TRINITY GLEN ROSE GROUNDWATER CONSERVATION DISTRICT

GROUNDWATER MANAGEMENT PLAN

ADOPTED JUNE 15, 2023

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GROUNDWATER MANAGEMENT PLAN

BOARD OF DIRECTORS

Member	District	Position
Joe duMenil……………….	District 2	...........................President
Stuart Birnbaum…………..	District 1	...................Vice President
Katrina Waring Castillo..	District 5	............................Member
Joe Silman…...................	District 4	…........................Treasurer
Harris Dickey…................	District 3	..Asst. Secretary/Treasurer

DISTRICT STAFF

George Wissmann…......................................General Manager
Amanda Maloukis….........................Assistant General Manager
Emily Green…......................Administrative Program Manager

REVISION RECORD

Date Adopted	Effective Date	Version/Resolution
October 14, 2004	October 14, 2004	Original Adoption, Board Resolution
October 14, 2010	October 14, 2010	Revision/Re-Adoption
November 12, 2015	November 12, 2015	Revision/Re-Adoption
December 10, 2020	December 10, 2020	Revision/Re-Adoption
June 15, 2023	June 15, 2023	Amended/Re-Adoption

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I. DISTRICT MISSION

The mission of the Trinity Glen Rose Groundwater Conservation District (District) is to conserve and protect the Trinity Group of Aquifers within the District using sound science, best management practices, community involvement and peer partnerships to preserve the resource for future generations.

II. PURPOSE OF MANAGEMENT PLAN & TIME PERIOD FOR THIS 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 water resource planning process and the actions necessary for the groundwater conservation districts (GCDs) to manage and conserve the groundwater resources of the State of Texas. These bills required all GCDs to develop a management plan defining the groundwater needs and groundwater supplies within each district and the goals each district has set to achieve its mission. Additionally, the 79th Texas Legislature enacted House Bill 1763 (HB 1763) in 2005 that requires joint planning among GCDs that are in the same groundwater management area (GMA).

This groundwater management plan fulfills the requirements of the Texas Water Development Board (TWDB) rules, specifically Texas Administrative Code, Chapter 356 (31 TAC §356). The plan includes the required planning elements, goals, objectives, performance standards, and tracking methods required by the TWDB.

This plan becomes effective upon adoption by the District Board of Directors and subsequent approval by the TWDB. This plan incorporates a planning period of 50 years. After five years, the plan will be reviewed for consistency with the applicable regional water plans, the State Water Plan, and Groundwater Management Area 9's (GMA 9's) desired future conditions (DFCs) and shall be readopted with or without amendments. The plan may be revised at any time in order to maintain such consistency or as necessary to address any new or revised data, groundwater availability models (GAMs), DFCs in GMA 9, or District management strategies.

A. STATEMENT OF GUIDING PRINCIPLES

The District was created in order that appropriate groundwater management techniques and strategies could be implemented at the local level to address groundwater issues or problems within the District. The District will continue to incorporate the best and most current available science and site-specific data available in the development of this plan to ensure the sustainability of the aquifers and achievement of the DFCs. This plan serves as a guideline for the District to ensure greater understanding of local aquifer conditions, development of groundwater management concepts and strategies, and subsequent implementation of appropriate groundwater management policies.

B. COMMITMENT TO IMPLEMENT GROUNDWATER MANAGEMENT PLAN

To address potential groundwater quantity and quality issues, the District is committed to, and will actively pursue, the groundwater management strategies identified in this management plan. These management strategies will be implemented in conjunction with District Rules, policies, and activities in order to effectively manage and regulate the drilling of wells, production of groundwater within the District, protection of recharge features, pollution and waste prevention, and the possible transfer of water out of the District. This includes the evaluation of the impact(s) of conjunctive use of surface and groundwater. The term "conjunctive use" is the combined use of groundwater and surface water sources that optimizes the beneficial characteristics of each source (Texas Water Code §36.001).

Additionally, the District will encourage conservation practices and efficient use of water resources, encourage compliance with the District Drought Contingency Plan, and provide for the identification of any critical groundwater depletion areas within the District.

To the greatest extent practicable, the District will cooperate with and coordinate its management plan and regulatory policies with adjacent GCDs, GMA 9, regional water planning groups, local water purveyors and stakeholders, and adjacent counties with similar aquifers and/or groundwater usage.

An electronic copy of the management plan is available online at www.trinityglenrose.com. A paper copy may be requested at the District office, located at 14789 Old Bandera Rd. #105, Helotes, TX 78023.

III. District Information

A. District Creation and Background

The District was created in 2001 during the 77th Texas Legislature and confirmed by voters in 2002. The District was created in response to the Texas Natural Resources Conservation Commission designating a portion of the Trinity Aquifer within Bexar County as a priority groundwater management area (PGMA). The District was created for the purpose of conserving, preserving, recharging, protecting and preventing waste of groundwater from the Trinity Aquifer in northern Bexar County and parts of Kendall and Comal counties.

The Texas Hill Country Area, which includes the District, was declared a PGMA by the then Texas Water Commission in 1990. This declaration, now known as the Hill Country PGMA, gave notice to the residents of the area that water availability and quality would be at risk within the next 25 years.

B. Authority

Beyond its enabling legislation, the District is governed primarily by the provisions of Chapter 36 of the Texas Water Code. The District has the capability and authority to undertake various studies and promote conservation; to adopt and amend, as needed, a management plan and rules; to establish a program for the registration and permitting of groundwater wells; and to implement structural facilities and non-structural programs to achieve its statutory mandates.

The District has rule-making authority to implement its policies and procedures of the groundwater resources. The District is charged with developing and implementing regulatory programs for the Trinity Group of Aquifers within District boundaries. With continued growth in northern Bexar County, the District is challenged with balancing the needs of families and businesses with the need to maintain the groundwater resources in this area.

To effectively meet these needs, the District's mission and activities include conducting research, regulating water well drilling and production from permitted, non-exempt wells, collecting and analyzing well water and aquifer data, issuing permits for well drilling, modification, and plugging, promote the capping or plugging of abandoned wells, developing education and conservation programming, providing information and educational material to local property owners, interacting with other governmental or organizational entities, working with stakeholders to ensure a comprehensive management strategy, and undertaking other groundwater-related activities that may help meet the purposes of the District.

The District's enabling legislation creates limitations in preserving and protecting groundwater resources as addressed in Chapter 36 of the Texas Water Code. According to language within the enabling legislation the District must recognize all public water supply wells drilled and completed prior to September 1, 2002 as exempt from District regulation.

C. DIRECTORS

The District is comprised of a five-member Board of Directors elected to serve four-year rotating terms. Director boundaries are re-drawn with each 10-year census based on population. Elections are held during the May General Election in even-numbered years.

D. DISTRICT LOCATION & EXTENT

The District is located in northern Bexar County and extends into portions of Kendall and Comal counties, encompassing approximately 311 square miles (199, 574 acres). The District's boundary overlies the Trinity Group of Aquifers with its jurisdiction limited to this groundwater resource.

In 2001, the Texas Legislature passed House Bill (HB) 2005 creating the District, in part due to a response to the State of Texas, Texas Commission on Environmental Quality (TCEQ) designating the portion of the Trinity Group of Aquifers underlying Bexar County as a PGMA. HB2005 outlined the District's creation, authority, structure, and funding.

In 2004, the City of Fair Oaks Ranch held an election and voted to become a part of the District, expanding the District to include those portions of Kendall and Comal counties within the boundaries of the City of Fair Oaks Ranch.

In 2009, the Texas Legislature passed HB1518 allowing an increase of production fees and allowing municipalities to request inclusion of annexed areas into the District as provided by Chapter 36 Texas Water Code, thereby expanding the District boundaries. The District operates under the authority of these house bills, as well as the authority and duties set forth in Chapter 36 of the Texas Water Code.

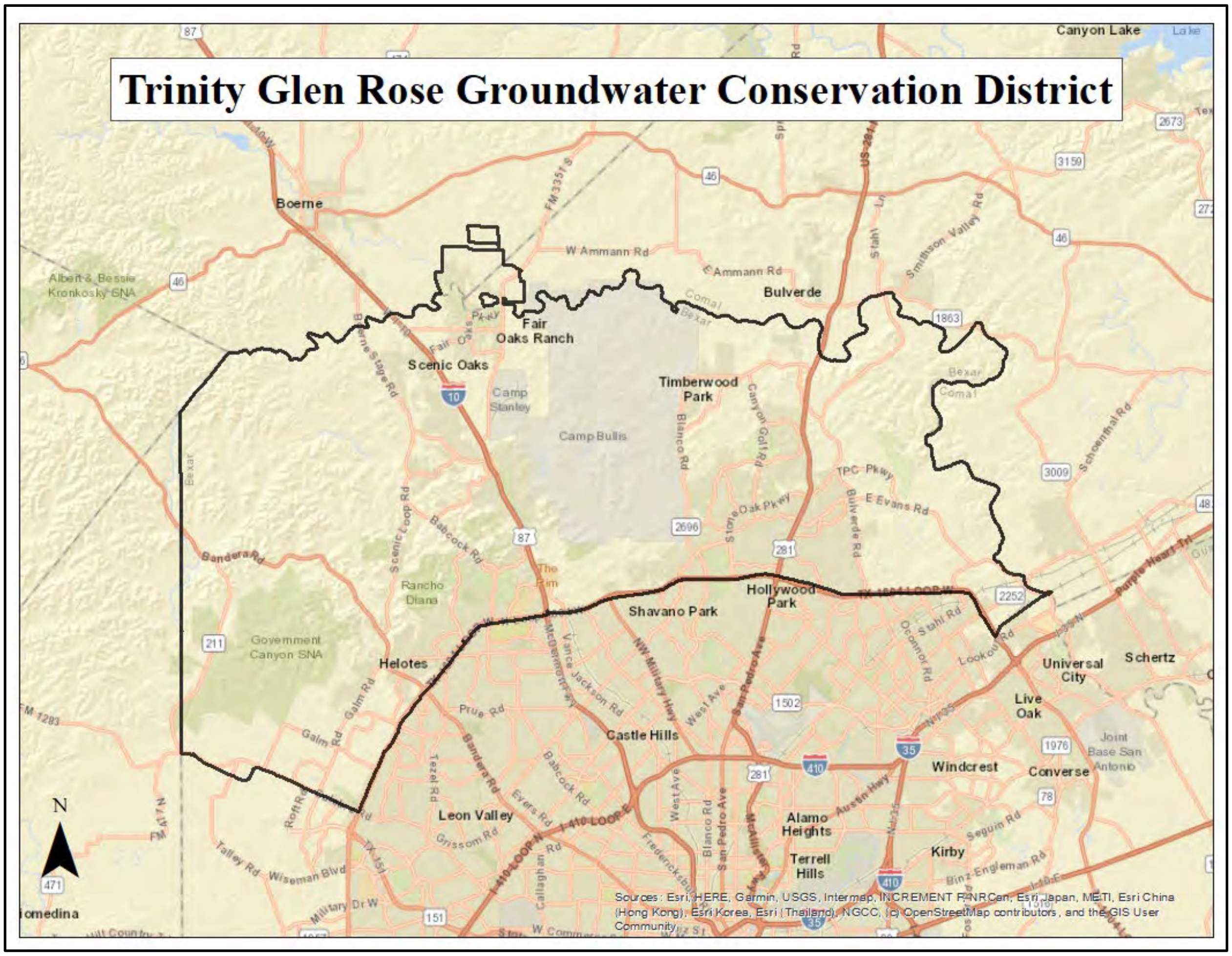

Figure 1. District Boundary & Jurisdiction

E. WATER RESOURCES

i. TOPOGRAPHY AND DRAINAGE

The District lies within the San Antonio River basin. The Cibolo Creek, Leon Creek, Salado Creek, and the Upper San Antonio River watersheds provide for surface drainage generally from the northwest to the southeast within the District. Cibolo Creek is a tributary of the San Antonio River and drains from northwest to southeast across the Trinity Group of Aquifers forming a large portion of the boundary between northern Bexar County and adjacent counties to the north. Cibolo Creek is a major recharge feature of the Trinity Group of Aquifers in northern Bexar County and eventually confluences with the San Antonio River.

The major geologic feature located within the District's boundaries is the Edwards Plateau. This broad, topographically high area is composed of Cretaceous Period limestone, dolomite and marl. Deep erosion and downcutting by streams and rivers in the area have resulted in the Edwards Plateau being perceptibly higher than adjacent areas. The plateau is the southernmost extension of the Great Plains, extending westward from the Colorado River to the Pecos, and covers many Central and West Texas counties. It is bordered on the northeast by the pre-Cambrian rocks of the Llano Uplift. Northern Bexar County lies near the southeastern edge of the Plateau.

Elevation within the District ranges from a low of approximately 730 feet above sea level where the Cibolo Creek leaves northern Bexar County to the southeast to approximately 1,892 feet above sea level at Mount Smith in the northwestern portion of the District.

ii. Groundwater Resources: Trinity Group of Aquifers

Within the District, the Trinity Group of Aquifers consists of the Upper Glen Rose Limestone, Lower Glen Rose Limestone, Cow Creek Limestone, Sligo Limestone and Hosston Sand.

In isolated areas, the Edwards (Balcones Fault Zone) Aquifer overlies portions of the Trinity Group of Aquifers and is utilized; however, these users do not fall within the District's jurisdiction. Trinity Aquifer water well depths vary from shallow, hand-dug wells to drilled wells ranging from 100 feet deep to over 1,600 feet deep based on TWDB records for Bexar County. Depths are highly variable and depend entirely on site-specific topography and geology, especially faulting.

Water quality and water quantity also vary greatly throughout the District. Water quality within a specific aquifer can be defined or characterized in a general sense, but can still be affected by local geology, hydrology and structure.

Recharge for the Trinity Group of Aquifers occurs via local precipitation on its outcrop; flows through Cibolo Creek, and through the overlying units where it is in the subsurface. Yields vary greatly and are highly dependent on local subsurface physical characteristics. Yields are generally low, less than 20 gallons per minute (gpm), but may occasionally be significantly higher, with yields of 600-800 gpm being reported in site-specific areas. Production from Trinity Aquifer wells is primarily used for municipal, rural domestic, irrigation, and mining demands.

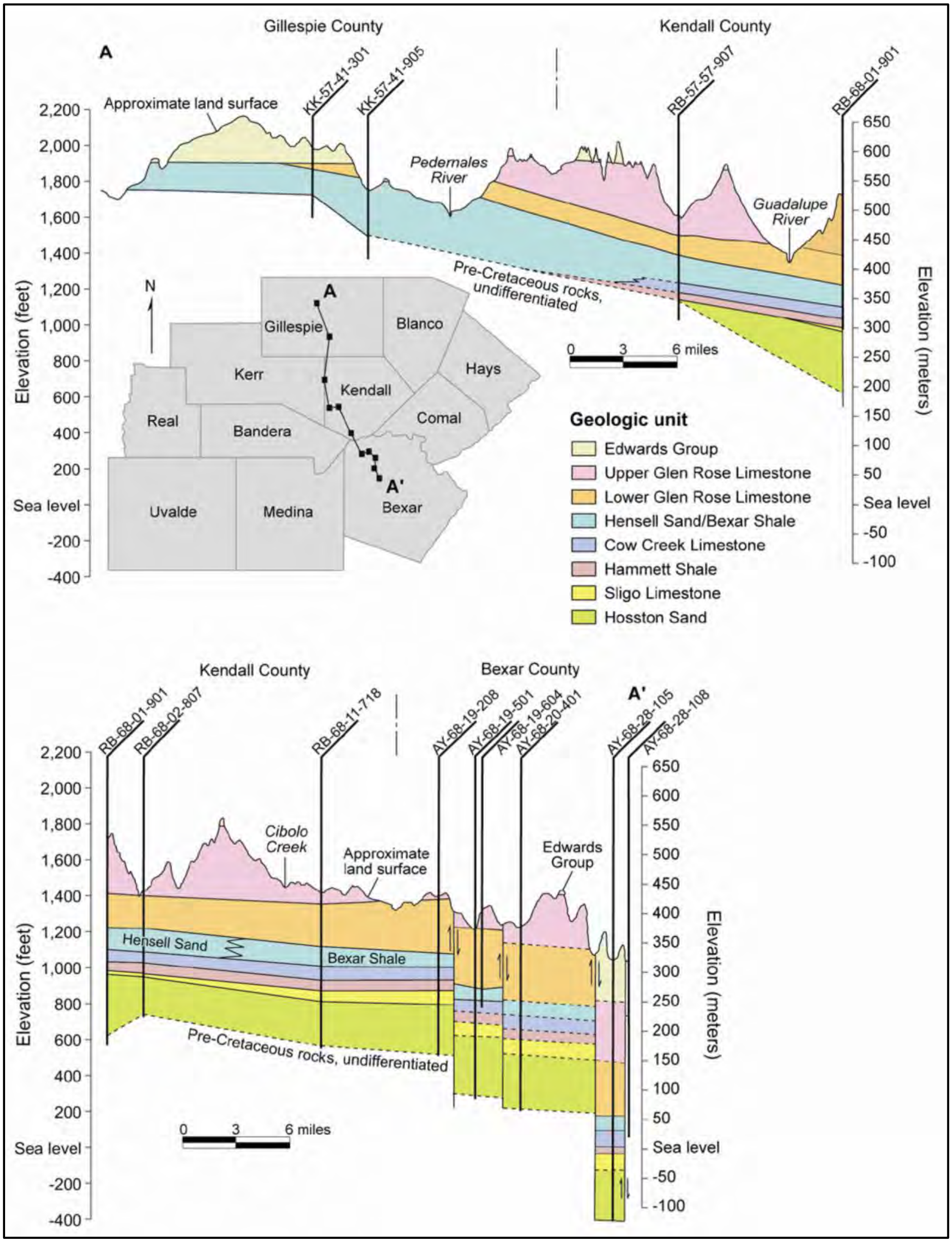

Figure 2: Groundwater Availability Model: Hill Country Portion of the Trinity Aquifer of Texas

IV. ESTIMATES OF TECHNICAL INFORMATION REQUIRED BY THE TEXAS WATER CODE SECTION 36.1071 AND 31 TAC 356.52

A. MODELED AVAILABLE GROUNDWATER

The 79th Texas Legislature enacted HB 1763 in 2005 that required joint planning among GCDs that are in the same GMA. These GCDs must jointly agree upon and establish the DFC of the aquifers within their respective GMAs. Through this process, the GCDs will submit the DFC to the Executive Administrator of the TWDB who, in turn, will provide each district within the GMA the amount of modeled available groundwater (MAG) within each district. The MAG will be based on the DFCs jointly established for each aquifer within the GMA.

According to the Texas Water Code Section 36.001, MAG is defined as “the amount of water that the Executive Administrator (of the TWDB) determines may be produced on an average annual basis to achieve a DFC established under §36.108.” The DFC is defined in §36.001 of the Texas Water Code as “a quantitative description, adopted in accordance with §36.108 of the Texas Water Code, of the desired condition of the groundwater resources in a management area at one or more specified future times.”

GMA 9 has adopted DFCs for the aquifers located within the planning area. Current groundwater availability for the District has been estimated by the TWDB using GAM Run 21-014 MAG, located in Appendix C. The total MAG for the Trinity Aquifer within the District is 25,511 acre-feet per year (2010-2060). The DFCs for the aquifers located within the District boundaries and within GMA 9 have been established by Resolution #111521-01, located in Appendix A.

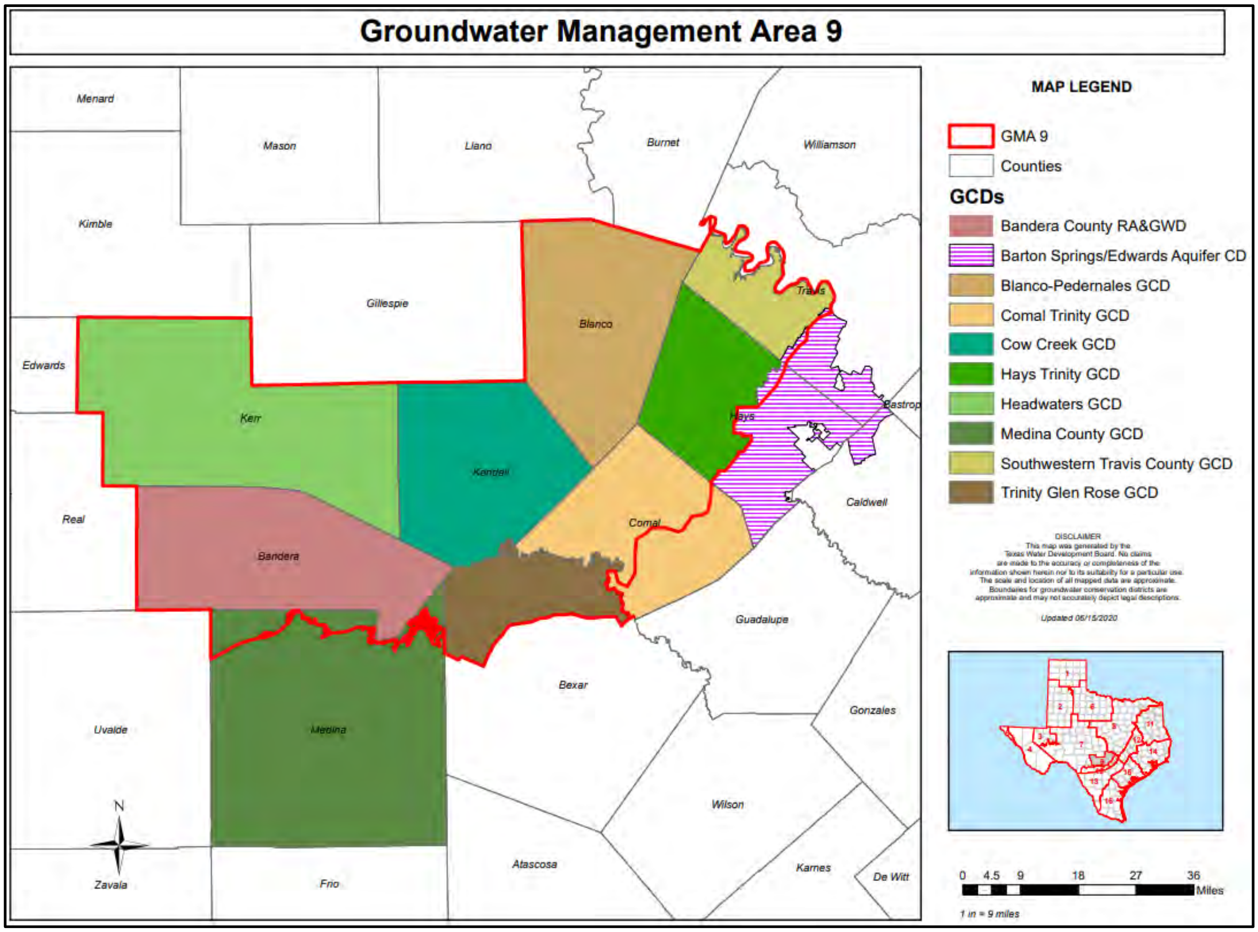

Figure 3: Map of Groundwater Management Area 9

B. Annual Groundwater Use

To estimate the annual amount of groundwater being used in District, the District uses the TWDB Annual Water Use Survey Data located within the TWDB's "Estimated Historical Groundwater Use and 2017 State Water Plan Datasets", in Appendix B and develops its own estimates using District-reported actual and estimated usage. The TWDB Water Use Survey Data is subject to variations in the completeness or accuracy of the data due to inconsistent reporting by some water user groups (WUGs). TWDB data on estimated groundwater use is available from 2002 to 2017.

Table 1 displays the amount of groundwater being used within the District on an annual basis from 2009-2019, pursuant to the District's required groundwater production reports. Figure 4 displays the amount of groundwater production by user group within the District for the year 2019.

It is important to note that the water available from other sources will fluctuate depending on demand and the service plans managed by major water utilities operating within the District.

User Group	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Municipal PWS	6,245	7,010	7,969	8,096	6,584	5,878	11,799	19,127	14,569	10,212	18,356
Irrigation	2,069	1,874	2,533	1,745	1,969	1,374	1,917	1,878	2,255	1,991	2,091
Quarries	1,230	1,458	1,155	1,032	1,480	822	864	972	956	1,162	796
Agriculture	100	100	100	100	100	100	100	100	100	100	100
Exempt *(estimated)*	1,500	1,500	1,500	1,500	1,714	1,615	1,634	1,767	1,690	1,715	1,764
Total	**11,144**	**11,942**	**13,257**	**12,473**	**11,847**	**9,849**	**16,375**	**23,888**	**19,595**	**15,180**	**23,106**

Table 1: District Historical Groundwater Usage as documented by the District's pumpage reports and estimated exempt use. Units are in acre-feet per year.

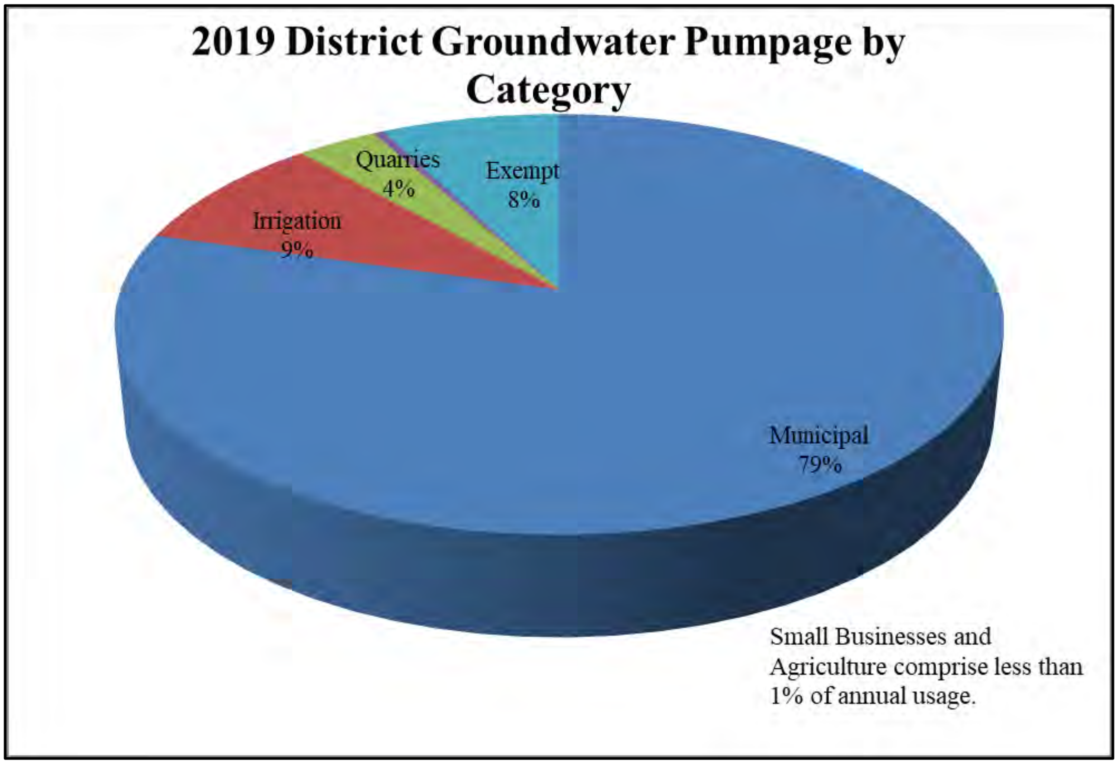

Figure 4: District Groundwater Production by Category, 2019 as documented by the District's pumpage reports and estimated exempt use.

C. Groundwater Budget

As previously discussed, the annual natural recharge occurring in Bexar County is thought to be through percolation of rainfall countywide and more localized recharge, along with potentially higher rates of recharge, occurring in the bed of Cibolo Creek and its tributaries. The District is currently unaware of any significant recharge feature in northern Bexar County that may be providing a major avenue for recharge other than unnamed sinkholes within Cibolo Creek and some cave/sinkhole structures within the District.

The Cibolo Creek Study prepared by the Army Corp of Engineers in 2005 helps define recharge through the Cibolo Creek area. Additionally, a calculated annual recharge coefficient of approximately 4% of annual rainfall was developed by Mace and others. (2000). It seems reasonable for the District to assume a 4% average for northern Bexar County Trinity Group of

Aquifers recharge—Mace, and others. has done this for the Trinity Group of Aquifers as a whole. Ashworth (1983) also developed a similar annual effective recharge coefficient—also 4% of average annual rainfall of about 29.5 inches—for the Trinity Group of Aquifers.

These recharge potentials are not to be confused with "recoverable" groundwater. Not all groundwater is recoverable. Some is lost to spring flow and seeps, some is used by plant life while the water is still near the surface, while some is almost permanently retained within the rock itself. However, water retained within the rock itself is a one-time recharge and should not affect available water from further recharge events.

For instance, some areas of the Trinity Group of Aquifers may be characterized as a rather "tight" formation, particularly in the vertical direction. The Trinity Group of Aquifers in some areas is known to have low porosity and permeability, limited fracturing and faulting, and a complicated stratigraphy that includes layers of rock that reduce transmissivity and retard downward-moving recharge water. In other areas, dissolution of the limestone, cave/sinkhole formation, faulting, fracturing, higher porosity and permeability increase water movement and transmissivities as well as vertical movement. As a result, individual well yields range from very low to very high. Though large quantities of water may be present in the subsurface, much of the groundwater may be unrecoverable in some areas due to these hydrogeologic conditions while in other areas a large portion of the water is recoverable.

As previously mentioned, some water recharging the Trinity Group of Aquifers will be lost, some through biologic uptake and some through discharge at springs and seeps that provide some base flow to local creeks and tributaries. This is water the aquifer rejects on an average annual basis, is potentially available, and can theoretically be retrieved (at least on a short-term basis) without diminishing the average volume of groundwater being recharged to storage or, in other words, without creating a water-losing situation within the aquifer. Extensive pumping will also reduce the pressure head and may result in a significantly larger quantity of recharge water actually percolating downward into the aquifer providing recharge that would not be normally available thus providing more reliable, long-term well production. Once pumping exceeds average annual recharge, then the aquifer(s) will be providing water from storage (thought to be a relatively large amount) and the groundwater level will decline over time.

i. ANNUAL AMOUNT OF GROUNDWATER RECHARGE FROM PRECIPITATION, WATER THAT DISCHARGES FROM THE AQUIFER, AND THE VOLUME OF FLOW INTO & OUT OF DISTRICT, AND BETWEEN AQUIFERS

The estimate of the annual amount of recharge from precipitation to the aquifers within the District is based on GAM Run 19-025 based on water-budget analyses conducted by the TWDB. These GAM runs and aquifer assessments from the TWDB are included in Appendix D. The amount of recharge from precipitation and aquifer flow values for the District are displayed in Table 2.

Management Plan Requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Trinity Aquifer	44,992
Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, and rivers	Trinity Aquifer	10,347
Estimated annual volume of flow into the district within each aquifer in the district	Trinity Aquifer	36,079
Estimated annual volume of flow out of the district within each aquifer in the district	Trinity Aquifer	26,417
Estimated net annual volume of flow between each aquifer in the district	From the Trinity Aquifer to the Edwards (Balcones Fault Zone) Aquifer	39,006

Table 2: Aquifer flow values for the District as documented in the TWDB GAM Run 19-025. See Appendix D for complete report. Units are in acre-feet per year.

D. PROJECTED SURFACE WATER SUPPLY IN THE DISTRICT

The most recently adopted State Water Plan is the 2017 State Water Plan. This Plan incorporated the 2016 Region L Water Plan, which provided projected surface water supplies in the District, including Bexar, Comal, and Kendall counties. The Projected Surface Water Supply Survey Data from the TWDB is included in Appendix B.

Canyon Lake is the only major surface water supplier within the District. Fair Oaks Ranch has up to 1,850 acre-feet (ac-ft) of surface water supply from Canyon Lake (Guadalupe-Blanco River Authority, GBRA). The San Antonio Water System (SAWS) has a base of 4,000 ac-ft of surface water supply and up to an additional 4,000 ac-ft of variable surplus water available from Canyon Lake (GBRA) that will decline annually due to increased demand from a growing population in Comal and Kendall counties. The agreement expires in 2037. The total surface water supplies in 2020 are 44,888 ac-ft and in year 2070 will be 42,871 ac-ft.

E. PROJECTED TOTAL DEMAND FOR WATER WITHIN THE DISTRICT

Population and water demand projections are provided for Bexar County in the Region L Plan. The projected total annual water demand within the District, including Bexar, Comal, and Kendall counties is summarized in Appendix B. As future demands increase, changes in the infrastructure will be necessary. It is projected that the greatest demand on water resources will be from municipal suburban users who will rely on groundwater and other supplies provided by municipal providers. The majority of infrastructure improvements necessary to service these new groundwater users will be provided by either developers or municipal water supply companies. Therefore, it is anticipated that the amount of water supplied at any given time will be primarily related to suburban growth patterns. The total water demand to water user groups in 2020 is 336,718 ac-ft and in year 2070 will be 517,342 ac-ft.

i. PROJECTED POPULATION WITHIN THE DISTRICT

The following Table 3 incorporates population revisions for Bexar County.

Population Projections for Bexar County	
2010	1,631,935
2020	1,974,041
2030	2,231,550
2040	2,468,254
2050	2,695,668
2060	2,904,319
2070	3,094,726

Table 3: Bexar County Population Projections as documented in the2021 Region L Initially Prepared Plan.

Much of the growth now occurring in northern Bexar County is focused on the major thoroughfares north of Loop 1604, including Highway 281 North, Interstate 10 West, and Highway 16 to Bandera as well as along the 1604 North corridor. These areas are generally served by municipal suppliers and private water wells producing from the middle Trinity stratigraphic units of the Trinity Group of Aquifers. Municipal water systems and the influx of non-Trinity based water may reduce dependence on the Trinity Group of Aquifers. At the same time, continued regional growth may have an impact on the Trinity Group of Aquifers and may lead to overextension of the resources available. Water availability will require careful monitoring to assure that impact is managed and minimized to the extent possible.

Northern Bexar County is comprised of primarily commercial, industrial, and residential developments. There are also large ranch holdings and military reservations in the area. The past 20 years has seen a dramatic increase in suburban development and increased residential population density. There is limited agricultural activity in the area that consists of small pastures, grazing, and native grassland open areas.

The population estimate within the District is 235,000. The largest city within the District is the City of San Antonio with a population of approximately 1.5 million, according to the U.S. Census Bureau for 2019. The District boundaries incorporate a portion of the City of San Antonio with the remainder of the District being comprised of smaller cities including Fair Oaks Ranch and Grey Forest, as well as smaller subdivisions and rural residential populations. The District encompasses a high-growth area with ongoing plans for future development.

V. Consider the Water Supply Needs and Water Management Strategies included in the Adopted State Water Plan

A. Projected Water Supply Needs

The most recently adopted State Water Plan is the 2017 State Water Plan. This Plan incorporated the 2016 Region L Water Plan, which provided the estimated water supply needs in the District including Bexar, Comal, and Kendall counties. These data appear in Appendix B. The tables in Appendix B for "Projected Water Supply Needs" provides a listing of individual WUGs with identified water supply needs (negative numbers in the table indicate a water supply shortage).

There are needs of water supply identified within the District such as, the City of San Antonio is projecting a water supply need for 2020 at -47,661 ac-ft and that number increases by the year 2070 to -155,087 ac-ft. The San Antonio Water System is projecting a water supply need for 2020 at -4,440 ac-ft and the number increases by the year 2070 to -23,038 ac-ft. The projected total water supply needs indicate water supply shortage for 2020 at -66,846 ac-ft and in year 2070 will be a water supply shortage of -236,720 ac-ft.

B. Water Management Strategies

Water management strategies are specific plans to increase water supply or maximize existing water supply to meet a specific need. The Regional Water Planning Group L has several recommendations throughout the planning area. Multiple strategies were identified for Bexar County, Comal County, and Kendall County within and outside of the District. The data appears in Appendix B.

There are no strategies identified for new groundwater wells or new groundwater production from the Trinity Aquifer within the District. Any identified additional groundwater as a management strategy within the District shows production from aquifers outside of the District, for example the Vista Ridge Project by the San Antonio Water System and expansion of use from the Carrizo-Wilcox Aquifer in Gonzales county. The City of Fair Oaks Ranch, the City of Helotes, the City of San Antonio, and the San Antonio Water System all have a water management strategy for water conservation. The City of San Antonio also includes other water management strategies such as recycled water, desalination, and brackish groundwater use.

The District is aware of private water marketers within the District that have plans to activate existing exempt wells they own with a goal to produce a high volume of groundwater to be utilized for communities outside of the District. Currently these water management strategies have not been identified in the State Regional Water Plan. The District has developed a detailed groundwater availability model down to half-a-square-mile grid cell within the District only, as a tool to evaluate estimated influence across the District for these large scale projects and has made it available to these companies.

Private water marketers are not entities planned for in the regional and state plans. The water marketer could be shown as either existing water supply or a water management strategy in the plan if they are selling the water to a municipality or other WUG. In order to be considered existing supply in the regional plans, the supply must be physically and legally available to the WUG. A strategy would make the supply accessible in future decades. If a WUG's supply and strategy information is not correct/up to date in the plans, it could lead to eligibility issues for state funding of water development projects (S. Backhouse, personal communication, September 22, 2020).

VI. DETAILS ON HOW THE DISTRICT WILL MANAGE GROUNDWATER

A. IMPLEMENTATION OF DISTRICT RULES & POLICIES

The Texas Legislature has determined that GCDs are the State's preferred method of groundwater management, through the rules developed, adopted, and promulgated by individual GCDs, as authorized by Chapter 36 of the Texas Water Code and the District's enabling legislation (Texas Water Code §36.0015). The District shall manage the use of groundwater in order to protect, preserve, conserve, and prevent waste of the resource.

The District's enabling legislation creates limitations in preserving and protecting groundwater resources as addressed in Chapter 36 of the Texas Water Code. According to language within the enabling legislation the District must recognize all public water supply wells drilled or completed prior to September 1, 2002 as exempt from District regulation. This creates a projection in which exempt groundwater production within the District exceeds the MAG and compromises the adopted DFC. The District strives to protect existing wells as empowered by the Texas Legislature.

The rules of the District were written with the intent to give all landowners a fair and equal opportunity to use groundwater resources of the Trinity Group of Aquifers. It will be the policy of the District to educate constituents of their responsibility for groundwater conservation and to employ regulation only as required to fulfill the District's mission statement and guiding principles. The District will manage its groundwater resources as practicably as possible, with the best available science, and will give consideration to the economic and cultural activities which occur within the District.

The District will manage the supply of groundwater within the District based on the District's best available science and data and its assessment of water availability and groundwater storage conditions, along with stakeholder input. The most current GAM and MAG developed by the TWDB for the Trinity Group of Aquifers or other groundwater models, as well as other studies performed by the District and other entities, will also aid in the decision-making process by the District.

The District has adopted rules that require the permitting of non-exempt wells within the District consistent with the District Management Plan, and pertinent sections of Chapter 36 of the Texas Water Code. The District gathers data by permitting, registering, and recording wells, and production data.

Monitoring of groundwater conditions will be practiced for monitoring whether production within the District is exceeding the MAG and if the District is achieving its DFC. Limitations of groundwater production may result should it appear the District cannot achieve its DFC. Development or analysis of new or existing groundwater or aquifer data (MAG revisions) may result in changes to the groundwater availability volumes, with a corresponding change in production limits from the affected Trinity Group of Aquifers.

The District will monitor groundwater conditions through its water level monitoring, water quality program, and production reporting program. If necessary, the District may, through the rule-making process, identify areas within the District which, based on results from District aquifer monitoring, are identified as Critical Groundwater Depletion Areas (CGDA). These areas, when identified by the District in accordance with District Rules, may require specific pumping limits or reduction measures to ensure that groundwater supply is maintained and protected.

The District will encourage cooperative and voluntary rule compliance. If rule enforcement becomes necessary, the enforcement will be legal, fair, and impartial.

VII. Actions, Procedures, Performance and Avoidance for Plan Implementation

To meet the requirements of Texas Water Code §36.107(e)(2), the District will act on the goals and directives established in this District Management Plan. The District will use the objectives and provisions of the Management Plan as a guideline in its policy implementation and decision making. In both its daily operations and long-term planning efforts, the District will continuously strive to comply with the initiatives and standards created by the Management Plan for the District.

The District will amend rules in accordance with Chapter 36 of the Texas Water Code and rules will be followed and enforced. The District may amend the District Rules as necessary to comply with changes to Chapter 36 of the Texas Water Code and to ensure the best management of the groundwater within the District. The development and enforcement of the rules of the District will be based on the best scientific and technical evidence available to the District.

The District will encourage public cooperation and coordination in the implementation of the District Management Plan. All operations and activities of the District will be performed in a manner that best encourages cooperation with the appropriate state, regional, and local water entities as well as landowners and the general public. Meetings of the District's Board of Directors will be noticed (announced) and conducted in accordance with the Texas Open Meetings Act. The District will also make available for public inspection all official documents, reports, records, and minutes of the District pursuant with the Texas Public Information Act.

District Rules are available on the District's website: https://www.trinityglenrose.com/tgr-business

VIII. Methodology for Tracking Progress in Achieving Management Goals

An annual report will be prepared and presented to the Board of Directors on District performance with regard to achieving management goals and objectives. The presentation of this report will occur within the first or second quarter of the following calendar year. The District will maintain the reports on file for public inspection at the District's office upon adoption.

IX. District Goals, Management Objectives, and Performance Standards

The management goals, objectives, performance standards and tracking methods of the District in the emphasis areas defined in 31 TAC §356 as follows.

1.0 Providing the Most Efficient Use of Groundwater

1.1 Maintain a Well Registration Process

Management Objective

The District will require the registration of all groundwater wells, exempt and non-exempt, new and existing, within the boundaries the District to be registered in accordance with the District Rules.

Performance Standard

The number of water wells registered in the District will be provided at the regular District Board meetings and in the District's Annual Report.

1.2 Maintain a Well Permitting Process

Management Objective

Maintain and regulate well construction and spacing standards through the issuance of well construction permits in accordance with the District Rules. Through an interlocal agreement with San Antonio Water System (SAWS), processing of well applications and well site inspections are performed before, during, and after the drilling of each new well in the District.

Performance Standard

Applications for all wells will be processed to be drilled or plugged pursuant to the permitting process of the District Rules. The number of water wells drilled and plugged within the District will be provided at the regular District Board meetings and in the District's Annual Report.

1.3 Maintain Electronic Databases

Management Objective

Maintain the necessary electronic databases for registrations, permits, and groundwater production. The databases shall include information deemed necessary by the District to enable effective monitoring and regulation of groundwater in the District.

Performance Standard

The District will document all new and plugged wells in the District's database. A summary of totals for new and plugged wells documented will be included in the District's Annual Report.

Performance Standard

The District will include a summary of the estimated volume of water produced within District in the District's Annual Report.

2.0 Controlling and Preventing Waste of Groundwater

2.1 Disseminate Information on Waste Prevention

Management Objective

The District will provide information on an annual basis for the purpose of educating the public on elimination, reduction, and prevention of the waste of groundwater. The District will use at least one of the following methods to provide information to the public annually:

a. Distribute literature packets or brochures;
b. Distribute the District's newsletter;
c. Conduct public or school presentations;
d. Sponsor an educational program or course;
e. Provide information on the District's web site;
f. Submit an article for publication with local papers;
g. Present displays at public events.

Performance Standard

A summary of the District's efforts to disseminate information on waste prevention will be included in the District's Annual Report.

3.0 Controlling and Preventing Subsidence

The District has considered the vulnerability of the District to subsidence associated with groundwater withdrawals from aquifers in the District, including a review of the TWDB's subsidence risk assessment report (LRE Water and others, 2017). Essentially, the structurally rigid geologic framework of the region has a low to moderate risk, and there has been no evidence of subsidence in the District occurring as a result of past groundwater withdrawals. Therefore, this goal is not applicable to the District.

4.0 Addressing Conjunctive Surface Water Management Issues

Northern Bexar County lies within the San Antonio River basin. For statewide water planning purposes, it is part of the South Central Texas Regional Water Planning Group (Region L). The District is also the southernmost portion of GMA 9. The region is unique in comparison to other areas within GMA 9 due to the population density, impact of increasing development, and recharge impact from Cibolo Creek Watershed.

4.1 Participating in the Regional Water Planning Process

Management Objective

Annually the District will participate in the regional water planning process by having a representative attend at least one meeting of the Region L.

Performance Standard

District representative attendance and report of the meeting for Region L will be presented to the Board of Directors at the following board meeting and dates of attendance will be included in the District's Annual Report.

5.0 Addressing Natural Resource Issues that Impact the Use and Availability of Groundwater and which are impacted by the use of Groundwater

The term "natural resource issues" is defined (31 TAC 356.10(15)) as "issues related to environmental and other concerns that may be affected by a district's plan and rules, such as impacts on endangered species, soils, oil and gas production, mining, air and water quality degradation, agriculture, and plant and animal life".

5.1 Collaborate on Research Projects

Management Objective

The District will collaborate and/or partner with appropriate agencies, consultants, and research groups and document in-house efforts to advance projects and research that might impact the use and availability of groundwater.

Performance Standard

If projects are identified, then a summary of District efforts for any research project that might impact the use and availability of groundwater—such as water quality sampling or District support to a program/project—will be included in the District's Annual Report.

5.2 Address Abandoned and Nuisance Wells

Management Objective

The District will encourage the plugging of abandoned and nuisance groundwater wells. The District or its authorized agents will document and conduct inspections of groundwater wells within the District's boundaries to encourage proper construction, plugging and maintenance of groundwater wells.

Performance Standard

A summary of the number of wells plugged will be included in the District's Annual Report.

6.0 Addressing Drought Conditions

6.1 Track Drought Conditions

Management Objective

The District will monitor drought conditions using the Palmer Drought Severity Index (PDSI) posted on the National Weather Service - Climate Prediction Center website.

Performance Standard

A summary report of monitored drought conditions will be provided to the District Board of Directors at least quarterly.

Performance Standard

A link to the TWDB's website on drought information will be made available to the public on the District's webpage, (http://waterdatafortexas.org/drought/).

6.2 Drought Contingency Plan

Management Objective

The District will monitor conditions that trigger action of its Drought Contingency Plan.

Performance Standard

The District quarterly will evaluate the need to implement the drought contingency plan and will document implementation in the District's Annual Report.

7.0 Addressing Conservation, Recharge Enhancement, Rainwater Harvesting, Precipitation Enhancement, and Brush Control Where Appropriate and Cost Effective

7.1 Disseminate Information on Water Conservation

Management Objective

The District will provide information on an annual basis for the purpose of educating the public on the importance of water conservation and water conservation methods. The District will use at least one of the following methods to provide information to the public annually:

a. Distribute literature packets or brochures;
b. Distribute the District's newsletter;
c. Conduct public or school presentations;
d. Sponsor an educational program or course;
e. Provide information on the District's web site;
f. Submit an article for publication with local papers;
g. Present displays at public events.

Performance Standard

A summary of the District's efforts to disseminate information on water conservation and water conservation methods will be included in the District's Annual Report.

7.2 Evaluation on Potential Recharge Enhancement Projects

The District has yet to assess potential recharge projects in the area. The District may solicit ideas and information and may investigate any potential recharge enhancement opportunities, natural or artificial, that are brought to the District's attention. Such projects may include, but are not limited to: cleanup or site protection projects at any identified significant recharge feature, encouragement of prudent brush control/water enhancement projects, non-point source pollution mitigation projects, aquifer storage and recovery projects, development of recharge ponds or small reservoirs, and the encouragement of appropriate and practical erosion and sedimentation control at construction projects located near surface streams.

Management Objective

Investigate potential natural or artificial recharge enhancement projects.

Performance Standard

If projects are identified, then a report of potential recharge enhancement opportunities identified will be reported to the Board of Directors and included in the District's Annual Report.

7.3 Rainwater Harvesting

Management Objective

The District will provide information on an annual basis for the purpose of educating the public on rainwater harvesting. The District will use at least one of the following methods to provide information to the public annually:

a. Distribute literature packets or brochures;
b. Distribute the District's newsletter;
c. Conduct public or school presentations;
d. Sponsor an educational program or course;
e. Provide information on the District's web site;
f. Submit an article for publication with local papers;
g. Present displays at public events.

Performance Standard

A summary of the District's efforts to disseminate information on rainwater harvesting will be included in the District's Annual Report.

7.4 Precipitation Enhancement

This strategy is cost prohibitive for consideration by the District at this time. Also, the District's small geographic area and the imprecision in the delivery location of enhanced precipitation also combine to make such a water management strategy impractical. Therefore, this goal is not applicable to the operations of this District at this time.

7.5 Brush Control

This strategy is not within the District's financial or managerial ability to implement or to be cost-effective. Further, brush is not expected to be a significant factor for groundwater availability in the District's primary, confined aquifers. Therefore, this goal is not considered applicable to the operations of this District at this time.

8.0 Addressing the Desired Future Conditions

8.1 Manage and Maintain a Water Level Monitoring Program

Management Objective

The District will monitor the static water level in the Trinity Aquifer to ensure the achievement of the adopted DFC. The District will monitor water levels within the District boundaries of the Trinity Aquifer at least annually and will evaluate the static water level trends to compare to the adopted DFCs.

Performance Standard

An annual comparison of static water level in the Trinity Aquifer to the District's adopted DFC will be evaluated and included in the District's Annual Report.

8.2 Monitor Estimated Annual Production

Management Objective

The District will estimate the total annual groundwater production based on groundwater production reports, estimated exempt use, and other relevant information and compare production estimates to the MAG.

Performance Standard

An annual comparison of total recorded and estimated annual production to the District's MAG will be evaluated and included in the District's Annual Report.

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APPENDIX A – RESOLUTION OF DESIGNATION OF DESIRED FUTURE CONDITIONS FOR GROUNDWATER MANAGEMENT AREA 9 AQUIFERS

STATE OF TEXAS	§	
	§	**RESOLUTION # 111521-01**
GROUNDWATER	§	
MANAGEMENT AREA 9	§	

Adopting the Groundwater Management Area 9 Joint Planning Committee's Proposed Classification of Locally Managed Aquifers as Non-Relevant for Joint Planning Purposes and the Desired Future Conditions for Relevant Major and Minor Aquifers in GMA 9, and authorizing the GMA 9 Chairman to formally submit them and all other required information to the TWDB.

WHEREAS, the Groundwater Conservation Districts (GCDs) located within or partially within Groundwater Management Area 9 (GMA 9) are required under Chapter 36.108, Texas Water Code to conduct joint planning and designate the Desired Future Conditions (DFCs) for aquifers within GMA 9; and

WHEREAS, the Board Presidents or their Designated Representatives of the GCD Members of the Groundwater Management Area 9 Joint Planning Committee (GMA 9) have met as a Committee in various meetings and conducted joint planning in accordance with Section 36.108, Texas Water Code since September 2005; and

WHEREAS, GMA 9, having given proper and timely notice, held an open meeting of the GMA 9 Committee on March 22, 2021 in a ZOOM Virtual Meeting format allowed under a variance to the Open Meetings Act issued by the Governor of Texas due to the Covid pandemic; and

WHEREAS, following GMA 9's March 22, 2021 adoption of GMA 9 Proposed DFCs and the Proposed Classification of Non-Relevant Aquifers, and in accordance with Section 36.108, GMA 9 has solicited and considered public comment during a Public Hearing at each GCD located within or partially within GMA 9, through written public comments, and through public comment in person at various GMA 9 Committee meetings; and

WHEREAS, the GMA 9 Committee received and considered technical advice regarding the requirements contained in Chapter 36.108(subsections c-d3), including but not limited to local aquifers, hydrology, geology, recharge characteristics, local groundwater demands and usage, population projections, ground and surface water inter-relationships, and other considerations that affect groundwater conditions from the Texas Water Development Board (TWDB), Regional Water Planning Groups J, K, and L, consultants, hydrologists, geologists, and other groundwater professionals; and

WHEREAS, following public discussion and due consideration of the current and future needs and conditions of the aquifers in question, the current and projected groundwater demand estimates from local GCDs, the TWDB, and Regional Water Planning Groups J, K, and L, the potential effects on springs, surface water, habitat, and water-dependent species for DFCs set through the year 2060 for the Trinity Aquifer or 2080 for the Edwards Group of the Edwards-Trinity (Plateau), the Ellenburger-San Saba, and Hickory aquifers, the following motions were made and acted upon:

Motion #1:

Moved by George Wissmann and seconded by Micah Voulgaris to adopt the following Desired Future Condition through the year 2060 for the Trinity Aquifer located in GMA 9:

- Allow for An Increase in Average Drawdown of Approximately 30 Feet Through 2060 (Throughout GMA 9) Consistent With "Scenario 6" in TWDB GAM Task 10-005.

The vote on the motion was 9 ayes, 0 nays, and 0 abstentions, and the Motion Passed.

Motion #2

Moved by Micah Voulgaris and seconded by Dave Mauk to adopt the following Desired Future Condition through the year 2080 for the Edwards Group of the Edwards-Trinity (Plateau) Aquifer for those portions located in Kendall and Bandera counties:

- Allow For No Net Increase in Average Drawdown in Kendall and Bandera Counties Through 2080.

The vote on the motion was 9 ayes, 0 nays, and 0 abstentions, and the Motion Passed.

Motion #3

Moved by Micah Voulgaris and seconded by Dave Mauk to adopt the following Desired Future Condition through the year 2080 for the portions of the Ellenburger-San Saba Aquifer located in Kendall County:

- Allow for An Increase in Average Drawdown of No More Than 7 Feet in Kendall County Through 2080.

The vote on the motion was 9 ayes, 0 nays, and 0 abstentions, and the Motion Passed.

Motion #4

Moved by Micah Voulgaris and seconded by Dave Mauk to adopt the following Desired Future Condition through the year 2080 for the portions of the Hickory Aquifer located in Kendall County:

- Allow for An Increase in Average Drawdown of No More Than 7 Feet in Kendall County Through 2080.

The vote on the motion was 9 ayes, 0 nays, and 0 abstentions, and the Motion Passed.

Motion #5

Moved by Jimmy Klepac and seconded by Gene Williams to propose the classification of the Edwards Group of the Edwards-Trinity (Plateau) Aquifer located in Blanco County and Kerr County as non-relevant for the purposes of joint planning.

The vote on the motion was 9 ayes, 0 nays, and 0 abstentions, and the Motion Passed

Motion #6

Moved by Jimmy Klepac and seconded by George Wissmann to propose the classification of the Ellenburger-San Saba Aquifer located in Blanco County and Kerr County as non-relevant for the purposes of joint planning.

The vote on the motion was 9 ayes, 0 nays, and 0 abstentions, and the Motion Passed.

Motion #7

Moved by Charlie Flatten and seconded by Jimmy Klepac to propose the classification of the Hickory Aquifer located in Blanco, Hays, Kerr, and Travis counties as non-relevant for the purposes of joint planning.

The vote on the motion was 9 ayes, 0 nays, and 0 abstentions, and the Motion Passed.

Motion #8

Moved by Jimmy Klepac and seconded by George Wissmann to propose the classification of the Marble Falls Aquifer located in Blanco County as non-relevant aquifer for the purposes of joint planning.

The vote on the motion was 9 ayes, 0 nays, and 0 abstentions, and the Motion Passed.

Motion #9

Moved by David Caldwell and seconded by Lane Cockrell to propose the classification of the Edwards Aquifer (Balcones Fault Zone) located in Bexar, Comal, Hays, and Travis counties as non-relevant for the purposes of joint planning.

The vote on the motion was 9 ayes, 0 nays, and 0 abstentions, and the Motion Passed.

Whereas, the above Motions and Votes of each Committee Member have been recorded in the Minutes of the November 15, 2021 GMA 9 Committee Meeting,

NOW THEREFORE BE IT RESOLVED, Groundwater Management Area 9 Joint Planning Committee Members present and voting on November 15, 2021 do hereby document, record, and confirm the above-described Motions and Votes.

Approved by consensus and signed on November 15, 2021 by the following Voting Groundwater Management Area 9 Joint Planning Committee Members:

Jimmy Klepac – Board President of the Blanco-Pedernales GCD

Dave Mauk – General Manager and Designated Representative for the Bandera County River Authority and Groundwater Conservation District

David Caldwell - General Manager and Designated Representative for the Medina County GCD

Charlie Flatten - General Manager and Designated Representative for the Hays Trinity GCD

Micah Voulgaris – General Manager and Designated Representative for the Cow Creek GCD

George Wissmann – General Manager and Designated Representative for the Trinity Glen Rose GCD

Gene Williams - General Manager and Designated Representative for the Headwaters GCD

H.L. Saur - General Manager and Designated Representative of the Comal Trinity GCD

Lane Cockrell - General Manager and Designated Representative for the Southwestern Travis County GCD

APPENDIX B – ESTIMATED HISTORICAL GROUNDWATER USE AND 2017 STATE WATER PLAN DATASETS: TRINITY GLEN ROSE GROUNDWATER CONSERVATION DISTRICT

Estimated Historical Groundwater Use And 2017 State Water Plan Datasets:

Trinity Glen Rose Groundwater Conservation District

by Stephen Allen
Texas Water Development Board
Groundwater Division
Groundwater Technical Assistance Section
stephen.allen@twdb.texas.gov
(512) 463-7317
June 12, 2020

GROUNDWATER MANAGEMENT PLAN DATA:

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

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

The five reports included in this part are:

1. Estimated Historical Groundwater Use (checklist item 2)

   from the TWDB Historical Water Use Survey (WUS)

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

   from the 2017 Texas State Water Plan (SWP)

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

DISCLAIMER:

The data presented in this report represents the most up-to-date WUS and 2017 SWP data available as of 6/12/2020. Although it does not happen frequently, either of these datasets are subject to change pending the availability of more accurate WUS data or an amendment to the 2017 SWP. District personnel must review these datasets and correct any discrepancies in order to ensure approval of their groundwater management plan.

The WUS dataset can be verified at this web address:

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

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

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

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

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

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

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

Estimated Historical Water Use

TWDB Historical Water Use Survey (WUS) Data

Groundwater and surface water historical use estimates are currently unavailable for calendar year 2018. TWDB staff anticipates the calculation and posting of these estimates at a later date.

BEXAR COUNTY *24.36% (multiplier)* All values are in acre-feet

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2017	GW	62,633	1,244	1,846	223	2,546	58	68,550
	SW	1,972	224	0	8,300	672	136	11,304
2016	GW	61,188	1,184	1,903	206	1,978	55	66,514
	SW	2,097	256	0	4,748	483	128	7,712
2015	GW	60,751	1,137	1,640	196	1,841	54	65,619
	SW	2,549	210	0	5,638	367	126	8,890
2014	GW	60,171	1,015	1,338	266	1,780	52	64,622
	SW	2,741	261	0	8,768	185	122	12,077
2013	GW	59,871	1,218	1,623	261	2,330	60	65,363
	SW	3,223	210	0	8,631	195	140	12,399
2012	GW	59,904	1,235	2,132	256	3,265	54	66,846
	SW	4,544	189	0	9,454	260	126	14,573
2011	GW	64,431	1,252	1,807	280	2,687	136	70,593
	SW	5,491	190	0	12,459	859	319	19,318
2010	GW	56,325	1,223	2,758	279	2,122	136	62,843
	SW	5,175	148	898	6,744	828	317	14,110
2009	GW	58,693	1,343	2,449	376	4,448	70	67,379
	SW	6,662	147	1,050	8,535	1,052	165	17,611
2008	GW	63,700	1,535	3,934	348	1,683	68	71,268
	SW	4,317	218	1,068	10,023	1,097	159	16,882
2007	GW	53,313	1,557	2,234	310	901	84	58,399
	SW	3,444	238	315	2,854	538	197	7,586
2006	GW	62,695	1,570	2,110	271	2,369	99	69,114
	SW	3,562	259	602	10,125	244	230	15,022
2005	GW	60,431	2,366	2,246	303	2,212	101	67,659
	SW	2,973	218	599	8,177	244	237	12,448
2004	GW	51,381	2,530	2,465	249	2,167	24	58,816
	SW	2,574	241	599	5,537	215	226	9,392
2003	GW	53,135	2,483	2,119	233	1,730	24	59,724
	SW	2,549	64	559	4,397	1,202	227	8,998
2002	GW	51,984	2,691	2,218	254	3,781	29	60,957
	SW	2,297	55	559	3,671	2,521	269	9,372

COMAL COUNTY

0.34% (multiplier)

All values are in acre-feet

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2017	GW	41	1	21	0	1	0	64
	SW	33	0	0	0	2	1	36
2016	GW	40	1	24	0	1	0	66
	SW	30	0	0	0	2	1	33
2015	GW	41	9	11	0	1	0	62
	SW	31	0	0	0	1	1	33
2014	GW	39	15	19	0	0	0	73
	SW	32	0	0	0	0	1	33
2013	GW	36	7	16	0	1	0	60
	SW	28	0	0	0	0	1	29
2012	GW	42	10	11	0	1	0	64
	SW	29	0	0	0	1	0	30
2011	GW	50	14	9	0	1	0	74
	SW	30	0	0	0	1	1	32
2010	GW	36	10	21	0	1	0	68
	SW	42	0	12	0	1	1	56
2009	GW	41	1	33	0	2	0	77
	SW	28	2	12	0	0	1	43
2008	GW	43	1	35	0	0	0	79
	SW	30	2	13	0	1	1	47
2007	GW	26	2	23	0	1	0	52
	SW	26	2	2	0	1	0	31
2006	GW	30	2	23	0	3	0	58
	SW	27	3	2	0	0	0	32
2005	GW	29	2	23	0	0	0	54
	SW	27	2	2	0	1	0	32
2004	GW	22	1	26	0	0	1	50
	SW	26	2	2	0	1	0	31
2003	GW	22	1	27	0	0	1	51
	SW	26	2	2	0	2	0	32
2002	GW	24	2	28	0	0	1	55
	SW	21	1	2	0	0	0	24

KENDALL COUNTY

0.48% (multiplier)

All values are in acre-feet

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2017	GW	18	0	0	0	1	1	20
	SW	12	0	0	0	0	0	12
2016	GW	17	0	0	0	1	1	19
	SW	12	0	0	0	1	0	13
2015	GW	16	0	0	0	1	1	18
	SW	10	0	0	0	0	0	10
2014	GW	16	0	0	0	1	1	18
	SW	11	0	0	0	0	0	11
2013	GW	16	0	0	0	2	1	19
	SW	11	0	0	0	0	0	11
2012	GW	17	0	0	0	3	1	21
	SW	10	0	0	0	0	0	10
2011	GW	20	0	0	0	4	2	26
	SW	10	0	0	0	0	0	10
2010	GW	16	0	0	0	3	2	21
	SW	8	0	0	0	1	0	9
2009	GW	14	0	0	0	4	1	19
	SW	8	0	0	0	1	0	9
2008	GW	15	0	0	0	0	1	16
	SW	8	0	0	0	1	0	9
2007	GW	13	0	0	0	0	2	15
	SW	7	0	0	0	0	0	7
2006	GW	16	0	0	0	1	2	19
	SW	6	0	0	0	0	0	6
2005	GW	19	0	0	0	1	2	22
	SW	4	0	0	0	0	0	4
2004	GW	15	0	0	0	0	1	16
	SW	3	0	0	0	1	0	4
2003	GW	15	0	0	0	1	1	17
	SW	3	0	0	0	2	0	5
2002	GW	15	0	0	0	4	1	20
	SW	2	0	0	0	1	1	4

Projected Surface Water Supplies
TWDB 2017 State Water Plan Data

BEXAR COUNTY

24.36% (multiplier)

All values are in acre-feet

RWPG	WUG	WUG Basin	Source Name	2020	2030	2040	2050	2060	2070
L	COUNTY-OTHER, BEXAR	SAN ANTONIO	SAN ANTONIO RUN-OF-RIVER	24	24	24	24	24	24
L	EAST CENTRAL SUD	SAN ANTONIO	CANYON LAKE/RESERVOIR	691	648	609	571	534	501
L	FAIR OAKS RANCH	SAN ANTONIO	CANYON LAKE/RESERVOIR	1,170	1,064	979	912	857	811
L	GREEN VALLEY SUD	SAN ANTONIO	CANYON LAKE/RESERVOIR	147	138	132	127	123	116
L	IRRIGATION, BEXAR	SAN ANTONIO	SAN ANTONIO RUN-OF-RIVER	478	478	478	478	478	478
L	LIVESTOCK, BEXAR	NUECES	NUECES LIVESTOCK LOCAL SUPPLY	43	43	43	43	43	43
L	LIVESTOCK, BEXAR	SAN ANTONIO	SAN ANTONIO LIVESTOCK LOCAL SUPPLY	98	98	98	98	98	98
L	MANUFACTURING, BEXAR	SAN ANTONIO	SAN ANTONIO RUN-OF-RIVER	3	3	3	3	3	3
L	SAN ANTONIO	SAN ANTONIO	CANYON LAKE/RESERVOIR	6,060	6,060	4,043	4,043	4,043	4,043
L	SAN ANTONIO	SAN ANTONIO	GUADALUPE RUN-OF-RIVER	270	270	270	270	270	270
L	SAN ANTONIO WATER SYSTEM	SAN ANTONIO	GUADALUPE RUN-OF-RIVER	0	0	0	0	0	0
L	SAN ANTONIO WATER SYSTEM	SAN ANTONIO	SAN ANTONIO RUN-OF-RIVER	3,739	3,675	3,625	3,585	3,551	3,522
L	ST. HEDWIG	SAN ANTONIO	CANYON LAKE/RESERVOIR	146	179	210	243	276	307
L	STEAM ELECTRIC POWER, BEXAR	SAN ANTONIO	CALAVERAS LAKE/RESERVOIR	8,989	8,989	8,989	8,989	8,989	8,989
L	STEAM ELECTRIC POWER, BEXAR	SAN ANTONIO	VICTOR BRAUNIG LAKE/RESERVOIR	2,923	2,923	2,923	2,923	2,923	2,923
	Sum of Projected Surface Water Supplies (acre-feet)			**24,781**	**24,592**	**22,426**	**22,309**	**22,212**	**22,128**

COMAL COUNTY

0.34% (multiplier)

All values are in acre-feet

RWPG	WUG	WUG Basin	Source Name	2020	2030	2040	2050	2060	2070
L	BULVERDE	GUADALUPE	CANYON LAKE/RESERVOIR	9	10	11	13	14	15
L	BULVERDE	SAN ANTONIO	CANYON LAKE/RESERVOIR	794	929	1,070	1,215	1,363	1,506
L	CANYON LAKE WATER SERVICE COMPANY	GUADALUPE	CANYON LAKE/RESERVOIR	3,908	3,773	3,641	3,514	3,387	3,266

Projected Surface Water Supplies
TWDB 2017 State Water Plan Data

RWPG	WUG	WUG Basin	Source Name	2020	2030	2040	2050	2060	2070
L	CANYON LAKE WATER SERVICE COMPANY	SAN ANTONIO	CANYON LAKE/RESERVOIR	961	938	915	889	862	836
L	COUNTY-OTHER, COMAL	GUADALUPE	CANYON LAKE/RESERVOIR	5	5	5	5	5	5
L	CRYSTAL CLEAR WSC	GUADALUPE	CANYON LAKE/RESERVOIR	153	149	144	140	136	133
L	FAIR OAKS RANCH	SAN ANTONIO	CANYON LAKE/RESERVOIR	95	96	96	98	98	99
L	GREEN VALLEY SUD	GUADALUPE	CANYON LAKE/RESERVOIR	16	18	18	19	19	20
L	IRRIGATION, COMAL	GUADALUPE	CANYON LAKE/RESERVOIR	1	1	1	1	1	1
L	IRRIGATION, COMAL	GUADALUPE	GUADALUPE RUN-OF-RIVER	1	1	1	1	1	1
L	LIVESTOCK, COMAL	GUADALUPE	GUADALUPE LIVESTOCK LOCAL SUPPLY	0	0	0	0	0	0
L	LIVESTOCK, COMAL	SAN ANTONIO	SAN ANTONIO LIVESTOCK LOCAL SUPPLY	0	0	0	0	0	0
L	MANUFACTURING, COMAL	GUADALUPE	CANYON LAKE/RESERVOIR	0	0	0	0	0	0
L	MANUFACTURING, COMAL	GUADALUPE	GUADALUPE RUN-OF-RIVER	0	0	0	0	0	0
L	NEW BRAUNFELS	GUADALUPE	CANYON LAKE/RESERVOIR	8,072	8,124	8,158	8,188	8,207	8,218
L	NEW BRAUNFELS	GUADALUPE	GUADALUPE RUN-OF-RIVER	1,075	1,082	1,086	1,090	1,093	1,094
L	SAN ANTONIO WATER SYSTEM	GUADALUPE	GUADALUPE RUN-OF-RIVER	0	0	0	0	0	0
L	SAN ANTONIO WATER SYSTEM	GUADALUPE	SAN ANTONIO RUN-OF-RIVER	88	113	135	153	169	182
L	SAN ANTONIO WATER SYSTEM	SAN ANTONIO	GUADALUPE RUN-OF-RIVER	0	0	0	0	0	0
L	SAN ANTONIO WATER SYSTEM	SAN ANTONIO	SAN ANTONIO RUN-OF-RIVER	75	97	116	132	145	158
	Sum of Projected Surface Water Supplies (acre-feet)			**15,253**	**15,336**	**15,397**	**15,458**	**15,500**	**15,534**

KENDALL COUNTY

0.48% (multiplier)

All values are in acre-feet

RWPG	WUG	WUG Basin	Source Name	2020	2030	2040	2050	2060	2070
L	BOERNE	SAN ANTONIO	BOERNE LAKE/RESERVOIR	645	645	645	645	645	645

Projected Surface Water Supplies
TWDB 2017 State Water Plan Data

RWPG	WUG	WUG Basin	Source Name	2020	2030	2040	2050	2060	2070
L	BOERNE	SAN ANTONIO	CANYON LAKE/RESERVOIR	3,611	3,611	3,611	3,611	3,611	3,611
L	COUNTY-OTHER, KENDALL	GUADALUPE	CANYON LAKE/RESERVOIR	12	12	12	12	12	12
L	FAIR OAKS RANCH	SAN ANTONIO	CANYON LAKE/RESERVOIR	585	690	775	840	895	940
L	IRRIGATION, KENDALL	GUADALUPE	GUADALUPE RUN-OF-RIVER	0	0	0	0	0	0
L	LIVESTOCK, KENDALL	COLORADO	COLORADO LIVESTOCK LOCAL SUPPLY	0	0	0	0	0	0
L	LIVESTOCK, KENDALL	GUADALUPE	GUADALUPE LIVESTOCK LOCAL SUPPLY	1	1	1	1	1	1
L	LIVESTOCK, KENDALL	SAN ANTONIO	SAN ANTONIO LIVESTOCK LOCAL SUPPLY	0	0	0	0	0	0
	Sum of Projected Surface Water Supplies (acre-feet)			**4,854**	**4,959**	**5,044**	**5,109**	**5,164**	**5,209**

Projected Water Demands
TWDB 2017 State Water Plan Data

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

BEXAR COUNTY *24.36% (multiplier)* All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
L	ALAMO HEIGHTS	SAN ANTONIO	2,216	2,268	2,240	2,227	2,225	2,225
L	ATASCOSA RURAL WSC	NUECES	88	103	117	131	145	158
L	ATASCOSA RURAL WSC	SAN ANTONIO	1,508	1,772	2,020	2,268	2,502	2,719
L	BALCONES HEIGHTS	SAN ANTONIO	518	566	612	662	711	758
L	CASTLE HILLS	SAN ANTONIO	395	375	359	351	350	349
L	CHINA GROVE	SAN ANTONIO	316	350	381	413	445	474
L	CONVERSE	SAN ANTONIO	2,536	2,744	2,930	2,905	2,898	2,897
L	COUNTY-OTHER, BEXAR	NUECES	366	399	432	467	501	532
L	COUNTY-OTHER, BEXAR	SAN ANTONIO	897	1,291	1,758	2,315	2,813	3,270
L	EAST CENTRAL SUD	SAN ANTONIO	1,357	1,461	1,561	1,671	1,784	1,890
L	ELMENDORF	SAN ANTONIO	308	394	474	552	625	691
L	FAIR OAKS RANCH	SAN ANTONIO	1,311	1,384	1,419	1,400	1,464	1,524
L	GREEN VALLEY SUD	SAN ANTONIO	250	265	281	301	323	343
L	HELOTES	SAN ANTONIO	1,622	1,998	2,349	2,690	3,005	3,295
L	HILL COUNTRY VILLAGE	SAN ANTONIO	234	230	226	224	224	224
L	HOLLYWOOD PARK	SAN ANTONIO	949	953	959	969	983	997
L	IRRIGATION, BEXAR	NUECES	317	304	291	278	267	256
L	IRRIGATION, BEXAR	SAN ANTONIO	2,515	2,409	2,307	2,209	2,116	2,034
L	KIRBY	SAN ANTONIO	942	1,012	986	977	974	974
L	LACKLAND AFB	SAN ANTONIO	1,054	1,013	981	962	959	959
L	LEON VALLEY	SAN ANTONIO	1,860	1,931	2,001	2,083	2,174	2,260
L	LIVE OAK	SAN ANTONIO	2,677	2,687	2,648	2,626	2,621	2,621
L	LIVESTOCK, BEXAR	NUECES	43	43	43	43	43	43
L	LIVESTOCK, BEXAR	SAN ANTONIO	239	239	239	239	239	239
L	LYTLE	NUECES	11	15	18	21	23	26
L	MANUFACTURING, BEXAR	SAN ANTONIO	5,539	6,154	6,773	7,317	7,907	8,546
L	MINING, BEXAR	SAN ANTONIO	1,905	2,129	2,322	2,534	2,777	3,045
L	OLMOS PARK	SAN ANTONIO	564	623	678	736	791	843
L	RANDOLPH AFB	SAN ANTONIO	97	109	121	132	142	151
L	SAN ANTONIO	SAN ANTONIO	235,320	258,645	280,772	303,790	326,624	347,849
L	SAN ANTONIO WATER SYSTEM	SAN ANTONIO	28,224	30,974	33,634	36,391	39,111	41,647

Projected Water Demands
TWDB 2017 State Water Plan Data

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

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
L	SCHERTZ	SAN ANTONIO	240	295	369	447	542	629
L	SELMA	SAN ANTONIO	788	879	969	1,056	1,136	1,211
L	SHAVANO PARK	SAN ANTONIO	1,104	1,234	1,356	1,476	1,588	1,692
L	SOMERSET	SAN ANTONIO	221	240	259	279	300	319
L	ST. HEDWIG	SAN ANTONIO	346	379	410	443	476	507
L	STEAM ELECTRIC POWER, BEXAR	SAN ANTONIO	6,142	7,186	7,862	8,612	9,446	10,359
L	TERRELL HILLS	SAN ANTONIO	1,299	1,276	1,257	1,247	1,245	1,245
L	THE OAKS WSC	SAN ANTONIO	370	433	492	551	605	656
L	UNIVERSAL CITY	SAN ANTONIO	3,195	3,210	3,151	3,118	3,112	3,111
L	VON ORMY	SAN ANTONIO	140	153	165	178	191	204
L	WATER SERVICES INC	SAN ANTONIO	660	715	767	826	884	937
L	WINDCREST	SAN ANTONIO	1,203	1,220	1,238	1,265	1,297	1,328
		Sum of Projected Water Demands (acre-feet)	**311,886**	**342,060**	**370,227**	**399,382**	**428,588**	**456,037**

COMAL COUNTY

0.34% (multiplier)

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
L	BULVERDE	GUADALUPE	9	10	11	13	14	15
L	BULVERDE	SAN ANTONIO	794	929	1,070	1,215	1,363	1,506
L	CANYON LAKE WATER SERVICE COMPANY	GUADALUPE	3,112	4,314	5,554	6,812	8,067	9,275
L	CANYON LAKE WATER SERVICE COMPANY	SAN ANTONIO	771	1,068	1,375	1,686	1,996	2,295
L	COUNTY-OTHER, COMAL	GUADALUPE	13	13	13	13	13	13
L	COUNTY-OTHER, COMAL	SAN ANTONIO	1	1	1	1	1	1
L	CRYSTAL CLEAR WSC	GUADALUPE	301	336	374	415	458	500
L	FAIR OAKS RANCH	SAN ANTONIO	106	125	140	150	168	186
L	GARDEN RIDGE	GUADALUPE	1,062	1,430	1,806	2,188	2,570	2,936
L	GARDEN RIDGE	SAN ANTONIO	600	808	1,021	1,237	1,452	1,660
L	GREEN VALLEY SUD	GUADALUPE	28	34	39	45	52	58
L	IRRIGATION, COMAL	GUADALUPE	1	1	1	1	1	1
L	IRRIGATION, COMAL	SAN ANTONIO	0	0	0	0	0	0
L	LIVESTOCK, COMAL	GUADALUPE	1	1	1	1	1	1
L	LIVESTOCK, COMAL	SAN ANTONIO	0	0	0	0	0	0

Projected Water Demands
TWDB 2017 State Water Plan Data

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

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
L	MANUFACTURING, COMAL	GUADALUPE	29	31	34	36	39	42
L	MANUFACTURING, COMAL	SAN ANTONIO	0	0	0	0	0	0
L	MINING, COMAL	GUADALUPE	28	33	37	41	46	51
L	MINING, COMAL	SAN ANTONIO	1	1	2	2	2	2
L	NEW BRAUNFELS	GUADALUPE	12,380	15,203	18,118	21,108	24,127	27,039
L	SAN ANTONIO WATER SYSTEM	GUADALUPE	661	956	1,254	1,558	1,866	2,157
L	SAN ANTONIO WATER SYSTEM	SAN ANTONIO	566	821	1,076	1,335	1,600	1,863
L	SCHERTZ	GUADALUPE	247	394	587	813	1,094	1,379
L	SCHERTZ	SAN ANTONIO	6	10	15	20	27	34
L	SELMA	SAN ANTONIO	3	4	5	6	6	7
		Sum of Projected Water Demands (acre-feet)	**20,720**	**26,523**	**32,534**	**38,696**	**44,963**	**51,021**

KENDALL COUNTY

0.48% (multiplier)

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
L	BOERNE	SAN ANTONIO	3,091	3,985	4,942	5,900	6,889	7,863
L	COUNTY-OTHER, KENDALL	COLORADO	0	0	0	0	0	0
L	COUNTY-OTHER, KENDALL	GUADALUPE	8	9	11	13	15	17
L	COUNTY-OTHER, KENDALL	SAN ANTONIO	5	5	6	6	6	7
L	FAIR OAKS RANCH	SAN ANTONIO	656	898	1,125	1,290	1,531	1,768
L	IRRIGATION, KENDALL	GUADALUPE	1	1	1	1	1	1
L	IRRIGATION, KENDALL	SAN ANTONIO	0	0	0	0	0	0
L	KENDALL COUNTY WCID #1	GUADALUPE	303	341	384	430	481	531
L	LIVESTOCK, KENDALL	COLORADO	0	0	0	0	0	0
L	LIVESTOCK, KENDALL	GUADALUPE	2	2	2	2	2	2
L	LIVESTOCK, KENDALL	SAN ANTONIO	0	0	0	0	0	0
L	WATER SERVICES INC	SAN ANTONIO	46	54	64	74	85	95
		Sum of Projected Water Demands (acre-feet)	**4,112**	**5,295**	**6,535**	**7,716**	**9,010**	**10,284**

Projected Water Supply Needs
TWDB 2017 State Water Plan Data

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

BEXAR COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
L	ALAMO HEIGHTS	SAN ANTONIO	-796	-848	-820	-807	-805	-805
L	ATASCOSA RURAL WSC	NUECES	-64	-79	-93	-107	-121	-134
L	ATASCOSA RURAL WSC	SAN ANTONIO	-1,103	-1,367	-1,615	-1,863	-2,097	-2,314
L	BALCONES HEIGHTS	SAN ANTONIO	0	0	0	0	0	0
L	CASTLE HILLS	SAN ANTONIO	0	0	0	0	0	0
L	CHINA GROVE	SAN ANTONIO	0	0	0	0	0	0
L	CONVERSE	SAN ANTONIO	-903	-1,111	-1,297	-1,272	-1,265	-1,264
L	COUNTY-OTHER, BEXAR	NUECES	1,364	755	277	-125	-411	-638
L	COUNTY-OTHER, BEXAR	SAN ANTONIO	2,973	1,830	256	-1,773	-3,671	-5,446
L	EAST CENTRAL SUD	SAN ANTONIO	243	72	-87	-255	-422	-577
L	ELMENDORF	SAN ANTONIO	0	0	0	0	0	0
L	FAIR OAKS RANCH	SAN ANTONIO	1,079	790	581	464	286	133
L	GREEN VALLEY SUD	SAN ANTONIO	-11	-40	-66	-93	-124	-154
L	HELOTES	SAN ANTONIO	0	0	0	0	0	0
L	HILL COUNTRY VILLAGE	SAN ANTONIO	0	0	0	0	0	0
L	HOLLYWOOD PARK	SAN ANTONIO	0	0	0	0	0	0
L	IRRIGATION, BEXAR	NUECES	-1,063	-1,008	-956	-905	-857	-814
L	IRRIGATION, BEXAR	SAN ANTONIO	-4,053	-3,617	-3,198	-2,798	-2,414	-2,077
L	KIRBY	SAN ANTONIO	-137	-207	-181	-172	-169	-169
L	LACKLAND AFB	SAN ANTONIO	946	987	1,019	1,038	1,041	1,041
L	LEON VALLEY	SAN ANTONIO	-97	-147	-196	-254	-317	-377
L	LIVE OAK	SAN ANTONIO	512	505	532	547	551	551
L	LIVESTOCK, BEXAR	NUECES	0	0	0	0	0	0
L	LIVESTOCK, BEXAR	SAN ANTONIO	0	0	0	0	0	0
L	LYTLE	NUECES	-3	-6	-8	-11	-13	-15
L	MANUFACTURING, BEXAR	SAN ANTONIO	8,666	6,139	3,601	1,368	-1,058	-3,680
L	MINING, BEXAR	SAN ANTONIO	0	0	0	0	0	0
L	OLMOS PARK	SAN ANTONIO	0	0	0	0	0	0
L	RANDOLPH AFB	SAN ANTONIO	1,903	1,891	1,879	1,868	1,858	1,849
L	SAN ANTONIO	SAN ANTONIO	-47,661	-66,591	-86,297	-109,901	-133,319	-155,087
L	SAN ANTONIO WATER SYSTEM	SAN ANTONIO	-4,440	-10,652	-14,484	-17,452	-20,353	-23,038
L	SCHERTZ	SAN ANTONIO	0	0	-35	-123	-224	-329

Projected Water Supply Needs
TWDB 2017 State Water Plan Data

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

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
L	SELMA	SAN ANTONIO	348	-7	-57	-107	-157	-206
L	SHAVANO PARK	SAN ANTONIO	-425	-555	-677	-797	-909	-1,013
L	SOMERSET	SAN ANTONIO	0	0	0	0	0	0
L	ST. HEDWIG	SAN ANTONIO	0	0	0	0	0	0
L	STEAM ELECTRIC POWER, BEXAR	SAN ANTONIO	23,685	19,399	16,625	13,545	10,125	6,374
L	TERRELL HILLS	SAN ANTONIO	0	0	0	0	0	0
L	THE OAKS WSC	SAN ANTONIO	121	58	-1	-60	-114	-165
L	UNIVERSAL CITY	SAN ANTONIO	-416	-431	-372	-339	-333	-332
L	VON ORMY	SAN ANTONIO	70	57	45	32	19	6
L	WATER SERVICES INC	SAN ANTONIO	402	337	274	206	139	78
L	WINDCREST	SAN ANTONIO	-326	-343	-361	-388	-420	-451
		Sum of Projected Water Supply Needs (acre-feet)	**-61,498**	**-87,009**	**-110,801**	**-139,602**	**-169,573**	**-199,085**

COMAL COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
L	BULVERDE	GUADALUPE	0	0	0	0	0	0
L	BULVERDE	SAN ANTONIO	0	0	0	0	0	0
L	CANYON LAKE WATER SERVICE COMPANY	GUADALUPE	796	-541	-1,913	-3,298	-4,680	-6,009
L	CANYON LAKE WATER SERVICE COMPANY	SAN ANTONIO	190	-130	-460	-797	-1,134	-1,459
L	COUNTY-OTHER, COMAL	GUADALUPE	722	754	822	851	918	965
L	COUNTY-OTHER, COMAL	SAN ANTONIO	92	69	33	24	2	6
L	CRYSTAL CLEAR WSC	GUADALUPE	40	-5	-54	-103	-156	-207
L	FAIR OAKS RANCH	SAN ANTONIO	88	71	56	50	33	16
L	GARDEN RIDGE	GUADALUPE	-653	-1,021	-1,398	-1,780	-2,161	-2,528
L	GARDEN RIDGE	SAN ANTONIO	-370	-578	-790	-1,006	-1,222	-1,429
L	GREEN VALLEY SUD	GUADALUPE	-2	-4	-9	-14	-21	-26
L	IRRIGATION, COMAL	GUADALUPE	493	528	563	598	632	652
L	IRRIGATION, COMAL	SAN ANTONIO	3	7	11	15	18	21
L	LIVESTOCK, COMAL	GUADALUPE	0	0	0	0	0	0
L	LIVESTOCK, COMAL	SAN ANTONIO	0	0	0	0	0	0
L	MANUFACTURING, COMAL	GUADALUPE	-4,089	-4,832	-5,556	-6,176	-7,049	-7,993
L	MANUFACTURING, COMAL	SAN ANTONIO	-41	-49	-56	-63	-71	-81

Projected Water Supply Needs
TWDB 2017 State Water Plan Data

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

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
L	MINING, COMAL	GUADALUPE	0	0	0	0	0	0
L	MINING, COMAL	SAN ANTONIO	0	0	0	0	0	0
L	NEW BRAUNFELS	GUADALUPE	2,069	-661	-3,515	-6,452	-9,435	-12,329
L	SAN ANTONIO WATER SYSTEM	GUADALUPE	-104	-329	-540	-749	-972	-1,194
L	SAN ANTONIO WATER SYSTEM	SAN ANTONIO	-89	-283	-463	-639	-833	-1,030
L	SCHERTZ	GUADALUPE	0	0	-56	-221	-452	-718
L	SCHERTZ	SAN ANTONIO	0	0	-2	-5	-11	-18
L	SELMA	SAN ANTONIO	2	-1	0	-1	-1	-1
	Sum of Projected Water Supply Needs (acre-feet)		**-5,348**	**-8,434**	**-14,812**	**-21,304**	**-28,198**	**-35,022**

KENDALL COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
L	BOERNE	SAN ANTONIO	2,159	1,265	308	-650	-1,639	-2,613
L	COUNTY-OTHER, KENDALL	COLORADO	47	40	31	22	13	3
L	COUNTY-OTHER, KENDALL	GUADALUPE	2,327	1,989	1,625	1,252	856	464
L	COUNTY-OTHER, KENDALL	SAN ANTONIO	383	341	272	168	84	1
L	FAIR OAKS RANCH	SAN ANTONIO	540	512	459	426	298	153
L	IRRIGATION, KENDALL	GUADALUPE	55	61	68	73	78	84
L	IRRIGATION, KENDALL	SAN ANTONIO	30	32	33	35	36	37
L	KENDALL COUNTY WCID #1	GUADALUPE	472	434	391	345	294	244
L	LIVESTOCK, KENDALL	COLORADO	0	0	0	0	0	0
L	LIVESTOCK, KENDALL	GUADALUPE	0	0	0	0	0	0
L	LIVESTOCK, KENDALL	SAN ANTONIO	0	0	0	0	0	0
L	WATER SERVICES INC	SAN ANTONIO	28	25	23	18	13	8
	Sum of Projected Water Supply Needs (acre-feet)		**0**	**0**	**0**	**-650**	**-1,639**	**-2,613**

BEXAR COUNTY

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

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
ALAMO HEIGHTS, SAN ANTONIO (L)							
BRACKISH WILCOX GROUNDWATER FOR SAWS	CARRIZO-WILCOX AQUIFER [BEXAR]	796	848	820	807	805	805
DROUGHT MANAGEMENT - ALAMO HEIGHTS	DEMAND REDUCTION [BEXAR]	111	0	0	0	0	0
EDWARDS TRANSFERS	EDWARDS-BFZ AQUIFER [MEDINA]	796	848	820	807	805	805
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [BEXAR]	104	280	442	601	755	895
		1,807	**1,976**	**2,082**	**2,215**	**2,365**	**2,505**
ATASCOSA RURAL WSC, NUECES (L)							
BRACKISH WILCOX GROUNDWATER FOR SAWS	CARRIZO-WILCOX AQUIFER [BEXAR]	64	79	94	108	121	134
DROUGHT MANAGEMENT - ATASCOSA RURAL WSC	DEMAND REDUCTION [BEXAR]	4	0	0	0	0	0
EDWARDS TRANSFERS	EDWARDS-BFZ AQUIFER [MEDINA]	64	63	94	108	121	134
FACILITIES EXPANSIONS - ATASCOSA RURAL WSC	EDWARDS-BFZ AQUIFER [BEXAR]	0	0	0	0	0	0
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [BEXAR]	0	0	0	0	0	3
		132	**142**	**188**	**216**	**242**	**271**
ATASCOSA RURAL WSC, SAN ANTONIO (L)							
BRACKISH WILCOX GROUNDWATER FOR SAWS	CARRIZO-WILCOX AQUIFER [BEXAR]	1,103	1,367	1,614	1,862	2,097	2,314
DROUGHT MANAGEMENT - ATASCOSA RURAL WSC	DEMAND REDUCTION [BEXAR]	76	0	0	0	0	0
EDWARDS TRANSFERS	EDWARDS-BFZ AQUIFER [MEDINA]	1,103	1,083	1,614	1,862	2,097	2,314
FACILITIES EXPANSIONS - ATASCOSA RURAL WSC	EDWARDS-BFZ AQUIFER [BEXAR]	0	0	0	0	0	0
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [BEXAR]	0	0	0	0	0	52
		2,282	**2,450**	**3,228**	**3,724**	**4,194**	**4,680**
BALCONES HEIGHTS, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [BEXAR]	0	0	0	0	12	32
		0	**0**	**0**	**0**	**12**	**32**

Projected Water Management Strategies
TWDB 2017 State Water Plan Data

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

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
CHINA GROVE, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [BEXAR]	13	40	71	107	138	155
		13	**40**	**71**	**107**	**138**	**155**
CONVERSE, SAN ANTONIO (L)							
DROUGHT MANAGEMENT - CONVERSE	DEMAND REDUCTION [BEXAR]	127	0	0	0	0	0
EDWARDS TRANSFERS	EDWARDS-BFZ AQUIFER [MEDINA]	903	1,111	1,297	1,272	1,265	1,264
HAYS/CALDWELL PUA PROJECT	CARRIZO-WILCOX AQUIFER [CALDWELL]	903	1,111	1,297	1,272	1,265	1,264
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [BEXAR]	0	0	0	0	0	9
		1,933	**2,222**	**2,594**	**2,544**	**2,530**	**2,537**
COUNTY-OTHER, BEXAR, NUECES (L)							
BRACKISH WILCOX GROUNDWATER FOR SAWS	CARRIZO-WILCOX AQUIFER [BEXAR]	0	0	0	125	411	638
EXPANDED LOCAL CARRIZO FOR SAWS	CARRIZO-WILCOX AQUIFER [BEXAR]	0	0	0	0	0	0
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [BEXAR]	65	177	253	303	366	432
		65	**177**	**253**	**428**	**777**	**1,070**
COUNTY-OTHER, BEXAR, SAN ANTONIO (L)							
BRACKISH WILCOX GROUNDWATER FOR SAWS	CARRIZO-WILCOX AQUIFER [BEXAR]	0	0	0	1,773	1,702	1,185
EXPANDED LOCAL CARRIZO FOR SAWS	CARRIZO-WILCOX AQUIFER [BEXAR]	0	0	0	0	1,969	4,225
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [BEXAR]	158	572	1,028	1,504	2,053	2,656
		158	**572**	**1,028**	**3,277**	**5,724**	**8,066**
EAST CENTRAL SUD, SAN ANTONIO (L)							
HAYS/CALDWELL PUA PROJECT	CARRIZO-WILCOX AQUIFER [CALDWELL]	0	415	410	406	422	577
		0	**415**	**410**	**406**	**422**	**577**
ELMENDORF, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [BEXAR]	0	0	0	2	17	35
		0	**0**	**0**	**2**	**17**	**35**

Projected Water Management Strategies

TWDB 2017 State Water Plan Data

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

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
FAIR OAKS RANCH, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [BEXAR]	73	191	307	406	521	617
		73	**191**	**307**	**406**	**521**	**617**
GREEN VALLEY SUD, SAN ANTONIO (L)							
BRACKISH WILCOX GROUNDWATER FOR CRWA	CARRIZO-WILCOX AQUIFER [WILSON]	0	0	0	0	0	68
CRWA SIESTA PROJECT	DIRECT REUSE [BEXAR]	0	0	0	43	0	308
CRWA SIESTA PROJECT	SAN ANTONIO RUN-OF-RIVER [WILSON]	0	0	0	36	0	245
CRWA WELLS RANCH PROJECT PHASE II	CARRIZO-WILCOX AQUIFER [GUADALUPE]	478	585	556	914	833	565
DROUGHT MANAGEMENT - GREEN VALLEY SUD	DEMAND REDUCTION [BEXAR]	12	0	0	0	0	0
		490	**585**	**556**	**993**	**833**	**1,186**
HELOTES, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [BEXAR]	67	132	195	276	370	476
		67	**132**	**195**	**276**	**370**	**476**
HILL COUNTRY VILLAGE, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [BEXAR]	10	27	43	58	66	70
		10	**27**	**43**	**58**	**66**	**70**
HOLLYWOOD PARK, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [BEXAR]	53	126	198	269	340	407
		53	**126**	**198**	**269**	**340**	**407**
IRRIGATION, BEXAR, NUECES (L)							
IRRIGATION WATER CONSERVATION	DEMAND REDUCTION [BEXAR]	0	0	0	0	0	0
		0	**0**	**0**	**0**	**0**	**0**
IRRIGATION, BEXAR, SAN ANTONIO (L)							
IRRIGATION WATER CONSERVATION	DEMAND REDUCTION [BEXAR]	0	0	0	0	0	0
		0	**0**	**0**	**0**	**0**	**0**
KIRBY, SAN ANTONIO (L)							
BRACKISH WILCOX GROUNDWATER FOR SAWS	CARRIZO-WILCOX AQUIFER [BEXAR]	137	207	181	172	169	169
DROUGHT MANAGEMENT - KIRBY	DEMAND REDUCTION [BEXAR]	47	0	0	0	0	0

Projected Water Management Strategies
TWDB 2017 State Water Plan Data

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

WUG, Basin (RWPG)	Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
	EDWARDS TRANSFERS	EDWARDS-BFZ AQUIFER [UVALDE]	137	207	181	172	169	169
			321	**414**	**362**	**344**	**338**	**338**
LEON VALLEY, SAN ANTONIO (L)								
	BRACKISH WILCOX GROUNDWATER FOR SAWS	CARRIZO-WILCOX AQUIFER [BEXAR]	97	147	196	254	317	377
	DROUGHT MANAGEMENT - LEON VALLEY	DEMAND REDUCTION [BEXAR]	93	0	0	0	0	0
	EDWARDS TRANSFERS	EDWARDS-BFZ AQUIFER [UVALDE]	97	147	196	254	317	377
	MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [BEXAR]	55	136	149	182	236	294
			342	**430**	**541**	**690**	**870**	**1,048**
LIVE OAK, SAN ANTONIO (L)								
	MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [BEXAR]	94	276	297	333	385	440
			94	**276**	**297**	**333**	**385**	**440**
LYTLE, NUECES (L)								
	DROUGHT MANAGEMENT - LYTLE	DEMAND REDUCTION [BEXAR]	0	0	0	0	0	0
	EDWARDS TRANSFERS	EDWARDS-BFZ AQUIFER [BEXAR]	3	6	8	11	13	15
	MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [BEXAR]	0	2	3	4	4	6
			3	**8**	**11**	**15**	**17**	**21**
MANUFACTURING, BEXAR, SAN ANTONIO (L)								
	DIRECT RECYCLED WATER PROGRAMS - SAWS	DIRECT REUSE [BEXAR]	0	0	0	0	1,058	3,680
			0	**0**	**0**	**0**	**1,058**	**3,680**
OLMOS PARK, SAN ANTONIO (L)								
	MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [BEXAR]	21	68	123	188	215	244
			21	**68**	**123**	**188**	**215**	**244**
RANDOLPH AFB, SAN ANTONIO (L)								
	MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [BEXAR]	3	5	9	13	17	21
			3	**5**	**9**	**13**	**17**	**21**
SAN ANTONIO, SAN ANTONIO (L)								
	BRACKISH WILCOX GROUNDWATER FOR SAWS	CARRIZO-WILCOX AQUIFER [BEXAR]	3,425	2,974	2,717	521	0	0

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

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
DIRECT RECYCLED WATER PROGRAMS - SAWS	DIRECT REUSE [BEXAR]	3,917	4,928	5,000	14,999	23,940	36,317
DROUGHT MANAGEMENT - SAWS	DEMAND REDUCTION [BEXAR]	14,673	38,515	55,533	59,873	64,180	68,185
EAHCP FOR SAWS	EDWARDS-BFZ AQUIFER [BEXAR]	0	0	0	0	0	0
EXPANDED LOCAL CARRIZO FOR SAWS	CARRIZO-WILCOX AQUIFER [BEXAR]	5,500	5,500	5,500	5,500	3,450	1,194
MUNICIPAL WATER CONSERVATION (URBAN) - SAN ANTONIO	DEMAND REDUCTION [BEXAR]	15,973	10,704	6,901	14,669	30,585	43,089
SAWS SEAWATER DESALINATION	GULF OF MEXICO [GULF OF MEXICO]	0	0	12,318	23,336	37,362	48,275
VISTA RIDGE PROJECT	CARRIZO-WILCOX AQUIFER [BURLESON]	4,173	4,193	5,227	5,612	4,273	950
		47,661	**66,814**	**93,196**	**124,510**	**163,790**	**198,010**

SAN ANTONIO WATER SYSTEM, SAN ANTONIO (L)

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
MUNICIPAL WATER CONSERVATION (SUBURBAN) - SAWS	DEMAND REDUCTION [BEXAR]	0	0	0	0	0	593
REGIONAL CARRIZO FOR SSLGC PROJECT EXPANSION	CARRIZO-WILCOX AQUIFER [GONZALES]	1,236	4,270	0	0	0	0
SAWS SEAWATER DESALINATION	GULF OF MEXICO [GULF OF MEXICO]	0	0	5,109	5,052	5,003	4,964
VISTA RIDGE PROJECT	CARRIZO-WILCOX AQUIFER [BURLESON]	3,204	6,382	9,375	12,400	15,350	18,075
		4,440	**10,652**	**14,484**	**17,452**	**20,353**	**23,632**

SCHERTZ, SAN ANTONIO (L)

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
CIBOLO VALLEY LGC CARRIZO PROJECT	CARRIZO-WILCOX AQUIFER [WILSON]	0	0	0	0	85	187
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [BEXAR]	8	13	21	33	53	75
REGIONAL CARRIZO FOR SSLGC PROJECT EXPANSION	CARRIZO-WILCOX AQUIFER [GONZALES]	17	29	36	122	140	140
		25	**42**	**57**	**155**	**278**	**402**

SELMA, SAN ANTONIO (L)

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [BEXAR]	41	55	80	109	141	176
REGIONAL CARRIZO FOR SSLGC PROJECT EXPANSION	CARRIZO-WILCOX AQUIFER [GONZALES]	0	7	57	107	157	206
		41	**62**	**137**	**216**	**298**	**382**

SHAVANO PARK, SAN ANTONIO (L)

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
DROUGHT MANAGEMENT - SHAVANO PARK	DEMAND REDUCTION [BEXAR]	55	0	0	0	0	0

Projected Water Management Strategies
TWDB 2017 State Water Plan Data

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

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
EDWARDS TRANSFERS	EDWARDS-BFZ AQUIFER [UVALDE]	425	555	677	797	909	1,013
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [BEXAR]	67	174	296	429	567	709
		547	**729**	**973**	**1,226**	**1,476**	**1,722**
ST. HEDWIG, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [BEXAR]	0	0	0	0	0	3
		0	**0**	**0**	**0**	**0**	**3**
STEAM ELECTRIC POWER, BEXAR, SAN ANTONIO (L)							
CPS DIRECT RECYCLE PIPELINE	DIRECT REUSE [BEXAR]	50,000	50,000	50,000	50,000	50,000	50,000
		50,000	**50,000**	**50,000**	**50,000**	**50,000**	**50,000**
TERRELL HILLS, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [BEXAR]	52	148	237	325	379	400
		52	**148**	**237**	**325**	**379**	**400**
THE OAKS WSC, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [BEXAR]	15	42	54	71	90	111
VISTA RIDGE PROJECT	CARRIZO-WILCOX AQUIFER [BURLESON]	0	0	1	60	114	165
		15	**42**	**55**	**131**	**204**	**276**
UNIVERSAL CITY, SAN ANTONIO (L)							
DROUGHT MANAGEMENT - UNIVERSAL CITY	DEMAND REDUCTION [BEXAR]	160	0	0	0	0	0
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [BEXAR]	0	0	0	0	69	143
REGIONAL CARRIZO FOR SSLGC PROJECT EXPANSION	CARRIZO-WILCOX AQUIFER [GONZALES]	416	431	372	339	333	332
		576	**431**	**372**	**339**	**402**	**475**
WATER SERVICES INC, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [BEXAR]	15	16	19	35	57	80
		15	**16**	**19**	**35**	**57**	**80**
WINDCREST, SAN ANTONIO (L)							
DROUGHT MANAGEMENT - WINDCREST	DEMAND REDUCTION [BEXAR]	60	0	0	0	0	0
EDWARDS TRANSFERS	EDWARDS-BFZ AQUIFER [UVALDE]	326	343	361	388	420	451

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

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [BEXAR]	51	139	228	309	340	372
		437	**482**	**589**	**697**	**760**	**823**
Sum of Projected Water Management Strategies (acre-feet)		**111,676**	**139,674**	**172,615**	**211,590**	**259,448**	**304,681**

COMAL COUNTY

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

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
BULVERDE, GUADALUPE (L)							
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [COMAL]	0	0	0	0	0	1
		0	**0**	**0**	**0**	**0**	**1**
BULVERDE, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [COMAL]	0	0	0	1	32	70
		0	**0**	**0**	**1**	**32**	**70**
CANYON LAKE WATER SERVICE COMPANY, GUADALUPE (L)							
GBRA - MBWSP - CONJUNCTIVE USE (OPTION 3A) - CARRIZO DEVELOPMENT	CARRIZO-WILCOX AQUIFER [GONZALES]	0	541	1,913	3,298	4,680	6,009
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [COMAL]	0	0	0	59	253	504
		0	**541**	**1,913**	**3,357**	**4,933**	**6,513**
CANYON LAKE WATER SERVICE COMPANY, SAN ANTONIO (L)							
GBRA - MBWSP - CONJUNCTIVE USE (OPTION 3A) - CARRIZO DEVELOPMENT	CARRIZO-WILCOX AQUIFER [GONZALES]	0	130	460	797	1,134	1,459
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [COMAL]	0	0	0	15	63	125
		0	**130**	**460**	**812**	**1,197**	**1,584**
CRYSTAL CLEAR WSC, GUADALUPE (L)							
CRWA WELLS RANCH PROJECT PHASE II	CARRIZO-WILCOX AQUIFER [GUADALUPE]	36	122	143	0	0	0
HAYS/CALDWELL PUA PROJECT	CARRIZO-WILCOX AQUIFER [CALDWELL]	59	138	110	246	239	233
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [COMAL]	0	0	0	0	0	9
		95	**260**	**253**	**246**	**239**	**242**

Projected Water Management Strategies
TWDB 2017 State Water Plan Data

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

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
FAIR OAKS RANCH, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [COMAL]	6	17	30	43	60	75
		6	**17**	**30**	**43**	**60**	**75**
GARDEN RIDGE, GUADALUPE (L)							
DROUGHT MANAGEMENT - GARDEN RIDGE	DEMAND REDUCTION [COMAL]	53	0	0	0	0	0
LOCAL TRINITY AQUIFER DEVELOPMENT	TRINITY AQUIFER [COMAL]	1,278	1,278	1,278	1,278	1,278	1,278
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [COMAL]	65	204	399	644	928	1,240
REGIONAL CARRIZO FOR SSLGC PROJECT EXPANSION	CARRIZO-WILCOX AQUIFER [GONZALES]	96	96	96	96	96	96
		1,492	**1,578**	**1,773**	**2,018**	**2,302**	**2,614**
GARDEN RIDGE, SAN ANTONIO (L)							
DROUGHT MANAGEMENT - GARDEN RIDGE	DEMAND REDUCTION [COMAL]	30	0	0	0	0	0
LOCAL TRINITY AQUIFER DEVELOPMENT	TRINITY AQUIFER [COMAL]	722	722	722	722	722	722
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [COMAL]	36	115	226	364	525	701
REGIONAL CARRIZO FOR SSLGC PROJECT EXPANSION	CARRIZO-WILCOX AQUIFER [GONZALES]	54	54	54	54	54	54
		842	**891**	**1,002**	**1,140**	**1,301**	**1,477**
GREEN VALLEY SUD, GUADALUPE (L)							
BRACKISH WILCOX GROUNDWATER FOR CRWA	CARRIZO-WILCOX AQUIFER [WILSON]	0	0	0	0	0	11
CRWA SIESTA PROJECT	DIRECT REUSE [BEXAR]	0	0	0	6	0	52
CRWA SIESTA PROJECT	SAN ANTONIO RUN-OF-RIVER [WILSON]	0	0	0	5	0	41
CRWA WELLS RANCH PROJECT PHASE II	CARRIZO-WILCOX AQUIFER [GUADALUPE]	54	75	77	139	140	105
DROUGHT MANAGEMENT - GREEN VALLEY SUD	DEMAND REDUCTION [COMAL]	1	0	0	0	0	0
		55	**75**	**77**	**150**	**140**	**209**
MANUFACTURING, COMAL, GUADALUPE (L)							
GBRA - MBWSP - CONJUNCTIVE USE (OPTION 3A) - CARRIZO DEVELOPMENT	CARRIZO-WILCOX AQUIFER [GONZALES]	4,089	4,832	5,556	1,916	0	0
GBRA - MBWSP - CONJUNCTIVE USE W/ASR (OPTION 3A)	CARRIZO-WILCOX AQUIFER ASR [GONZALES]	0	0	0	4,260	7,049	7,993
		4,089	**4,832**	**5,556**	**6,176**	**7,049**	**7,993**

Projected Water Management Strategies
TWDB 2017 State Water Plan Data

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

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
MANUFACTURING, COMAL, SAN ANTONIO (L)							
GBRA - MBWSP - CONJUNCTIVE USE (OPTION 3A) - CARRIZO DEVELOPMENT	CARRIZO-WILCOX AQUIFER [GONZALES]	41	49	56	31	0	0
GBRA - MBWSP - CONJUNCTIVE USE W/ASR (OPTION 3A)	CARRIZO-WILCOX AQUIFER ASR [GONZALES]	0	0	0	32	71	81
		41	**49**	**56**	**63**	**71**	**81**
NEW BRAUNFELS, GUADALUPE (L)							
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [COMAL]	535	1,817	3,556	4,738	5,853	7,057
NEW BRAUNFELS UTILITY - ASR	TRINITY AND/OR BRACKISH EDWARDS AQUIFER ASR [COMAL]	6,893	6,937	6,967	6,992	7,008	7,018
NEW BRAUNFELS UTILITY - TRINITY DEVELOPMENT	TRINITY AQUIFER [COMAL]	0	3,343	3,357	3,370	3,377	3,382
REUSE - NEW BRAUNFELS	DIRECT REUSE [COMAL]	5,834	6,604	7,191	8,095	9,047	9,900
		13,262	**18,701**	**21,071**	**23,195**	**25,285**	**27,357**
SAN ANTONIO WATER SYSTEM, GUADALUPE (L)							
MUNICIPAL WATER CONSERVATION (SUBURBAN) - SAWS	DEMAND REDUCTION [COMAL]	0	0	0	0	0	31
REGIONAL CARRIZO FOR SSLGC PROJECT EXPANSION	CARRIZO-WILCOX AQUIFER [GONZALES]	29	132	0	0	0	0
SAWS SEAWATER DESALINATION	GULF OF MEXICO [GULF OF MEXICO]	0	0	190	216	239	257
VISTA RIDGE PROJECT	CARRIZO-WILCOX AQUIFER [BURLESON]	75	197	350	533	733	936
		104	**329**	**540**	**749**	**972**	**1,224**
SAN ANTONIO WATER SYSTEM, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION (SUBURBAN) - SAWS	DEMAND REDUCTION [COMAL]	0	0	0	0	0	27
REGIONAL CARRIZO FOR SSLGC PROJECT EXPANSION	CARRIZO-WILCOX AQUIFER [GONZALES]	25	113	0	0	0	0
SAWS SEAWATER DESALINATION	GULF OF MEXICO [GULF OF MEXICO]	0	0	163	185	205	222
VISTA RIDGE PROJECT	CARRIZO-WILCOX AQUIFER [BURLESON]	64	170	300	454	628	809
		89	**283**	**463**	**639**	**833**	**1,058**
SCHERTZ, GUADALUPE (L)							
CIBOLO VALLEY LGC CARRIZO PROJECT	CARRIZO-WILCOX AQUIFER [WILSON]	0	0	0	0	170	409
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [COMAL]	9	16	33	62	107	165

Projected Water Management Strategies
TWDB 2017 State Water Plan Data

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

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
REGIONAL CARRIZO FOR SSLGC PROJECT EXPANSION	CARRIZO-WILCOX AQUIFER [GONZALES]	18	39	56	221	282	310
		27	**55**	**89**	**283**	**559**	**884**
SCHERTZ, SAN ANTONIO (L)							
CIBOLO VALLEY LGC CARRIZO PROJECT	CARRIZO-WILCOX AQUIFER [WILSON]	0	0	0	0	4	10
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [COMAL]	0	0	1	2	3	4
REGIONAL CARRIZO FOR SSLGC PROJECT EXPANSION	CARRIZO-WILCOX AQUIFER [GONZALES]	0	1	1	5	7	8
		0	**1**	**2**	**7**	**14**	**22**
SELMA, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [COMAL]	0	0	0	1	1	1
REGIONAL CARRIZO FOR SSLGC PROJECT EXPANSION	CARRIZO-WILCOX AQUIFER [GONZALES]	0	1	0	1	1	1
		0	**1**	**0**	**2**	**2**	**2**
Sum of Projected Water Management Strategies (acre-feet)		**20,102**	**27,743**	**33,285**	**38,881**	**44,989**	**51,406**

KENDALL COUNTY

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

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
BOERNE, SAN ANTONIO (L)							
LOCAL TRINITY AQUIFER DEVELOPMENT	TRINITY AQUIFER [KENDALL]	0	0	0	1,000	1,000	1,000
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [KENDALL]	136	484	985	1,513	1,888	2,294
WESTERN CANYON EXPANSION	CANYON LAKE/RESERVOIR [RESERVOIR]	0	0	0	0	639	1,613
		136	**484**	**985**	**2,513**	**3,527**	**4,907**
COUNTY-OTHER, KENDALL, COLORADO (L)							
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [KENDALL]	0	0	0	0	0	0
		0	**0**	**0**	**0**	**0**	**0**

Projected Water Management Strategies
TWDB 2017 State Water Plan Data

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

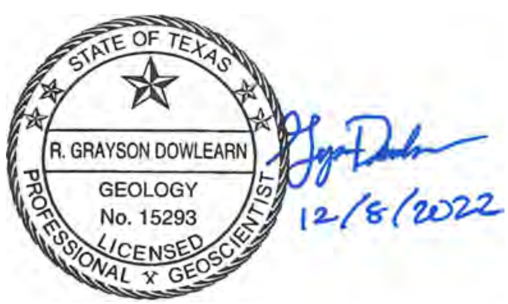
Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
COUNTY-OTHER, KENDALL, GUADALUPE (L)							
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [KENDALL]	0	0	0	0	0	9
		0	**0**	**0**	**0**	**0**	**9**
COUNTY-OTHER, KENDALL, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [KENDALL]	0	0	0	0	0	4
		0	**0**	**0**	**0**	**0**	**4**
FAIR OAKS RANCH, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [KENDALL]	37	123	243	373	546	715
		37	**123**	**243**	**373**	**546**	**715**
WATER SERVICES INC, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [KENDALL]	1	1	2	3	5	8
		1	**1**	**2**	**3**	**5**	**8**
Sum of Projected Water Management Strategies (acre-feet)		**174**	**608**	**1,230**	**2,889**	**4,078**	**5,643**

APPENDIX C – GAM RUN 21-014 MAG

GAM Run 21-014 MAG: Modeled Available Groundwater for the Aquifers in Groundwater Management Area 9

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

December 8, 2022



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GAM RUN 21-014 MAG: MODELED AVAILABLE GROUNDWATER FOR THE AQUIFERS IN GROUNDWATER MANAGEMENT AREA 9

Grayson Dowlearn, P.G.
Texas Water Development Board
Groundwater Division
Groundwater Modeling Section
512-475-1552
December 8, 2022

EXECUTIVE SUMMARY:

Groundwater Management Area (GMA) 9 adopted the desired future conditions for the Hickory and Ellenburger-San Saba aquifers, for the combined Trinity Aquifer and Trinity Group of the Edwards-Trinity (Plateau) Aquifer, and for the Edwards Group of the Edwards-Trinity (Plateau) Aquifer on November 15, 2021. Groundwater Management Area 9 submitted a Desired Future Conditions Explanatory Report (GMA 9 and others, 2021) and other supporting documents to the Texas Water Development Board (TWDB) on December 9, 2021. The TWDB determined that the explanatory report and other materials submitted by the district representatives were administratively complete on November 8, 2022.

Modeled available groundwater estimates are approximately 140 acre-feet per year for the Hickory Aquifer and approximately 60 acre-feet per year for the Ellenburger-San Saba Aquifer for the period between 2020 and 2080. Modeled available groundwater estimates range between a maximum of 90,264 acre-feet per year in 2020 and a minimum of 89,491 acre-feet per year in 2060 for the combination of Trinity Aquifer and Trinity group of the Edwards-Trinity (Plateau) Aquifer within Groundwater Management Area 9. Modeled available groundwater estimates are approximately 2,210 acre-feet per year for the Edwards Group of the Edwards-Trinity (Plateau) Aquifer for the period between 2020 and 2080. Modeled available groundwater estimates are provided in Tables 2 through 10.

Figure 1 provides the groundwater conservation district and county boundaries within Groundwater Management Area 9. Figure 2 provides the county, regional water planning area, and river basin boundaries within Groundwater Management Area 9.

REQUESTOR:

Mr. Ronald Fieseler, General Manager of Blanco Pedernales Groundwater Conservation District and Administrator of Groundwater Management Area 9.

DESCRIPTION OF REQUEST:

Mr. Ronald Fieseler provided the TWDB with the desired future conditions of the aquifers within Groundwater Management Area 9 on behalf of Groundwater Management Area (GMA) 9 in a letter dated December 9, 2021. Groundwater conservation district representatives in Groundwater Management Area 9 adopted desired future conditions for the aquifers within Groundwater Management Area 9 on November 15, 2021, as described in Resolution No. 111521-01 (Appendix D in GMA 9 and others, 2021). Desired future conditions are listed in Table 1 and represent average water level drawdowns across the specified area until the specified ending year.

TABLE 1. DESIRED FUTURE CONDITIONS FOR GROUNDWATER MANAGEMENT AREA 9 EXPRESSED AS AVERAGE DRAWDOWN (ADAPTED FROM SUBMITTED RESOLUTION).

Major or minor aquifer	Desired future condition
Trinity Aquifer and Trinity Group of the Edwards-Trinity (Plateau) Aquifer	Allow for an increase in average drawdown of approximately 30 feet through 2060 (throughout GMA 9) consistent with "Scenario 6" in TWDB GAM Task 10-005
Edwards Group of Edwards-Trinity (Plateau)	Allow for no net increase in average drawdown in Bandera and Kendall counties through 2080
Ellenburger-San Saba	Allow for an increase in average drawdown of no more than 7 feet in Kendall County through 2080
Hickory	Allow for an increase in average drawdown of no more than 7 feet in Kendall County through 2080

Additionally, Groundwater Management Area 9 voted to declare certain aquifers and/or portions of aquifers to be non-relevant for the purposes of joint planning, as shown in Table 2.

TABLE 2. AQUIFERS AND PORTIONS OF AQUIFERS WHICH WERE DECLARED NON-RELEVANT FOR THE PURPOSES OF JOINT PLANNING WITHIN GROUNDWATER MANAGEMENT AREA 9.

Major or minor aquifer	Non-relevant area
Edwards (Balcones Fault Zone) Aquifer	Entire aquifer (Bexar, Comal, Hays, and Travis counties)
Edwards Group of Edwards-Trinity (Plateau) Aquifer	Portion in Blanco and Kerr counties
Ellenburger-San Saba Aquifer	Portion in Blanco and Kerr counties
Hickory Aquifer	Portion in Blanco, Hays, Kerr, and Travis counties
Marble Falls Aquifer	Entire aquifer (Blanco County)

After reviewing the submitted documents, TWDB staff requested clarifications regarding the methodology and assumptions used in the definitions of desired future conditions. Appendix A includes the responses to these clarifications that Groundwater Management Area 9 provided to the TWDB on October 17, 2022.

METHODS:

Hickory and Ellenburger-San Saba Aquifers

The groundwater availability model for the minor aquifers of the Llano Uplift Region of Texas (Version 1.01; Shi and others, 2016a, 2016b) was used to calculate the drawdown and modeled available groundwater for the Hickory and Ellenburger-San Saba aquifers (Llano Uplift aquifers) within Groundwater Management Area 9. The predictive model files used in the evaluation were originally developed by the TWDB in the previous joint planning cycle for GAM Run 16-023 (Jones, 2017). The evaluation in GAM Run 16-023 only went to 2070, so the TWDB extended the model files to 2080 for this evaluation.

Pumping was distributed evenly across the Kendall County portion of the Llano Uplift aquifers and then varied until the desired future condition was achieved within the accepted tolerance defined by Groundwater Management Area 9. Modeled water levels were extracted for December 2010 (initial water levels equivalent to the final stress period of the historically calibrated model) and December 2080 (stress period 70). Drawdown was calculated as the difference in water levels between those two endpoints. Drawdown averages were calculated by aquifer for each area specified in the desired future conditions. The modeled available groundwater values were determined by extracting pumping rates by decade from the model results using ZONEBUDGET USG Version 1.00 (Panday and others, 2013).

Trinity Aquifer and Trinity Group of the Edwards-Trinity (Plateau) Aquifer

The groundwater availability model for the Hill Country Portion of the Trinity Aquifer (Version 2.01; Jones and others, 2011) was used to calculate the drawdown and modeled available groundwater values for the combination of Trinity Aquifer and Trinity Group of the Edwards-Trinity (Plateau) Aquifer within Groundwater Management Area 9. Predictive model files from TWDB GAM Task 10-005 (Hutchison, 2010) were used, as specified by Resolution No. 111521-01 (Appendix D in GMA 9 and others, 2021). GAM Task 10-005 (Hutchison, 2010) ran a predictive pumping scenario ("Scenario 6") under 387 different recharge conditions. For every model run, modeled water levels were extracted for December 2008 (initial water levels) and December 2060 (stress period 50), and drawdown was calculated as the difference in water level between those two endpoints. The drawdown average across Groundwater Management Area 9 was calculated as the average of the 387 scenarios. The TWDB confirmed that the desired future conditions adopted by Groundwater Management Area 9 are achievable using this methodology. The modeled available groundwater values were determined by extracting pumping rates by decade from each model run's results and then averaging the modeled pumping rates from the 387 scenarios using custom Fortran scripts developed by the TWDB for Task 10-005 (Hutchison, 2010).

Edwards Group of the Edwards-Trinity (Plateau) Aquifer

The groundwater availability model for the Hill Country Portion of the Trinity Aquifer (Version 2.01; Jones and others, 2011) was also used to calculate the drawdown and modeled available groundwater for the Edwards Group of the Edwards-Trinity (Plateau) Aquifer within Groundwater Management Area 9. The predictive model files used in the evaluation were originally developed by the TWDB in the previous joint planning cycle for GAM Run 16-023 (Jones, 2017). The evaluation in GAM Run 16-023 only went to 2070, so the TWDB extended these model files to 2080 for this evaluation.

The TWDB created a predictive pumping scenario by copying "Scenario 6" from TWDB Task 10-005 and then varying Edwards Group pumping by a constant multiplier across Bandera and Kendall counties until the desired future condition was achieved within the accepted tolerance defined by Groundwater Management Area 9. The TWDB used these predictive model files to extract modeled water levels from December 1997 (initial water levels equivalent to the final stress period of the historically calibrated model) and December 2080 (stress period 83) and drawdown was calculated as the difference in water level between those two endpoints. The modeled available groundwater values were determined by extracting pumping rates by decade from the model results using ZONEBUDGET Version 3.01 (Harbaugh, 2009).

Modeled Available Groundwater and Permitting

As defined in Chapter 36 of the Texas Water Code (2011), "modeled available groundwater" is the estimated average amount of water that may be produced annually to achieve a desired future condition. Groundwater conservation districts are required to consider modeled available groundwater, along with several other factors, when issuing permits in order to manage groundwater production to achieve the desired future condition(s). The other factors districts must consider include annual precipitation and production patterns, the estimated amount of pumping exempt from permitting, existing permits, and a reasonable estimate of actual groundwater production under existing permits.

PARAMETERS AND ASSUMPTIONS:

Hickory and Ellenburger-San Saba aquifers

- Version 1.01 of the groundwater availability model for the minor aquifers of the Llano Uplift Region of Texas was the base model for this analysis. See Shi and others (2016a, 2016b) for assumptions and limitations of the historical calibrated model.
- In the previous joint planning cycle, the TWDB created predictive model files to extend the base model to 2070 for planning purposes. For the current analysis, these model files were extended an additional ten years to 2080 using the same assumptions used in the previous cycle. See GAM Run 16-023 (Jones, 2017) for assumptions and limitations of this predictive model simulation.
- The model has eight layers, which represent the Cretaceous age and younger water-bearing units (Layer 1), Permian and Pennsylvanian age confining units (Layer 2), the Marble Falls Aquifer and equivalent (Layer 3), Mississippian age confining units (Layer 4), the Ellenburger-San Saba Aquifer and equivalent (Layer 5), Cambrian age confining units (Layer 6), the Hickory Aquifer and equivalent (Layer 7), and Precambrian age confining units (Layer 8).
- To be consistent with assumptions made by Groundwater Management Area 9 (see GMA 9 and others, 2021), the TWDB assumed a tolerance of five percent of the drawdown when comparing desired future conditions to modeled drawdown results.

- The model was run with MODFLOW-USG (Panday and others, 2013).
- Drawdown averages and modeled available groundwater volumes were calculated based on the extent of the official TWDB aquifer boundary (Figures 3 and 4). The most recent TWDB model grid file dated August 23, 2022 (*lnup_grid_poly082322.csv*) was used to determine model cell entity assignment (county, groundwater management area, groundwater conservation district, river basin, regional water planning area).
- Drawdowns for cells that became dry during the simulation were excluded from the drawdown averages. Pumping in dry cells was excluded from the modeled available groundwater calculations.
- Estimates of modeled available groundwater from the model simulation were rounded to the nearest whole number.

Trinity Aquifer and Edwards-Trinity (Plateau) Aquifer

- Version 2.01 of the groundwater availability model for the Hill Country Portion of the Trinity Aquifer was the base model for this analysis. See Jones and others (2011) for assumptions and limitations of the historical calibrated model.
- The model has four layers which represent the Edwards Group of the Edwards-Trinity (Plateau) Aquifer (Layer 1), the Upper Trinity hydrostratigraphic unit (Layer 2), the Middle Trinity hydrostratigraphic unit (Layer 3), and the Lower Trinity hydrostratigraphic unit (Layer 4).
- The evaluation of the Trinity Aquifer and the Trinity Group of the Edwards-Trinity (Plateau) Aquifer used predictive model files created by the TWDB that extended the base model to 2060 for planning purposes and represented 387 different potential recharge scenarios. See GAM Task 10-005 (Hutchison, 2010) for the assumptions and limitations of these predictive model simulations.
- The evaluation of the Edwards Group of the Edwards-Trinity (Plateau) Aquifer used predictive model files created by the TWDB during the previous joint planning cycle that extended the base model to 2070 for planning purposes. For the current analysis, the TWDB extended these model files an additional ten years to 2080 using the same assumptions used in the previous cycle. See GAM Run 16-023 (Jones, 2017) for assumptions and limitations of this predictive model simulation.
- Although the base model (Jones and others, 2011) was only calibrated to 1997, the TWDB developed a subsequent steady-state version of the model representing observed conditions in the Trinity Aquifer as of 2008 (Chowdhury, 2010). Since that model provided the initial water levels for the GAM Task 10-005 (Hutchison, 2010) predictive model files, the reference year of 2008 can be used for drawdown calculations for the Trinity Aquifer and the Trinity Group of Edwards-Trinity (Plateau) Aquifer. Since this verification did not apply to the Edwards Group of the Edwards-Trinity (Plateau) Aquifer, the original reference year of 1997 from the base model was used for drawdown calculations in that unit.
- Drawdowns for cells that became dry during the simulation were excluded from the drawdown averages. Pumping volumes are reduced to zero if a cell becomes dry during the predictive model run. The modeled available groundwater values do not include dry cells for decades after the cell becomes dry.

- Drawdown averages and modeled available groundwater volumes were calculated based on the extent of active model cells, not the official TWDB aquifer boundary (Figures 5 and 6). The most recent TWDB model grid file dated August 15, 2022 (*trnt_h_grid_poly081522.csv*) was used to determine model cell entity assignment (county, groundwater management area, groundwater conservation district, river basin, regional water planning area).
- To be consistent with Groundwater Management Area 9's assumptions (see GMA 9 and others, 2021), a tolerance of five percent of the desired future condition drawdown was assumed when comparing desired future conditions to modeled drawdown results.
- The model was run with MODFLOW-96 (Harbaugh and McDonald, 1996)
- Estimates of modeled available groundwater from the model simulation were rounded to the nearest whole number.

RESULTS:

The modeled available groundwater estimates that achieve the desired future conditions adopted by Groundwater Management Area 9 are as follows:

- Hickory Aquifer: 140 acre-feet per year (summarized by county and groundwater conservation district in Table 3 and by county, regional water planning area, and river basin in Table 4).
- Ellenburger-San Saba Aquifer: Approximately 60 acre-feet per year for the that (summarized by county and groundwater conservation district in Table 5 and by county, regional water planning area, and river basin in Table 6).
- Combined Trinity Aquifer and Trinity Group of the Edwards-Trinity (Plateau) Aquifer: Ranges from a maximum of 90,264 acre-feet per year in 2020 and a minimum of 89,491 acre-feet per year in 2060 (summarized by county and groundwater conservation district in Table 7 and by county, regional water planning area, and river basin in Table 8).
- Edwards Group of the Edwards-Trinity (Plateau) Aquifer: 2,210 acre-feet per year (summarized by county and groundwater conservation district in Table 9 and by county, regional water planning area, and river basin in Table 10).

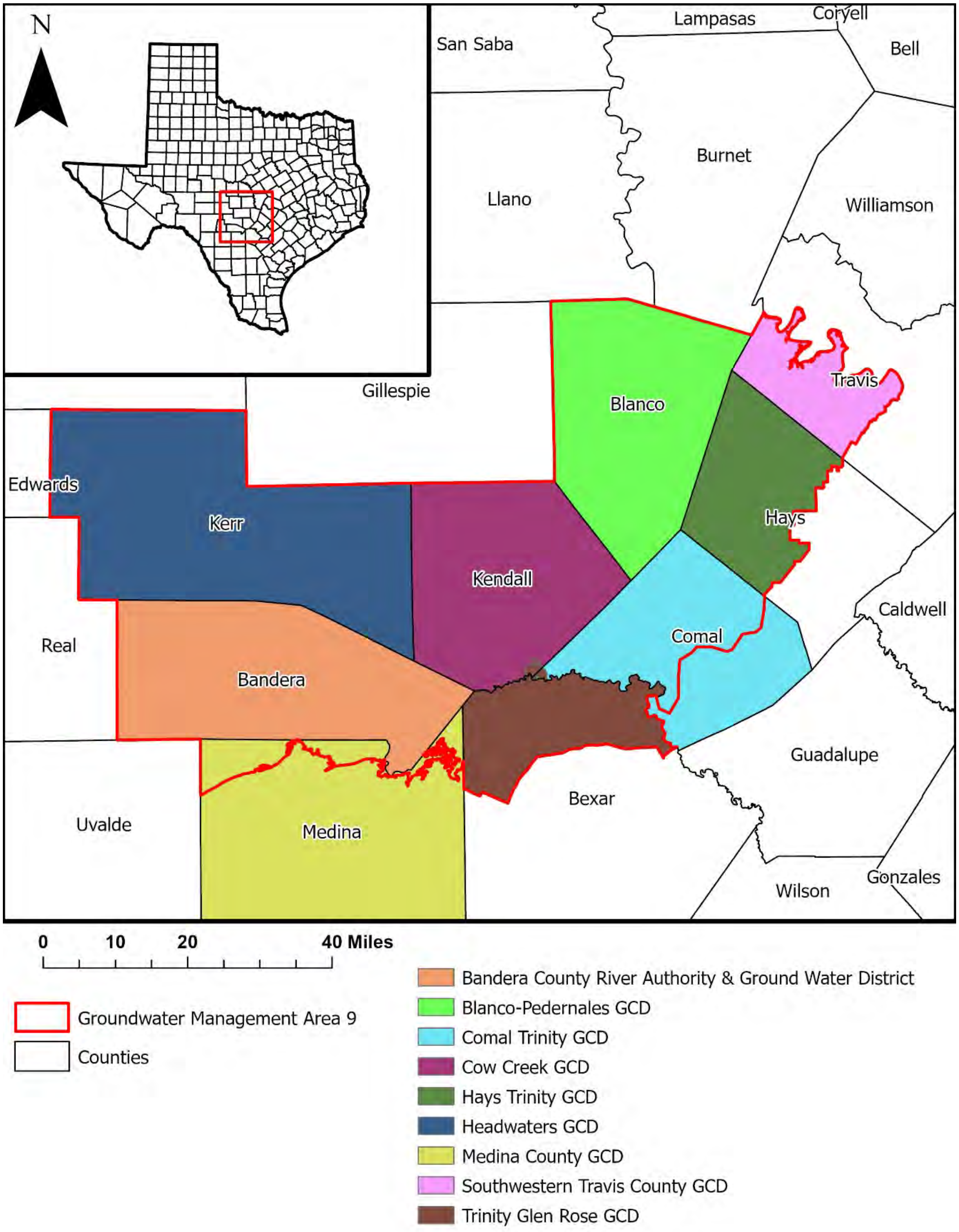

FIGURE 1. MAP SHOWING GROUNDWATER MANAGEMENT AREA 9, GROUNDWATER CONSERVATION DISTRICTS (GCD), AND COUNTY BOUNDARIES.

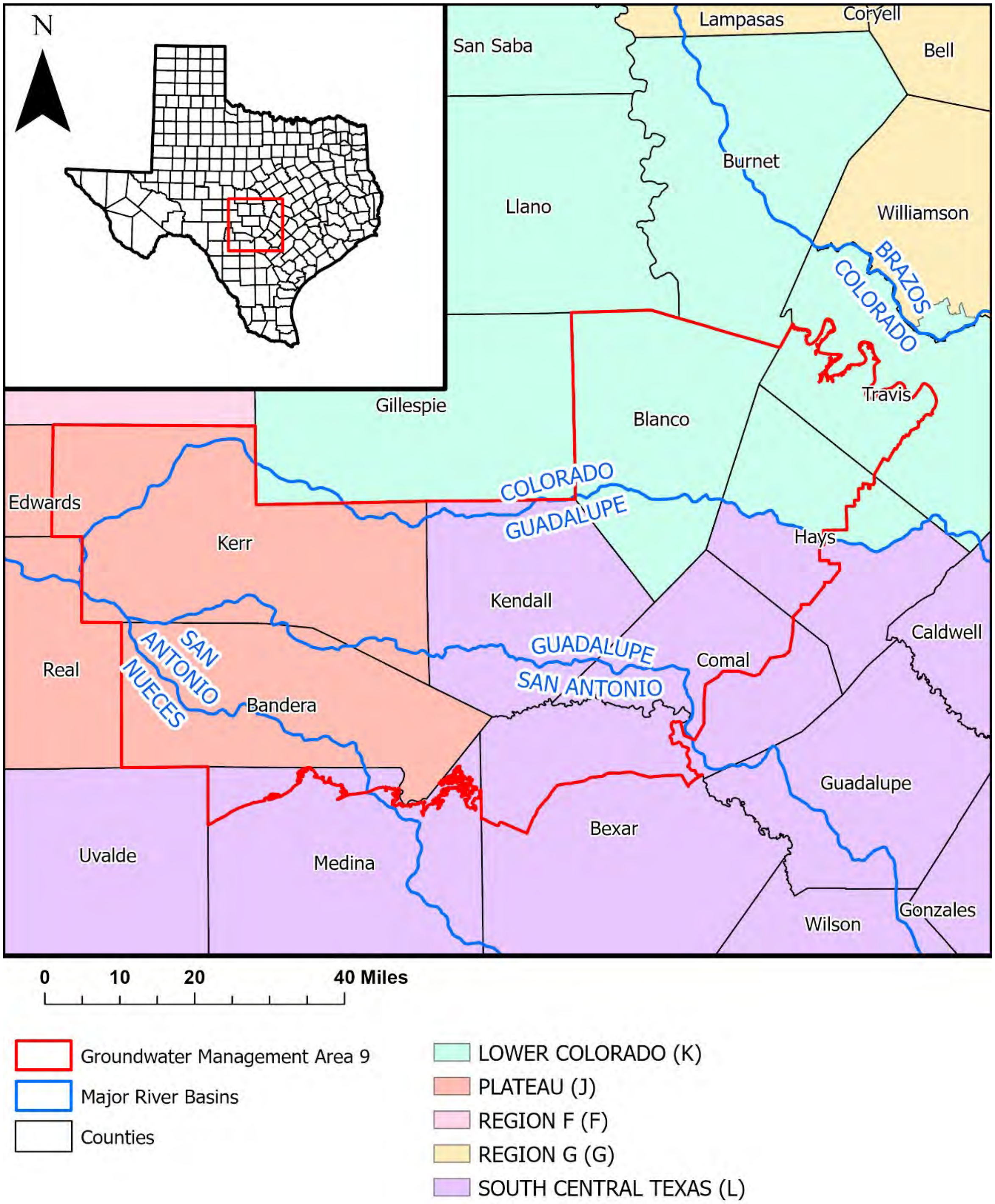

FIGURE 2. MAP SHOWING GROUNDWATER MANAGEMENT AREA 9, REGIONAL WATER PLANNING AREAS, RIVER BASINS, AND COUNTY BOUNDARIES.

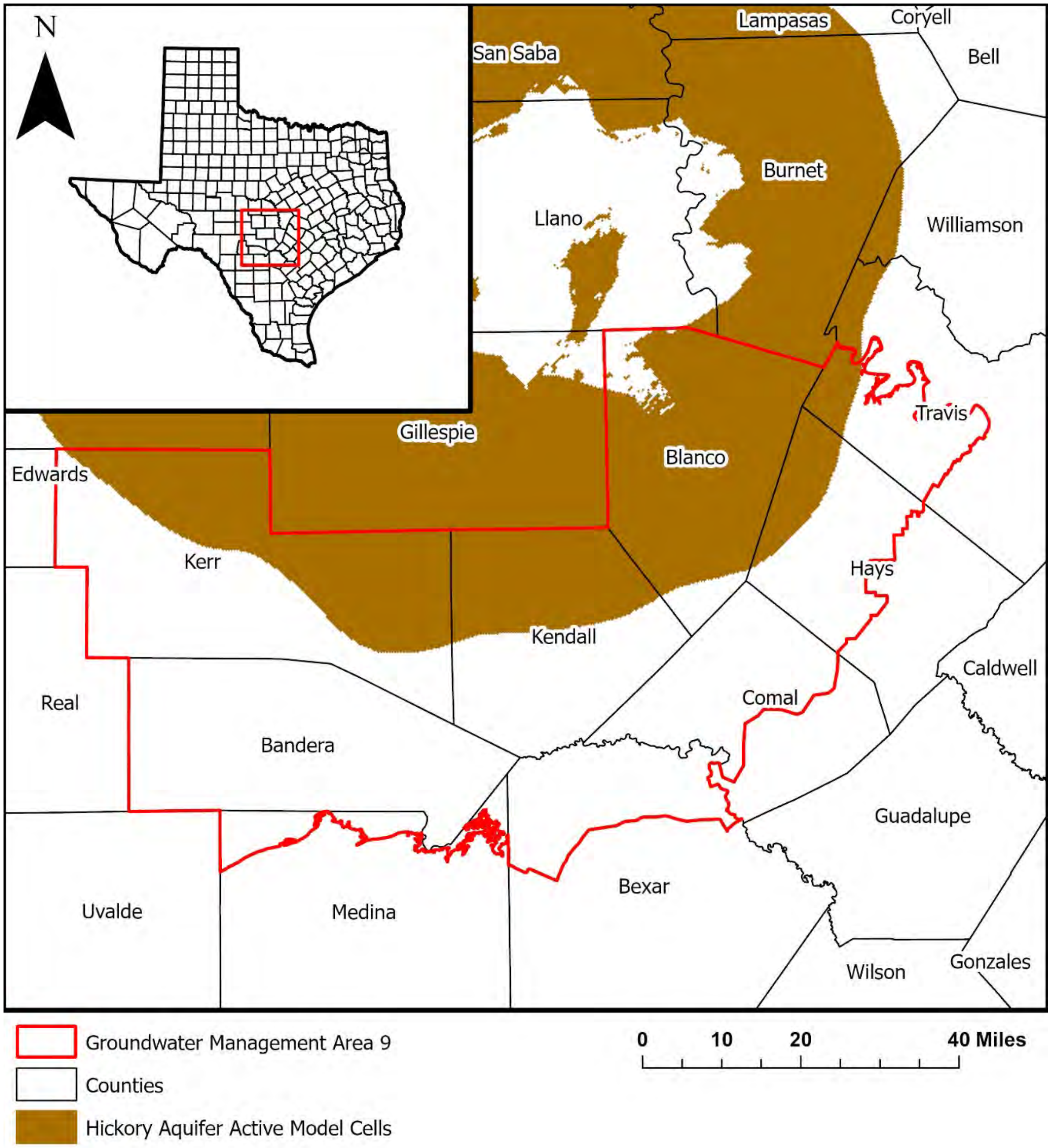

FIGURE 3. MAP SHOWING THE ACTIVE MODEL CELLS REPRESENTING THE HICKORY AQUIFER (LAYER 7) IN THE MINOR AQUIFERS OF THE LLANO UPLIFT REGION OF TEXAS GROUNDWATER AVAILABILITY MODEL IN RELATION TO GROUNDWATER MANAGEMENT AREA 9.

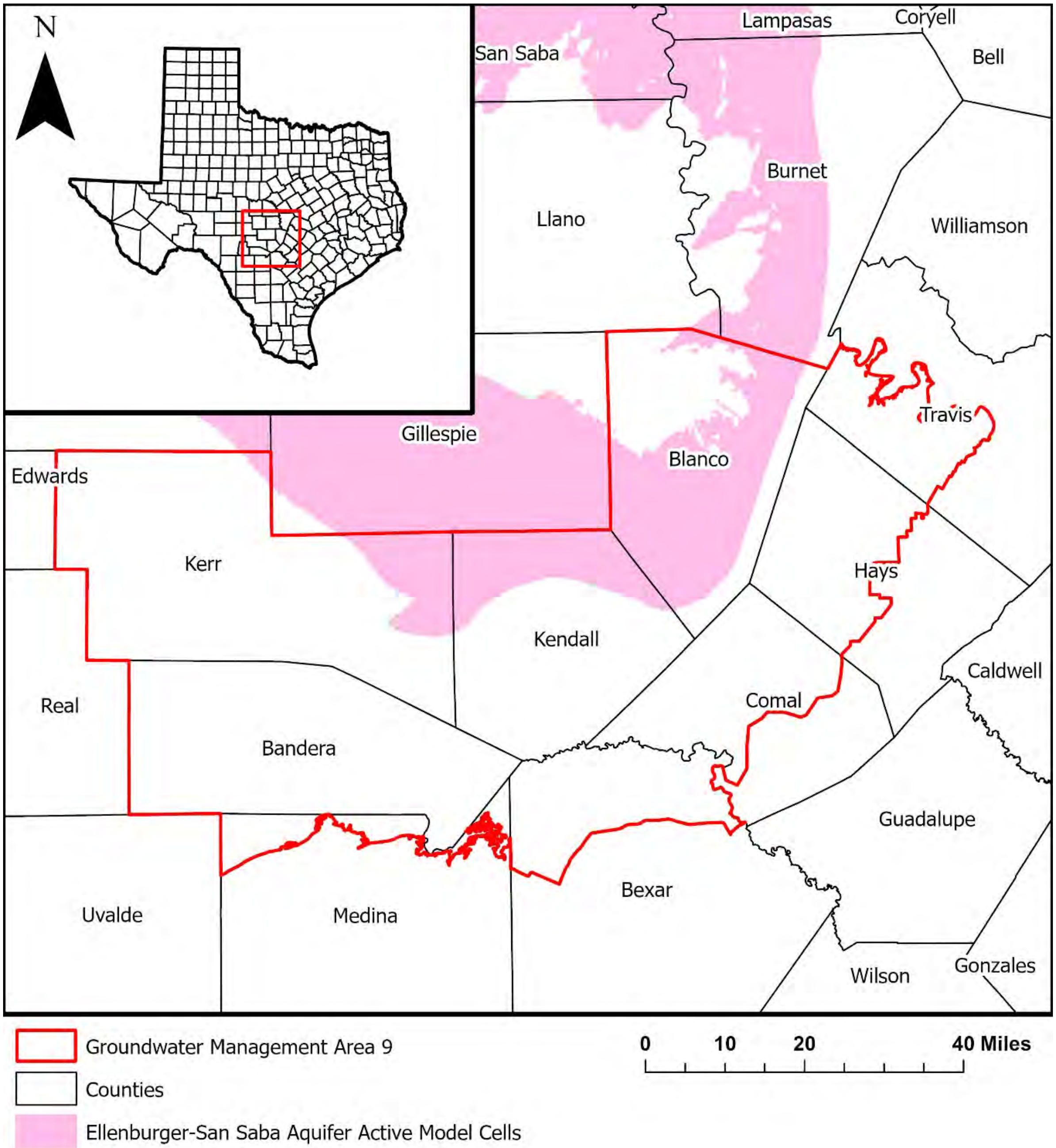

FIGURE 4. MAP SHOWING THE ACTIVE MODEL CELLS REPRESENTING THE ELLENBURGER-SAN SABA AQUIFER (LAYER 5) IN THE MINOR AQUIFERS OF THE LLANO UPLIFT REGION OF TEXAS GROUNDWATER AVAILABILITY MODEL IN RELATION TO GROUNDWATER MANAGEMENT AREA 9.

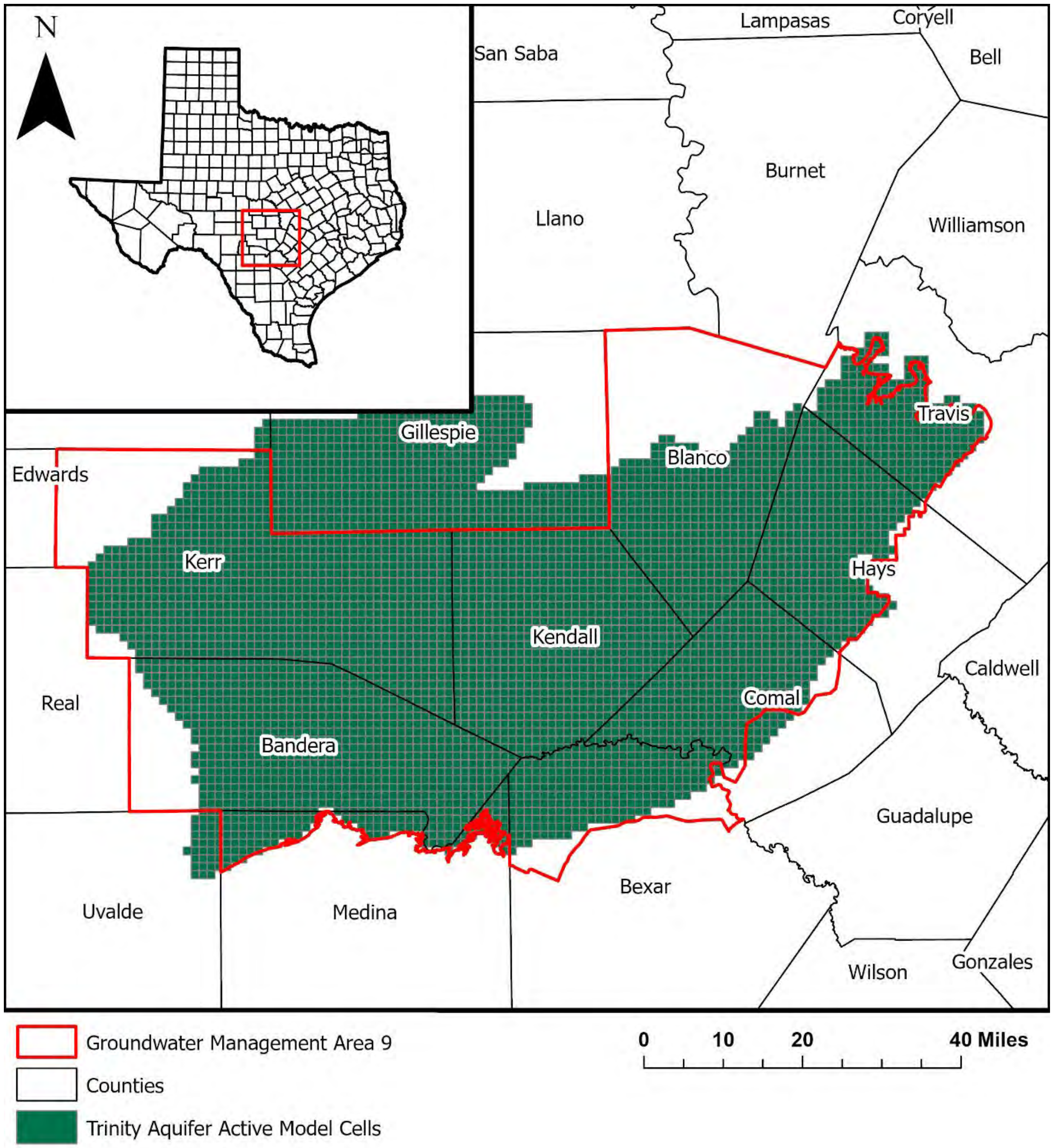

FIGURE 5. MAP SHOWING THE ACTIVE MODEL CELLS REPRESENTING THE TRINITY AQUIFER AND TRINITY GROUP OF THE EDWARDS-TRINITY (PLATEAU) AQUIFER (LAYERS 2, 3, AND 4) IN THE HILL COUNTRY PORTION OF THE TRINITY AQUIFER GROUNDWATER AVAILABILITY MODEL IN RELATION TO GROUNDWATER MANAGEMENT AREA 9.

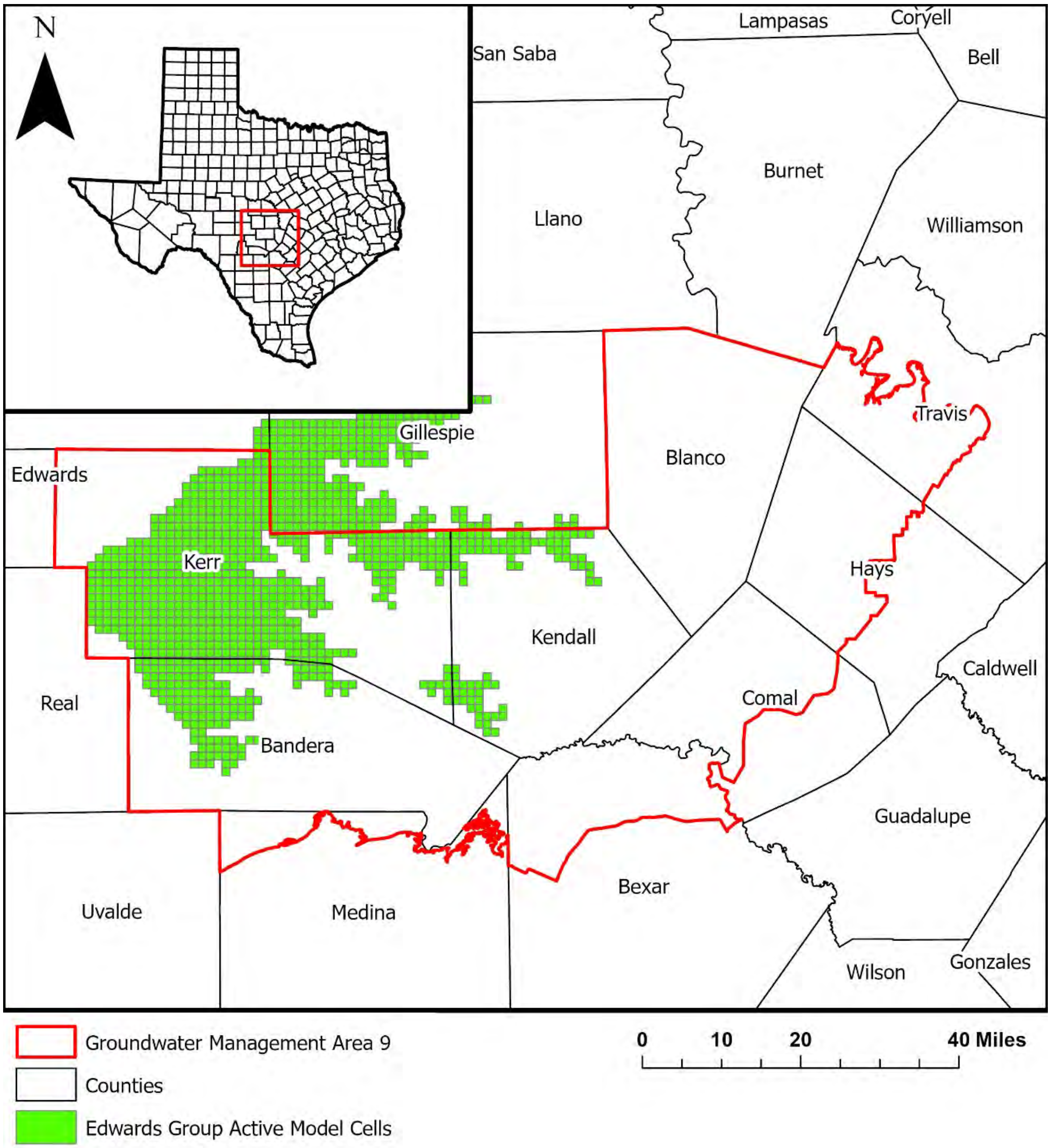

FIGURE 6. MAP SHOWING THE ACTIVE MODEL CELLS REPRESENTING THE EDWARDS GROUP OF THE EDWARDS-TRINITY (PLATEAU) AQUIFER (LAYER 1) IN THE HILL COUNTRY PORTION OF THE TRINITY AQUIFER GROUNDWATER AVAILABILITY MODEL IN RELATION TO GROUNDWATER MANAGEMENT AREA 9.

TABLE 3. **MODELED AVAILABLE GROUNDWATER FOR THE HICKORY AQUIFER IN GROUNDWATER MANAGEMENT AREA 9 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2080. VALUES ARE IN ACRE-FEET PER YEAR.**

Groundwater Conservation District (GCD)	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
Cow Creek GCD	Kendall	Hickory	141	140	141	140	141	140	141

TABLE 4. **MODELED AVAILABLE GROUNDWATER FOR THE HICKORY AQUIFER IN GROUNDWATER MANAGEMENT AREA 9. RESULTS ARE SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), AND RIVER BASIN FOR EACH DECADE FROM 2030 TO 2080. VALUES ARE IN ACRE-FEET PER YEAR.**

County	RWPA	Basin	Aquifer	2030	2040	2050	2060	2070	2080
Kendall	L	Colorado	Hickory	12	12	12	12	12	12
Kendall	L	Guadalupe	Hickory	128	128	128	128	128	128
Groundwater Management Area 9 Total			**Hickory**	**140**	**140**	**140**	**140**	**140**	**140**

TABLE 5. **MODELED AVAILABLE GROUNDWATER FOR THE ELLENBURGER-SAN SABA AQUIFER IN GROUNDWATER MANAGEMENT AREA 9 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2080. VALUES ARE IN ACRE-FEET PER YEAR.**

Groundwater Conservation District (GCD)	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
Cow Creek GCD	Kendall	Ellenberger-San Saba	62	62	62	62	62	62	62

TABLE 6. **MODELED AVAILABLE GROUNDWATER FOR THE ELLENBURGER-SAN SABA AQUIFER IN GROUNDWATER MANAGEMENT AREA 9. RESULTS ARE SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), AND RIVER BASIN FOR EACH DECADE FROM 2030 TO 2080. VALUES ARE IN ACRE-FEET PER YEAR.**

County	RWPA	Basin	Aquifer	2030	2040	2050	2060	2070	2080
Kendall	L	Colorado	Ellenberger-San Saba	9	9	9	9	9	9
Kendall	L	Guadalupe	Ellenberger-San Saba	53	54	53	54	53	54
Groundwater Management Area 9 Total			**Ellenberger-San Saba**	**62**	**63**	**62**	**63**	**62**	**63**

TABLE 7. MODELED AVAILABLE GROUNDWATER FOR THE TRINITY AQUIFER AND TRINITY GROUP OF THE EDWARDS-TRINITY (PLATEAU) AQUIFER IN GROUNDWATER MANAGEMENT AREA 9 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2060. VALUES ARE IN ACRE-FEET PER YEAR.

Groundwater Conservation District	County	Aquifer	2020	2030	2040	2050	2060
Bandera County River Authority & Ground Water District	Bandera	Trinity	7,284	7,284	7,284	7,284	7,284
Blanco-Pedernales GCD	Blanco	Trinity	2,573	2,573	2,573	2,573	2,573
Comal Trinity GCD	Comal	Trinity	9,383	9,383	9,383	9,383	9,383
Cow Creek GCD	Kendall	Trinity	10,622	10,622	10,622	10,622	10,622
Hays Trinity GCD	Hays	Trinity	9,074	9,071	9,070	9,070	9,070
Headwaters GCD	Kerr	Trinity	14,918	14,845	14,556	14,239	14,223
Medina County GCD	Medina	Trinity	2,340	2,340	2,340	2,340	2,340
Southwestern Travis County GCD	Travis	Trinity	8,559	8,542	8,530	8,515	8,485
Trinity Glen Rose GCD	Bexar	Trinity	24,856	24,856	24,856	24,856	24,856
	Comal	Trinity	138	138	138	138	138
	Kendall	Trinity	517	517	517	517	517
Trinity Glen Rose GCD Total		**Trinity**	**25,511**	**25,511**	**25,511**	**25,511**	**25,511**
Groundwater Management Area 9 Total		**Trinity**	**90,264**	**90,171**	**89,869**	**89,537**	**89,491**

TABLE 8 MODELED AVAILABLE GROUNDWATER FOR THE TRINTY AQUIFER AND TRINITY GROUP OF THE EDWARDS-TRINITY (PLATEAU) AQUIFER IN GROUNDWATER MANAGEMENT AREA 9. RESULTS ARE SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), AND RIVER BASIN FOR EACH DECADE FROM 2030 TO 2060. VALUES ARE IN ACRE-FEET PER YEAR.

County	RWPA	Basin	Aquifer	2030	2040	2050	2060
Bandera	J	Guadalupe	Trinity	76	76	76	76
Bandera	J	Nueces	Trinity	903	903	903	903
Bandera	J	San Antonio	Trinity	6,305	6,305	6,305	6,305
Bexar	L	San Antonio	Trinity	24,856	24,856	24,856	24,856
Blanco	K	Colorado	Trinity	1,322	1,322	1,322	1,322
Blanco	K	Guadalupe	Trinity	1,251	1,251	1,251	1,251
Comal	L	Guadalupe	Trinity	6,252	6,252	6,252	6,252
Comal	L	San Antonio	Trinity	3,269	3,269	3,269	3,269
Hays	K	Colorado	Trinity	4,707	4,706	4,706	4,706
Hays	L	Guadalupe	Trinity	4,364	4,364	4,364	4,364
Kendall	L	Colorado	Trinity	135	135	135	135
Kendall	L	Guadalupe	Trinity	6,028	6,028	6,028	6,028
Kendall	L	San Antonio	Trinity	4,976	4,976	4,976	4,976
Kerr	J	Colorado	Trinity	318	318	318	318
Kerr	J	Guadalupe	Trinity	14,056	13,767	13,450	13,434
Kerr	J	Nueces	Trinity	0	0	0	0
Kerr	J	San Antonio	Trinity	471	471	471	471
Medina	L	Nueces	Trinity	1,575	1,575	1,575	1,575
Medina	L	San Antonio	Trinity	765	765	765	765
Travis	K	Colorado	Trinity	8,542	8,530	8,515	8,485
Groundwater Management Area 9 Total			**Trinity**	**90,171**	**89,869**	**89,537**	**89,491**

TABLE 9 MODELED AVAILABLE GROUNDWATER FOR THE EDWARDS GROUP OF THE EDWARDS-TRINITY (PLATEAU) AQUIFER IN GROUNDWATER MANAGEMENT AREA 9 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2080. VALUES ARE IN ACRE-FEET PER YEAR.

GCD	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
Bandera County River Authority & Ground Water District	Bandera	Edwards	2,009	2,009	2,009	2,009	2,009	2,009	2,009
Cow Creek GCD	Kendall	Edwards	200	200	200	200	200	200	200
Groundwater Management Area 9 Total		**Edwards**	**2,209**	**2,209**	**2,209**	**2,209**	**2,209**	**2,209**	**2,209**

TABLE 10 MODELED AVAILABLE GROUNDWATER FOR THE EDWARDS GROUP OF THE EDWARDS-TRINITY (PLATEAU) AQUIFER IN GROUNDWATER MANAGEMENT AREA 9. RESULTS ARE SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), AND RIVER BASIN FOR EACH DECADE FROM 2030 TO 2080. VALUES ARE IN ACRE-FEET PER YEAR.

County	RWPA	Basin	Aquifer	2030	2040	2050	2060	2070	2080
Bandera	J	Guadalupe	Edwards	81	81	81	81	81	81
Bandera	J	Nueces	Edwards	38	38	38	38	38	38
Bandera	J	San Antonio	Edwards	1,890	1,890	1,890	1,890	1,890	1,890
Kendall	L	Colorado	Edwards	69	69	69	69	69	69
Kendall	L	Guadalupe	Edwards	130	130	130	130	130	130
Groundwater Management Area 9 Total			**Edwards**	**2,208**	**2,208**	**2,208**	**2,208**	**2,208**	**2,208**

LIMITATIONS:

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

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

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

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

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

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APPENDIX A: CLARIFICATIONS

Groundwater Management Area 9 Joint Planning Committee

Bandera County River Authority and Groundwater District
Blanco-Pedernales Groundwater Conservation District
Comal Trinity Groundwater Conservation District
Cow Creek Groundwater Conservation District
Hays-Trinity Groundwater Conservation District
Headwaters Groundwater Conservation District
Medina County Groundwater Conservation District
Trinity Glen Rose Groundwater Conservation District
Southwestern Travis County Groundwater Conservation District

Mr. Micah Voulgaris, GMA 9 Planning Committee Chairman P.O. Box 1557 Boerne, Texas 78006

October 17, 2022

Stephen Allen, P.G., Geoscientist
Groundwater Technical Assistance Team
Groundwater Resources
Texas Water Development Board
P. O. Box 13231
1700 North Congress Avenue
Austin, Texas 78711-3231

Re: Acknowledgement of clarifications needed for the Texas Water Development Board to declare the Groundwater Management Area 9 Desired Future Conditions submittal administratively complete

Mr. Allen,

This letter is in response to your email sent to me on Tuesday, October the 11th.

It was the intent of the Groundwater Management Area 9 Joint Planning Committee to adopt Desired Future Conditions that produced drawdown values consistent with the previous two planning cycles.

GMA 9 acknowledges and accepts all ten of the "other clarifications" and the two "optional clarifications" as outlined in the attached document sent by the TWDB.

Please let us know if you need additional information or if further action is required.

Thank you,
Groundwater Management Area 9

Micah Voulgaris
GMA 9 Chairman

Enclosure: *GMA09_Clarifications_v1*

FIGURE A1: PAGE 1 OF CORRESPONDENCE BETWEEN GROUNDWATER MANAGEMENT AREA 9 AND THE TWDB RELATED TO CLARIFIACTIONS (LETTER FROM GROUNDWATER MANAGEMENT AREA 9 ACKNOWLEDGING AND ACCEPTING CLARIFICATIONS)

Critical Clarifications *(need additional files or an update to Legal DFC Resolution)***:**

- None, unless the GMA disagrees with clarifications and assumptions below.

Other Clarifications (*TWDB will only need acknowledgement for administratively complete*)**:**

Trinity Aquifer:

1. Please confirm that the phrase *"average drawdown of approximately 30 feet through 2060 consistent with Scenario 6 in TWDB GAM Task 10-005"* in the DFC Resolution means *"no more than 30 feet of average water level decline in 2060, as compared to 2008 water levels, averaged over all TWDB GAM Task 10-005 Scenario 6 model iterations."*[1] This method produces drawdown values consistent with the DFC values provided in the Explanatory Report and is consistent with the methodology used in the previous planning cycle.
2. Please confirm that the GMA accepts the following assumptions for calculating modeled drawdown: 1) exclude all cells that become dry and 2) use all active model cells even if they do not fall within the official TWDB aquifer boundary. This method produces drawdown values consistent with the DFC values provided in the Explanatory Report and is consistent with the methodology used in the previous planning cycle.
3. As in the previous planning cycle, we will only provide MAG values calculated within the extent of the TWDB Trinity (Hill Country) Aquifer GAM. Since this model does not extend across the entire GMA, these MAG values will not include any pumping that might occur outside the model extent. Please confirm that this methodology is acceptable to the GMA. Otherwise, please contact TWDB to request additional MAG value calculations.

Edwards Group of the Edwards-Trinity (Plateau) Aquifer:

4. Please confirm that the phrase *"no net increase in average drawdown through 2080"* in the DFC Resolution means *"no average water level decline in 2080, as compared to 1997 water levels."*[2] This method produces drawdown values consistent with the DFC values provided in the Explanatory Report and is consistent with the methodology used in the previous planning cycle.
5. Since the GMA did not provide predictive model files, TWDB used the predictive model files *[based on Trinity (Hill Country) Aquifer GAM]* developed by TWDB during the previous planning cycle (see GAM Run 16-023) and extended them to 2080 by assuming the same recharge rates and the same percentage increase in pumping rates as was used in the previous planning cycle. Please confirm that this methodology is acceptable to the GMA.
6. Please confirm that the GMA accepts the following assumptions for calculating modeled drawdown: 1) exclude all cells that become dry and 2) include all active model cells even if they do not fall within the official TWDB aquifer boundary. This method produces drawdown values consistent with the DFC values provided in the Explanatory Report and is consistent with the methodology used in the previous planning cycle.
7. As in the previous planning cycle, we will only provide MAG values calculated within the extent of the TWDB Trinity (Hill Country) Aquifer GAM. Since this model does not extend across the entire GMA, these MAG values will not include any pumping that might occur outside the model extent.

[1] 2008 is the last calibrated water level available from the TWDB GAM Task 10-005 model
[2] 1997 is the last calibrated water level available from the TWDB Trinity (Hill Country) Aquifer GAM

FIGURE A2: PAGE 2 OF CORRESPONDENCE BETWEEN GROUNDWATER MANAGEMENT AREA 9 AND THE TWDB RELATED TO CLARIFIACTIONS (OTHER CLARIFICATIONS NUMBERS 1 TO 7)

Please confirm that this methodology is acceptable to the GMA. Otherwise, please contact TWDB to request additional MAG value calculations.

Ellenburger-San Saba & Hickory Aquifers:

8. Please confirm that the phrase "*average drawdown of no more than 7 feet in Kendall County through 2080*" in the DFC Resolution means "*average water level decline of no more than 7 feet in 2080, as compared to 2010 water levels.*"[3] This method produces drawdown values consistent with the DFC values provided in the Explanatory Report and is consistent with the methodology used in the previous planning cycle.
9. Since the GMA did not provide predictive model files, TWDB used the predictive model files *[based on Llano Uplift GAM]* developed by TWDB during the previous planning cycle (see GAM Run 16-023) and extended them to 2080 by assuming the same recharge rates and the same pumping rates and distribution as was used in the previous planning cycle. Please confirm that this methodology is acceptable to the GMA.
10. Please confirm that the GMA accepts the following assumptions for calculating modeled drawdown: 1) only include active model cells within the official TWDB aquifer boundary. This method produces drawdown values consistent with the DFC values provided in the Explanatory Report and is consistent with the methodology used in the previous planning cycle.

Optional Clarifications *(Clerical corrections to Explanatory Report)*[4]:

Edwards Group of the Edwards-Trinity (Plateau) Aquifer:

– baseline year for DFC incorrectly listed as 2008 rather than 1997 *(see Clarification #4)*

Ellenburger-San Saba & Hickory Aquifers:

– baseline year for DFC incorrectly listed as 2008 rather than 2010 *(see Clarification #8)*

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[3] 2010 is the last calibrated water level available from the TWDB Llano Uplift GAM.

[4] Since TWDB considers the legal DFC Resolution documents, rather than the Explanatory Report, as the official definition of DFCs, TWDB does not officially require corrections to the Explanatory Report. However, because the Explanatory Report is often used as a simplified, more-readable summary of the legal DFC Resolution documents, we recommend correcting the Explanatory Report to match the DFC Resolutions to avoid confusion.

FIGURE A3: PAGE 3 OF CORRESPONDENCE BETWEEN GROUNDWATER MANAGEMENT AREA 9 AND THE TWDB RELATED TO CLARIFIACTIONS (OTHER CLARIFICATIONS NUMBERS 8 TO 10 AND OPTIONAL CLARIFICATIONS)

APPENDIX D – GAM RUN 19-025

GAM Run 19-025: Trinity Glen Rose Groundwater Conservation District Groundwater Management Plan

Stephen Bond, P.G.
Texas Water Development Board
Groundwater Division
Groundwater Availability Modeling Department
512-475-1520
October 31, 2019

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GAM RUN 19-025: TRINITY GLEN ROSE GROUNDWATER CONSERVATION DISTRICT GROUNDWATER MANAGEMENT PLAN

Stephen Bond, P.G.
Texas Water Development Board
Groundwater Division
Groundwater Availability Modeling Department
512-463-5076
October 30, 2019

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 Trinity Glen Rose 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 Trinity Glen Rose Groundwater Conservation District should be adopted by the district on or before October 16, 2020 and submitted to the Executive Administrator of the TWDB on or before November 15, 2020. The current management plan for the Trinity Glen Rose Groundwater Conservation District expires on January 14, 2021.

This report discusses the methods, assumptions, and results from a model run using the groundwater availability model for the Hill Country portion of the Trinity Aquifer System (Jones and others, 2011). This report replaces the results of GAM Run 15-001 (Wade, 2015), as the approach used for analyzing model results has been since refined.

METHODS:

In accordance with the provisions of the Texas State Water Code, Section 36.1071, Subsection (h), the groundwater availability model mentioned above was used to estimate information for the Trinity Glen Rose Groundwater Conservation District management plan. Water budgets were extracted for the historical model period for the (1981 through 1997) 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 net inter-aquifer flow (lower) for the portion of the aquifer located within the district are summarized in this report.

PARAMETERS AND ASSUMPTIONS:

Hill Country portion of the Trinity Aquifer System

- We used version 2.01 of the groundwater availability model for the Hill Country portion of the Trinity Aquifer System. See Jones and others (2011) for assumptions and limitations of the groundwater availability model.
- The groundwater availability model includes four layers, representing (from top to bottom):

    1. the Edwards Group of the Edwards-Trinity (Plateau) Aquifer,
    2. the Upper Trinity Aquifer,
    3. the Middle Trinity Aquifer, and
    4. the Lower Trinity Aquifer.

- Layer 1 is not present in the district. An individual water budget for the district was determined for the remaining layers of the Hill Country portion of the Trinity Aquifer System (Layer 2 to Layer 4, collectively).

- The General-Head Boundary (GHB) package of MODFLOW was used to represent flow out of the study area between the Hill Country portion of the Trinity Aquifer and the Edwards (Balcones Fault Zone) Aquifer or the confined parts of the Trinity Aquifer underlying the Edwards (Balcones Fault Zone) Aquifer.

- The groundwater availability model includes some portions of the Edwards Group outside the official boundary of the Edwards-Trinity (Plateau) Aquifer. Though flow for these areas is not explicitly reported, the interaction between the Edwards Group (outside the Edwards-Trinity Plateau Aquifer) and the underlying Trinity Aquifer would be shown in the "flow between aquifers" segment of Table 1, if Layer 1 was present in the district.

- Only the outcrop area of the Hill County portion of the Trinity Aquifer was modeled, and the down-dip extent that underlies the Edwards (Balcones Fault Zone) Aquifer is not included.

- The model was run with MODFLOW-96 (Harbaugh and McDonald, 1996).

RESULTS:

A groundwater budget summarizes the amount of water entering and leaving the aquifers according to the groundwater availability model. Selected groundwater budget components listed below were extracted from the groundwater availability model results for the Hill Country potion of the Trinity Aquifer System located within the Trinity Glen Rose Groundwater Conservation District and averaged over the historical calibration periods, as shown in Table 1.

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.

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 HILL COUNTRY PORTION OF THE TRINITY AQUIFER SYSTEM FOR TRINITY GLEN ROSE 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	44,992
Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, and rivers	Trinity Aquifer	10,347
Estimated annual volume of flow into the district within each aquifer in the district	Trinity Aquifer	36,079
Estimated annual volume of flow out of the district within each aquifer in the district	Trinity Aquifer	26,417
Estimated net annual volume of flow between each aquifer in the district	From the Trinity Aquifer to the Edwards (Balcones Fault Zone) Aquifer.	39,006

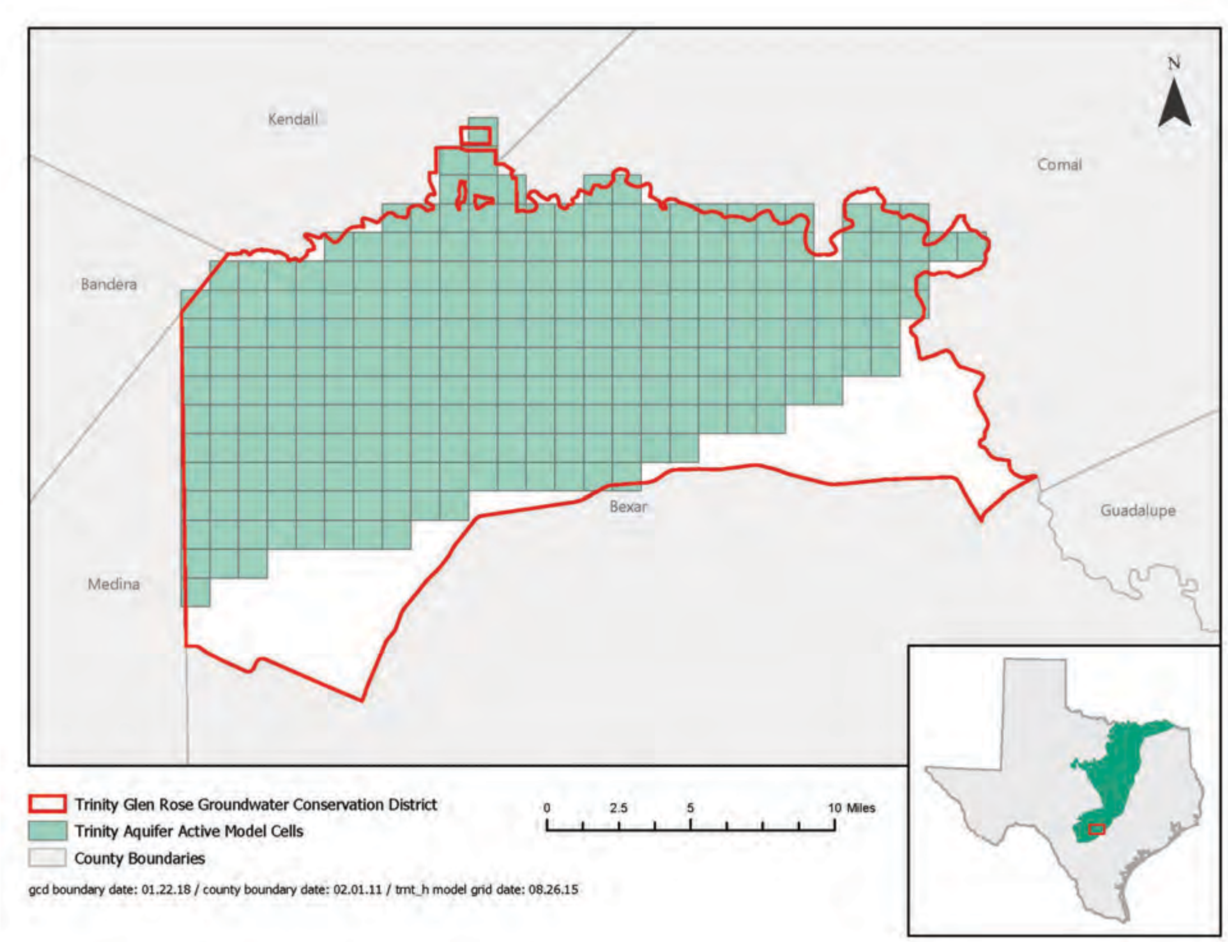

FIGURE 1 AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE HILL COUNTRY PORTION OF THE TRINITY AQUIFER SYSTEM FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED (THE TRINITY AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

LIMITATIONS:

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

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

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

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

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

REFERENCES:

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

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Wade, S. C., 2015, GAM Run 15-001: Texas Water Development Board, GAM Run 15-001 Report, 9 p., http://www.twdb.texas.gov/groundwater/docs/GAMruns/GR15-001.pdf.

APPENDIX E – CERTIFIED COPY OF ADOPTED RESOLUTION

STATE OF TEXAS §
§ **RESOLUTION #061523-01**
COUNTY OF BEXAR §

TRINITY GLEN ROSE
GROUNDWATER CONSERVATION DISTRICT

RESOLUTION BY THE BOARD OF DIRECTORS OF THE
TRINITY GLEN ROSE GROUNDWATER CONSERVATION DISTRICT
ADOPTING ITS AMENDED MANAGEMENT PLAN

WHEREAS, the Trinity Glen Rose Groundwater Conservation District ("District") is charged by the Texas Legislature with providing for the conservation, preservation, protection, and prevention of waste of groundwater, and of groundwater resources in Bexar County, Texas, under §36.0015, Tex. Water Code;

WHEREAS, the District is authorized to make and enforce fair and impartial rules to manage groundwater resources as scientifically necessary to conserve and protect groundwater resources in the area under §36.101, Tex. Water Code;

WHEREAS, pursuant to §36.1071 and §36.1072, Tex. Water Code, following notice and hearing, the District amended the developed comprehensive management plan that addresses the required management goals, as applicable, and shall submit the amended Management Plan to the Texas Water Development Board as provided under §36.1071, §36.1072, and §36.1073 Tex. Water Code; and

WHEREAS, the District initially submitted its Amended Management Plan to the Texas Water Development Board in May of 2023 for pre-review, made revisions requested by the Texas Water Development Board staff and received their preliminary approval.

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE TRINITY GLEN ROSE GROUNDWATER CONSERVATION DISTRICT THAT:

THE DISTRICT ADOPTS THE TRINITY GLEN ROSE GROUNDWATER CONSERVATION DISTRICT AMENDED MANAGEMENT PLAN AND SUBMITS IT TO THE TEXAS WATER DEVELOPMENT BOARD FOR REVIEW AND APPROVAL.

The motion passed with 4 ayes, and Ø nayes.

PASSED AND APPROVED this the 15th day of June 2023.

TRINITY GLEN ROSE GROUNDWATER CONSERVATION DISTRICT

SIGNED AND SEALED the 15th day of June 2023

Joseph duMenil, President

ATTESTED BY:

Stuart Birnbaum, Vice President