



District Management Plan

Originally Adopted – April 16, 2007

Revision One – Adopted May 21, 2012

Revision Two – Adopted March 17, 2017

Revision Three – Adopted March 15, 2019

Revision Four - Adopted March 1, 2022

Central Texas Groundwater Conservation District
District Management Plan

REVISION RECORD

<u>Date</u> <u>Adopted</u>	<u>Effective</u> <u>Date</u>	<u>Affected Sections or General Comments</u>
4/16/07	4/16/07	Original Adoption
5/21/12	5/21/12	Revision 1: 5 year Statutory Review, General Revisions, and New Chapter 36 Requirements Including DFCs
3/17/17	3/17/17	Revision 2: 5 year Statutory Review and General Revisions
3/15/19	3/15/19	Revision 3: Updated DFCs and MAGs
3/01/22	3/01/22	Revision 4: 5 year Statutory Review and General Revisions

I. DISTRICT MISSION

The mission of the Central Texas Groundwater Conservation District (District) is to protect and enhance the groundwater resources of Burnet County while protecting groundwater users and maintaining the economic vitality of the communities it serves, by adopting and enforcing rules consistent with State law.

II. PURPOSE OF THE MANAGEMENT PLAN

Senate Bill 1 (SB 1), enacted by the 75th Texas Legislature in 1997, and Senate Bill 2 (SB 2), enacted by the 77th Texas Legislature in 2001, established a comprehensive statewide planning process and the actions necessary for districts to manage and conserve the groundwater resources of the state of Texas. These bills required all underground water conservation districts to develop a management plan which defines the water needs and supply within each district and the goals each district will use to manage the underground water in order to meet its needs. In addition, the 79th Texas Legislature enacted HB 1763 in 2005 that requires joint planning among districts that are in the same Groundwater Management Area (GMA). These districts must establish the desired future conditions of the aquifers within their respective GMAs. Through this process, the districts will submit the desired future conditions to the executive administrator of the Texas Water Development Board (TWDB) who will provide each district with the estimates concerning the modeled available groundwater in the management area based on the desired future conditions of the aquifers in the area. Technical information, such as the desired future conditions of the aquifers within the District's jurisdiction and the amount of modeled available groundwater from such aquifers is required by statute to be included in the District's management plan and will guide the District's regulatory and management policies. This management plan is intended to satisfy the requirements of SB 1, SB 2, HB 1763, the statutory requirements of Texas Water Code (TWC) Chapter 36, and the rules and requirements of the TWDB.

This plan is required by the TWC and developed in accordance with instruction from the TWDB. The TWC and the TWDB require use of certain data provided by the TWDB. The projections of future water demands, surface water availability, water management strategies, and groundwater use in Burnet County were all provided to the District by TWDB. This document should be considered as a PLAN and will be used to identify activities or programs that the District will develop. The District considers the collection and development of site-specific data on groundwater use in Burnet County and the groundwater sources of Burnet County to be a high priority. This Plan will be updated as the District develops the site-specific data on the local groundwater use and aquifer conditions. The District is not restricted by the TWC or TWDB as to the frequency with which the Plan may be updated if considered it is appropriate by the District, but is required to be updated every five years.

III. DISTRICT INFORMATION

A. Creation

The 79th Texas Legislature (Regular Session) created the District in 2005 by passage of SB

967 and the enabling act was amended by the 83rd Texas Legislature (Regular Session) by passage of SB 168. The citizens of Burnet County confirmed creation of the District by an election held on September 24, 2005. The District was formed to protect the underground water resources for the citizens of Burnet County. To manage the groundwater resources under its jurisdiction the District is charged with the rights and responsibilities specified in its enabling legislation; the provisions of Chapter 36 of the Texas Water Code; this Management Plan, and the District Rules.

B. Directors

The Board of Directors consists of five members. These five directors are elected by the voters of Burnet County and serve a four-year term. The District observes the same four precincts as the Burnet County Commissioners with one at-large position. Director terms are staggered on a two-year interval. Elections are held in even numbered years. A director may serve consecutive terms.

C. Authority

The District has the rights and responsibilities provided for in TWC Chapter 36 and 31 Texas Administrative Code (TAC) Chapter 356. The District is charged with undertaking hydrogeological studies, adopting a management plan, providing for the permitting of certain water wells and implementing programs to achieve statutory mandates. The District has rule-making authority to implement the policies and procedures needed to manage the groundwater resources of Burnet County.

D. Location and Extent

The boundaries of the District are the same as Burnet County. (Figure 1) This area encompasses approximately 1,019 square miles (approximately 652,160 acres). The District is bounded by Lampasas County to the north, Bell and Williamson Counties to the east, Travis and Blanco Counties to the south, and Llano and San Saba Counties to the west.

E. Topography and Drainage

Burnet County is located on the margin of two geographic regions. The eastern portion of the County is located in the Hill Country Region of the Balcones Escarpment. The western portion of the County is located in the Llano Uplift Region. The Colorado River and its tributaries drain the western and southern portions of the County. The tributaries of the Brazos River drain the northern and eastern portions the County.

F. Groundwater Resources of Burnet County

Burnet County enjoys a variety of groundwater resources. TWDB recognizes one major and three minor aquifers in the County. In addition to the aquifers defined by TWDB, there also exist two local water bearing formations that are important sources of water in Burnet County.

The TWDB classifies groundwater sources as major or minor aquifers. Major aquifers are defined by TWDB as aquifers that are capable of producing large yields to wells or that produce groundwater over a large area. TWDB has established no definition for a large area, but a large yield may be considered as greater than 500 gallons per minute. Minor aquifers are defined by TWDB as aquifers that may be capable of producing only limited yields to wells or that produce groundwater over a limited area. TWDB has established no definition for a limited area, but a limited yield may be less than 100 gallons per minute. Many localized sources of groundwater may not be listed as a major or minor aquifer by TWDB. However, TWDB recognizes that these classifications, or lack thereof, have no bearing on the local importance of a particular source of groundwater. The District is committed to better defining the extent and character of the complex groundwater resources of Burnet County. The geologic layers and hydrogeologic units of Burnet County can be found in Table 1.

Central Texas Groundwater Conservation District Boundary

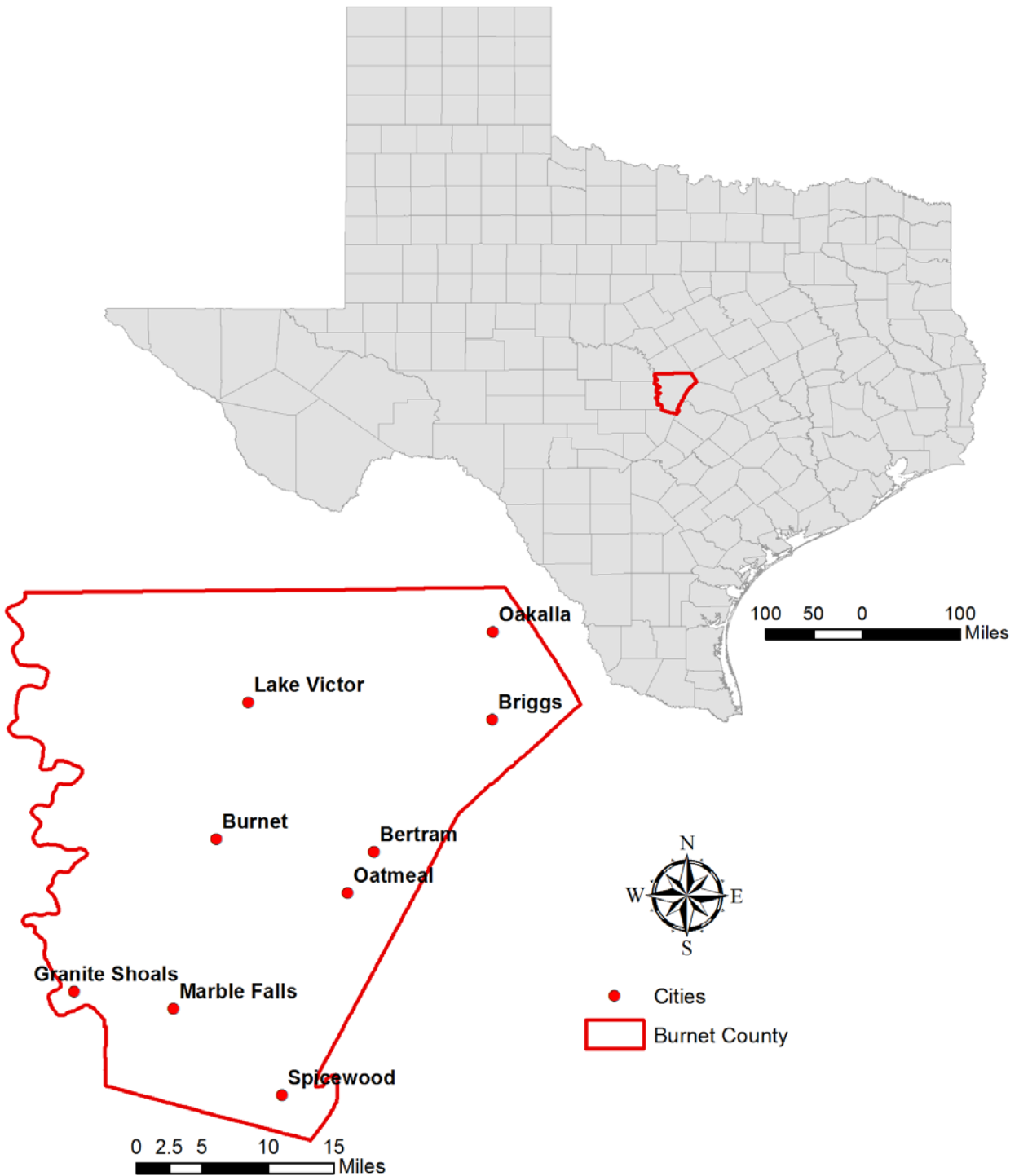


Figure 1: Location and Boundaries of the Central Texas Groundwater Conservation District

Major Aquifer

The only major aquifer located in Burnet County is the Trinity aquifer. (Figure 2)

Trinity Aquifer

The Trinity Aquifer is composed of three subdivisions; the Upper Trinity; the Middle Trinity and the Lower Trinity aquifers. The Upper Trinity Aquifer is composed of the Paluxy Sand and Glen Rose Formation; the Middle Trinity Aquifer is composed of the Hensell Sand and Cow Creek Limestone; and the Lower Trinity Aquifer is composed of the Sligo Limestone and Hosston Sand.

The following descriptions are taken from the District's report *Trinity Aquifer Characterization and Groundwater Availability Assessment Burnet County, 2011*.

Hosston Sand Formation

The Hosston is present in the extreme eastern and southeastern part of Burnet County. The outcrop equivalent of the Hosston is the Sycamore Sand, which outcrops along the Colorado River. Well yields are often small, generally less than 20 gallons per minute (gpm). The unit is generally non-water bearing, except beneath the surface of Lake Travis where more permeable facies exist. Well data from southeastern Burnet County appear to support this conclusion. The Hosston, some distance north of Lake Travis, is generally thin and not a significant source of groundwater. The Hosston has not been found in the western or northwestern part of the Trinity Aquifer area of the District.

Cow Creek Limestone Member

The Cow Creek ranges in thickness from 35 feet in the west to about 140 feet in the east. The Cow Creek is defined as the interval from the base of the Hensell Sand to the Hosston or the Ellenburger/Smithwick.

Hensell Sand Member

The Hensell Sand is the primary source of groundwater in the Trinity Aquifer of the District. Except for wells completed in the Ellenburger below the Trinity in the western part of the Trinity area, the vast majority of wells are completed in the Hensell. Well yields in the Hensell are generally in the range of 10-40 gpm. However, along Hwy. SH-29, well yields are frequently estimated to be greater than 50 gpm, and even up to 100+ gpm.

Glen Rose Limestone

The Glen Rose overlies the Hensell Sand and is a limited source of groundwater in the District. The primary limitation is saturated thickness. Thus, the Glen Rose is a source of groundwater in the District, but is dependent upon location.

Paluxy Formation

The Paluxy overlies the Glen Rose and is present in the upland inter-stream areas. The formation is thin and unrecognizable during drilling. The Paluxy is not a source of groundwater in the District.

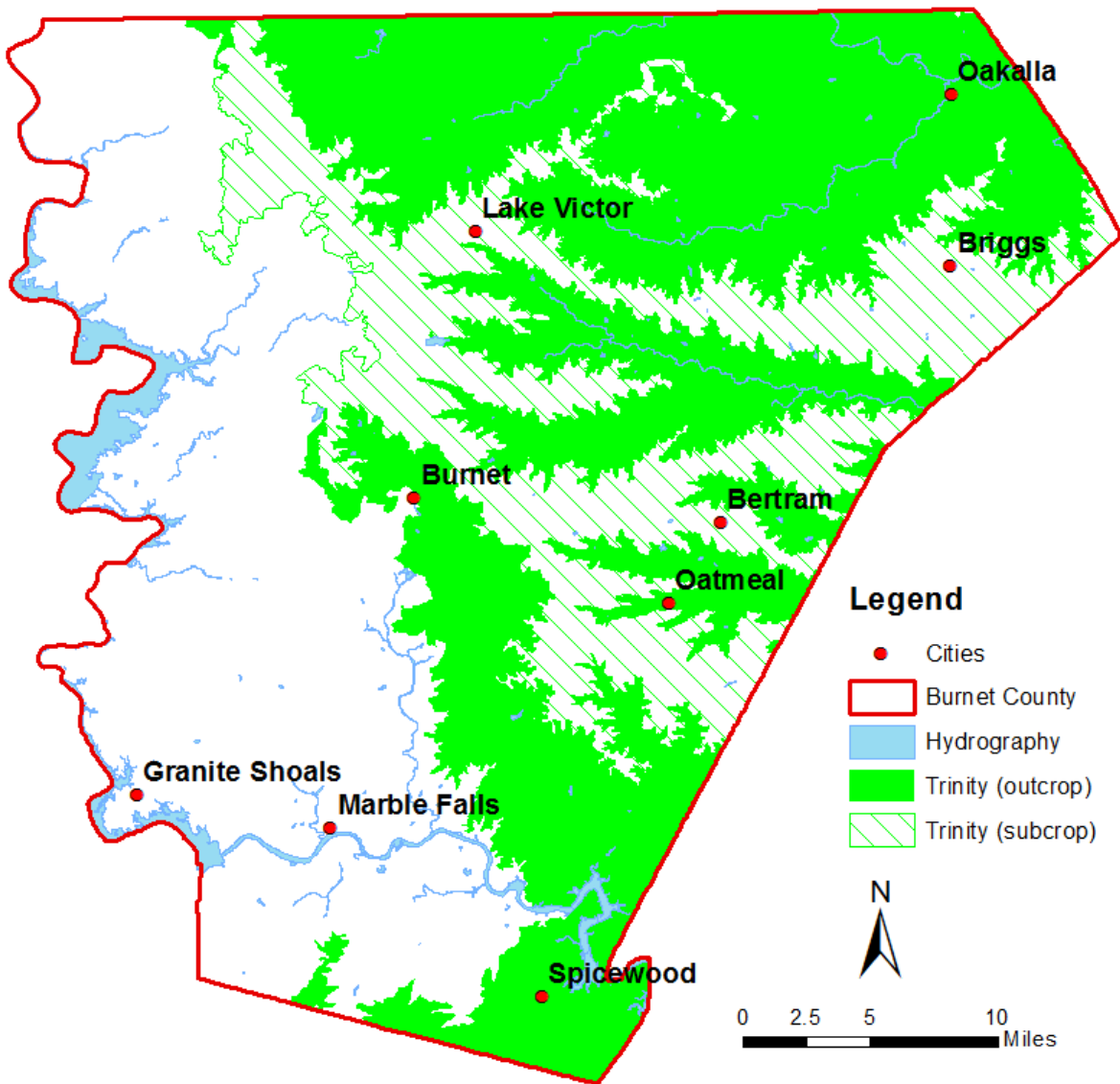


Figure 2: Occurrence of the Trinity Aquifer in Burnet County

Minor Aquifers

There are three minor aquifers within Burnet County which include the Marble Falls, Ellenburger-San Saba, and Hickory. In some areas wells produce water from formations which are not recognized as major or minor aquifers and may not have a large area of occurrence but which are vitally important local sources of groundwater. The information available on the characteristics of each of these minor aquifers and unrecognized formations is limited, particularly when compared to the data currently existing on major aquifers like the Trinity Aquifer. Even though TWDB recognizes the potential local importance of unrecognized sources of groundwater little or no research may have been devoted to defining the extent or characterizing these resources.

Marble Falls Aquifer

The Marble Falls Aquifer occurs in several separated outcrops. Water occurs in fractures and solution cavities in the limestone of the Marble Falls Formation of the Pennsylvanian Bend Group. Maximum thickness of the formation is 600 feet, but the thickness in Burnet County is unclear. The quality of water produced from the aquifer is suitable for most purposes. The Marble Falls aquifer is not known to have a down-dip extent in Burnet County and may occur only in the several outcrop areas. (Ashworth and Hopkins, 1995) The recharge zone of the aquifer in Burnet County is approximately 15,790 acres. (Figure 3)

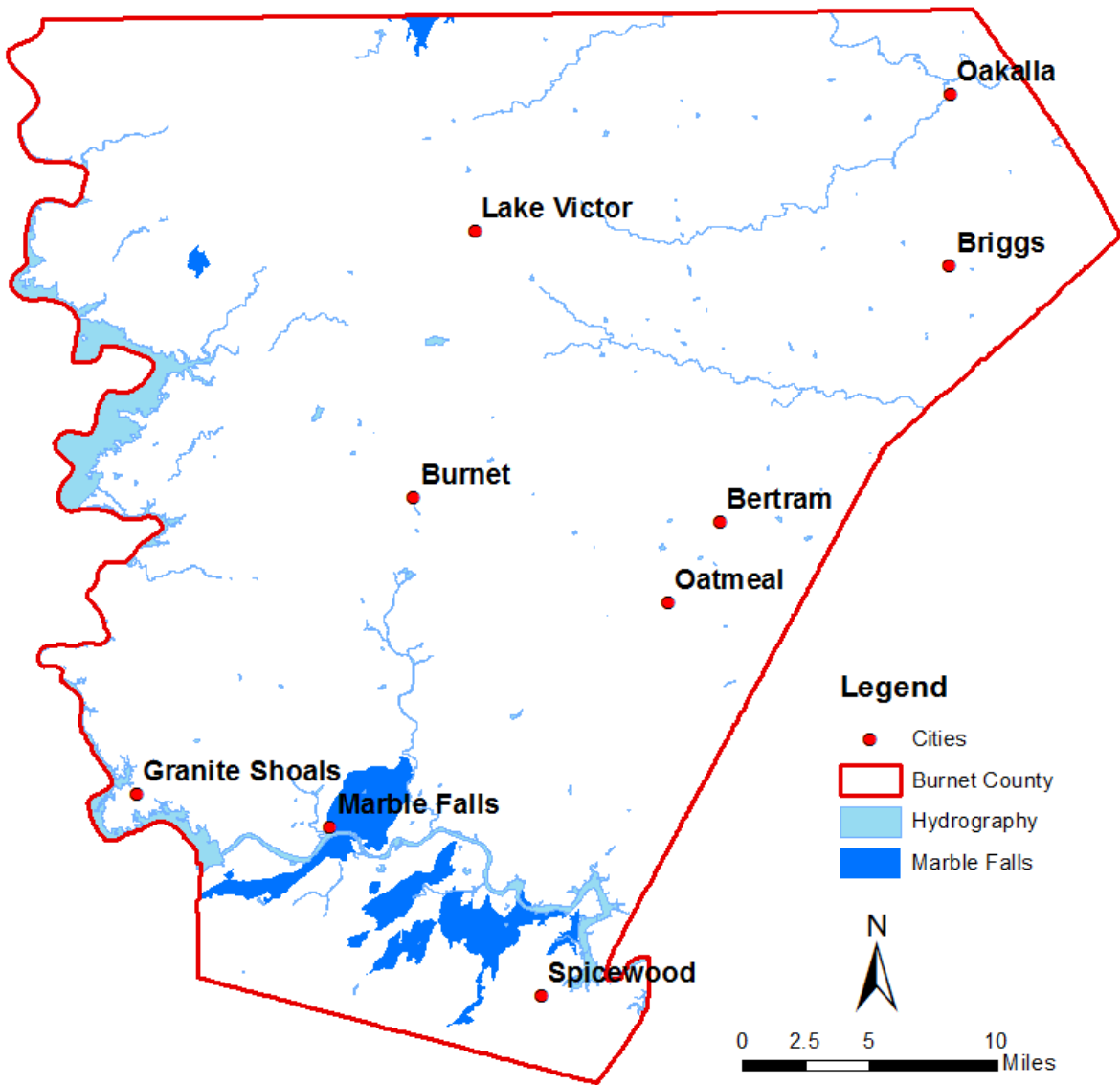


Figure 3: Occurrence of the Marble Falls Aquifer in Burnet County

Ellenburger-San Saba Aquifer

The Ellenburger-San Saba Aquifer occurs along the margin of the Llano Uplift in Central Texas. Discontinuous outcrops of the aquifer surround older rocks of the uplift, and the remaining downdip portion may extend to depths of up to 3,000 feet below land surface. It is unknown if the aquifer reaches this depth in Burnet County. The aquifer is compartmentalized by block faulting. The aquifer is composed of the limestone and dolomite of the San Saba Member of the Wilberns Formation of late Cambrian age, and the Honeycut, Gorman, and Tanyard formations of the Ellenburger Group of early Ordovician age. Water occurs in solution cavities formed along faults and related fractures. Water produced from the aquifer may be hard but have less than 1,000 mg/l dissolved solids. (Ashworth and Hopkins, 1995) The recharge zone for the aquifer in Burnet County is approximately 110,413 acres. (Figure 4)

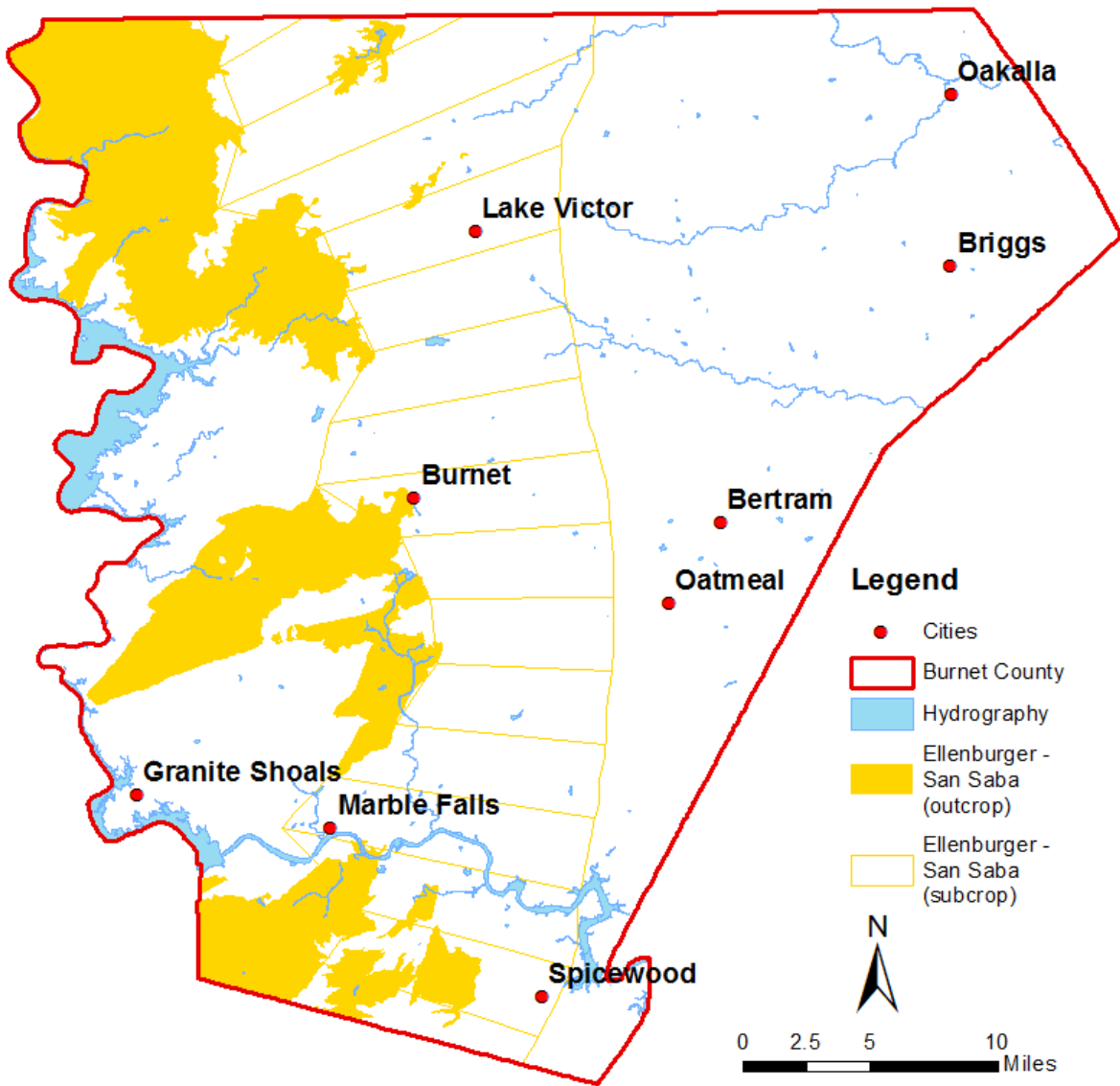


Figure 4: Occurrence of the Ellenburger- San Saba Aquifer in Burnet County

Hickory Aquifer

The Hickory Aquifer occurs in the Llano Uplift region of Central Texas. Non-continuous Hickory Sandstone outcrops may overlie or flank exposed Precambrian rocks forming the central uplift core. The downdip (artesian) portion of the aquifer surrounds the uplift and may extend to depths approaching 4,500 feet. It is unknown if the aquifer occurs at this depth in Burnet County. The Hickory Sandstone Member of the Cambrian Riley Formation is one of the oldest sedimentary rock formations in Texas. In the southern and eastern extents of the aquifer, the Hickory consists of two units. The flow of the Hickory aquifer is restricted due to block faulting. Water from the aquifer is generally fresh, but locally may have alpha particle and radium concentrations in excess of drinking water standards. The water may contain radon gas. The Hickory may produce water with iron concentrations exceeding drinking water standards. (Ashworth and Hopkins, 1995) Water which exceeds a drinking water standard must be treated to meet or exceed the drinking water standard established by the United States Environmental Protection Agency before it may be distributed by a public water supply system. The recharge zone of the aquifer in Burnet County is approximately 8,590 acres. (Figure 5)

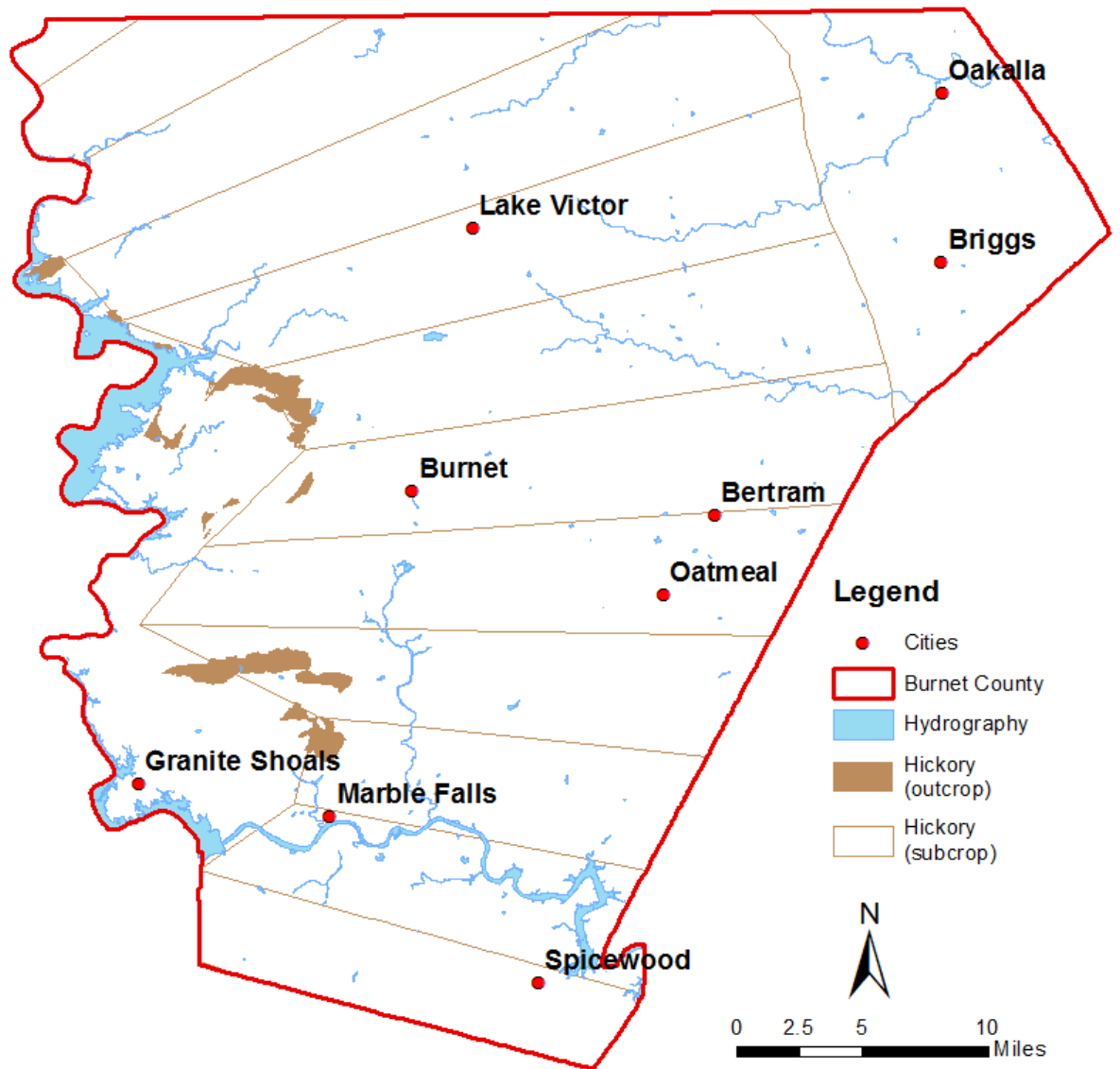


Figure 5: Occurrence of the Hickory Aquifer in Burnet County

Local Water Bearing Formations

In addition to the aquifers that TWDB has identified, there also exist two local water bearing formations within Burnet County. The District recognizes these as the Granite and Granite Gravel aquifers. The District has been committed to developing characteristics and hydrologic data for these aquifers, and will continue to do so in the future.

Granite Gravel Aquifer

The following descriptions come from the District's report *Hydrogeologic Assessment of the Granite Gravel Aquifer in Burnet County, Texas, 2011*.

The Granite Gravel Aquifer is a local water bearing formation located in the southwest portion of Burnet County (Figure 6). It is located in what is known as the Llano Uplift area of Central Texas. The Llano Uplift is a structural anomaly that has exposed ancient Precambrian rock in the midst of the younger Cretaceous aged Edwards Plateau. The Precambrian Town Mountain Granite is part of the core of the Llano uplift and is the formation that forms the Granite Gravel Aquifer. The Town Mountain Granite is described as being coarse-grained, pink, quartz-plagioclase-microcline rock. In Burnet County much of the formation is decomposed and weathered on the surface and down to the bedrock.

The Granite Gravel Aquifer is composed of weathered or decomposed Town Mountain Granite. A solid bedrock of granite forms the base of the aquifer and its depth below surface can vary greatly. The saturated thickness of the aquifer is dependent on the depth to the bedrock which can range from a few feet in some locations, and up toward 100 ft in others. There exist locations in which the granite bedrock is exposed to the surface or just beneath it, therefore these areas contain little to no granite gravel. Flow in the Granite Gravel Aquifer is controlled by the depth to the top of the granite bedrock and presence of adjacent geologic formations that have been juxtaposed to the granite in some instances. The variations in the depth to the granite bedrock cause well yields to vary widely throughout the aquifer. Estimated well yields for the aquifer can range from as little as 5 gpm up to 100+ gpm.

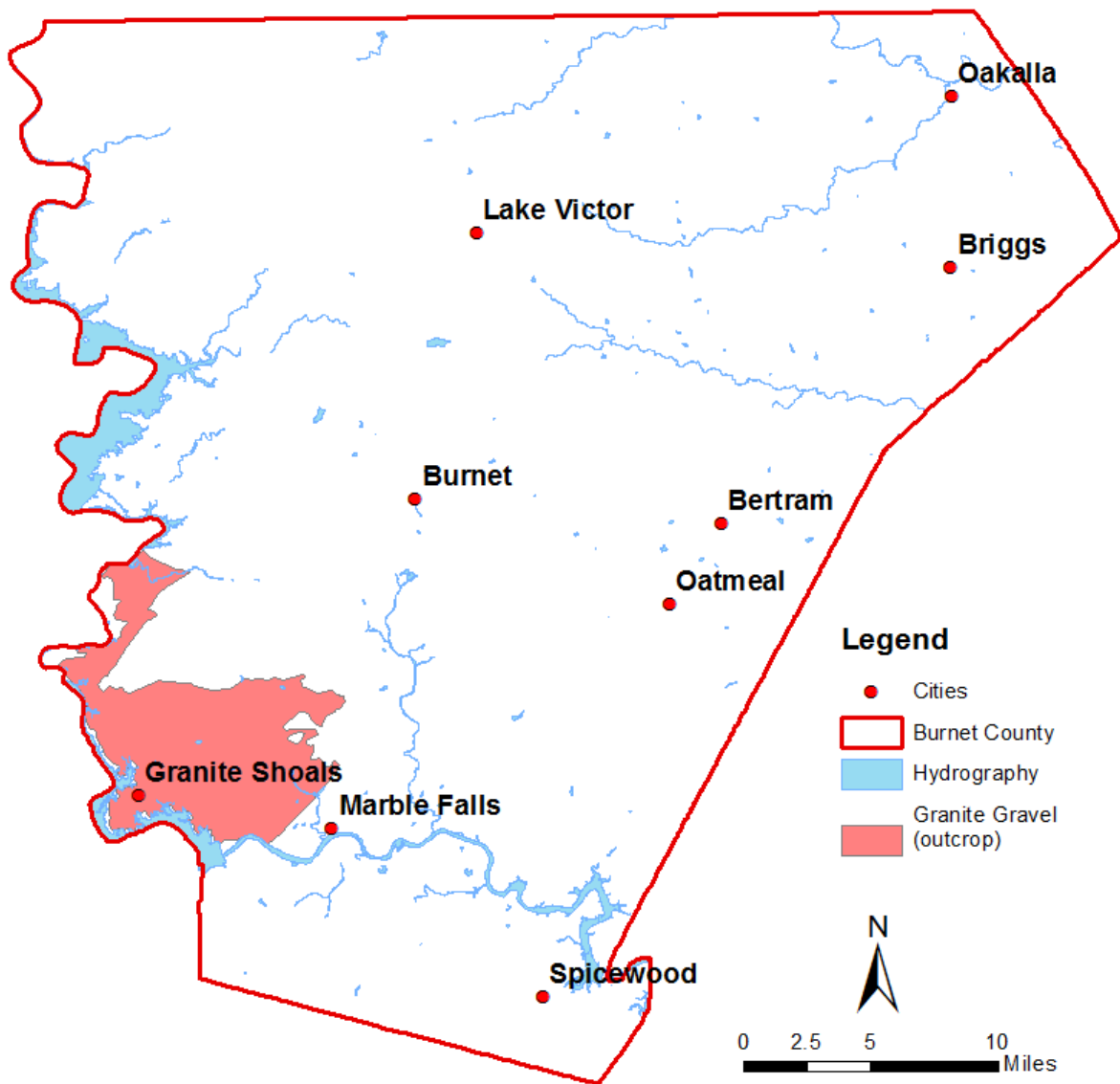


Figure 6: Occurrence of Granite Gravel Aquifer in Burnet County

Granite Aquifer

The Granite Aquifer is a general name for the water bearing formation that is composed of various Precambrian formations, which consist mostly of Town Mountain Granite and Valley Spring Gneiss among others. In Burnet County the Granite Aquifer outcrops in the western part of the county mainly along the highland lakes west of HWY 281 (Figure 7). The downdip portion surrounds the Llano Uplift and generally dips to the east. The Granite Aquifer is a fractured aquifer system that is highly diversified in nature. Wells completed in the Granite Aquifer are generally suitable only for domestic use because well yields are typically low (less than 25 gpm) and many cannot sustain continuous pumping (Partridge, 2011).

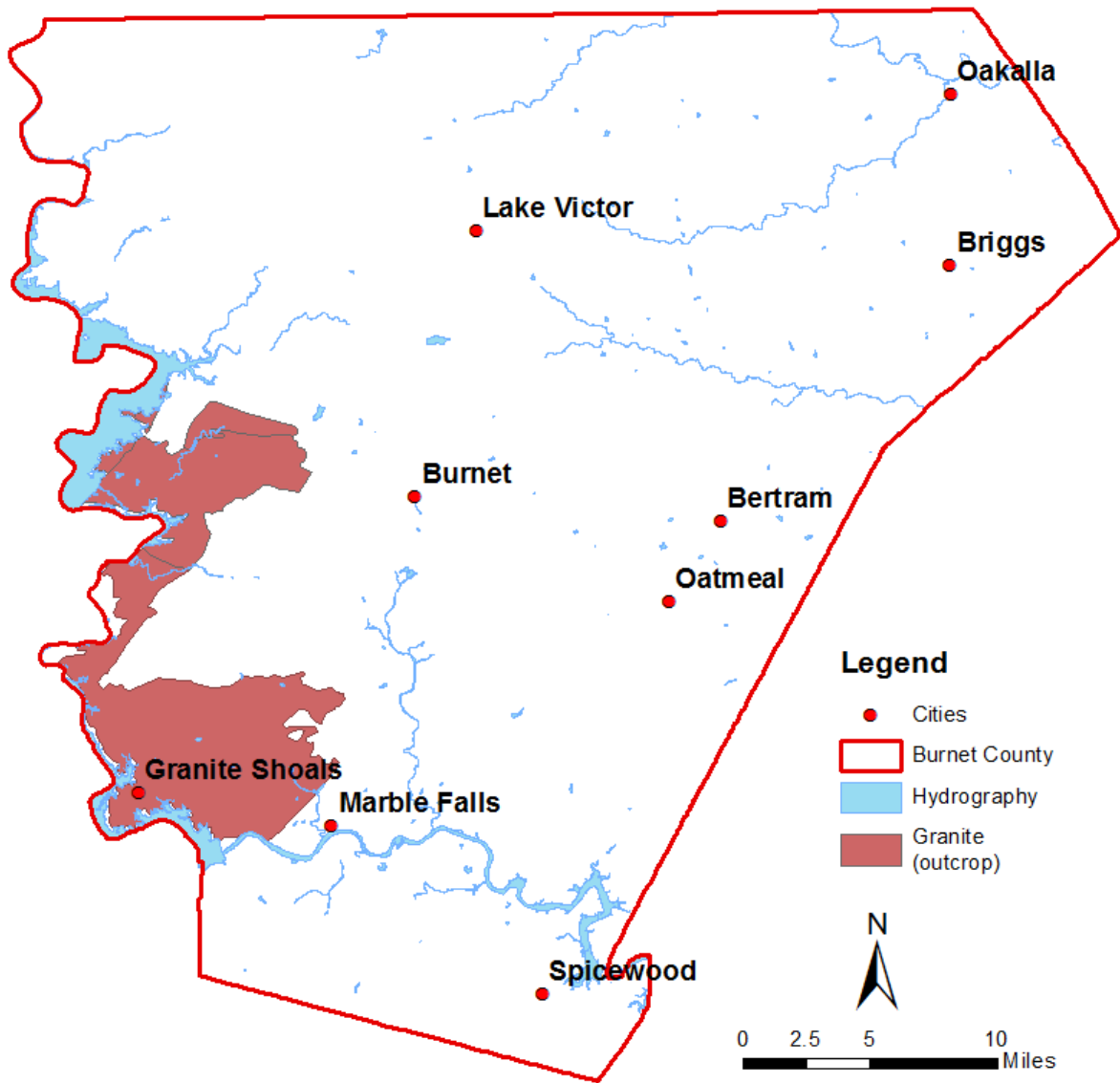


Figure 7: Occurrence of Granite Aquifer in Burnet County

Geologic Units								
Era	System	Group	Formation	Member or Unit	Hydrogeologic Units			
Cenozoic	Quaternary	Pleistocene to Recent floodplain (alluvium and fluvial terrace deposits)			localized alluvial aquifers			
Mesozoic	Cretaceous	Edwards Group	Segovia Formation		Edwards Plateau Aquifer	Edwards Trinity aquifer		
			Fort Terrett Formation	Kirchburg evaporite Mbr.				
				Dolomite Member				
				Burrowed Member				
		Basal Nodular Bed Member		confining bed				
		Trinity Group	Glen Rose Limestone		Upper Member		Upper and Middle Trinity Aquifer	
			Travis Peak equivalent	Hensell Sand	Bexar			Lower Member
				Cow Creek Limestone				
				Hammett Shale				
				Sligo				
Sycamore Sand				Lower Trinity aquifer				
Hosston								
Paleozoic	Pennsylvanian	Canyon Group	undivided		confining beds			
		Strawn Group	undivided					
		Bend Group	Smithwick	undivided				
	Marble Falls Limestone		Marble Falls aquifer					
	Mississippian and Devonian	Composed of youngest to oldest – Barnett Formation(Miss.), Chappel Limestone(Miss) Houy Formation(Dev) and the Stribling Formation (Dev)			Usually confining beds			
		Ordovician	Ellenberger Group	Honeycut Formation		Ellenburger-San Saba aquifer		
	Gorman Formation							
	Tanyard Formation			Staendebach Member				
				Threadgill Member				
	Cambrian	Moore Hollow Group	Wilberns Formation		San Saba Member	confining beds		
					Point Peak Member			
					Morgan Creek Limestone Mbr			
			Riley Formation		Welge Sandstone Member	Mid-Cambrian aquifer		
Lion Mountain Sandstone Mbr					confining beds			
Cap Mountain Limestone Mbr								
		Hickory Sandstone Member	Hickory aquifer					
Precambrian	Llanite Oat Creek Granite Six Mile Granite Pegmatite and quartz veins Town Mountain Granite Melaryolite dikes Red Mountain Gneiss Coal Creek Serpentine Mafic igneous rocks Packsaddle Schist Lost Creek Gneiss Valley Springs Gneiss			Usually confining beds				

Table 1, Geologic and hydrogeologic units of Burnet County (after Preston and others, 1996).

IV. STATEMENT OF GUIDING PRINCIPLES

The District recognizes that the groundwater resources of Burnet County and the Central Texas region are of vital importance to the many users who are dependent on these valuable resources. The District will strive to manage and conserve this most valuable resource in a prudent and cost effective manner through education, cooperation and development of a comprehensive understanding of the aquifers. The District's management plan is intended to serve as a tool to focus the thoughts and actions of those given the responsibility for the execution of the District's activities.

V. CRITERIA FOR PLAN CERTIFICATION

A. Planning Horizon

The time period for this plan is 5 years from the date of approval by the TWDB. This plan will be reviewed as required and necessary. The District will consider the necessity to amend the plan and re-adopt the plan with or without amendments as required by TWC 36.1072(e)

This management plan will remain in effect until replaced by a revised management plan approved by the TWDB.

B. Board Resolution

A certified copy of the Central Texas Groundwater Conservation District resolution adopting the plan is located in Appendix A - District Resolution.

C. Plan Adoption

Public notices documenting that the plan was adopted following appropriate public meetings and hearings are located in Appendix B – Notice of Meetings.

D. Coordination with Surface Water Management Entities

Letters transmitting copies of this plan to the Lower Colorado River Authority and the Brazos River Authority are located in Appendix C – Letters to Surface Water Management Entities.

VI. ESTIMATES OF TECHNICAL INFORMATION REQUIRED BY TWC § 36.1071 / 31 TAC 356.52

A. Modeled available groundwater in the district based on the desired future condition established under TWC 36.108—TWC § 36.10701(e)(3)(A)

Modeled available groundwater (MAG) is defined in TWC §36.001 as “the amount of water that the executive administrator determines may be produced on an average annual basis to achieve a desired future condition.” The desired future conditions (DFCs) of the aquifer may only be determined through joint planning with other groundwater conservation districts (GCDs) in the same groundwater management area (GMA) as required by the 79th Legislature with the passage of HB 1763 into law. The District is located in GMA 8. The GCDs of GMA 8 first adopted desired future conditions in 2007 and 2008. The first desired future conditions were adopted for the Trinity aquifer on September 17, 2008 and for the Ellenburger-San Saba, Hickory, and Marble Falls aquifers on May 19, 2008. GMA 8 passed a resolution to readopt desired future conditions for all aquifers in GMA 8 on April 27, 2011. GMA 8 adopted new desired future conditions for all aquifers in GMA 8 on January 31, 2017. The desired future conditions shall continue in effect until amended, superseded, or repealed.

The DFCs of each aquifer are from the 2010 to 2070 planning cycle. The MAG for the District is derived from the adopted DFCs of each aquifer. For the Trinity aquifer within the District, the TWDB used Version 2.01 of the updated groundwater availability model for the northern Trinity and Woodbine aquifers by Kelley and others (2014) to construct the predictive model simulation for this analysis (Beach and others, 2016). For the Ellenburger-San Saba, Hickory, and Marble Falls aquifers, Version 1.01 of the groundwater availability model for the minor aquifers in Llano Uplift region by Shi and others (2016) was used to develop the predictive model simulation used for this analysis.

The District recognizes that there are several localized sources of groundwater in Burnet County which have not been recognized as major or minor aquifers but which are of vital local importance as a source of water supply. The TWDB or other State agencies have not researched or characterized these groundwater sources. The District has and will continue to expand the knowledge of these important local resources so that management of these aquifers may be established in the future.

Trinity Aquifer

A new groundwater availability model, version 2.01 of the Trinity and Woodbine aquifers, was created recently and was utilized in the modeling of the selected management conditions within the District. The District will continue to use the updated model and will input newly collected data to refine the management conditions as it becomes available.

a. Selected Management Conditions

The District selected the management conditions that were reflective of average feet of drawdown during the 2010 to 2070 planning cycle for each subdivision of the Trinity aquifer.

The desired future conditions of the Trinity aquifer are:

Glen Rose: The average drawdown of the Glen Rose aquifer will be approximately 2 feet.

Hensell: The average drawdown of the Hensell aquifer will be approximately 7 feet.

Hosston: The average drawdown of the Hosston aquifer will be approximately 20 feet.

Travis Peak: The average drawdown of the Travis Peak aquifer will be approximately 16 feet.

b. Groundwater Availability

The MAG for the Trinity Aquifer in Burnet County is broken down for each subdivision within the Trinity aquifer and is derived from the amount of groundwater that could be pumped while maintaining the selected management conditions in each aquifer subdivision discussed above. The following MAG values come from TWDB report GAM Run 17-029 MAG:

Aquifer	Modeled Available Groundwater- GAM Run 17-029 MAG							
	All values in acre-feet/year							
	2009	2010	2020	2030	2040	2050	2060	2070
Trinity (Glen Rose)	35	423	425	423	425	423	425	423
Trinity (Hensell)	51	1,888	1,894	1,888	1,894	1,888	1,894	1,888
Trinity (Hosston)	1,799	1,379	1,382	1,379	1,382	1,379	1,382	1,379
Trinity (Travis Peak)	1,906	3,464	3,474	3,464	3,474	3,464	3,474	3,464

Minor Aquifers

A new model created by the TWDB, the Llano Uplift Region GAM version 1.01, was recently completed. At the time of this writing, very few GAM runs have been simulated as a result of the recent timing of the model completion and adoption of DFCs. In the future GMA 8 will study and assess the accuracy of the DFCs and MAG within the new GAM.

a. Selected Management Conditions

The District selected the maintenance of the saturated thickness for the Llano Uplift aquifers during the 2010-2070 planning cycle as the preferred desired future condition. The District will continue to use the new model and will input newly collected data to refine the management conditions as it becomes available.

Marble Falls aquifer – Maintain at least 90 percent of the saturated thickness.

Ellenburger-San Saba aquifer – Maintain at least 90 percent of the saturated thickness.

Hickory aquifer – Maintain at least 90 percent of the saturated thickness.

b. Groundwater Availability

The total estimated modeled available groundwater values for the three minor aquifers come from TWDB report GAM Run 17-029 MAG.

Aquifer	Modeled Available Groundwater- GAM Run 17-029 MAG All values in acre-feet/year							
	2009	2010	2020	2030	2040	2050	2060	2070
Ellenburger-San Saba	5,256	10,827	10,857	10,827	10,857	10,827	10,857	10,827
Hickory	1,088	3,413	3,423	3,413	3,423	3,413	3,423	3,413
Marble Falls	2,220	2,736	2,744	2,736	2,744	2,736	2,744	2,736

B. Amount of groundwater being used within the district on an annual basis—31 TAC 356.52 (a)(5)(B) (Implementing TWC §36.1071(e)(3)(B))

SEE APPENDIX G

C. Annual amount of recharge from precipitation to the groundwater resources within the district—31 TAC 356.52 (a)(5)(C) (Implementing TWC §36.1071 (e)(3)(C))

SEE APPENDIX H

D. For each aquifer, annual volume of water that discharges from the aquifer to springs and any surface water bodies, including lakes, streams, and rivers—TWC §36.1071(e)(3)(D)

SEE APPENDIX H

E. Annual volume of flow into and out of the district within each aquifer and between aquifers in the district, if a groundwater availability model is available — TWC §36.1071 (e)(3)(E)

SEE APPENDIX H

F. Projected surface water supply in the district, according to the most recently adopted state water plan— TWC §36.1071(e)(3)(F)

SEE APPENDIX G

G. Projected total demand for water in the district according to the most recently adopted state water plan— TWC §36.1071(e)(3)(G)

SEE APPENDIX G

VII. CONSIDER THE WATER SUPPLY NEEDS AND WATER MANAGEMENT STRATEGIES INCLUDED IN THE ADOPTED STATE WATER PLAN— TWC §36.1071(E)(4)

The District considered the water supply needs and water management strategies that were identified in the regional water planning process. Water supply needs from the TWDB 2022 State Water Plan are identified in Appendix G and include mining, municipal needs for the cities of Bertram, County-other, Granite Shoals, Horseshoe Bay, and Marble Falls. Water management strategies from the TWDB 2022 State Water Plan identified in Appendix G included conservation of groundwater sources for many municipalities and development of groundwater sources from the Ellenburger-San Saba Aquifer for the city of Bertram, and development of the Ellenburger-San Saba, Hickory, and Marble Falls aquifers for mining use. These water management strategies were considered by the District and GMA 8 when adopting DFCs.

VIII. DETAILS ON THE DISTRICT MANAGEMENT OF GROUNDWATER

The District will manage the use of groundwater within the District in order to conserve the resource while seeking to maintain the economic viability of all resource user groups, public and private. The District seeks to manage the groundwater resources of the District as practicably as possible as defined in the plan by the management goals established for each aquifer or aquifer subdivision. The Texas Legislature established that groundwater conservation districts are the preferred method of groundwater management in Section 36.0015 of the Texas Water Code. 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 may result in the conservation of groundwater in the District. The District will manage groundwater resources through rules developed and implemented in accordance with Chapter 36 of the Texas Water Code and the provisions of the District Act.

An extensive monitoring well network has been established and maintained in order to monitor changing storage conditions of groundwater supplies within the District. The District will make a regular assessment of water supply and groundwater storage conditions and will report those conditions to the District Board of Directors and to the public. The District may undertake, as necessary, investigations of the groundwater resources within the District and will make the results

of investigations available to the public. The District will cooperate with investigations of the groundwater resources of the District undertaken by other local political subdivisions or agencies of the State of Texas.

In order to better manage groundwater resources the District may establish management zones for; and adopt different rules for: (1) each aquifer, subdivision of an aquifer, or geologic strata located in whole or in part within the boundaries of the District; or (2) each geographic area overlying an aquifer or subdivision of an aquifer located in whole or in part within the boundaries of the district.

For the purpose of managing the use of groundwater within the District, the District may define sustainable use as the use of an amount of groundwater in the District as a whole or any management zone established by the District that does not exceed:

- a) The desired future conditions of aquifers in the District established by the District prior to the establishment of the desired future condition of aquifers in a groundwater management area in which the District is located or
- b) The desired future conditions of aquifers within the District established by a groundwater management area in which the District is participating or
- c) The amount of modeled available groundwater resulting from the establishment of a desired future aquifer condition established by the District or a groundwater management area in which the District is located or
- d) The amount of annual recharge of the aquifer or aquifer subdivision in which the use occurs as recognized by the District or
- e) Any other criteria established by the District as being a threshold of use beyond which further use of the aquifer or aquifer subdivision may result in a specified undesirable or injurious condition

The District has adopted rules that protect existing or historic use of groundwater in the District prior to the effective date of the rules to the maximum extent practicable consistent with this plan and the goals and objectives set forth herein. The District may impose more restrictive permit conditions on new permit applications and permit amendment applications to increase use by historic users if the limitations:

- a) Apply to all subsequent new permit applications and permit amendment applications to increase use by historic users, regardless of the type or location of use;
- b) Bear a reasonable relationship to the District's existing management plan; and
- c) Are reasonably necessary to protect existing use

The District has adopted rules to regulate groundwater withdrawals by means of spacing and/or production limits. The relevant factors to be considered in making a determination to grant or deny a permit or limit groundwater withdrawals shall include those set forth in the District Act, Chapter 36 of the Texas Water Code, and the rules of the District. The District has and will continue to employ technical resources, as needed, to evaluate the groundwater resources available within the District and to determine the effectiveness of regulatory or conservation measures. In consideration of particular individual, localized or District-wide conditions, including without limitation climactic conditions, the District may by rule allow an increase or impose a decrease in the total production in a

management zone above or below the sustainable amount for a period of time considered necessary by the District in order to accomplish the purposes set forth in Chapter 36, Water Code, or the District Act. The exercise of said discretion by the Board shall not be construed as limiting the power of the Board.

IX. ACTIONS, PROCEDURES, PERFORMANCE AND AVOIDANCE FOR PLAN IMPLEMENTATION

The District will implement the provisions of this plan and will utilize the provisions of this plan as a guidepost for determining the direction or priority for all District activities. All operations of the District, all agreements entered into by the District, and any additional planning efforts in which the District may participate will be consistent with the provisions of this plan.

Rules adopted by the District for the permitting of wells and the use of groundwater shall comply with TWC Chapter 36, including §36.113, and the provisions of this management plan. All rules will be adhered to and enforced. The promulgation and enforcement of the rules will be based on the best technical evidence available to the District. The District's rules can be found at www.centraltexasgcd.org.

X. METHODOLOGY FOR TRACKING DISTRICT PROGRESS IN ACHIEVING MANAGEMENT GOALS – 31 TAC 356.52(a)(4)

The District will prepare and present an Annual Report to the Board of Directors on District performance in regards to achieving management goals and objectives for the fiscal year. The report will be presented within 120 days following the completion of the District's fiscal year, beginning with FY2007. The Board will maintain the report on file, for public inspection at the District's offices upon adoption in a regular noticed meeting of the Board.

XI. GOALS, MANAGEMENT OBJECTIVES AND PERFORMANCE STANDARDS

The management goals, objectives, and performance standards of the District in the areas specified in 31 TAC§356.52 are addressed below.

Management Goals

A. Providing the Most Efficient Use of Groundwater –31 TAC 356.52(a)(1)(A) (Implementing TWC §36.1071 (a)(1))

1. Objective: Each year the District will require the registration of all wells within the District's jurisdiction.

Performance Standard: Each year the number of all registered wells within the District will be presented in the District's annual report.

2. Objective: Each year the District will require permits for all non-exempt use of groundwater in the District as defined in the District's rules, in accordance with adopted procedures.

Performance Standard: Each year a summary of the number of applications for the permitted use of groundwater and the disposition of the applications will be presented in the District's annual report.

**B. Controlling and Preventing Waste of Groundwater –31 TAC 356.52(a)(1)(B)
(Implementing TWC §36.1071 (a)(2))**

Objective: Each year, the District will provide information on eliminating and reducing the waste of groundwater and focusing on water quality protection. This may be accomplished annually by at least one of the following methods:

- a. compile literature packets for distribution to schools in Burnet County;
- b. conduct classroom presentations;
- c. sponsor an educational program/curriculum;
- d. post information on the District's website;
- e. submit newspaper articles for publication;
- f. conduct public presentations;
- g. set up displays at public events;
- h. distribute brochures/literature;
- i. compile links and information on District website.

Performance Standard: The annual report will include a summary of the District activities during the year to disseminate educational information on eliminating and reducing the wasteful use of groundwater focusing on water quality protection.

**C. Addressing Conjunctive Surface Water Management Issues – 31 TAC 356.52 (a)(1)(D)
(Implementing TWC §36.1071 (a)(4))**

Objective: Senate Bill 660 passed by the 82nd Texas Legislature requires that each Regional Water Planning Group (RWPG) will have a representative from each groundwater management area (GMA). Currently the District is the only GCD in GMA 8 that is also in the Lower Colorado Regional Water Planning Group (Region K). Each year, the District will participate in the regional planning process by attending Region K meetings.

Performance Standard: Each year, attendance at Region K meetings by a representative of the District will be reflected in the District's annual report and will include the number of meetings attended and the dates.

D. Addressing Natural Resource Issues which Impact the Use and Availability of Groundwater, and which are Impacted by the Use of Groundwater – 31 TAC 356.52 (a)(1)(E) (Implementing TWC §36.1071(a)(5))

Objective: Each year the District will collect and test a minimum of 20 groundwater quality samples

for coliform and E.coli bacteria for wells located in the District.

Performance Standard: Each year, the District's Annual Report will provide a status report on the number of wells tested and the results.

E. Addressing Drought Conditions – 31 TAC 356.52 (a)(1)(F) (Implementing TWC §36.1071(a)(6))

Objective: The District has a Drought Management Plan that addresses drought conditions locally. The Drought Management Plan lists several stages of conservation depending on the severity of the present drought conditions. Issuing a drought stage requires Board action.

Performance Standard: At least quarterly, a report of the current drought status will be given at a regular Board Meeting and action can be taken on the drought stage. Each year the District's Annual Report will provide the minutes of each board meeting pertaining to the drought management plan.

F. Addressing Conservation, Recharge Enhancement, Rainwater Harvesting, or Brush Control, Where Appropriate and Cost-Effective – 31 TAC 356.52 (a)(1)(G) (Implementing TWC §36.1071 (a)(7))

1. Objective: Each year, the District will promote rainwater harvesting by posting information on rainwater harvesting on the District web site.

Performance Standard: Each year, the annual report will include a copy of the information on rainwater harvesting that is provided on the District web site.

2. Objective: Each year, the District will provide information relating to recharge enhancement and brush control on the District web site.

Performance Standard: Each year, the District annual report will include a copy of the information that has been provided on the District web site relating to recharge enhancement and brush control.

3. Objective: Each year, the District will promote conservation by at least one of the following methods:

- a. conduct an annual contest on water conservation;
- b. distribute conservation literature packets to schools in Burnet County;
- c. conduct classroom conservation presentations;
- d. sponsor an educational conservation program/curriculum;
- e. post conservation information on the District's website;
- f. provide a newspaper article on conservation for publication;
- g. publish an article on conservation in the District newsletter;
- h. conduct a public conservation presentation;
- i. set up a conservation display at a public event or;

- j. distributing conservation brochures/literature to the public.

Performance Standard: Each year, the annual report will include a summary of the District activity during the year to promote conservation.

G. Addressing the Desired Future Conditions of the Groundwater Resources – 31 TAC 356.52 (a)(1)(H) (Implementing TWC §36.1071(a)(8))

Objective: For each aquifer that has approved desired future conditions (DFCs) and has assigned MAG numbers from the TWDB, the District will assess if they are sufficient and are being met accordingly.

Performance Standard: Each year the District will use its monitor well program to make assessments of the drawdowns of the various aquifers. The drawdowns will be compared to historical averages and trends to monitor the District’s compliance of the desired future conditions. A report of the drawdowns will be included in the District’s annual report.

XII. MANAGEMENT GOALS DETERMINED NOT-APPLICABLE TO THE DISTRICT

A. Controlling and Preventing Subsidence – 31 TAC§356.52 (a)(1)(C)

This category of management goal is not applicable to the District because the major water producing formations in the District are composed primarily of competent limestone. The structural competency of the aquifer materials significantly limits the potential for the occurrence of land surface subsidence in the District.

The TWDB funded a study and development of a tool to assess the potential threat of subsidence: Identification of the Vulnerability of the Major and Minor Aquifers of Texas to Subsidence with Regard to Groundwater Pumping – TWDB Contract Number 1648302062 (Furnans and others 2017). The District has reviewed this report, and utilized the tool, and have concluded that the updated information indicates the Trinity aquifer has a low to medium risk for future subsidence due to pumping as seen in Furnans and others (2017) Figure 4.49. The Ellenburger-San Saba Aquifer have a low to medium-low risk of future subsidence due to pumping as seen in Furnans and others (2017) Figure 4.91. The Marble Falls Aquifer has a low risk for future subsidence due to pumping as seen in Furnans and others (2017) Figure 4.114. The Hickory Aquifer has a low risk for future subsidence due to pumping as seen in Furnans and others (2017) Figure 4.96. Based on this review, it has been determined that this management goal is not applicable to the District. However, the District will continue to monitor any new studies or information, related to this issue, that becomes available.

B. Addressing Precipitation Enhancement-31 TAC 356.52 (a)(1)(G)

Precipitation enhancement is not an appropriate or cost-effective program for the District at this time because there is not an existing precipitation enhancement program operating in nearby counties in which the District could participate and share costs. The cost of operating a single-county precipitation enhancement program is prohibitive and would require the District to increase taxes in Burnet County. Therefore, this category of management goal is not applicable to the District.

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APPENDIX A - RESOLUTION AMENDING MANAGEMENT PLAN

**RESOLUTION 2022 - 01
RESOLUTION RE-ADOPTING DISTRICT MANAGEMENT PLAN**

THE STATE OF TEXAS §
 §
CENTRAL TEXAS GROUNDWATER §
CONSERVATION DISTRICT §

WHEREAS, the Central Texas Groundwater Conservation District (the “District”) is a political subdivision of the State of Texas organized and existing under and by virtue of Article XVI, Section 59, of the Texas Constitution as a groundwater conservation district, acting pursuant to and in conformity with Chapter 36, Texas Water Code and Act of May 25, 2005, 79th Leg., R.S., Ch. 855, 2005 Tex. Gen. Laws 2899 *codified at* Chapter 8810 of the Texas Special District Local Laws Code (the “District Enabling Act”);

WHEREAS, the original Management Plan of the District was adopted by the Board of Directors of the District (the “Board”), which was subsequently approved by the Texas Water Development Board (“TWDB”) on July 3, 2007, revised on May 21, 2012, revised on March 17, 2017, and revised on March 15, 2019;

WHEREAS, the District Board is statutorily required to readopt its Management Plan every five years as required by Section 36.1072(e) of the Texas Water Code;

WHEREAS, under the direction of the Board, and in accordance with Sections 36.1071, 36.1072, and 36.108 of the Texas Water Code, and 31 Texas Administrative Code Chapter 356, the District has undertaken revisions to its Management Plan;

WHEREAS, Section 36.1085 of the Texas Water Code requires the District to ensure that its Management Plan contains the goals and objectives consistent with achieving the Desired Future Conditions (“DFCs”) adopted through the joint planning process set forth in Chapter 36 of the Texas Water Code;

WHEREAS, as part of the process of readopting its Management Plan, the District requested and received the assistance of the TWDB and worked closely with the TWDB staff to obtain staff’s input and comments on the revisions to its Management Plan and its technical and legal sufficiency;

WHEREAS, the Board, District staff, and the District’s geoscientist have reviewed and analyzed the District’s best available data, groundwater availability modeling information, and other information and data required by the TWDB;

WHEREAS, the District issued the notice in the manner required by state law and the District’s rules and held a public hearing on March 1, 2022, at 9:00 a.m. in Burnet, Texas to receive public and written comments on the revised Management Plan;

WHEREAS, the District coordinated it’s planning efforts on a regional basis with the appropriate surface water management entities during the preparation of the revised Management

Plan;

WHEREAS, the Board finds that the revised Management Plan meets all of the requirements of Chapter 36, Water Code, and 31 Texas Administrative Code Chapter 356; and

WHEREAS, at the public hearing, the Board of Directors considered re-adoption of its Management Plan as revised and approval of this resolution after due consideration of all comments received.

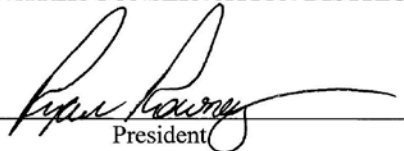
NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE CENTRAL TEXAS GROUNDWATER CONSERVATION DISTRICT AS FOLLOWS:

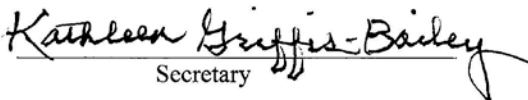
1. The above recitals are true and correct;
2. The Board of Directors of the District hereby readopts its Management Plan as revised as the Management Plan for the District, subject to the changes directed by the Board of Directors based on comments received at the public hearing;
3. The Board President and the General Manager of the District are further authorized to take all steps necessary to implement this resolution and submit the readopted Management Plan to the TWDB for its approval; and
4. The Board President and General Manager of the District are further authorized to take any and all action necessary to coordinate with the TWDB as may be required in furtherance of TWDB's approval pursuant to the provisions of Section 36.1072 of the Texas Water Code.

AND IT IS SO ORDERED.

PASSED AND ADOPTED on this 1st day of March, 2022.

CENTRAL TEXAS GROUNDWATER CONSERVATION DISTRICT

By: 
President


Secretary

APPENDIX B - NOTICE OF HEARING FOR PLAN AMENDMENTS

POSTED JANET PARKER
Burnet County Clerk
By Stephanie Sherrill at 9:50 am, Feb 09, 2022

CENTRAL TEXAS GROUNDWATER CONSERVATION DISTRICT NOTICE OF HEARING ON PROPOSED RE-ADOPTION OF DISTRICT MANAGEMENT PLAN MARCH 1, 2022

NOTICE IS HEREBY GIVEN to all interested persons within Burnet County, Texas:

That the Board of Directors of the Central Texas Groundwater Conservation District ("District") will hold a public hearing to discuss, consider, receive public comments, and potentially act upon the proposed re-adoption of the District Management Plan. All interested members of the public are invited to attend.

The hearing on the proposed re-adoption of the Management Plan will be held on Tuesday, March 1, 2022, beginning at 9:00 a.m. at the District's office at 225 S. Pierce Street, Suite 104, Burnet, Texas 78611. At the conclusion of the hearing or any time or date thereafter, the proposed Management Plan may be re-adopted in the form presented or as amended based upon comments received from the public, the Texas Water Development Board, District staff, attorneys, consultants, or members of the Board of Directors without any additional notice.

Any person who desires to appear at the hearing and present comment or other information on the proposed Management Plan may do so in person, by legal representative, or both. Limits may be placed on the amount of time that each person is allowed to present verbal comments. In addition, persons interested in submitting written comments on the proposed Management Plan may do so by sending any such comments to the Central Texas Groundwater Conservation District, P.O. Box 870, Burnet, Texas 78611. The hearing posted in this notice may be recessed from day to day or continued where appropriate.

At any time during the hearing and in compliance with Chapter 551, Government Code, the District Board may meet in a closed executive session on the above hearing item for consultation concerning attorney-client matters. Any subject discussed in executive session may be subject to action during an open session of the District Board.

The District is committed to compliance with the Americans with Disabilities Act ("ADA"). Any person with a disability who needs special accommodations should contact the District at 512-756-4900 at least 24 hours in advance if accommodation is needed.

A copy of the proposed Management Plan may be requested by email at district@centraltexasgcd.org, is available at the District's website at www.centraltexasgcd.org, and may be reviewed or copied at 225 S. Pierce, Suite 104, Burnet, Texas 78611. Any person who wishes to receive more detailed information on this notice should contact the District's General Manager, Mitchell Sodek, at 512-756-4900.

Certification: I, the undersigned authority, do hereby certify that on February 9, 2022 at or before 4:00 p.m., I posted and filed the above notice with the Burnet County Clerk's office for filing in the hallway of the Burnet County Courthouse in a place convenient and readily accessible to the general public at all times. I also certify that a copy of the notice was posted on the door and on an outside window of the District's office and that it will remain so posted continuously for at least 72 Hours immediately preceding the scheduled time of said hearing.



Mitchell Sodek, General Manager
Central Texas Groundwater Conservation District

APPENDIX C-Surface Water Coordination

The attached letter was sent to the following entities:

General Manager
Lower Colorado River Authority
P.O. Box 220
Austin, Texas 78767

Windermere Oaks WSC
424 Coventry Road
Spicewood, TX 78669-3119

LCRA-Region K
P.O. Box 220
Austin, TX 78767-0220

Mayor
City of Bertram
P.O. Box 1604
Bertram, Texas 78605

Groundwater Management Area 8
PO Box 508
Gainesville, TX 76240

City of Cottonwood Shores
3808 Cottonwood Dr.
Cottonwood Shores, Texas 78657

General Manager/CEO
Brazos River Authority
P. O. Box 7555
Waco, Texas 76714

City Manager
City of Marble Falls
800 Third Street
Marble Falls, Texas 78654

City Manager
City of Burnet
P.O. Box 1369
Burnet, Texas 78611

City Manager
City of Granite Shoals
2221 N. Phillips Ranch Road
Granite Shoals, TX 78654

Texas Parks & Wildlife Dept.
4200 Smith School Rd.
Austin, TX 78744-3218
Attn: Executive Director
TPWD Inks State Park

City Manager
City of Meadowlakes
177 Broadmoor, Suite A
Meadowlakes, Texas 78654

Corix Utilities
P.O. Box 140164
Austin, Texas 78714

General Manager
Kingsland Water Supply Corp
1422 West Drive
Kingsland, TX 78639

APPENDIX D - CORRESPONDENCE LETTER



SEE ATTACHED LIST:

Enclosed is a copy of the amended District Management Plan adopted by the Board of Directors at a Public Hearing held on March 1, 2022. The Management Plan will be used to manage the groundwater resources of Burnet County.

If you have comments on the plan please contact the District at:

P.O. Box 870
225 S. Pierce, Suite 104
Burnet, Texas 78611

Phone: 512-756-4900
Fax: 512-756-4997
or
sodek@centraltexasgcd.org.

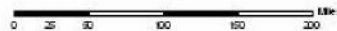
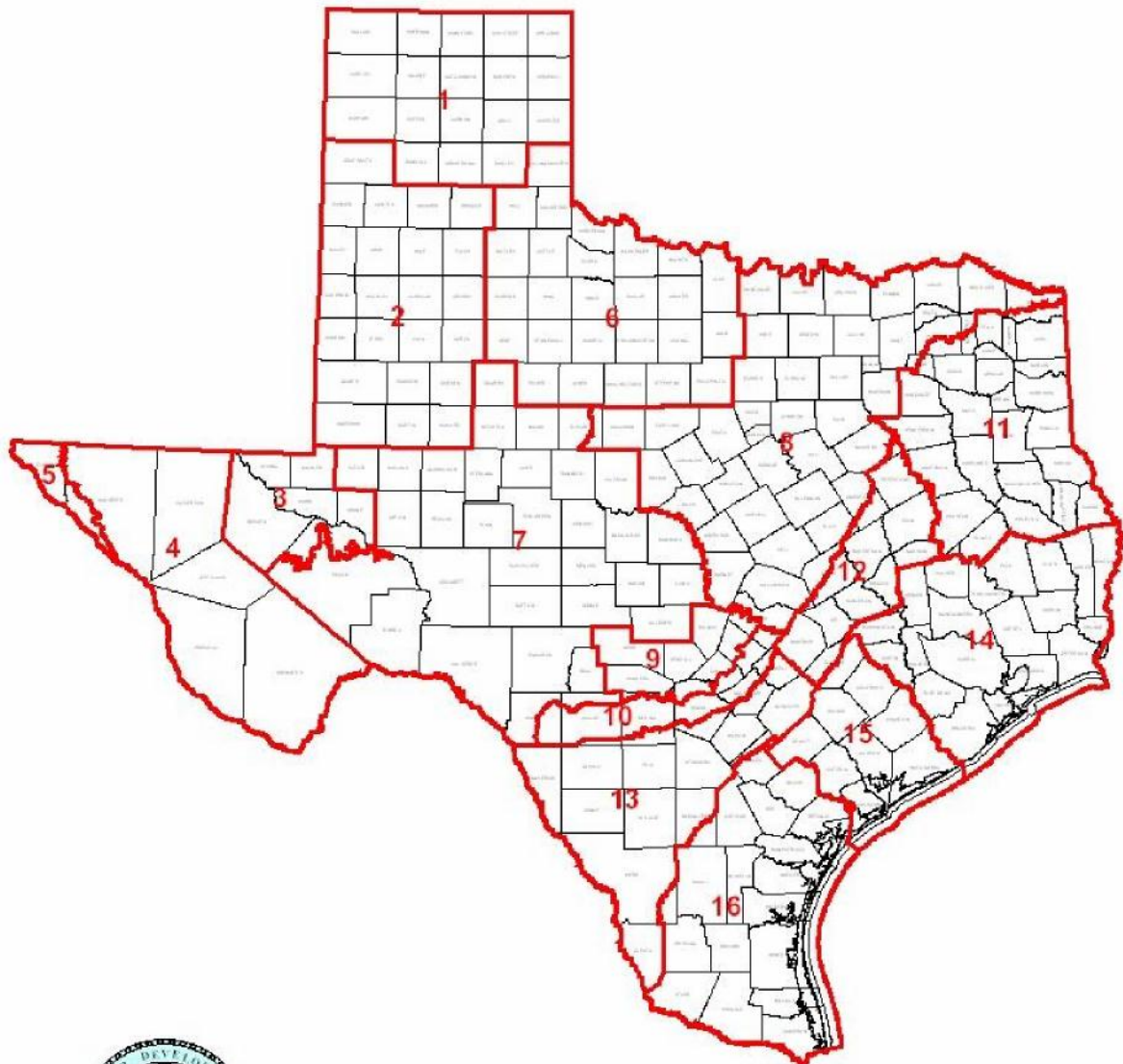
Sincerely,



Mitchell Sodek
General Manager

APPENDIX E - GROUNDWATER MANAGEMENT AREAS

Groundwater Management Areas In Texas



Information provided by the Texas Water Development Board is for informational purposes only and does not constitute a warranty or any other form of assurance. The user assumes all responsibility for the use of this information.

Map prepared by Scott Brown
MapScale.com/MapScale.com
11/18/2018

APPENDIX F-SPRINGS OF BURNET COUNTY

Springs and Spring Discharge Rates in Burnet County

Spring	Aquifer	Discharge (acre-feet/year)
BT-57-22-202 ¹	San Saba Ls. of Ellenburger-San Saba aquifer	8.07
Delaware Springs ¹	San Saba Ls. of Ellenburger-San Saba aquifer	500.03
BT-57-14-902 ¹	San Saba Ls. of Ellenburger-San Saba aquifer	64.52
Big Spring ¹	San Saba Ls. of Ellenburger-San Saba aquifer	701.66
	Total=	1,274.28
Holland & Sand Springs ¹	Ellenburger Gp of Ellenburger-San Saba aquifer	3.06
BT_57-14-903 ¹	Ellenburger Gp of Ellenburger-San Saba aquifer	8.07
Patterson Springs ¹	Ellenburger Gp of Ellenburger-San Saba aquifer	4.74
Ebeling Springs ²	Ellenburger Gp of Ellenburger-San Saba aquifer	690.30
Tanyard Springs ²	Ellenburger Gp of Ellenburger-San Saba aquifer	5.11
Persimmon Springs ²	Ellenburger Gp of Ellenburger-San Saba aquifer	89.49
Mud Springs ²	Ellenburger Gp of Ellenburger-San Saba aquifer	69.04
Boiling Springs ²	Ellenburger Gp of Ellenburger-San Saba aquifer	43.47
Soldier Spring ²	Ellenburger Gp of Ellenburger-San Saba aquifer	24.29
Greenwood Springs ³	Ellenburger Gp of Ellenburger-San Saba aquifer	-
Wolf Springs ³	Ellenburger Gp of Ellenburger-San Saba aquifer	-
Williams Springs ³	Ellenburger Gp of Ellenburger-San Saba aquifer	-
Sulphur Springs ⁴	Ellenburger Gp of Ellenburger-San Saba aquifer	-
	Total=	937.57
Krause Springs ²	Marble Falls aquifer	485.77
	Total=	485.77
Buzzard Roost Spring ¹	Tanyard Fm. of Ellenburger-San Saba aquifer	16.13
BT-57-15-709 ¹	Tanyard Fm. of Ellenburger-San Saba aquifer	1.61
Lemons South Spring ¹	Tanyard Fm. of Ellenburger-San Saba aquifer	20.97
Lemons Middle Spring ¹	Tanyard Fm. of Ellenburger-San Saba aquifer	35.49
Lemons Park Office Spring ¹	Tanyard Fm. of Ellenburger-San Saba aquifer	140.33
	Total=	214.53
BT-57-30-801 ¹	Honeycut Fm. of Ellenburger-San Saba aquifer	322.60
Boil Springs ¹	Honeycut Fm. of Ellenburger-San Saba aquifer	241.95
Horseshoe Springs ¹	Honeycut Fm. of Ellenburger-San Saba aquifer	96.78
Felps Spring ¹	Honeycut Fm. of Ellenburger-San Saba aquifer	646.82
	Total=	1,308.15
Pecan Spring ¹	Unknown origin	14.48
Flatrock Springs ¹	Unknown origin	130.30
	Total=	144.78
	Burnet County Total=	4,365.08

1 - Data from USGS, 2003.

2 - Data from Brune, 1981.

3 - These springs were mentioned in Brune, 1981; however, no discharge values were given.

4 - No discharge values were given for these springs because they are currently under seven meters of water due to the creation of the Marble Falls Reservoir.

APPENDIX G-2022 STATE WATER PLAN DATASETS

Estimated Historical Groundwater Use And 2022 State Water Plan Datasets:

Central Texas Groundwater Conservation District

Texas Water Development Board
Groundwater Division
Groundwater Technical Assistance Section
stephen.allen@twdb.texas.gov
(512) 463-7317
January 10, 2022

GROUNDWATER MANAGEMENT PLAN DATA:

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

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

The five reports included in this part are:

1. Estimated Historical Groundwater Use (checklist item 2)
from the TWDB Historical Water Use Survey (WUS)
2. Projected Surface Water Supplies (checklist item 6)
3. Projected Water Demands (checklist item 7)
4. Projected Water Supply Needs (checklist item 8)
5. Projected Water Management Strategies (checklist item 9)
from the 2022 Texas State Water Plan (SWP)

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

DISCLAIMER:

The data presented in this report represents the up-to-date WUS and 2022 SWP data available as of 1/10/2022. Although it does not happen frequently, either of these datasets are subject to change pending the availability of more accurate WUS data or an amendment to the 2022 SWP. District personnel must review these datasets and correct any discrepancies in order to ensure approval of their groundwater management plan.

The WUS dataset can be verified at this web address:

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

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

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

Estimated Historical Water Use and 2022 State Water Plan Dataset:

Central Texas Groundwater Conservation District

January 10, 2022

Page 2 of 10

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

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

BURNET COUNTY

All values are in acre-feet

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2019	GW	2,338	15	89	0	297	771	3,510
	SW	3,832	77	103	0	307	335	4,654
2018	GW	2,344	38	81	0	795	802	4,060
	SW	3,778	33	1	0	141	246	4,199
2017	GW	2,524	45	85	0	815	316	3,785
	SW	4,140	61	0	0	258	296	4,755
2016	GW	2,732	60	85	0	409	296	3,582
	SW	3,683	42	0	0	315	280	4,320
2015	GW	2,672	65	44	0	103	322	3,206
	SW	4,035	73	1	0	431	312	4,852
2014	GW	2,915	62	41	0	238	311	3,567
	SW	3,942	83	1	0	252	212	4,490
2013	GW	3,093	51	14	0	322	300	3,780
	SW	4,367	106	2	0	368	199	5,042
2012	GW	3,082	56	31	0	1,360	356	4,885
	SW	4,742	115	2	0	308	223	5,390
2011	GW	3,308	16	0	0	725	690	4,739
	SW	5,239	235	2	0	350	480	6,306
2010	GW	2,871	13	1,734	0	1,000	666	6,284
	SW	4,330	217	1,816	0	500	5,016	11,879
2009	GW	2,549	9	1,766	0	103	398	4,825
	SW	4,530	248	1,755	0	1,481	4,556	12,570
2008	GW	2,348	8	1,716	0	109	354	4,535
	SW	4,803	251	1,690	0	2,063	3,392	12,199
2007	GW	2,033	8	104	0	88	518	2,751
	SW	3,856	215	6	0	1,329	3,310	8,716
2006	GW	2,497	9	124	0	440	474	3,544
	SW	4,348	430	24	0	693	5,518	11,013
2005	GW	3,767	9	108	0	185	507	4,576
	SW	3,296	205	20	0	715	4,734	8,970
2004	GW	2,144	8	111	0	101	262	2,626
	SW	3,520	431	1,496	0	1,591	4,100	11,138

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Projected Surface Water Supplies TWDB 2022 State Water Plan Data

BURNET COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	Source Name	2020	2030	2040	2050	2060	2070
K	BURNET	COLORADO	HIGHLAND LAKES LAKE/RESERVOIR SYSTEM	3,226	3,226	3,226	3,226	3,226	3,226
K	CORIX UTILITIES TEXAS INC	COLORADO	HIGHLAND LAKES LAKE/RESERVOIR SYSTEM	185	185	185	185	185	185
K	COTTONWOOD SHORES	COLORADO	HIGHLAND LAKES LAKE/RESERVOIR SYSTEM	495	495	495	495	495	495
K	COUNTY-OTHER, BURNET	COLORADO	HIGHLAND LAKES LAKE/RESERVOIR SYSTEM	2,249	2,249	2,249	2,249	2,249	2,249
K	GEORGETOWN	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	84	100	114	128	140	150
K	GRANITE SHOALS	COLORADO	HIGHLAND LAKES LAKE/RESERVOIR SYSTEM	830	830	830	830	830	830
K	HORSESHOE BAY	COLORADO	HIGHLAND LAKES LAKE/RESERVOIR SYSTEM	398	398	398	398	398	398
K	IRRIGATION, BURNET	COLORADO	COLORADO RUN-OF-RIVER	276	276	276	276	276	276
K	IRRIGATION, BURNET	COLORADO	HIGHLAND LAKES LAKE/RESERVOIR SYSTEM	333	333	333	333	333	333
K	KEMPNER WSC	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	132	146	158	171	184	196
K	KINGSLAND WSC	COLORADO	HIGHLAND LAKES LAKE/RESERVOIR SYSTEM	64	64	64	64	64	64
K	LIVESTOCK, BURNET	BRAZOS	BRAZOS LIVESTOCK LOCAL SUPPLY	444	444	444	444	444	444
K	LIVESTOCK, BURNET	COLORADO	COLORADO LIVESTOCK LOCAL SUPPLY	582	582	582	582	582	582
K	MANUFACTURING, BURNET	COLORADO	HIGHLAND LAKES LAKE/RESERVOIR SYSTEM	500	500	500	500	500	500
K	MARBLE FALLS	COLORADO	HIGHLAND LAKES LAKE/RESERVOIR SYSTEM	3,000	3,000	3,000	3,000	3,000	3,000
K	MEADOWLAKES	COLORADO	COLORADO RUN-OF-RIVER	567	567	567	567	567	567
K	MINING, BURNET	BRAZOS	BRAZOS OTHER LOCAL SUPPLY	966	966	966	966	966	966

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Sum of Projected Surface Water Supplies (acre-feet)	14,331	14,361	14,387	14,414	14,439	14,461
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*Estimated Historical Water Use and 2022 State Water Plan Dataset:
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Projected Water Demands TWDB 2022 State Water Plan Data

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

BURNET COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
K	BERTRAM	BRAZOS	430	511	581	649	710	764
K	BURNET	BRAZOS	7	8	9	10	11	12
K	BURNET	COLORADO	1,654	1,968	2,235	2,496	2,731	2,937
K	CORIX UTILITIES TEXAS INC	COLORADO	126	149	168	187	204	220
K	COTTONWOOD SHORES	COLORADO	245	291	330	368	402	433
K	COUNTY-OTHER, BURNET	BRAZOS	1,228	1,366	1,364	1,499	1,627	1,740
K	COUNTY-OTHER, BURNET	COLORADO	2,186	2,432	2,428	2,668	2,897	3,098
K	GEORGETOWN	BRAZOS	84	100	114	128	140	150
K	GRANITE SHOALS	COLORADO	578	646	701	765	877	1,052
K	HORSESHOE BAY	COLORADO	548	767	952	1,128	1,285	1,421
K	IRRIGATION, BURNET	BRAZOS	160	160	160	160	160	160
K	IRRIGATION, BURNET	COLORADO	1,338	1,338	1,338	1,338	1,338	1,338
K	KEMPNER WSC	BRAZOS	132	146	158	171	184	196
K	KINGSLAND WSC	COLORADO	46	55	62	69	75	81
K	LIVESTOCK, BURNET	BRAZOS	630	630	630	630	630	630
K	LIVESTOCK, BURNET	COLORADO	1,061	1,061	1,061	1,061	1,061	1,061
K	MANUFACTURING, BURNET	COLORADO	251	299	299	299	299	299
K	MARBLE FALLS	COLORADO	2,354	3,400	4,884	5,661	6,184	6,446
K	MEADOWLAKES	COLORADO	852	843	838	836	835	835
K	MINING, BURNET	BRAZOS	1,123	1,354	1,595	1,815	2,067	2,354
K	MINING, BURNET	COLORADO	3,367	4,058	4,784	5,440	6,196	7,058
Sum of Projected Water Demands (acre-feet)			18,400	21,582	24,691	27,378	29,913	32,285

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Projected Water Supply Needs TWDB 2022 State Water Plan Data

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

BURNET COUNTY All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
K	BERTRAM	BRAZOS	-60	-141	-211	-279	-340	-394
K	BURNET	BRAZOS	7	6	5	4	3	2
K	BURNET	COLORADO	2,979	2,665	2,398	2,137	1,902	1,696
K	CORIX UTILITIES TEXAS INC	COLORADO	172	149	130	111	94	78
K	COTTONWOOD SHORES	COLORADO	250	204	165	127	93	62
K	COUNTY-OTHER, BURNET	BRAZOS	350	212	214	79	-49	-162
K	COUNTY-OTHER, BURNET	COLORADO	3,179	2,933	2,937	2,697	2,468	2,267
K	GEORGETOWN	BRAZOS	0	0	0	0	0	0
K	GRANITE SHOALS	COLORADO	252	184	129	65	-47	-222
K	HORSESHOE BAY	COLORADO	-67	-286	-471	-647	-804	-940
K	IRRIGATION, BURNET	BRAZOS	270	270	270	270	270	270
K	IRRIGATION, BURNET	COLORADO	63	63	63	63	63	63
K	KEMPNER WSC	BRAZOS	0	0	0	0	0	0
K	KINGSLAND WSC	COLORADO	35	26	19	12	6	0
K	LIVESTOCK, BURNET	BRAZOS	0	0	0	0	0	0
K	LIVESTOCK, BURNET	COLORADO	0	0	0	0	0	0
K	MANUFACTURING, BURNET	COLORADO	261	213	213	213	213	213
K	MARBLE FALLS	COLORADO	2,326	1,280	-204	-981	-1,504	-1,766
K	MEADOWLAKES	COLORADO	-285	-276	-271	-269	-268	-268
K	MINING, BURNET	BRAZOS	576	345	104	-116	-368	-655
K	MINING, BURNET	COLORADO	-935	-1,626	-2,352	-3,008	-3,764	-4,626
Sum of Projected Water Supply Needs (acre-feet)			-1,347	-2,329	-3,509	-5,300	-7,144	-9,033

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Projected Water Management Strategies TWDB 2022 State Water Plan Data

BURNET COUNTY

WUG, Basin (RWPG)

All values are in acre-feet

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
BERTRAM, BRAZOS (K)							
DROUGHT MANAGEMENT	DEMAND REDUCTION [BURNET]	78	85	88	89	94	101
EXPANSION OF CURRENT GROUNDWATER SUPPLIES - ELLENBURGER-SAN SABA AQUIFER	ELLENBURGER-SAN SABA AQUIFER [BURNET]	0	750	2,000	2,000	2,000	2,000
MUNICIPAL CONSERVATION - BERTRAM	DEMAND REDUCTION [BURNET]	39	85	142	205	238	257
		117	920	2,230	2,294	2,332	2,358
BURNET, BRAZOS (K)							
DROUGHT MANAGEMENT	DEMAND REDUCTION [BURNET]	1	1	1	1	2	2
MUNICIPAL CONSERVATION - BURNET	DEMAND REDUCTION [BURNET]	1	1	2	3	3	3
		2	2	3	4	5	5
BURNET, COLORADO (K)							
DROUGHT MANAGEMENT	DEMAND REDUCTION [BURNET]	301	328	338	361	395	425
LCRA - EXCESS FLOWS RESERVOIR	LCRA NEW OFF-CHANNEL RESERVOIR (2030 DECADE) [RESERVOIR]	0	1,000	2,000	2,000	2,000	2,000
MUNICIPAL CONSERVATION - BURNET	DEMAND REDUCTION [BURNET]	149	329	543	691	754	810
		450	1,657	2,881	3,052	3,149	3,235
CORIX UTILITIES TEXAS INC, COLORADO (K)							
DROUGHT MANAGEMENT	DEMAND REDUCTION [BURNET]	25	30	34	37	41	44
		25	30	34	37	41	44
COTTONWOOD SHORES, COLORADO (K)							
DROUGHT MANAGEMENT	DEMAND REDUCTION [BURNET]	45	53	61	68	75	80
MUNICIPAL CONSERVATION - COTTONWOOD SHORES	DEMAND REDUCTION [BURNET]	22	26	27	28	29	32
		67	79	88	96	104	112
COUNTY-OTHER, BURNET, BRAZOS (K)							
DROUGHT MANAGEMENT	DEMAND REDUCTION [BURNET]	246	273	273	300	325	348
LCRA - EXCESS FLOWS RESERVOIR	LCRA NEW OFF-CHANNEL RESERVOIR (2030 DECADE) [RESERVOIR]	0	500	1,000	1,000	1,000	1,000
MUNICIPAL CONSERVATION - BURNET COUNTY-OTHER	DEMAND REDUCTION [BURNET]	63	91	71	68	70	74

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		309	864	1,344	1,368	1,395	1,422
COUNTY-OTHER, BURNET, COLORADO (K)							
DROUGHT MANAGEMENT	DEMAND REDUCTION [BURNET]	437	486	486	534	579	620
LCRA - EXCESS FLOWS RESERVOIR	LCRA NEW OFF-CHANNEL RESERVOIR (2030 DECADE) [RESERVOIR]	0	2,641	4,397	4,397	4,397	4,397
MUNICIPAL CONSERVATION - BURNET COUNTY-OTHER	DEMAND REDUCTION [BURNET]	112	162	127	122	125	131
		549	3,289	5,010	5,053	5,101	5,148
GEORGETOWN, BRAZOS (K)							
DROUGHT MANAGEMENT	DEMAND REDUCTION [BURNET]	15	17	17	19	20	22
MUNICIPAL CONSERVATION - GEORGETOWN	DEMAND REDUCTION [BURNET]	8	17	28	35	39	41
		23	34	45	54	59	63
GRANITE SHOALS, COLORADO (K)							
DROUGHT MANAGEMENT	DEMAND REDUCTION [BURNET]	29	32	35	38	44	53
LCRA - MID BASIN RESERVOIR	LCRA NEW OFF-CHANNEL RESERVOIR (2030 DECADE) [RESERVOIR]	0	0	0	0	50	170
		29	32	35	38	94	223
HORSESHOE BAY, COLORADO (K)							
DIRECT REUSE - HORSESHOE BAY	DIRECT REUSE [LLANO]	0	154	154	154	154	154
DROUGHT MANAGEMENT	DEMAND REDUCTION [BURNET]	125	158	178	190	195	194
LCRA - MID BASIN RESERVOIR	LCRA NEW OFF-CHANNEL RESERVOIR (2030 DECADE) [RESERVOIR]	0	0	400	600	800	800
MUNICIPAL CONSERVATION - HORSESHOE BAY	DEMAND REDUCTION [BURNET]	49	134	241	368	505	645
		174	446	973	1,312	1,654	1,793
KEMPNER WSC, BRAZOS (K)							
DROUGHT MANAGEMENT	DEMAND REDUCTION [BURNET]	32	35	39	42	45	49
MUNICIPAL CONSERVATION - KEMPNER WSC	DEMAND REDUCTION [BURNET]	12	12	11	11	12	12
		44	47	50	53	57	61
KINGSLAND WSC, COLORADO (K)							
DROUGHT MANAGEMENT	DEMAND REDUCTION [BURNET]	2	3	3	3	4	4
		2	3	3	3	4	4
MARBLE FALLS, COLORADO (K)							
DIRECT REUSE - MARBLE FALLS	DIRECT REUSE [BURNET]	0	100	200	300	400	500
DROUGHT MANAGEMENT	DEMAND REDUCTION [BURNET]	428	567	738	772	759	776
LCRA - EXCESS FLOWS RESERVOIR	LCRA NEW OFF-CHANNEL RESERVOIR (2030 DECADE) [RESERVOIR]	0	4,000	4,000	4,000	4,000	4,000
MUNICIPAL CONSERVATION - MARBLE FALLS	DEMAND REDUCTION [BURNET]	212	567	1,193	1,801	2,387	2,566

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		640	5,234	6,131	6,873	7,546	7,842
MEADOWLAKES, COLORADO (K)							
DIRECT REUSE - MEADOWLAKES	DIRECT REUSE [BURNET]	75	75	75	75	75	75
DROUGHT MANAGEMENT	DEMAND REDUCTION [BURNET]	155	140	126	113	102	92
MUNICIPAL CONSERVATION - MEADOWLAKES	DEMAND REDUCTION [BURNET]	77	145	210	271	326	377
		307	360	411	459	503	544
MINING, BURNET, BRAZOS (K)							
DEVELOPMENT OF NEW GROUNDWATER SUPPLIES - ELLENBURGER-SAN SABA AQUIFER	ELLENBURGER-SAN SABA AQUIFER [BURNET]	0	0	0	300	400	700
		0	0	0	300	400	700
MINING, BURNET, COLORADO (K)							
DEVELOPMENT OF NEW GROUNDWATER SUPPLIES - HICKORY AQUIFER	HICKORY AQUIFER [BURNET]	0	1,000	1,000	1,000	1,000	1,000
DEVELOPMENT OF NEW GROUNDWATER SUPPLIES - MARBLE FALLS AQUIFER	MARBLE FALLS AQUIFER [BURNET]	0	0	1,000	1,000	1,000	1,000
EXPANSION OF CURRENT GROUNDWATER SUPPLIES - ELLENBURGER-SAN SABA AQUIFER	ELLENBURGER-SAN SABA AQUIFER [BURNET]	0	1,000	1,000	1,000	1,000	1,000
MINING CONSERVATION - BURNET COUNTY	DEMAND REDUCTION [BURNET]	1,300	1,300	1,300	1,300	1,300	1,800
		1,300	3,300	4,300	4,300	4,300	4,800
Sum of Projected Water Management Strategies (acre-feet)		4,038	16,297	23,538	25,296	26,744	28,354

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APPENDIX H- GAM RUN 21-005

**GAM RUN 21-005: CENTRAL TEXAS
GROUNDWATER CONSERVATION DISTRICT
MANAGEMENT PLAN**

Shirley Wade, Ph.D., P.G.
Texas Water Development Board
Groundwater Division
Groundwater Modeling Department
(512) 936-0883
October 8, 2021



Shirley C Wade
10/8/2021

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GAM RUN 21-005: CENTRAL TEXAS GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN

Shirley Wade, Ph.D., P.G.
Texas Water Development Board
Groundwater Division
Groundwater Modeling Department
(512) 936-0883
October 8, 2021

EXECUTIVE SUMMARY:

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

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

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

The groundwater management plan for the Central Texas Groundwater Conservation District should be adopted by the district on or before March 1, 2022 and submitted to the executive administrator of the TWDB on or before March 31, 2022. The current management plan for the Central Texas Groundwater Conservation District expires on May 30, 2022.

We used two groundwater availability models to estimate the management plan information for the aquifers within the Central Texas Groundwater Conservation District. Information for the Hickory, Ellenburger-San Saba, and Marble Falls aquifers is from version 1.01 of the groundwater availability model for the minor aquifers of the Llano Uplift area (Shi and others, 2016a and b). Information for the Trinity Aquifer is from version 2.01 of the groundwater availability model for the northern portion of the Trinity and Woodbine aquifers (Kelley and others, 2014). This report replaces the results of GAM Run 16-006 (Shi, 2016), as the approach used for analyzing model results has been since refined to more accurately delineate flows between hydraulically connected units and because of updates to the spatial grid file used to define county, groundwater conservation district, and aquifer boundaries. In addition, this analysis includes results from the final groundwater availability model for the minor aquifers of the Llano Uplift area, whereas only the draft model was available at the time of publication for GAM Run 16-006. Tables 1 through 4 summarize the groundwater availability model data required by statute. Figures 1, 3, 5, and 7 show the area of the models from which the values in the tables were extracted. Figures 2, 4, 6, and 8 provide generalized diagrams of the groundwater flow components provided in Tables 1 through 4. If, after review of the figures, the Central Texas Groundwater Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the TWDB at your earliest convenience.

METHODS:

In accordance with the provisions of the Texas State Water Code, Section 36.1071, Subsection (h), the groundwater availability models mentioned above were used to estimate information for the Central Texas Groundwater Conservation District management plan. Water budgets were extracted for the historical model period for the Hickory, Ellenburger-San Saba, and Marble Falls aquifers (1981-2010) using ZONEBUDGET USG Version 1.00 (Panday and others, 2013). Water budgets were extracted for the historical model period for the Trinity Aquifer (1980-2012) 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, and the flow between aquifers within the district are summarized in this report.

PARAMETERS AND ASSUMPTIONS:

Hickory, Ellenburger-San Saba, and Marble Falls aquifers

- We used version 1.01 of the groundwater availability model for the minor aquifers in the Llano Uplift Region to analyze the Hickory, Ellenburger-San Saba, and Marble Falls aquifers. See Shi and others (2016a and b) for assumptions and limitations of the model.
- The groundwater availability model for the minor aquifers in the Llano Uplift Region contains eight layers (from top to bottom):
 - Layer 1 — Cretaceous age and younger water-bearing units
 - Layer 2 — Permian and Pennsylvanian age confining units
 - Layer 3 — the Marble Falls Aquifer and equivalent
 - Layer 4 — Mississippian age confining units
 - Layer 5 — the Ellenburger-San Saba Aquifer and equivalent
 - Layer 6 — Cambrian age confining units
 - Layer 7 — the Hickory Aquifer and equivalent, and
 - Layer 8 — Precambrian age confining units
- Individual water budgets for the district were determined for the Marble Falls (Layer 3), Ellenburger-San Saba Aquifer (Layer 5) and the Hickory Aquifer (Layer 7).
- Water budget terms were averaged for the period 1981 to 2010 (stress periods 2 through 31)
- The model was run with MODFLOW-USG (Panday and others, 2013).

Trinity Aquifer

- We used version 2.01 of the groundwater availability model for the northern portion of the Trinity and Woodbine aquifers. See Kelley and others (2014) for assumptions and limitations of the model.
- The groundwater availability model for the northern portion of the Trinity and Woodbine aquifers contains eight layers that generally represent the following: Layer 1 (the surficial outcrop area of the units in layers 2 through 8 and units younger than Woodbine Aquifer), Layer 2 (Woodbine Aquifer), Layer 3 (Washita and Fredericksburg Groups, and the Edwards (Balcones Fault Zone) Aquifer), and Layers 4 through 8 (Trinity Aquifer). Layers 2 through 7 also include pass-through cells. The Woodbine and Edwards (Balcones Fault Zone) aquifers are not located within the Central Texas Groundwater Conservation District.
- Perennial rivers and reservoirs were simulated using the MODFLOW River package. Ephemeral streams, flowing wells, springs, and evapotranspiration in riparian zones along perennial rivers were simulated using the MODFLOW Drain package. Groundwater discharge to surface water bodies in the district was the sum of groundwater discharge from the MODFLOW river and drain packages minus the riparian zone evapotranspiration discharge and minus flowing well discharge.
- The model was run using MODFLOW-NWT (Niswonger and others, 2011).

RESULTS:

A groundwater budget summarizes the amount of water entering and leaving the aquifer according to the groundwater availability model. Selected groundwater budget components listed below were extracted from the groundwater availability model results for the Hickory, Ellenburger-San Saba, Marble Falls, and Trinity aquifers located within the Central Texas Groundwater Conservation District and averaged over the historical calibration periods, as shown in Tables 1 through 4.

1. Precipitation recharge—the areally distributed recharge sourced from precipitation falling on the outcrop areas of the aquifers (where the aquifer is exposed at land surface) within the district.
2. Surface-water outflow—the total water discharging from the aquifer (outflow) to surface-water features such as streams, reservoirs, and springs.

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

The information needed for the district’s management plan is summarized in Tables 1 through 4. It is important to note that sub-regional water budgets are not exact. This is due to the size of the model cells and the approach used to extract data from the model. To avoid double accounting, a model cell that straddles a political boundary, such as a district or county boundary, is assigned to one side of the boundary based on the location of the centroid of the model cell. For example, if a cell contains two counties, the cell is assigned to the county where the centroid of the cell is located.

TABLE 1: SUMMARIZED INFORMATION FOR THE HICKORY AQUIFER THAT IS NEEDED FOR THE CENTRAL TEXAS GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Hickory Aquifer	332
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Hickory Aquifer	3,301
Estimated annual volume of flow into the district within each aquifer in the district	Hickory Aquifer	7,873
Estimated annual volume of flow out of the district within each aquifer in the district	Hickory Aquifer	6,337
Estimated net annual volume of flow between each aquifer in the district	From the Hickory Aquifer to equivalent units outside the official Hickory Aquifer extent	2,882
	From the Hickory Aquifer to the Cretaceous units (including the Trinity Aquifer)	1
	From the Hickory Aquifer to the Ellenburger-San Saba Aquifer	7,631
	Into the Hickory Aquifer from the Cambrian age confining unit	20,382
	From the Hickory Aquifer to the Precambrian age confining unit	5,061

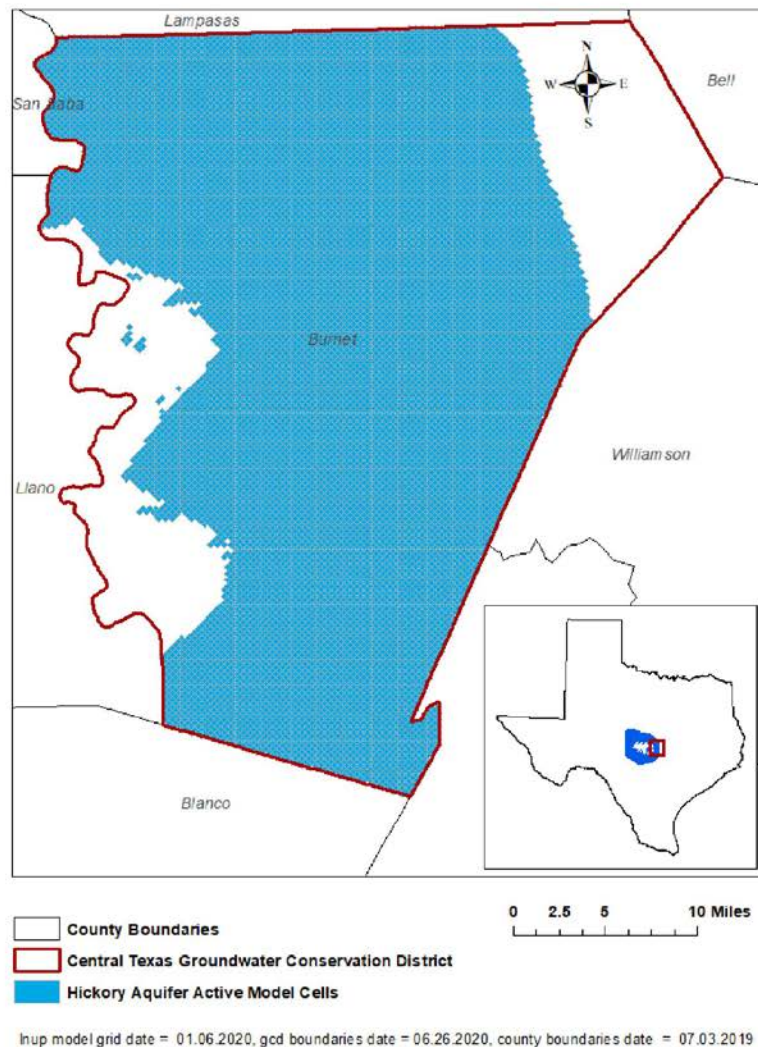
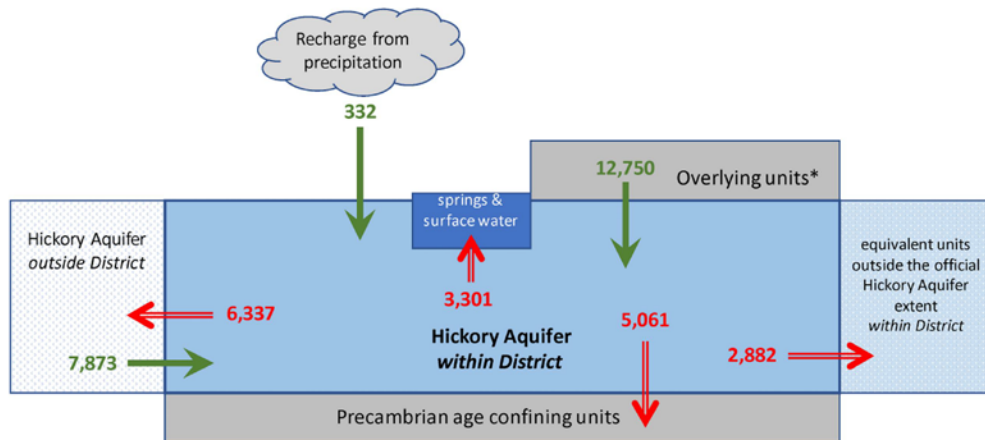


FIGURE 1: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE MINOR AQUIFERS IN THE LLANO UPLIFT REGION FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED (THE HICKORY AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).



* Flow from overlying units includes net outflow of 1 acre-feet per year to Cretaceous age units, 7,631 acre-feet per year net outflow to the Ellenburger-San Saba Aquifer and 20,382 acre-feet per year net inflow from the Cambrian age confining units.

Caveat: This diagram only includes the water budget items provided in Table 1. A complete water budget would include additional inflows and outflows. If the District requires values for additional water budget items, please contact TWDB.

FIGURE 2: GENERALIZED DIAGRAM OF THE SUMMARIZED BUDGET INFORMATION FROM TABLE 1, REPRESENTING DIRECTIONS OF FLOW FOR THE HICKORY AQUIFER WITHIN CENTRAL TEXAS GROUNDWATER CONSERVATION DISTRICT. FLOW VALUES EXPRESSED IN ACRE-FEET PER YEAR.

TABLE 2: SUMMARIZED INFORMATION FOR THE ELLENBURGER-SAN SABA AQUIFER THAT IS NEEDED FOR THE CENTRAL TEXAS GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Ellenburger-San Saba Aquifer	68,867
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Ellenburger-San Saba Aquifer	68,060
Estimated annual volume of flow into the district within each aquifer in the district	Ellenburger-San Saba Aquifer	19,920
Estimated annual volume of flow out of the district within each aquifer in the district	Ellenburger-San Saba Aquifer	8,250
Estimated net annual volume of flow between each aquifer in the district	From the Ellenburger-San Saba Aquifer to equivalent units outside the official Ellenburger-San Saba Aquifer extent	6,673
	Into the Ellenburger-San Saba Aquifer from Cretaceous units (including Trinity Aquifer)	265
	From the Ellenburger-San Saba Aquifer to the Marble Falls Aquifer	1,165
	From the Ellenburger-San Saba Aquifer to the Mississippian age confining unit	9,601
	From the Ellenburger-San Saba Aquifer to Cambrian age confining units	27,146
	Into the Ellenburger-San Saba Aquifer from the Hickory Aquifer	7,631
	Into the Ellenburger-San Saba Aquifer from the Precambrian age confining unit	670

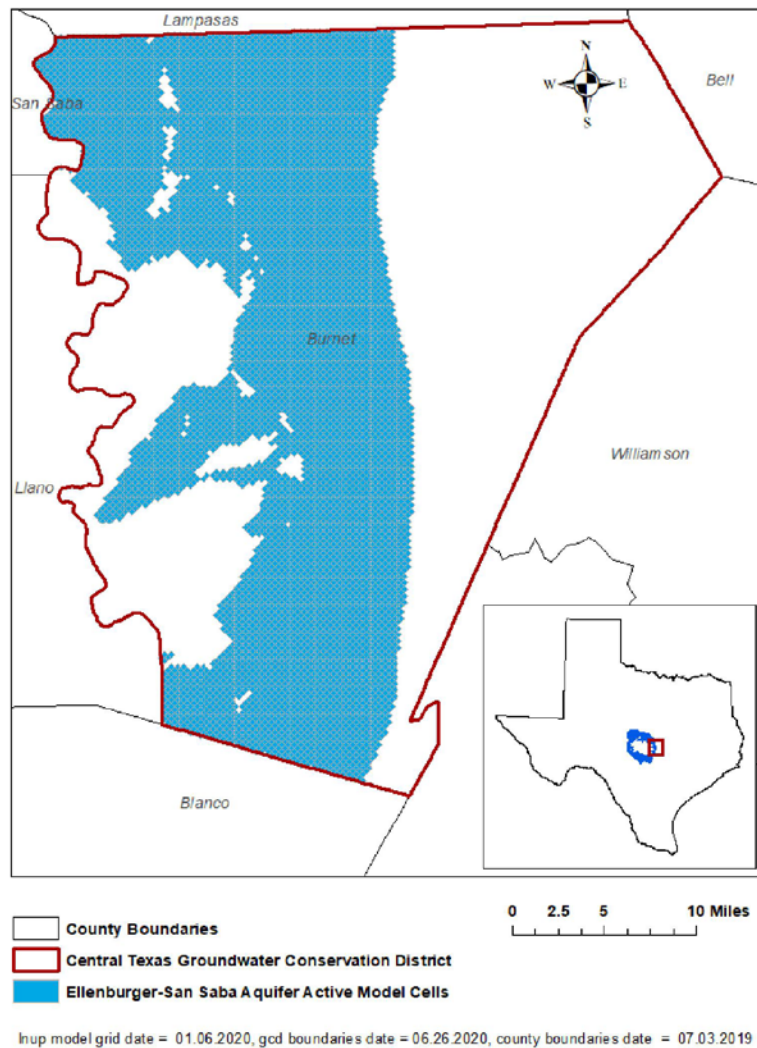
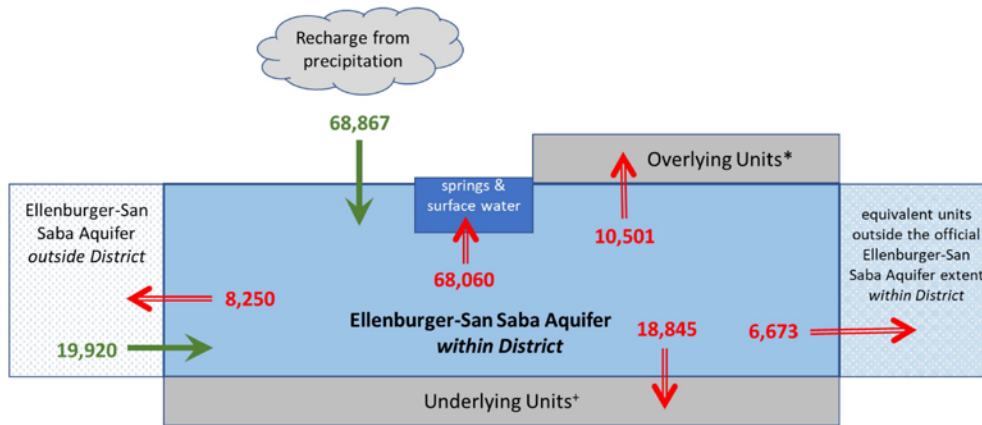


FIGURE 3: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE MINOR AQUIFERS IN THE LLANO UPLIFT REGION FROM WHICH THE INFORMATION IN TABLE 2 WAS EXTRACTED (THE ELLENBURGER-SAN SABA AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).



+ Flow into underlying units includes net outflow of 27,146 acre-feet per year to Cambrian age confining units, 7,631 acre-feet per year net inflow from the Hickory Aquifer, and 670 acre-feet per year net inflow from the Precambrian age confining units.

* Flow into overlying units includes net inflow of 265 acre-feet per year from Cretaceous age unit, 1,165 acre-feet per year net outflow to the Marble Falls Aquifer, and 9,601 acre-feet per year net outflow to the Mississippian age confining

Caveat: This diagram only includes the water budget items provided in Table 2. A complete water budget would include additional inflows and outflows. If the District requires values for additional water budget items, please contact TWDB.

FIGURE 4: GENERALIZED DIAGRAM OF THE SUMMARIZED BUDGET INFORMATION FROM TABLE 2, REPRESENTING DIRECTIONS OF FLOW FOR THE ELLENBURGER-SAN SABA AQUIFER WITHIN CENTRAL TEXAS GROUNDWATER CONSERVATION DISTRICT. FLOW VALUES EXPRESSED IN ACRE-FEET PER YEAR.

TABLE 3: SUMMARIZED INFORMATION FOR THE MARBLE FALLS AQUIFER THAT IS NEEDED FOR THE CENTRAL TEXAS GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Marble Falls Aquifer	2,181
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Marble Falls Aquifer	10,772
Estimated annual volume of flow into the district within each aquifer in the district	Marble Falls Aquifer	10
Estimated annual volume of flow out of the district within each aquifer in the district	Marble Falls Aquifer	60
Estimated net annual volume of flow between each aquifer in the district	Into the Marble Falls Aquifer from equivalent units outside the official Marble Falls Aquifer extent	2,153
	Into the Marble Falls Aquifer from the Cretaceous units (including Trinity Aquifer)	16
	From the Marbles Falls Aquifer to the Pennsylvanian and Permian age confining units	284
	From the Marble Falls Aquifer to the Mississippian Age confining units	1,941
	Into the Marble Falls Aquifer from the Ellenburger-San Saba Aquifer	1,165

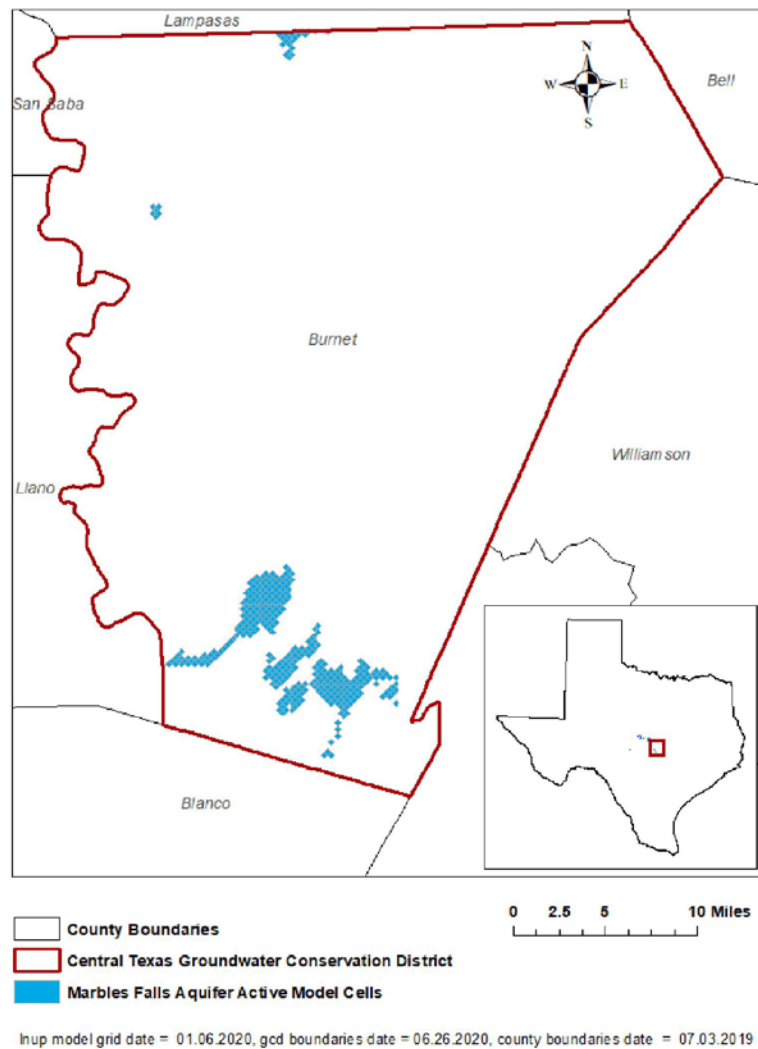
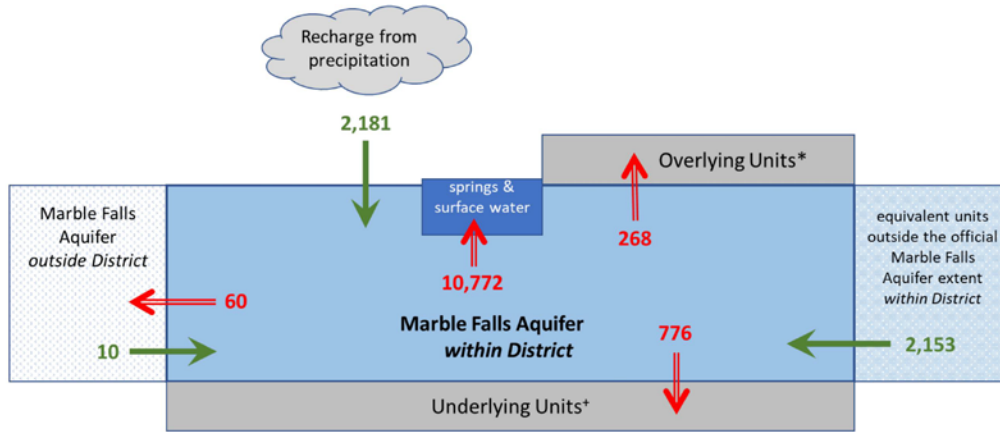


FIGURE 5: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE MINOR AQUIFERS IN THE LLANO UPLIFT REGION FROM WHICH THE INFORMATION IN TABLE 3 WAS EXTRACTED (THE MARBLE FALLS AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).



+ Flow into underlying units includes net outflow of 1,941 acre-feet per year to Mississippian age confining units and 1,165 acre-feet per year net inflow from Ellenburger-San Saba Aquifer.
 * Flow into overlying units includes net inflow of 16 acre-feet per year from Cretaceous units and 284 acre-feet per year net outflow to Pennsylvanian and Permian age confining units.

Caveat: This diagram only includes the water budget items provided in Table 3. A complete water budget would include additional inflows and outflows. If the District requires values for additional water budget items, please contact TWDB.

FIGURE 6: GENERALIZED DIAGRAM OF THE SUMMARIZED BUDGET INFORMATION FROM TABLE 3, REPRESENTING DIRECTIONS OF FLOW FOR THE MARBLE FALLS AQUIFER WITHIN CENTRAL TEXAS GROUNDWATER CONSERVATION DISTRICT. FLOW VALUES EXPRESSED IN ACRE-FEET PER YEAR.

TABLE 4: SUMMARIZED INFORMATION FOR THE TRINITY AQUIFER THAT IS NEEDED FOR THE CENTRAL TEXAS GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Trinity Aquifer	13,831
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers.	Trinity Aquifer	13,729
Estimated annual volume of flow into the district within each aquifer in the district	Trinity Aquifer	2,947
Estimated annual volume of flow out of the district within each aquifer in the district	Trinity Aquifer	12,339
Estimated net annual volume of flow between each aquifer in the district	Into the Trinity Aquifer from younger overlying Washita and Fredericksburg Confining Units	8,034
	From the Trinity Aquifer into underlying Paleozoic Aquifers ¹	263
	From the Trinity Aquifer to underlying Pennsylvanian and Permian age confining units ¹	20,443

¹ Flow from the Trinity Aquifer to underlying units is based on the Groundwater Availability Model for the Minor Aquifers of the Llano Uplift Region of Texas.

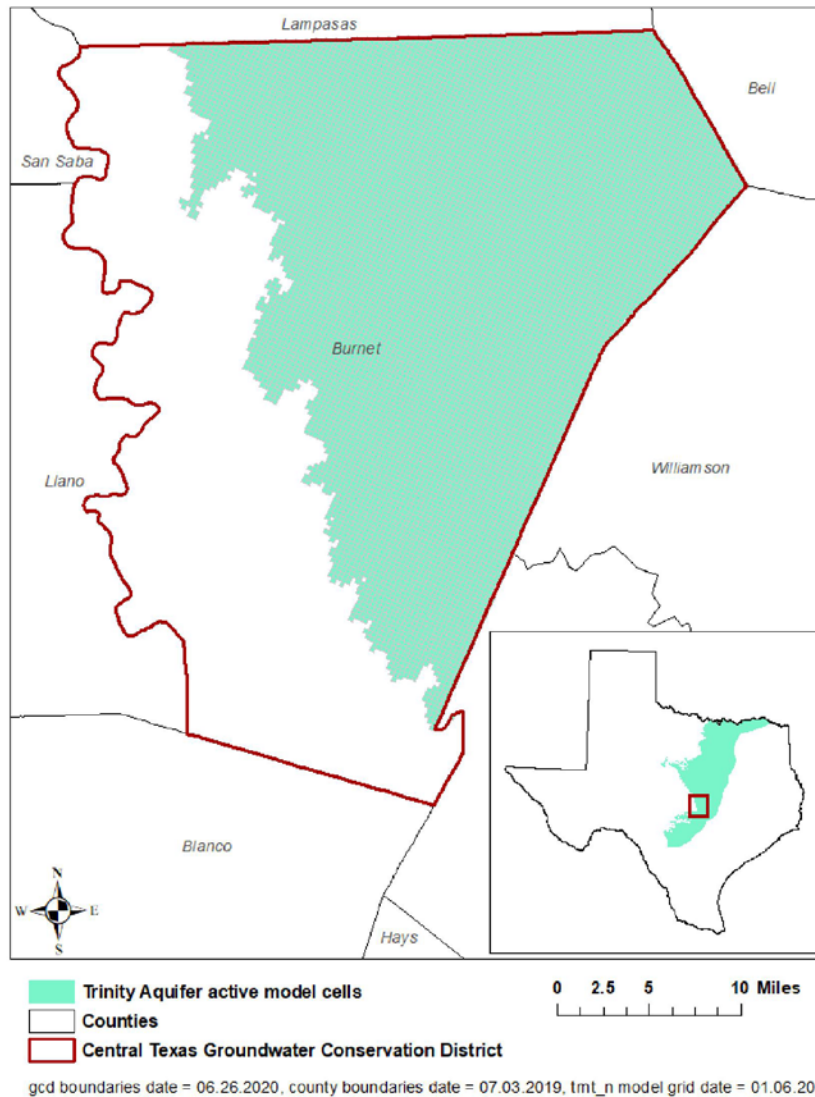
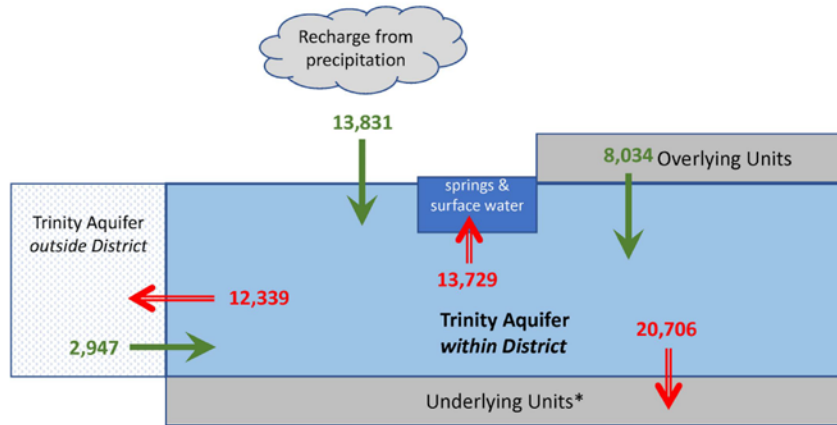


FIGURE 7: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE NORTHERN PORTION OF THE TRINITY AND WOODBINE AQUIFERS FROM WHICH THE INFORMATION IN TABLE 4 WAS EXTRACTED (THE TRINITY AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).



* Flow from the Trinity Aquifer to underlying units based on the Groundwater Availability Model for the Minor Aquifers of the Llano Uplift Region of Texas. This term includes 263 acre-feet per year net outflow from the Trinity Aquifer into the underlying Paleozoic Aquifers and 20,443 acre-feet per year net outflow from the Trinity Aquifer to Pennsylvanian and Permian age confining units.

Caveat: This diagram only includes the water budget items provided in Table 4. A complete water budget would include additional inflows and outflows. If the District requires values for additional water budget items, please contact TWDB.

FIGURE 8: GENERALIZED DIAGRAM OF THE SUMMARIZED BUDGET INFORMATION FROM TABLE 4, REPRESENTING DIRECTIONS OF FLOW FOR THE TRINITY AQUIFER WITHIN CENTRAL TEXAS GROUNDWATER CONSERVATION DISTRICT. FLOW VALUES EXPRESSED IN ACRE-FEET PER YEAR.

LIMITATIONS:

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

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

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

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

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

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