

**COKE COUNTY  
UNDERGROUND WATER  
CONSERVATION DISTRICT**

**MANAGEMENT PLAN**

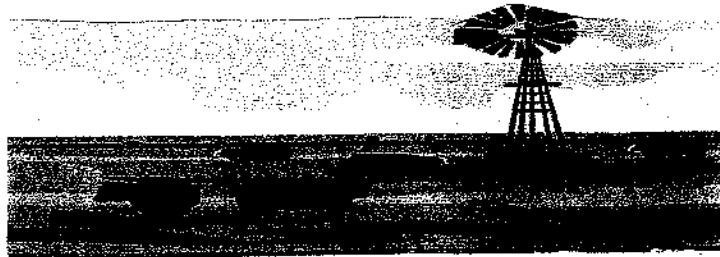
**2018-2023**

Re-Adopted:  
January 29, 2019

P.O. Box 1110  
Robert Lee, Texas 76945  
Ph: 325-453-2232 Fax: 325-453-2157 E-mail: [ccuwcd@wcc.net](mailto:ccuwcd@wcc.net)

# Coke County Underground Water Conservation District

P.O. Box 1110  
Robert Lee, Texas 76945



Phone: 325-453-2232

Fax: 325-453-2157

Cell: 325-763-7262

E-mail: [ccuwcd@wcc.net](mailto:ccuwcd@wcc.net)

Office location 13 East 7th

Office & Field hours  
Monday through Friday

8:00 A.M. to 12 P.M.

You Never Miss The Water Until The Well Runs Dry

**Coke County Underground Water  
Conservation District**

P.O. Box 1110 Robert Lee, Texas 76945 Phone (325) 453-2232

**Table of Contents**

DISTRICT MISSION ..... I

PURPOSE OF MANAGEMENT PLAN.....I

REGIONAL COOPERATION AND COORDINATION ..... 2

TIME PERIOD FOR THIS PLAN ..... 2

STATEMENT OF GUIDING PRINCIPLES ..... 2

GENERAL DESCRIPTION .....3

    Location and Extent ..... 3

    Topography and Drainage ..... 3

GROUNDWATER RESOURCES ..... 4

DESIRED FUTURE CONDITIONS ..... 5

REQUIRED DISTRICT SPECIFIC INFORMATION ..... 5

MANAGEMENT OF GROUNDWATER SUPPLIES AND ACTIONS, PROCEDURES,  
PERFORMANCE AND AVOIDANCE FOR PLAN IMPLEMENTATION..... 6

METHODOLOGY FOR TRACKING PROGRESS ..... 6

GOALS: MANAGEMENT OBJECTIVES AND PERFORMANCE STANDARDS.....	7
1.0 Provide for Efficient Use of Groundwater within the District.....	7
2.0 Control and Prevention Waste of Water.....	7
3.0 Conjunctive Surface Management.....	7
4.0 Natural Resource Issues.....	8
5.0 Drought Conditions.....	8
6.0 Conservation, Recharge, Enhancement.....	8-9
7.0 Desired Future Condition of the Aquifers.....	10
MANAGEMENT GOALS DETERMINED NOT-APPLICABLE.....	10
Control and prevent of Subsidence.....	10
SUMMARY DEFINITIONS.....	11

Appendix A - Estimated Historical Use and 2017 Texas State Water Plan Datasets

Appendix B - GAM Run 17-014: Coke County Underground Water Conservation District  
Management Plan

Appendix C - GAM Run 16-026 MAG Modeled Available Groundwater

Appendix D - District Rules

Appendix E - Resolution Adopting the Management Plan

Appendix F - Evidence of Notice and Hearing

Appendix G- Static Water-Levels and Average Rainfall for District

Appendix H – Letters to Entities

# **COKE COUNTY UNDERGROUND WATER CONSERVATION DISTRICT**

## **DISTRICT MISSION**

The overall objective of the Coke County Underground Water Conservation District (District) is to preserve the integrity of the groundwater in the aquifer over which the land in the District is located. This objective may be accomplished as the District provides for the conservation, preservation, protection, recharge, and prevention of waste of the groundwater reservoirs. This groundwater management plan will help provide guidance to accomplish the overall objective of the District. The plan is an open-ended document and can be revised or updated as needed to help meet the District goals and objectives.

## **PURPOSE OF MANAGEMENT PLAN**

The 75th Texas Legislative in 1997 enacted Senate Bill 1 ("SB1") to establish a comprehensive statewide water planning process. SB1 contained provisions that required groundwater conservation districts to prepare management plan to identify the water supply resources and water demands that will shape the decisions of each district. SB1 designed the 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 ("SB2") to build on the planning requirements of SB1 and to future clarify the actions necessary for districts to manage and conserve the groundwater resources of the state of Texas.

The Texas Legislative 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 conservative 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. In addition, HB 1763 required GCDs, to share management plans with the other GCDs in the GMA for review by the other GCDs.

The Coke County Underground Water Conservation District's groundwater management plan satisfies the statutory requirements of Chapter 36 of the Texas Water Code, and the administrative requirements of the Texas Water Development Board' s (TWDB) rules.

## REGIONAL COOPERATION AND COORDINATION

The District is a member of the West Texas Regional Groundwater Alliance (WTRGA). This WTRGA consists of seventeen (17) locally created and locally funded districts that encompass approximately eighteen (18.2) million acres or twenty-eight thousand three hundred sixty-eight (28,368) square miles of West Texas.

In May of 1988 four (4) groundwater districts; Coke County UWCD, Glasscock County UWCD, Irion County WCD, and Sterling County UWCD adopted the original Cooperative Agreement. As new districts were created, they too adopted the Cooperative Agreement. In the fall of 1996, the original Cooperative Agreement was redrafted, and the West Texas Regional Groundwater Alliance was created. The current member districts are:

Coke County UWCD	(1988)	Crockett County GCD	(1992)	Glasscock County GCD	(1988)
Hickory UWCD No. 1	(1997)	Hill Country UWCD	(2005)	Irion County WCD	(1988)
Kimble County GCD	(2004)	Lip an-Kickapoo GCD	(1989)	Lone Wolf GCD	(2002)
Menard County UWD	(2000)	Middle Pecos GCD	(2005)	Permian Basin UWCD	(2006)
Plateau UWCS D	(1991)	Santa Rita UWCD	(1990)	Sterling County UWCD	(1988)
Sutton County UWCD	(1991)	Wes-Tex GCD	(2005)		

This Alliance was created because the local districts have a common objective to facilitate the conservation, preservation, and beneficial use of water and related resources. Local districts monitor the water-related activities of the State's largest industries such as farming and ranching, oil and gas and municipalities. The alliance provides coordination essential to the activities of these member districts as they monitor these activities to accomplish their objectives.

### TIME PERIOD FOR THIS PLAN

This amended plan becomes effective upon adoption by the Board of Directors and reapproved by the Texas Water Development Board executive administrator due to change in statute several years ago. The plan remains in effect for ten years with the required review and re-adoption, with or without revisions, every five years.

### STATEMENT OF GUIDING PRINCIPLE

The District recognizes that the groundwater resources of the region are of vital importance. The preservation of this most valuable resource can be managed in a prudent and cost-effective manner through regulation and permitting. The greatest threat to prevent the District from achieving the stated mission is inappropriate management, based in part on a lack of understanding of local conditions. A basic understanding of the aquifers and their hydrogeologic properties, as well as a quantification of resources is the foundation from which to build prudent planning measures. This management document is intended as a tool to focus the thoughts and actions of those given the responsibility for the execution of District activities.

## **GENERAL DESCRIPTION**

The Coke County Underground Water District was created by Acts of 69th Legislature (1985), p. 6960, Ch. 950, H.B. 2418 under authority of Articles XVI, Section 59 of the Constitution of Texas.

The residents confirmed the District and voted to fund the District operations through local property taxes. It became an active district on April 5, 1986.

On April 5, 1986, the District adopted rules and by-laws which became effective immediately and on this date the District adopted a management plan. With the adoption of these rules, the District implemented a well permitting and registration program. The current members of the Board of Directors are: President Joe R. Ash, Vice-President LeDrew Arrott, Secretary Jimmie Byrne, and members Wes Washam, Shane Webb. The District General Manager is Winton Milliff. The Coke County UWCD covers all of Coke County. Recreational areas include golf, hunting, and fishing.

## **LOCATION AND EXTENT**

The District has an area extent of 911 square miles located approximately 32 miles north of San Angelo and 65 miles southwest of Abilene. The population of the District was about 3,306 in 2017. Two incorporated cities lie within the boundaries of the District: Robert Lee, population 1026, the county seat and Bronte, population 980.

The economy of Coke County is based on ranching, farming, and oil and gas production. The annual income from agriculture is approximately \$16,615 million. Cattle, sheep and goats' sales represent more than 90 percent of the farm and ranch income. In 2018, the county produced 453,751 barrels of oil and 3,316,942 MCF gas. The highly volatile price of petroleum products makes it very hard to estimate. The water used in Coke County comes from both groundwater and surface water sources. The District has one small lake Mountain Creek and two major reservoirs in the county impounding surface water runoff. The two largest is E.V. Spence Reservoir, which is formed on the Colorado River near Robert Lee. Oak Creek Reservoir, in the northeast corner of the county, furnishes water to the towns of Sweetwater, Bronte, Robert Lee and Blackwell. Bronte's water well field supplements Oak Creek water. Water for livestock needs is furnished by either small surface water catchment tanks or by wells. Groundwater of varying quality is used in drilling and fracturing of oil and gas wells in the District.

## **TOPOGRAPHY AND DRAINAGE**

The southwestern part of Coke County is in the Edwards Plateau section of the Great Plains physiological province; the northwestern part of the county is in the Central Texas section, which includes the Callahan Divide. The county is bisected diagonally by the southeastward flowing Colorado River. Altitudes range from about 1,700 feet above mean sea level in the river valley to more than 2,600 feet on the Edwards Plateau.



Except for the rugged and dissected escarpment, the Edwards Plateau is relatively flat. The soils are mostly thin, dark-colored, calcareous loams. The Central Texas section is characterized by a rolling topography and deep red-brown loam soils. Much of the area, however, is capped with caliche.

Surface drainage on the plateau is mostly internal, but during periods of heavy rainfall, some intermittent low-gradient streams flow southward to the North Concho River. Intermittent streams in canyons along the escarpment flow to the Colorado River. The Central Texas section is drained by the Colorado River and its intermittent tributaries, many of which enter Robert Lee Reservoir.

## **GROUNDWATER RESOURCES OF THE COKE COUNTY UWCD**

The oldest geologic units cropping out in the county are the westward-dipping Permian "red beds". These rocks are composed mainly of shale and fine-grained sandstone, and scattered beds, lenses and stringers of gypsum, anhydrite, and dolomite. In the western and southern plateau areas, the Permian rocks are overlain by eastward-dipping sand, clay and limestone of Cretaceous age. Alluvial deposits of Quaternary age occur in the Valleys of the Colorado River and its tributaries.

Water in the alluvium and in the Cretaceous rocks (Fredericksburg and Trinity Groups) occurs under water table conditions. Water in the Permian rocks (Clear Fork, Pease River and Artesian Groups, and Ochoa Series) occurs under both water tables and artesian conditions. The water producing zones in the geological units are (1) sand and gravel in the alluvium, (2) fine sands or fractures and solution openings in limestone beds of the Fredericksburg and Trinity Groups and (3) sand, gypsum and dolomite strings or lenses in the Permian rocks.

The Edwards-Trinity (Plateau) Aquifer enters Coke County on the West and progresses to the southeast. Wells in the southeast corner of the county produce large volumes of water. The northeast part of the county lies over the Trinity Aquifer.

Chemical quality of the Edwards-Trinity (Plateau) groundwater ranges from fresh to slightly saline. The water is typically hard and may vary widely in concentrations of dissolved solids made up mostly of calcium and bicarbonate. The principal sources of recharge to the aquifers of Coke County are (1) direct precipitation on the outcrops; (2) infiltration of water from surface reservoirs, rivers, and numerous intermittent streams; and (3) subsurface inflow from adjoining counties.

## **DESIRED FUTURE CONDITIONS**

On March 22, 2018, upon completion of the second cycle of joint planning among districts in Groundwater Management Area 7 mandated by section 36.108 of the Texas Water Code, GMA 7 adopted the following Desired Future Conditions for aquifers of the Coke County Underground Water District as an average drawdown of 0 feet for the Edwards-Trinity (Plateau) Aquifer from 2010 to 2070.

## **REQUIRED DISTRICT SPECIFIC INFORMATION**

### ***Modeled Available Groundwater in the District***

The modeled available groundwater is provided in Appendix C.

### ***Amount of Groundwater Being Used Within the District***

The estimated historical groundwater use from the TWDB Historical Water Use Survey is provided in Appendix A.

### ***Projected Surface Water Supply within the District***

There are 3 surface water lakes in Coke County UWCD, Lake Spence, Mountain Creek Lake located at Robert Lee and Oak Creek Lake located near Blackwell. The projected surface water supply within the District can be found in Appendix A.

### ***Projected Total Demand for Water within the District***

The projected total demand for water within the district is provided in Appendix A.

### ***Water Supply Needs within the District***

Within Coke County UWCD, there are projected water supply needs identified in the 2017 State Water Plan. Needs are identified for the cities of Bronte and Robert Lee, irrigation, livestock, mining, and steam electric power. Details on these projected water supply needs are listed in Appendix A.

### ***Water Management Strategies within the District***

Water management strategies identified in the 2017 State Water Plan that impact Coke County UWCD are development of groundwater supplies from the Edwards-Trinity (Plateau) Aquifer for mining and the City of Bronte, Details on the water management strategies are listed in Appendix A

### *Estimates of aquifer recharge, discharge, and flows*

The required estimates from GAM Run 17-014, of annual amount of recharge from precipitation, discharge from the aquifer to springs and any surface water bodies, and annual flow into the district, out of the district, and between aquifers are included in Appendix B

## **MANAGEMENT OF GROUNDWATER SUPPLIES AND ACTIONS, PROCEDURES, PERFORMANCE AND AVOIDANCE FOR PLAN IMPLEMENTATION**

The District will manage the supply of groundwater within the District to preserve and protect the resource, while seeking to maintain the economic viability of all the groundwater user groups. 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 preservation and protection of the groundwater. The District will implement provisions of this plan and will utilize the provisions of this plan as guideposts for determining the direction or priority for Districts. Rules adopted by the District shall be pursuant to TWC Chapter 36 and the provisions of this plan. All rules will be enforced and will be based on the best technical evidence available. The District adopted rules in 1989 and amended rules in 1994 and 2003 and will amend the rules as necessary. A copy of the rules is included as Appendix D.

## **METHODOLOGY FOR TRACKING PROGRESS**

The methodology that the District will use to trace its progress on an annual basis, in achieving all its management goals will be as follows:

The District manager will prepare and present an annual report to the Board of Directors on District performance regarding achieving management goals and objectives for the previous fiscal year, during the first meeting of each new fiscal year. The report will include the number of instances each activity was engaged in during the year.

The annual report will be maintained on file at the District office.

**GOALS, MANAGEMENT OBJECTIVES  
AND PERFORMANCE STANDARDS**

**Goal 1.0     *Providing the most efficient use of groundwater***

Management Objective

- 1.1     Each year the District will locate at least one or more water wells for map location, check water levels and chemical analysis.

Performance Standards

- 1.1a    Annual report to the Board of Directors will include the number of wells located, the number of wells measured for water levels, and the number of wells sampled for chemical analysis.

**Goal 2.0     *Controlling and preventing waste of groundwater***

Management Objective

- 2.1     Annually, investigate every wasteful practice reported by the public or identified by District personnel within the District.

Performance Standards

- 2.1a    Annual report to Board of Directors will include the number of wasteful practices identified and a summary of action taken to resolve the waste of groundwater in each identified case.

**Goal 3.0     *Addressing conjunctive surface water management issues***

Management Objective

- 3.1     Monitor rainfall events on the watersheds within the District that will impact surface water runoff and groundwater recharge.

Performance Standards

- 3.1a    District will maintain files on rainfall events to monitor surface water runoff and underground recharge within the District through a voluntary rainfall network. These rainfall totals will be reported annually to the Board.

**Goal 4.0**     *Addressing natural resource issues that impact the use and availability of groundwater and which are impacted by the use of groundwater*

Management Objective

4.1     To measure, record and accumulate an historic record of static water levels in monitor network wells on a periodic basis.

Performance Standards

4.1a    The District will establish a water level monitoring network and annually measure at least five wells in the network.

**Goal 5.0**     *Addressing drought conditions*

Management Objective

5.1     District will monitor the Palmer Drought Severity Index (PDSI) by Texas Climate Divisions. If PDSI indicates that the District will experience severe drought conditions, the District will notify all public water suppliers within the District.

Performance Standard

5.1a    The District staff will monitor the PDSI and report the number of times the PDSI is less than -1 (mild drought) to the District Board of Directors on a quarterly basis.

**Goal 6.0**     *Conservation, Recharge Enhancement, Rainwater-Harvesting, Precipitation Enhancement and Brush Control where appropriate and cost effective*

Management Objective

6.1     Each year the District will provide and distribute literature on water conservation to promote conservation and efficient use of water.

Performance Standard

6.1a    The District staff will publish an article concerning water conservation in a local newspaper at least one time a year.

Management Objective: Recharge Enhancement

6.1 Provide information to area residents about recharge enhancement.

Performance Standard

6.2 a District staff will provide information, upon request, to area residents about recharge enhancement.

Management Objective: Rainwater Harvesting

6.3 Provide information to area residents about rainwater harvesting.

Performance Standard

6.2a District staff will provide information, upon request to area residents about rainwater harvesting.

Management Objective: Precipitation Enhancement

6.3 Provide information to area residents about precipitation enhancement.

Performance Standard

6.4 a District staff will provide information, upon request to area residents about precipitation enhancement.

Management Objective Brush Control

6.5 Provide information to area residents about brush control.

Performance Standard

6.5a District staff will provide information, upon request to area residents about brush control.

***Goal 7.0 Addressing the Desired Future Conditions Adopted by the District***

**Management Objective**

Each year the District will collect water-levels in at least 90% of their static level monitoring wells.

**Performance Standard**

Each year the District will post the static levels measurements collected from the monitoring wells and post them in the newspaper and present them to the Board of Directors in the Annual Report.

**Management Goal Determined Not-Applicable**

**Goal - Controlling and preventing subsidence**

There is no history of subsidence of aquifer formations within the District upon water level depletion and available scientific information is that the formations are of sufficient rigidity that subsidence will not occur.

## 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 applicable law, including the Rules and Regulations of the District, the Texas Water well Drillers' Act, Texas Natural Resource Conservation Commission, 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 Coke County Underground Water Conservation District

"District" - the Coke 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:

withdrawal of groundwater from a groundwater reservoir at a rate and in an amount that caused 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 a 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, natural watercourse, depression, lake, reservoir, drain, sewer, street, highway, road or creek, ditch, or onto 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 tail water onto 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.

"Well"- means an artificial excavation that is dug or drilled for the purpose of producing groundwater.

# APPENDIX A

# Estimated Historical Water Use And 2017 State Water Plan Datasets:

Coke County Underground Water Conservation District

by Stephen Allen  
Texas Water Development Board  
Groundwater Division  
Groundwater Technical Assistance Section  
stephen.allen@twdb.texas.gov  
(512) 463-7317  
August 24, 2018

## ***GROUNDWATER MANAGEMENT PLAN DATA:***

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

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

The five reports included in this part are:

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

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

***DISCLAIMER:***

The data presented in this report represents the most up-to-date WUS and 2017 SWP data available as of 8/24/2018. Although it does not happen frequently, either of these datasets are subject to change pending the availability of more accurate WUS data or an amendment to the 2017 SWP. District personnel must review these datasets and correct any discrepancies in order to ensure approval of their groundwater management plan.

The WUS dataset can be verified at this web address:

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

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

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

# Estimated Historical Water Use

## TWDB Historical Water Use Survey (WUS) Data

Groundwater and surface water historical use estimates are currently unavailable for calendar year 2017. TWDB staff anticipates the calculation and posting of these estimates at a later date.

### COKE COUNTY

All values are in acre-feet

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2016	GW	92	0	0	31	511	172	806
	SW	396	0	76	0	0	49	521
2015	GW	81	0	0	0	429	170	680
	SW	234	0	1	0	0	48	283
2014	GW	91	0	10	0	580	167	848
	SW	175	0	0	0	0	47	222
2013	GW	255	0	54	0	567	168	1,044
	SW	166	0	11	0	0	48	225
2012	GW	170	0	5	0	522	267	964
	SW	373	0	45	0	0	75	493
2011	GW	147	0	241	0	902	299	1,589
	SW	475	0	109	0	0	84	668
2010	GW	144	0	96	0	871	293	1,404
	SW	491	0	50	0	0	83	624
2009	GW	116	0	62	0	394	323	895
	SW	613	0	39	0	0	91	743
2008	GW	112	0	28	0	685	336	1,161
	SW	333	0	27	0	5	95	460
2007	GW	130	0	0	0	609	227	966
	SW	345	0	18	0	0	64	427
2006	GW	219	0	0	0	937	248	1,404
	SW	304	0	18	0	28	70	420
2005	GW	234	0	0	0	758	225	1,217
	SW	221	0	18	0	37	64	340
2004	GW	217	0	0	0	755	26	998
	SW	232	0	18	0	37	230	517
2003	GW	272	0	0	0	411	23	706
	SW	172	0	18	0	37	209	436
2002	GW	184	0	0	2	980	35	1,201
	SW	228	0	18	104	160	319	829
2001	GW	159	0	0	0	799	41	999
	SW	237	0	20	765	130	366	1,518

*Estimated Historical Water Use and 2017 State Water Plan Dataset:*

*Coke County Underground Water Conservation District*

*August 24, 2018*

*Page 3 of 9*



# Projected Surface Water Supplies

## TWDB 2017 State Water Plan Data

### COKE COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	Source Name	2020	2030	2040	2050	2060	2070
F	BRONTE	COLORADO	OAK CREEK LAKE/RESERVOIR	0	0	0	0	0	0
F	COUNTY-OTHER, COKE	COLORADO	OAK CREEK LAKE/RESERVOIR	0	0	0	0	0	0
F	IRRIGATION, COKE	COLORADO	COLORADO RUN-OF- RIVER	11	11	11	11	11	11
F	LIVESTOCK, COKE	COLORADO	COLORADO LIVESTOCK LOCAL SUPPLY	370	370	370	370	370	370
F	MINING, COKE	COLORADO	CRMWD DIVERTED WATER SYSTEM	0	0	0	0	0	0
F	ROBERT LEE	COLORADO	EV SPENCE LAKE/RESERVOIR NON-SYSTEM PORTION	0	0	0	0	0	0
F	ROBERT LEE	COLORADO	OAK CREEK LAKE/RESERVOIR	0	0	0	0	0	0
<b>Sum of Projected Surface Water Supplies (acre-feet)</b>				<b>381</b>	<b>381</b>	<b>381</b>	<b>381</b>	<b>381</b>	<b>381</b>

# Projected Water Demands

## TWDB 2017 State Water Plan Data

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

All values are in acre-feet

### COKE COUNTY

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
F	BRONTE	COLORADO	252	248	244	242	242	242
F	COUNTY-OTHER, COKE	COLORADO	127	120	115	113	113	113
F	IRRIGATION, COKE	COLORADO	965	963	962	962	962	962
F	LIVESTOCK, COKE	COLORADO	431	431	431	431	431	431
F	MINING, COKE	COLORADO	488	482	430	376	328	286
F	ROBERT LEE	COLORADO	296	290	287	286	286	286
F	STEAM ELECTRIC POWER, COKE	COLORADO	247	289	339	401	477	528
<b>Sum of Projected Water Demands (acre-feet)</b>			<b>2,806</b>	<b>2,823</b>	<b>2,808</b>	<b>2,811</b>	<b>2,839</b>	<b>2,848</b>



# Projected Water Management Strategies

## TWDB 2017 State Water Plan Data

### COKE COUNTY

WUG, Basin (RWPG)

All values are in acre-feet

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
<b>BRONTE, COLORADO (F)</b>							
DEVELOP GROUNDWATER FROM EDWARDS-TRINITY PLATEAU IN NOLAN COUNTY - BRONTE	EDWARDS-TRINITY-PLATEAU AQUIFER [NOLAN]	78	78	78	78	78	78
MUNICIPAL CONSERVATION - BRONTE	DEMAND REDUCTION [COKE]	5	5	5	5	5	5
SUBORDINATION - OAK CREEK RESERVOIR	OAK CREEK LAKE/RESERVOIR [RESERVOIR]	280	276	272	270	270	270
WATER AUDITS AND LEAK - BRONTE	DEMAND REDUCTION [COKE]	12	12	11	11	11	11
		<b>375</b>	<b>371</b>	<b>366</b>	<b>364</b>	<b>364</b>	<b>364</b>
<b>COUNTY-OTHER, COKE, COLORADO (F)</b>							
SUBORDINATION - OAK CREEK RESERVOIR	OAK CREEK LAKE/RESERVOIR [RESERVOIR]	29	28	28	27	27	27
VOLUNTARY TRANSFER FROM IRRIGATION - COKE COUNTY OTHER	OTHER AQUIFER [COKE]	22	20	18	18	18	18
		<b>51</b>	<b>48</b>	<b>46</b>	<b>45</b>	<b>45</b>	<b>45</b>
<b>IRRIGATION, COKE, COLORADO (F)</b>							
IRRIGATION CONSERVATION - COKE COUNTY	DEMAND REDUCTION [COKE]	48	96	115	115	115	115
		<b>48</b>	<b>96</b>	<b>115</b>	<b>115</b>	<b>115</b>	<b>115</b>
<b>MINING, COKE, COLORADO (F)</b>							
DEVELOP ADDITIONAL EDWARDS-TRINITY PLATEAU AQUIFER - COKE COUNTY MINING	EDWARDS-TRINITY-PLATEAU AQUIFER [COKE]	250	250	250	250	250	250
MINING CONSERVATION - COKE COUNTY	DEMAND REDUCTION [COKE]	34	34	30	26	23	20
SUBORDINATION - CRMWD BRACKISH WATER SYSTEM	CRMWD DIVERTED WATER SYSTEM [RESERVOIR]	38	36	34	32	30	28
		<b>322</b>	<b>320</b>	<b>314</b>	<b>308</b>	<b>303</b>	<b>298</b>
<b>ROBERT LEE, COLORADO (F)</b>							
MUNICIPAL CONSERVATION - ROBERT LEE	DEMAND REDUCTION [COKE]	6	6	6	6	6	6
SUBORDINATION - OAK CREEK RESERVOIR	OAK CREEK LAKE/RESERVOIR [RESERVOIR]	242	237	235	234	234	234
		<b>248</b>	<b>243</b>	<b>241</b>	<b>240</b>	<b>240</b>	<b>240</b>

# Projected Water Supply Needs TWDB 2017 State Water Plan Data

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

All values are in acre-feet

<b>COKE COUNTY</b>			2020	2030	2040	2050	2060	2070
<b>RWPG</b>	<b>WUG</b>	<b>WUG Basin</b>						
F	BRONTE	COLORADO	-184	-182	-181	-180	-180	-180
F	COUNTY-OTHER, COKE	COLORADO	-51	-48	-46	-45	-45	-45
F	IRRIGATION, COKE	COLORADO	-202	-200	-199	-199	-199	-199
F	LIVESTOCK, COKE	COLORADO	0	0	0	0	0	0
F	MINING, COKE	COLORADO	-318	-312	-260	-206	-158	-116
F	ROBERT LEE	COLORADO	-248	-243	-241	-240	-240	-240
F	STEAM ELECTRIC POWER, COKE	COLORADO	-247	-289	-339	-401	-477	-528
<b>Sum of Projected Water Supply Needs (acre-feet)</b>			<b>-1,250</b>	<b>-1,274</b>	<b>-1,266</b>	<b>-1,271</b>	<b>-1,299</b>	<b>-1,308</b>

# Projected Water Management Strategies

## TWDB 2017 State Water Plan Data

**WUG, Basin (RWPG)**

All values are in acre-feet

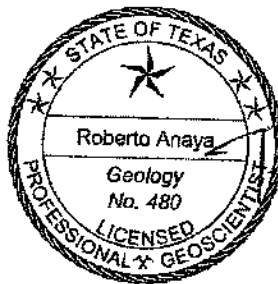
Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
<b>STEAM ELECTRIC POWER, COKE, COLORADO (F)</b>							
SEP CONSERVATION - ALTERNATIVE COOLING TECHNOLOGIES - COKE COUNTY	DEMAND REDUCTION [COKE]	247	289	339	401	477	528
<b>Sum of Projected Water Management Strategies (acre-feet)</b>		<b>1,291</b>	<b>1,367</b>	<b>1,421</b>	<b>1,473</b>	<b>1,544</b>	<b>1,590</b>

## **APPENDIX B**

---

**GAM RUN 17-014: COKE COUNTY  
UNDERGROUND WATER CONSERVATION DISTRICT  
GROUNDWATER MANAGEMENT PLAN**

Roberto Anaya, P.G.  
Texas Water Development Board  
Groundwater Division  
Groundwater Availability Modeling Department  
(512) 463-6115  
May 31, 2018



*Roberto Anaya*  
5/31/18

*This page is intentionally blank*

---

# **GAM RUN 17-014: COKE COUNTY UNDERGROUND WATER CONSERVATION DISTRICT GROUNDWATER MANAGEMENT PLAN**

Roberto Anaya, P.G.  
Texas Water Development Board  
Groundwater Division  
Groundwater Availability Modeling Department  
(512) 463-6115  
May 31, 2018

## ***EXECUTIVE SUMMARY:***

Texas Water Code, Section 36.1071, Subsection (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 Coke 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](mailto:stephen.allen@twdb.texas.gov). Part 2 is the required groundwater availability modeling information and this information includes:

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

The groundwater management plan for the Coke County Underground Water Conservation District should be adopted by the district on or before June 1, 2018, and submitted to the Executive Administrator of the TWDB on or before July 1, 2018. The current management

plan for the Coke County Underground Water Conservation District expires on August 30, 2018.

We used the groundwater availability models for the Edwards-Trinity (Plateau) Aquifer (Anaya and Jones, 2009), High Plains Aquifer System (Deeds and Jigmond, 2015), and Lipan Aquifer (Beach and others, 2004) to estimate the management plan information for the aquifers within Coke County Underground Water Conservation District. This report replaces the results of GAM Run 12-019 (Kohlrenken, 2012). GAM Run 17-014 meets current standards set after GAM Run 12-019 was released and includes results from the recently released groundwater availability model for the High Plains Aquifer System. Tables 1 through 3 summarize the groundwater availability model data required by statute and Figures 1 through 3 show the area of the models from which the values in the tables were extracted. If after review of the figures, the Coke County Underground Water Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the TWDB at your earliest convenience.

### ***METHODS:***

In accordance with the provisions of the Texas Water Code, Section 36.1071, Subsection (h), groundwater availability models for the High Plains Aquifer System (1980 through 2012), Edwards-Trinity (Plateau) and Pecos Valley aquifers (1981 through 2000), and the Lipan Aquifer (1980 through 1998) were run for this analysis. Water budgets for each year of the transient model periods were extracted using ZONEBUDGET Version 3.01 (Harbaugh, 2009). The average annual water budget values for recharge, surface water outflow, inflow to the district, outflow from the district, net cross-formation flow between aquifers, and net flow between aquifer and its brackish portion located within the district are summarized in this report.

### ***PARAMETERS AND ASSUMPTIONS:***

#### ***High Plains Aquifer System***

- We used version 1.01 of the groundwater availability model for the High Plains Aquifer System to analyze the Dockum Aquifer. See Deeds and Jigmond (2015) for assumptions and limitations of the model.
- The model has four layers which represent the Ogallala Aquifer (Layer 1), the Edwards-Trinity (High Plains) or (Plateau) Aquifer (Layer 2), and the Dockum



Aquifer (Layers 3 and 4). Within the Coke County Underground Water Conservation District the Ogallala and Edwards-Trinity (High Plains) aquifers are not present.

- Water budgets for the district were determined for the Dockum Aquifer (layers 3 and 4 combined). Interaction between the Edwards-Trinity (Plateau) and Dockum aquifers was determined using water budget information for layer 2, 3, and 4.
- The model was run with MODFLOW-NWT (Niswonger and others, 2011).

#### ***Edwards-Trinity (Plateau) Aquifer***

- We used version 1.01 of the groundwater availability model for the Edwards-Trinity (Plateau) and Pecos Valley aquifers. See Anaya and Jones (2009) for assumptions and limitations of the groundwater availability model for the Edwards-Trinity (Plateau) and Pecos Valley aquifers. The Pecos Valley Aquifer does not occur within Coke County Underground Water District and therefore no groundwater budget values are included for it in this report.
- Within Coke County Underground Water District only layer two of the groundwater availability model is active and it generally represents the Edwards Group and the Trinity Group of the Edwards-Trinity (Plateau) Aquifer.
- The model was run with MODFLOW-96 (Harbaugh and McDonald, 1996).

#### ***Lipan Aquifer***

- We used version 1.01 of the groundwater availability model for the Lipan Aquifer for this analysis. See Beach and others (2004) for assumptions and limitations of the model.
- The Lipan Aquifer model includes one layer representing the Quaternary Leona Formation, portions of the underlying Permian Formations, and the Edwards-Trinity (Plateau) Aquifer to the west, south, and north. The model does not include all of the aquifer within the district boundaries.
- The model uses general head boundaries to simulate the eastern and western aquifer boundaries. Inflow on the general-head boundary to the west represents inflow from the Edwards-Trinity (Plateau) Aquifer.
- Recharge rates are based on a fraction of precipitation (Beach and others, 2004).
- The model was run with MODFLOW-96 (Harbaugh and McDonald, 1996).

## **RESULTS:**

A groundwater budget summarizes the amount of water entering and leaving the aquifer according to the groundwater availability model. Selected groundwater budget components listed below were extracted from the model results for the aquifers located within the district and averaged over the duration of the calibration portion of the model runs in the district. The components of the modified budget shown in tables 1 through 3 include:

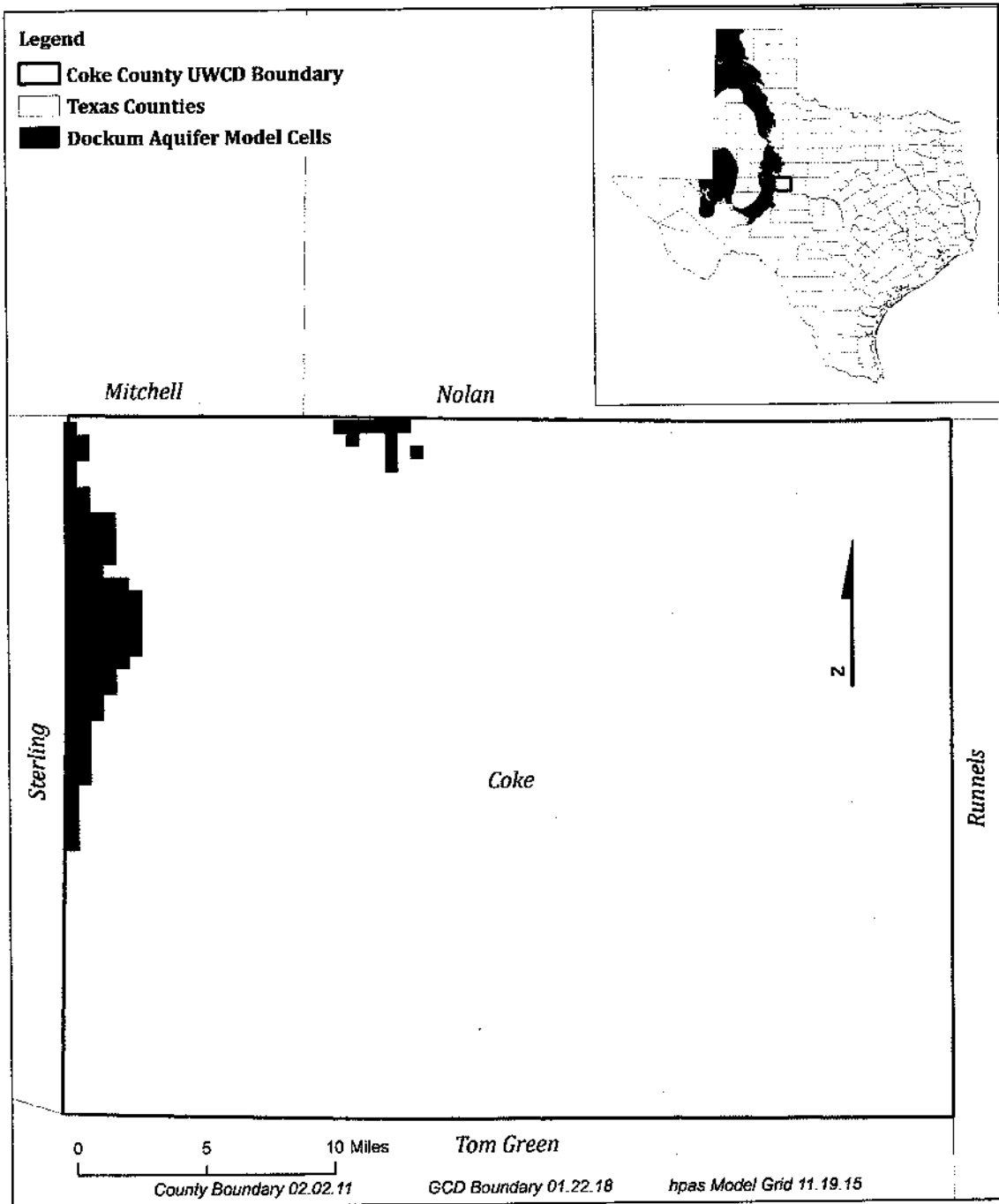
- Precipitation recharge—the areally distributed recharge sourced from precipitation falling on the outcrop areas of the aquifers (where the aquifer is exposed at land surface) within the district.
- Surface-water outflow—the total water discharging from the aquifer (outflow) to surface-water features such as streams, reservoirs, and springs.
- Flow into and out of district—the lateral flow within the aquifer between the district and adjacent counties.
- Flow between aquifers—the net vertical flow between 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. 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 district or county boundaries, 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 (Figures 1 through 3).

**TABLE 1: SUMMARIZED INFORMATION FOR THE DOCKUM AQUIFER THAT IS NEEDED FOR COKE 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.**

<i>Management Plan requirement</i>	<i>Aquifer or confining unit</i>	<i>Results</i>
Estimated annual amount of recharge from precipitation to the district	Dockum Aquifer	129
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Dockum Aquifer	264
Estimated annual volume of flow into the district within each aquifer in the district	Dockum Aquifer	56
Estimated annual volume of flow out of the district within each aquifer in the district	Dockum Aquifer	39
Estimated net annual volume of flow between each aquifer in the district	From Dockum Aquifer into Dockum equivalent unit	15*
	From Edwards-Trinity (Plateau) Aquifer into Dockum Aquifer	63

\* Groundwater flow from the Dockum Aquifer into hydraulically connected active model cells of a Dockum Group equivalent unit.

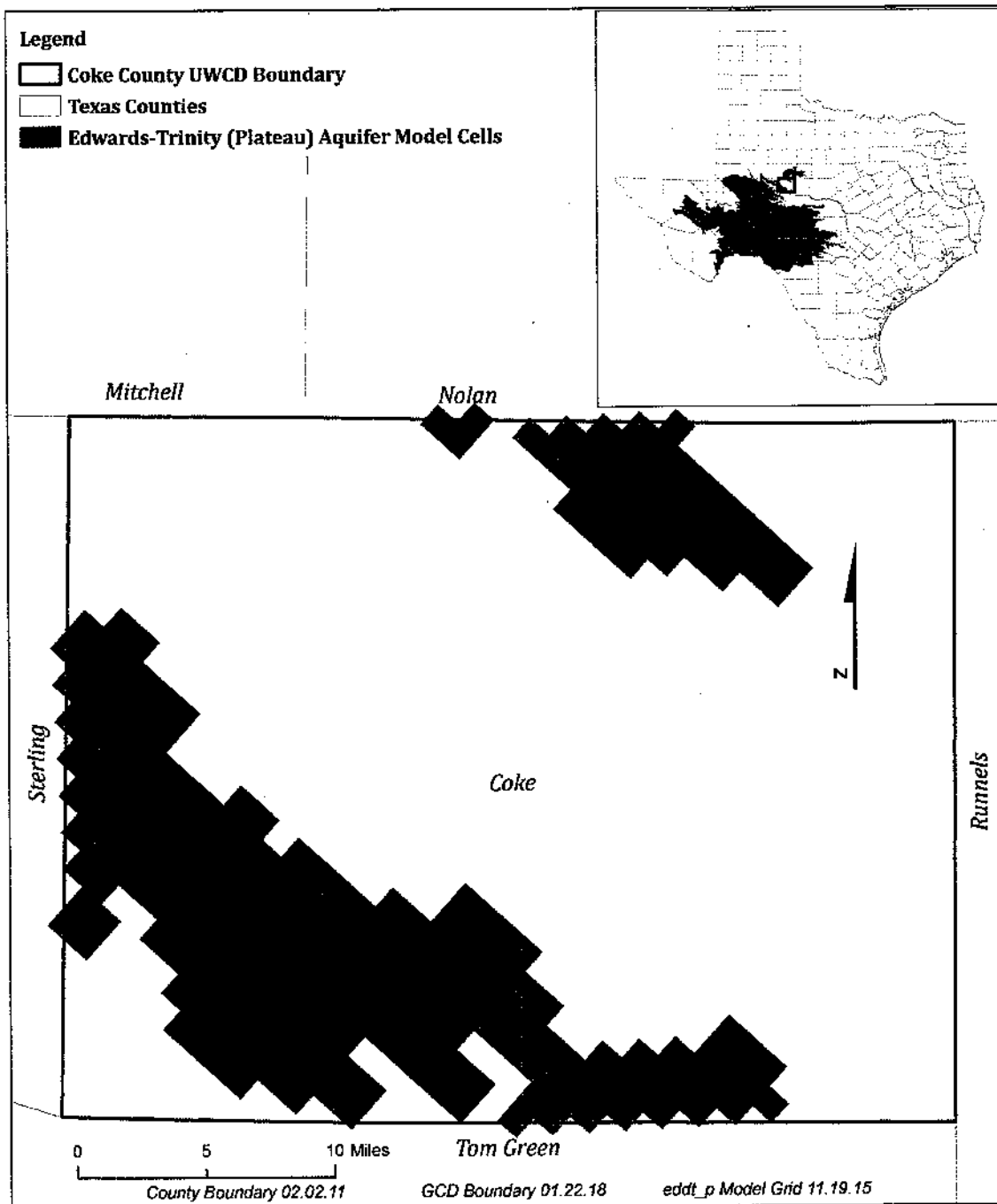


**FIGURE 1: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE HIGH PLAINS AQUIFER SYSTEM FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED (THE DOCKUM AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).**

**TABLE 2: SUMMARIZED INFORMATION FOR THE EDWARDS-TRINITY (PLATEAU) AQUIFER THAT IS NEEDED FOR COKE 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.**

<i>Management Plan requirement</i>	<i>Aquifer or confining unit</i>	<i>Results</i>
Estimated annual amount of recharge from precipitation to the district	Edwards-Trinity (Plateau) Aquifer	5,828
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	6,688
Estimated annual volume of flow into the district within each aquifer in the district	Edwards-Trinity (Plateau) Aquifer	1,234
Estimated annual volume of flow out of the district within each aquifer in the district	Edwards-Trinity (Plateau) Aquifer	1,024
Estimated net annual volume of flow between each aquifer in the district	From the Edwards-Trinity (Plateau) Aquifer into older Paleozoic units undifferentiated	56*

\* Groundwater flow from the Edwards-Trinity (Plateau) Aquifer into underlying Permian units. This value differs from the value Table 3 because it does not include flows into the adjacent Lipan Aquifer.

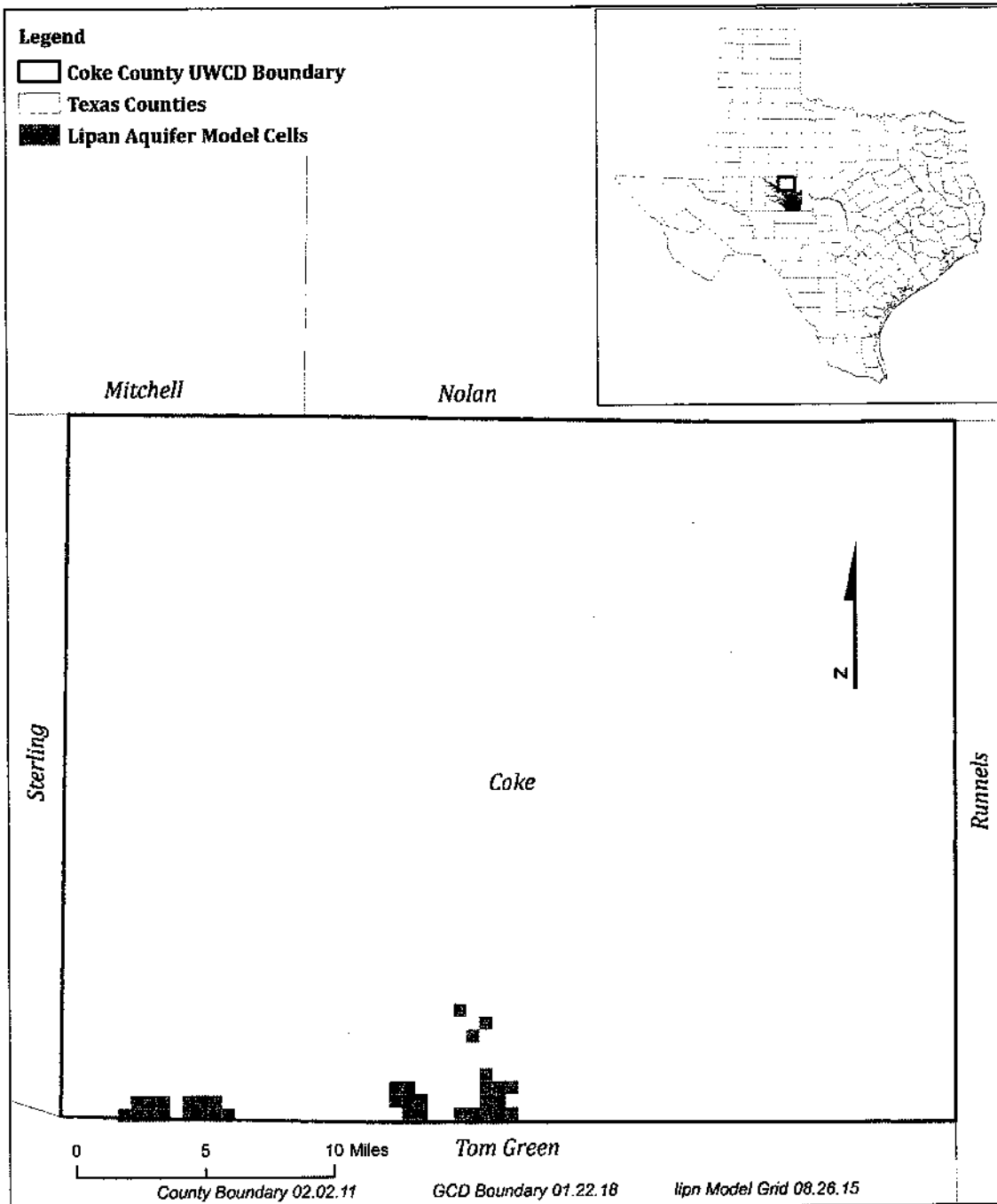


**FIGURE 2: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE EDWARDS-TRINITY (PLATEAU) AQUIFER FROM WHICH THE INFORMATION IN TABLE 2 WAS EXTRACTED (THE EDWARDS-TRINITY (PLATEAU) AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).**

**TABLE 3: SUMMARIZED INFORMATION FOR THE LIPAN AQUIFER THAT IS NEEDED FOR COKE 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.**

<i>Management Plan requirement</i>	<i>Aquifer</i>	<i>Results</i>
Estimated annual amount of recharge from precipitation to the district	Lipan Aquifer	271
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Lipan Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Lipan Aquifer	0
Estimated annual volume of flow out of the district within each aquifer in the district	Lipan Aquifer	648
Estimated net annual volume of flow between each aquifer in the district	From the Edwards-Trinity (Plateau) Aquifer into the Lipan Aquifer	503*

\* Groundwater flow consists of flows from the adjacent Edwards-Trinity (Plateau) Aquifer in hydraulic connection with the Lipan Aquifer as well as flows from adjacent Permian units underlying the Edwards-Trinity (Plateau) Aquifer and in hydraulic connection with the Lipan Aquifer.



**FIGURE 3: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE LIPAN AQUIFER FROM WHICH THE INFORMATION IN TABLE 3 WAS EXTRACTED (THE LIPAN AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).**



### **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 historical groundwater flow conditions includes the assumptions about the location in the aquifer where historical 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 historical 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. Historical 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.,  
[http://www.twdb.texas.gov/groundwater/models/gam/eddt\\_p/ET-Plateau\\_Full.pdf](http://www.twdb.texas.gov/groundwater/models/gam/eddt_p/ET-Plateau_Full.pdf).
- Beach, James A., Burton, Stuart, and Kolarik, Barry, 2004, Groundwater availability model for the Lipan Aquifer in Texas: final report prepared for the Texas Water Development Board by LBG-Guyton Associates, 246 p.,  
[http://www.twdb.texas.gov/groundwater/models/gam/lipn/LIPN\\_Model\\_Report.pdf](http://www.twdb.texas.gov/groundwater/models/gam/lipn/LIPN_Model_Report.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](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.
- Harbaugh, A. W., Banta, E. R., Hill, M. C., and McDonald, M. G., 2000, MODFLOW-2000, the U.S. Geological Survey modular ground-water model -- User guide to modularization concepts and the Ground-Water Flow Process: U.S. Geological Survey Open-File Report 00-92, 121 p.
- 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.
- Kohlrenken, W., 2013, GAM Run 12-019: Coke County Underground Water Conservation District Management Plan, 14 p.  
<https://www.twdb.texas.gov/groundwater/docs/GAMruns/GR12-019.pdf>
- 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.
- 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.

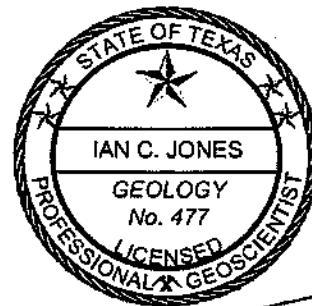
*This page is intentionally left blank.*

## **APPENDIX C**

---

**GAM RUN 16-026 MAG VERSION 2:  
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 Availability Modeling Department  
(512) 463-6641  
September 21, 2018



*I. C. Jones*  
9/24/2018

*This page is intentionally left blank.*

---

# **GAM RUN 16-026 MAG VERSION 2: 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 Availability Modeling Department  
(512) 463-6641  
September 21, 2018

## **EXECUTIVE SUMMARY:**

We have 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 September 22, 2016 and March 22, 2018. The explanatory reports and other materials submitted to the Texas Water Development Board (TWDB) were determined to be administratively complete on June 22, 2018.

The original version of GAM Run 16-026 MAG inadvertently included modeled available groundwater estimates for areas declared not relevant by the groundwater management area and areas that had no desired future conditions for the Edwards-Trinity (Plateau), Pecos Valley, and Trinity aquifers. GAM Run 16-026 MAG Version 2 (this report) contains updates that only include relevant portions of these aquifers in the reported total modeled available groundwater estimates and Tables 5 and 6 for the Edwards-Trinity (Plateau), Pecos Valley, and Trinity aquifers.

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 are 26,164 acre-feet per year in the Capitan Reef Complex Aquifer; 2,324 acre-feet per year in the Dockum Aquifer; 474,464 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; 6,570 to 8,019 acre-feet per year in the Ogallala 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 (Jones, 2016); the High Plains Aquifer System (Deeds and Jigmond, 2015); the minor aquifers of the Llano Uplift Area (Shi and others, 2016), and the Rustler Aquifer (Ewing and others, 2012). In addition, the alternative 1-layer model for the Edwards-Trinity (Plateau), Pecos Valley, and Trinity aquifers (Hutchison and others, 2011) 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, 2011) and the model associated with a hydrogeological study for Val Verde County and the City of Del Rio (EcoKai Environmental, Inc. and Hutchison, 2014), respectively, were used to estimate modeled available groundwater. The Val Verde County/Del Rio model covers Val Verde County. This model was used to simulate multiple pumping scenarios indicating the effects of a proposed wellfield. The model indicated the effects of varied pumping rates and wellfield locations. These model runs were used by Groundwater Management Area 7 as the basis for the desired future conditions for Val Verde County.

**REQUESTOR:**

Mr. Joel Pigg, chair of Groundwater Management Area 7 districts.

**DESCRIPTION OF REQUEST:**

In letters dated November 22, 2016 and March 26, 2018, Dr. William Hutchison on behalf of Groundwater Management Area 7 provided the TWDB with the desired future conditions for the Capitan, Dockum, Edwards-Trinity (Plateau), Ellenburger-San Saba, Hickory, Ogallala, Pecos Valley, Rustler, and Trinity aquifers in Groundwater Management Area 7. Groundwater Management Area 7 provided additional clarifications through emails to the TWDB on March 23, 2018 and June 12, 2018 for the use of model extents (Dockum, Ellenburger-San Saba, Hickory, Ogallala, Rustler aquifers), the use of aquifer extents (Capitan Reef Complex, Edwards-Trinity [Plateau], Pecos Valley, and Trinity aquifers), and desired future conditions for the Edwards-Trinity (Plateau) Aquifer of Kinney and Val Verde counties.

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

**Capitan Reef [Complex] Aquifer**

Total net drawdown of the Capitan Reef [Complex] Aquifer not to exceed 56 feet in Pecos County (Middle Pecos [Groundwater Conservation District]) in 2070 as compared with 2006 aquifer levels (Reference: Scenario 4, GMA 7 Technical Memorandum 15-06, 4-8-2015).



**Dockum Aquifer**

Total net drawdown of the Dockum Aquifer not to exceed 14 feet in Reagan County (Santa Rita [Groundwater Conservation District]) in 2070, as compared with 2012 aquifer levels.

Total net drawdown of the Dockum Aquifer not to exceed 52 feet in Pecos County (Middle Pecos [Groundwater Conservation District]) in 2070, as compared with 2012 aquifer levels.

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

Average drawdown for [the Edwards-Trinity (Plateau), Pecos Valley, and Trinity aquifers] in the following [Groundwater Management Area] 7 counties not to exceed drawdowns from 2010 to 2070 [...].

County	[...] Average Drawdowns from 2010 to 2070 [feet]
Coke	0
Crockett	10
Ector	4
Edwards	2
Gillespie	5
Glasscock	42
Irion	10
Kimble	1
Menard	1
Midland	12
Pecos	14
Reagan	42
Real	4
Schleicher	8
Sterling	7
Sutton	6

Taylor	0
Terrell	2
Upton	20
Uvalde	2

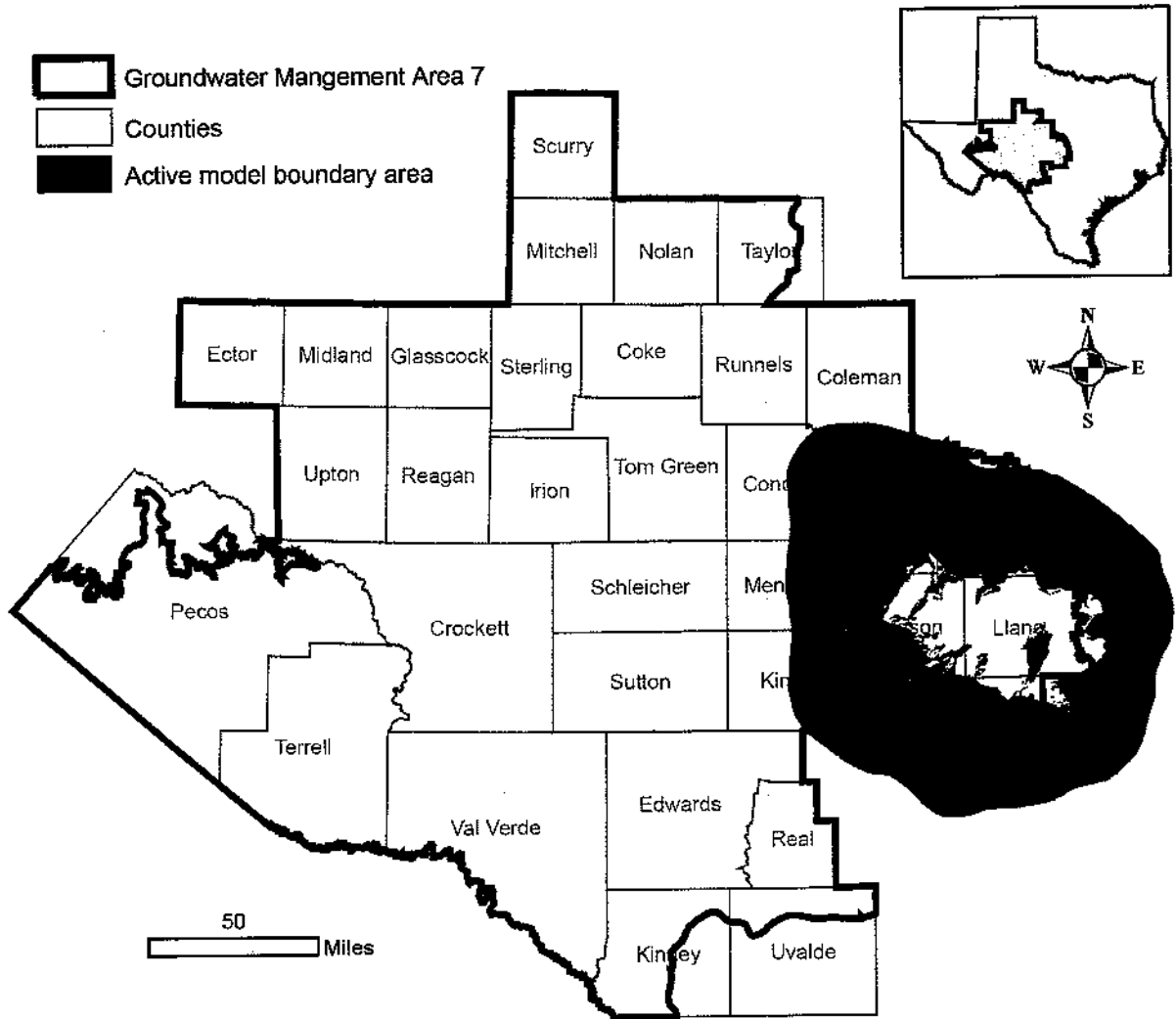
Total net drawdown [of the Edwards-Trinity (Plateau), Pecos Valley, and Trinity aquifers] in Kinney County in 2070, as compared with 2010 aquifer levels, shall be consistent with maintenance of an annual average flow of 23.9 [cubic feet per second] and an annual median flow of 23.9 [cubic feet per second] at Las Moras Springs [...].

Total net drawdown [of the Edwards-Trinity (Plateau), Pecos Valley, and Trinity aquifers] 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 [million gallons per day] at San Felipe Springs.

**Minor Aquifers of the Llano Uplift Area**

Total net drawdowns of [Ellenburger-San Saba Aquifer] levels in 2070, as compared with 2010 aquifer levels, shall not exceed the number of feet set forth below, respectively, for the following counties and districts:

County	[Groundwater Conservation District]	Drawdown in 2070 (feet)
Gillespie	Hill Country [Underground Water Conservation District]	8
Mason	Hickory [Underground Water Conservation District] no. 1	14
McCulloch	Hickory [Underground Water Conservation District] no. 1	29
Menard	Menard County [Underground Water District] and Hickory [Underground Water Conservation District] no. 1	46
Kimble	Kimble County [Groundwater Conservation District] and Hickory	18



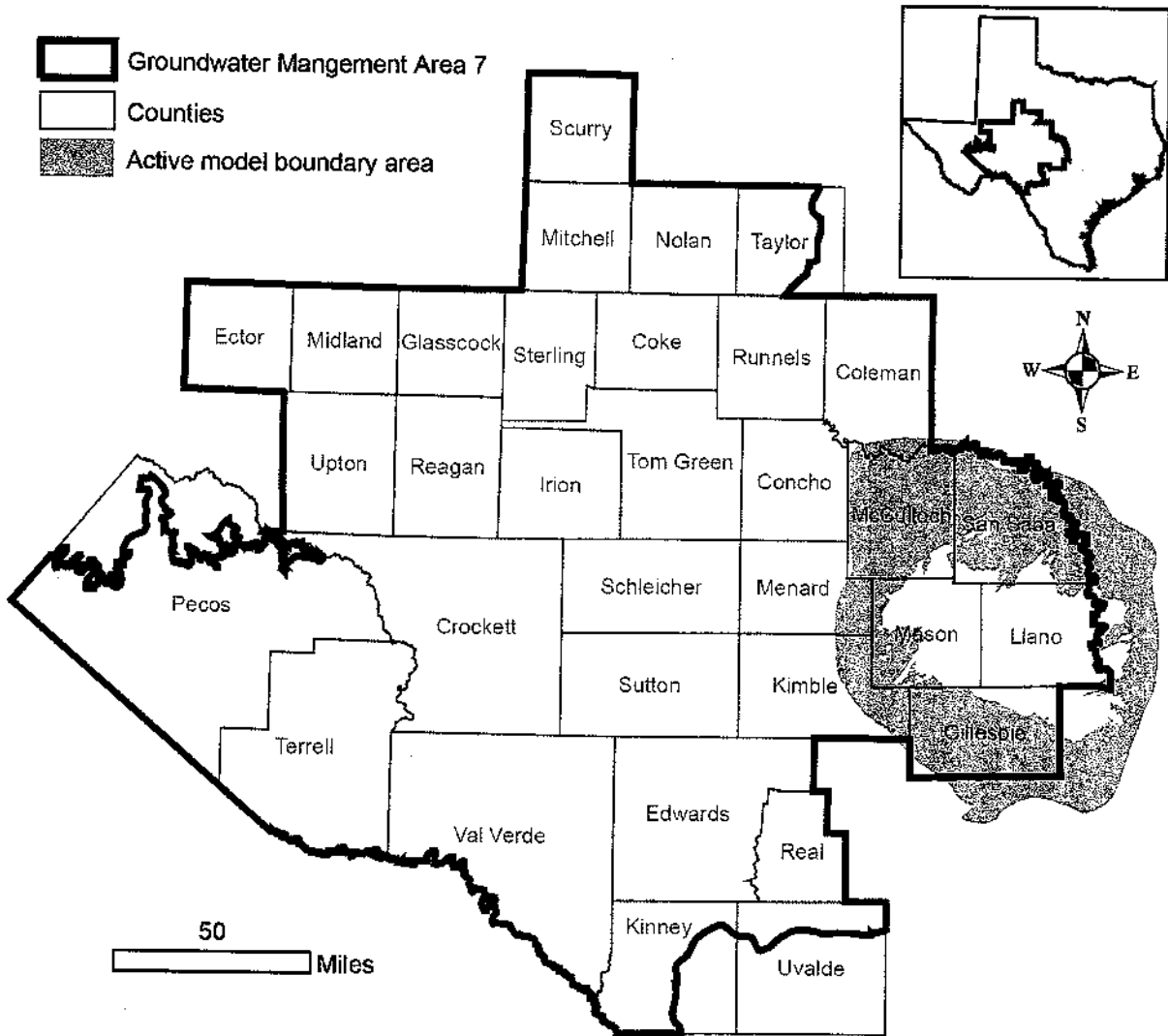
**FIGURE 10. MAP SHOWING AREAS COVERED BY THE HICKORY AQUIFER IN THE GROUNDWATER AVAILABILITY MODEL FOR THE MINOR AQUIFERS OF THE LLANO UPLIFT AREA IN GROUNDWATER MANAGEMENT AREA 7.**



**TABLE 7. MODELED AVAILABLE GROUNDWATER FOR THE ELLENBURGER-SAN SABA AQUIFER IN GROUNDWATER MANAGEMENT AREA 7 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) AND COUNTY FOR EACH DECADE BETWEEN 2011 AND 2070. RESULTS ARE IN ACRE-FEET PER YEAR. UWCD IS THE ABBREVIATION FOR UNDERGROUND WATER CONSERVATION DISTRICT AND UWD IS UNDERGROUND WATER DISTRICT.**

District	County	Year									
		2011	2020	2030	2040	2050	2060	2070			
Hickory UWCD No. 1	Kimble	344	344	344	344	344	344	344	344	344	344
	Mason	3,237	3,237	3,237	3,237	3,237	3,237	3,237	3,237	3,237	3,237
	McCulloch	3,466	3,466	3,466	3,466	3,466	3,466	3,466	3,466	3,466	3,466
	Menard	282	282	282	282	282	282	282	282	282	282
	San Saba	5,559	5,559	5,559	5,559	5,559	5,559	5,559	5,559	5,559	5,559
<b>Total</b>		<b>12,887</b>	<b>12,887</b>	<b>12,887</b>	<b>12,887</b>	<b>12,887</b>	<b>12,887</b>	<b>12,887</b>	<b>12,887</b>	<b>12,887</b>	<b>12,887</b>
Hill Country UWCD		6,294	6,294	6,294	6,294	6,294	6,294	6,294	6,294	6,294	6,294
<b>Total</b>		<b>6,294</b>	<b>6,294</b>	<b>6,294</b>	<b>6,294</b>	<b>6,294</b>	<b>6,294</b>	<b>6,294</b>	<b>6,294</b>	<b>6,294</b>	<b>6,294</b>
Kimble County GCD		178	178	178	178	178	178	178	178	178	178
<b>Total</b>		<b>178</b>	<b>178</b>	<b>178</b>	<b>178</b>	<b>178</b>	<b>178</b>	<b>178</b>	<b>178</b>	<b>178</b>	<b>178</b>
Menard County UWD		27	27	27	27	27	27	27	27	27	27
<b>Total</b>		<b>27</b>	<b>27</b>	<b>27</b>	<b>27</b>	<b>27</b>	<b>27</b>	<b>27</b>	<b>27</b>	<b>27</b>	<b>27</b>
No District		898	898	898	898	898	898	898	898	898	898
		2,331	2,331	2,331	2,331	2,331	2,331	2,331	2,331	2,331	2,331
<b>Total</b>		<b>3,229</b>	<b>3,229</b>	<b>3,229</b>	<b>3,229</b>	<b>3,229</b>	<b>3,229</b>	<b>3,229</b>	<b>3,229</b>	<b>3,229</b>	<b>3,229</b>
<b>GMA 7</b>		<b>22,616</b>	<b>22,616</b>	<b>22,616</b>	<b>22,616</b>	<b>22,616</b>	<b>22,616</b>	<b>22,616</b>	<b>22,616</b>	<b>22,616</b>	<b>22,616</b>

Note: The year 2011 is used because the 2010 desired future condition baseline year for the Ellenburger-San Saba Aquifer is an initial condition in the predictive model run.



**FIGURE 9. 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 6. (CONTINUED).**

County	RWPA	River Basin	Year					
			2020	2030	2040	2050	2060	2070
Schleicher	F	Colorado	6,403	6,403	6,403	6,403	6,403	6,403
		Rio Grande	1,631	1,631	1,631	1,631	1,631	1,631
		<b>Total</b>	<b>8,034</b>	<b>8,034</b>	<b>8,034</b>	<b>8,034</b>	<b>8,034</b>	<b>8,034</b>
Sterling	F	Colorado	2,495	2,495	2,495	2,495	2,495	2,495
		<b>Total</b>	<b>2,495</b>	<b>2,495</b>	<b>2,495</b>	<b>2,495</b>	<b>2,495</b>	<b>2,495</b>
Sutton	F	Colorado	388	388	388	388	388	388
		Rio Grande	6,022	6,022	6,022	6,022	6,022	6,022
		<b>Total</b>	<b>6,410</b>	<b>6,410</b>	<b>6,410</b>	<b>6,410</b>	<b>6,410</b>	<b>6,410</b>
Taylor	G	Brazos	331	331	331	331	331	331
		Colorado	158	158	158	158	158	158
		<b>Total</b>	<b>489</b>	<b>489</b>	<b>489</b>	<b>489</b>	<b>489</b>	<b>489</b>
Terrell	E	Rio Grande	1,420	1,420	1,420	1,420	1,420	1,420
		<b>Total</b>	<b>1,420</b>	<b>1,420</b>	<b>1,420</b>	<b>1,420</b>	<b>1,420</b>	<b>1,420</b>
		Colorado	21,243	21,243	21,243	21,243	21,243	21,243
Upton	F	Rio Grande	1,126	1,126	1,126	1,126	1,126	1,126
		<b>Total</b>	<b>22,369</b>	<b>22,369</b>	<b>22,369</b>	<b>22,369</b>	<b>22,369</b>	<b>22,369</b>
		Nueces	1,993	1,993	1,993	1,993	1,993	1,993
Uvalde	L	<b>Total</b>	<b>1,993</b>	<b>1,993</b>	<b>1,993</b>	<b>1,993</b>	<b>1,993</b>	<b>1,993</b>
		Rio Grande	50,000	50,000	50,000	50,000	50,000	50,000
Val Verde	J	<b>Total</b>	<b>50,000</b>	<b>50,000</b>	<b>50,000</b>	<b>50,000</b>	<b>50,000</b>	<b>50,000</b>
		<b>GMA 7</b>	<b>474,464</b>	<b>474,464</b>	<b>474,464</b>	<b>474,464</b>	<b>474,464</b>	<b>474,464</b>

\*The modeled available groundwater for Kimble and Menard counties excludes the parts of the counties that fall within Hickory Underground Water Conservation District No. 1.







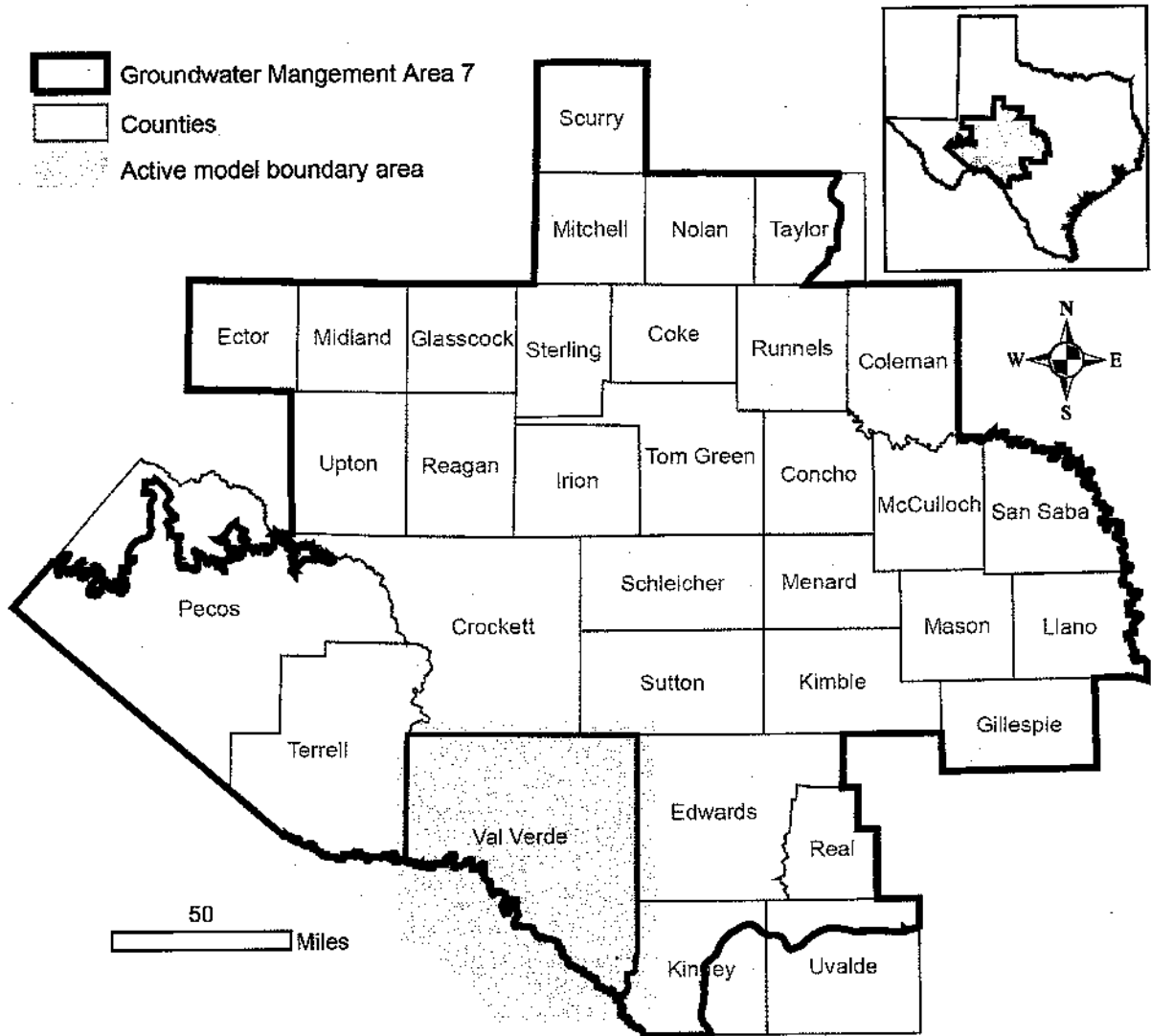
**TABLE 5. (CONTINUED).**

District	County	Year						
		2010	2020	2030	2040	2050	2060	2070
No district		102,415	102,415	102,415	102,415	102,415	102,415	102,415
<b>GMA 7</b>		<b>474,464</b>	<b>474,464</b>	<b>474,464</b>	<b>474,464</b>	<b>474,464</b>	<b>474,464</b>	<b>474,464</b>

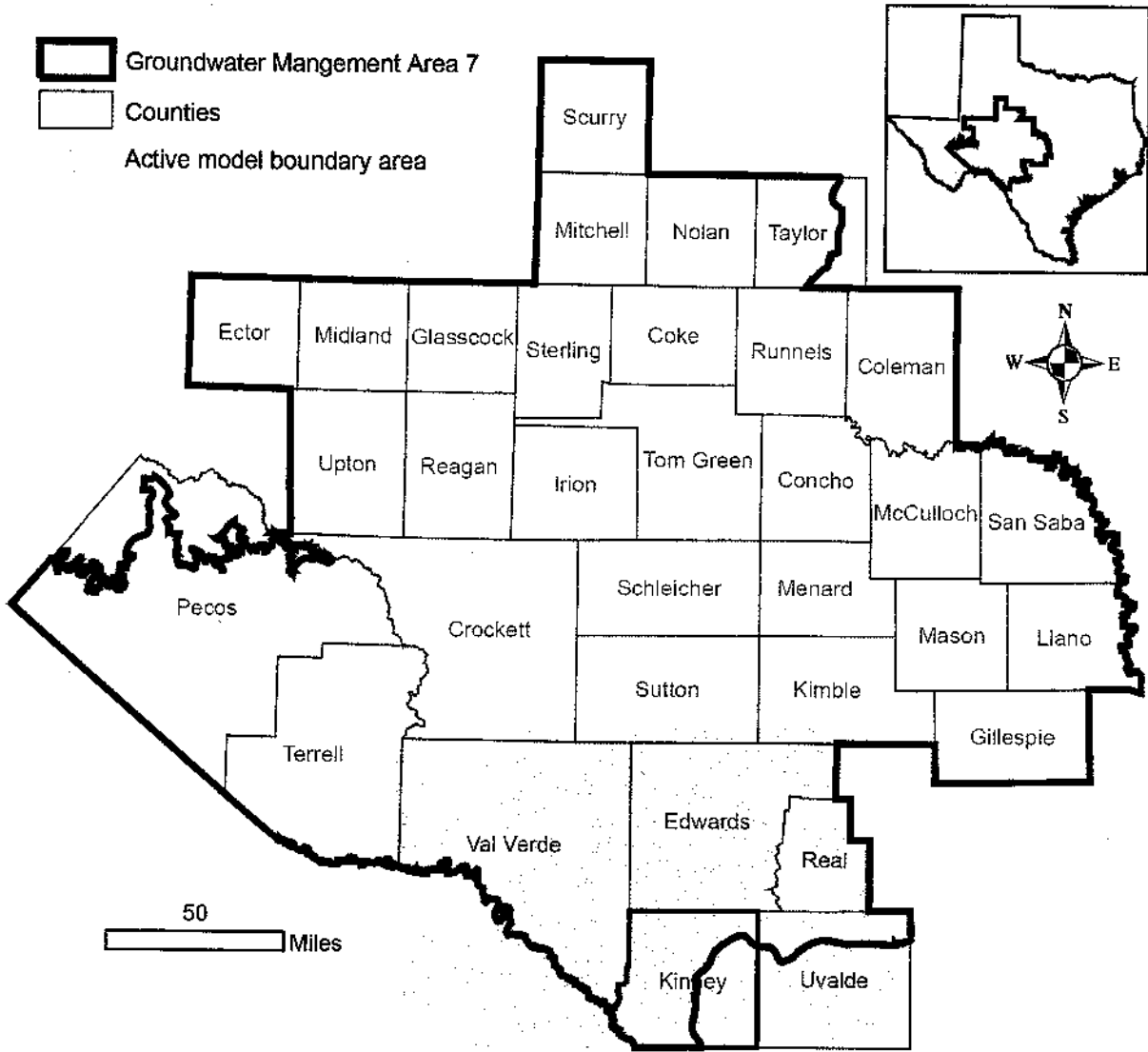
\*The modeled available groundwater for Irion County WCD only includes the portion of the district that falls within Irion County.



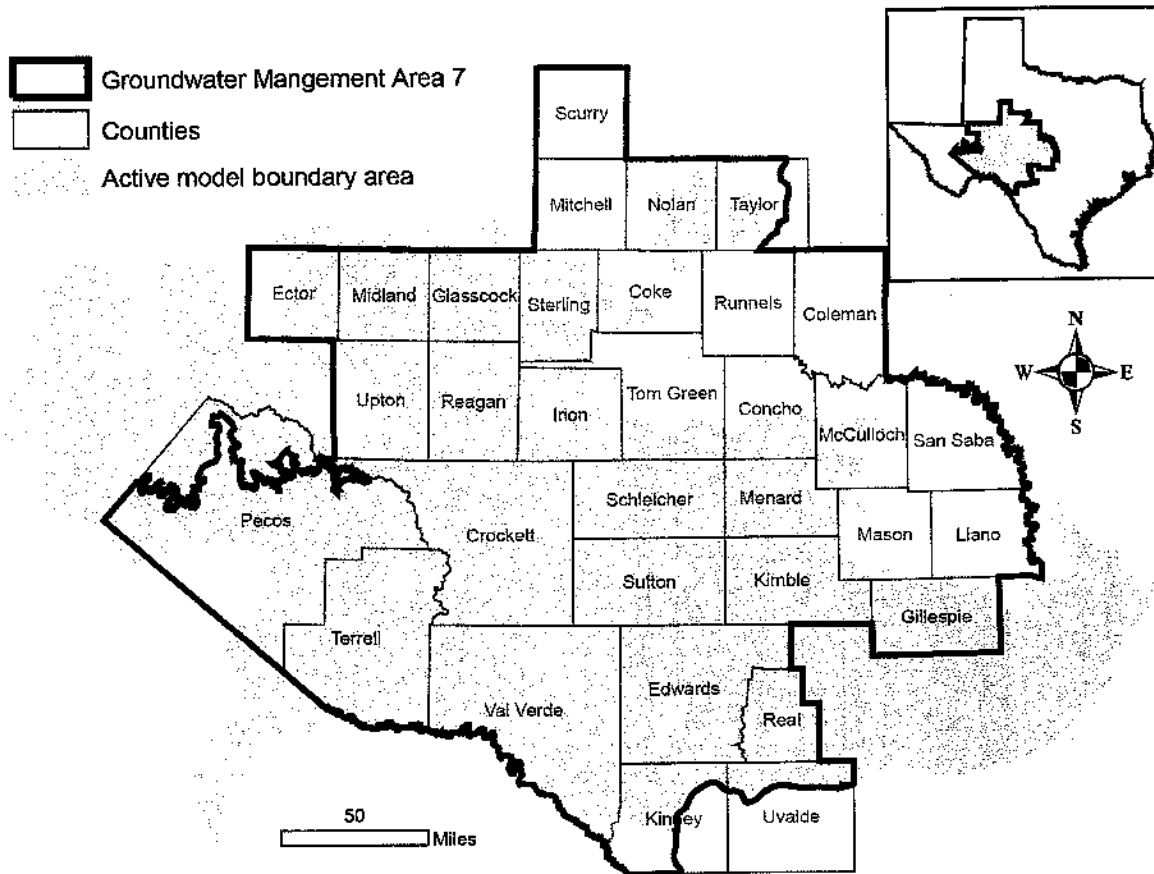




**FIGURE 8. MAP SHOWING THE AREAS COVERED BY THE EDWARDS-TRINITY (PLATEAU) AQUIFER IN THE GROUNDWATER FLOW MODEL FOR THE EDWARDS-TRINITY (PLATEAU) AQUIFER IN VAL VERDE COUNTY.**



**FIGURE 7. MAP SHOWING THE AREAS COVERED BY THE EDWARDS-TRINITY (PLATEAU) AQUIFER IN THE ALTERNATIVE MODEL FOR THE EDWARDS-TRINITY (PLATEAU) AQUIFER IN KINNEY COUNTY.**



**FIGURE 6. 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.**

**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 2020 AND 2070. RESULTS ARE IN ACRE-FEET PER YEAR.**

County	RWPA	River Basin	Year						
			2020	2030	2040	2050	2060	2070	
Pecos	F	Rio Grande	2,022	2,022	2,022	2,022	2,022	2,022	2,022
		<b>Total</b>	<b>2,022</b>	<b>2,022</b>	<b>2,022</b>	<b>2,022</b>	<b>2,022</b>	<b>2,022</b>	<b>2,022</b>
Reagan	F	Colorado	302	302	302	302	302	302	302
		Rio Grande	0	0	0	0	0	0	0
		<b>Total</b>	<b>962</b>	<b>962</b>	<b>962</b>	<b>962</b>	<b>962</b>	<b>962</b>	<b>962</b>
<b>GMA 7</b>			<b>2,324</b>	<b>2,324</b>	<b>2,324</b>	<b>2,324</b>	<b>2,324</b>	<b>2,324</b>	<b>2,324</b>

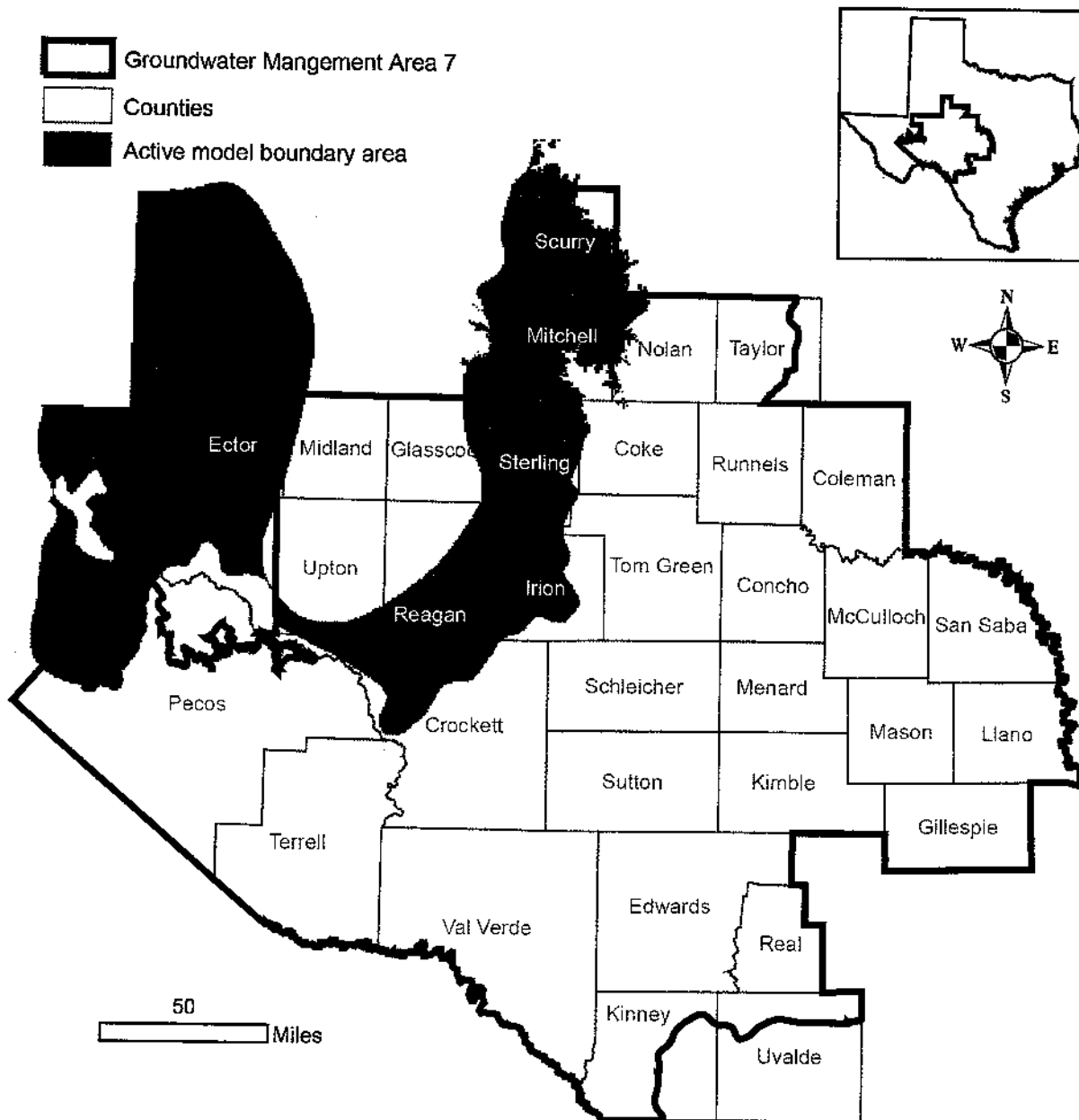
Note: The modeled available groundwater for Reagan County excludes parts of Reagan County that fall outside of Santa Rita Underground Water Conservation District.



**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 2013 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									
		2013	2020	2030	2040	2050	2060	2070			
Middle Pecos GCD	Pecos	2,022	2,022	2,022	2,022	2,022	2,022	2,022	2,022	2,022	2,022
	<b>Total</b>	<b>2,022</b>	<b>2,022</b>	<b>2,022</b>	<b>2,022</b>	<b>2,022</b>	<b>2,022</b>	<b>2,022</b>	<b>2,022</b>	<b>2,022</b>	<b>2,022</b>
Santa Rita UWCD	Reagan	302	302	302	302	302	302	302	302	302	302
	<b>Total</b>	<b>302</b>	<b>302</b>	<b>302</b>	<b>302</b>	<b>302</b>	<b>302</b>	<b>302</b>	<b>302</b>	<b>302</b>	<b>302</b>
<b>GMA 7</b>		<b>2324</b>	<b>2,324</b>	<b>2,324</b>	<b>2,324</b>	<b>2,324</b>	<b>2,324</b>	<b>2,324</b>	<b>2,324</b>	<b>2,324</b>	<b>2,324</b>

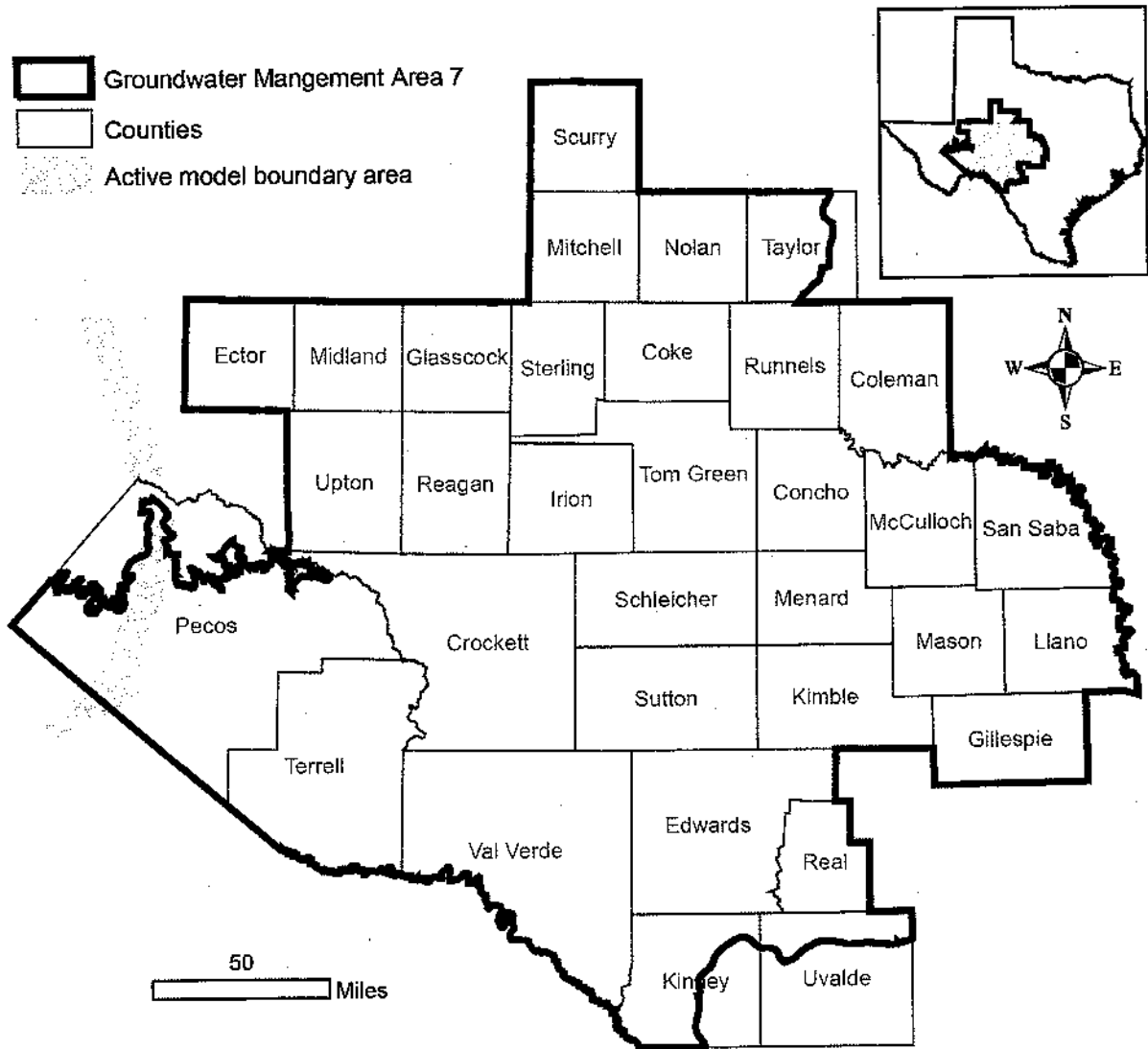
Note: The modeled available groundwater for Santa Rita Underground Water Conservation District excludes parts of Reagan County that fall within Glasscock Groundwater Conservation District. The year 2013 is used because the 2012 desired future condition baseline year for the Dockum Aquifer is an initial condition in the predictive model run.



**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.**







**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.**

GAM Run 16-026 MAG Version 2:

Modeled Available Groundwater for the Aquifers in Groundwater Management Area 7

September 21, 2018

Page 21 of 50

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.

### **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 (2016g) 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.

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

The model was run for the interval 2011 through 2070 for a 60-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. 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.

### **RESULTS:**

The modeled available groundwater estimates are 26,164 acre-feet per year in the Capitan Reef Complex Aquifer, 474,464 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, 6,570 to 7,925 acre-feet per year in the Ogallala Aquifer, 2,324 acre-feet per year in the Dockum 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 9 and 10). This decline is attributable to the occurrence of increasing numbers of cells where

limitations of the model. See Hutchison (2016e; 2018b) 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 then 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 aquifer boundaries within Groundwater Management Area 7 in Val Verde County.

### **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. 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.



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. Comparison of 2010 simulated and measured water levels indicate a root mean squared error of 84 feet or 3 percent of the range in water-level elevations.

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 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 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.

Modeled available groundwater volumes are based on the official aquifer boundaries 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 (2014) for assumptions and

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. It is important for groundwater management areas 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.

The model was run for the interval 2013 through 2070 for a 58-year predictive simulation. Drawdowns were calculated by subtracting 2012 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. Modeled available groundwater analysis excludes pass-through cells.

Drawdown averages and modeled available groundwater volumes are based on the model boundaries within Groundwater Management Area 7 for the Dockum Aquifer and official aquifer boundaries 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 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; 2018c) 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).

## **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 (2016h) 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.

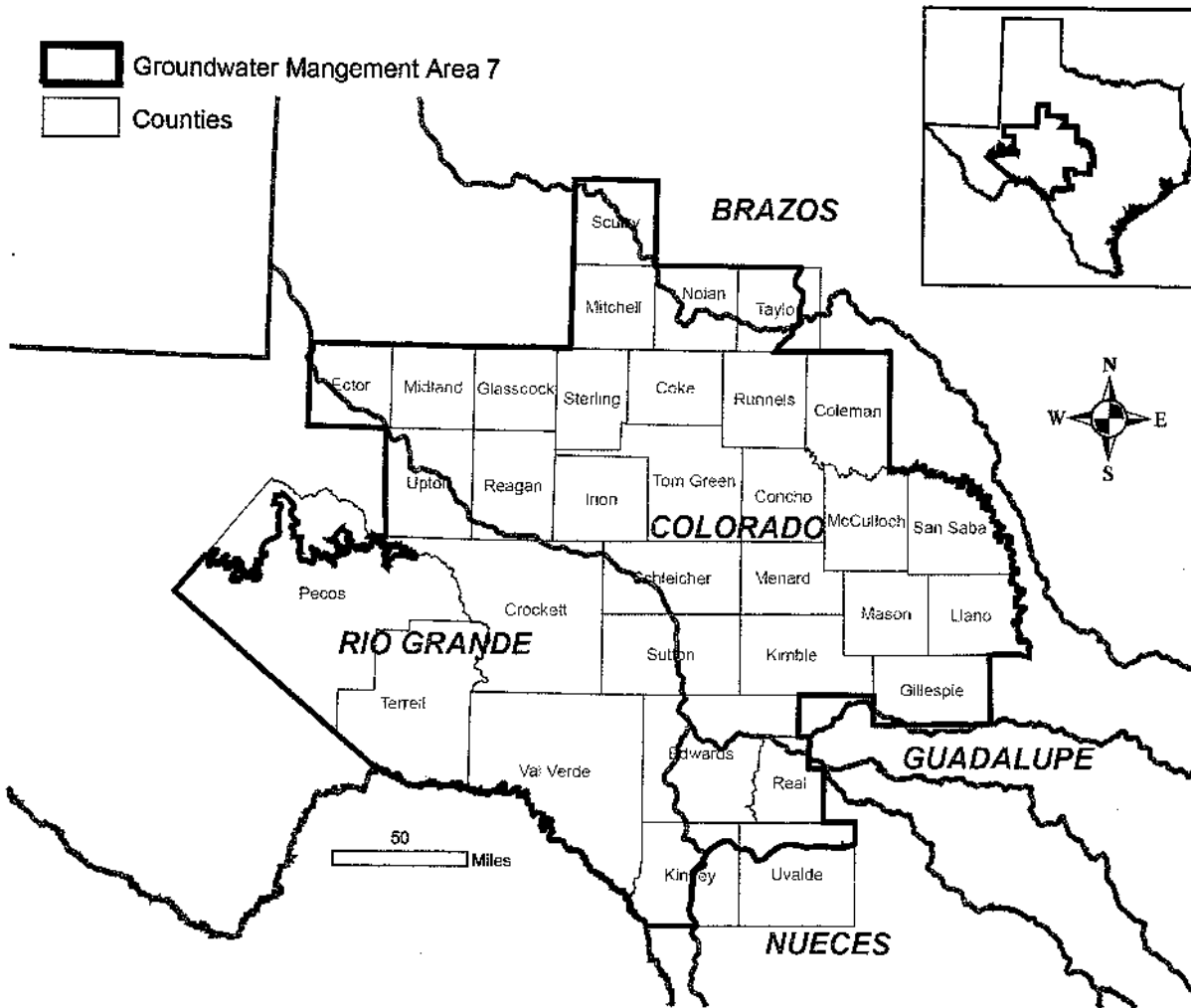
During predictive simulations, there were no cells where water levels were below the base elevation of the cell ("dry" cells). Therefore, all drawdowns were included in the averaging.

Drawdown averages and modeled available groundwater volumes are based on the official aquifer boundary within Groundwater Management Area 7.

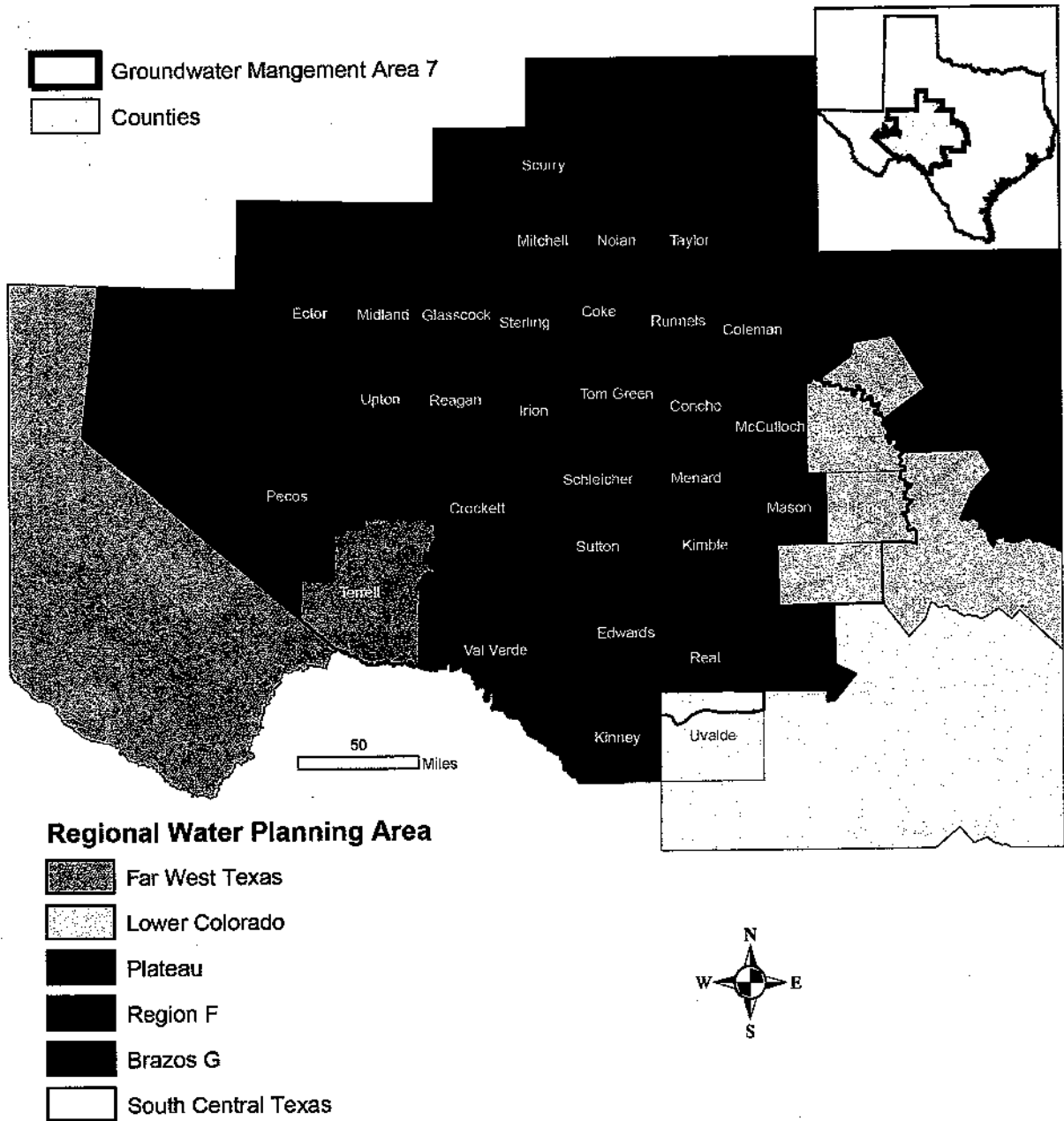
### **Dockum and Ogallala Aquifers**

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 (2016f) for details of the initial assumptions.

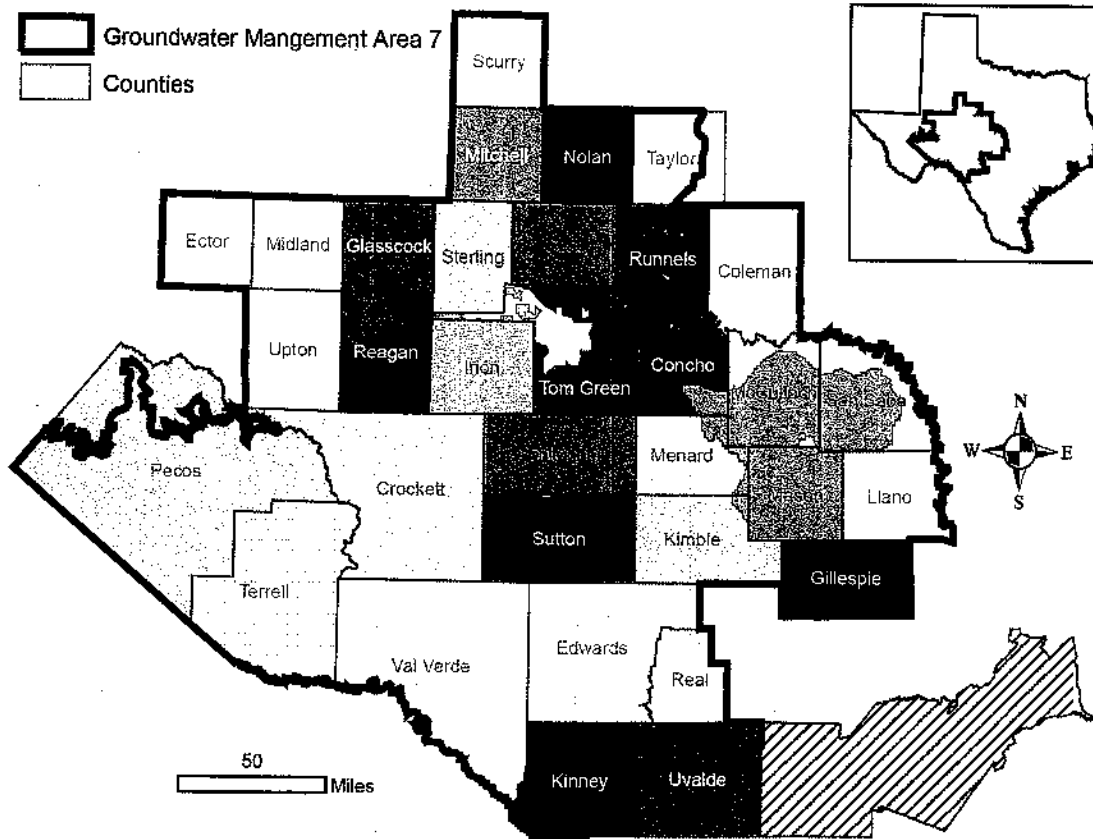
The model has four layers which represent the Ogallala and Pecos Valley Alluvium aquifers (Layer 1), the Edwards-Trinity (High Plains) and Edwards-Trinity (Plateau) aquifers (Layer 2), the Upper Dockum Aquifer (Layer 3), and the Lower Dockum Aquifer (Layer 4). Pass-through cells exist in layers 2 and 3 where the Dockum Aquifer was absent but provided pathway for flow between the Lower Dockum and the Ogallala or Edwards-Trinity (High Plains) aquifers vertically. These pass-through cells were excluded from the calculations of drawdowns and modeled available groundwater.



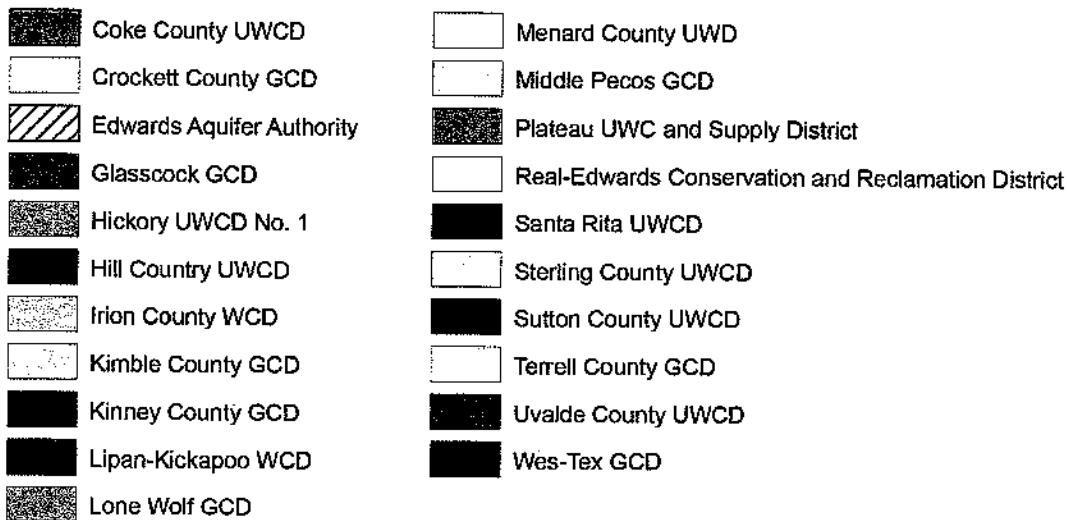
**FIGURE 3. MAP SHOWING RIVER BASINS IN GROUNDWATER MANAGEMENT AREA 7. THESE INCLUDE PARTS OF THE BRAZOS, COLORADO, GUADALUPE, NUECES, AND RIO GRANDE RIVER BASINS.**



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



**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).**

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 are 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).

baseline water levels. In the case of the High Plains Aquifer System (Dockum and Ogallala aquifers) and the minor aquifers of the Llano Uplift area (Ellenburger-San Saba and Hickory aquifers), baseline water levels represent water levels at the end of the calibrated transient model are the initial water level conditions in the predictive simulation—water levels at the end of the preceding year. In the case of the Capitan Reef Complex, Edwards-Trinity (Plateau), Pecos Valley, and Trinity, and Rustler aquifers, the baseline water levels may occur in a specified year, early in the predictive simulation. These baseline years are 2006 in the groundwater availability model for the Capitan Reef Complex Aquifer, 2010 in the alternative model for the Edwards-Trinity (Plateau), Pecos Valley, and Trinity 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 2009 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. 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 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 is 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 is 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



### **Ogallala Aquifer**

Calculate modeled available groundwater values based on the official aquifer boundary and use the same model assumptions used in Groundwater Management Area Technical Memorandum 16-01 (Hutchison, 2016f).

Modeled available groundwater analysis excludes pass-through cells.

Well pumpage decreases as the saturated thickness of the aquifer decreases below a 30-foot threshold.

Assume that modeled drawdown verifications within 1 foot achieve the desired future conditions.

### **Rustler Aquifer**

Use 2008 as the baseline year and run the model from 2009 through 2070 (end of 2008/beginning of 2009 as initial conditions), as used in the submitted predictive model run.

Use 2008 recharge conditions throughout the predictive period.

Calculate modeled available groundwater values based on the spatial extent of the groundwater availability model for the Rustler Aquifer.

General-head boundary heads decline at a rate of 1.5 feet per year.

Use the same model assumptions used in Groundwater Management Area 7 Technical Memorandum 15-05 (Hutchison, 2016d).

Assume that modeled drawdown verifications within 1 foot achieve the desired future conditions.

### **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 in order to manage groundwater production to achieve the desired future condition(s). The other factors districts must consider include annual precipitation and production patterns, the estimated amount of pumping exempt from permitting, existing permits, and a reasonable estimate of actual groundwater production under existing permits.

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 specified

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

Calculate modeled available groundwater values based on the official aquifer boundaries.

Assume that modeled drawdown verifications within 1 foot achieve the desired future conditions.

#### ***Kinney County***

Use the modeled available groundwater values and model assumptions from GAM Run 10-043 MAG Version 2 (Shi, 2012) to maintain annual average springflow of 23.9 cubic feet per second and a median flow of 24.4 cubic feet per second at Las Moras Springs from 2010 to 2060.

#### ***Val Verde County***

There is no associated drawdown as a desired future condition. The desired future condition is based solely on simulated springflow 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 2018b).

### **Minor Aquifers of the Llano Uplift Area**

Calculate modeled available groundwater values based on the spatial extent of the Ellenburger-San Saba and Hickory aquifers in the groundwater availability model for the aquifers of the Llano Uplift Area and use the same model assumptions used in Groundwater Management Area 7 Technical Memorandum 16-02 (Hutchison 2016g).

Drawdown calculations do not take into consideration the occurrence of dry cells where water levels are below the base of the aquifer.

Assume that modeled drawdown verifications within 1 foot achieve the desired future conditions.

### **Dockum Aquifer**

Calculate modeled available groundwater values based on the spatial extent of the groundwater availability model for the Dockum Aquifer.

Modeled available groundwater analysis excludes pass-through cells.

Assume that modeled drawdown verifications within 1 foot achieve the desired future conditions.

### **Ogallala Aquifer**

Total net [drawdown] of the Ogallala Aquifer in Glasscock County (Glasscock [Groundwater Conservation District]) in 2070, as compared with 2012 aquifer levels, not to exceed 6 feet [...].

### **Rustler Aquifer**

Total net drawdown of the Rustler Aquifer in Pecos County (Middle Pecos GCD) in 2070 not to exceed 94 feet as compared with 2009 aquifer levels.

Additionally, districts in Groundwater Management Area 7 voted to declare that the following aquifers or parts of aquifers are non-relevant for the purposes of joint planning:

- The Blaine, Igneous, Lipan, Marble Falls, and Seymour aquifers.
- The Edwards-Trinity (Plateau) Aquifer in Hickory Underground Water Conservation District No. 1, the Lipan-Kickapoo Water Conservation District, Lone Wolf Groundwater Conservation District, and Wes-Tex Groundwater Conservation District.
- The Ellenburger-San Saba Aquifer in Llano County.
- The Hickory Aquifer in Llano County.
- The Dockum Aquifer outside of Santa Rita Groundwater Conservation District and Middle Pecos Groundwater Conservation District.
- The Ogallala Aquifer outside of Glasscock County.

In response to a several requests for clarifications from the TWDB in 2017 and 2018, the Groundwater Management Area 7 Chair, Mr. Joel Pigg, and Groundwater Management Area 7 consultant, Dr. William R. Hutchison, indicated the following preferences for verifying the desired future condition of the aquifers and calculating modeled available groundwater volumes in Groundwater Management Area 7:

### **Capitan Reef Complex Aquifer**

Calculate modeled available groundwater values based on the official aquifer boundaries.

Assume that modeled drawdown verifications within 1 foot achieve the desired future conditions.

	[Underground Water Conservation District] no. 1	
San Saba	Hickory [Underground Water Conservation District] no. 1	5

Total net drawdown of [Hickory Aquifer] levels in 2070, as compared with 2010 aquifer levels, shall not exceed the number of feet set forth below, respectively, for the following counties and districts:

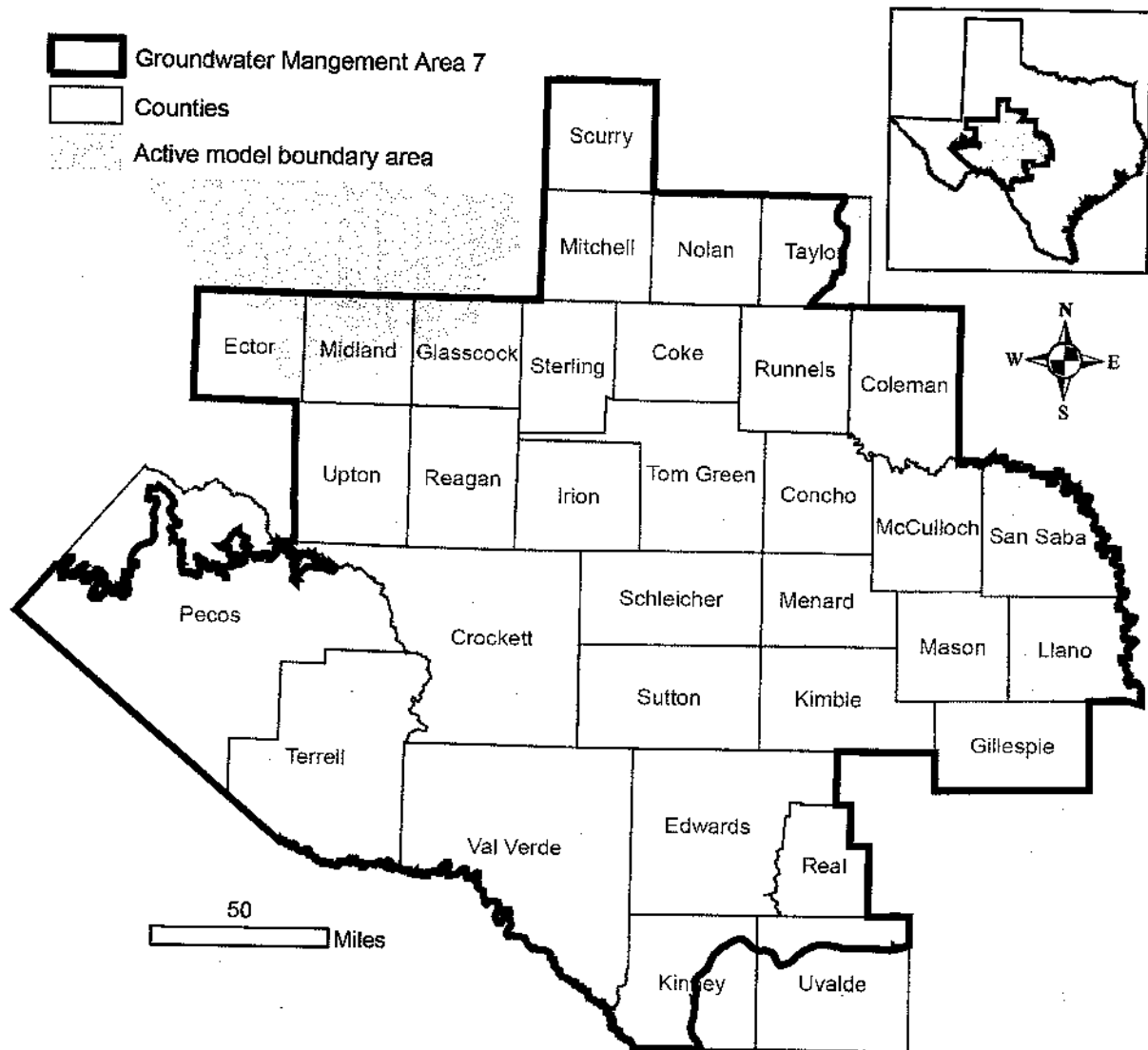
County	[Groundwater Conservation District]	Drawdown in 2070 (feet)
Concho	Hickory [Underground Water Conservation District No. 1]	53
Gillespie	Hill Country UWCD	9
Mason	Hickory [Underground Water Conservation District No. 1]	17
McCulloch	Hickory [Underground Water Conservation District No. 1]	29
Menard	Menard UWD and Hickory [Underground Water Conservation District No. 1]	46
Kimble	Kimble County [Groundwater Conservation District] and Hickory [Underground Water Conservation District No. 1]	18
San Saba	Hickory [Underground Water Conservation District No. 1]	6

**TABLE 9. MODELED AVAILABLE GROUNDWATER FOR THE HICKORY AQUIFER IN GROUNDWATER MANAGEMENT AREA 7 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) AND COUNTY FOR EACH DECADE BETWEEN 2011 AND 2070. RESULTS ARE IN ACRE-FEET PER YEAR. UWCD IS THE ABBREVIATION FOR UNDERGROUND WATER CONSERVATION DISTRICT AND UWD IS UNDERGROUND WATER DISTRICT.**

District	County	Year									
		2011	2020	2030	2040	2050	2060	2070			
Hickory UWCD No. 1	Concho	13	13	13	13	13	13	13	13	13	13
	Kimble	42	42	42	42	42	42	42	42	42	42
	Mason	13,212	13,212	13,212	13,212	13,212	13,212	13,212	13,212	13,212	13,212
	McCulloch	21,950	21,950	21,950	21,950	21,950	21,950	21,950	21,950	21,950	21,950
	Menard	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600	2,600
	San Saba	7,027	7,027	7,027	7,027	7,027	7,027	7,027	7,027	7,027	7,027
<b>Total</b>		<b>44,843</b>	<b>44,843</b>	<b>44,843</b>	<b>44,843</b>	<b>44,843</b>	<b>44,843</b>	<b>44,843</b>	<b>44,843</b>	<b>44,843</b>	
Hill Country UWCD	Gillespie	1,751	1,751	1,751	1,751	1,751	1,751	1,751	1,751	1,751	1,751
	<b>Total</b>	<b>1,751</b>	<b>1,751</b>	<b>1,751</b>	<b>1,751</b>	<b>1,751</b>	<b>1,751</b>	<b>1,751</b>	<b>1,751</b>	<b>1,751</b>	
Kimble County GCD	Kimble	123	123	123	123	123	123	123	123	123	123
	<b>Total</b>	<b>123</b>	<b>123</b>	<b>123</b>	<b>123</b>	<b>123</b>	<b>123</b>	<b>123</b>	<b>123</b>	<b>123</b>	
Lipan-Kickapoo WCD	Concho	13	13	13	13	13	13	13	13	13	13
	<b>Total</b>	<b>13</b>	<b>13</b>	<b>13</b>	<b>13</b>	<b>13</b>	<b>13</b>	<b>13</b>	<b>13</b>	<b>13</b>	
Menard County UWD	Menard	126	126	126	126	126	126	126	126	126	126
	<b>Total</b>	<b>126</b>	<b>126</b>	<b>126</b>	<b>126</b>	<b>126</b>	<b>126</b>	<b>126</b>	<b>126</b>	<b>126</b>	
No District	McCulloch	2,427	2,427	2,427	2,427	2,427	2,427	2,427	2,427	2,427	2,427
	San Saba	652	652	652	652	652	652	652	652	652	
	<b>Total</b>	<b>3,080</b>	<b>3,080</b>	<b>3,080</b>	<b>3,080</b>	<b>3,080</b>	<b>3,080</b>	<b>3,080</b>	<b>3,080</b>	<b>3,080</b>	
<b>GMA 7</b>		<b>49,936</b>	<b>49,936</b>	<b>49,936</b>	<b>49,936</b>	<b>49,936</b>	<b>49,936</b>	<b>49,936</b>	<b>49,936</b>	<b>49,936</b>	

Note: The year 2011 is used because the 2010 desired future condition baseline year for the Hickory Aquifer is an initial condition in the predictive model run.





**FIGURE 11. 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 11. MODELED AVAILABLE GROUNDWATER FOR THE OGALLALA AQUIFER IN GROUNDWATER MANAGEMENT AREA 7 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) AND COUNTY FOR EACH DECADE BETWEEN 2013 AND 2070. RESULTS ARE IN ACRE-FEET PER YEAR.**

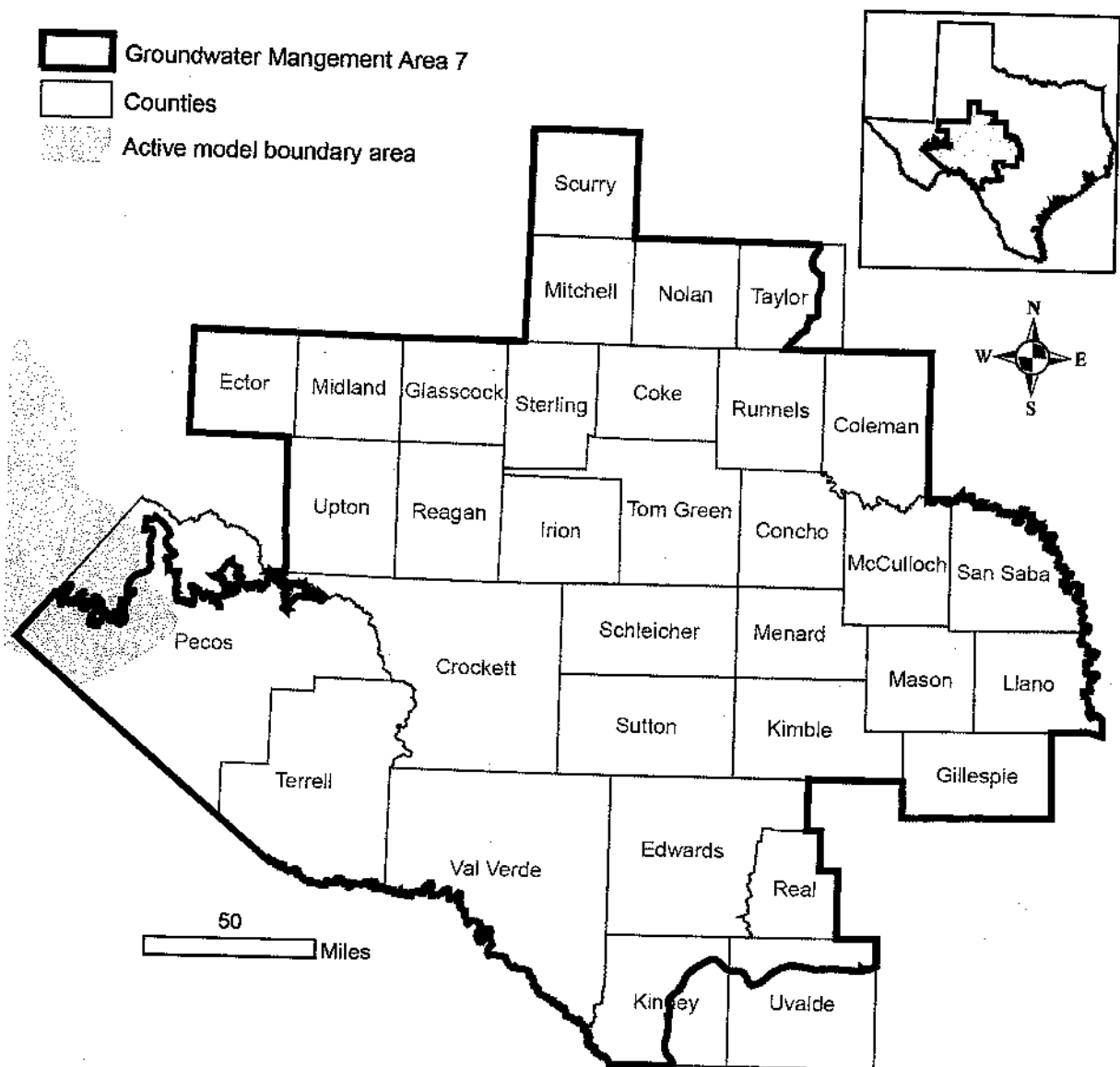
District	County	Year						
		2013	2020	2030	2040	2050	2060	2070
Glasscock GCD	Glasscock	8,019	7,925	7,673	7,372	7,058	6,803	6,570
	<b>Total</b>	<b>8,019</b>	<b>7,925</b>	<b>7,673</b>	<b>7,372</b>	<b>7,058</b>	<b>6,803</b>	<b>6,570</b>
<b>GMA 7</b>		<b>8,019</b>	<b>7,925</b>	<b>7,673</b>	<b>7,372</b>	<b>7,058</b>	<b>6,803</b>	<b>6,570</b>

Note: The year 2013 is used because the 2012 desired future condition baseline year for the Ogallala Aquifer is an initial condition in the predictive model run.

**TABLE 12. 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 2020 AND 2070. RESULTS ARE IN ACRE-FEET PER YEAR.**

County	RWPA	River Basin	Year					
			2020	2030	2040	2050	2060	2070
Glasscock	F	Colorado	7,925	7,673	7,372	7,058	6,803	6,570
		<b>Total</b>	<b>7,925</b>	<b>7,673</b>	<b>7,372</b>	<b>7,058</b>	<b>6,803</b>	<b>6,570</b>
<b>GMA 7</b>			<b>7,925</b>	<b>7,673</b>	<b>7,372</b>	<b>7,058</b>	<b>6,803</b>	<b>6,570</b>





**FIGURE 12. MAP SHOWING AREAS COVERED BY THE RUSTLER AQUIFER IN THE GROUNDWATER AVAILABILITY MODEL FOR THE RUSTLER AQUIFER IN GROUNDWATER MANAGEMENT AREA 7.**



## **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**

The predictive model run for this analysis results 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.

## REFERENCES:

- Anaya, R., and Jones, I. C., 2009, Groundwater Availability Model for the Edwards-Trinity (Plateau) and Pecos Valley Aquifers of Texas: Texas Water Development Board Report 373, 103p.  
[http://www.twdb.texas.gov/groundwater/models/gam/eddt\\_p/ET-Plateau\\_Full.pdf](http://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, Prepared by INTERA Incorporated for Texas Water Development Board, 640p.  
[http://www.twdb.texas.gov/groundwater/models/gam/hpas/HPAS\\_GAM\\_Numerical\\_Report.pdf](http://www.twdb.texas.gov/groundwater/models/gam/hpas/HPAS_GAM_Numerical_Report.pdf)
- EcoKai Environmental, Inc. and Hutchison, W. R., 2014, Hydrogeological Study for Val Verde and Del Rio, Texas: Prep. For Val Verde County and City of Del Rio, 167 p.
- Ewing, J. E., Kelley, V. A., Jones, T. L., Yan, T., Singh, A., Powers, D. W., Holt, R. M., and Sharp, J. M., 2012, Final Groundwater Availability Model Report for the Rustler Aquifer, Prepared for the Texas Water Development Board, 460p.  
[http://www.twdb.texas.gov/groundwater/models/gam/rslr/RSLR\\_GAM\\_Report.pdf](http://www.twdb.texas.gov/groundwater/models/gam/rslr/RSLR_GAM_Report.pdf)
- Harbaugh, A. W., 2005, MODFLOW-2005, The US Geological Survey Modular Groundwater-Model – the Ground-Water Flow Process. Chapter 16 of Book 6. Modeling techniques, Section A Ground Water: U.S. Geological Survey Techniques and Methods 6-A16. 253p.
- 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.
- Harbaugh, A. W., Banta, E. R., Hill, M. C., 2000, MODFLOW-2000, the U.S. Geological Survey Modular Ground-Water Model – User Guide to Modularization Concepts and the Ground-Water Flow Process: U.S. Geological Survey, Open-File Report 00-92, 121p.
- Hutchison, W. R., Jones, I. C., and Anaya, R., 2011a, Update of the Groundwater Availability Model for the Edwards-Trinity (Plateau) and Pecos Valley Aquifers of Texas, Texas Water Development Board, 61 p.  
[http://www.twdb.texas.gov/groundwater/models/alt/eddt\\_p\\_2011/ETP\\_PV\\_One\\_Layer\\_Model.pdf](http://www.twdb.texas.gov/groundwater/models/alt/eddt_p_2011/ETP_PV_One_Layer_Model.pdf)

- Hutchison, W. R., Shi, J., and Jigmond, M., 2011b, Groundwater Flow Model of the Kinney County Area, Texas Water Development Board, 217 p.  
[http://www.twdb.texas.gov/groundwater/models/alt/knny/Kinney County Model Report.pdf](http://www.twdb.texas.gov/groundwater/models/alt/knny/Kinney_County_Model_Report.pdf)
- Hutchison, W. R., 2016a, GMA 7 Explanatory Report—Final, Aquifers of the Llano Uplift Region (Ellenburger-San Saba, Hickory, Marble Falls): Prep. For Groundwater Management Area 7, 79 p.
- Hutchison, W. R., 2016b, GMA 7 Explanatory Report—Final, Ogallala and Dockum Aquifers: Prep. For Groundwater Management Area 7, 78 p.
- Hutchison, W. R., 2016c, GMA 7 Explanatory Report—Final, Rustler Aquifer: Prep. For Groundwater Management Area 7, 64 p.
- Hutchison, W. R., 2016d, GMA 7 Technical Memorandum 15-05—Final, Rustler Aquifer: Nine Factor Documentation and Predictive Simulation with Rustler GAM, 27 p.
- Hutchison, W. R., 2016e, GMA 7 Technical Memorandum 15-06—Final, Edwards-Trinity (Plateau) and Pecos Valley Aquifers: Nine Factor Documentation and Predictive Simulation, 60 p.
- Hutchison, W. R., 2016f, GMA 7 Technical Memorandum 16-01—Final, Dockum and Ogallala Aquifers: Initial Predictive Simulations with HPAS, 29 p.
- Hutchison, W. R., 2016g, GMA 7 Technical Memorandum 16-02—Final, Llano Uplift Aquifers: Initial Predictive Simulations with Draft GAM, 24 p.
- Hutchison, W. R., 2016h, GMA 7 Technical Memorandum 16-03—Final, Capitan Reef Complex Aquifer: Initial Predictive Simulations with Draft GAM, 8 p.
- Hutchison, W. R., 2018a, GMA 7 Explanatory Report—Final, Capitan Reef Complex Aquifer: Prep. For Groundwater Management Area 7, 63 p.
- Hutchison, W. R., 2018b, GMA 7 Explanatory Report—Final, Edwards-Trinity, Pecos Valley and Trinity Aquifers: Prep. For Groundwater Management Area 7, 173 p.
- Hutchison, W. R., 2018c, GMA 7 Technical Memorandum 18-01—Final, Edwards-Trinity (Plateau) and Pecos Valley Aquifers: Update of Average Drawdown Calculations, 10 p.
- Jones, I. C., 2016, Groundwater Availability Model: Eastern Arm of the Capitan Reef Complex Aquifer of Texas. Texas Water Development Board, March 2016, 488p.  
[http://www.twdb.texas.gov/groundwater/models/gam/crcx/CapitanModelReport Final.pdf](http://www.twdb.texas.gov/groundwater/models/gam/crcx/CapitanModelReport_Final.pdf)

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](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.

Panday, S., Langevin, C. D., Niswonger, R. G., Ibaraki, M., and Hughes, J. D., 2013, MODFLOW-USG version 1: An unstructured grid version of MODFLOW for simulating groundwater flow and tightly coupled processes using a control volume finite-difference formulation: U.S. Geological Survey Techniques and Methods, book 6, chap. A45, 66 p.

Shi, J., 2012, GAM Run 10-043 MAG (Version 2): Modeled Available Groundwater for the Edwards-Trinity (Plateau), Trinity, and Pecos Valley aquifers in Groundwater Management Area 7, Texas Water Development Board GAM Run Report 10-043, 15 p. [www.twdb.texas.gov/groundwater/docs/GAMruns/GR10-043\\_MAG\\_v2.pdf](http://www.twdb.texas.gov/groundwater/docs/GAMruns/GR10-043_MAG_v2.pdf)

Shi, J., Boghici, R., Kohlrenken, W., and Hutchison, W., 2016, Numerical model report: minor aquifers of the Llano Uplift Region of Texas (Marble Falls, Ellenburger-San Saba, and Hickory): Texas Water Development Board published report, 400 p. [http://www.twdb.texas.gov/groundwater/models/gam/llano/Llano\\_Uplift\\_Numerical\\_Model\\_Report\\_Final.pdf](http://www.twdb.texas.gov/groundwater/models/gam/llano/Llano_Uplift_Numerical_Model_Report_Final.pdf)

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

*This page is intentionally left blank.*

# **APPENDIX D**



**DISTRICT RULES**

RULES OF THE COKE COUNTY  
UNDERGROUND WATER CONSERVATION DISTRICT

The Rules of Coke County Underground Water Conservation District and as amended are hereby published as of the 27th day of March, 1989.

In accordance with Section 59 of Article 16 of the Texas Constitution and with Acts of the 69th Legislature (1985), p. 3210, Ch. 950, H. B. 2418 and Chapters 51 and 52 of the Texas Water Code, the following rules are hereby ratified and adopted as the rules of the District by its Board. All rules or parts of rules in conflict with these rules are hereby repealed. Each rule as worded herein has been in effect since date of passage and as may be hereafter amended.

The rules, regulations and modes of procedure herein contained are and have been adopted for the purpose of simplifying procedure, avoiding delays, saving expense, and facilitating the administration of the ground water laws of the State and the rules of this District. To the end that these objectives be attained, these rules shall be so construed.

These rules may be used as guides in the exercise of discretion, where discretion is vested. However, under no circumstances and in no particular case shall they, or any of them, be construed as a limitation or restriction upon the exercise of any discretion, where such exists; nor shall they in any event be construed to deprive the Board of an exercise of powers, duties and jurisdiction conferred by law, nor to limit or restrict the amount and character of data or information which may be required for the proper administration of the law.

**RULE 1 -- DEFINITIONS**

Unless the context hereof indicates a contrary meaning, the words hereinafter defined shall have the following meaning in these rules:

(a) "Abandonment" shall mean the intentional discontinuation of use.

(b) The "Board" shall mean the Board of Directors of the Coke County Underground Water Conservation District, consisting of five (5) duly elected members.

(c) "Capping" shall mean equipping a well with a suitable device that will prevent the entrance of surface pollutants into the well.

(d) "Casing" shall mean a tubular watertight structure installed in the excavated or drilled hole to maintain the well opening and, along with cementing, to confine ground waters to their zones of origin and prevent the entrance of surface pollutants.

(e) "Cement" shall mean a neat Portland or construction cement mixture of not more than seven gallons of water per 94-pound sack of dry cement, or a cement slurry which contains cement along with bentonite, gypsum, or other additives; the well driller will adhere to the manufacturer's recommended water content for the mix.

(f) "Completion" shall mean the sealing off access of undesirable water to the well bore by proper casing and/or cementing procedures.

(g) "District" shall mean the Coke County Underground Water Conservation District, maintaining its principal office in Robert Lee, Texas. Where applications, reports and other papers are required to be filed with or sent to "the District", this means the District's headquarters in Robert Lee, Texas.

(h) The term "well" or "Water Well" shall mean and include any artificial excavation constructed to produce or which produces more than 25,000 gallons of water per day or 17.36 gallons per minute.

(i) "Water" shall mean underground water.

(j) "Owner" shall mean and include any person, firm, partnership or corporation that has the right to produce water from the land either by ownership, contract, lease, easement, or any other estate in the land.

(k) "Person" shall mean any individual, partnership, firm, or corporation.

(l) The word "Waste" as used herein shall have the same meaning as defined by the Legislature, as follows:

(1) The withdrawal of underground water from an underground water reservoir at such rate and in such amount so as to cause the intrusion therein of water not suitable for agricultural, gardening, domestic, or stock raising purposes.

(2) The flowing or producing of wells from an underground water reservoir when the water produced therefrom is not used for a beneficial purpose.

(3) The escape of underground water from one underground water reservoir to any other reservoir not containing underground water.

(4) The pollution or harmful alteration of the character of the underground water within the underground water reservoir of the District by means of salt water or other deleterious matter admitted from some other stratum or strata or from the surface of the ground; and

(5) Willfully or negligently causing, suffering, or permitting underground water to escape into any river, creek, watercourse, depression, or lake, reservoir, drain, sewer, street, highway, road, or road ditch, or onto any land of any other person than the owner of such well.

(m) An "Authorized Well Site" shall be:

(1) The location of a proposed well on an application duly filed until such application is denied; or

(2) The location of a proposed well on a valid permit. (An authorized well site is not a permit to drill.)

(n) "Open or Uncovered Well" shall mean any artificial excavation drilled or dug for the purpose of producing water from the underground reservoir, not capped or covered as required by these rules, which is as much as ~~ten~~ (10) feet deep, nor more than six (6) feet in diameter.

(o) "Exempt Well" shall mean and include any artificial excavation constructed to produce or which produces less than 25,000 gallons per day or 17.36 gallons per minute. For all purposes herein, an "exempt well" as defined herein shall be exempt from any and all rules and regulations created hereunder.

(p) "Mud" shall mean a relatively homogenous, relatively viscous fluid produced by the suspension of clay-size particles in water.

(q) "Plugging" shall mean an absolute sealing of the well bore.

(r) "Pollution" shall mean the alteration of the physical, thermal, chemical, or biological quality of, or the contamination of, any water in the District that renders the water harmful, detrimental, or injurious to humans, animal life, vegetation, or property or to public health, safety, or welfare, or impairs the usefulness or the public enjoyment of the water for any lawful or reasonable purpose.

(s) "Undesirable Water" shall mean water that is injurious to vegetation, to land or to fresh water, or water that can cause pollution.

(t) "Well log" shall mean a log accurately kept, on forms prescribed by the Water Well Drillers Board of Texas, or any successor regulatory agency with jurisdiction therefor, at the time of drilling showing the depth, thickness, character of the different strata penetrated, location of water-bearing strata, depth, size and character of casing installed, together with any other data or information required by the Water Well Drillers Board of Texas or of this Board. Each copy of a well log shall include the name, mailing address, and telephone number of the District as well as the Water Well Drillers Board of Texas and the Texas Water Commission.

#### RULE 2 -- WASTE

(a) Underground water shall not be produced within, or used within or without the District, in such a manner or under such conditions as to constitute waste as defined in Rule 1 hereof.

(b) Any person producing or using underground water shall use every possible precaution, in accordance with the most approved methods, to stop and prevent waste of such water.

(c) No person shall pollute or harmfully alter the character of the underground water reservoir of the District by means of salt water or other deleterious matter admitted from some other stratum or strata or from the surface of the ground.

(d) No person shall commit waste as that term is defined by Section (1), Rule 1 of the Rules of the Coke County Underground Water Conservation District.

#### RULE 3 -- PERMIT REQUIRED

(a) No person shall hereafter begin to drill or drill a well, or increase the size of a well or pump therein, which well could reasonably be expected to produce, or a pump designed to produce, in excess of 25,000 gallons of water per day, without having first applied to the Board, and had issued a permit to do so, unless the drilling and operation of the well is exempt by the law or by these rules.

ADDITION

The following addition is being made to the Rules of the Coke County Underground Water Conservation District effective as of May 12, 2003.

RULE 3

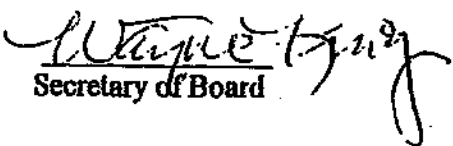
Rule 3 (a) and (b) shall remain as written. Rule 3 (c) will be added as follows:

{c} Preregistration required for exempt wells. A completed application for the drilling of an exempt well (preregistration) must be filed with the District on forms provided by the District prior to the drilling of an exempt well. Preregistration is required for all wells defined as exempt under Rule 1 (o).

Preregistration shall include the following information submitted on forms provided by the District.

- (1) name and address of the well owner,
- (2) location of the well or proposed location including the county, section, block, survey, abstract, acreage or lot size, and the number of feet to the nearest non-parallel property lines.
- (3) Distance in feet to nearest well;
- (4) Well use or proposed use;
- (5) Signed statement by the applicant indicating that
  - (i) the proposed well is to be for domestic use on 2 acres or less of land or is exempt from permitting; and
  - (ii) the applicant will furnish the District with a completed Well Registration form within 30 days after completion of the well.
- (6) The application to drill an exempt well shall be signed by the owner of the land or his duly appointed agent, including a partner, operator, driller or any other person who has the authority to construct the well and/or operate the well for the proposed use.
- (7) Such additional data as may be required by the Board.

ATTEST:

  
Secretary of Board

  
President of Board

(b) No permit shall be required for the drilling of temporary wells exempt by Subsection 118 of Chapter 52, Texas Water Code (being generally wells used for the production of oil, gas, or other minerals and water wells used in conjunction therewith).

RULE 4 — DEPOSITS

Each application for a permit to drill a well shall be accompanied by a \$50.00 deposit which shall be accepted by the District. Said deposit shall be returned to the applicant by the District if: (1) the application is denied; or (2) if the application is granted, upon receipt of correctly completed registration and log of the well; or (3) if said permit location is abandoned without having been drilled, upon return and surrender of said permit marked "abandoned" by the applicant. In the event neither the registration and log of the well nor the permit marked abandoned is returned to such District within six (6) months after the approval date of the permit or the extension date thereof, the said deposit shall become the property of the District. All deposits heretofore made or which shall hereafter be made shall become the property of the District if such registration and log or permit has not been returned or is not returned to the District with which deposit was made within six months from the approval date of the permit.

RULE 5 — ISSUANCE OF PERMITS

(a) The Board shall issue or cause to be issued a drilling permit for a well properly spaced upon proper application executed and filed by the owner with the District and containing the matters specified below. An application shall be considered filed when properly made out, completed, and signed and tendered to the District or a person duly designated by such District to receive the same.

Such applications shall be on forms provided by the District and shall be in writing and shall be prepared in accordance with and contain the information called for in the form of application, if any, prescribed by the Board, and all instructions which may have been issued by the Board with respect to the filing of an application. Otherwise, the application will not be considered.

(b) Rules for the filing of applications:

(1) If the applicant is an individual, the application shall be signed by the applicant or his duly appointed agent. The agent may be requested to present satisfactory evidence of his authority to represent the applicant.

(2) If the application is by a partnership, the applicant shall be designated by the firm name followed by the words "a Partnership" and the application shall be signed by at least one of the general partners who is duly authorized to bind all of the partners.

(3) In the case of a corporation, public district, county or municipality, the application shall be signed by a duly authorized official. A copy of the resolution or other authorization to make the application may be required by the officer or agent receiving the application.

(4) In the case of an estate or guardianship, the application shall be signed by the duly appointed guardian or representative of the estate.

(c) Such applications shall set forth the following:

AMENDMENTS

The following amendments to Rules of The Coke Count. Underground Water Conservation District became effective on 6-6-94.

RULE VII --MINIMUM SPACING OF WELLS

Amend Rule VII, Section A-1 as follows:

A. Distance Requirements.

1. No well to be drilled subsequent to the date of enactment of this rule shall be drilled such that said well shall be located nearer than the distances shown below from the nearest property line.

WELLS PRODUCING

Up to 50gpm  
50gpm to 100gpm  
over 100gpm

MINIMUM DISTANCE  
FROM PROPERTY  
LINE

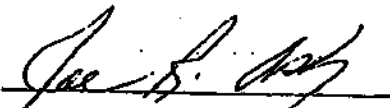
exempt  
50 feet  
100 feet

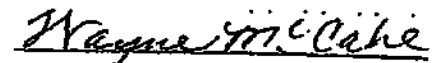
The Board, in order to prevent waste or to prevent confiscation of property, may grant exceptions to permit drilling within shorter distances than described above when the Board shall determine that such exceptions are necessary either to prevent waste or to prevent confiscation of property. The balance of Rule VII is not affected by this amendment.

RULE XXI --TRANSPORTATION OF WATER FROM THE DISTRICT - OMIT

RULE XXIV --DISPOSAL OF HAZARDOUS WASTES - OMIT

ATTEST:

12/11/94   
Secretary of Board

  
President of Board

(1) The exact proposed location of the well to be drilled as provided in the application including the county, the section, block, survey and township; labor and league; and exact number of yards to the two nearest non-parallel property lines (legal survey line); or other adequate legal description.

(2) The proposed use of the well to be drilled, whether municipal, industrial, or irrigation.

(3) The size of the pump.

(4) The approximate date drilling operations are to begin.

(5) The location of the three (3) nearest wells within a quarter of a mile of the proposed location, and the names and addresses of the owners thereof.

(6) An agreement by the applicant that a completed well registration and log will be furnished to the District (on forms furnished by it) by the applicant upon completion of this well and prior to the production of water therefrom (except for such production as may be necessary to the drilling and testing of such well).

(7) Such additional data as may be required by the Board.

(8) The name and address of the fee owner of the land upon which the well location is to be made.

**RULE 6 — REQUIREMENT OF DRILLER'S LOG, CASING AND PUMP DATA**

(a) Complete records shall be kept and reports thereof made to the District concerning the drilling, maximum production potential, equipping and completion of all wells drilled. Such records shall include an accurate driller's log, any electric log which shall have been made, and such additional data concerning the description of the well, its potential, hereinafter referred to as "maximum rate of production" and its actual equipment and rate of discharge permitted by said equipment as may be required by the Board. Such records shall be filed with the District Board within 30 days after completion of the well.

(b) No person shall produce water from any well hereafter drilled and equipped within the District, except that necessary to the drilling and testing of such well and equipment, unless or until the District has been furnished an accurate driller's log, any electric log which shall have been made, and a registration of the well correctly furnishing all available information required on the forms furnished by the District.

(c) No person shall be required to equip and produce any well to its maximum rate of production; provided, however, that for purposes of reworking, redrilling or replacing a well pursuant to Rule 10 hereof, the maximum rate of production of each well established hereunder shall be considered the actual production rate even though said well is produced at a lesser rate of production.

**RULE 7 — MINIMUM SPACING OF WELLS**

(a) Distance Requirements.

*OUT*

(1) No well to be drilled subsequent to the date of enactment of this rule shall be drilled such that said well shall be located nearer than three hundred thirty (330') feet from the nearest



property line; provided that the Board, in order to prevent waste or to prevent confiscation of property, may grant exceptions to permit drilling within shorter distances than above described when the Board shall determine that such exceptions are necessary either to prevent waste or to prevent confiscation of property.

(2) In the interest of protecting life and for the purpose of preventing waste and preventing confiscation of property, the Board reserves the right in particular subterranean water zones and/or reservoirs to enter special orders increasing or decreasing distances provided by this rule.

(3) (i) In applying this rule and in applying every special rule with relation to spacing in all the of subterranean water zones and/or reservoirs underlying the confines of this District, no subdivision of property made subsequent to the adoption of the original spacing rule will be considered in determining whether or not any property is being confiscated within the terms of such spacing rule, and no subdivision of property will be regarded in applying such spacing rule or in determining the matter of confiscation if such subdivision took place subsequent to the promulgation and adoption of the original spacing rule.

(ii) Any subdivision of property creating a tract of such size and shape that it is necessary to obtain an exception to the spacing rule before a well can be drilled thereon is a voluntary subdivision and not entitled to a permit to prevent confiscation of property if it were either, (a) segregated from a larger tract in contemplation of water resource development, or (b) segregated by fee title conveyance from a larger tract after the spacing rule became effective and the voluntary subdivision rule attached.

(iii) The date of attachment of the voluntary subdivision rule is the date of discovery of underground water production in a certain continuous reservoir regardless of the subsequent lateral extensions of such reservoir, provided that such rule does not attach in the case of a segregation of a small tract by fee title conveyance which is not located in an underground water production area having a discovery date prior to the date of such segregation.

(iv) The date of attachment of the voluntary subdivision rule for a reservoir under any special circumstance which the Board deems sufficient to provide for an exception, may be established other than above so that innocent parties may have their rights protected.

(b) Well Density. Subject to paragraph (a)(1) et seq. above, no more than a cumulative total of 16 wells, whether drilled prior to or subsequent to enactment of this rule, shall be permitted per section (hereinafter referred to as "drilled to density". In the event the applicant owns less than a full section, then the number of wells permitted for said tract shall be proportionately reduced so that the total number of wells permitted shall be established by multiplying sixteen (16) times the quotient of the number of acres owned by the Applicant divided by the number of acres in the section; provided, however, that this density rule shall not apply to acreage drilled to density pursuant to these rules where the cumulative average of water production allowed per acre per minute is less than 2 gallons per acre per minute. In this event the landowner shall be permitted to drill additional water wells on said lands until the ~~2-gallons/acre/minute basis is attained.~~ Said cumulative average gallonage per acre per minute basis shall be computed by District personnel according to

7

maximum pumping capability of the water well established at the time the well is drilled.

#### RULE 8 — EXCEPTION TO SPACING RULE

(a) In order to protect vested property rights, to prevent waste, to prevent confiscation of property, or to protect correlative rights, the Board may grant exception to the above spacing regulations. This rule shall not be construed so as to limit the power of the Board, and the powers stated are cumulative only of all other powers possessed by the Board.

(b) If an exception to such spacing regulations is desired, application therefor shall be submitted by the applicant in writing to the Board at its district office on forms furnished by the District. The application shall be accompanied by a plat or sketch, drawn to scale of one (1) inch equalling two hundred (200) yards. The plat or sketch shall show thereon the property lines in the immediate area and shall show accurately to scale all wells within a quarter mile of the proposed well site. The application shall also contain the names and addresses of all property owners adjoining the tract on which the well is to be located and the ownership of the wells within a quarter mile of the proposed location. Such application and plat shall be certified by some person actually acquainted with the facts who shall state that all the facts therein are true and correct.

(c) Such exception may be granted ten (10) days after written notice has been given to the applicant and all adjoining owners and all well owners within a quarter mile of the proposed location and a after public hearing at which all interested parties may appear and be heard, and after the Board has decided that an exception should be granted. Provided, however, that if all such owners execute a waiver in writing stating that they do not object to the granting of such exception, the Board may thereupon proceed to decide upon the granting or refusing of such application without notice of hearing except to the applicant. The applicant may also waive notice or hearing or both.

#### RULE 9 — PLACE OF DRILLING OF WELL

After an application for a well permit has been granted, the well, if drilled, must be drilled within ten yards of the location specified in the permit, and not elsewhere. If the well should be commenced or drilled at a different location, the drilling or operation of such well may be enjoined by the Board pursuant to Chapter 52, Texas Water Code.

#### RULE 10 — REWORKING OR REPLACING OF WELL

(a) No person shall rework, redrill, or re-equip a well in a manner that would increase the maximum rate of production of water from such well beyond any previous actual rate of production of such well as established by Rule 6 above without first having made an application to the Board, and having been granted a permit by the Board to do so. Nor shall any person replace a well without a permit from the Board. A replacement well, in order to be considered as such, must be drilled within one hundred fifty (150) feet of the old well and not elsewhere. It must not be located toward any other well or authorized well site unless the new location complies with the minimum spacing requirements set out in Rule 7; otherwise the replacement well shall be considered to to be a new well for which application must be made under Rule 7 above. Provided, however, that the Board may grant an exception without notice or hearing in any

instance where the replacement well is placed farther away from any existing wells or authorized well sites.

The location of the old well (the well being replaced) shall be protected in accordance with the spacing rules of the District until the replacement well is drilled and tested. The landowner or his agent must within 120 days of the issuance of the permit declare in writing to the District which one of these two wells he desires to produce. If the landowner does not notify the District of his choice within this 120 days, then it will be conclusively presumed that the new well is the well he desires to retain. Immediately after determining which well will be retained for production, the other well shall be:

- (1) Plugged and abandoned; or
- (2) Properly equipped in such a manner that it cannot produce more than 25,000 gallons of water a day; or
- (3) Closed in accordance with Article 9202, Vernon's Annotated Civil Statutes, as amended. Violation of such Article is made punishable thereby a fine of not less than \$100.00 nor more than \$500.00.

An application to rework, re-equip, redrill or replace an existing well may be granted by the Board without notice or hearing.

(b) The size or maximum rate of production of a well shall not be hereafter changed to a larger size or capacity so as to substantially increase the rate of production of a well without a permit from the Board. (For example, increasing the size of the well bore from six inches to eight inches.) Such permit may be granted only after written notice to adjacent owners and owners of a well within a quarter of a mile from such well and a public hearing, as provided in Rule 8(c) above, and after a decision by the Board that such change will not cause unreasonable drawdown of the water table or unreasonable interference between wells, waste, or confiscation of property. Provided that if the adjacent owners and owners of a well within a quarter of a mile indicate to the Board in writing that they have no objection to the proposed change, then the Board may proceed to decide such matter. Provided that if the well is a sufficient distance from other wells to comply with spacing regulations for new wells of the desired capacity the Board may proceed to act on such application.

(c) In the event the application meets all spacing requirements and no contest is filed, the Board may grant such application without further action.

#### RULE 11 — TIME DURING WHICH A PERMIT SHALL REMAIN VALID

Any permit granted hereunder shall be valid if the work permitted shall have been completed within four (4) months from the filing date of the application. It shall thereafter be void. Provided, however, that the Board, for good cause, may extend the life of such permit for an additional four (4) months if an application for such extension shall have been made to the District during the first four (4) months period. Provided, further, that when it is made known to the Board that a proposed project will take more time to complete, the Board, upon receiving written application may grant such time as is reasonably necessary to complete such project.

#### RULE 12 — CHANGED CONDITIONS

The decision of the Board on any matter contained herein may be reconsidered by it on its own motion or upon motion showing changed conditions, or upon the discovery of new or different conditions or facts after the hearing or decision on such matter. If the Board should decide to reconsider a matter after having announced a ruling or decision, or after having finally granted or denied an application, it shall give notice to persons who were proper parties to the original action, and such persons shall be entitled to a hearing thereon if they file a request therefor within fifteen days from the date of the mailing of such notice.

#### RULE 13 — RIGHT TO INSPECT AND TEST WELLS

Any authorized officer, employee, agent, or representative of the District shall have the right at all reasonable times to enter upon lands upon which a well or wells may be located within the boundaries of the District, to inspect such well or wells and to read, or interpret any meter, weir box or other instrument for the purpose of measuring production of water from said well or wells or for determining the pumping capacity of said well or wells; and any authorized officer, employee, agent, or representative of the District shall have the right at all reasonable times to enter upon any lands upon which a well or wells may be located within the boundaries of the District for the purposes of testing the pump and the power unit of the well or wells and of making any other reasonable and necessary inspections and tests that may be required or necessary for the information or the enforcement of the rules and regulations of the District. The operation of any well may be enjoined by the Board immediately upon the refusal to permit the gathering of information as above provided from such well.

#### RULE 14 — OPEN WELLS TO BE CAPPED

Every owner or operator of any land within the District upon which is located any open or uncovered well is, and shall be, required to close or cap the same permanently with a covering capable of sustaining weight of not less than four hundred (400) pounds, except when said well is in actual use by the owner or operator thereof; and no such owner or operator shall permit or allow any open or uncovered well to exist in violation of this requirement. Officers, agents and employees of the District are authorized to serve or cause to be served written notice upon any owner or operator of a well in violation of this rule, thereby requesting such owner and/or operator to close or cap such well permanently with a covering in compliance herewith. In the event any owner or operator fails to comply with such request within ten (10) days after such written notice, any officer, agent, or employee of the District may go upon said land and close or cap said well in a manner complying with this rule and all expenditures thereby incurred shall constitute a lien upon the land where such well is located, provided, however, no such lien shall exceed the sum of One Hundred Dollars (\$100.00) for any single closing. Any officer, agent, or employee of the District, is authorized to perfect said lien by the filing of the affidavit authorized by Section 52.119 of the Texas Water Code. All of the powers and authority granted in such section are hereby adopted by the District, and its officers, agents, and employees are hereby bestowed with all of such powers and authority.

10

**RULE 15 — FINAL ORDERS OF THE BOARD**

The orders of the Board in any non-contested application or proceeding shall become the final order of the Board on the day it is entered by the Board. All orders of the Board in contested applications, appeals or other proceedings shall contain a statement that the same was contested. In such event the order will become final after fifteen (15) days from the entry thereof and be binding on the parties thereto unless a motion for rehearing is filed under Rule 16 hereof.

**RULE 16 — REHEARING**

(a) Any person whose application is denied, whose contest is overruled, or who is not granted the relief desired, may file with the Board a motion for rehearing within fifteen (15) days from the announcement by the Board of its decision or action. The Board shall act thereon within a reasonable time. If such a motion for rehearing is filed and is overruled, the order of the Board shall be final on the date the motion is overruled.

(b) The Board may, in a proper case, find that an emergency exists and that substantial injustice will result from delay. In that event, and upon recitation of such finding, the order of the Board will become final on the date of the announcement of the order by the Board, and no motion for rehearing will be considered thereon.

(c) If an application or a contest is denied by the Board, and if the applicant or contestant shall not have had and shall not have been afforded an opportunity for a hearing before the Board, as elsewhere provided by these rules, the applicant or contestant shall be entitled to a hearing before the Board. A written request to the Board for such a hearing, stating such facts, must be filed with the Board within the above fifteen (15) day period. If such motion is in order and is duly filed, the Board shall give notice to the applicant and all proper and necessary parties of the time and place of such hearing, and shall proceed to conduct such a hearing.

**RULE 17 — RULES GOVERNING PROTESTS**

(a) **NOTICE OF PROTEST:** In the event anyone should desire to protest or oppose any pending matter before the Board, a written notice of protest or opposition shall be filed with the Board on or before the date on which such application or matter has been set for hearing. For the convenience of the Board, it is urged that protests be filed at least five days before the hearing date.

(b) **PROTEST REQUIREMENTS:** Protests shall be submitted in writing with a duplicate copy to the opposite party or parties and shall comply in substance with the following requirements:

(1) Each protest shall show the name and address of the protestant and show that protestant has read either the application or a notice relative thereto published by the Board.

(2) There shall be an allegation of injury to protestant which will result from the proposed action or matter to be considered by the Board.

(3) If the protest is based upon claim of interference with some present right of protestant, it shall include a statement of the basis of protestant's claim of right.

(4) Protestant should call attention to any amendment of the application or adjustment which, if made, would result in withdrawal of the protest.

(c) **CONTESTED APPLICATIONS OR PROCEEDINGS DEFINED:** An application, appeal, motion or proceedings pending before the Board is considered contested when either protestants or intervenors, or both, files the notice of protest as above set out and appears at the hearing held on the application, motion or proceeding and present testimony or evidence in support of their contentions, or present a question or questions of law with regard to the application, motion or proceedings. Where neither protestants nor intervenors so appear and offer testimony or evidence in support of their contentions, or raise a question of law with reference to any pending application, motion or proceeding, the same shall be considered as non-contested.

(d) In the event of a contested hearing each party shall furnish other parties to the proceeding with a copy of all motions, amendments or briefs filed by him with the Board.

#### **RULE 18 -- GENERAL RULES OF PROCEDURE FOR HEARING**

(a) Hearings will be conducted in such manner as the Board deems most suitable to the particular case, and technical rules of legal and court procedure need not be applied. It is the purpose of the Board to obtain all the relevant information and testimony pertaining to the issue before it as conveniently, inexpensively and expeditiously as possible without prejudicing the rights of either applicants or protestants.

(b) **WHO MAY APPEAR:** Any party at interest in a proceeding, may appear either in person or by attorney or both in such proceedings. A party at interest is any person owning a water right within the bounds of the District who is or may be affected by such proceeding. At the discretion of the Board anyone not a party at interest in a proceeding may appear.

(c) **ADMISSIBILITY:** Evidence will be admitted if it is of that quality upon which reasonable persons are accustomed to rely in the conduct of serious affairs. It is intended that needful and proper evidence shall be conveniently, inexpensively and speedily produced while preserving the substantial rights of the parties to the proceeding.

(d) **TESTIMONY SHALL BE PERTINENT:** The testimony shall be confined to the subject matter contained in the application or contest. In the event that any party at a hearing shall pursue a line of testimony or interrogation of a witness that is clearly irrelevant, incompetent or immaterial, the person conducting the hearing may forthwith terminate such line of interrogation.

(e) **A STIPULATION:** Evidence may be stipulated by agreement of all parties at interest.

(f) **LIMITING NUMBER OF WITNESSES:** The right is reserved to the Board in any proceeding to limit the number of witnesses appearing whose testimony may be merely cumulative.

#### **RULE 19 -- GENERAL RULES**

(a) **COMPUTING TIME:** In computing any period of time prescribed or allowed by these rules, by order of the Board, or by any applicable statute, the day of the act, event or default from which the designated period of time begins to run, is not to be included, but

AMENDMENTS

The following amendments to Rules of The Coke Count Underground Water Conservation District became effective on 6-6-94.

RULE VII --MINIMUM SPACING OF WELLS

Amend Rule VII, Section A-1 as follows:

A. Distance Requirements.

1. No well to be drilled subsequent to the date of enactment of this rule shall be drilled such that said well shall be located nearer than the distances shown below from the nearest property line.

WELLS PRODUCING

Up to 50gpm  
50gpm to 100gpm  
over 100gpm

MINIMUM DISTANCE  
FROM PROPERTY  
LINE


exempt  
50 feet  
100 feet

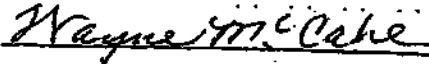
The Board, in order to prevent waste or to prevent confiscation of property, may grant exceptions to permit drilling within shorter distances than described above when the Board shall determine that such exceptions are necessary either to prevent waste or to prevent confiscation of property. The balance of Rule VII is not affected by this amendment.

RULE XXI --TRANSPORTATION OF WATER FROM THE DISTRICT - OMIT

RULE XXIV --DISPOSAL OF HAZARDOUS WASTES - OMIT

ATTEST:

2/1/94   
Secretary of Board

  
President of Board

the last day of the period so computed is to be included, unless it be a Sunday or legal holiday, in which event the period runs until the end of the next day which is neither a Sunday nor a legal holiday.

(b) **TIME LIMIT:** Applications, requests, or other papers or documents required or permitted to be filed under these rules or by law must be received for filing at the Board's offices at Robert Lee, Texas, or, in a proper case, at the office of the proper county committee, within the time limit, if any, for such filing. The date of receipt and not the date of posting is determinative.

(c) **SHOW CAUSE ORDERS AND COMPLAINTS:** The Board, either on its own motion or upon receipt of sufficient written protest or complaint, may at any time, after due notice to all interested parties, cite any person operating within the District to appear before it in a public hearing and require him to show cause why his operating authority or permit should not be suspended, cancelled, or otherwise restricted and limited, for failure to comply with the orders or rules of the Board or the relevant statutes of the State, or for failure to abide by the terms and provisions of the permit or operating authority itself. The matter of evidence and all other matters of procedure at any such hearing will be conducted in accordance with these rules of procedures and practice.

#### RULE 20 -- WELL VALIDATION

In order to provide for the validation of existing water wells that are subject to the rules and regulations of the Coke County Underground Water Conservation District (hereinafter referred to as the District), it shall be the policy of this Board that a certification of validation for a well can be issued only after the location of the well and the wellhead equipment of the well has been determined by field survey by District personnel, and/or designated agents acting for said District.

It is the privilege of this Board to cause to be issued a validation certificate for wells drilled and equipped within the District for which the landowner or his agent has not applied for an Application For Water Well Permit; or for wells not otherwise properly permitted, provided that such wells were not drilled, equipped and operated (pumped) in such a manner as to violate any other rules and regulations of the District; and provided that the costs of such well validation are paid to the District as provided by this resolution. Nothing in this resolution is intended to limit the powers of this Board to any other course of action granted within Texas Law, or within its rules and regulations, or within the prerogative of the Board.

The District's Manager is hereby directed to establish and administer the District's program for well validation; with appeals to the Manager's well validating decisions being subject to Board review at any of its regularly called meetings, or at special called meetings.

#### RULE 21 -- TRANSPORTATION OF WATER FROM THE DISTRICT

*out*  
I. Every person must obtain a permit from the District for the transporting of water by pipeline, channel, ditch, watercourse or other natural or artificial facilities, or any combination of such facilities, if such water is produced from wells located or to be located within the District, and if all or any part of such water is used or is intended for use outside of the boundaries of the District. However, the requirement for a permit hereunder shall not apply to any well currently in operation located within the District prior to the



effective date of this Rule provided the amount of water transported from such well annually shall not exceed the amount of water so transported in either the calendar year 1986 or 1987 or 1988, whichever was the greatest.

(a) The permit provided for herein must be applied for and filed with the District in the form or forms promulgated by the District hereunder and such permit must be obtained from the District prior to the proposed transporting of water, all in accordance with the provisions of this rule.

(b) An application for the transportation of water for which a permit is required under this Rule must:

- (1) be in writing and sworn to;
- (2) contain the name, post office address and place of residence or principal office of the applicant;
- (3) identify the location of the well from which the water to be transported is produced or to be produced;
- (4) describe specifically the proposed transportation facilities;
- (5) state the nature and purposes of the proposed use and the amount of water to be used for each purpose;
- (6) state the time within which the proposed construction or alteration is to begin;
- (7) state the length of time required for the proposed use of the water;
- (8) provide information showing the effect of the proposed transportation on the quantity and quality of water available within the District;
- (9) identify any other possible sources which could be used for the stated purposes, including quality and quantity of such alternate sources;
- (10) identify any other liquids that could be substituted for the fresh ground water and possible sources of such liquid including quantity and quality.

(c) The application must be accompanied by a map or plat drawn on a scale not less than one inch equals 4,000 feet, showing substantially:

- (1) the location of the existing or proposed well; and
- (2) the location of the existing or proposed water transporting facilities; and
- (3) the location of the proposed or increased use or uses.

(d) The application must be accompanied by an application fee in an amount of \$50.00.

(e) The District shall determine whether the application, maps, and other materials comply with the requirements of this Act. The District may require amendment of the application, maps, or other materials to achieve necessary compliance.

(f) The District shall conduct a hearing on each application within ninety (90) days of the filing of the complete application.

(g) The District shall give notice of the hearing on the application as prescribed by this Rule, stating:

- (1) the name and address of the applicant;
- (2) the date the application was filed;
- (3) the location and purpose of the well from which the water to be transported is produced or to be produced;
- (4) the time and place of the hearing; and
- (5) any additional information the District considers necessary.

(h) At the time and place stated in the notice, the District shall hold a hearing on the application. The hearing may be held in conjunction with any regular or special meeting of the District, or a special meeting may be called for the purpose of holding a hearing. Any person may appear at the hearing, in person or by attorney, or may enter his appearance in writing. Any person who appears may present objections to the issuance of the permit. The District may receive evidence, orally or by affidavit, in support or in opposition to the issuance of the permit, and it may hear arguments.

(i) After the hearing the District shall make a written decision granting or denying the application. The application may be granted in whole or in part. Any decision to grant a permit, in whole or in part, shall require a majority vote of Directors present.

(j) Such application shall not be approved unless the Board of Directors finds and determines that the transporting of water for use outside the District applied for will not substantially affect the quantity and quality of water available to any person or property within the District; that all other feasible sources of water available to the person requesting a permit have been developed and used to the fullest; that no other liquid could be feasibly substituted for the use of fresh ground water; and that the proposed use, or any part of the proposed use, will not constitute waste as defined under the laws of the State of Texas. In evaluating the application, the District shall consider the quantity of water proposed to be transported; the term for which the transporting is requested; the safety of the proposed transportation facilities with respect to the contamination of the aquifer; the nature of the proposed use; the effect of the proposed use of the water to be transported on District residents taking into account all beneficial use of District residents, including municipal, agricultural, industrial, recreational and other categories; and such other factors as are consistent with the purposes of the District.

(k) On approval of an application, the District shall issue a permit to the applicant. The applicant's right to transport shall be limited to the extent and purposes stated in the permit. A permit shall not be transferable except as provided in Paragraph (o).

(1) The permit shall be in writing and attested by the seal of the District and it shall contain substantially the following information:

- (1) the name of the person to whom the permit is issued;
- (2) the date the permit is issued;
- (3) the term for which the permit is issued;
- (4) the date the original application was filed;
- (5) the destination and use or purpose for which the water is to be transported;
- (6) the maximum quantity of water to be transported annually;
- (7) the time within which construction or work on the well transportation facilities must begin and the time within which it must be completed; and
- (8) any other information the District prescribed.

(m) The permittee shall file with the District quarterly reports describing the amount of water transported and used for the permitted purpose. Such report shall be filed on the appropriate form or forms provided by the District within ten (10) days of the March 31, June 30, September 30, and December 31 next following the commencement of transporting of water, and within ten (10) days of each such quarterly date thereafter.

(n) All transporting facilities for wells subject to the requirements of this Subsection shall be equipped with flow monitoring devices approved by the District available for District inspection at any time.

(o) A permittee may apply for an extension of any permit granted under this Subsection or for transfer of a permit to another person. The District shall consider and grant or deny such application for extension or transfer of a permit in the same manner as is provided herein for the application for a permit.

(p) Any permit granted under this Subsection shall be subject to revocation for nonuse or waste by the permittee, or for substantial deviation from the purposes or other terms stated in the permit. Revocation of a permit for nonuse shall require that no water is transported under the permit for a period of five years.

II. Any person transporting water produced from wells located within the District for use outside of the District, regardless of the amount of water so transported, must register such transporting with the District. Such registration shall be made within one hundred eighty (180) days after the effective date of this Rule.

(a) Any person subject to the requirements of this Subsection (II) shall file with the District quarterly reports describing the amount of water transported, the destination and use of such water. Such report shall be filed on the appropriate form or forms provided by the District within ten (10) days of the March 31, June 30, September 30 and December 31 next following the commencement of transporting of water and within ten (10) days of each such quarterly date thereafter.

(b) All transporting facilities for wells subject to the requirements of this Subsection shall be equipped with flow monitoring devices approved by the District and available for District inspection at any time.

**RULE 22 -- WELL DRILLING, COMPLETION, CAPPING, AND PLUGGING**

174 (a) Responsibility

(1) All well drillers and persons having a well drilled, deepened, or otherwise altered shall adhere to the provisions of this Rule prescribing the location of wells and proper drilling, completion, capping, and plugging.

(b) Location of Domestic, Industrial, Injection and Irrigation Wells.

(1) Except as noted in paragraph (c)(1) of this Rule (relating to Standards of Completion for Domestic, Industrial, Injection and Irrigation Wells), a well shall be located a minimum horizontal distance of 50 feet from any water-tight sewage and liquid-waste collection facility.

(2) Except as noted in paragraph (c)(1) of this Rule (relating to Standards of Completion for Domestic, Industrial, Injection and Irrigation Wells), a well shall be located a minimum horizontal distance of 150 feet from any concentrated sources of contamination, such as existing or proposed livestock or poultry yards, privies, and septic system absorption fields.

(3) A well shall be located at a site not generally subject to flooding; provided, however, that if a well must be placed in a flood prone area, it shall be completed with a watertight sanitary well seal and steel casing extending a minimum of 24 inches above known flood level.

(c) Standards of Completion For Domestic, Industrial, Injection and Irrigation Wells. Domestic, industrial, injection and irrigation wells shall be completed in accordance with the following specifications and in compliance with local county and/or incorporated city ordinances:

(1) The annular space between the borehole and the casing shall be filled from ground level to a depth of not less than 10 feet below the land surface or well head with cement slurry. The distances given in Paragraph (b)(1) and (2) of this Paragraph (relating to Location of Domestic, Industrial, Injection and Irrigation Wells) may be decreased provided the total depth of cement slurry is increased by twice the horizontal reduction. In areas of shallow, unconfined groundwater aquifers, the cement need not be placed below the static water level. In areas of shallow, confined groundwater aquifers having artesian head, the cement need not be placed below the top of the water-bearing strata.

(2) In all wells where plastic casing is used, a concrete slab or sealing block shall be placed above the cement slurry around the well at the ground surface.

(1) The slab or block shall extend at least two feet from the well in all directions and have a minimum thickness of four inches and shall be separated from the well casing by a plastic or mastic coating or sleeve to prevent bonding of the slab to the casing.

(ii) The surface of the slab shall be sloped to drain away from the well.

(iii) The top of the casing shall extend a minimum of one foot above the top of the slab.

(3) In all wells where steel casing is used:

(i) The casing shall extend a minimum of one foot above the original ground surface; and

(ii) A slab or block as described in Paragraph (2)(1) is required above the cement slurry except when a pitless adapter is used.

Pitless adapters may be used in such wells provided that:

(a) the adapter is welded to the casing or fitted with another suitably effective seal; and

(b) the annular space between the borehole and the casing is filled with cement to a depth not less than 15 feet below the adapter connection.

(4) All wells, especially those that are gravel packed, shall be completed so that aquifers or zones containing waters that are known to differ significantly in chemical quality are not allowed to commingle through the borehole-casing annulus or the gravel pack and cause quality degradation of any aquifer or zone.

(5) The well casing shall be capped or completed in a manner that will prevent pollutants from entering the well.

(d) Standards for Completion for Wells Encountering Undesirable Water.

(1) If a well encounters undesirable water and the well is not plugged, the licensed well driller or owner shall see that the well drilled, deepened or otherwise alters is forthwith completed in accordance with the following:

(i) When undesirable water is encountered in a well, the undesirable water shall be sealed off and confined to the zone(s) of origin.

(ii) When undesirable water is encountered in a zone overlying fresh water, the well shall be cased from the top of the fresh water zone to the land surface.

(iii) The annular space between the casing and the wall of the borehole shall be cemented to the land surface.

(iv) When undesirable water is encountered in a zone underlying a fresh water zone, the part of the well bore opposite the undesirable water zone shall be filled with cement to a height that will prevent the entrance of the undesirable water into the pumping well.

(2) The person who performs the well completion on a well shall, within 30 days after completing the well, submit a well completion report to the District Manager, on forms supplied by the District Manager.

(e) Standards for Wells Producing Undesirable Water.

(1) Wells completed to produce undesirable water shall be cased from the top of the undesirable water zone or 50 feet below the lowermost fresh water zone to the land surface.

(2) The annular space between the casing and the wall of the borehole shall be cemented to the land surface, or as a minimum, to a height greater than the hydrostatic head of the undesirable water aquifer plus the uppermost 10 feet of casing.

(3) If the undesirable water does not enter the cased part of the well, the lowermost and uppermost 10 feet (minimum) of the casing shall be cemented in order to seal off all other water-bearing or other permeable sections from the well.

(f) Recompletions.

(1) The landowner shall have the continuing responsibility of insuring that a well does not allow the commingling of undesirable water and fresh water or the unwanted loss of water through the wellbore to other porous strata.

(2) If a well is allowing the commingling of undesirable water and fresh water or the unwanted loss of water, and the casing in the well cannot be removed and the well recompleted with the applicable rules, the casing in the well shall be perforated and squeeze cemented in a manner that will prevent the commingling or loss of water. If such a well has no casing then the well shall be cased and cemented, or plugged in a manner that will prevent such commingling or loss of water.

(3) The District Manager may direct the landowner to take proper steps to prevent the commingling of undesirable water and fresh water, or the unwanted loss of water.

(g) Well Plugging and Capping.

(1) It is the responsibility of the landowner or person having the well drilled, deepened, or otherwise altered, to cap or have capped, under standards set forth in this Rule (relating to Well Drilling, Completion, Capping, and Plugging), any well which is open at the surface.

(2) It is the responsibility of the landowner or person having the well drilled, deepened or otherwise altered to plug or have plugged a well which is abandoned.

(3) It shall be the responsibility of the landowner or person having the well drilled, deepened, or otherwise altered to see that any well which encounters undesirable water is plugged under the standards set forth in this Rule (relating to Well Drilling, Completion, Capping and Plugging).

(4) The person that plugs such a well shall, within 30 days after completion or plugging is complete, submit a well completion and plugging report to the District Manager, on forms supplied by the District Manager.

(h) Standards for Plugging Wells.

(1) If the use of a well that does not contain any undesirable water zones is permanently discontinued, all removable casing shall be removed from the well and the entire well filled with cement to the land surface.

AMENDMENTS

The following amendments to Rules of The Coke Count. Underground Water Conservation District became effective on 6-6-94.

RULE VII --MINIMUM SPACING OF WELLS

Amend Rule VII, Section A-1 as follows:

A. Distance Requirements.

1. No well to be drilled subsequent to the date of enactment of this rule shall be drilled such that said well shall be located nearer than the distances shown below from the nearest property line.

WELLS PRODUCING

Up to 50gpm  
50gpm to 100gpm  
over 100gpm

MINIMUM DISTANCE  
FROM PROPERTY  
LINE

exempt  
50 feet  
100 feet

The Board, in order to prevent waste or to prevent confiscation of property, may grant exceptions to permit drilling within shorter distances than described above when the Board shall determine that such exceptions are necessary either to prevent waste or to prevent confiscation of property. The balance of Rule VII is not affected by this amendment.

RULE XXI --TRANSPORTATION OF WATER FROM THE DISTRICT - OMIT

RULE XXIV --DISPOSAL OF HAZARDOUS WASTES - OMIT

ATTEST:

Joe B. [Signature]  
Secretary of Board

Wayne M. Cahle  
President of Board

2/1/94

(2) In lieu of the procedure in subsection (1) of this paragraph, the well may be filled with heavy mud followed by a cement plug extending from land surface to a depth of not less than 10 feet.

(1) Standards for Plugging Wells That Penetrate Undesirable Water Zones.

(1) If the use of well that penetrates undesirable water is to be permanently discontinued, all removable casing shall be removed from the well and the entire well filled with cement to the land surface.

(2) In lieu of the procedure in subsection (1) of this paragraph, either the zone(s) contributing undesirable water, or the fresh water zone(s), shall be isolated with cement plugs and the remainder of the wellbore filled with heavy mud to form a base for a cement plug extending from land surface to a depth of not less than 10 feet.

**RULE 23 -- REPORTING UNDESIRABLE WATER**

(1) Each licensed well driller shall immediately inform the landowner of person having a well drilled, deepened, or otherwise altered when undesirable water has been encountered.

(2) The well driller shall submit to the District Manager and the landowner or person having the well drilled, deepened, or otherwise altered, on forms supplied by the District Manager, a statement signed by the well driller indicating that the landowner or person having the well drilled, deepened, or otherwise altered, has been informed that undesirable water has been encountered and shall note on all logs filed the depth such undesirable water was found.

(3) The statement indicated in subsection (2) of this Rule must be submitted within 30 days after encountering undesirable water.

**RULE 24 -- DISPOSAL AND STORAGE OF WASTES**

(1) None of the following materials and substances may be imported from outside the district to a point within the district, nor moved within the district from point to point, for the purpose of temporarily, or permanently disposing, discharging or storing of such materials or substances within the district without first obtaining a permit from the district:

- (a) Radioactive wastes;
- (b) Toxic substances;
- (c) Hazardous substances;
- (d) Polychlorinated biphenyls;
- (e) Oil, gas, and mineral production and refinement wastes;
- (f) Soil, fluids or other materials or substances contaminated with any of the above; and
- (g) Any other substance that presents a threat to the quality or quantity of groundwater used within the district.

(2) Exclusions. The following substances are hereby expressly excluded from this rule:

- (a) Agricultural insecticides, pesticides, herbicides or other agri-chemicals applied to the surface at the appropriate rate and for their intended use only; provided, however, that this rule shall not exclude the disposal from washing out of equipment used for applying the chemicals by any operator.



(3) The following activities are prohibited unless a permit is granted by the district:

(a) Construction, operation, maintenance or use of waste disposal wells for disposal of any of the materials or substances enumerated in subparagraphs (1) (a) through (1) (g) inclusive of this Rule 24; and

(b) Construction, operation, maintenance or use of tanks, reservoirs, pits, depressions, sites, land fills, or other manner of storage of any of the materials or substances enumerated in subparagraphs (1) (a) through (1) (g) inclusive of this Rule 24 on either a temporary or a permanent basis within the district.

(4) Exceptions. This rule shall be strictly enforced in its application; provided, however, circumstances may arise that are materially different from those normally encountered in, or resulting from, any of the disposal or storage operations or activities described or prohibited by this rule. However, an exception may be granted at the discretion of the board upon due evidence presented that such prohibition shall cause undue hardship and the board finds that such disposal, or means of disposal, does not constitute a threat of waste, pollution or harmful alteration of groundwater within the district.

(a) Any person, firm, corporation, partnership, association of persons, or other entity desiring an exception to any of the provisions contained in this Rule shall file a written, sworn application with the District Office in Robert Lee, Texas which shall state the following:

- (1) The nature of the exception requested;
- (2) The type of substance or material for which the exception is requested;
- (3) The quantity of the substance or material to be stored and/or disposed of;
- (4) The rate of disposal and method of disposal of such substance or material;
- (5) The exact location of storage and/or disposition of such substance or material;
- (6) A description of the present place facilities and environment of the substance or material including the method of storage and safeguards afforded thereby;
- (7) The justification for granting the exception; and
- (8) Any information that the Applicant deems appropriate in support of said Application.

(b) Seven copies of any Application for an Exception under this rule shall be submitted to the district at its general office in Robert Lee, Texas.

(c) All Applications for an Exception shall be heard and considered by the Board of Directors meeting in regular or special session within ninety (90) days after submittal. Thirty (30) days prior to the date of hearing the district shall give notice of such hearing to the applicant and any known interested parties, including, but not limited to all governmental agencies having potential concurrent jurisdiction, and notice shall also be given to the public by appropriate notice given by the district by appropriate notice published in a newspaper of general circulation within the district at least thirty (30) days prior to the date of hearing.

(d) Upon hearing of the evidence presented, within sixty (60) days the Board shall enter an order granting or denying an Application for Exception, with any such conditions as it shall deem proper and

necessary to protect the quality and/or quality of the groundwaters underlying said district. In this regard, as one of such conditions, the district may require the installation of requisite equipment at the sole expense of the applicant to monitor water quality, as well as require testing and water analysis of the groundwater from areas around the waste disposal site. In addition, this monitoring equipment shall be in place and in working condition at all times and district personnel and/or agents or its contractors shall have the right to inspect and obtain samples from said equipment at any time deemed necessary by the district.

(e) Any hearings hereunder shall be public in nature and shall be conducted pursuant to Rules 15 through 19, inclusive, provided herein.

(f) At the hearing the Applicant will be given the opportunity to present evidence with respect to the type of substance or materials for which an exception is sought, the quantity, location, description of the present facilities and environment of the materials or substances, whether the substances or materials will alter or harm the groundwater, and protective devices and/or techniques to be employed by the Applicant to prevent such alteration or harm to the groundwater.

(g) The decision of the Board shall be based upon a preponderance of the evidence submitted at the hearing by the Applicant, by the district, or by other interested parties, local, state or federal agencies or public officials.

(h) The board may grant an exception to more than one applicant with the same waste disposal process.

(5) All persons, firms, partnerships, corporations, associations of persons, or other legal entities having in their possession or under their care, custody and control within the district any of the materials and substances enumerated in subparagraphs (1)(a) through (1)(g) inclusive of this rule as of the date on which this rule becomes effective, whether for use, storage or disposal, shall report by sworn inventory to the district office in Robert Lee, Texas within sixty (60) days of the effective date of this rule. The report shall include a description of the materials or substances possessed, amount, location, status and whether a plan or schedule has been formulated for the ultimate disposal of the materials or substances and the place of such disposal.

Within sixty (60) days after receipt of such report, the board shall either approve same or set a hearing according to the procedures outlined herein.

(6) In the event of a change in the quality or quantity of the groundwater which would indicate possible contamination of the groundwater, at any time, the board shall have the right, power and authority to require the disposal facility to shut down until the source of the contamination is located and measures have been taken to correct the source of contamination and restore the water quality to its previous condition.

**Repeal of Prior Regulations**

All of the previous rules and regulations of the District have been revised and amended; and except as they are herein republished, they are repealed. Any previous rule or regulation which conflicts with or is contrary to these rules is hereby repealed.

Savings Clause

If any section, sentence, paragraph, clause, or part of these rules and regulations should be held or declared invalid for any reason by a final judgment of the courts of this state or of the United States, such decision or holding shall not affect the validity of the remaining portions of these rules; and the Board does hereby declare that it would have adopted and promulgated such remaining portions of such rules irrespective of the fact that any other sentence, section, paragraph, clause, or part thereof may be declared invalid.

ENTERED this 27 day of March, A.D. 1989.

Attest:

*Asch C. Matheson*  
Secretary of Board of Directors

*Royce Steue*  
President of Board of Directors

*Fred G. McCullough*  
Director

*Chris Smith*  
Director

*J. D. Harmon*  
Director

Accepted this 27 day of March, 1989.

*J. R. Cummins*  
Manager of the District

# **APPENDIX E**

BOARD OF DIRECTORS

COKE COUNTY UNDERGROUND WATER CONSERVATION DISTRICT

ROBERT LEE, TEXAS

OFFICIAL MINUTES OF THE MEETING HELD ON January 29, 2019

at Robert Lee, Texas . The Called Board meeting of the District Directors of the Coke County Underground Water Conservation District called to order by

Joe Ash , President, with

Wes Washam, Mike Arrott, Jimmie Byrne present. Others present was Winton Milliff .

The Public Hearing was called to order at 6:00 P.M. by Joe Ash President.

There was no public attendance.

There was a lengthy discussion on the Management Plan for 2018-2023. Motion by Jimmie Byrne and seconded by Mike Arrott to adopt the 2018-2023 Management Plan for the District. Motion carried 100%.

There being no other business to come before the Board the Public Hearing was adjourned at 6:45 P.M. Motion by Wes Washam and seconded by Jimmie Byrne. Motion carried 100%.

  
Secretary

  
President

# **APPENDIX F**



72007  
**C** OKE  
O U N T Y U N D E R G R O U N D W A T E R  
O N S E R V A T I O N D I S T  
P. O. B O X 1 1 1 0  
R O B E R T L E E, T E X A S 7 6 9 4 5  
P H. 3 2 5 - 4 5 3 - 2 2 3 2 F A X 3 2 5 - 4 5 3 - 2 1 5 7

January 24, 2019

Notice

Called Board Meeting

Adoption of 2018-2023 Management Plan

The Coke County Underground Water Conservation District will hold a Public Hearing on Tuesday January 29, 2019 in the District Office at the Coke County Courthouse 13th E. 7th Street Robert Lee, Texas. The Hearing will begin at 6.00 pm, to receive public comment on the adoption of the 2018-2023 Management Plan. Copies of the Management Plan can be obtained at the District Office. Written comment will be received thru January 28, 2019 by mail or hand delivery.

1. Call Meeting to Order.
2. Public Comments.
3. Adopt Management Plan 2018-2023.
4. Adjournment.

Joe Ash

for President  
*Stanton Millett*

FILED FOR RECORD  
TIME: 12:55PM

JAN 24 2019

COKE COUNTY & DIST. CLERK  
MONICA REYES

# **APPENDIX G**



**Coke County Underground Water**

**Conservation District**

**Static Levels & Rainfall – 2001-2018**

**Static Levels Below Surface**

**Rainfall Net Work**

2001----61.75'

-----

2002----61.67'

-----

2003----61.82'

2003 24.69"

2004----62.07'

2004 33.54"

2005----61.65'

2005 28.15"

2006---60.97'

2006 15.29"

2007---60.24'

2007 33.08"

2008---61.88'

2008 20.68"

2009---61.76'

2009 19.00"

2010---61.55'

2010 26.33"

2011---64.43'

2011 8.94"

2012---65.72'

2012 25.61"

2013---69.80'

2013 21.57"

2014---69.23'

2014 18.53"

2015---60.40'

2015 32.16"

2016---59.76'

2016 36.44

2017---58.84'

2017 23.25"

2018---47.00'

2018 35.69"

18 Years Static Avg.  
20 Wells  
61.86'

16 Years Rainfall Avg.  
29 Gauges  
25.18 "

## APPENDIX H



**C** OKE  
 OUNTY UNDERGROUND WATER  
 ONSERVATION DIST  
 P.O. BOX 1110  
 ROBERT LEE, TEXAS 76945  
 PH. 325-453-2232 FAX 325-453-2157

February 6, 2019

CRMWD  
 John Grant  
 P.O. Box 869  
 Big Spring, Tex. 79721

Dear John:

If you would like a copy of the Coke County UWCD Management Plan 2018-2023, please give me a call.

Thanks.

*Winton Milliff*  
 Winton Milliff  
 General Manager

SENDER: COMPLETE THIS SECTION	COMPLETE THIS SECTION ON DELIVERY																	
<ul style="list-style-type: none"> <li>Complete items 1, 2, and 3.</li> <li>Print your name and address on the reverse so that we can return the card to you.</li> <li>Attach this card to the back of the mailpiece, or on the front if space permits.</li> </ul>	A. Signature <i>X W. Milliff</i>																	
1. Article Addressed to:  CRMWD P.O. Box 869 Big Spring, TX 79721	B. Received by (Printed Name) _____	C. Date of Delivery 2/11/19																
2. Article Number (Transfer from service label) 7015 3010 0001 1944 8921	D. Is delivery address different from item 1? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If YES, enter delivery address below: _____																	
9590 9402 3304 7196 7127 95	3. Service Type <table border="0"> <tr> <td><input type="checkbox"/> Adult Signature</td> <td><input type="checkbox"/> Priority Mail Express</td> </tr> <tr> <td><input type="checkbox"/> Adult Signature Restricted Delivery</td> <td><input type="checkbox"/> Registered Mail</td> </tr> <tr> <td><input type="checkbox"/> Certified Mail</td> <td><input type="checkbox"/> Registered Mail Restricted Delivery</td> </tr> <tr> <td><input type="checkbox"/> Certified Mail Restricted Delivery</td> <td><input type="checkbox"/> Return Receipt for Merchandise</td> </tr> <tr> <td><input type="checkbox"/> Collect on Delivery</td> <td><input type="checkbox"/> Signature Confirmation™</td> </tr> <tr> <td><input type="checkbox"/> Collect on Delivery Restricted Delivery</td> <td><input type="checkbox"/> Signature Confirmation Restricted Delivery</td> </tr> <tr> <td><input type="checkbox"/> Insured Mail</td> <td><input type="checkbox"/> Signature Confirmation Restricted Delivery (over \$500)</td> </tr> <tr> <td><input type="checkbox"/> Insured Mail Restricted Delivery (over \$500)</td> <td></td> </tr> </table>		<input type="checkbox"/> Adult Signature	<input type="checkbox"/> Priority Mail Express	<input type="checkbox"/> Adult Signature Restricted Delivery	<input type="checkbox"/> Registered Mail	<input type="checkbox"/> Certified Mail	<input type="checkbox"/> Registered Mail Restricted Delivery	<input type="checkbox"/> Certified Mail Restricted Delivery	<input type="checkbox"/> Return Receipt for Merchandise	<input type="checkbox"/> Collect on Delivery	<input type="checkbox"/> Signature Confirmation™	<input type="checkbox"/> Collect on Delivery Restricted Delivery	<input type="checkbox"/> Signature Confirmation Restricted Delivery	<input type="checkbox"/> Insured Mail	<input type="checkbox"/> Signature Confirmation Restricted Delivery (over \$500)	<input type="checkbox"/> Insured Mail Restricted Delivery (over \$500)	
<input type="checkbox"/> Adult Signature	<input type="checkbox"/> Priority Mail Express																	
<input type="checkbox"/> Adult Signature Restricted Delivery	<input type="checkbox"/> Registered Mail																	
<input type="checkbox"/> Certified Mail	<input type="checkbox"/> Registered Mail Restricted Delivery																	
<input type="checkbox"/> Certified Mail Restricted Delivery	<input type="checkbox"/> Return Receipt for Merchandise																	
<input type="checkbox"/> Collect on Delivery	<input type="checkbox"/> Signature Confirmation™																	
<input type="checkbox"/> Collect on Delivery Restricted Delivery	<input type="checkbox"/> Signature Confirmation Restricted Delivery																	
<input type="checkbox"/> Insured Mail	<input type="checkbox"/> Signature Confirmation Restricted Delivery (over \$500)																	
<input type="checkbox"/> Insured Mail Restricted Delivery (over \$500)																		
PS Form 3811, July 2015 PSN 7530-02-000-9053	Domestic Return Receipt																	



**C** OKE  
 OUNTY UNDERGROUND WATER  
 ONSERVATION DIST  
 P.O. BOX 1110  
 ROBERT LEE, TEXAS 76945  
 PH. 325-453-2232 FAX 325-453-2157

February 6, 2018


David A. Vela  
 City Manager  
 P.O.Box 450  
 Sweetwater, Tex. 79556

Dear Mr. Vela:

If you would like a copy of the Coke County UWCD Management Plan 2018-2023, please give me a call.

Thanks.

*Winton Milliff*  
 Winton Milliff  
 General Manager

SENDER: COMPLETE THIS SECTION	COMPLETE THIS SECTION ON DELIVERY
<ul style="list-style-type: none"> <li>Complete items 1, 2, and 3</li> <li>Print your name and address on the reverse so that we can return the card to you.</li> <li>Attach this card to the back of the mailpiece, or on the front if space permits.</li> </ul>	A. Signature <input checked="" type="checkbox"/> Agent <input checked="" type="checkbox"/> Addressee
1. Article Addressed to: David Vela City Manager PO Box 450 Sweetwater, TX 79556   9590 9402 3304 7196 7128 18	B. Received By (Printed Name) BJ Menezes C. Date of Delivery 2/8/19 D. Is delivery address different from item 1? <input type="checkbox"/> Yes If YES, enter delivery address below: <input type="checkbox"/> No
2. Article Number (Transfer from service label) 15 3010 0001 1944 8907	3. Service Type <input type="checkbox"/> Adult Signature <input type="checkbox"/> Adult Signature Restricted Delivery <input type="checkbox"/> Certified Mail® <input type="checkbox"/> Certified Mail Restricted Delivery <input type="checkbox"/> Collect on Delivery <input type="checkbox"/> Collect on Delivery Restricted Delivery <input type="checkbox"/> Insured Mail <input type="checkbox"/> Insured Mail Restricted Delivery (over \$500) <input type="checkbox"/> Priority Mail Express® <input type="checkbox"/> Registered Mail™ <input type="checkbox"/> Registered Mail Restricted Delivery <input type="checkbox"/> Return Receipt for Merchandise <input type="checkbox"/> Signature Confirmation™ <input type="checkbox"/> Signature Confirmation Restricted Delivery

Domestic Return Receipt



**C** OKE  
 OUNTY UNDERGROUND WATER  
 ONSERVATION DIST  
 P.O. BOX 1110  
 ROBERT LEE, TEXAS 76945  
 PH. 325-453-2232 FAX 325-453-2157

February 6, 2019

City of Robert Lee  
 Mayor Allyson Crenshaw  
 P.O. Box 26  
 Robert Lee, Tex. 76945

Dear Allyson:

If you would like a copy of the Coke County UWCD Management Plan 2018-2023, please give me a call.

Thanks.

*Winton Milliff*  
 Winton Milliff  
 General Manager

SENDER: COMPLETE THIS SECTION	COMPLETE THIS SECTION ON DELIVERY																
<ul style="list-style-type: none"> <li>Complete items 1, 2, and 3.</li> <li>Print your name and address on the reverse so that we can return the card to you.</li> <li>Attach this card to the back of the mailpiece, or on the front if space permits.</li> </ul>	<p>A. Signature <input checked="" type="checkbox"/> Agent  <input checked="" type="checkbox"/> Addressee</p>																
<p>1. Article Addressed to:          City of Robert Lee          Mayor Allyson Crenshaw          PO Box 26          Robert Lee TX 76945</p>	<p>B. Received by (Printed Name) C. Date of Delivery          Irene Gamba 2-8-19</p>																
<p>9590 9402 3304 7196 7128 01</p>	<p>D. Is delivery address different from item 1? <input checked="" type="checkbox"/> Yes          If YES, enter delivery address below: <input type="checkbox"/> No</p>																
<p>2. Article Number (transfer from service label)          7015 3010 0001 1944 8914</p>	<p>3. Service Type</p> <table border="0"> <tr> <td><input type="checkbox"/> Adult Signature</td> <td><input type="checkbox"/> Priority Mail Express</td> </tr> <tr> <td><input type="checkbox"/> Adult Signature Restricted Delivery</td> <td><input type="checkbox"/> Registered Mail™</td> </tr> <tr> <td><input type="checkbox"/> Certified Mail®</td> <td><input type="checkbox"/> Registered Mail Restricted Delivery</td> </tr> <tr> <td><input type="checkbox"/> Certified Mail Restricted Delivery</td> <td><input type="checkbox"/> Return Receipt for Merchandise</td> </tr> <tr> <td><input type="checkbox"/> Collect on Delivery</td> <td><input type="checkbox"/> Signature Confirmation™</td> </tr> <tr> <td><input type="checkbox"/> Collect on Delivery Restricted Delivery</td> <td><input type="checkbox"/> Signature Confirmation Restricted Delivery</td> </tr> <tr> <td><input type="checkbox"/> Insured Mail</td> <td></td> </tr> <tr> <td><input type="checkbox"/> Insured Mail Restricted Delivery (over \$500)</td> <td></td> </tr> </table>	<input type="checkbox"/> Adult Signature	<input type="checkbox"/> Priority Mail Express	<input type="checkbox"/> Adult Signature Restricted Delivery	<input type="checkbox"/> Registered Mail™	<input type="checkbox"/> Certified Mail®	<input type="checkbox"/> Registered Mail Restricted Delivery	<input type="checkbox"/> Certified Mail Restricted Delivery	<input type="checkbox"/> Return Receipt for Merchandise	<input type="checkbox"/> Collect on Delivery	<input type="checkbox"/> Signature Confirmation™	<input type="checkbox"/> Collect on Delivery Restricted Delivery	<input type="checkbox"/> Signature Confirmation Restricted Delivery	<input type="checkbox"/> Insured Mail		<input type="checkbox"/> Insured Mail Restricted Delivery (over \$500)	
<input type="checkbox"/> Adult Signature	<input type="checkbox"/> Priority Mail Express																
<input type="checkbox"/> Adult Signature Restricted Delivery	<input type="checkbox"/> Registered Mail™																
<input type="checkbox"/> Certified Mail®	<input type="checkbox"/> Registered Mail Restricted Delivery																
<input type="checkbox"/> Certified Mail Restricted Delivery	<input type="checkbox"/> Return Receipt for Merchandise																
<input type="checkbox"/> Collect on Delivery	<input type="checkbox"/> Signature Confirmation™																
<input type="checkbox"/> Collect on Delivery Restricted Delivery	<input type="checkbox"/> Signature Confirmation Restricted Delivery																
<input type="checkbox"/> Insured Mail																	
<input type="checkbox"/> Insured Mail Restricted Delivery (over \$500)																	
<p>PS Form 3811, July 2015 PSN 7530-02-000-9053</p>	<p>Domestic Return Receipt</p>																