,111	96,747	73,687	62,502	56,622	53,198	51,064
	Lamb	204,808	120,172	77,677	60,088	52,063	47,868	45,425
	Lubbock	135,045	110,472	100,950	95,478	91,655	88,877	86,735
	Lynn	99,629	88,768	82,064	77,033	73,324	70,707	68,886
	Parmer	144,423	92,025	63,568	46,835	37,743	32,290	28,757
	Swisher	119,920	73,407	48,754	35,887	28,541	23,972	20,935
High Plains UWCD No.1 Total		**1,931,923**	**1,330,392**	**969,807**	**757,048**	**637,333**	**567,402**	**523,797**
Llano Estacado UWCD Total	**Gaines**	**254,329**	**205,486**	**177,777**	**159,523**	**147,028**	**138,157**	**131,974**
Mesa UWCD Total	**Dawson**	**156,735**	**121,336**	**98,590**	**84,192**	**75,448**	**70,262**	**66,945**

TABLE 1 (CONTINUED): MODELED AVAILABLE GROUNDWATER FOR THE OGALLALA AND EDWARDS-TRINITY (HIGH PLAINS) AQUIFERS IN GROUNDWATER MANAGEMENT AREA 2 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2080. VALUES ARE IN ACRE-FEET PER YEAR. (UWCD = UNDERGROUND WATER CONSERVATION DISTRICT)

Groundwater Conservation District	County	2020	2030	2040	2050	2060	2070	2080
No District County	Andrews	22,379	19,391	17,897	16,937	16,260	15,764	15,378
	Borden	5,448	4,432	3,893	3,591	3,393	3,227	3,072
	Briscoe	26,813	17,859	12,598	9,600	7,844	6,743	6,016
	Castro	4,726	3,742	2,496	1,874	1,475	1,214	1,039
	Crosby	2,529	2,506	2,276	1,897	1,685	1,562	1,479
	Deaf Smith	20,853	18,024	15,387	13,553	12,267	11,301	10,556
	Floyd	0	0	0	0	0	0	0
	Hockley	15,302	12,402	7,093	3,411	2,028	1,419	1,102
	Howard	483	471	474	483	494	504	513
No District County Total		**98,533**	**78,827**	**62,114**	**51,346**	**45,446**	**41,734**	**39,155**
Permian Basin UWCD	Howard	16,677	15,160	14,344	13,882	13,596	13,411	13,287
	Martin	55,313	48,293	43,032	39,019	36,358	34,521	33,171
Permian Basin UWCD Total		**71,990**	**63,453**	**57,376**	**52,901**	**49,954**	**47,932**	**46,458**
Sandy Land UWCD Total	**Yoakum**	**128,498**	**90,983**	**70,810**	**59,346**	**53,002**	**49,187**	**46,687**
South Plains UWCD	Hockley	4,157	2,638	1,005	493	331	265	234
	Terry	180,555	134,878	108,182	96,190	89,977	86,343	84,043
South Plains UWCD Total		**184,712**	**137,516**	**109,187**	**96,683**	**90,308**	**86,608**	**84,277**
Groundwater Management Area 2 Total		**2,842,239**	**2,041,501**	**1,558,063**	**1,272,756**	**1,109,782**	**1,012,230**	**950,014**

TABLE 2: MODELED AVAILABLE GROUNDWATER FOR THE DOCKUM AQUIFER IN GROUNDWATER MANAGEMENT AREA 2 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2080. VALUES ARE IN ACRE-FEET PER YEAR. (UWCD = UNDERGROUND WATER CONSERVATION DISTRICT)

Groundwater Conservation District	County	2020	2030	2040	2050	2060	2070	2080
Garza County UWCD Total	**Garza**	**1,038**	**1,038**	**1,038**	**1,038**	**1,038**	**1,038**	**1,038**
High Plains UWCD No.1	Bailey	949	949	949	949	949	949	949
	Castro	484	484	484	484	484	484	484
	Cochran	1,106	1,106	1,106	1,106	1,106	1,106	1,106
	Crosby	4,312	4,312	4,312	4,312	4,312	4,312	4,312
	Deaf Smith	5,006	5,006	5,006	5,006	5,006	5,006	5,006
	Floyd	3,674	3,674	3,674	3,674	3,674	3,674	3,674
	Hale	1,277	1,277	1,277	1,277	1,277	1,277	1,277
	Hockley	1,109	1,109	1,109	1,109	1,109	1,109	1,109
	Lamb	1,051	1,051	1,051	1,051	1,051	1,051	1,051
	Lubbock	1,236	1,236	1,236	1,236	1,236	1,236	1,236
	Lynn	1,039	1,039	1,039	1,039	1,039	1,039	1,039
	Parmer	6,207	6,207	6,207	6,207	5,202	5,188	5,182
	Swisher	1,796	1,796	1,796	1,796	1,796	1,796	1,796
High Plains UWCD No.1 Total		**29,246**	**29,246**	**29,246**	**29,246**	**28,241**	**28,227**	**28,221**
Llano Estacado UWCD	**Gaines**	**880**	**880**	**880**	**880**	**880**	**880**	**880**
Mesa UWCD Total	**Dawson**	**640**	**640**	**640**	**640**	**640**	**640**	**640**

TABLE 2 (CONTINUED): MODELED AVAILABLE GROUNDWATER FOR THE DOCKUM AQUIFER IN GROUNDWATER MANAGEMENT AREA 2 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2080. VALUES ARE IN ACRE-FEET PER YEAR. (UWCD = UNDERGROUND WATER CONSERVATION DISTRICT)

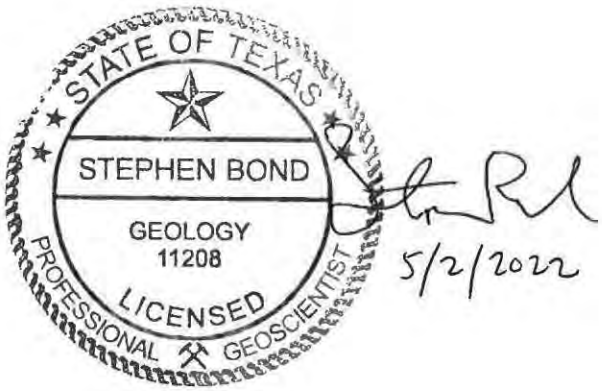
Groundwater Conservation District	County	2020	2030	2040	2050	2060	2070	2080
No District County	Andrews	1,503	1,503	1,503	1,503	1,503	1,503	1,503
	Borden	1,026	1,026	1,026	1,026	1,026	1,026	1,026
	Briscoe	0	0	0	0	0	0	0
	Castro	0	0	0	0	0	0	0
	Crosby	81	81	81	81	81	81	81
	Deaf Smith	7	7	7	7	7	7	7
	Floyd	0	0	0	0	0	0	0
	Hockley	95	95	95	95	95	95	95
	Howard	134	134	134	134	134	134	134
No District County Total		**2,846**	**2,846**	**2,846**	**2,846**	**2,846**	**2,846**	**2,846**
Permian Basin UWCD	Howard	6,636	6,636	6,636	6,636	6,636	6,636	6,636
	Martin	11,449	11,449	11,449	11,449	11,449	11,449	11,449
Permian Basin UWCD Total		**18,085**	**18,085**	**18,085**	**18,085**	**18,085**	**18,085**	**18,085**
Sandy Land UWCD Total	**Yoakum**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
South Plains UWCD	Hockley	0	0	0	0	0	0	0
	Terry	0	0	0	0	0	0	0
South Plains UWCD Total		**0**	**0**	**0**	**0**	**0**	**0**	**0**
Groundwater Management Area 2 Total		**52,735**	**52,735**	**52,735**	**52,735**	**51,730**	**51,716**	**51,710**

REFERENCES:

Bond, S. and Dowlearn, R. G., 2022, GAM Run 22-008: Modeled Available Groundwater for the High Plains Aquifer System (Ogallala, Edwards-Trinity (High Plains), and Dockum aquifers) in Groundwater Management Area 2, GAM Run Report, 23 p. http://www.twdb.texas.gov/groundwater/docs/GAMruns/GR21-008_MAG.pdf

GAM Run 21-008 MAG: Modeled Available Groundwater for the High Plains Aquifer System (Ogallala, Edwards-Trinity (High Plains), and Dockum aquifers) in Groundwater Management Area 2

Stephen Bond, P.G. and Grayson Dowlearn
Texas Water Development Board
Groundwater Division
Groundwater Availability Modeling Section
(512) 475-1552
May 2, 2022



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GAM RUN 21-008 MAG: MODELED AVAILABLE GROUNDWATER FOR THE HIGH PLAINS AQUIFER SYSTEM (OGALLALA, EDWARDS-TRINITY (HIGH PLAINS), AND DOCKUM AQUIFERS) IN GROUNDWATER MANAGEMENT AREA 2

Stephen Bond, P.G. and Grayson Dowlearn
Texas Water Development Board
Groundwater Division
Groundwater Availability Modeling Section
(512) 475-1552
May 2, 2022

EXECUTIVE SUMMARY:

Modeled available groundwater for the Ogallala and Edwards-Trinity (High Plains) aquifers in Groundwater Management Area 2 decreases from 2,041,501 acre-feet per year in 2030 to 950,014 acre-feet per year in 2080. Modeled available groundwater for the Dockum Aquifer decreases from 52,735 acre-feet per year in 2030 to 51,710 acre-feet per year in 2080. The modeled available groundwater for the Ogallala and Edwards-Trinity (High Plains) aquifers is summarized by groundwater conservation districts and counties in Table 1, and by river basins, regional planning areas, and counties in Table 3. The modeled available groundwater for the Dockum Aquifer is summarized by groundwater conservation districts and counties in Table 2, and by river basins, regional planning areas, and counties in Table 4.

The estimates are based on the desired future conditions for the High Plains Aquifer System (the Ogallala, Edwards-Trinity (High Plains), and Dockum aquifers) adopted by groundwater conservation district representatives in Groundwater Management Area 2 on August 17, 2021. The Pecos Valley Alluvium and Edwards-Trinity (Plateau) aquifers were declared not relevant for the purpose of joint planning. The Texas Water Development Board (TWDB) determined that the explanatory report and other materials submitted by the district representatives were administratively complete on February 25, 2022.

Please note that, for the High Plains Underground Water Conservation District No. 1, only the portion of relevant aquifers within Groundwater Management Area 2 is covered in this report.

REQUESTOR:

Mr. Jason Coleman, General Manager of High Plains Underground Water Conservation District No. 1 and Coordinator of Groundwater Management Area 2.

DESCRIPTION OF REQUEST:

In an email dated August 26, 2021, Dr. William Hutchison, on behalf of Groundwater Management Area (GMA) 2, provided the TWDB with the desired future conditions of the High Plains Aquifer System. The desired future conditions (defined by drawdown) were determined using several predictive groundwater flow simulations (Hutchison, 2021a). The predictive simulations were developed from the groundwater availability model for the High Plains Aquifer System (Version 1.01; Deeds and Jigmond, 2015) from 2013 through 2080 under different pumping scenarios, with an initial water level equal to that of the model's last stress period (i.e., year 2012). The drawdown was calculated as the water level difference between 2012 and 2080.

The desired future conditions for the High Plains Aquifer System, as described in Resolution No. 21-01, were adopted on August 17, 2021 by the groundwater conservation district representatives in Groundwater Management Area 2. The desired future conditions are described below:

Ogallala and Edwards-Trinity (High Plains) Aquifers

- An average drawdown of 28 feet for all of GMA 2 between the years 2013 and 2080.

Dockum Aquifer

- An average drawdown of 31 feet for all of GMA 2 between the years 2013 and 2080.

After review of the submittal, TWDB sent an email on November 16, 2021 to Mr. Jason Coleman, Coordinator of Groundwater Management Area 2, to clarify if Groundwater Management Area 2 accepted the tolerance of three (3) feet and assumptions used to calculate average drawdown. On November 19, 2021 TWDB received the final clarification email from Mr. Jason Coleman confirming the three (3) feet of tolerance and drawdown calculation assumptions, specified in the Methods and Parameters and Assumptions sections below, can be used. TWDB then proceeded with the calculation of the modeled available groundwater which is summarized in the following sections.

METHODS:

To estimate the modeled available groundwater, TWDB used the predictive simulation for Scenario 19 (Hutchison, 2021a). TWDB reviewed the submitted model files and attempted to replicate the adopted desired future conditions using these files. Since groundwater conservation districts in GMA 2 manage groundwater with total dissolved solids concentrations above 3,000 mg/L (Hutchison, 2021b), active model cells, rather than official aquifer boundaries, were used for the basis of the average drawdown calculations. Cell-by-cell drawdowns were calculated based on the difference between modeled head

values at the end of 2012 and model heads extracted for the year 2080. Average heads were calculated by summing cell-by-cell heads and dividing by the total number of cells in each aquifer or set of aquifers considered.

Average drawdown results matched the adopted desired future conditions precisely if all active cells were included in the calculations. Excluding cells that went dry during the model run, or cells that were part of the Pecos Alluvium or Edwards-Trinity (Plateau) aquifers changed the results by less than half a foot. Excluding pass-through cells, modeled cells which are not representative of a rock unit but hydraulically connect two model layers when one or more layers between the two is no longer present (for example, the Lower Dockum is connected to the Ogallala Aquifer through two layers of pass-through cells where the Upper Dockum and Edwards-Trinity (High Plains) aquifers are absent) reduced average drawdown for the Ogallala and Edwards-Trinity (High Plains) aquifers from 28 feet to 25 feet.

Modeled available groundwater values were determined by extracting pumping rates by decade from the model results using ZONEBUDGET Version 3.01 (Harbaugh, 2009). Annual pumping rates were then divided by county, river basin, regional water planning area, and groundwater conservation district within Groundwater Management Area 2 (Figure 5 and Tables 1 through 4).

Modeled Available Groundwater and Permitting

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

PARAMETERS AND ASSUMPTIONS:

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

- Version 1.01 of the groundwater availability model for the High Plains Aquifer System by Deeds and Jigmond (2015) was revised to construct the predictive model simulation for this analysis. See Hutchison (2021b) 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). The Pecos Valley Alluvium and Edwards-Trinity (Plateau) aquifers were declared not relevant for the purpose of joint planning and were

excluded from the modeled available groundwater calculation. Model layers are shown in Figures 1 through 4.

- Where the Upper Dockum and Edwards-Trinity (High Plains) aquifers are absent in layers 3 and 2, respectively, pass-through cells hydraulically connect the Ogallala Aquifer to the Upper or Lower Dockum, or connect the Edwards-Trinity (High Plains) Aquifer to the Lower Dockum. These pass-through cells contain no pumping and were excluded from the drawdown calculation.

- 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.

- During the predictive model run, some model cells within Groundwater Management Area 2 went dry in each model layer by the end of the simulation in the year 2080.

- Drawdown averages and modeled available groundwater volumes were calculated based on the extent of the model area. The most recent available model grid file (dated January 6,2020) was used to determine which model cells were assigned to specific county, groundwater management area, groundwater conservation district, river basin, or regional water planning area.

- A tolerance of three feet was assumed when comparing desired future conditions to modeled drawdown results.

- For the High Plains Underground Water Conservation District No. 1, only the portion within Groundwater Management Area 2 is covered in this report.

- Estimates of modeled drawdown and available groundwater from the model simulation were rounded to nearest whole numbers.

RESULTS:

The modeled available groundwater for the Ogallala and Edwards-Trinity (High Plains) aquifers combined that achieves the desired future condition adopted by Groundwater Management Area 2 decreases from 2,041,501 to 950,014 acre-feet per year between 2030 and 2080. The modeled available groundwater is summarized by groundwater conservation district and county in Table 1. Table 3 summarizes the modeled available groundwater by county, river basin, and regional water planning area for use in the regional water planning process.

The modeled available groundwater for the Dockum Group and Aquifer that achieves the desired future condition adopted by Groundwater Management Area 2 decreases from 52,735 to 51,710 acre-feet per year between 2030 and 2080. The modeled available groundwater is summarized by groundwater conservation district and county in Table 2. Table 4 summarizes the modeled available groundwater by county, river basin, and regional water planning area for use in the regional water planning process.

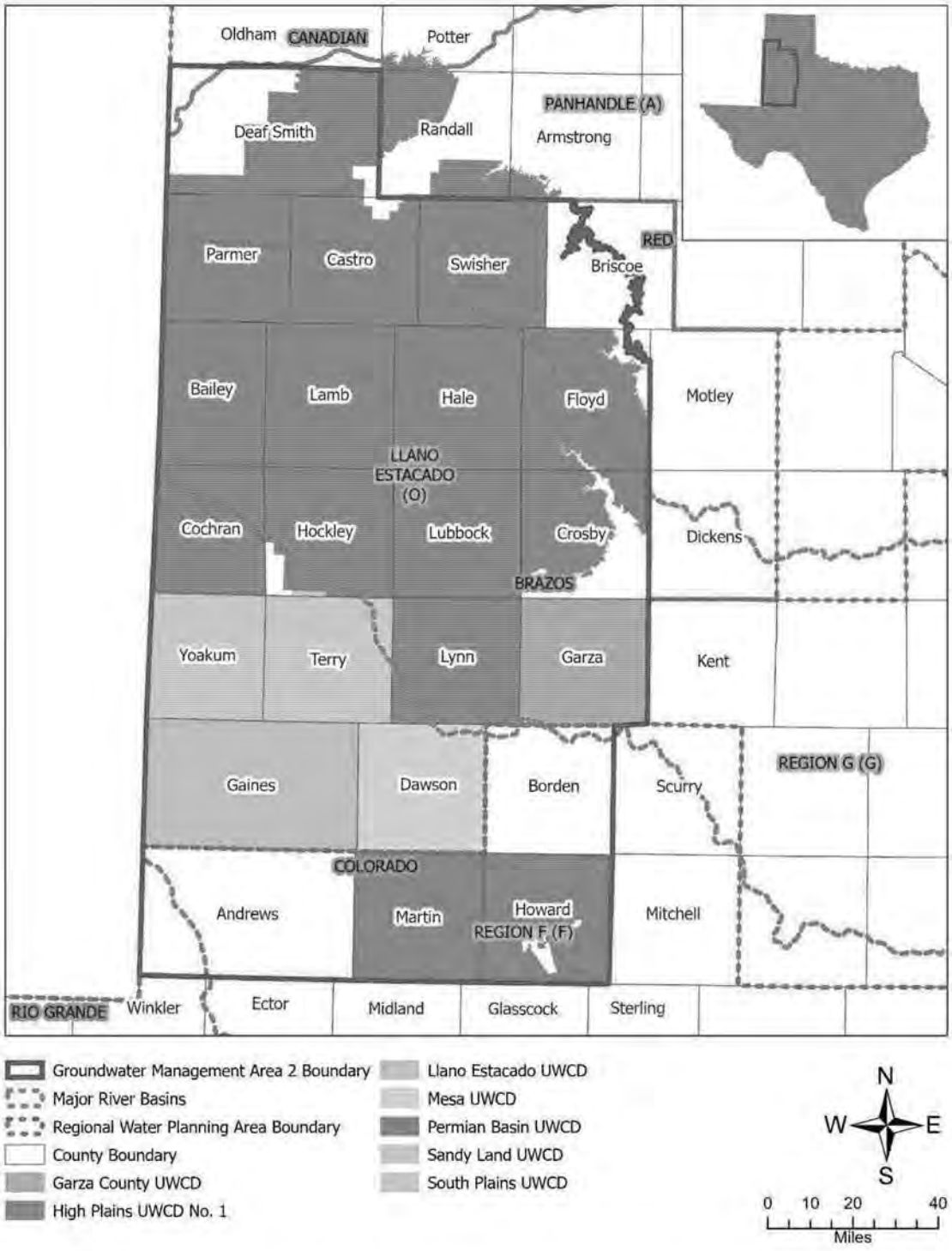

FIGURE 1. MAP SHOWING REGIONAL WATER PLANNING AREAS, GROUNDWATER CONSERVATION DISTRICTS (ALSO KNOWN AS UNDERGROUND WATER CONSERVATION DISTRICT OR UWCD), COUNTIES, AND RIVER BASINS IN GROUNDWATER MANAGEMENT AREA 2

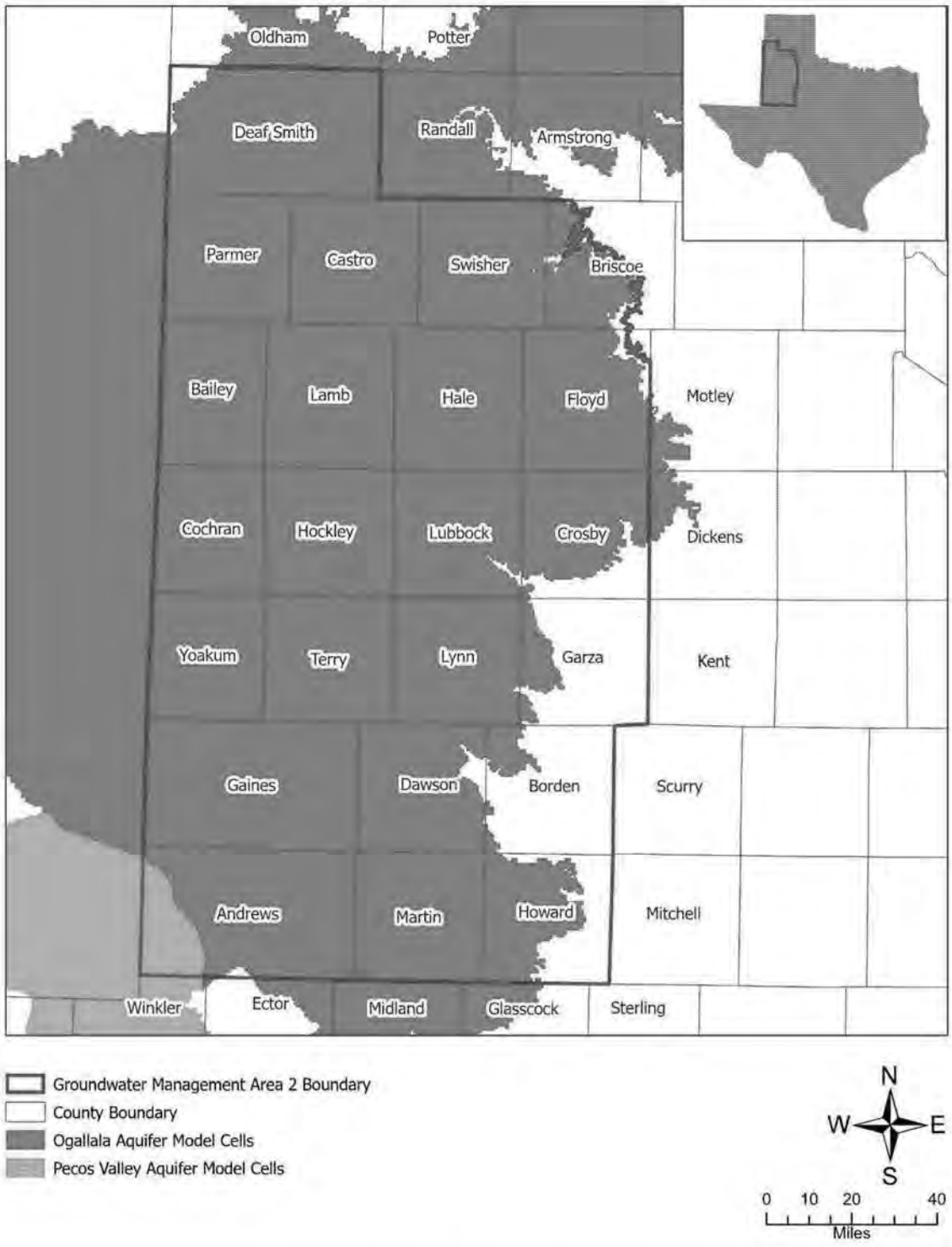

FIGURE 2. MAP SHOWING THE ACTIVE MODEL CELLS REPRESENTING THE OGALLALA AQUIFER AND THE PECOS VALLEY AQUIFER IN LAYER 1 OF THE HIGH PLAINS AQUIFER SYSTEM GROUNDWATER AVAILABILITY MODEL

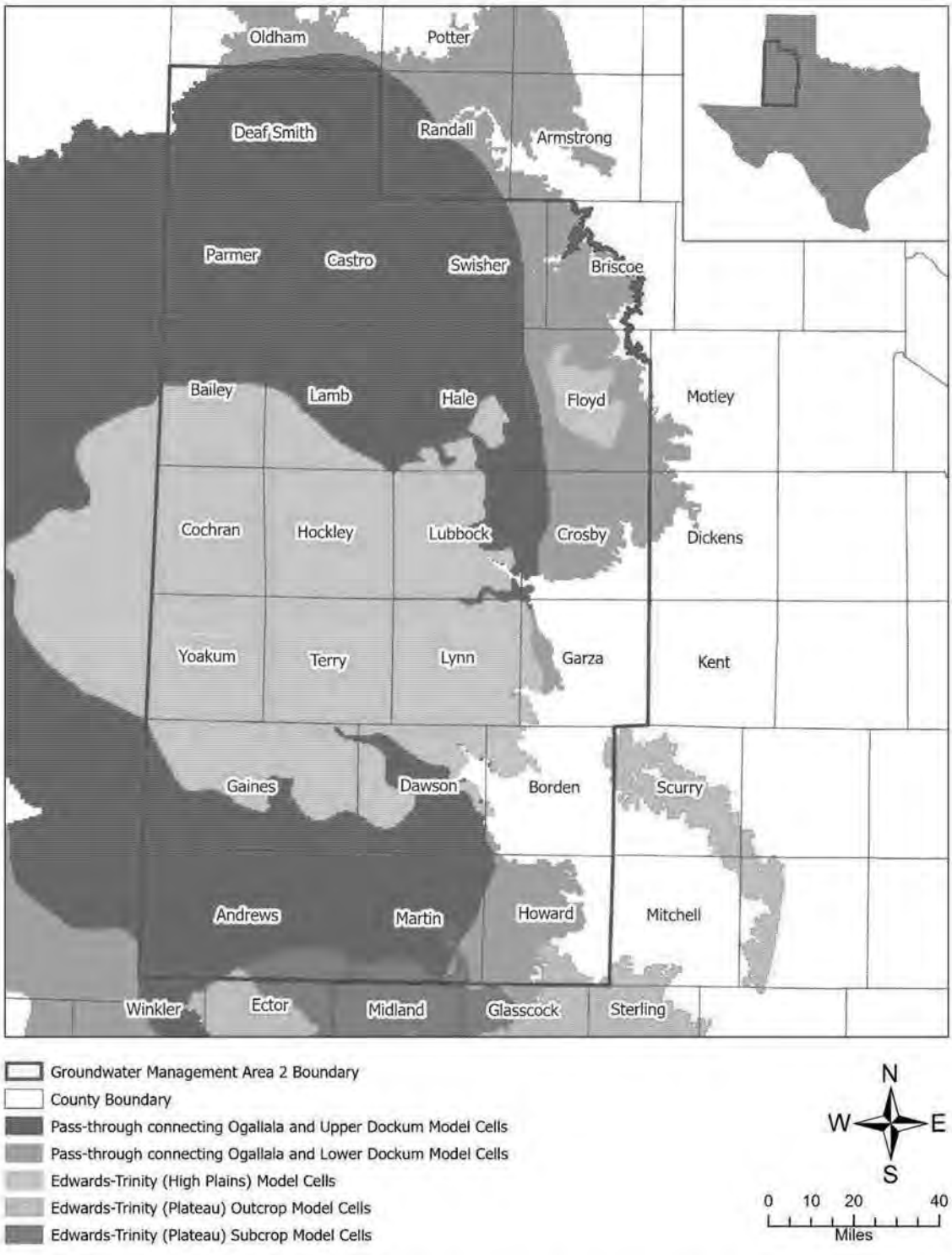

FIGURE 3. MAP SHOWING THE ACTIVE MODEL CELLS REPRESENTING THE EDWARDS-TRINITY (HIGH PLAINS) AQUIFER, THE EDWARDS-TRINITY (PLATEAU) AQUIFER, AND PASS-THROUGH CELLS IN LAYER 2 OF THE HIGH PLAINS AQUIFER SYSTEM GROUNDWATER AVAILABILITY MODEL

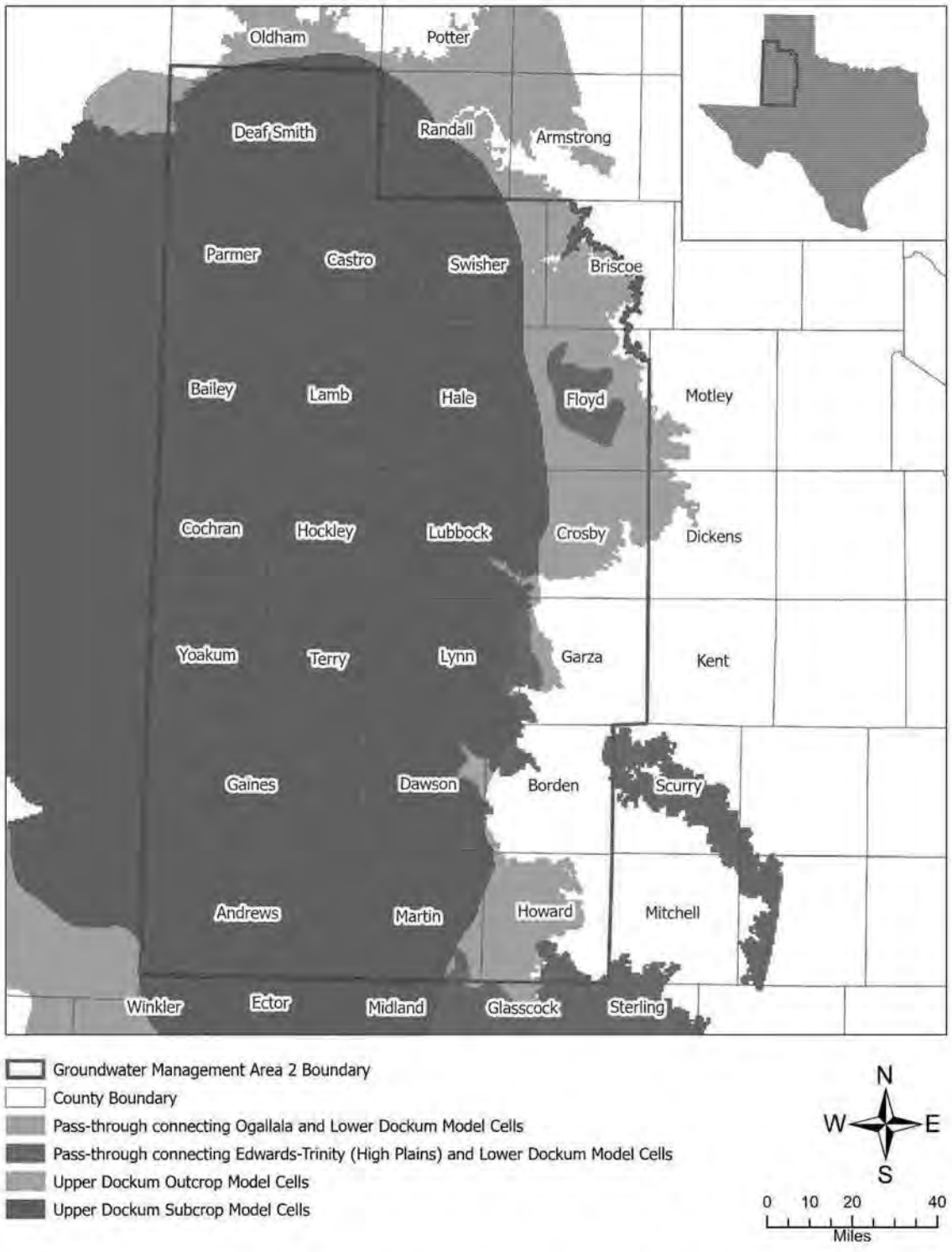

FIGURE 4. MAP SHOWING THE ACTIVE MODEL CELLS REPRESENTING THE UPPER PORTION OF THE DOCKUM AQUIFER AND PASS-THROUGH CELLS IN LAYER 3 OF THE HIGH PLAINS AQUIFER SYSTEM GROUNDWATER AVAILABILITY MODEL

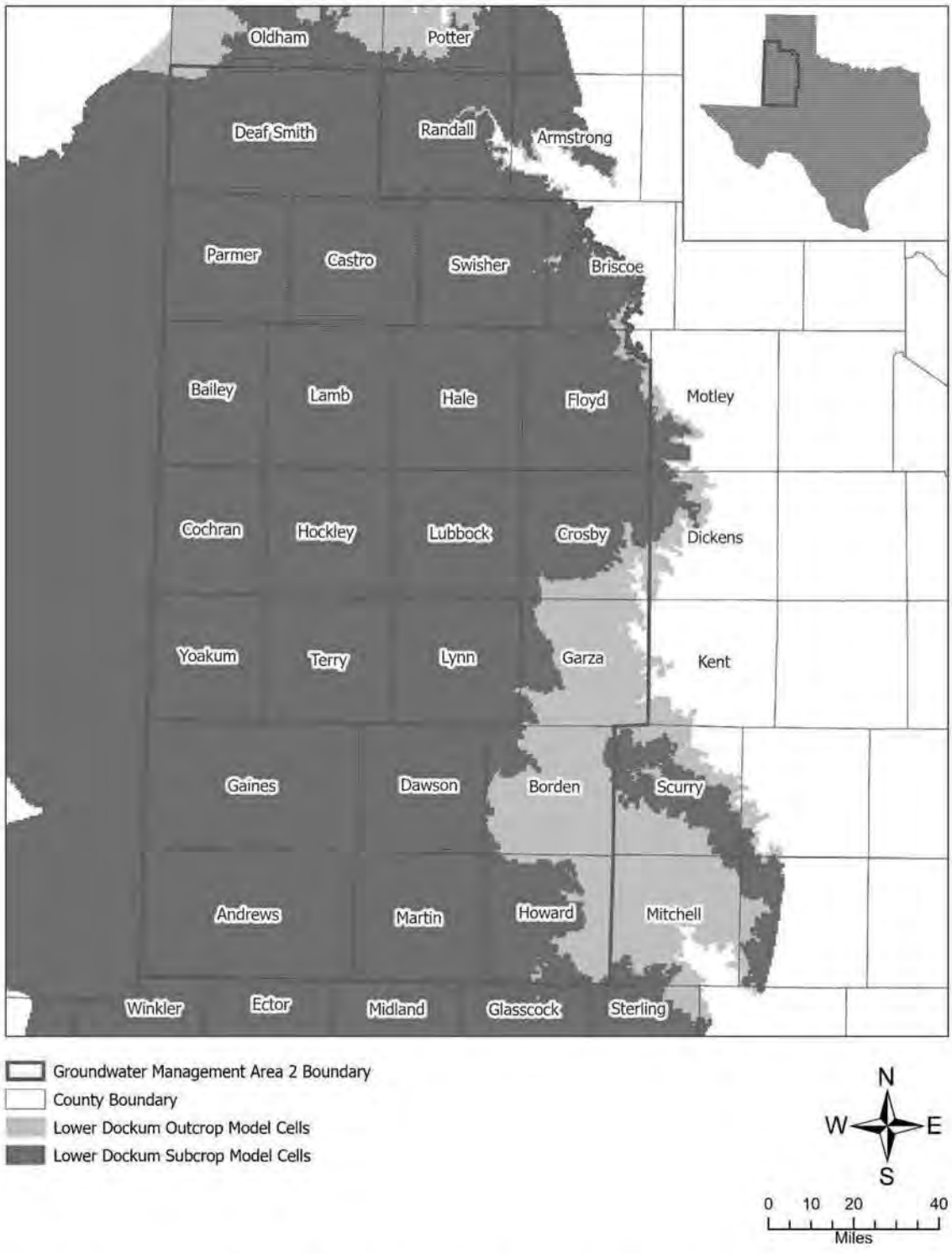

FIGURE 5. MAP SHOWING ACTIVE MODEL CELLS REPRESENTING THE LOWER PORTION OF THE DOCKUM AQUIFER IN LAYER 4 OF THE HIGH PLAINS AQUIFER SYSTEM GROUNDWATER AVAILABILITY MODEL

TABLE 1. MODELED AVAILABLE GROUNDWATER FOR THE OGALLALA AND EDWARDS-TRINITY (HIGH PLAINS) AQUIFERS IN GROUNDWATER MANAGEMENT AREA 2 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT AND COUNTY FOR EACH DECADE BETWEEN 2030 AND 2080. VALUES ARE IN ACRE-FEET PER YEAR. (UWCD = UNDERGROUND WATER CONSERVATION DISTRICT)

Groundwater Conservation District	County	2030	2040	2050	2060	2070	2080
Garza County UWCD Total	**Garza**	**13,508**	**12,402**	**11,717**	**11,263**	**10,948**	**10,721**
High Plains UWCD No.1	Bailey	65,138	50,725	42,532	37,743	34,724	32,675
	Castro	176,186	116,578	68,325	42,856	30,477	23,914
	Cochran	73,991	62,095	54,265	48,561	43,632	40,036
	Crosby	105,559	73,026	51,628	39,354	32,169	27,680
	Deaf Smith	117,359	80,488	56,872	43,574	35,948	31,405
	Floyd	93,953	65,087	52,305	44,155	39,232	35,987
	Hale	116,615	75,108	53,298	41,142	34,308	30,298
	Hockley	96,747	73,687	62,502	56,622	53,198	51,064
	Lamb	120,172	77,677	60,088	52,063	47,868	45,425
	Lubbock	110,472	100,950	95,478	91,655	88,877	86,735
	Lynn	88,768	82,064	77,033	73,324	70,707	68,886
	Parmer	92,025	63,568	46,835	37,743	32,290	28,757
	Swisher	73,407	48,754	35,887	28,541	23,972	20,935
High Plains UWCD No.1 Total		**1,330,392**	**969,807**	**757,048**	**637,333**	**567,402**	**523,797**
Llano Estacado UWCD Total	**Gaines**	**205,486**	**177,777**	**159,523**	**147,028**	**138,157**	**131,974**
Mesa UWCD Total	**Dawson**	**121,336**	**98,590**	**84,192**	**75,448**	**70,262**	**66,945**

Groundwater Conservation District	County	2030	2040	2050	2060	2070	2080
No District County	Andrews	19,391	17,897	16,937	16,260	15,764	15,378
	Borden	4,432	3,893	3,591	3,393	3,227	3,072
	Briscoe	17,859	12,598	9,600	7,844	6,743	6,016
	Castro	3,742	2,496	1,874	1,475	1,214	1,039
	Crosby	2,506	2,276	1,897	1,685	1,562	1,479
	Deaf Smith	18,024	15,387	13,553	12,267	11,301	10,556
	Floyd	0	0	0	0	0	0
	Hockley	12,402	7,093	3,411	2,028	1,419	1,102
	Howard	471	474	483	494	504	513
No District County Total		**78,827**	**62,114**	**51,346**	**45,446**	**41,734**	**39,155**
Permian Basin UWCD	Howard	15,160	14,344	13,882	13,596	13,411	13,287
	Martin	48,293	43,032	39,019	36,358	34,521	33,171
Permian Basin UWCD Total		**63,453**	**57,376**	**52,901**	**49,954**	**47,932**	**46,458**
Sandy Land UWCD Total	**Yoakum**	**90,983**	**70,810**	**59,346**	**53,002**	**49,187**	**46,687**
South Plains UWCD	Hockley	2,638	1,005	493	331	265	234
	Terry	134,878	108,182	96,190	89,977	86,343	84,043
South Plains UWCD Total		**137,516**	**109,187**	**96,683**	**90,308**	**86,608**	**84,277**
Groundwater Management Area 2 Total		**2,041,501**	**1,558,063**	**1,272,756**	**1,109,782**	**1,012,230**	**950,014**

TABLE 2. MODELED AVAILABLE GROUNDWATER FOR THE DOCKUM AQUIFER IN GROUNDWATER MANAGEMENT AREA 2 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT AND COUNTY FOR EACH DECADE BETWEEN 2030 AND 2080. VALUES ARE IN ACRE-FEET PER YEAR. (UWCD = UNDERGROUND WATER CONSERVATION DISTRICT)

Groundwater Conservation District	County	2030	2040	2050	2060	2070	2080
Garza County UWCD Total	**Garza**	**1,038**	**1,038**	**1,038**	**1,038**	**1,038**	**1,038**
High Plains UWCD No.1	Bailey	949	949	949	949	949	949
	Castro	484	484	484	484	484	484
	Cochran	1,106	1,106	1,106	1,106	1,106	1,106
	Crosby	4,312	4,312	4,312	4,312	4,312	4,312
	Deaf Smith	5,006	5,006	5,006	5,006	5,006	5,006
	Floyd	3,674	3,674	3,674	3,674	3,674	3,674
	Hale	1,277	1,277	1,277	1,277	1,277	1,277
	Hockley	1,109	1,109	1,109	1,109	1,109	1,109
	Lamb	1,051	1,051	1,051	1,051	1,051	1,051
	Lubbock	1,236	1,236	1,236	1,236	1,236	1,236
	Lynn	1,039	1,039	1,039	1,039	1,039	1,039
	Parmer	6,207	6,207	6,207	5,202	5,188	5,182
	Swisher	1,796	1,796	1,796	1,796	1,796	1,796
	Gaines	880	880	880	880	880	880
High Plains UWCD No.1 Total		**30,126**	**30,126**	**30,126**	**29,121**	**29,107**	**29,101**
Mesa UWCD Total	**Dawson**	**640**	**640**	**640**	**640**	**640**	**640**

Groundwater Conservation District	County	2030	2040	2050	2060	2070	2080
No District County	Andrews	1,503	1,503	1,503	1,503	1,503	1,503
	Borden	1,026	1,026	1,026	1,026	1,026	1,026
	Briscoe	0	0	0	0	0	0
	Castro	0	0	0	0	0	0
	Crosby	81	81	81	81	81	81
	Deaf Smith	7	7	7	7	7	7
	Floyd	0	0	0	0	0	0
	Hockley	95	95	95	95	95	95
	Howard	134	134	134	134	134	134
No District County Total		**2,846**	**2,846**	**2,846**	**2,846**	**2,846**	**2,846**
Permian Basin UWCD	Howard	6,636	6,636	6,636	6,636	6,636	6,636
	Martin	11,449	11,449	11,449	11,449	11,449	11,449
Permian Basin UWCD Total		**18,085**	**18,085**	**18,085**	**18,085**	**18,085**	**18,085**
Sandy Land UWCD Total	**Yoakum**	**0**	**0**	**0**	**0**	**0**	**0**
South Plains UWCD	Hockley	0	0	0	0	0	0
	Terry	0	0	0	0	0	0
South Plains UWCD Total		**0**	**0**	**0**	**0**	**0**	**0**
Groundwater Management Area 2 Total		**52,735**	**52,735**	**52,735**	**51,730**	**51,716**	**51,710**

TABLE 3. MODELED AVAILABLE GROUNDWATER BY DECADE FOR THE OGALLALA AND EDWARDS-TRINITY (HIGH PLAINS) AQUIFERS IN GROUNDWATER MANAGEMENT AREA 2. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), AND RIVER BASIN.

County	RWPA	River Basin	2030	2040	2050	2060	2070	2080
Andrews	Region F	Colorado	19,391	17,897	16,937	16,260	15,764	15,378
Andrews	Region F	Rio Grande	0	0	0	0	0	0
Bailey	Llano Estacado	Brazos	65,138	50,725	42,532	37,743	34,724	32,675
Borden	Region F	Brazos	673	615	581	559	543	532
Borden	Region F	Colorado	3,759	3,278	3,010	2,834	2,684	2,540
Briscoe	Llano Estacado	Red	17,859	12,598	9,600	7,844	6,743	6,016
Castro	Llano Estacado	Brazos	106,971	71,565	40,493	24,591	17,282	13,530
Castro	Llano Estacado	Red	72,957	47,509	29,706	19,740	14,409	11,423
Cochran	Llano Estacado	Brazos	20,220	18,297	17,034	16,204	15,655	15,283
Cochran	Llano Estacado	Colorado	53,771	43,798	37,231	32,357	27,977	24,753
Crosby	Llano Estacado	Brazos	105,148	72,526	50,976	38,890	31,952	27,655
Crosby	Llano Estacado	Red	2,917	2,776	2,549	2,149	1,779	1,504
Dawson	Llano Estacado	Brazos	1,390	1,294	1,230	1,187	1,156	1,134
Dawson	Llano Estacado	Colorado	119,946	97,296	82,962	74,261	69,106	65,811
Deaf Smith	Llano Estacado	Canadian	0	0	0	0	0	0
Deaf Smith	Llano Estacado	Red	135,383	95,875	70,425	55,841	47,249	41,961

County	RWPA	River Basin	2030	2040	2050	2060	2070	2080
Floyd	Llano Estacado	Brazos	73,465	45,024	32,571	24,708	20,244	17,492
Floyd	Llano Estacado	Red	20,488	20,063	19,734	19,447	18,988	18,495
Gaines	Llano Estacado	Colorado	205,486	177,777	159,523	147,028	138,157	131,974
Garza	Llano Estacado	Brazos	13,508	12,402	11,717	11,263	10,948	10,721
Garza	Llano Estacado	Colorado	0	0	0	0	0	0
Hale	Llano Estacado	Brazos	116,240	74,782	53,039	40,940	34,150	30,172
Hale	Llano Estacado	Red	375	326	259	202	158	126
Hockley	Llano Estacado	Brazos	84,987	67,316	58,259	53,255	50,258	48,358
Hockley	Llano Estacado	Colorado	26,800	14,469	8,147	5,726	4,624	4,042
Howard	Region F	Colorado	15,631	14,818	14,365	14,090	13,915	13,800
Lamb	Llano Estacado	Brazos	120,172	77,677	60,088	52,063	47,868	45,425
Lubbock	Llano Estacado	Brazos	110,472	100,950	95,478	91,655	88,877	86,735
Lynn	Llano Estacado	Brazos	82,425	76,194	71,817	68,689	66,499	64,962
Lynn	Llano Estacado	Colorado	6,343	5,870	5,216	4,635	4,208	3,924
Martin	Region F	Colorado	48,293	43,032	39,019	36,358	34,521	33,171
Parmer	Llano Estacado	Brazos	51,129	37,132	28,030	22,549	19,129	16,878

County	RWPA	River Basin	2030	2040	2050	2060	2070	2080
Parmer	Llano Estacado	Red	40,896	26,436	18,805	15,194	13,161	11,879
Swisher	Llano Estacado	Brazos	11,508	6,845	4,598	3,421	2,759	2,360
Swisher	Llano Estacado	Red	61,899	41,909	31,289	25,120	21,213	18,575
Terry	Llano Estacado	Brazos	6,825	6,322	5,998	5,776	5,612	5,487
Terry	Llano Estacado	Colorado	128,053	101,860	90,192	84,201	80,731	78,556
Yoakum	Llano Estacado	Colorado	90,983	70,810	59,346	53,002	49,187	46,687
Groundwater Management Area 2 Total			**2,041,501**	**1,558,063**	**1,272,756**	**1,109,782**	**1,012,230**	**950,014**

TABLE 4. MODELED AVAILABLE GROUNDWATER BY DECADE FOR THE DOCKUM AQUIFER IN GROUNDWATER MANAGEMENT AREA 2. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), AND RIVER BASIN.

County	RWPA	River Basin	2030	2040	2050	2060	2070	2080
Andrews	Region F	Colorado	1,503	1,503	1,503	1,503	1,503	1,503
Andrews	Region F	Rio Grande	0	0	0	0	0	0
Bailey	Llano Estacado	Brazos	949	949	949	949	949	949
Borden	Region F	Brazos	323	323	323	323	323	323
Borden	Region F	Colorado	703	703	703	703	703	703
Briscoe	Llano Estacado	Red	0	0	0	0	0	0
Castro	Llano Estacado	Brazos	0	0	0	0	0	0
Castro	Llano Estacado	Red	484	484	484	484	484	484
Cochran	Llano Estacado	Brazos	118	118	118	118	118	118
Cochran	Llano Estacado	Colorado	988	988	988	988	988	988
Crosby	Llano Estacado	Brazos	4,393	4,393	4,393	4,393	4,393	4,393
Crosby	Llano Estacado	Red	0	0	0	0	0	0
Dawson	Llano Estacado	Brazos	0	0	0	0	0	0
Dawson	Llano Estacado	Colorado	640	640	640	640	640	640
Deaf Smith	Llano Estacado	Canadian	0	0	0	0	0	0
Deaf Smith	Llano Estacado	Red	5,013	5,013	5,013	5,013	5,013	5,013
Floyd	Llano Estacado	Brazos	3,389	3,389	3,389	3,389	3,389	3,389
Floyd	Llano Estacado	Red	285	285	285	285	285	285
Gaines	Llano Estacado	Colorado	880	880	880	880	880	880
Garza	Llano Estacado	Brazos	1,038	1,038	1,038	1,038	1,038	1,038
Garza	Llano Estacado	Colorado	0	0	0	0	0	0
Hale	Llano Estacado	Brazos	1,244	1,244	1,244	1,244	1,244	1,244
Hale	Llano Estacado	Red	33	33	33	33	33	33
Hockley	Llano Estacado	Brazos	1,013	1,013	1,013	1,013	1,013	1,013
Hockley	Llano Estacado	Colorado	191	191	191	191	191	191

County	RWPA	River Basin	2030	2040	2050	2060	2070	2080
Howard	Region F	Colorado	6,770	6,770	6,770	6,770	6,770	6,770
Lamb	Llano Estacado	Brazos	1,051	1,051	1,051	1,051	1,051	1,051
Lubbock	Llano Estacado	Brazos	1,236	1,236	1,236	1,236	1,236	1,236
Lynn	Llano Estacado	Brazos	901	901	901	901	901	901
Lynn	Llano Estacado	Colorado	138	138	138	138	138	138
Martin	Region F	Colorado	11,449	11,449	11,449	11,449	11,449	11,449
Parmer	Llano Estacado	Brazos	3,590	3,590	3,590	2,585	2,571	2,565
Parmer	Llano Estacado	Red	2,617	2,617	2,617	2,617	2,617	2,617
Swisher	Llano Estacado	Brazos	29	29	29	29	29	29
Swisher	Llano Estacado	Red	1,767	1,767	1,767	1,767	1,767	1,767
Terry	Llano Estacado	Brazos	0	0	0	0	0	0
Terry	Llano Estacado	Colorado	0	0	0	0	0	0
Yoakum	Llano Estacado	Colorado	0	0	0	0	0	0
Groundwater Management Area 2 Total			**52,735**	**52,735**	**52,735**	**51,730**	**51,716**	**51,710**

LIMITATIONS:

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

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

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

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

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

REFERENCES:

Deeds, Neil E. and Jigmond, Marius, 2015, Numerical Model Report for the High Plains Aquifer System Groundwater Availability Model: Prepared for Texas Water Development Board, 640 p., http://www.twdb.texas.gov/groundwater/models/gam/hpas/HPAS_GAM_Numerical_Report.pdf .

Harbaugh, A. W., 2009, Zonebudget Version 3.01, A computer program for computing sub-regional water budgets for MODFLOW ground-water flow models, U.S. Geological Survey Groundwater Software.

Hutchison, William, 2021a, GMA 2 Technical Memorandum 20-01 (Final): Joint Planning Simulations with High Plains Aquifer System Groundwater Availability Model: Updated Dockum Aquifer Pumping (Scenarios 16 to 21)

Hutchison, William, 2021b, Explanatory Report For Desired Future Conditions, Ogallala, Edwards-Trinity (High Plains), and Dockum Aquifers, Groundwater Management Area 2 (Final)

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., http://www.nap.edu/catalog.php?record_id=11972.

Niswonger, R.G., Panday, S., and Ibaraki, M., 2011, MODFLOW-NWT, a Newton formulation for MODFLOW-2005: United States Geological Survey, Techniques and Methods 6-A37, 44 p.

Texas Water Code, 2011, http://www.statutes.legis.state.tx.us/docs/WA/pdf/WA.36.pdf.

NOTICE
OF
REGULAR MEETING

GARZA COUNTY UNDERGROUND WATER CONSERVATION DISTRICT WILL HOLD A SPECIAL MEETING ON WEDNESDAY, NOVEMBER 20, 2024, AT 8:30 A.M. ON THE 3RD FLOOR IN THE COMMISSIONERS COURT ROOM, AT THE GARZA COUNTY COURTHOUSE.

AGENDA

1. **HEARING TO ADOPT THE 5 YEAR GROUNDWATER MANAGEMENT PLAN**

Dicky Wallace

DICKY WALLACE, PRESIDENT

IN ACCORDANCE WITH TITLE III OF THE AMERICANS WITH DISABILITIES ACT, WE INVITE ALL ATTENDEES TO ADVISE US OF ANY SPECIAL ACCOMMODATIONS DUE TO DISABILITY. PLEASE SUBMIT YOUR REQUEST AS FAR IN ADVANCE AS POSSIBLE, OF THE MEETING YOU WISH TO ATTEND BY CONTACTING THE SECRETARY OF OFFICE @ 806- 495-4425 or DICKY WALLACE @ 806-620-4121.

FILED FOR RECORD
14th day of November 2024
at 8:38 o'clock A M
TERRI LAURENCE
COUNTY CLERK, GARZA COUNTY TEXAS
By Shelly Kimbrell Deputy

GARZA COUNTY
UNDERGROUND WATER
CONSERVATON DISTRICT

CALLED MEETING/HEARING MINUTES
November 20, 2024

Directors Present:

Dicky Wallace
Billy Weaver
Ronnie Graves
Brent Mason

Public Hearing was called to order at 8:30 am on Wednesday, November 20, 2024.

With no public comment, motion to adopt the 2024-2029 Groundwater Management Plan was made by Ronnie Graves and seconded by Billy Weaver.

Motion passed.

With no further business, motion to adjourn was made by Ronnie Graves and seconded by Billy Weaver.

Motion passed.

Meeting adjourned at 9:00 am.

_____
Dicky Wallace, President

_____
Billy Weaver, Vice-President

_____
Ronnie Graves

_____
John Boren

_____
Brent Mason, Secretary

Garza County
Underground Water Conservation District

November 20, 2024

Llano Estacado UWCD
200 SE Ave C
Seminole, Texas 79360

Dear Llano Estacado UWCD :

In accordance with Chapter 36,1071 (a), Texas Water Code we are providing you with a copy of the Groundwater Management Plan of the Garza County Underground Water Conservation District, for the years 2024-2029.

If you have any comments, please feel free to contact us.

Sincerely,

Dicky Wallace

Dicky Wallace
President

Mailing Address
300 West Main
Post, TX 79356

Telephone
806-495-4425

Garza County
Underground Water Conservation District

November 20, 2024

Sandy Land UWCD
1012 Ave F
Plains, Texas 79355

Dear Sandy Land UWCD :

In accordance with Chapter 36,1071 (a), Texas Water Code we are providing you with a copy of the Groundwater Management Plan of the Garza County Underground Water Conservation District, for the years 2024-2029.

If you have any comments, please feel free to contact us.

Sincerely,

Dicky Wallace
President

Mailing Address
300 West Main
Post, TX 79356

Telephone
806-495-4425

Garza County
Underground Water Conservation District

November 20, 2024

South Plains UWCD
802 Tahoka Road
Brownfield, Texas 79316

Dear South Plains UWCD :

In accordance with Chapter 36,1071 (a), Texas Water Code we are providing you with a copy of the Groundwater Management Plan of the Garza County Underground Water Conservation District, for the years 2024-2029.

If you have any comments, please feel free to contact us.

Sincerely,

Dicky Wallace
President

Mailing Address
300 West Main
Post, TX 79356

Telephone
806-495-4425

Garza County
Underground Water Conservation District

November 20, 2024

Mesa UWCD
212 N Avenue G
Lamesa, Texas 79331

Dear Mesa UWCD :

In accordance with Chapter 36,1071 (a), Texas Water Code we are providing you with a copy of the Groundwater Management Plan of the Garza County Underground Water Conservation District, for the years 2024-2029.

If you have any comments, please feel free to contact us.

Sincerely,

Dicky Wallace

Dicky Wallace
President

Mailing Address
300 West Main
Post, TX 79356

Telephone
806-495-4425

Garza County
Underground Water Conservation District

November 20, 2024

High Plains UWCD
2930 Avenue Q
Lubbock, Texas 79411-2499

Dear High Plains UWCD :

In accordance with Chapter 36,1071 (a), Texas Water Code we are providing you with a copy of the Groundwater Management Plan of the Garza County Underground Water Conservation District, for the years 2024-2029.

If you have any comments, please feel free to contact us.

Sincerely,

Dicky Wallace
President

Mailing Address
300 West Main
Post, TX 79356

Telephone
806-495-4425

Garza County
Underground Water Conservation District

November 20, 2024

Brazos River Authority
4600 Cobbs Drive
Waco, TX 76714

Dear Brazos River Authority :

In accordance with Chapter 36,1071 (a), Texas Water Code we are providing you with a copy of the Groundwater Management Plan of the Garza County Underground Water Conservation District, for the years 2024-2029.

If you have any comments, please feel free to contact us.

Sincerely,

Dicky Wallace

Dicky Wallace
President

Mailing Address
300 West Main
Post, TX 79356

Telephone
806-495-4425

Garza County
Underground Water Conservation District

November 20, 2024

City Of Lubbock
1314 Avenue K
Lubbock, Texas 79401

Dear City of Lubbock :

In accordance with Chapter 36,1071 (a), Texas Water Code we are providing you with a copy of the Groundwater Management Plan of the Garza County Underground Water Conservation District, for the years 2024-2029.

If you have any comments, please feel free to contact us.

Sincerely,

Dicky Wallace

Dicky Wallace
President

Mailing Address
300 West Main
Post, TX 79356

Telephone
806-495-4425

Garza County
Underground Water Conservation District

November 20, 2024

White River Municipal Water District
2880 FM 2794
Spur, TX 79370

Dear White River Municipal Water District :

In accordance with Chapter 36,1071 (a), Texas Water Code we are providing you with a copy of the Groundwater Management Plan of the Garza County Underground Water Conservation District, for the years 2024-2029.

If you have any comments, please feel free to contact us.

Sincerely,

Dicky Wallace

Dicky Wallace
President

Mailing Address
300 West Main
Post, TX 79356

Telephone
806-495-4425

Garza County Underground Water Conservation District
300 West Main Street
Post, Texas 79356
806-495-4425

Bryan McMath
Executive Administrator
Texas Water Development Board
P.O. Box 13231
Austin, Texas 78711-3231

November 20, 2024

Dear Mr. McMath:

On Wednesday, November 20, 2024, the Garza County Underground Water Conservation District held a hearing and adopted the Underground Water Management Plan for the years 2024-2029.

Sincerely,

Dicky Wallace

Dicky Wallace--President