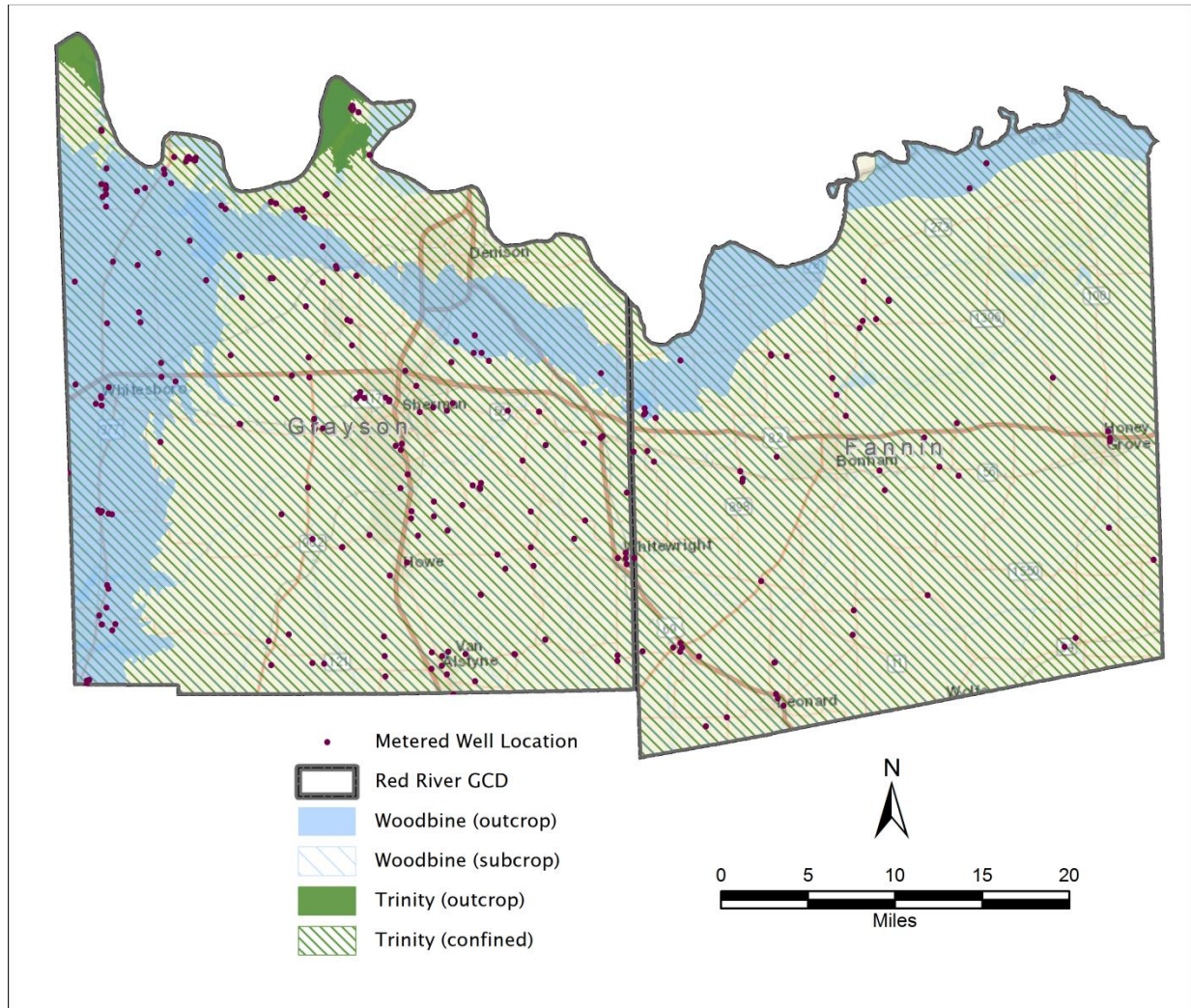


RED RIVER GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN



Adopted March 16, 2017

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GLOSSARY OF SYMBOLS/TERMS/ACRONYMS IN MANAGEMENT PLAN

§:	Section (referring to a statutory provision)
Board:	Board of Directors of the Red River Groundwater Conservation District
District:	Red River Groundwater Conservation District
District Act:	Enabling legislation of Red River Groundwater Conservation District (codified at Tex. Spec. Dist. Loc. Laws Code Ch. 8859)
DFC:	Desired Future Condition
GPM:	Gallons per minute
GAM:	Groundwater Availability Model
GCD:	Groundwater Conservation District
GMA:	Groundwater Management Area
HB:	House Bill
MAG:	Modeled Available Groundwater
SB:	Senate Bill
TWDB:	Texas Water Development Board
WUG:	Water user group

1 Introduction

The Red River Groundwater Conservation District (the District), after notice and hearing, adopts this Management Plan according to the requirements of Texas Water Code § 36.1071. The Red River Groundwater Conservation District Management Plan represents the management goals of the District for the next five years, including the desired future conditions of the aquifers within the jurisdictional boundaries of the District. These desired future conditions were adopted through the joint planning process in Groundwater Management Area 8 as prescribed in Chapter 36, Texas Water Code.

1.1 District Mission

The Mission of the Red River Groundwater Conservation District is to develop rules to provide protection to existing wells, prevent waste, promote conservation, provide a framework that will allow availability and accessibility of groundwater for future generations, protect the quality of the groundwater in the recharge zone of the aquifer, insure that the residents of Fannin and Grayson Counties maintain local control over their groundwater, and operate the District in a fair and equitable manner for all residents of the District.

1.2 Guiding Principles

The District is committed to managing and protecting the groundwater resources within its jurisdiction and to working with others to ensure a sustainable, adequate, high quality and cost effective supply of water, now and in the future. The District will strive to develop, promote, and implement water conservation, augmentation, and management strategies to protect water resources for the benefit of the citizens, economy and environment of the District. The preservation of this most valuable resource can be managed in a prudent and cost effective manner through conservation, education, and management. The District will endeavor to consider and respect individual property owner rights when acting on related matters.

2 History and Purpose of the Management Plan

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

The Texas Legislature enacted significant changes to the management of groundwater resources in Texas with the passage of House Bill 1763 ("HB 1763") in 2005. HB 1763 created a long-term planning process in which groundwater conservation districts ("GCDs") in each Groundwater Management Area ("GMA") are required to meet and determine the Desired Future Conditions ("DFCs") for the groundwater resources within their boundaries by September 1, 2010. In addition, HB 1763 required GCDs to share management plans with the other GCDs in the GMA for review by the other GCDs. In 2011, Senate Bills 660 and 737 further modified these groundwater laws and GCD management requirements in Texas.

Senate Bill 660 required that GMA representatives must participate within each applicable RWPG. It also required the Regional Water Plans be consistent with the DFCs in place when the regional plans are initially developed. TWDB technical guidelines for the current round of planning establishes that the MAG (within each county and basin) is the maximum amount of groundwater that can be used for existing uses and new strategies in Regional Water Plans. In other words, the MAG volumes are a cap on groundwater production for TWDB planning purposes.

"Managed available groundwater" was redefined as "modeled available groundwater" in Senate Bill 737 by the 82nd Legislature. Modeled available groundwater is "the amount of water that can be produced on an average annual basis" to achieve a desired future condition.

All of these changes in laws have been incorporated into the Texas Water Code and used as a framework to develop this management plan.

3 District Information

3.1 Creation

The Red River Groundwater Conservation District (the "District") was created by the 81st Texas Legislature under the authority of Section 59, Article XVI, of the Texas Constitution, and in accordance with Chapter 36 of the Texas Water Code ("Water Code"), by the Act of May 25, 2009, 81st Leg., R.S., Ch. 248, 2009 Tex. Gen. Laws 686, codified at Tex. Spec. Dist. Loc. Laws Code Ch. 8859 ("the District Act").

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

3.2 Directors

The District is governed by a board of seven appointed directors. Directors serve staggered four-year terms, with the terms of three or four directors from each appointing county expiring on August 31 of each odd-numbered year. A director serves until the director's successor has qualified to serve.

3.3 Authority

The District has the rights and responsibilities provided for in Chapter 36 of the Texas Water Code and 31 Texas Administrative Code Chapter 356. The District is charged with conducting hydrogeological studies, adopting a management plan, providing for the permitting of non-exempt water wells and implementing programs to achieve statutory mandates. The District has rulemaking authority to implement the policies and procedures needed to manage the groundwater resources of Grayson and Fannin Counties.

3.4 Location and Extent

The District's boundaries are coextensive with the boundaries of Grayson and Fannin Counties, Texas. The District covers an area of approximately 1,878 square miles. A map is included as Figure 1.

3.5 Topography and Drainage

The District is located within the Red, Trinity and Sulphur River Basins. The northern two-thirds of Grayson and Fannin Counties drain north and east to the Red River, the southern portion of Grayson County drains toward the south to the Trinity River, the southeastern one-third of Fannin County drains east to the Sulphur River. Elevations in the District range from approximately 500 to 900 ft. above mean sea level (amsl) and the physiography consists primarily of gently rolling prairieland, blacklands, woodlands and wooded bottomlands in the river valleys. Average annual rainfall is about 43 inches.

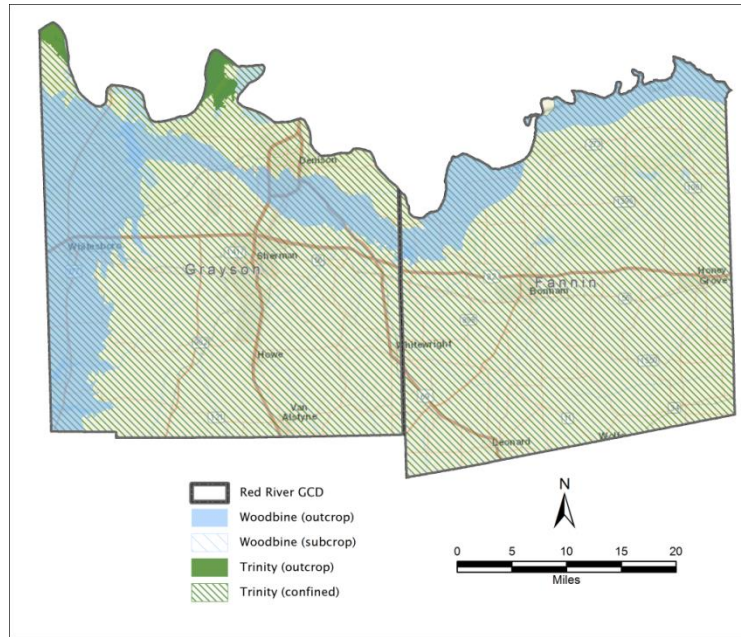


Figure 1. District Map

4 Criteria for Plan Approval

4.1 Planning Horizon

This management plan becomes effective upon adoption by the District Board of Directors and subsequent approval by the Executive Administrator of the Texas Water Development Board (TWDB). This management plan incorporates a planning period of ten years in accordance with 31 Texas Administrative Code §356.5(a).

4.2 Board Resolution

A certified copy of the Red River Groundwater Conservation District resolution adopting the plan is located in Appendix A – Resolution Adopting the Management Plan.

4.3 Plan Adoption

Public notices documenting that the plan was adopted following appropriate public meetings and hearings are located in Appendix B – Evidence that the Management Plan was adopted.

4.4 Coordination with Surface Water Management Entities

A template letter transmitting copies of this plan to the surface water management entities in the District along with a list of the surface water management entities to which the plan was sent are located in Appendix C – Evidence that the District coordinated development of the Management Plan with surface water entities.

5 Actions, Procedures, Performance, and Avoidance for Plan Implementation, and Management of Groundwater Supplies

The District is currently operating pursuant to a set of ~~temporary rules adopted on August 29, 2011 and most recently amended on January 1, 2017~~that became effective January 1, 2019 (Appendix D). The temporary rules are housed on the District's website <http://www.redrivergcd.org/district-information.html>. ~~The District anticipates operating under permanent rules beginning in the Spring of 2018 and will amend the Plan accordingly at that time. In the meantime, the temporary~~The rules were adopted under the authority of Sections 36.101 and 36.1071(f), Texas Water Code, and the District Act for the purpose of conserving, preserving, protecting, and recharging groundwater in the District in order to prevent subsidence, prevent degradation of water quality, prevent waste of groundwater, and to carry out the powers and duties of Chapter 36, Texas Water Code, and the District Act.

These rules are used by the District in the exercise of the powers conferred on the District by law and in the accomplishment of the purposes of the law creating the District. These rules may be used as guides in the exercise of discretion, where discretion is warranted. However, under no circumstances and in no particular case will they or any part therein, be construed as a limitation or restriction upon the District to exercise powers, duties and jurisdiction conferred by law. These rules create no rights or privileges in any person or water well, and shall not be construed to bind the Board in any manner in its promulgation of the District Management Plan, ~~or~~ amendments to these ~~Temporary Rules, or promulgation of permanent rules.~~

The District may amend the District rules as necessary to comply with changes to Chapter 36 of the Texas Water Code and to insure the best management of the groundwater within the District. The development and enforcement of the rules of the District has been and will continue to be based on the best scientific and technical evidence available to the District.

The District has encouraged and will continue to encourage public cooperation and coordination in the implementation of the management plan for the District, as it is amended. All operations and activities of the District have been and will be performed in a manner that best encourages cooperation with the appropriate state, regional or local water entity. The meetings of the Board of the District are noticed and conducted at all times in accordance with the Texas Open Meetings Law. The District has also made available for public inspection all official documents, reports, records and minutes of the District pursuant to the Texas Public Information Act and will continue to do so in the future.

6 Methodology to Track District Progress in Achieving Management Goals

An annual report ("Annual Report") will be created by the general manager and staff of the District and provided to the members of the Board of Directors. The Annual Report will cover the activities

of the District including information on the District's performance in regards to achieving the District's management goals and objectives. The Annual Report will be delivered to the Board within 180 days following the completion of the District's fiscal year, beginning with the fiscal year that started on January 1, 2012. A hard copy of the Annual Report will be kept on file and will be available for public inspection at the District's offices upon adoption. Annual reports will also be available via the District's website.

7 Management Objectives and Performance Standards

The following goals, management objectives, and performance standards have been developed and adopted to ensure the management and conservation of groundwater resources within the District's jurisdiction.

For purposes of this management plan, an exempt well means wells that meet any one of the following, unless a different meaning is set forth in the District rules, or the context clearly provides otherwise: (1) any ~~new or existing well of any size or capacity~~ well that was applied for or existed prior to January 1, 2019 that is used solely for domestic use, livestock use, or poultry use; (2) any well that was applied for or existed prior to January 1, 2019 ~~new or existing well~~ that does not have the capacity, as equipped, to produce more than ~~25-27.7~~ gallons per minute and is used in whole or in part for commercial, industrial, municipal, manufacturing, or public water supply use, use for oil or gas or other hydrocarbon exploration or production, or any other purpose of use other than solely for domestic, livestock, or poultry use, except that if the total sum of the capacities of wells that operate as part of a well system is greater than ~~25-27.7~~ gallons per minute, the well system and individual wells that are part of it are not considered to be exempt; (3) any new well applied for after January 1, 2019 that does not have the capacity, as equipped, to produce more than 17.36 gallons per minute; or (34) leachate wells, monitoring wells, and piezometers. All wells that do not meet one of these criteria are considered to be non-exempt for purposes of this management plan. The characterization of exempt and non-exempt wells is intended to apply only to wells described in this management plan and shall not be interpreted to mean that the wells will be considered exempt or not exempt from permitting under any ~~permanent~~ rules adopted by the District in the future.

Goal 1 - Providing the most efficient use of groundwater

The District, through strategies and programs adopted in this management plan and rules, strives to ensure the most efficient use of groundwater in order to sustain available resources for the future while maintaining the economic growth of the District.

Management Objective 1.1

The District will require that all wells be registered in accordance with its current rules.

Performance Standard 1.1

The Board of Directors will receive quarterly briefings by the General Manager regarding the District's well registration program. These quarterly reports will be included in the Annual Report to the Board of Directors. The District is currently in the beginning phase of making improvements to the online geodatabase that will make additional statistics available for this report such as the aquifer in which wells are being completed. In addition, a handout will be provided annually to local realtor associations detailing the requirement of new property owners to register their existing wells within 90 days of transfer of ownership.

Management Objective 1.2

It is the goal of the District that all non-exempt wells and exempt wells be registered. In order to ensure that all wells required by District rules to be registered have been accurately registered the District's Field Technician manages a Field Inspections Program, with the objective of conducting field inspections of at least five wells per month. These inspections will confirm that a well has been registered, accuracy of well location, and accuracy of other required well registration information.

Performance Standard 1.2

Quarterly briefings by the General Manager will be provided to the Board of Directors regarding the number of well sites inspected each month to confirm well registration requirements have been met. This information will also be included in the Annual Report to the Board of Directors.

Management Objective 1.3 (a)

In order to evaluate continually the effectiveness of the District's rules in meeting the goal of ensuring the efficient use of groundwater, the District will operate a groundwater monitoring program to collect information on the quantity and quality of groundwater resources throughout the District. This monitoring program is based on the establishment of a network of monitoring wells. The District staff has assumed the responsibility of monitoring all available TWDB wells at least annually. In addition, one additional well will be added in each county, for a total of two new wells to the system in accordance with the District's well monitoring plan.

For the purpose of water quality sampling, samples collected for water quality taken by Texas Commission on Environmental Quality staff every five years will be used for monitoring purposes initially, and may be supplemented in the future as determined by the Board. All information collected in the monitoring program will be entered into the District's geodatabase after the current geodatabase improvements project is complete. The results of the monitoring program will be included in the Annual Report presented by the General Manager.

Performance Standard 1.3 (a)(1)

Track the number of wells in Fannin and Grayson counties for which water levels were measured per year as reported in the Annual Report presented by the General Manager to the Board of Directors.

Performance Standard 1.3 (a)(2)

Number of wells in Fannin and Grayson counties for which water samples were collected for the testing of water quality: The Texas Commission on Environmental Quality provides a Consumer Confidence Report that provides consumers with information about the quality of drinking water. This data may be reviewed at: <https://www.tceq.texas.gov/drinkingwater/ccr> for water systems.

Management Objective 1.3 (b)

In order to ensure the efficient use of groundwater, adequate data must be collected to facilitate groundwater availability modeling activities necessary to understand current groundwater resources and the projected availability of those resources in the future. Monitoring wells will be established by the District on a schedule determined by the Board of Directors as funds are available.

Performance Standard 1.3 (b)

Track the number of wells for which water level data is available will be accessible online after the current geodatabase improvements project is complete.

Management Objective 1.4

A critical component of the District's goal of ensuring the efficient use of groundwater is the collection of accurate water use information. The District has established by temporary rule a requirement that all non-exempt wells be equipped with meters to measure the use of groundwater. The well owner/operator is responsible for maintaining a meter log with at least monthly records of water use. Cumulative water use is to be reported to the District by the well owner/operator quarterly. All water use information will be entered and maintained in the District's geodatabase. It is the objective of the District that 95 percent of all registered non-exempt wells will report water use by the reporting deadlines established in the District's rules.

Performance Standard 1.4

Percent of registered non-exempt wells meeting reporting requirements of water use will be provided in the Annual Report to the Board of Directors.

Management Objective 1.5

In order to ensure that registered non-exempt wells have been equipped with District-approved meters and that water use is being accurately reported, the District Field Technician facilitates a meter inspection program to insure that all registered non-exempt wells will be inspected on at least a five-year cycle by District personnel. These inspections will, at a minimum, verify proper installation and operational status of meters and record the meter reading at the time of inspection. This meter reading will be compared to the most recent water use report for the inspected well. Any potential violations of District rules regarding meter installation and reporting requirements will be reported to the Board of Directors at the next practicable meeting for consideration of possible enforcement actions. Annual water use will be included in the Annual Report presented by the General Manager to the Board of Directors.

Performance Standard 1.5 (a)

Percentage of registered non-exempt wells inspected by District personnel annually is provided in the Annual Report presented by the General Manager.

Performance Standard 1.5 (b)

Comparison of annual water use versus estimates of modeled available groundwater established as a result of the adopted Desired Future Conditions shall be included in the Annual Report presented by the General Manager no later than ~~2019~~2021, after the current geodatabase improvements project is completed.

Management Objective 1.6

A critical component to accomplishing the District's mission is to ensure that proper data is being collected and that the data is being utilized to the fullest extent and efficiently. Shortly after the District's creation, the District hired a consultant to build an online geodatabase that would make workflows, data entry and data utilization easier and more efficient for well owners, well drillers, general public, District staff and the Board of Directors. After several years of utilizing the geodatabase the District had built, the District has identified areas in which the existing system can be upgraded.

Performance Standard 1.6

The District will make substantial upgrades and improvements to the online geodatabase ~~by 2019~~, in order to make workflows, data entry and data utilization easier and more efficient.

Management Objective 1.7

The District will develop a methodology to quantify current and projected annual groundwater production from exempt wells.

Performance Standard 1.7

The District will provide the TWDB with its methodology and estimates of current and projected annual groundwater production from exempt wells. The District will also utilize the information in the future in developing and achieving desired future conditions and in developing and implementing its production allocation and permitting system and rules. Information related to implementation of this objective will be included in the Annual Report to the Board of Directors by 2019.

Goal 2 - Controlling and preventing the waste of groundwater

Another important goal of the District is to implement strategies that will control and prevent the waste of groundwater.

Management Objective 2.1

The District will annually provide information to the public on eliminating and reducing wasteful practices in the use of groundwater by publishing information on groundwater waste reduction on the District's website at least once a year.

Performance Standard 2.1

Information on groundwater waste reduction will be provided on the District's website and the information published on the website will be included in the District's Annual Report to be provided to the Board of Directors.

Management Objective 2.2

The District will encourage the elimination and reduction of groundwater waste through a collection of water-use fees for non-exempt production wells within the District.

Performance Standard 2.2

Annual reporting of the total fees paid and total groundwater used by non-exempt wells will be included in the Annual Report provided to the Board of Directors.

Management Objective 2.3

The District will identify well owners that are not in compliance with District well registration, reporting, and fee payment requirements and bring them into compliance.

Performance Standard 2.3

The District will compare existing state records and field staff observations with well registration database to identify noncompliant well owners.

Management Objective 2.4

The District will investigate instances of potential waste of groundwater.

Performance Standard 2.4

District staff will report to Board of Directors as needed regarding potential waste of groundwater and include number of investigations in Annual Report.

Goal 3 - Controlling and preventing subsidence

Due to the geology of the Northern Trinity/Woodbine Aquifers in the District, problems resulting from water level declines causing subsidence are not technically feasible and as such, a goal addressing subsidence is not applicable.

Goal 4 - Addressing conjunctive surface water management issues

Surface water resources represent a vital component in meeting current and future water demands in all water use sectors within the District. The District coordinates with surface water management entities within the region by designating a board member or the general manager to attend and coordinate on water supply and management issues with the Region C Water Planning Group.

Management Objective 4.1

Coordination with surface water management agencies - the designated board member or General Manager will attend, at a minimum, 75 percent of the meetings and events of the Region C Water Planning Group. Participation in the regional water planning process will ensure coordination with surface water management agencies that are participating in the regional water planning process.

Performance Standard 4.1

The designated board member or General Manager will report on actions of the Region C Water Planning Group as appropriate to the board, and the General Manager will document meetings attended in the Annual Report.

Management Objective 4.2

The General Manager of the District will monitor and participate in relevant stakeholder meetings concerning water resources relevant to the District.

Performance Standard 4.2

The General Manager of the District will monitor and participate in relevant stakeholder meetings that concern water resources relevant to the District. The meetings that are attended will be presented in the District's Annual Report.

Goal 5 - Addressing natural resource issues

The District understands the important nexus between water resources and natural resources. The exploration and production of natural resources such as oil and gas along with mining efforts for road aggregate materials such as sand and gravel clearly represent potential management issues for the District. For example, improperly plugged oil and gas wells may provide a conduit for various hydrocarbon and drilling fluids to potentially migrate and contaminate groundwater resources in the District.

Management Objective 5.1

The District has engaged a firm to monitor all injection well applications within the District and notify the General Manager of any potential impacts.

Performance Standard 5.1

General Manager will report to the Board of Directors any information provided by the consultant engaged to monitor injection well applications within the District to the Board of Directors and document the information in the Annual Report to the Board of Directors.

Management Objective 5.2

The District will monitor compliance by oil and gas companies of well registration, metering, production reporting, and fee payment requirements of the District's rules.

Performance Standard 5.2

As with other types of wells, instances of non-compliance by owners and operators of water wells for oil and gas activities will be reported to the Board of Directors as appropriate for enforcement action. A summary of such enforcement activities will be included in the Annual Report to the Board of Directors.

Goal 6 - Addressing drought conditions

Management Objective 6.1

The District will make available through the District's website easily accessible drought information with an emphasis on developing droughts and on any current drought conditions. Examples of links that will be provided include routine updates to the Palmer Drought Severity Index (PDSI) map for the region, the Drought Preparedness Council Situation Report (routinely posted on the Texas

Water Information Network, and the TWDB Drought Page at <https://waterdatafortexas.org/drought>.

Performance Standard 6.1

Current drought conditions information from multiple resources including the Palmer Drought Severity Index (PDSI) map for the region and the Drought Preparedness Council Situation Report is available to the public through the District's website

Goal 7 - Address conservation, recharge and precipitation enhancement, rainwater harvesting, and brush control

Texas Water Code § 36.1071(a)(7) requires that a management plan include a goal that addresses conservation, recharge enhancement, rainwater harvesting, precipitation enhancement, or brush control, where appropriate and cost-effective. The District has determined that a goal addressing recharge enhancement and precipitation enhancement is not appropriate or cost-effective, and therefore is not applicable to the District.

Management Objective 7.1

The primary goal, perhaps viewed as the *"umbrella goal"* of the District is to provide for and facilitate the conservation of groundwater resources within the District. The District will include a link on the District's website to the electronic library of water conservation resources supported by the Water Conservation Advisory Council. For example, one important resource available through this internet-based resource library is the Water Conservation Best Management Practices Guide developed by the Texas Water Conservation implementation Task Force. This Guide contains over 60 Best Management Practices for municipalities, industry, and agriculture that will be beneficial to water users in the District.

Performance Standard 7.1

Link to the electronic library of water conservation resources supported by the Water Conservation Advisory Council is available on the District's website.

Management Objective 7.2

The District will submit at least one article regarding water conservation for publication each year to at least one newspaper of general circulation in the District's Counties.

Performance Standard 7.2

A copy of the article submitted by the District for publication to a newspaper of general circulation in one of the District's Counties regarding water conservation will be included in the Annual Report to the Board of Directors.

Management Objective 7.3

The District will provide educational curriculum regarding water conservation offered by the Texas Water Development Board (Major Rivers) to at least one elementary school in each county of the District.

Performance Standard 7.3

Each year the District will seek to provide water conservation curriculum to at least one elementary school in each county within the District. The elementary schools for which the curriculum is provided will be listed in the Annual Report to the Board of Directors.

Management Objective 7.4

While the District does not regulate rainwater harvesting, it has become a viable water source either as a supplemental water supply or as the primary water supply in both urban and rural areas of Texas. As a result, Texas has become internationally recognized for the widespread use and innovative technologies that have been developed, primarily through efforts at the TWDB. To ensure these educational materials are readily available to citizens in the District, a link to rainwater harvesting materials including system design specifications and water quality requirements will be maintained on the District's website.

Performance Standard 7.4

Link to rainwater harvesting resources at the TWDB is available on the District's website.

Management Objective 7.5

Educate public on importance of brush control as it relates to water table consumption.

Performance Standard 7.5

Link to information concerning brush control is available on the District's website.

Goal 8 - Achieving desired future conditions of groundwater resources

The desired future conditions of the aquifers in Groundwater Management Area 8 represent average water levels in the various aquifers at the end of 50-years based on meeting current and projected groundwater supply needs. The Board of Directors has adopted a strategic approach that

includes the adoption of this management plan and rules necessary to achieve the desired future conditions. This management plan and the companion rules have been designed as an integrated program that will systematically collect and review water data on water quantity, water quality, and water use, while at the same time, implementing public awareness and public education activities that will result in a better informed constituency.

Management Objective 8.1

State statute requires GCDs to review, amend as necessary, and readopt management plans at least every five years. The General Manager will annually present a summary report on the status of achieving the adopted desired future conditions. Prior to the adoption date of the next management plan, the General Manager will work with the Board of Directors to conduct a focused review to determine if any elements of this management plan or rules need to be amended in order to achieve the adopted desired future conditions, or if the adopted desired future conditions need to be revised to better reflect the needs of the District.

Performance Standard 8.1

The General Manager will include a summary report on the status of achieving the adopted desired future conditions in the Annual Report beginning by ~~2019~~2021, after the geodatabase improvements project is complete. This summary report will primarily be based on data collected from the District's groundwater monitoring program.

Four years after the adoption of this management plan, and based on the annual review conducted by the General Manager and the Board of Directors, the Board of Directors will determine which of the following apply to the District; (1) the current management plan and rules are working effectively to meet the adopted desired future conditions, (2) specific amendments need to be made to this management plan and/or rules in order to achieve the adopted desired future conditions, (3) amendments are needed to the adopted desired future conditions in order to better meet the needs of the District, or (4) a combination of (2) and (3). This determination will be made at a regularly scheduled meeting of the Board of Directors.

8 Estimates of Technical Information

8.1 Modeled Available Groundwater based on Desired Future Conditions

Texas Water Code § 36.001 defines modeled available groundwater as “the amount of water that the executive administrator determines may be produced on an average annual basis to achieve a desired future condition established under Section 36.108”.

The amount of water that may be permitted from an aquifer is not the same amount as the total amount that can be pumped from an aquifer. Total pumping includes uses of water both subject to

permitting and exempt from permitting (“exempt use”). Examples of exempt use include: domestic, livestock, and some types of water use associated with oil and gas exploration.

To determine the DFCs, a series of simulations using the TWDB’s Groundwater Availability Model (“GAM”) for the Northern Trinity and Woodbine aquifers were completed. Each GAM simulation was done by iteratively applying various amounts of simulated groundwater pumping from the aquifer over a predictive period that included a simulated repeat of the drought of record. Pumping was increased until the amount of pumping that could be sustained by the aquifer without impairing the aquifer conditions selected for consideration as the indicator of the aquifer desired future condition was identified.

The desired future conditions of the Northern Trinity aquifer in GMA 8 are documented in GAM Run ~~10-063~~17-029 MAG, which is included as Appendix E. The DFCs are based on average drawdown in feet after 50 years for each Trinity aquifer unit. DFCs for the Woodbine aquifer are documented in GAM Run ~~10-064~~17-029 MAG, which is also included as Appendix E.

In the Red River District, the geologic units comprising the Trinity are: the Antlers (which includes all of the Trinity Group Formations), the Paluxy Sand, the Glen Rose Limestone, and the Twin Mountain (which includes the Hensell and the Hosston Formations that are differentiated further to the south). ~~The old Trinity DFCs are not reported in terms of the Region-specific formations that were incorporated into the updated North Trinity GAM.~~ The District is located in Regions 1 and 2. Figure 2 presents the location of each hydrogeologic region in the area.

The joint planning process set forth in Texas Water Code § 36.108 must be collectively conducted by all groundwater conservation districts within the same GMA. The District is a member of GMA 8. During the second round of joint planning, GMA-8 passed and adopted a resolution proposing DFCs for all relevant aquifers by letter dated April 1, 2016. The adopted DFCs were then forwarded to the TWDB for development of the MAG calculations. ~~The District is awaiting the updated MAG estimates from the TWDB, and will amend the Plan when this data is made available.~~ A summary of the desired future conditions and the modeled available groundwater are presented in Tables 1 and 2 below.

~~Table 1. Current desired future conditions for the Trinity and Woodbine aquifers based on total average feet of drawdown~~

GMA-8 Adopted DFCs						
County	Woodbine	Paluxy	Glen-Rose	Twin Mountain	Travis-Peak	Antlers
Fannin	247	688	280	372	269	251
Grayson	160	922	337	417	-	348

**Table 21. Estimates of Modeled Available Groundwater
for pumping in the Trinity and Woodbine aquifers
(GAM Run ~~17-029 10-063~~ and GAM Run 10-064)**

County	Aquifer	Modeled Available Groundwater (acre-feet per year)							
		2009	2010	2020	2030	2040	2050	2060	2070
Fannin	Antlers	389	2,087	2,092	2,087	2,092	2,087	2,092	2,087
Fannin	Woodbine	5,495	4,920	4,934	4,920	4,934	4,920	4,934	4,920
Fannin	County Total	5,884	7,007	7,026	7,007	7,026	7,007	7,026	7,007
Grayson	Antlers	6872	10,708	10,738	10,708	10,738	10,708	10,738	10,708
Grayson	Woodbine	5,056	7,521	7,541	7,521	7,541	7,521	7,541	7,521
Grayson	County Total	11,928	18,229	18,279	18,229	18,279	18,229	18,279	18,229
District Total		17,812	25,236	25,305	25,236	25,305	25,236	25,305	25,236

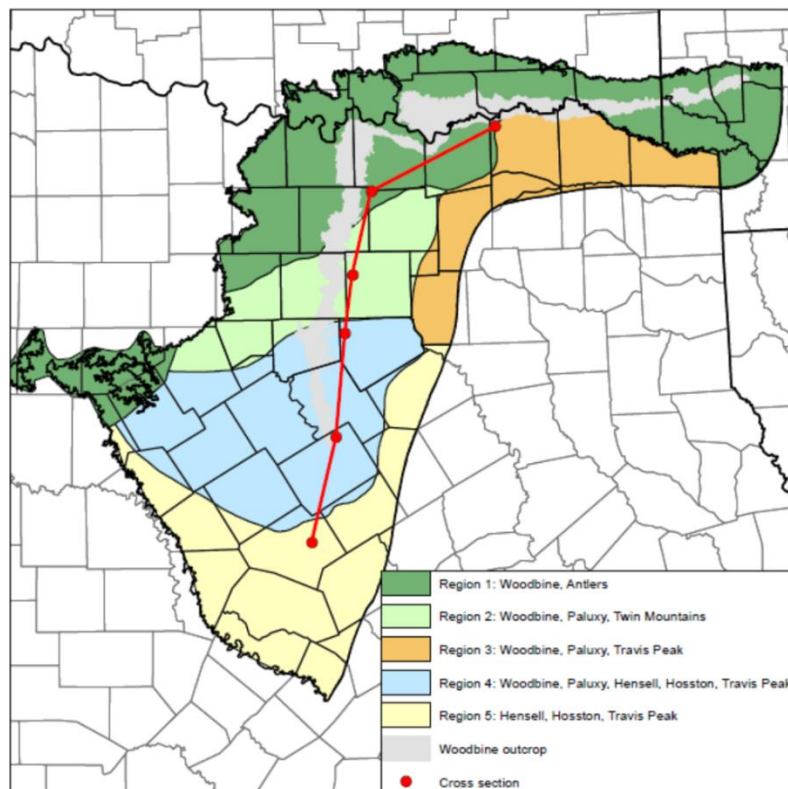


Figure 2. Hydrogeologic Region Extents

8.2 Amount of Groundwater Being Used within the District

Each year the TWDB conducts an annual survey of ground and surface water use by municipal and industrial entities within the state of Texas. The information obtained is then utilized by the TWDB for water resources planning. The historical water use estimates are subject to revision as additional data and corrections are made available to the TWDB.

Estimates of historical water use in Grayson and Fannin Counties in the years 2000 through 2015 is presented in Appendix F. TWDB data included in Appendix F do not differentiate between exempt and non-exempt use.

Estimated groundwater use in the District by category in 2015 was approximately 70 percent for municipal use, 15 percent for irrigation use, 10 percent for livestock use, 5 percent for manufacturing use, less than one percent for mining use, and zero percent for steam-electric power use. In the TWDB Water Use Survey, the municipal use category includes small water providers and rural domestic pumping in addition to municipalities.

Total groundwater use was about 21,320 acre-feet in 2000, with a gradual decline between 2001 and 2004 to a minimum of about 16,322 acre-feet in 2004. Between 2005 and 2008 water use continued to decline on average by 490 acre-feet per year. Starting in 2009, total usage increased reaching a peak in 2012 with a maximum use of 27,638 acre-feet. Total water use decreased to 19,474 acre-feet in 2013, 18,232 acre-feet in 2014, and to 16,472 in 2015. Water use for irrigation purposes decreased to zero in 2008 and was greatest from 2009 through 2014, with a slight decline shown for 2015. Usage for mining purposes increased in 2008 through 2012. Livestock use remained between about 100 and 255 acre-feet per year from 2000 through 2004 and then increased to a maximum use of approximately 1,892 acre-feet in 2005. Water use for steam-electric power generation was greatest in 2000 at approximately 503 acre-feet. Between 2008 through 2010 usage steadily declined and reached zero acre-feet per year in 2011 through 2015. Generally, municipal water use has been greater than about 11,000 acre-feet per year throughout the historical record with maximum usage in 2009 through 2012. Historic water use from 2000 to 2015 is taken from the 2017 State Water Plan. [Figure 3](#) and [Figure 4](#) present the historic water usage for Fannin and Grayson Counties, respectively. Refer to Appendix F for the data table.

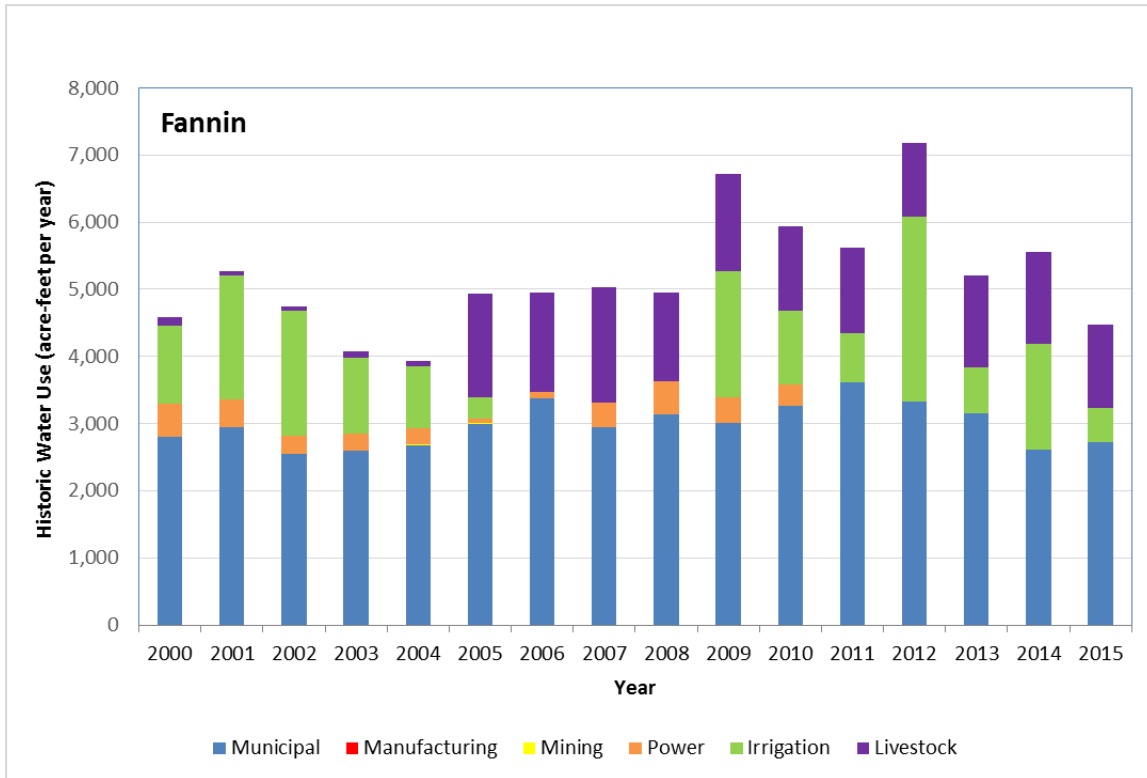


Figure 3. Historic Groundwater Use Estimate for Fannin County

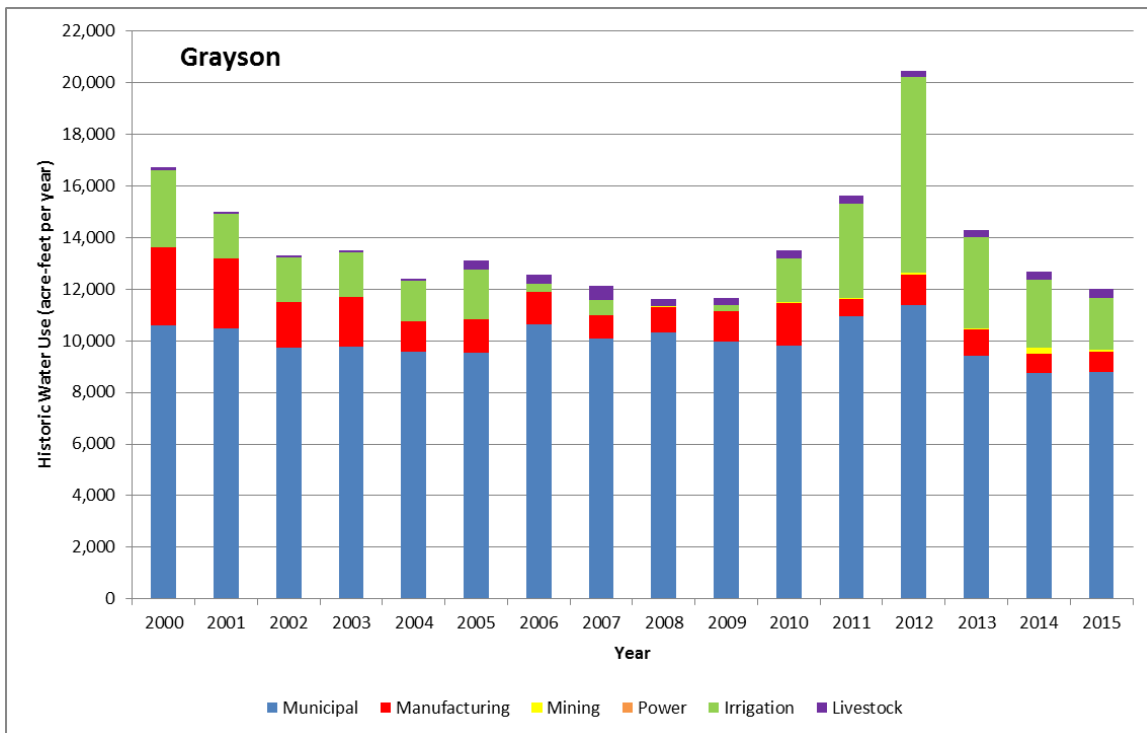


Figure 4. Historic Groundwater Use Estimate for Grayson County

8.3 Annual Amount of Recharge from Precipitation

Recharge from precipitation falling on the outcrop of the aquifer (where the aquifer is exposed to the surface) within the Red River GCD was estimated by the TWDB in the GAM Run 16-005 dated May 16, 2016. Water budget values of recharge extracted for the transient model period indicate that precipitation accounts for 428 acre-feet per year of recharge to the Trinity aquifer and 73,888 acre-feet per year of recharge to the Woodbine aquifer within the boundaries of the Red River GCD (Appendix E).

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

The total water discharged from the aquifer to surface water features such as streams, reservoirs and springs is defined as the surface water outflow. Water budget values of surface water outflow within the Red River GCD were estimated by the TWDB in the GAM Run 16-005 (Appendix E). Modeled values are 258 acre-feet per year of discharge from the Trinity aquifer and 46,096 acre-feet per year of discharge from the Woodbine aquifer to surface water bodies that are located within the Red River GCD.

8.5 Annual Volume of Flow In and Out of the District and Between Aquifers in the District

Flow into and out of the District is defined as the lateral flow within an aquifer between the District and adjacent counties. Flow between aquifers is defined as the vertical flow between aquifers or confining units that occurs within the boundaries of the District. The flow is controlled by hydrologic properties as well as relative water levels in the aquifers and confining units. Water budget values of flow for the Red River GCD were estimated by the TWDB in the GAM Run 16-005 (Appendix E).

8.6 Projected Surface Water Supply within the District

The 2017 Texas State Water Plan, the most recent plan available, provides an estimate of projected surface water supplies in Grayson and Fannin Counties. These estimates are included in Appendix F.

Total projected surface water supplies by county are illustrated in [Figure 5](#)~~Figure 5~~. The estimated projections range from a maximum of 15,618 acre-feet in 2030 to a minimum of 14,934 acre-feet in 2020 for Fannin County, from a maximum of 30,846 acre-feet in 2070 to a minimum of 30,244 acre-feet in 2050 for Grayson County. They also indicate that projected surface water supplies for the District, which are on the order of 46,464 acre-feet per year, are even or slightly less than historical groundwater use in the District, which is on the order of 20,000 to 50,000 acre-feet per year for 2000 through 2015.

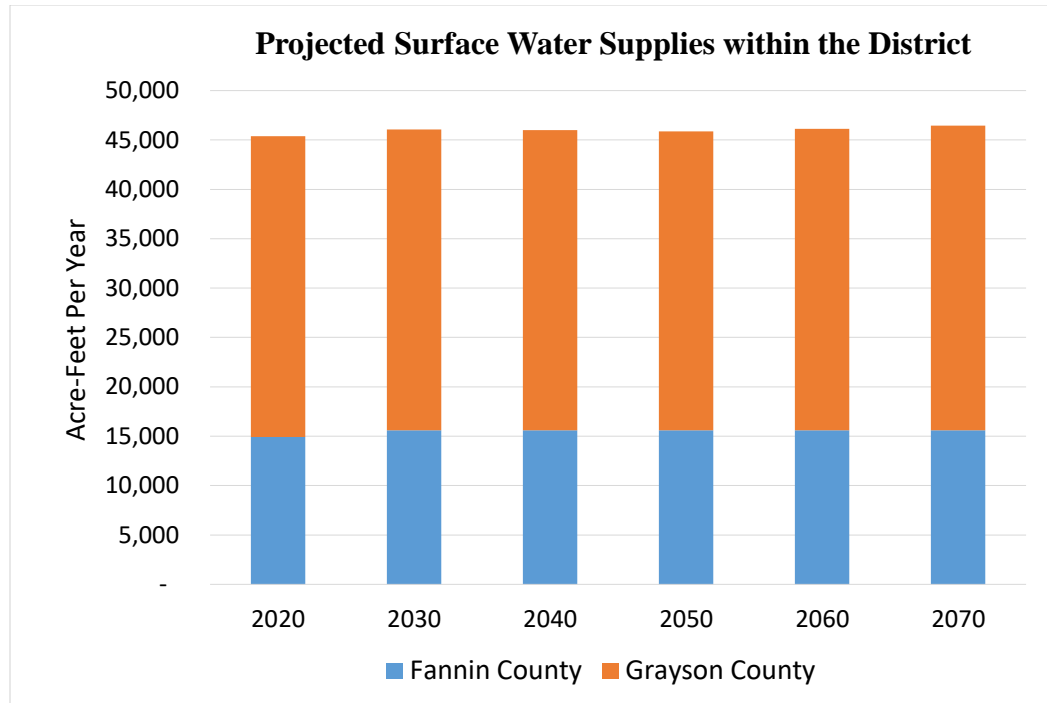


Figure 5. Projected Surface Water Supplies within the District

8.7 Projected Total Demand for Water within the District

Appendix F contains an estimate of projected net water demand in Fannin and Grayson Counties based on the 2017 Texas State Water Plan.

The analyses to develop water demand projections are primarily conducted in Texas as part of the regional water supply planning process (created by the 75th Texas Legislature through the passage of Senate Bill 1 in 1997). Water demand projections are developed for the following water user categories; municipal, rural (county-other), irrigation, livestock, manufacturing, mining, and steam-electric power generation.

Texas Water Code § 36.1071(e)(3)(G) requires that a management plan include projections of the total demand for water (surface water and groundwater) from the most recently adopted state water plan. The projected total demand for the District increases significantly from 62,140 acre-feet per year in 2020 to 126,130 acre-feet per year in 2070. Projected demands are significantly higher in Grayson than in Fannin County ([Figure 6](#)).

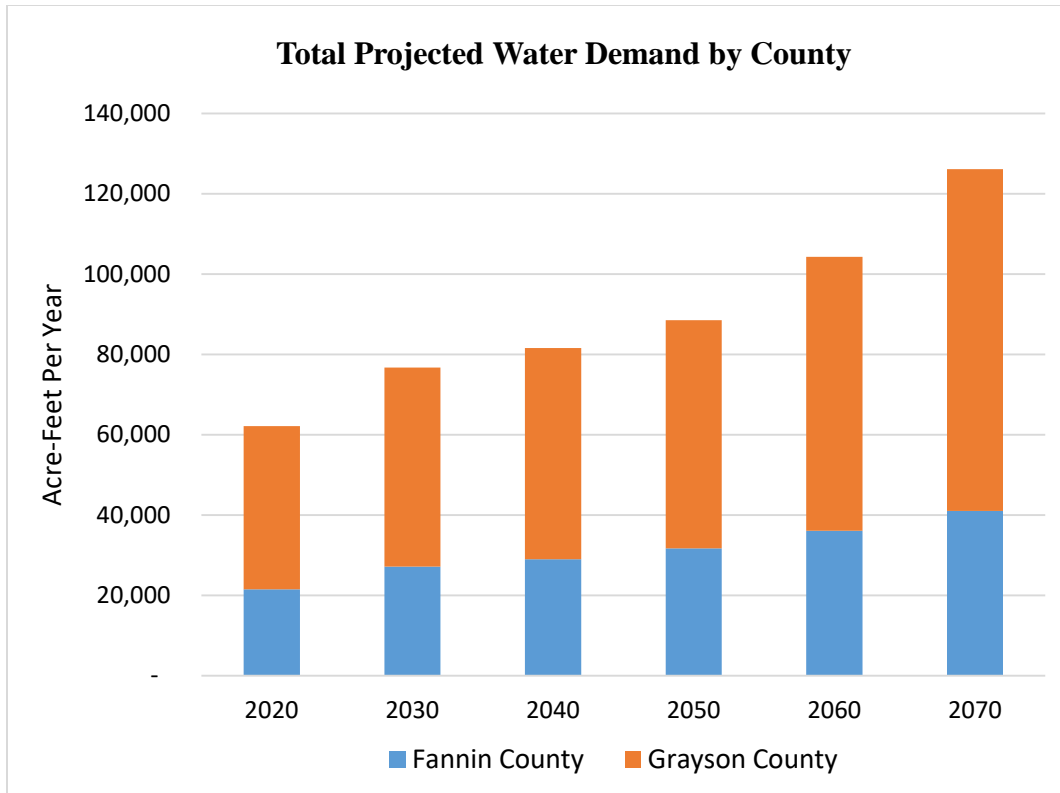


Figure 6. Total Projected Water Demand within the District

8.8 Projected Water Supply Needs

Projected water needs for the counties in the District were developed for the 2017 State Water Plan. Those needs reflect conditions when projected water demands exceed projected water supplies in the event of a drought of record. Projected water needs were estimated on the county-basin level for all water user group categories for every decade from 2020 through 2070. Appendix F lists the total water supply needs for Grayson and Fannin Counties as adopted in the TWDB 2017 State Water Plan.

Data for the 2017 State Water Plan projects future water needs for both counties in the District. There are 17 water user groups in Fannin County. A water need at some point between 2020 and 2070 is projected for all but five of those water user groups. The projected need in Fannin County increases significantly from 56 acre-feet per year in 2020 to 18,776 acre-feet per year in 2070. Of the 26 water user groups in Grayson County, a need at some point between 2020 and 2070 is projected for 20 of those water user groups. For the District as a whole, the total projected water need increases from 142 acre-feet per year in 2020 to 55,020 acre-feet per year in 2070. [Figure 7](#) shows the total projected water needs for the District through 2070.

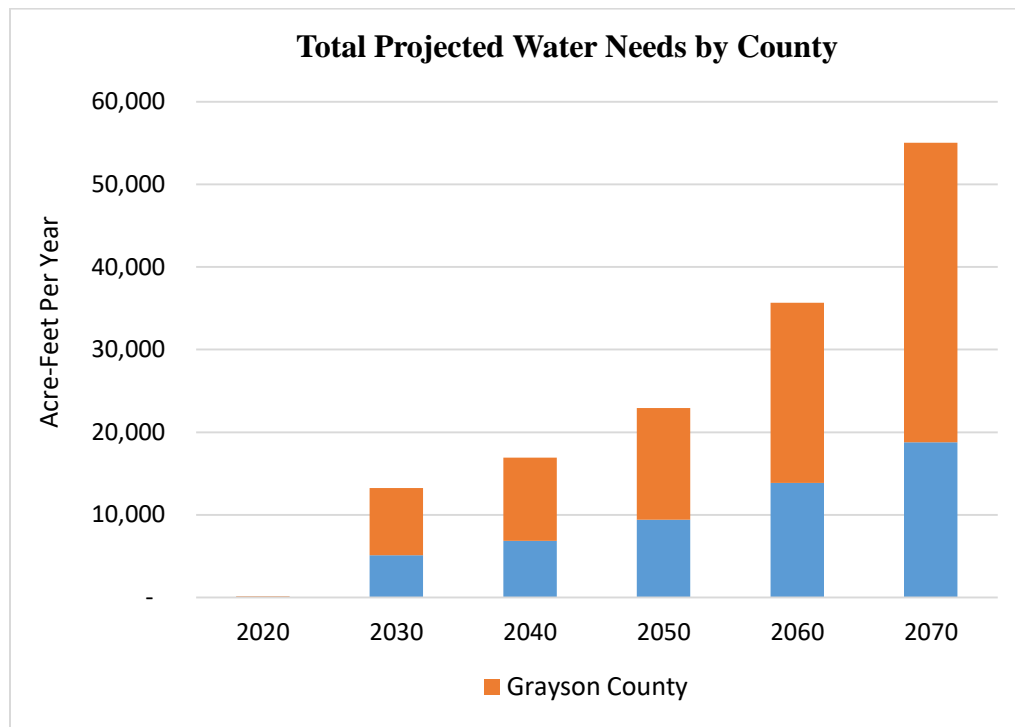


Figure 7. Total Projected Water Needs by County

8.9 Water Management Strategies

The 2017 State Water Plan assessed and recommended water management strategies to meet the identified needs for every decade from 2020 through 2070. Potential strategies include water conservation, developing additional groundwater and surface water supplies, expanding and improving management of existing water supplies, water reuse, and alternative approaches such as desalination. The projected water management strategies for the counties in the District from the 2017 State Water Plan are shown in Appendix F by water user group (WUG).

9 Groundwater Resources of Fannin and Grayson Counties

A map showing the extent of the aquifers in the District is included as [Figure 8](#). Cross sections through the aquifers are included as Figures 9 and 10.

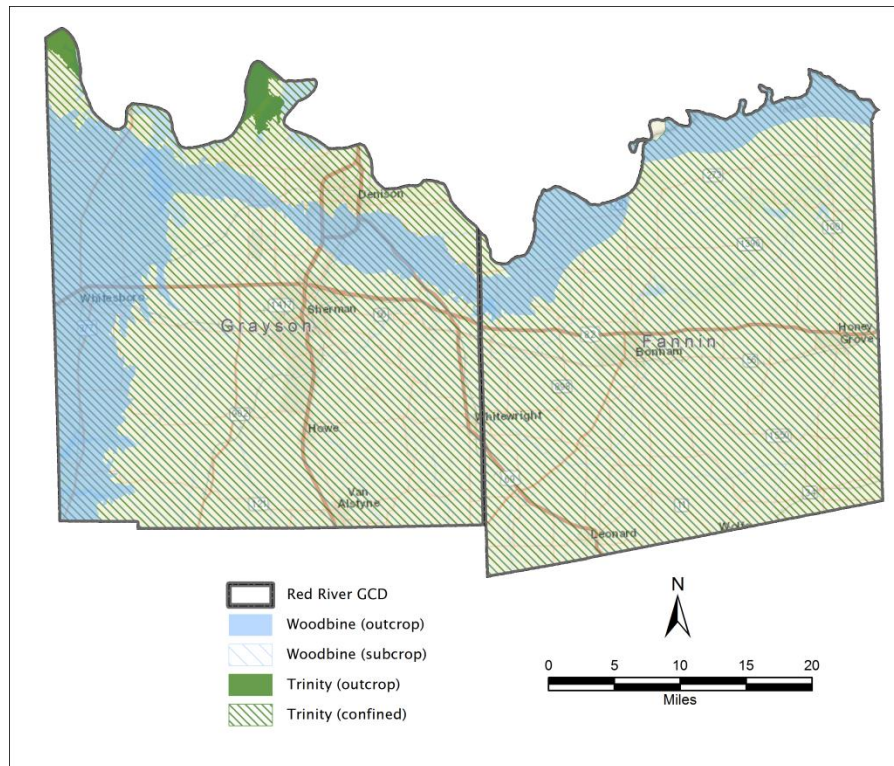


Figure 8. Red River District Aquifers

The Trinity aquifer consists of early Cretaceous age formations of the Trinity Group where they occur in a band extending through the central part of the state in all or parts of 55 counties, from the Red River in North Texas to the Hill Country of South-Central Texas. Trinity Group deposits also occur in the Panhandle and Edwards Plateau regions where they are included as part of the Edwards-Trinity (High Plains and Plateau) aquifers.

Formations comprising the Trinity Group are (from youngest to oldest) the Paluxy, Glen Rose, and Twin Mountains-Travis Peak. Up-dip, where the Glen Rose thins or is missing, the Paluxy and Twin Mountains coalesce to form the Antlers Formation. The Antlers consists of up to 900 feet of sand and gravel, with clay beds in the middle section. Water from the Antlers is mainly used for irrigation in the outcrop area of North and Central Texas. Forming the upper unit of the Trinity Group, the Paluxy Formation consists of up to 400 feet of predominantly fine-to-coarse-grained sand interbedded with clay and shale. The formation pinches out downdip and does not occur south of the Colorado River.

Underlying the Paluxy, the Glen Rose Formation forms a gulf-ward-thickening wedge of marine carbonates consisting primarily of limestone. South of the Colorado River, the Glen Rose is the upper unit of the Trinity Group and is divisible into an upper and lower member.

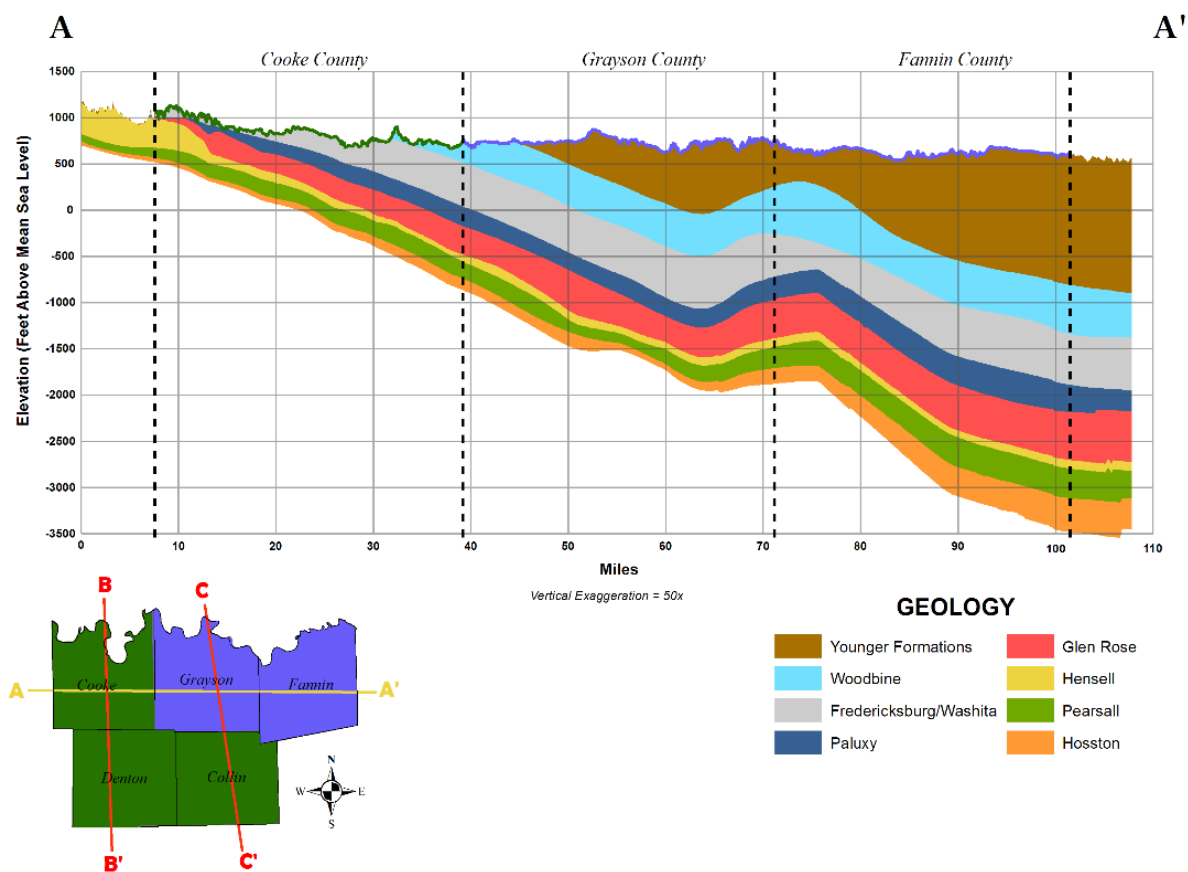


Figure 9. Cross Section A-A'

The basal unit of the Trinity Group consists of the Twin Mountains and Travis Peak formations, which are laterally separated by a facies change. To the north, the Twin Mountains formation consists mainly of medium- to coarse-grained sands, silty clays, and conglomerates. The Twin Mountains is the most prolific of the Trinity aquifers in North-Central Texas; however, the quality of the water is generally not as good as that from the Paluxy or Antlers Formations. To the south, the Travis Peak Formation contains calcareous sands and silts, conglomerates, and limestones. The formation is subdivided into the following members in descending order: Hensell, Pearsall, Cow Creek, Hammett, Sligo, Hosston, and Sycamore.

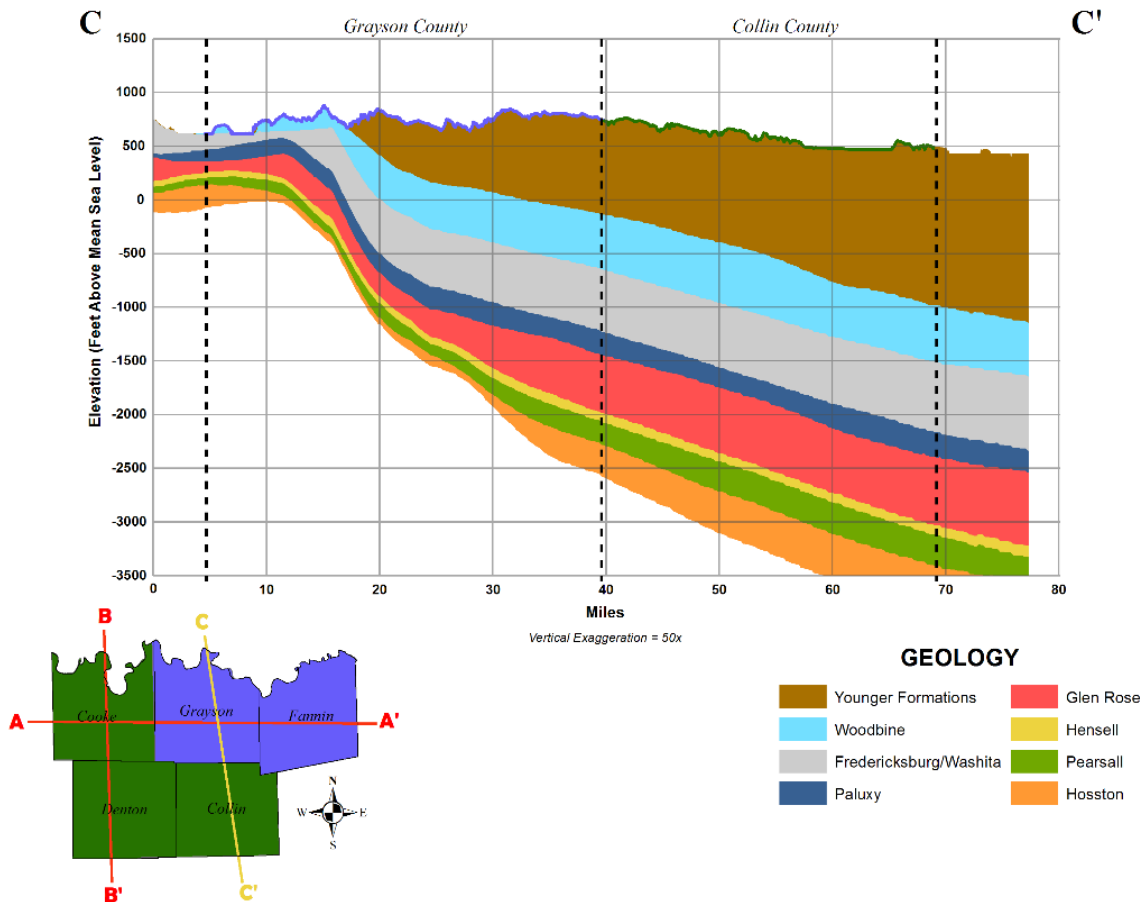


Figure 10. Cross Section C-C'

The depth to the top of the Trinity Group Antlers and Paluxy Formations ranges between approximately 500 feet in northwest Grayson County to over 3,500 feet in southeast Fannin County. The depth to the base of Cretaceous ranges between 900 ft and 4,500 feet from northwest to southeast across Grayson and Fannin Counties. The total thickness of the Trinity Formations ranges from 400 and 1,000 feet across the District.

The Woodbine aquifer extends from McLennan County in North-Central Texas northward to Cooke County and eastward to Red River County, paralleling the Red River. Groundwater produced from the aquifer furnishes municipal, industrial, domestic, livestock, and small irrigation supplies throughout its North Texas extent. The Woodbine Formation is composed of water-bearing sandstone beds interbedded with shale and clay. Within the District, the Woodbine Formation dips eastward into the subsurface where the top of the formation reaches a maximum depth of

approximately 1,200 feet below land surface and a maximum thickness of approximately 600 feet near the eastern Fannin County line.

The Woodbine aquifer is divided into three water-bearing zones that differ considerably in productivity and quality. Only the lower two zones of the aquifer are developed to supply water for domestic and municipal uses. Chemical quality deteriorates rapidly in well depths below 1,500 feet. In areas between the outcrop and this depth, quality is considered good overall as long as ground water from the upper Woodbine is sealed off. The upper Woodbine contains water of extremely poor quality in down-dip locales and contains excessive iron concentrations along the outcrop.

Red River Alluvium

A review of state well reports in both northern Fannin County and the northeast corner of Grayson County indicates that significant water-bearing alluvial deposits have accumulated along the Red River Basin. The depth from land surface to the base of the river alluvium occurs up to a maximum depth of about 95 feet, with an average alluvium thickness of 50 feet. The thick deposits that parallel the sides of the river channel are a result of the river down-cutting through existing fluvial deposits, which are typically composed of clay, sand and gravel. Gravel is usually identified at the base of the alluvial sequences. The extent of the alluvial aquifer in the District is shown on Figure 11.

There are 66 wells registered within the District that have been completed in the alluvium that have not been plugged or drilled as dry holes. Ten of those wells are non-exempt. These numbers are based on District well registry data collected through October 2015.

Sand pit operations that are located in the alluvium aquifer discharge a significant amount of groundwater for dewatering operations. Other uses include irrigation and domestic use. Well yields range from one gallons per minute ("gpm") to 150 gpm, with an average yield of approximately 25 gpm.

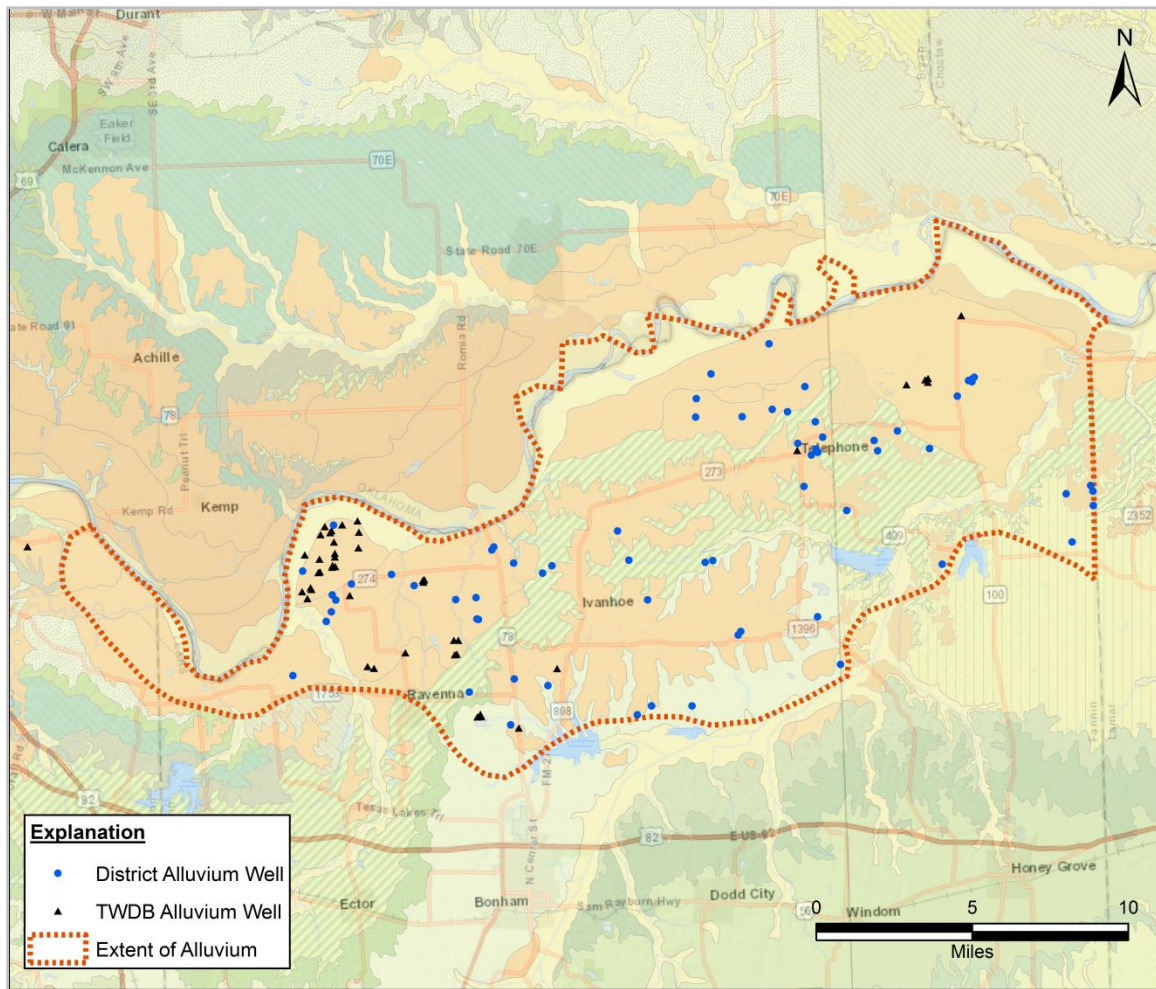


Figure 11. Extent of Alluvium within the District