Clearwater Underground Water Conservation District

District Management Plan

Original Plan Adopted October 24, 2000
(Certified by TWDB February 21, 2001)

Revisions Adopted
December 13, 2005 (Approved by TWDB March 6, 2006)
February 8, 2011 (Approved by TWDB April 13, 2011)

Reviewed and Revisions Adopted
January 13, 2016 (Approved by TWDB February 19, 2016)

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APPENDICES & EXHIBITS

I. DISTRICT MISSION

The mission of the Clearwater Underground Water Conservation District (District) is to develop and implement an efficient, economical and environmentally sound groundwater management program to protect and enhance the water resources of the District.

II. PURPOSE OF THE MANAGEMENT PLAN

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

The District's management plan satisfies the requirements of SB 1, SB 2, HB 1763, the statutory requirements of Texas Water Code (TWC) Chapter 36, and the rules and requirements of the TWDB.

III. DISTRICT INFORMATION

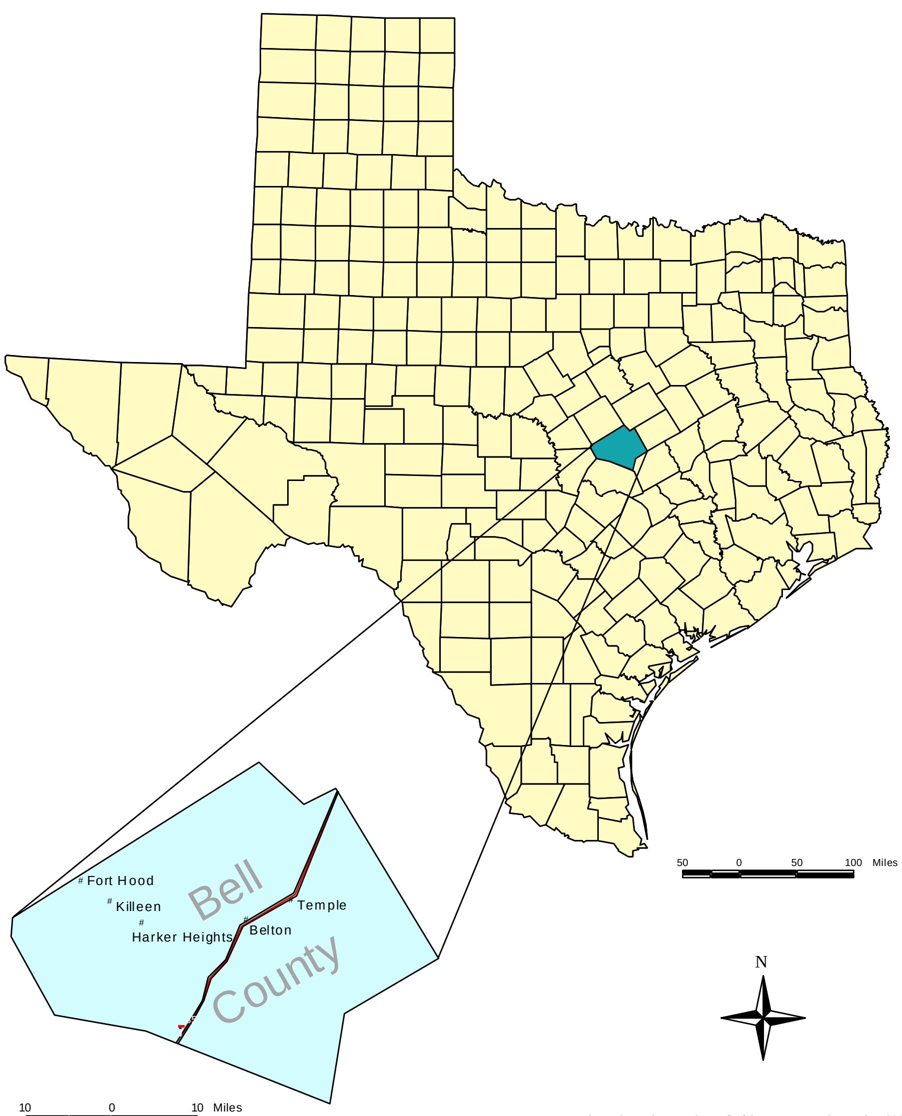
A. Creation

Clearwater Underground Water Conservation District (CUWCD) is a political subdivision of the State of Texas and underground water conservation district created and operating under and by virtue of Article XVI, Section 59, of the Texas Constitution; Texas Water Code Chapter 36; the District's enabling act, Act of May 27, 1989, 71st Legislature, Regular Session, Chapter 524 (House Bill 3172), as amended by Act of April 25, 2001, 77th Legislature, Regular Session, Chapter 22 (Senate Bill 404), Act of May 7, 2009, 81st Legislature, Regular Session, Chapter 64 (Senate Bill 1755), and Act of May 27, 2015, 84th Legislature, Regular Session, Chapter 1196, Section 2 (Senate Bill 1336)(omnibus districts bill); and the applicable general laws of the State of Texas; and confirmed by voters of Bell County on August 21, 1999.

The District was formed to protect the underground water resources for the citizens of Bell County. Beyond its enabling legislation, the District is governed primarily by the provisions of Chapter 36 of the Texas Water Code, the District's Management Plan, and the District Rules.

Exhibit A

CLEARWATER UNDERGROUND WATER CONSERVATION DISTRICT BOUNDARY



B. Directors

The Board of Directors consists of five members. These five directors are elected by the voters of Bell County and serve a four year term. CUWCD observes the same precincts as the Bell County Commissioners—four precincts with one at-large position. Director terms are staggered with a two year interval. Directors from Precincts 1 and 3 serve the same term while directors from Precincts 2, 4 and the at-large position serve the same term. Elections are held in November in even numbered years.

C. Authority

CUWCD is governed by the provisions of TWC Chapter 36. CUWCD has the power and authority to undertake various hydrogeological studies, to adopt a management plan, to establish a program for the permitting of certain water wells, and to implement programs to achieve its statutory mandates. CUWCD has rule-making authority to implement its policies and procedures and to help ensure the management of the groundwater resources of Bell County.

D. Location and Extent

The jurisdiction of CUWCD includes all territory located within Bell County (Exhibit A). This area encompasses approximately 1,055 square miles**.** CUWCD is bounded by McLennan County to the north; Falls and Milam Counties to the east; Williamson County to the south; and Burnet, Lampasas, and Coryell Counties to the west. Bell County has a vibrant economy dominated by the military, medical, manufacturing, and agricultural communities. Based on the 2012 Census of Agriculture, approximately 421,362 of Bell County's 675,200 acres, or 62.4% of this area, is farmland.

E. Topography and Drainage

Bell County is divided into two separate ecological regions by the Balcones Escarpment, which runs from the southeast part of the county to the northwest. The region east of the Balcones Escarpment is the Blackland Prairie while the Grand Prairie is located to the west.

In the Grand Prairie area drainage flows to the Little River and its tributaries. The Leon and Lampasas Rivers and Salado Creek converge at Three Forks.

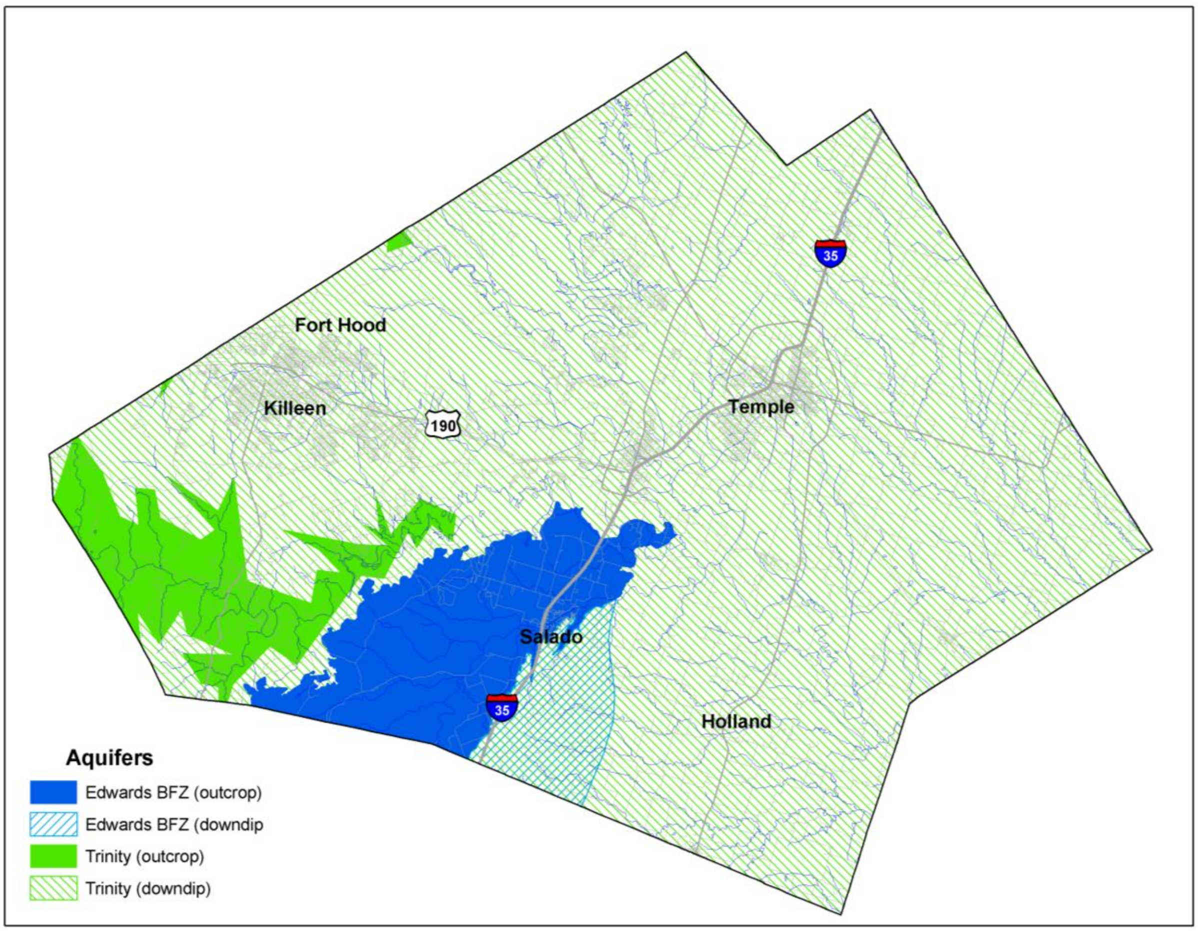
F. Groundwater Resources of Bell County

Bell County enjoys a variety of groundwater resources. The two primary sources of groundwater in Bell County are the Edwards Balcones Fault Zone (BFZ) Aquifer and the Trinity Aquifer. These aquifers are recognized as major aquifers by the TWDB. The Edwards (BFZ) Aquifer is the source of Salado Springs and is the primary source of water supply for the City of Salado. The Trinity Aquifer consists of three distinct subdivisions. It is the primary source of groundwater in much of western Bell County. The deepest subdivision of the Trinity Aquifer also serves or has served the Cities of Rogers, Holland,

and Bartlett in eastern Bell County. The portion of Bell County east of IH-35 also has a number of groundwater sources that are not widely recognized as aquifers outside of the County but are of vital importance. Approximately 40 percent of the wells registered with the District are located in eastern Bell County and produce water from alluvium, the Lake Waco Formation (Fm), the Kemp Fm, the Ozan Fm, the Pecan Gap Fm, the Austin Chalk, or the Buda Limestone. Additionally there are wells which produce water from the Edwards Fm and associated limestones outside of the recognized limits of the Edwards (BFZ) Aquifer which are recognized by CUWCD as producing water from the Edwards Equivalent Aquifer.

See Appendix A: Groundwater Resources of Bell County
See Appendix B: CUWCD - Bell County Historical Groundwater use (2011-2015).
See Appendix C: TWDB Estimated Historical Water Use for Bell County.
See Appendix D: TWDB Data Definitions

Exhibit B -- Major Aquifers in Bell County



IV. STATEMENT OF GUIDING PRINCIPLES

CUWCD recognizes that the groundwater resources of Bell County and the Central Texas region are of vital importance and that local management provides essential localized leadership, local discernment, local accountability, based on local oversite, and local expert understanding of the resource. Preservation of this most valuable resource can be managed in a prudent and cost effective manner through education, cooperation, and developing a comprehensive understanding of the aquifers. The greatest threat to CUWCD in achieving its stated mission is the misunderstanding of the resource by elected officials, property owners, and water users. Scientific understanding can support localized management of the groundwater resources, if the district continues to invest in science based research to bolster understanding of local conditions. CUWCD's management plan is intended to serve as a tool to focus the thoughts and actions of those given the responsibility for the execution of the District's activities.

V. CRITERIA FOR PLAN APPROVAL

A. Planning Horizon

The time period for this plan is five years from the date of approval by the executive administrator or, if appealed, on approval by the TWDB. The original management plan was certified by the TWDB in February 2001. The District's Board of Directors adopted a revised groundwater management plan on December 13, 2005 and approved by TWDB in March 2006. This plan was revised and amended by the Board of Directors on February 8, 2011 and approved by TWDB April 13, 2011, will expire on April 13, 2016. This plan is being submitted as part of the next five-year review for final approval by TWDB Executive Administrator 60 days and re-adoption process as required by TWC 36.1072(e). This management plan will remain in effect until a revised management plan is approved by the Executive Administrator or the TWDB. The Plan shall be reviewed (annually), and updated and readopted in accordance with the requirements of the Texas Water Code and remain effective for five years from the approval date by the Executive Administrator.

B. Board Resolution

Copy of the Clearwater Underground Water Conservation District resolution adopting the plan.

A copy of the Clearwater Underground Water Conservation District resolution adopting the plan is located. S*ee Appendix E: CUWCD Resolution*

C. Plan Adoption

Evidence that the plan was adopted after notice and hearing.

Public notices documenting that the plan was adopted following appropriate public meetings and hearings are located. *See Appendix F: CUWCD Notice of Public Hearing*

D. Coordination with Surface Water Management Entities

Evidence that following notice and hearing the District coordinated in the development of its management plan with surface water management entities.

CUWCD reference letter documenting transmitting a copy of this plan to surface water management entities after adoption of the plan. S*ee Appendix G*: *Notice to Surface Water Management Entities.*

VI. ESTIMATES OF TECHNICAL INFORMATION REQUIRED BY TEXAS WATER CODE CHAPTER 36.

A. Modeled available groundwater in the district based on the desired future condition established

Modeled available groundwater is defined in TWC §36.001 as the amount of water the Executive Administrator determines may be produced on an average annual basis to achieve a desired future condition established under section 36.108. The desired future condition of the aquifer may only be determined through joint planning with other groundwater conservation districts (GCDs) in the same groundwater management area (GMA) as required by the 79th Legislature with the passage of HB 1763 into law. The District is located in GMA 8. The GCDs of GMA 8 have completed the joint planning process to determine the desired future condition of the aquifers in the GMA.

To determine the desired future conditions, the District conducted a series of simulations using the TWDB's Groundwater Availability Models (GAMs) for the Northern Edwards (BFZ) and the Northern Trinity/Woodbine Aquifers. Each series of GAM simulations was conducted by iteratively applying varying 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.

See Appendix H: TWDB Map of the GMA boundaries

1. <u>Edwards (BFZ) Aquifer</u>

   a. <u>Desired Future Conditions</u>
   The desired future condition of the Edwards (BFZ) Aquifer is based on maintaining Salado Spring discharge into Salado Creek during a repeat of conditions similar to the 1950's drought of record. Under the drought of record conditions, a spring discharge of 200 acre-feet per month is preferred and 100 acre-feet per month is the minimum acceptable spring flow.

   b. <u>Modeled Available Groundwater</u>
   The modeled available groundwater value for the Edwards (BFZ) Aquifer in Bell County, as given in TWDB GAM Run 10-065 MAG, is 6,469 acre-feet per year, and is based on the desired future condition discussed above. CUWCD estimates that by year 2060, exempt use of the Edwards (BFZ) Aquifer may reach

approximately 825 acre-feet per year and that volume of water is allocated for exempt well users on an annual basis. This leaves approximately **5,644 acre-feet per year as the volume of groundwater available for permitting in the Edwards (BFZ) aquifer**. *See Appendix I: TWDB GAM Run 10-065 MAG*

2. <u>Trinity Aquifer</u>

a. <u>Desired Future Conditions</u>
There are three recognized subdivisions in the Trinity Aquifer: the Upper, Middle and Lower Trinity Aquifers. In Bell County the three subdivisions of the Trinity Aquifer are made up of several geologic units. The geologic units are: the Paluxy Sand; the Glen Rose Limestone and; the Hensell Sand and Hosston Conglomerate of the Travis Peak Formation. GMA 8 developed a desired future condition for each of the water-bearing geologic units which make up the Trinity Aquifer in Bell County. The desired future conditions for the several water-bearing units describe the amount of water-level draw down which may occur after 50 years when the draw down is averaged across the area of occurrence of the water bearing unit in the District. The amount of draw down described in the desired future conditions is indexed to year 2000 water levels.

- From estimated year 2000 conditions, the average draw down of the Paluxy Aquifer should not exceed approximately 134 feet after 50 years.
- From estimated year 2000 conditions, the average draw down of the Glen Rose Aquifer should not exceed approximately 155 feet after 50 years.
- From estimated year 2000 conditions, the average draw down of the Hensell Aquifer should not exceed approximately 286 feet after 50 years.
- From estimated year 2000 conditions, the average draw down of the Hosston Aquifer should not exceed approximately 319 feet after 50 years.

For the purpose of managing groundwater in the District, CUWCD groups the water-bearing geologic units into the three Trinity Aquifer subdivisions as follows: the Upper Trinity Aquifer (Paluxy Sand + Glen Rose Limestone); the Middle Trinity Aquifer (Hensell Sand); and the Lower Trinity Aquifer (Hosston Conglomerate).

b. <u>Modeled Available Groundwater</u>
The total of modeled available groundwater values for the Trinity Aquifer in Bell County, as given in GAM Run 10-063 MAG is 7,068 acre-feet per year which is based on the amounts of groundwater that could be pumped while maintaining the desired future conditions in each water-bearing geologic unit discussed above. CUWCD estimates that by year 2060, exempt use of the Trinity Aquifer may reach approximately 1,419 acre-feet per year and that volume of water is allocated for exempt well users on an annual basis. This leaves approximately **5,649 acre-feet per year as the volume of groundwater available for permitting in the Trinity Aquifer**.

The modeled available groundwater values of the several water-bearing geologic units of the Trinity Aquifer in Bell County, as given in TWDB GAM Run 10-063 MAG, are as follows:

a. Paluxy – 96 ac-ft per year
b. Glen Rose – 880 ac-ft per year
c. Hensell – 1,099 ac-ft per year
d. Hosston – 4,993 ac-ft per year

CUWCD intends through its rules to regulate the Trinity Aquifer within the District, however, at some time in the future and within the duration of the effectiveness of this plan, CUWCD may consider management of the Trinity Aquifer within the District by aquifer subdivision or geologic water-bearing unit, if determined appropriate. If management by subdivision or geologic unit is implemented through the District's rules, the modeled available groundwater values for each Trinity Aquifer subdivision or geologic water-bearing unit will require a separate allocation of water for exempt well use. *See Appendix J: TWDB GAM Run 10-063 MAG*

3. Other Water Bearing Formations

Other groundwater sources in Bell County include Alluvium, the Austin Chalk, the Buda Limestone, the Edwards Group and equivalent rocks outside the recognized bounds of the Edwards (BFZ) Aquifer (Edwards Equivalent Aquifer), the Kemp Fm., the Lake Waco Fm., the Ozan Fm., and the Pecan Gap Fm. These sources of groundwater produce limited water supply in limited areas in the District. GMA 8 did not find these aquifers relevant for planning purposes at the present time or develop desired future conditions for them; as a result there are no modeled available groundwater values for these sources of groundwater. See *Appendix A* for a more detailed discussion of these water bearing formations.

B. Amount of groundwater being used within the district on an annual basis.

The amount of groundwater used in Bell County from 2011 to 2015 is shown in the *Appendix B*. Data from 2000-2013 is provided by the Texas Water Development Board from their Water Use Survey database, *Appendix C*. The CUWCD data, A*ppendix B*, does distinguish between exempt and non-exempt wells. Exempt wells are wells that are used for domestic use or livestock watering (including certain additional uses defined in State law) and not capable of producing more than approximately 17 gallons per minute. Groundwater use data for 2011 through 2015 is provided from the District's records. The District began registering wells in February 2002 and began recording production from non-exempt wells during 2003. At the end of September 2015, approximately 5,117 wells were registered. Although CUWCD has made considerable progress in registering wells, it is likely there are still 1-2% of wells in Bell County that are not registered, and are therefore not considered in *Appendix B*. The District requires monthly production reports for all Classification 2 non-exempt wells (commercial). Classification 1 non-exempt wells are wells that would otherwise be considered exempt but are located on a tract of land of less than 10 acres and greater than 2 acres subdivided after March 1, 2004. Production reports are not required for Classification 1 wells; however, production cannot exceed 25,000 gallons per day. In 2004, the District began estimating production from exempt wells. *See Appendix B: CUWCD - Bell County Historical Groundwater Use (2011-2015)*

C. Annual amount of recharge from precipitation to the groundwater resources within the district.

The estimates of the annual amount of recharge to the groundwater resources of the District that are recognized as Major Aquifers by TWDB are based on the GAM simulations provided by TWDB to the District for use in this plan. The District has made no estimate of the amount of annual recharge to the local sources of groundwater in the District.

1. Edwards (BFZ) Aquifer Recharge 27,565 acre-feet per year

2. Trinity Aquifer Recharge 2,816 acre-feet per year

Estimate source: TWDB GAM Run 15-003; November 24, 2015

D. For each aquifer, annual volume of water that discharges from the aquifer to springs and any surface water bodies, including lakes, streams, and rivers.

The estimates of the annual amount of water discharged to surface water systems by the groundwater resources of the District recognized as Major Aquifers by TWDB are based the GAM simulations provided by TWDB to the District for use in this plan. The District has made no estimate of the amount of the annual discharge to surface water systems by the minor sources of groundwater in the District.

1. Edwards (BFZ) Aquifer 27,556 acre-feet per year

2. Trinity Aquifer 11,131 acre-feet per year

Estimate source: TWDB GAM Run 15-003; November 24, 2015

E. Annual volume of flow into and out of the district within each aquifer and between aquifers in the district, if a groundwater availability model is available

There are two aquifers in the District for which a TWDB GAM is available; the Trinity and the Edwards (BFZ) Aquifers. The estimates of the amount of water flowing into and out of the District within each aquifer and between aquifers in the District are based on the GAM simulations provided by TWDB to the District for use in this plan.

1. Edwards (BFZ) Aquifer

   Flow into the aquifer within the District: 5,853 acre-feet/year

   Flow out of the aquifer in the District: 1,090 acre-feet/year

Net flow out of the aquifer to overlying units in the District: 121 acre-feet/year

2. Trinity Aquifer

Flow into the aquifer within the District: 7,230 acre-feet/year

Flow out of the aquifer within the District: 5,659 acre-feet/year

Net flow into the aquifer from the overlying Washita-Fredericksburg Confining Unit in the District: 5,587 acre-feet/year

Estimate source: TWDB GAM Run 15-003; November 24, 2015

F. Projected surface water supply in the district, according to the most recently adopted state water plan.

The most recently adopted state water plan is the 2012 State Water Plan. The 2012 State Water Plan indicates a projected surface water supply for Bell County of 98,187 acre-feet/year for year 2060.

Two major water reservoirs located in Bell County are Lake Belton and Lake Stillhouse Hollow. The 2011 Brazos G Initially Prepared Regional Water Plan (*Appendix L:* Table 3.1-1, Major Reservoirs of the Brazos River Basin) identifies 100,257 acre-feet/year as the authorized diversion, or permitted yield, from Lake Belton, and 67,768 acre-feet/year for Lake Stillhouse Hollow. This provides a total yield of 168,025 acre-feet/year for the two lakes. Currently, the Brazos River Authority has under contract approximately 113,906 acre-feet/year to Bell County entities. The US Corps of Engineers is the owner and operator of Lakes Belton and Stillhouse Hollow. The Brazos River Authority manages water rights in both lakes. The Department of the Army (Fort Hood) also manages the water rights from Lake Belton.

Source Appendix C: TWDB 2012 State Water Plan Datasets for Bell County (p. 4-6)

G. Projected total demand for water in the district according to the most recently adopted state water plan.

The most recently adopted state water plan is the 2012 State Water Plan. The 2012 State Water Plan indicates a projected total water demand for Bell County of 63,783 acre-feet/year for year 2010. The projections are from year 2010 to 2060 and include demands that may be met by water from either or both surface water and groundwater. District records indicate that actual groundwater usage in Bell County during year 2011 by the Water Utility Groups totaled 3,655.52 acre-feet or approximately 5.7% of the County's projected 2010 total demand for water in the 2012 State Water Plan.

Source Appendix C: TWDB 2012 State Water Plan Datasets for Bell County (page 7)

VII. CONSIDER THE WATER SUPPLY NEEDS AND WATER MANAGEMENT STRATEGIES INCLUDED IN THE ADOPTED STATE WATER PLAN.

The most recently adopted state water plan is the 2012 State Water Plan. In the 2012 State Water Plan, water needs were identified for eight Water User Groups (WUGs) in Bell County. Water needs are identified when the projected water demand of a WUG exceeds the projected water supplies of the WUG, *Appendix C*. Positive values given in the tables indicate a water surplus and negative values (expressed as values with a " – " symbol) indicate a water need.

In the 2012 State Water Plan thirteen water management strategies (WMSs) were recommended for the eleven Bell County WUGs with identified water needs. Two of the WMSs involved conservation of existing water supplies. Each of the remaining eight recommended WMSs involve the redistribution and/or increase of surface water supplies of the respective WUGs. The City of Temple has been identified as a WUG with the need for an increase in surface water treatment capacity in the Regional Water Planning process. There is one conjunctive use strategy for Chisholm Trail SUD to increase groundwater with surface water based on the WMS, yet Chisholm Trail SUD has no groundwater wells in Bell County with no delivery of public water supply to the 65,000 acres of their respective CCN that lies in Bell County. This strategy is recommended in the 2012 State Water plan but does not supply or enhance the WUGs in Bell County who serve in other counties with conjunctive use of groundwater and surface water from Bell County. The desired future conditions and amounts of groundwater available for annual use in modeled available groundwater values for the Edwards (BFZ) and Trinity Aquifers in the District will not prevent the implementation of any recommended WMS or restrict the amount of groundwater considered available in the 2012 State Water Plan.

Source Appendix C: TWDB 2012 State Water Plan Datasets for Bell County (page 8)

A. Water Shortages

Of the 30 Bell County WUGs identified in the 2012 State Water Plan, seven were projected to have water shortages by the year 2060. The projected shortage of water for these seven users ranges from approximately 243 acre-feet in 2010 to approximately 10,943 acre-feet/year in 2060. Three of these users use only surface water (City of Temple; City of Morgan's Point Resort, Steam Electric Power), two use a mixture of groundwater and surface water (Bell-Milam-Falls WSC; City of Little River-Academy), and two use only groundwater (City of Bartlett, Jarrell-Schwertner WSC). The source of groundwater for these users is identified as the Trinity Aquifer and the Edwards (BFZ) Aquifer. Some of the management strategies involve purchasing additional surface water, implementing conservation measures, direct reuse and groundwater from the Carrizo-Wilcox Aquifer in Burleson County. Additional use of groundwater from the Trinity and Edwards BFZ Aquifers within CUWCD's jurisdiction have not been identified as a management strategy. Jarrell-Schwertner WSC's service area includes southern Bell County and northern Williamson County. The State Water Plan identifies them as a water user in Williamson

County. In the 2012 Brazos G Regional Water Plan, by the year 2060 they are projected to have a shortage of water of 140 acre-feet/year. Their water supply is groundwater from the Edwards (BFZ) Aquifer. Their recommended management strategies include implementing conservation measures and purchasing surface water. Additional use of groundwater in Bell County is not identified as part of the management strategies. Through participation in a local water supply planning initiative, Jarrell-Schwertner WSC is participating in the Lake Granger Conjunctive Use Project.

Source Appendix C: TWDB 2012 State Water Plan Datasets for Bell County (page 8)

B. Water Surplus

Twenty two of the Water User Groups identified in the Brazos G Regional Water Plan are projected to have surplus water through the year 2060. Four of these are identified as using both surface water and groundwater (East Bell WSC; Moffat WSC; Salado WSC; City of Troy). With the exception of Salado WSC, the source of groundwater is identified as the Trinity Aquifer. Salado WSC uses water from the Edwards (BFZ) Aquifer. However, District records indicate six others also use or have the potential to use groundwater (City of Holland; Pendleton WSC; City of Rogers; Mining; Irrigation; Livestock). Since these users are projected to have a surplus of water or no projected needs, no changes in water supply are recommended.

Source Appendix C: TWDB 2012 State Water Plan Datasets for Bell County (page 9-10)

VII. MANAGEMENT OF GROUNDWATER SUPPLIES

TWC Section 36.0015 states that groundwater conservation districts (GCDs) are the state's preferred method of groundwater management and establishes that GCDs will manage groundwater resources through rules developed and implemented in accordance with TWC Chapter 36. Chapter 36 gives directives to GCDs and the statutory authority to carry out such directives, so that GCDs are provided the proper tools to protect and manage the groundwater resources within their boundaries.

CUWCD will manage the supply of groundwater within the District in order to conserve the groundwater resources while seeking to maintain the economic viability of all groundwater user groups - public and private. In consideration of the economic and cultural activities occurring within the District, CUWCD will identify and engage in such activities and practices which, if implemented, would result in a reduction of groundwater use. The existing observation network of groundwater wells will be used to monitor the changing conditions of the groundwater resources within the District. If necessary, the observation network may be expanded.

The regulatory tools granted to GCDs by TWC Chapter 36 enable GCD's to preserve historic and existing users of groundwater. CUWCD protects historic and existing users by granting such groundwater users historic and existing use permits that have priority over operating permits. TWC Chapter 36 also allows GCDs to establish management zones within an aquifer or aquifer subdivision. The District's rules provide for the designation of management areas as needed to better manage and regulate the groundwater resources of Bell County.

CUWCD may deny a water well drilling permit or limit groundwater withdrawals in accordance with the requirements stated in the rules of the District. In making a determination to deny a permit or limit groundwater withdrawals, the District will consider criteria identified in TWC Section 36.113.

In accordance with CUWCD's mission of protecting the groundwater resources of Bell County, the District may require reduction of groundwater withdrawals to amounts that will not cause harm to the aquifer when considering the desired future condition of the District's aquifers and the amount of modeled available groundwater within the District. To achieve this purpose, the District may, at the discretion of the Board, amend or revoke any permits after notice and hearing. The determination to seek the amendment or revocation of a permit by the District will be based on aquifer conditions as observed by the District. The District will enforce the terms and conditions of permits and the rules of the District by injunction or other appropriate relief in a court of competent jurisdiction as provided for in TWC §36.102.

A contingency plan to cope with the effects of water supply deficits due to climatic or other conditions may be developed by CUWCD and adopted by the Board after notice and hearing. In developing the contingency plan, CUWCD will consider the economic effect of conservation measures upon all water resource user groups, the local implications of the extent and effect of changes in water storage conditions, the unique hydrogeologic conditions of the aquifers within the District, and the appropriate conditions under which the contingency plan will be implemented. CUWCD will evaluate the groundwater resources available within the District and determine the effectiveness of regulatory or conservation measures. A public or private user may appeal to the Board for discretion in enforcement of the provisions of the water supply deficit contingency plan on grounds of adverse economic hardship or unique local conditions. The exercise of said discretion by the Board shall not be construed as limiting the power of the Board.

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

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

Rules adopted by the District for the permitting of wells and the production of groundwater shall comply with TWC Chapter 36, including §36.113, and the provisions of this management plan. All rules will be adhered to and enforced. The promulgation and enforcement of the rules will be based on the best technical evidence available to the District. District Rules are available on the District website at http://www.cuwcd.org/regulatory-program/district-rules/.

X. METHODOLOGY FOR TRACKING DISTRICT PROGRESS IN ACHIEVING MANAGEMENT GOALS.

CUWCD general manager will prepare a draft Annual Report to the Board of Directors on District performance in regards to achieving management goals and objectives in each fiscal year for consideration for adoption by the Board of Directors. The report will be presented within 180 days following the completion of each fiscal year of the District. The Board will maintain the report on file for public inspection at the District's offices upon adoption.

XI. GOALS, MANAGEMENT OBJECTIVES and PERFORMANCE STANDARDS

The management goals, objectives, and performance standards of the District in the areas specified in **31TAC§356.5** are addressed below.

Management Goals

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

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

   Performance Standard: Each year, the number of new and existing wells registered with CUWCD will be presented in the District's annual report.

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

   Performance Standard: Each year, CUWCD will prepare a summary of the number of applications for the drilling of non-exempt wells, the number of applications for the permitted use of groundwater and the disposition of the applications will be will be presented in the District's annual report.

3. Objective: Each year, CUWCD will maintain a groundwater database to include information relating to well location, production volume, and other pertinent information deemed necessary by the District to enable effective monitoring of groundwater in Bell County.

   Performance Standard:

   a. Each year, CUWCD's annual report will include a status report of the database development.
   b. Each year, CUWCD's annual report will include a summary of changes in the water-level condition of the aquifers included in the district water-level monitoring program.

4. Objective: Each year, CUWCD will disseminate educational information on groundwater through publication of a District newsletter.

   Performance Standard: The CUWCD annual report will include a copy of the District newsletter published each year.

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

Objective: Each year, CUWCD will disseminate educational information on controlling and preventing the waste of groundwater focusing on water quality protection through at least one classroom or public presentation.

Performance Standard: The CUWCD annual report will include a summary of the District presentation to disseminate educational information on controlling and preventing the waste of groundwater focusing on water quality protection.

C. Addressing Conjunctive Surface Water Management Issues-31TAC356.52 (a)(1)(D) ((Implementing TWC §36.1071(a)(4))

Objective: Each year, CUWCD will participate in the regional planning process by attending a minimum of two meetings of the Brazos G Regional Water Planning Group per fiscal year.

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

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

Objective: Each year CUWCD will monitor water quality within the District by obtaining water samples from wells and testing the water quality of at least 15 wells.

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

E. Addressing Drought Conditions – 31TAC356.52 (a)(1)(F) ((Implementing TWC §36.1071(a)(6))

1. Objective: Each year, CUWCD will monitor drought conditions in the Edwards (BFZ) Aquifer through the process established in the drought management plan for the Edwards (BFZ) Aquifer adopted by the Board of Directors.

Performance Standard: Each year, a summary of CUWCD's monitoring of drought conditions in the Edwards (BFZ) Aquifer and the implementation of any conservation measures will be provided in the annual report.

2. Objective: Each year, CUWCD will monitor drought conditions in the Trinity Aquifer through the process established in the drought management plan for the Trinity Aquifer adopted by the Board of Directors.

   Performance Standard: Each year, a summary of CUWCD's monitoring of drought conditions in the Trinity Aquifer and the implementation of any conservation measures will be provided in the annual report.

F. Addressing Conservation, Recharge Enhancement, Rainwater Harvesting, Precipitation Enhancement, and Brush Control, Where Appropriate and Cost-Effective – 31TAC356.52 (a)(1)(G) (Implementing TWC §36.1071(a)(7))

Conservation

Objective: Each year, CUWCD will promote conservation by conducting an annual scholastic contest on water conservation or by distributing conservation brochures and literature to the public.

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

Rainwater Harvesting

Objective: Each year, CUWCD will promote rainwater harvesting by posting information on rainwater harvesting on the District website.

Performance Standard: Each year, CUWCD's annual report will include a copy of the information on rainwater harvesting that is provided on the District website.

Brush Control

Objective: Each year, the District will provide information relating to brush control on the District website.

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

Recharge Enhancement

Objective: Each year, CUWCD will provide information relating to recharge enhancement on the District website.

Performance Standard: Each year, CUWCD's annual report will include a copy of the information that has been provided on the District website relating to recharge enhancement.

G. Addressing in a Quantitative Manner the Desired Future Conditions of the Groundwater Resources – TWC §36.108, 31TAC 356.52(a)(1)(H), (Implementing TWC §36.1071(a)(8))

1. Objective – Each year, CUWCD will operate a gauge system on Salado Creek by contract with USGS Water Science Team in Austin Texas, to accurately record the estimates of the discharge from the Edwards (BFZ) Aquifer at the Salado Springs Complex (Big Boiling, Little Bubbly, Critchfield, Benedict and Anderson Springs).

   Performance Standard – Each year, CUWCD will include a summary of the monthly average discharge rate of Salado Springs and a discussion of the conservation measures implemented (if any are necessary) to avoid impairment of the Desired Future Conditions for the Edwards (BFZ) Aquifer established by GMA 8, in the Annual Report to the Board of Directors.

2. Objective – Each year, CUWCD will collect at least 5 water-level measurements from the Trinity Aquifer monitor wells located in the District.

   Performance Standard
   a. Each year, the CUWCD Annual Report to the Board of Directors will post the water-level measurements collected from the Trinity Aquifer and identify the aquifer subdivision from which the measurement is taken.

   b. Each year, the CUWCD Annual Report to the Board of Directors will include a discussion of the change in water-levels in each Trinity Aquifer subdivision for which a Desired Future Condition is stablished by GMA 8.

   b. Every five years, the CUWCD Annual Report to the Board of Directors will include a discussion of the change in water-levels in each Trinity Aquifer subdivision for which a Desired Future Condition is established by GMA 8 comparing the change to the incremental time-appropriate change in water-levels indicated by the established Desired Future Condition of the aquifer.

XII. MANAGEMENT GOALS DETERMINED NOT-APPLICABLE TO THE DISTRICT

A. Controlling and Preventing Subsidence 31TAC§356.52(a)(1)(C), TWC §36.1071(a)(6)

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

B. Precipitation Enhancement – 31TAC§356.52(a)(1)(G), TWC §36.107(a)(7)

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

APPENDIX A

Groundwater Resources of Bell County

The Texas Water Development Board classifies groundwater sources as major or minor aquifers. Major aquifers are aquifers that are capable of producing large yields to wells or that produce groundwater over a large area. Minor aquifers are aquifers that may be capable of producing only limited yields to wells or that produce groundwater over a limited area. Many localized sources of groundwater may not be listed as a major or minor aquifer by TWDB. However, TWDB recognizes that whether an aquifer is classified as a major aquifer, a minor aquifer or not included in either list may have no bearing on the local importance of a particular source of groundwater.

Major Aquifers

Two major aquifers are located in Bell County. They are the Trinity and Edwards Balcones Fault Zone (BFZ) aquifers (Exhibit I). Several water supply corporations in Bell County have the ability to utilize groundwater in an emergency situation.

Edwards (BFZ) aquifer

The Edwards (BFZ) aquifer is composed of the Edwards and Associated Limestones. It is located in the southern part of the county and serves as the water supply for the City of Salado and other communities in the area. The outcrop of the aquifer is generally found to the west of I-35 and the down-dip portion of the aquifer is generally to the east of I-35. Recharge to the Edwards aquifer generally is from percolation of storm run-off water in intermittent streams flowing across the outcrop area, as well as direct infiltration of rainfall over the outcrop area. Water quality in the Edwards aquifer is generally high; however, within a relatively short distance east of IH 35 the water quality is rapidly reduced. In Bell County water in the aquifer generally moves from the recharge zone toward natural discharge via the Salado Springs. Within Bell County the availability of groundwater from the Edwards aquifer water is based on maintaining at least a minimum spring flow at Salado Springs during a repeat of the drought of record.

Trinity aquifer

The Trinity aquifer is composed of three subdivisions; the Upper Trinity; the Middle Trinity and the Lower Trinity aquifers. The Upper Trinity aquifer is composed of the Glen Rose Formation; the Middle Trinity aquifer is composed of the Hensell Sand and Cow Creek Limestone; and the Lower Trinity aquifer is composed of the Sligo Limestone and Hosston Sand. The Upper Trinity aquifer crops out in western Bell County and is located generally west of the Edwards aquifer outcrop. The Middle and Lower Trinity aquifers do not outcrop in Bell County. However, the Trinity aquifer underlies all of Bell County. Water quality in the Trinity aquifer is good to moderate in western Bell County. East of IH 35 the water quality in the Upper and Middle Trinity aquifers deteriorates, but the water quality of the Lower Trinity aquifer remains useable for most purposes over most of Bell County. The availability of groundwater from the subdivisions of the Trinity aquifer is based on the management of aquifer pumping to maintain the resulting draw down within acceptable limits. The Trinity aquifer has established management targets for the limit of acceptable draw down.

Other Local Sources of Groundwater

The local sources of groundwater which are not recognized as major or minor aquifers by TWDB are particularly important to Bell County. A significant percentage of the wells registered with CUWCD are completed in formations which are not widely recognized as aquifers but are vitally important sources of water. In the area of Bell County east of IH-35, the majority of wells registered with CUWCD are completed in these water bearing formations. A brief description of these groundwater sources follows:

Alluvium / Terrace deposits

Alluvium and Terrace deposits consist of sand, gravel, silt and clay deposited by streams. Alluvium deposits are unconsolidated; terrace deposits may have some cement. Alluvium is closely associated with stream channels and terrace deposits are found at higher elevation across the broader floodplain of the stream. Well yields range from low to moderate.

Austin Chalk

The Austin Chalk consists of nodular chalk and marl with some clay seams. Well yields are typically low with generally fresh water.

Buda Limestone

The Buda Limestone is a fine grained hard limestone with abundant fossils or fossil fragments. Wells completed in this formation may yield little or no water.

Edwards Equivalent

The term Edwards Equivalent aquifer refers to the areas in Bell County where the limestones and associated formations of the Edwards Group are productive of generally limited volumes of groundwater and which are located outside of the TWDB recognized bounds of the Edwards (BFZ) aquifer.

Kemp Clay-Marlbrook Marl / Pecan Gap Fm / Ozan Fm

These three geologic units are distinguishable from each other but consist of similar materials and have similar water bearing properties. They consist of thick beds of marl, chalky marl or calcareous clays containing thin beds of silt. Well yields are typically low with fresh to moderately saline water. These geologic units are all associated as members of the Taylor Marl.

Lake Waco Fm

The Lake Waco Fm is a member of the Eagle Ford Group. The formation consists of limestone and shale. While not generally recognized as productive of water it appears to produce limited amounts of useable quality water in limited areas of Bell County.

Exhibit I -- Geologic and Hydrologic Units of Bell County

Group	Formation	Member	Hydrologic Unit
N/A	Alluvium		Alluvium and terrace deposits
	Terrace deposits		
Navarro/Taylor	Kemp Clay / Marlbrook Marl		Kemp Clay/ Marlbrook Marl
	Pecan Gap Chalk		Pecan Gap Formation
	Ozan Formation		Ozan Formation
Austin	Austin Chalk		Austin Chalk
Eagle Ford	Eagle Ford Shale Lake Waco Fm		Eagle Ford not recognized as a groundwater source; Lake Waco has limited production in limited areas
Washita	Buda Formation		Buda Limestone
	Del Rio Clay		Not recognized as a groundwater source
Edwards	Georgetown		Edwards (Balcones Fault Zone) aquifer
	Kiamichi		
	Edwards		
	Comanche Peak		
	Walnut		Not recognized as a groundwater source
Trinity	Paluxy		Upper Trinity aquifer
	Glen Rose		
	Travis Peak	Hensell Sand	Middle Trinity aquifer
		Cow Creek Limestone	
		Hammett Shale	Not recognized as a groundwater source
		Sligo limestone	Lower Trinity aquifer
		Hosston Sand/Conglomerate	

Source: Geologic and Hydrologic Units of Bell County, after Duffin and Musick, 1991

APPENDIX B

Clearwater Underground Water Conservation District
P.O. Box 1989, Belton, Texas 76513
Phone: 254/933-0120 Fax: 254/933-8396
www.cuwcd.org

Every drop counts!

2011-2015
Historical Groundwater Use by WUG's
All Values in acre-feet/year
(Non-Exempt and Exempt Use Combined)

Table 1

Year	Municipal	Manu	Mining	Steam Electric	Irrigation	Livestock	Domestic	*Other	Total GW USE
2015 YTD	1,929.78	.42	53.69	0	327.56	558.71	1,572.33	16.97	4,444.91
2014	2,091.85	1.03	70.28	0	424.59	529.76	1,572.28	35.96	4,665.11
2013	2,170.80	1.99	31.45	0	504.18	529.36	1,559.81	66.64	4,864.23
2012	2,472.07	1.86	53.35	0	587.42	618.95	1,629.58	36.11	5,399.34
2011	2,762.52	1.08	62.23	0	632.80	818.77	2,345.57	74.55	6,697.52

2011-2015
Historical Groundwater Use by Non-Exempt Permittees
All Values in acre-feet/year

Table 2

Year	Edwards BFZ Aquifer	Trinity Aquifer Glen Rose Layer	Trinity Aquifer Hensell Layer	Trinity Aquifer Hosston Layer	Other	Total GW USE
2015 YTD	1,521.00	119.90	58.07	521.69	105.25	2,325.91
2014	1,724.71	74.70	87.08	540.87	172.75	2,600.11
2013	1,878.79	105.14	55.25	689.12	70.93	2,799.23
2012	1,998.14	106.77	81.47	772.84	280.12	3,239.34
2011	2,069.93	123.15	92.15	1,005.39	364.90	3,655.52

2011-2015
Historical (Estimates) of Groundwater Use by Source Aquifer by Exempt Well Owners
All Values in acre-feet/year

Table 3

Year	Edwards BFZ Aquifer	Trinity Aquifer Glen Rose Layer	Trinity Aquifer Hensell Layer	Trinity Aquifer Hosston Layer	Other Formations	Total GW USE
2015	438	327	363	67	924	2,119
2014	385	491	386	52	751	2,065
2013	384	494	384	54	749	2,065
2012	478	495	384	53	750	2,160
2011	468	753	450	68	1303	3,042

2011-1015
Historical Groundwater Beneficial Use By Exempt Well Owners
All Values in acre-feet/year

Table 4

Year	Domestic Use	Livestock & Poultry	Total GW USE
2015	1,561	558	2,119
2014	1,541	524	2,065
2013	1,542	523	2,065
2012	1,554	606	2,160
2011	2,236	806	3,042

Source: CUWCD annual estimates and CUWCD annual production reports
**represents production for small business, restaurants, funeral homes, auto repairs,*

<u>APPENDIX C</u>

Estimated Historical Water Use And 2012 State Water Plan Datasets:

Clearwater Underground Water Conservation District

by Stephen Allen
Texas Water Development Board
Groundwater Resources Division
Groundwater Technical Assistance Section
stephen.allen@twdb.texas.gov
(512) 463-7317
October 19, 2015

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 part 1 are:

1. Estimated Historical Water Use (checklist Item 2)

   from the TWDB Historical Water Use Survey (WUS)
2. Projected Surface Water Supplies (checklist Item 6)
3. Projected Water Demands (checklist Item 7)
4. Projected Water Supply Needs (checklist Item 8)
5. Projected Water Management Strategies (checklist Item 9)

   reports 2-5 are from the 2012 Texas State Water Plan (SWP)

Part 2 of the 2-part package is the groundwater availability model (GAM) report. 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 2012 SWP data available as of 10/19/2015. Although it does not happen frequently, neither of these datasets are static so they are subject to change pending the availability of more accurate WUS data or an amendment to the 2012 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 2012 SWP dataset can be verified by contacting Sabrina Anderson (sabrina.anderson@twdb.texas.gov or 512-936-0886).

For additional questions regarding this data, please contact Stephen Allen (stephen.allen@twdb.texas.gov or 512-463-7317) or Rima Petrossian (rima.petrossian@twdb.texas.gov or 512-936-2420).

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

Groundwater and surface water historical use estimates are currently unavailable for calendar year 2014. TWDB staff anticipates the calculation and posting of these estimates at a later date.

BELL COUNTY

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2013	GW	3,616	0	8	0	1,259	232	5,115
	SW	48,444	608	0	0	1,500	543	51,095
2012	GW	4,046	0	6	0	897	242	5,191
	SW	52,415	601	10	0	1,618	564	55,208
2011	GW	4,619	0	1,052	0	1,474	524	7,669
	SW	56,505	559	1,270	0	1,658	1,221	61,213
2010	GW	3,568	0	1,155	0	1,560	510	6,793
	SW	46,242	521	1,514	0	1,300	1,190	50,767
2009	GW	3,110	0	1,106	0	583	311	5,110
	SW	47,284	652	1,562	0	1,836	727	52,061
2008	GW	2,592	0	1,056	0	63	293	4,004
	SW	49,250	664	1,515	0	1,769	684	53,882
2007	GW	2,158	0	0	0	308	292	2,758
	SW	41,932	706	140	0	2,013	681	45,472
2006	GW	2,489	0	0	0	60	311	2,860
	SW	46,584	818	306	0	2,119	727	50,554
2005	GW	2,182	50	0	0	222	306	2,760
	SW	43,771	490	305	0	2,103	715	47,384
2004	GW	2,305	0	0	0	173	92	2,570
	SW	39,872	542	193	0	749	828	42,184
2003	GW	2,550	0	0	0	454	92	3,096
	SW	42,117	517	456	0	2,553	828	46,471
2002	GW	2,551	0	0	0	611	94	3,256
	SW	42,248	491	552	0	1,241	846	45,378
2001	GW	2,379	0	0	0	564	95	3,038
	SW	41,155	442	578	0	1,144	853	44,172
2000	GW	2,471	0	258	0	558	95	3,382
	SW	41,529	429	30	0	1,121	858	43,967

Projected Surface Water Supplies
TWDB 2012 State Water Plan Data

BELL COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
G	439 WSC	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	1,195	1,195	1,195	1,195	1,195	1,195
G	BELL-MILAM FALLS WSC	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	196	196	196	196	196	196
G	BELTON	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	2,824	3,199	3,542	3,723	3,875	3,920
G	CHISHOLM TRAIL SUD	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	366	366	365	365	364	364
G	COUNTY-OTHER	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	1,088	1,088	1,088	1,088	1,088	1,088
G	DOG RIDGE WSC	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	671	671	671	671	671	671
G	DOG RIDGE WSC	BRAZOS	BRAZOS RIVER AUTHORITY MAIN STEM LAKE/RESERVOIR SYSTEM	1,500	1,500	1,500	1,500	1,500	1,500
G	EAST BELL COUNTY WSC	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	235	235	235	235	235	235
G	ELM CREEK WSC	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	178	215	247	275	293	317
G	FORT HOOD	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	6,144	6,144	6,144	6,144	6,144	6,144

Projected Surface Water Supplies
TWDB 2012 State Water Plan Data

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
G	HARKER HEIGHTS	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	3,904	4,959	5,800	6,507	6,698	6,815
G	HOLLAND	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	258	258	258	258	258	258
G	IRRIGATION	BRAZOS	BRAZOS RIVER COMBINED RUN-OF-RIVER IRRIGATION	5,682	5,712	5,741	5,770	5,799	5,829
G	JARRELL-SCHWERTNER WSC	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	264	264	264	264	264	238
G	KEMPNER WSC	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	1,809	1,781	1,713	1,654	1,667	1,636
G	KILLEEN	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	19,530	25,462	27,985	30,141	32,207	34,432
G	LITTLE RIVER-ACADEMY	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	68	68	68	68	68	68
G	LIVESTOCK	BRAZOS	LIVESTOCK LOCAL SUPPLY	953	953	953	953	953	953
G	MINING	BRAZOS	BRAZOS RIVER COMBINED RUN-OF-RIVER MINING	1	1	2	2	2	2
G	MOFFAT WSC	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	826	854	881	892	901	912
G	MORGANS POINT RESORT	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	291	291	291	291	291	291
G	NOLANVILLE	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	349	359	365	365	369	374

Projected Surface Water Supplies
TWDB 2012 State Water Plan Data

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
G	PENDLETON WSC	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	250	265	273	278	282	287
G	ROGERS	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	368	368	368	368	368	368
G	SALADO WSC	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	1,600	1,600	1,600	1,600	1,600	1,600
G	TEMPLE	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	22,925	22,919	22,912	22,906	22,900	22,840
G	TEMPLE	BRAZOS	LEON RIVER RUN-OF-RIVER	4,524	4,530	4,537	4,543	4,549	4,609
G	TROY	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	124	124	124	124	124	124
G	WEST BELL COUNTY WSC	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	921	921	921	921	921	921
	Sum of Projected Surface Water Supplies (acre-feet/year)			**79,044**	**86,498**	**90,239**	**93,297**	**95,782**	**98,187**

Projected Water Demands
TWDB 2012 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.

BELL COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
G	439 WSC	BRAZOS	803	909	999	1,057	1,090	1,122
G	CHISHOLM TRAIL SUD	BRAZOS	103	127	149	166	176	183
G	DOG RIDGE WSC	BRAZOS	715	799	876	926	955	982
G	ELM CREEK WSC	BRAZOS	184	206	224	236	243	249
G	BARTLETT	BRAZOS	184	196	206	211	216	220
G	BELTON	BRAZOS	2,824	3,199	3,542	3,723	3,875	3,920
G	FORT HOOD	BRAZOS	4,395	4,337	4,279	4,221	4,182	4,182
G	HARKER HEIGHTS	BRAZOS	3,904	4,959	5,800	6,507	6,698	6,815
G	HOLLAND	BRAZOS	125	121	117	114	111	111
G	KILLEEN	BRAZOS	19,530	25,462	27,985	30,141	32,207	34,432
G	LITTLE RIVER-ACADEMY	BRAZOS	275	285	292	294	297	301
G	MORGANS POINT RESORT	BRAZOS	473	520	563	591	607	623
G	NOLANVILLE	BRAZOS	349	359	365	365	369	374
G	MANUFACTURING	BRAZOS	980	1,085	1,180	1,273	1,355	1,463
G	STEAM ELECTRIC POWER	BRAZOS	0	3,674	4,296	5,053	5,977	7,102
G	ROGERS	BRAZOS	195	191	188	184	181	181
G	SALADO WSC	BRAZOS	1,195	1,334	1,461	1,544	1,594	1,636
G	TEMPLE	BRAZOS	21,033	23,018	25,170	26,892	28,804	30,613
G	TROY	BRAZOS	185	181	176	171	168	168
G	COUNTY-OTHER	BRAZOS	200	187	174	167	161	159
G	MINING	BRAZOS	155	150	147	144	141	139
G	IRRIGATION	BRAZOS	1,656	1,634	1,611	1,591	1,569	1,546
G	LIVESTOCK	BRAZOS	953	953	953	953	953	953
G	BELL-MILAM FALLS WSC	BRAZOS	342	371	398	415	425	435
G	EAST BELL COUNTY WSC	BRAZOS	263	271	276	279	282	286
G	JARRELL-SCHWERTNER WSC	BRAZOS	308	344	376	395	409	420
G	KEMPNER WSC	BRAZOS	1,142	1,297	1,443	1,535	1,591	1,636
G	MOFFAT WSC	BRAZOS	402	430	457	468	477	488
G	PENDLETON WSC	BRAZOS	250	265	273	278	282	287
G	WEST BELL COUNTY WSC	BRAZOS	660	642	623	605	599	599
	Sum of Projected Water Demands (acre-feet/year)		**63,783**	**77,506**	**84,599**	**90,499**	**95,994**	**101,625**

Projected Water Supply Needs
TWDB 2012 State Water Plan Data

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

BELL COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
G	439 WSC	BRAZOS	392	286	196	138	105	73
G	BARTLETT	BRAZOS	-58	-70	-80	-85	-90	-94
G	BELL-MILAM FALLS WSC	BRAZOS	9	-20	-47	-64	-74	-84
G	BELTON	BRAZOS	0	0	0	0	0	0
G	CHISHOLM TRAIL SUD	BRAZOS	278	254	231	214	203	196
G	COUNTY-OTHER	BRAZOS	901	914	927	934	940	942
G	DOG RIDGE WSC	BRAZOS	1,456	1,372	1,295	1,245	1,216	1,189
G	EAST BELL COUNTY WSC	BRAZOS	99	91	86	83	80	76
G	ELM CREEK WSC	BRAZOS	67	82	96	112	123	141
G	FORT HOOD	BRAZOS	1,749	1,807	1,865	1,923	1,962	1,962
G	HARKER HEIGHTS	BRAZOS	0	0	0	0	0	0
G	HOLLAND	BRAZOS	133	137	141	144	147	147
G	IRRIGATION	BRAZOS	4,790	4,842	4,894	4,943	4,994	5,047
G	JARRELL-SCHWERTNER WSC	BRAZOS	-2	-38	-70	-89	-103	-140
G	KEMPNER WSC	BRAZOS	667	484	270	119	76	0
G	KILLEEN	BRAZOS	0	0	0	0	0	0
G	LITTLE RIVER-ACADEMY	BRAZOS	-1	-11	-18	-20	-23	-27
G	LIVESTOCK	BRAZOS	0	0	0	0	0	0
G	MANUFACTURING	BRAZOS	483	378	283	190	108	0
G	MINING	BRAZOS	27	32	36	39	42	44
G	MOFFAT WSC	BRAZOS	562	562	562	562	562	562
G	MORGANS POINT RESORT	BRAZOS	-182	-229	-272	-300	-316	-332
G	NOLANVILLE	BRAZOS	0	0	0	0	0	0
G	PENDLETON WSC	BRAZOS	0	0	0	0	0	0
G	ROGERS	BRAZOS	173	177	180	184	187	187
G	SALADO WSC	BRAZOS	2,415	2,276	2,149	2,066	2,016	1,974
G	STEAM ELECTRIC POWER	BRAZOS	0	-3,674	-4,296	-5,053	-5,977	-7,102
G	TEMPLE	BRAZOS	6,416	4,431	2,279	557	-1,355	-3,164
G	TROY	BRAZOS	29	33	38	43	46	46
G	WEST BELL COUNTY WSC	BRAZOS	261	279	298	316	322	322
	Sum of Projected Water Supply Needs (acre-feet/year)		**-243**	**-4,042**	**-4,783**	**-5,611**	**-7,938**	**-10,943**

Projected Water Management Strategies
TWDB 2012 State Water Plan Data

BELL COUNTY

WUG, Basin (RWPG)

All values are in acre-feet/year

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
BARTLETT, BRAZOS (G)							
BRA SUPPLY THROUGH THE EWCRWTS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM [RESERVOIR]	90	90	90	90	90	90
MUNICIPAL WATER CONSERVATION	CONSERVATION [BELL]	12	30	25	19	18	18
BELL-MILAM FALLS WSC, BRAZOS (G)							
VOLUNTARY REDISTRIBUTION	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	20	47	64	74	84
CHISHOLM TRAIL SUD, BRAZOS (G)							
GROUNDWATER/SURFACE WATER CONJUNCTIVE USE (LAKE GRANGER AUGMENTATION)	CARRIZO-WILCOX AQUIFER [BURLESON]	0	0	0	0	10	10
HARKER HEIGHTS, BRAZOS (G)							
WASTEWATER REUSE	DIRECT REUSE [BELL]	185	185	185	185	185	185
JARRELL-SCHWERTNER WSC, BRAZOS (G)							
BRA SUPPLY THROUGH THE EWCRWTS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	13	13	13	13	13
MUNICIPAL WATER CONSERVATION	CONSERVATION [WILLIAMSON]	12	73	84	87	107	127
KEMPNER WSC, BRAZOS (G)							
VOLUNTARY REDISTRIBUTION	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	0	10	10
KILLEEN, BRAZOS (G)							
WASTEWATER REUSE	DIRECT REUSE [BELL]	2,488	2,488	2,488	2,488	2,488	2,488
LITTLE RIVER-ACADEMY, BRAZOS (G)							
VOLUNTARY REDISTRIBUTION	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM [RESERVOIR]	50	50	50	50	50	50

Projected Water Management Strategies
TWDB 2012 State Water Plan Data

WUG, Basin (RWPG)

All values are in acre-feet/year

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
MORGANS POINT RESORT, BRAZOS (G)							
VOLUNTARY REDISTRIBUTION	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM [RESERVOIR]	206	255	300	330	346	363
STEAM ELECTRIC POWER, BRAZOS (G)							
WASTEWATER REUSE	DIRECT REUSE [BELL]	0	8,407	8,407	8,407	8,407	8,407
TEMPLE, BRAZOS (G)							
INCREASE TREATMENT CAPACITY	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM [RESERVOIR]	7,584	7,535	15,330	15,300	15,284	15,267
Sum of Projected Water Management Strategies (acre-feet/year)		**10,627**	**19,146**	**27,019**	**27,033**	**27,082**	**27,112**

<u>APPENDIX D</u>

Data Definitions*

1. Projected Water Demands*

From the 2012 State Water Plan Glossary: "**WATER DEMAND** Quantity of water projected to meet the overall necessities of a water user group in a specific future year." (See 2012 State Water Plan Chapter 3 for more detail.)

Additional explanation: These are water demand volumes as projected for specific Water User Groups in the 2011 Regional Water Plans. This is NOT groundwater pumpage or demand based on any existing water source. This demand is how much water each Water User Group is projected to require in each decade over the planning horizon.

2. Projected Surface Water Supplies*

From the 2012 State Water Plan Glossary: "**EXISTING *[surface]* WATER SUPPLY -** Maximum amount of *[surface]* water available from existing sources for use during drought of record conditions that is physically and legally available for use." (See 2012 State Water Plan Chapter 5 for more detail.)

Additional explanation: These are the existing surface water supply volumes that, without implementing any recommended WMSs, could be used during a drought (in each planning decade) by Water User Groups located within the specified geographic area.

3. Projected Water Supply Needs*

From the 2012 State Water Plan Glossary: "**NEEDS -**Projected water demands in excess of existing water supplies for a water user group or a wholesale water provider." (See 2012 State Water Plan Chapter 6 for more detail.)

Additional explanation: These are the volumes of water that result from comparing each Water User Group's projected existing water supplies to its projected water demands. If the volume listed is a negative number, then the Water User Group shows a projected need during a drought if they do not implement any water management strategies. If the volume listed is a positive number, then the Water User Group shows a projected surplus. Note that if a Water User Group shows a need in any decade, then they are considered to have a potential need during the planning horizon, even if they show a surplus elsewhere.

4. Projected Water Management Strategies*

From the 2012 State Water Plan Glossary: "**RECOMMENDED WATER MANAGEMENT STRATEGY -** Specific project or action to increase water supply or maximize existing supply to meet a specific need." (See 2012 State Water Plan Chapter 7 for more detail.)

Additional explanation: These are the specific water management strategies (with associated water volumes) that were recommended in the 2011 Regional Water Plans.

**Terminology used by TWDB staff in providing data for 'Estimated Historical Water Use And 2012 State Water Plan Datasets' reports issued by TWDB.*

<u>APPENDIX E</u>

RESOLUTION
OF THE BOARD OF DIRECTORS OF THE
CLEARWATER UNDERGROUND WATER CONSERVATION DISTRICT
MEETING HELD January 13, 2016

A RESOLUTION ADOPTING AMENDED MANAGEMENT PLAN

WHEREAS, Clearwater Underground Water Conservation District is a political subdivision of the State of Texas and underground water conservation district created and operating under and by virtue of Article XVI, Section 59, of the Texas Constitution; Texas Water Code Chapter 36; the District's enabling act, Act of May 27, 1989, 71st Legislature, Regular Session, Chapter 524 (House Bill 3172), as amended by Act of April 25, 2001, 77th Legislature, Regular Session, Chapter 22 (Senate Bill 404), Act of May 7, 2009, 81st Legislature, Regular Session, Chapter 64 (Senate Bill 1755), and Act of May 27, 2015, 84th Legislature, Regular Session, Chapter 1196, Section 2 (Senate Bill 1336)(omnibus districts bill); and the applicable general laws of the State of Texas; and confirmed by voters of Bell County in 1999.

WHEREAS, under the direction of the Board of Directors, and in accordance with Texas Water Code §§ 36.1071 and 36.1072, Title 31, Chapter 356 of the Texas Administrative Code, and the District's rules, the District has timely undertaken the requisite five-year review of its existing Management Plan, initially adopted by the District's Board on October 24, 2000, and certified by the Texas Water Development Board (the "TWDB") on February 21, 2001, and revised and readopted by the District's Board on December 13, 2005, and certified by TWDB on March 6, 2006; and revised and readopted by the District's Board on February 8, 2011 and certified by TWDB on April 13, 2011.

WHEREAS, in conducting a five-year review of its existing Management Plan, the District and its consultants reviewed, analyzed, and factored in the District's best available data, the groundwater availability modeling information provided by the TWDB, the technical information and estimates required by the TWDB, the Desired Future Conditions of the aquifers within the District, and the available site-specific information that has previously been provided by the District to the TWDB for review and comment;

WHEREAS, the District issued the appropriate notice and held a public hearing to receive public comments on the proposed amendments to the Management Plan at the District's office located at 2180 North Main, Belton, Texas, on January 13, 2016;

WHEREAS, the District obtained comments from the TWDB through a preliminary review of the District's Management Plan conducted by TWDB staff, and the District has considered and addressed all such comments in the development of its Management Plan;

WHEREAS, the District received, reviewed, and took into consideration comments from the Brazos River Authority during preparation of its Management Plan;

WHEREAS, the Board of Directors finds that the Management Plan meets all of the requirements of Chapter 36 of the Texas Water Code, the District's enabling act, Chapter 356, Title 31, Texas Administrative Code, and the District's rules; and

WHEREAS, the Board of Directors, upon proper notice and in an open meeting, seeks to readopt its existing Management Plan pursuant to Texas Water Code § 36.1072(e).

NOW THEREFORE BE IT RESOLVED THAT:

The above recitals are true and correct;

The Management Plan is hereby readopted with those changes reflected in the proposed, draft Management Plan before the District's Board of Directors on this date, along with those changes agreed upon during deliberation and after formal action on this date by the District's Board of Directors;

The Board of Directors further instructs the General Manager to compile a final, readopted Management Plan, and file it with the TWDB's Executive Director within 60 calendar days from the date of re-adoption, pursuant to Texas Water Code § 36.1072(e); and

The Board of Directors and General Manager are further authorized to take any and all action necessary to coordinate with the TWDB as may be required in furtherance of TWDB's approval pursuant to the provisions of § 36.1072 of the Texas Water Code.

AND IT IS SO ORDERED.

Upon motion duly made by Judy Parker, and seconded by Director David Cole, and upon discussion, the Board of Directors voted 4 in favor and 0 opposed, 0 abstained, and 1 absent, and the motion thereby PASSED on this 13th day of January 2016.

CLEARWATER UNDERGROUND WATER CONSERVATION DISTRICT

By: Wallace Biskup
Wallace Biskup
Board Vice President

ATTEST:
Judy Parker
Judy Parker
Board Secretary

<u>APPENDIX F</u>

NOTICE OF PUBLIC HEARING

The Clearwater Underground Water Conservation District (CUWCD) will hold a public hearing and consider adopting the proposed revisions to the District Management Plan at 1:30 p.m., January 13, 2016 at the District Headquarters located at 700 Kennedy Court Belton, Texas. Copies of the revised Management Plan are available for review at the CUWCD office and on the CUWCD website at http://www.cuwcd.org.

Contact CUWCD at 254-933-0120 for additional information.

Dated: December 18, 2015

CLEARWATER UNDERGROUND WATER CONSERVATION DISTRICT

By: ______________________

Dirk Aaron
General Manager
Assistant Secretary to the Board of Directors

KILLEEN DAILY HERALD

Serving The Growing Central Texas Area

PUBLISHER'S AFFIDAVIT

THE STATE OF TEXAS

COUNTY OF BELL

Personally appeared before the undersigned authority

Tracy Stoker who being sworn says that the attached ad for: **Clearwater Underground Water Conservation District** published in the **Killeen Daily Herald on** the following dates to-wit: **December 23, 2015** at a cost of **$139.00**

NOTICE OF PUBLIC HEARING

The Clearwater Underground Water Conservation District (CUWCD) will hold a public hearing and consider adopting proposed revisions to the District Management Plan at 1:30 p.m., January 13, 2016 at the District headquarters located at 700 Kennedy Court, Belton, Texas. Copies of the revised Management Plan are available for review at the CUWCD office and on the CUWCD website at http://www.cuwcd.org. Contact CUWCD at 254-933-0120 for additional information.

Clearwater *Every Drop Counts!*

Advertising Representative

Subscribed and sworn before me on January 18, 2016.

Notary Public, Bell, Texas

NOTARY PUBLIC STATE OF TEXAS

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PEOPLE IN THE NEWS

Auction of Stallone's film memorabilia fetches $3 million

LOS ANGELES — An auction of **Sylvester Stallone**'s black leather "Rocky" jacket and other movie memorabilia has earned more than $3 million.


Stallone

Heritage Auctions President **Greg Rohan** said Stallone's leather jacket was the top item sold at the three-day auction, with a winning bid of $149,000.

A poncho worn by Stallone in the first "Rambo" film fetched $60,000 in a sale that featured boxing trunks and gloves, and other items from the actor-director's storied career.

Portions of the proceeds will benefit military charities.

Publicist: Nicolas Cage was buyer of stolen dinosaur skull

NEW YORK — **Nicolas Cage** has agreed to give back a national treasure from Mongolia.

A publicist for the star of the "National Treasure" adventure films confirmed Tuesday that Cage was the unwitting buyer of a dinosaur skull that federal prosecutors in New York said was stolen. Prosecutors announced last week they were seeking court approval to take custody of the 32-inch fossil so it could be returned to the Asian nation, but they did not name the buyer.

Cage purchased the skull at auction from Los Angeles-based **I.M. Chait** gallery and auction house and received a certificate of authenticity, publicist **Alex Schack** said in an email. After being notified last year that authorities suspected the item was stolen, the actor "fully cooperated with the investigation, including arranging an inspection of the fossil by agents," and later agreed to forfeit it, Schack said.

Birthdays

Actor **Ronnie Schell** is 84. Emperor **Akihito** of Japan is 82. Pro and College Football Hall of Famer **Paul Hornung** is 80. Actor **Frederic Forrest** is 79. Actor-comedian **Harry Shearer** is 72. Retired U.S. Army Gen. **Wesley K. Clark** is 71. Actress **Susan Lucci** is 69. Singer-musician **Adrian Belew** is 66. Rock musician **Dave Murray** (Iron Maiden) is 59. Rock singer **Eddie Vedder** (Pearl Jam) is 51. Rock musician **Jamie Murphy** is 40. Jazz musician **Irvin Mayfield** is 38. Actress **Estella Warren** is 37. Actress **Anna Maria Perez de Tagle** is 25. Actor **Spencer Daniels** (TV: "Mom") is 23.

Deaths

NEW YORK — **Angela McEwan**, who became a professional actress in her 70s and drew acclaim for her role in **Alexander Payne**'s "Nebraska," died Sunday from complications due to lung cancer, a publicist for McEwan confirmed Tuesday. She was 81.

The Los Angeles-born McEwan set out early in her life to become an actor, but largely gave it up to raise a family and work as a criminal-court Spanish interpreter. But after her gastroenterologist husband, **Guillermo McEwan**, retired, McEwan took up acting lessons and landed roles in TV shows including "Parks and Recreation," "New Girl" and HBO's "Getting On."

Herald wire reports

Publisher's Affidavit

State of Texas
County of Bell

Before Me, The Undersigned Authority, this day personally appeared Gary Garner after being by me duly sworn, says that he is the Advertising Manager of the Temple Daily Telegram, a newspaper published in Bell County, Texas and that the stated advertisement was published in said newspaper on the following date for Clearwater UWCD:

2 col. X 3.5" Meeting Notice ---Wednesday, December 23, 2015

Gary Garner
Advertising Manager

Subscribed and sworn to before me, this 18th day of January 2016.

Notary Public in and for Bell County, Texas

NOTARY PUBLIC STATE OF TEXAS
BRENDA L. KELLEY
MY COMMISSION EXPIRES
May 25, 2016

Darrin Phegley, Courier & Press/AP

evin Swank and his wife Sue, dressed as Santa Claus and Mrs. Claus, laugh Tuesday as Quen-m Rae tells them what he wants for Christmas at the Easter Seals Rehabilitation Center in vansville, Ind. Preschool director Judy Waldroup said they've been preparing the kids for Santa's isit and that his visit has a therapeutic affect on the kids.

IATION & WORLD DIGEST

Ian pleads guilty in iigh school shooting, jets 12-year term

FREDERICK, Md. – The al-eged gunman in a high school hooting that wounded two eenage boys pleaded guilty uesday to two counts of first-legree assault and was sen-enced to 12 years in prison.

Brandon Tyler, 22, fired at a group of rival gang members utside the Frederick High School gymnasium after a jun-or varsity basketball game on he night of Feb. 4, Frederick County Deputy State's Attorney David Callahan said.

Nations on Tuesday said Canada's government is "obliged to make an apology" for the crimes it says Hyeon Soo Lim committed.

Lim was sentenced last week after being accused of trying to use religion to destroy the North Korean system. Trudeau's comments followed.

Lim's relatives have said the pastor, who is in his 60s, trav-eled in January on a regular humanitarian mission to North Korea.

A spokeswoman for Canada's Global Affairs De-partment has said Canada is "dismayed at the unduly harsh sentence."

and notes detailing his racial hatred in his bedroom.

Judge John Bevan said Tues-day that Colborne was a "warped individual" whose "ex-traordinarily violent fantasies" were seriously concerning.

UN demands Syria allow urgent aid deliveries to 13.5M

UNITED NATIONS – Facing a worsening humanitarian crisis in Syria, the United Nations Se-curity Council unanimously ap-proved a resolution Tuesday demanding that all combat-ants but especially the Syrian government allow the urgent

WORLD FIGHTING ISLAMIC STATE

Troops advance in battle for IS-held city of Ramadi

BAGHDAD (AP) — Iraqi forces on Tuesday reported progress in the military opera-tion to retake the city of Ra-madi from the Islamic State group, saying they made the most significant incursion into the city since it fell to the mili-tants in May.

Losing Ramadi — the capital of sprawling western Anbar province and Iraq's Sunni heartland — was a major blow to the Iraqi government. It was the government's biggest defeat since IS militants swept through areas in the country's north and west, including Iraq's second-largest city of Mosul, in the summer of 2014.

Iraqi forces announced a counteroffensive shortly after-ward Mosul fell but progress has been sluggish and clawing territory back from IS has proven more difficult than ex-pected.

Col. Steve Warren, a spokesman for the U.S. military in Baghdad, said there are 250 to 350 Islamic State fighters in Ramadi, as well as several hun-dred outside the city on the northern and western perimeter.

"I think the fall of Ramadi is inevitable," Warren told Penta-gon reporters. "But that said, it's going to be a tough fight ... it's gonna take some time."

He said American military ad-visers remained outside the city at al-Taqaddum, a desert air base that is serving as a training site. It was a U.S. military hub during the 2003-2011 war.

Iraqi spokesman Sabah al-Numan said troops crossed the Euphrates River north of the city and its Warar tributary to the west and pushed into down-town Ramadi.

From the south, troops led by the counter-terrorism agency made progress in the Dubbat and Aramil neighborhoods, about 2 miles from the city cen-ter, Gen. Ismail al-Mahallawi, the head of operations in Anbar province, told AP.

Sporadic clashes broke out and advancing Iraqi forces were forced to remove roadside bombs planted by the extrem-ists, al-Numan added.

On Tuesday, the Dubbat neighborhood saw heavy fight-ing, with one soldier killed and 14 wounded, said an official in the Anbar operations room, speaking on condition of anonymity because he was not authorized to brief the media.

Warren said U.S. officials found a pamphlet in Fallujah that was distributed to IS fight-ers, calling on them to disguise themselves as Iraqi security forces and then film themselves committing atrocities, such as killing and torturing civilians and blowing up mosques.

NOTICE OF PUBLIC HEARING

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APPENDIX G

Every drop counts!

Clearwater Underground Water Conservation District
P.O. Box 1989, Belton, Texas 76513
Phone: 254/933-0120 Fax: 254/933-8396
www.cuwcd.org

January 15, 2016

TO: Surface Water Management Entities (via email)

RE: Revised Management Plan

Dear Manager:

Attached is the revised District Management Plan for the Clearwater Underground Water Conservation District (CUWCD). As required in Texas Water Code §36.1072, we have conducted a five year review and update of our Management Plan. One component of the plan is evidence of its coordination with surface water management entities pursuant to TWC 36.1071 (a):

> *Evidence that following notice and hearing the Clearwater Underground Water Conservation District coordinated in the development of its Management plan with surface water management entities.*

The Directors of the CUWCD approved the revised Management Plan on January 13, 2016 and are submitting it for review and approval by the Texas Water Development Board.

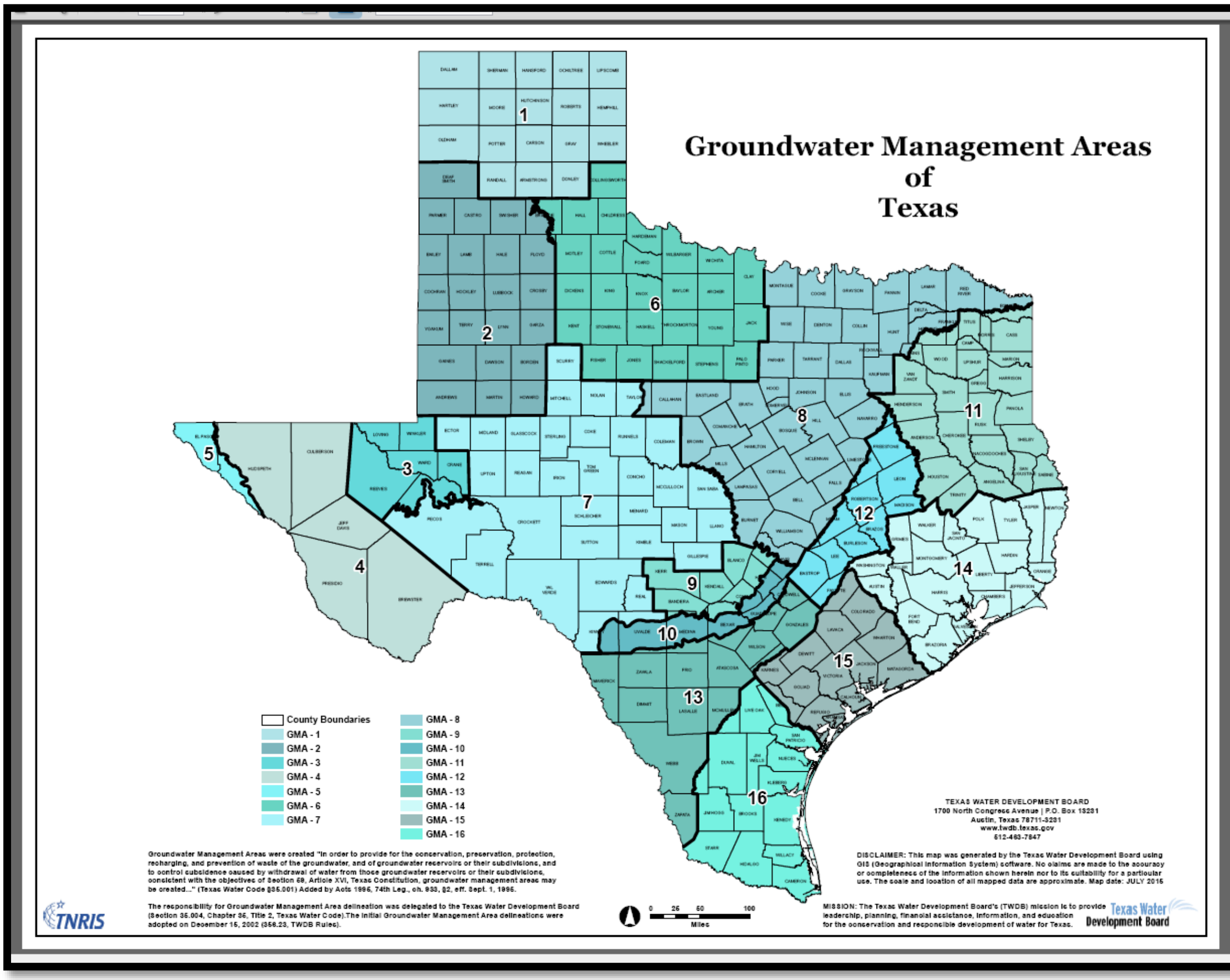
Please feel free to contact me if you have any questions regarding the Management Plan or need additional information.

Sincerely,

Dirk Aaron
General Manager
Clearwater UWCD

WSC	Contact	Phone	Address	City	State	Zip	Email
439 WSC	Glen Grandy	254-933-2133	5041 West Dr	Belton	TX	76513	439water@439watersupply.com
Armstrong WSC	Jerry Mays	254-657-2429	P.O. Box 155	Holland	Texas	76534	gliles@embarqmail.com
Bell County WCID #1	Jerry Atkinson	254-501-9243	201 S. 38th Street	Killeen	Texas	76543	j.atkinson@wcid1.org
Bell County WCID #2	Bill Easley	254-982-4685	P.O. Box 338	Little River	Texas	76554	belcountywater@embarqmail.com
Bell Coounty WCID #5	Dwayne Jekel	254-697-4016	P. O. Drawer 150	Cameron	Texas	76520	dlservice@farm-market.net
Bell Milam Falls WSC	Dwayne Jekel	254-697-4016	P. O. Drawer 150	Cameron	Texas	76520	dlservice@farm-market.net
Bluebonnet WSC	Jim Lilly	254-986-2949	6100 Water Supply Rd	Temple	Texas	76502	unavaiable
Central Texas WSC	Lee Kelley	254-698-3583	4020 Lakecliff Drive	Harker Heights	Texas	76548	ctwscgm@embarqmail.com
Chisholm Trail SUD	Delton Robinson	254-793-3103	P.O. Box 249	Florence	Texas	76527	info@ctsud.org
City of Troy	David Lowry	254-938-2505	P.O. Box 389	Troy	Texas	76579	dlowry@cityoftroy.us
Dog Ridge WSC	Dennis Rabroker	254-939-6533	P.O. Box 232	Belton	Texas	76513	unavaiable
East Bell WSC	Cheryl Walden	254-985-2611	16490 Hwy 53	Temple	Texas	76501	eastbellwsc@embarqmail.com
Elm Creek WSC	Steve Hubbard	254-853-3838	603 Avenue E.	Moody	Texas	76557	unavaiable
Jarrell Schwertner WSC	David Yohe	512-746-2114	P.O. Box 40	Jarrell	Texas	76537	office@jswatersupply.com
Kempner WSC	Delores Goode	512-932-3701	PO Box 103	Kempner	Texas	76539	delores@kempnerwsc.com
Little Elm Valley WSC	Dwayne Jekel	254-697-4016	P. O. Drawer 150	Cameron	Texas	76520	dlservice@farm-market.net
Moffat WSC	Mark Truelove	254-986-2457	5456 Lakeaire Blvd	Temple	Texas	76502	moffatwsc@embarqmail.com
Oenavile & Belfalls WSC	Randy Frei	254-985-2243	11821 State Hwy 53	Temple	Texas	76501	freienterprises@embarqmail.com
Pendleton WSC	Velva Moody	254-773-5876	P.O. Box 100	Pendleton	Texas	76564	pwsc@vvm.com
Salado WSC	Ricky Preston	254-947-5425	P.O. Box 1283	Salado	Texas	76571	swsc1@embarqmail.com
The Grove WSC	Justin Veazey	254-865-5567	103 Robert H Evetts Dr	Gatesville	Texas	76528	justin.veazey@yahoo.com
West Bell County WSC	John Whitson	254-634-1727	4201 Chaparral Road	Killeen	Texas	76542	westbellwater@hotmail.com
Brazos River Authority	Phil Ford	254-761-3100	4600 Cobbs Drive	Waco	Texas	76710	pford@brazos.org
City of Bartlett	Sabrina Pope	254-527-0196	P.O. Drawer H	Bartlett	Texas	76511	sabrina.pope@bartlett-tx.us
City of Belton	Sam Listi	254-933-5818	P.O. Box 120	Belton	Texas	76513	slisti@ci.belton.tx.us
City of Harker Heights	David Mitchell	254-953-5600	305 Millers Crossing	Harker Heights	Texas	76548	dmitchell@ci.harker-heights.tx.us
City of Holland	Mae Smith	254-657-2460	P.O. Box 157	Holland	Texas	76534	mae.smith@thecityofholland.org
City of Killeen	Glenn Morrison	254-501-7600	101 N. College Street	Killeen	Texas	76541	gmorrison@killeentexas.gov
City of Morgan's Point Resort	David Huseman	254-780-1334	8 Morgan's Point Blvd.	Morgan's Point Resort	Texas	76513	David.Huseman@mprtx.us
City of Rogers	Ann McCord	254-642-3312	P.O. Box 250	Rogers	Texas	76569	ctyhall@vvm.com
City of Temple	Jonathan Graham	254-298-5600	2 North Main Street	Temple	Texas	76501	jgraham@templetx.gov

APPENDIX H


Groundwater Management Areas of Texas
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County Boundaries
GMA - 1
GMA - 2
GMA - 3
GMA - 4
GMA - 5
GMA - 6
GMA - 7
GMA - 8
GMA - 9
GMA - 10
GMA - 11
GMA - 12
GMA - 13
GMA - 14
GMA - 15
GMA - 16
Groundwater Management Areas were created "In order to provide for the conservation, preservation, protection, recharging, and prevention of waste of the groundwater, and of groundwater reservoirs or their subdivisions, and to control subsidence caused by withdrawal of water from those groundwater reservoirs or their subdivisions, consistent with the objectives of Section 59, Article XVI, Texas Constitution, groundwater management areas may be created..." (Texas Water Code §35.001) Added by Acts 1995, 74th Leg., ch. 933, §2, eff. Sept. 1, 1995.
The responsibility for Groundwater Management Area delineation was delegated to the Texas Water Development Board (Section 35.004, Chapter 36, Title 2, Texas Water Code).The initial Groundwater Management Area delineations were adopted on December 15, 2002 (356.23, TWDB Rules).
TEXAS WATER DEVELOPMENT BOARD
1700 North Congress Avenue | P.O. Box 13231
Austin, Texas 78711-3231
www.twdb.texas.gov
512-463-7847
DISCLAIMER: This map was generated by the Texas Water Development Board using GIS (Geographical Information System) software. No claims are made to the accuracy or completeness of the information shown herein nor to its suitability for a particular use. The scale and location of all mapped data are approximate. Map date: JULY 2015
0 25 50 100
Miles
MISSION: The Texas Water Development Board's (TWDB) mission is to provide leadership, planning, financial assistance, information, and education for the conservation and responsible development of water for Texas.
TNRIS
Texas Water Development Board

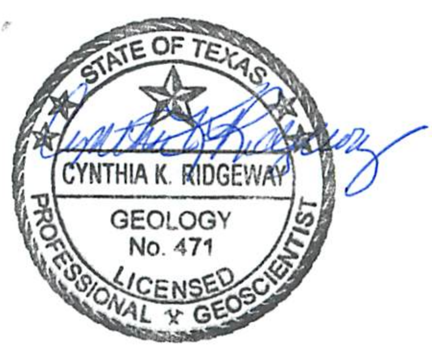
APPENDIX I

GAM Run 10-065 MAG

by Mohammad Masud Hassan, P.E.

Edited and finalized by Wade Oliver to reflect statutory changes
effective September 1, 2011

Texas Water Development Board
Groundwater Availability Modeling Section
(512) 463-3132
December 14, 2011



Cynthia K. Ridgeway, the Manager of the Groundwater Availability Modeling Section and Interim Director of the Groundwater Resources Division, is responsible for oversight of work performed by employees under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G. 471 on December 14, 2011.

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EXECUTIVE SUMMARY:

The modeled available groundwater for the Edwards (Balcones Fault Zone) Aquifer as a result of the desired future conditions adopted by the members of Groundwater Management Area 8 is approximately 15,200 acre-feet per year between 2010 and 2060. This is summarized by county, regional water planning area, and river basin as shown in Table 1 for use in the regional water planning process. The modeled available groundwater is also summarized by county, regional water planning area, river basin, and groundwater conservation district in tables 2 through 5.

REQUESTOR:

Mr. Eddy Daniel of the North Texas Groundwater Conservation District on behalf of the groundwater conservation districts within Groundwater Management Area 8

DESCRIPTION OF REQUEST:

In a letter dated August 31, 2011, Mr. Eddy Daniel provided the Texas Water Development Board (TWDB) with the desired future conditions for the northern segment of the Edwards (Balcones Fault Zone) Aquifer that were adopted in a resolution, dated April 27, 2011, by the members of Groundwater Management Area 8. This resolution referenced the desired future conditions previously adopted for the aquifer on December 17, 2007 by the groundwater conservation districts within Groundwater Management Area 8. These are described below:

- *Maintain at least 100 acre-feet per month of stream/spring flow in Salado Creek during a repeat of the Drought of Record in Bell County.*
- *Maintain at least 42 acre-feet per month of aggregated stream/spring flow during a repeat of the Drought of Record in Travis County.*
- *Maintain at least 60 acre-feet per month of aggregated stream/spring flow during a repeat of the Drought of Record in Williamson County.*

Because the desired future conditions were identical to the previous submission, the modeled available groundwater estimates in this report are identical to the previously released “managed available groundwater” estimates that were in Groundwater Availability Model (GAM) Run 08-10mag (Anaya, 2008).

METHODS:

The location of Groundwater Management Area 8, the northern segment of the Edwards (Balcones Fault Zone) Aquifer, and the groundwater availability model cells that represent the aquifer are shown in Figure 1. The modeled available groundwater for Groundwater Management Area 8 presented in this report was divided by county, regional water planning area, river basin, and groundwater conservation district. These areas are shown in Figure 2.

Modeled Available Groundwater and Permitting

As defined in Chapter 36 of the Texas Water Code, “modeled available groundwater” is the estimated average amount of water that may be produced annually to achieve a desired future condition. This is distinct from “managed available groundwater,” shown in the draft version of this report dated December 21, 2010, which was a permitting value and accounted for the estimated use of the aquifer exempt from permitting. This change was made to reflect changes in statute by the 82nd Texas Legislature, effective September 1, 2011.

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. The estimated amount of pumping exempt from permitting, which the Texas Water Development Board is now required to develop after soliciting input from applicable groundwater conservation districts, will be provided in a separate report.

PARAMETERS AND ASSUMPTIONS:

The parameters and assumptions for the model run using the groundwater availability model for the northern segment of the Edwards (Balcones Fault Zone) Aquifer are described below:

- The results for modeled available groundwater presented here are taken from the results reported as "managed available groundwater" in GAM Run 08-10mag (Anaya, 2008). See GAM Run 08-10mag for a full description of the methods and assumptions associated with the model simulation.

- Version 1.01 of the groundwater availability model for the northern segment of the Edwards (Balcones Fault Zone) Aquifer (Jones, 2003) was used for this analysis. See Jones (2003) for a more detailed discussion of assumptions and limitations of the groundwater availability model.

- The model consists of one layer representing the northern segment of the Edwards (Balcones Fault Zone) Aquifer and assumes no hydraulic communication with the underlying Trinity Aquifer.

- The root mean squared error (a measure of the difference between simulated and measured water levels during model calibration) in the groundwater availability model is 32 feet for the 1980 steady-state calibration period (Jones, 2003).

RESULTS:

The modeled available groundwater for the northern segment of the Edwards (Balcones Fault Zone) Aquifer in Groundwater Management Area 8 as a result of the desired future conditions is approximately 15,200 acre-feet per year between 2010 and 2060. This has been divided by county, regional water planning area, and river basin for each decade between 2010 and 2060 for use in the regional water planning process (Table 1). The modeled available groundwater is also summarized by county, regional water planning area, river basin, and groundwater conservation district as shown in tables 2, 3, 4, and 5, respectively. Note that the only district within Groundwater Management Area 8 that contains the aquifer is Clearwater Underground Water Conservation District.

LIMITATIONS:

The groundwater model used in developing estimates of modeled available groundwater is the best available scientific tool that can be used to estimate the pumping that will achieve the desired future conditions. Although the groundwater model used in this analysis is the best available scientific tool for this purpose, it, like all models, has limitations. 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 develop estimates of modeled available groundwater is the need to make assumptions about the location in the aquifer where future pumping will occur. As actual pumping changes in the future, it will be necessary to evaluate the amount of that pumping as well as its location in the context of the assumptions associated with this analysis. Evaluating the amount and location of future pumping is as important as evaluating the changes in groundwater levels, spring flows, and other metrics that describe the condition of the groundwater resources in the area that relate to the adopted desired future condition(s).

Given these limitations, users of this information are cautioned that the modeled available groundwater numbers should not be considered a definitive, permanent description of the amount of groundwater that can be pumped to meet the adopted desired future condition. 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 future groundwater pumping as well as whether or not they are achieving their desired future conditions. Because of the limitations of the model and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine the modeled available groundwater numbers given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future.

REFERENCES:

Anaya, Robert, 2008, GAM Run 08-010mag: Texas Water Development Board GAM Run 0810mag Report, 7 p.

Jones, I.C., 2003, Groundwater availability modeling: Northern Segment of the Edwards Aquifer: Texas Water Development Board, Report 358, 75 p.

National Research Council, 2007, Models in Environmental Regulatory Decision Making. Committee on Models in the Regulatory Decision Process, National Academies Press, Washington D.C., 287 p.

Table 1. Modeled available groundwater for the northern segment of the Edwards (Balcones Fault Zone) Aquifer in Groundwater Management Area 8. Results are in acre-feet per year and are divided by county, regional water planning area, and river basin.

County	Regional Water Planning Area	River Basin	Year					
			2010	2020	2030	2040	2050	2060
Bell	G	Brazos	6,469	6,469	6,469	6,469	6,469	6,469
Williamson	G	Brazos	3,351	3,351	3,351	3,351	3,351	3,351
		Colorado	101	101	101	101	101	101
	K	Brazos	6	6	6	6	6	6
		Colorado	4	4	4	4	4	4
Travis	K	Brazos	275	275	275	275	275	275
		Colorado	4,962	4,962	4,962	4,962	4,962	4,962
Total			**15,168**	**15,168**	**15,168**	**15,168**	**15,168**	**15,168**

Table 2. Modeled available groundwater pumping for the northern segment of the Edwards (Balcones Fault Zone) Aquifer summarized by county in Groundwater Management Area 8 for each decade between 2010 and 2060. Results are in acre-feet per year.

County	Year					
	2010	2020	2030	2040	2050	2060
Bell	6,469	6,469	6,469	6,469	6,469	6,469
Williamson	3,462	3,462	3,462	3,462	3,462	3,462
Travis	5,237	5,237	5,237	5,237	5,237	5,237
Total	**15,168**	**15,168**	**15,168**	**15,168**	**15,168**	**15,168**

Table 3. Modeled available groundwater for the northern segment of the Edwards (Balcones Fault Zone) Aquifer summarized by regional water planning area in Groundwater Management Area 8 for each decade between 2010 and 2060. Results are in acre-feet per year.

Regional Water Planning Area	Year					
	2010	2020	2030	2040	2050	2060
G	9,921	9,921	9,921	9,921	9,921	9,921
K	5,247	5,247	5,247	5,247	5,247	5,247
Total	**15,168**	**15,168**	**15,168**	**15,168**	**15,168**	**15,168**

Table 4. Modeled available groundwater for the northern segment of the Edwards (Balcones Fault Zone) Aquifer summarized by river basin in Groundwater Management Area 8 for each decade between 2010 and 2060. Results are in acre-feet per year.

River Basin	Year					
	2010	2020	2030	2040	2050	2060
Brazos	10,101	10,101	10,101	10,101	10,101	10,101
Colorado	5,067	5,067	5,067	5,067	5,067	5,067
Total	**15,168**	**15,168**	**15,168**	**15,168**	**15,168**	**15,168**

Table 5. Modeled available groundwater for the northern segment of the Edwards (Balcones Fault Zone) Aquifer summarized by groundwater conservation district (GCD) in Groundwater Management Area 8 for each decade between 2010 and 2060. Results are in acre-feet per year. UWCD refers to Underground Water Conservation District.

Groundwater Conservation District	**Year**					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Clearwater UWCD	6,469	6,469	6,469	6,469	6,469	6,469
No District	8,699	8,699	8,699	8,699	8,699	8,699
Total	**15,168**	**15,168**	**15,168**	**15,168**	**15,168**	**15,168**

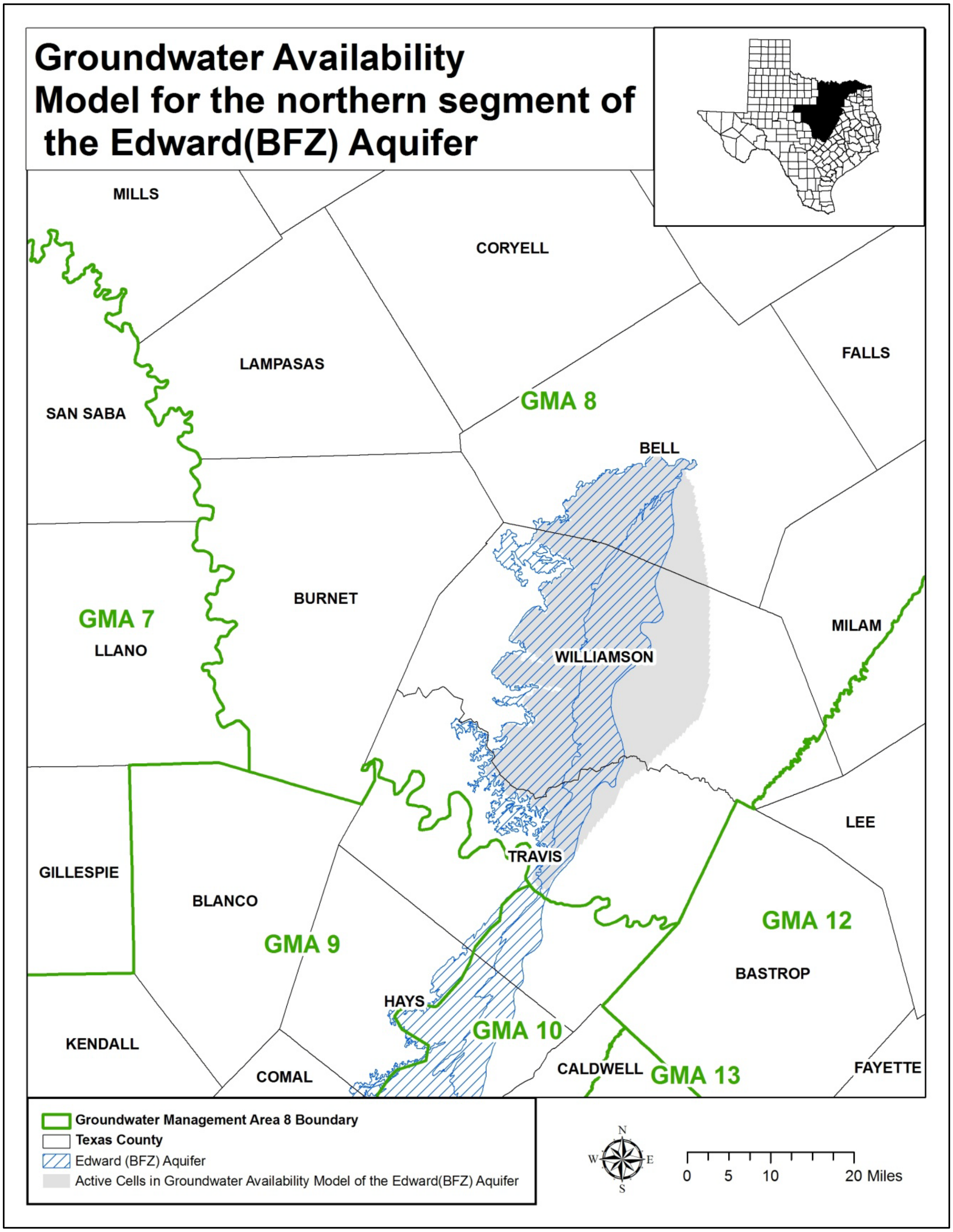


Figure 1. Map showing the areas covered by the groundwater availability model for the Edwards (Balcones Fault Zone) Aquifer.

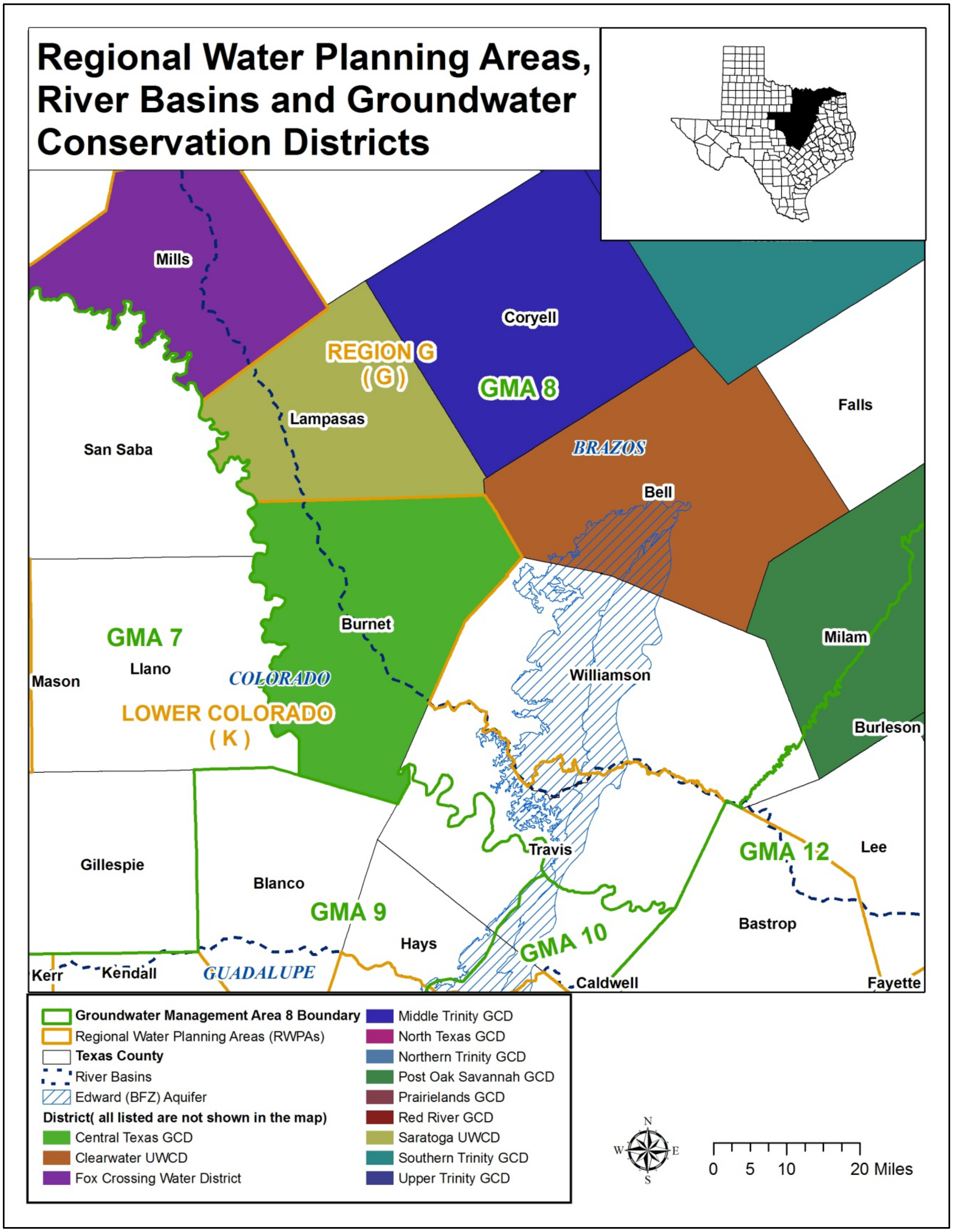


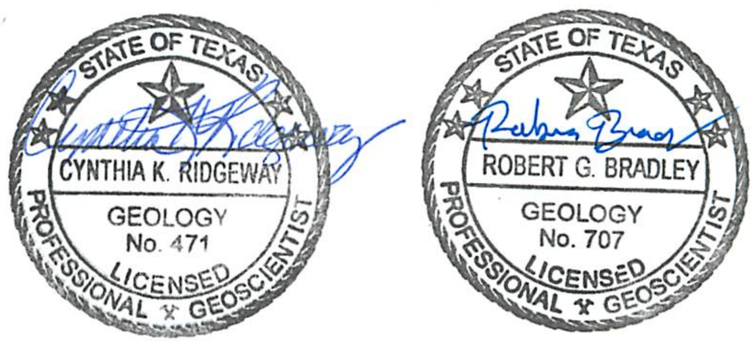
Figure 2. Map showing regional water planning areas (RWPAs), groundwater conservation districts (GCDs), counties, and river basins in Groundwater Management Area 8. UWCD refers to Underground Water Conservation District.

APPENDIX J

GAM Run 10-063 MAG

by Mr. Wade Oliver and Mr. Robert G. Bradley, P.G.

Texas Water Development Board
Groundwater Availability Modeling Section
(512) 463-3132
December 14, 2011



Cynthia K. Ridgeway, the Manager of the Groundwater Availability Modeling Section and Interim Director of the Groundwater Resources Division, is responsible for oversight of work performed by employees under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G. 471 on December 14, 2011.

Robert G. Bradley, P.G. is responsible for the water budget approach for Comanche and Erath counties within Middle Trinity Groundwater Conservation District. The seal appearing on this document was authorized by Robert G. Bradley, P.G. 707 on December 14, 2011.

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EXECUTIVE SUMMARY:

In response to receiving the adopted desired future conditions for the Trinity Aquifer in Groundwater Management Area 8, the Texas Water Development Board completed Groundwater Availability Model (GAM) Run 08-84mag, which reported the "managed available groundwater" that achieves the adopted desired future conditions. Subsequent to the release of GAM Run 08-84mag, the Middle Trinity Groundwater Conservation District requested that the Texas Water Development Board reevaluate the "managed available groundwater" for Comanche and Erath counties. This resulted in the completion of Aquifer Assessment 09-07, which addressed these counties. In April 2011, the groundwater conservation districts in Groundwater Management Area 8 readopted the desired future conditions for the Trinity Aquifer previously adopted in September 2008.

This report, an update to GAM Run 08-84mag and Aquifer Assessment 09-07, incorporates the changes above and addresses the readopted desired future conditions. In addition, the pumping estimates previously reported as "managed available groundwater" in the above reports are reported here as "modeled available groundwater" to reflect changes in statute effective September 1, 2011. The modeled available groundwater for the Trinity Aquifer as a result of the desired future conditions adopted by the members of Groundwater Management Area 8 is approximately 261,000 acre-feet per year.

REQUESTOR:

Mr. Eddy Daniel of North Texas Groundwater Conservation District on behalf of Groundwater Management Area 8

DESCRIPTION OF REQUEST:

In a letter dated August 31, 2011, Mr. Eddy Daniel provided the Texas Water Development Board (TWDB) with the desired future conditions of the Trinity Aquifer adopted in a resolution, dated April 27, 2011, by the members of Groundwater Management Area 8. This resolution referenced the desired future conditions previously adopted for the aquifer on September 17, 2008 by the groundwater conservation districts within Groundwater Management Area 8. These are summarized in Table 1.

In response to receiving the initially adopted desired future conditions from September 2008, the Texas Water Development Board completed Groundwater Availability Model (GAM) Run 08-84mag, which reported the "managed available groundwater" that achieves the above desired future conditions (Wade, 2009). On June 12, 2009, the general manager and consultants for the Middle Trinity Groundwater Conservation District met with Texas Water Development Board staff to discuss issues they had concerning GAM Run 08-84mag. After discussion, staff reevaluated pumping estimates using a water-budget approach based on the desired future conditions for Comanche and Erath counties and released this analysis as Aquifer Assessment 09-07 on November 22, 2010 (Bradley, 2010). This report, an update to GAM Run 08-84mag and Aquifer Assessment 09-07, incorporates the two changes above. In addition, the pumping estimates previously reported as "managed available groundwater" in the above reports are reported here as "modeled available groundwater" to reflect changes in statute effective September 1, 2011.

METHODS:

Groundwater Management Area 8 contains the Trinity Aquifer, a major aquifer in Texas as defined in the 2007 State Water Plan (TWDB, 2007). The location of Groundwater Management Area 8, the Trinity Aquifer, and the groundwater availability model cells that represent the aquifer are shown in Figure 1.

Modeled Available Groundwater and Permitting

As defined in Chapter 36 of the Texas Water Code, "modeled available groundwater" is the estimated average amount of water that may be produced annually to achieve a desired future condition. This is distinct from "managed available groundwater," shown in the draft version of this report dated December 20, 2010, which was a permitting value and accounted for the estimated use of the aquifer exempt from permitting. This change was made to reflect changes in statute by the 82nd Texas Legislature, effective September 1, 2011.

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. The estimated amount of pumping exempt from permitting, which the Texas Water Development Board is now required to develop after soliciting input from applicable groundwater conservation districts, will be provided in a separate report.

PARAMETERS AND ASSUMPTIONS:

The groundwater availability model for the northern portion of the Trinity Aquifer was used for the results presented in this report outside of Comanche and Erath counties. In those counties, a water budget approach was used. The parameters and assumptions for developing the modeled available groundwater are described below:

Groundwater Availability Model for the Northern Portion of the Trinity Aquifer

- The results for modeled available groundwater presented here are based on the results reported as "managed available groundwater" in GAM Run 08-84mag (Wade, 2009) for all areas except Comanche and Erath counties. See GAM Run 08-84mag for a full description of the methods and assumptions associated with the model simulation. Because GAM Run 08-84mag presented constant pumping from 2000 to 2050, it was assumed for the purposes of this analysis that pumping from 2051 to 2060 was also constant at the same level. As summarized in Table 1, desired future conditions were defined by the groundwater conservation districts in Groundwater Management Area 8 for 2050. It is expected that pumping from 2051 to 2060 would cause additional drawdown, but this analysis does not estimate drawdown in 2060. Pumping estimates for 2060 were important to include for purposes of regional water planning.

- Version 1.01 of the groundwater availability model for the northern portion of the Trinity Aquifer was used for this analysis. See Bené and others (2004) for assumptions and limitations of the model.

- The model includes seven layers which generally correspond to the Woodbine Aquifer (Layer 1), the Washita and Fredericksburg Groups (Layer 2), the Paluxy Formation (Layer 3), the Glen Rose Formation (Layer 4), the Hensell Formation (Layer 5), the Pearsall/Cow Creek/Hammett/Sligo Members (Layer 6), and the Hosston Formation (Layer 7).

- The mean absolute error (a measure of the difference between simulated and measured water levels during model calibration) for the four main aquifers in the model (Woodbine, Paluxy, Hensell, and Hosston) for the calibration and verification time periods (1980 to 2000) ranged from approximately 38 to 75 feet. The root mean squared error was less than ten percent of the maximum change in water levels across the model (Bené and others, 2004).

- Average annual recharge conditions based on climate data from 1980 to 1999 were assumed for the first 47 years of the simulation. The last three years of the simulation drought-of-record recharge conditions were assumed, which were defined as the years 1954 to 1956.

- Groundwater conservation district boundaries were updated since the release of GAM Run 08-84mag. The results presented here correspond to the official district boundaries as of the date of this report.

Water Budget Approach for Comanche and Erath Counties

- The modeled available groundwater presented for Comanche and Erath counties is based on Aquifer Assessment 09-07 (Bradley, 2010). See Aquifer Assessment 09-07 for a full description of the methods and assumptions associated with the water budget calculations.

- The Hensell and Hosston members were grouped as the Twin Mountains Formation in Aquifer Assessment 09-07. To be consistent with the desired future conditions, however, it was necessary to split the pumping in Aquifer Assessment 09-07 into the Hensell and Hosston members. In Comanche County, 10 percent of the pumping in the Twin Mountains Formation was assigned to the Hensell member while 90 percent was assigned to the Hosston. In Erath County, 35 percent of the pumping in Aquifer Assessment 09-07 was assigned to the Hensell with the remaining 65 percent assigned to the Hosston. These percentages were developed after a preliminary review of available pumping information and discussion with Joe Cooper of Middle Trinity Groundwater Conservation District.

RESULTS:

The modeled available groundwater for the Trinity Aquifer in Groundwater Management Area 8 as a result of the desired future conditions is approximately 261,000 acre-feet per year between 2010 and 2060. This pumping has been divided by county, regional water planning area, and river basin for each decade between 2010 and 2060 for use in the regional water planning process (Table 2). These areas are shown in Figure 2.

Since the desired future conditions are specified for individual units of the Trinity Aquifer (Paluxy, Glen Rose, Hensell, and Hosston) based on the layering used in the model, the modeled available groundwater is shown for each unit in the subsequent tables. Tables 3, 4, 5, and 6 show the modeled available groundwater summarized by county in the Paluxy, Glen Rose, Hensell, and Hosston units of the Trinity Aquifer, respectively. Tables 7, 8, 9, and 10 show the modeled available groundwater summarized by regional water planning area for the same units, respectively. Tables 11, 12, 13, and 14 show the modeled available groundwater summarized by river basin for each of the above units, respectively. The modeled available groundwater summarized by groundwater conservation district is shown for the Paluxy, Glen Rose, Hensell, and Hosston units in tables 15, 16, 17, and 18, respectively. Notice that the pumping is totaled both excluding and including areas outside of a groundwater conservation district.

LIMITATIONS:

The groundwater model used in developing estimates of modeled available groundwater is the best available scientific tool that can be used to estimate the pumping that will achieve the desired future conditions. Although the groundwater model used in this analysis is the best available scientific tool for this purpose, it, like all models, has limitations. 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 develop estimates of modeled available groundwater is the need to make assumptions about the location in the aquifer where future pumping will occur. As actual pumping changes in the future, it will be necessary to evaluate the amount of that pumping as well as its location in the context of the assumptions associated with this analysis. Evaluating the amount and location of future pumping is as important as evaluating the changes in groundwater levels, spring flows, and other metrics that describe the condition of the groundwater resources in the area that relate to the adopted desired future condition(s).

Given these limitations, users of this information are cautioned that the modeled available groundwater numbers should not be considered a definitive, permanent description of the amount of groundwater that can be pumped to meet the adopted desired future condition. 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 future groundwater pumping as well as whether or not they are achieving their desired future conditions. Because of the limitations of the model and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine the modeled available groundwater numbers given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future.

REFERENCES:

Bené, J., Harden, B., O’Rourke, D., Donnelly, A., and Yelderman, J., 2004, Northern Trinity/Woodbine Groundwater Availability Model: contract report to the Texas Water Development Board by R.W. Harden and Associates, 391 p.

Bradley, R.G., 2010, GTA Aquifer Assessment 09-07: Texas Water Development Board, GTA Aquifer Assessment 09-07 Report, 19 p.

National Research Council, 2007, Models in Environmental Regulatory Decision Making. Committee on Models in the Regulatory Decision Process, National Academies Press, Washington D.C., 287 p.

Texas Water Development Board, 2007, Water for Texas – 2007—Volumes I-III; Texas Water Development Board Document No. GP-8-1, 392 p.

Wade, S., 2009, GAM Run 08-84mag, Texas Water Development Board GAM Run 08-84mag Report, 37 p.

Table 1. Desired future conditions (in feet of drawdown) for each unit of the Trinity Aquifer adopted by members of Groundwater Management Area 8.

County	Average water level decrease (feet)			
	Paluxy	Glen Rose	Hensell	Hosston
Bell	134	155	286	319
Bosque	26	33	201	220
Brown	0	0	1	1
Burnet	1	1	11	29
Callahan	n/a	n/a	0	2
Collin	298	247	224	236
Comanche	0	0	2	11
Cooke	26	42	60	78
Coryell	15	15	156	179
Dallas	240	224	263	290
Delta	175	162	162	159
Denton	98	134	180	214
Eastland	0	0	0	0
Ellis	265	283	336	362
Erath	1	1	11	27
Falls	279	354	459	480
Fannin	212	196	182	181
Grayson	175	161	160	165
Hamilton	0	2	39	51
Hill	209	253	381	406
Hood	1	2	16	56
Hunt	286	245	215	223
Johnson	37	83	208	234
Kaufman	303	286	295	312
Lamar	132	130	136	134
Lampasas	0	1	12	23
Limestone	328	392	475	492
McLennan	251	291	489	527
Milam	252	294	337	344
Mills	0	0	3	12
Montague	0	1	3	12
Navarro	344	353	399	413
Parker	5	6	16	40
Red River	82	77	78	78
Rockwall	346	272	248	265
Somervell	1	4	53	113
Tarrant	33	75	160	173
Taylor	n/a	n/a	n/a	3
Travis	124	61	98	116
Williamson	108	88	142	166
Wise	4	14	23	53

Table 2. Modeled available groundwater in acre-feet for the Trinity Aquifer in Groundwater Management Area 8 by county, regional water planning area, and river basin.

County	Regional Water Planning Area	Basin	Year					
			2010	2020	2030	2040	2050	2060
Bell	G	Brazos	7,068	7,068	7,068	7,068	7,068	7,068
Bosque	G	Brazos	5,849	5,849	5,849	5,849	5,849	5,849
Brown	F	Brazos	28	28	28	28	28	28
		Colorado	2,017	2,017	2,017	2,017	2,017	2,017
Burnet	K	Brazos	2,723	2,723	2,723	2,723	2,723	2,723
		Colorado	823	823	823	823	823	823
Callahan	G	Brazos	1,792	1,792	1,792	1,792	1,792	1,792
		Colorado	1,985	1,985	1,985	1,985	1,985	1,985
Collin	C	Sabine	0	0	0	0	0	0
		Trinity	2,104	2,104	2,104	2,104	2,104	2,104
Comanche	G	Brazos	32,115	32,115	32,115	32,115	32,115	32,115
		Colorado	120	120	120	120	120	120
Cooke	C	Red	1,284	1,284	1,284	1,284	1,284	1,284
		Trinity	5,566	5,566	5,566	5,566	5,566	5,566
Coryell	G	Brazos	3,716	3,716	3,716	3,716	3,716	3,716
Dallas	C	Trinity	5,458	5,458	5,458	5,458	5,458	5,458
Delta	D	Sulphur	362	362	362	362	362	362
Denton	C	Trinity	19,333	19,333	19,333	19,333	19,333	19,333
Eastland	G	Brazos	4,489	4,489	4,489	4,489	4,489	4,489
		Colorado	231	231	231	231	231	231
Ellis	C	Trinity	3,959	3,959	3,959	3,959	3,959	3,959
Erath	G	Brazos	32,926	32,926	32,926	32,926	32,926	32,926
Falls	G	Brazos	169	169	169	169	169	169
Fannin	C	Red	617	617	617	617	617	617
		Sulphur	0	0	0	0	0	0
		Trinity	83	83	83	83	83	83
Franklin	D	Sulphur	0	0	0	0	0	0
Grayson	C	Red	7,722	7,722	7,722	7,722	7,722	7,722
		Trinity	1,678	1,678	1,678	1,678	1,678	1,678
Hamilton	G	Brazos	2,144	2,144	2,144	2,144	2,144	2,144
Hill	G	Brazos	3,086	3,086	3,086	3,086	3,086	3,086
		Trinity	61	61	61	61	61	61
Hood	G	Brazos	11,081	11,081	11,081	11,081	11,081	11,081
		Trinity	64	64	64	64	64	64
Hunt	D	Sabine	0	0	0	0	0	0
		Sulphur	0	0	0	0	0	0
		Trinity	551	551	551	551	551	551
Johnson	G	Brazos	4,940	4,940	4,940	4,940	4,940	4,940
		Trinity	7,931	7,931	7,931	7,931	7,931	7,931
Kaufman	C	Sabine	45	45	45	45	45	45
		Trinity	1,136	1,136	1,136	1,136	1,136	1,136

Table 2. Continued.

County	Regional Water Planning Area	Basin	Year					
			2010	2020	2030	2040	2050	2060
Lamar	D	Red	1,320	1,320	1,320	1,320	1,320	1,320
		Sulphur	2	2	2	2	2	2
Lampasas	G	Brazos	2,925	2,925	2,925	2,925	2,925	2,925
		Colorado	192	192	192	192	192	192
Limestone	G	Brazos	69	69	69	69	69	69
		Trinity	0	0	0	0	0	0
McLennan	G	Brazos	20,690	20,690	20,690	20,690	20,690	20,690
Milam	G	Brazos	288	288	288	288	288	288
Mills	K	Brazos	1,273	1,273	1,273	1,273	1,273	1,273
		Colorado	1,128	1,128	1,128	1,128	1,128	1,128
Montague	B	Brazos	0	0	0	0	0	0
		Red	129	129	129	129	129	129
		Trinity	2,545	2,545	2,545	2,545	2,545	2,545
Navarro	C	Trinity	1,873	1,873	1,873	1,873	1,873	1,873
Parker	C	Brazos	2,799	2,799	2,799	2,799	2,799	2,799
		Trinity	12,449	12,449	12,449	12,449	12,449	12,449
Red River	D	Red	263	263	263	263	263	263
		Sulphur	267	267	267	267	267	267
Rockwall	C	Sabine	0	0	0	0	0	0
		Trinity	958	958	958	958	958	958
Somervell	G	Brazos	2,485	2,485	2,485	2,485	2,485	2,485
Tarrant	C	Trinity	18,747	18,747	18,747	18,747	18,747	18,747
Taylor	G	Brazos	153	153	153	153	153	153
		Colorado	278	278	278	278	278	278
Travis	K	Brazos	8	8	8	8	8	8
		Colorado	3,882	3,882	3,882	3,882	3,882	3,882
Williamson	G	Brazos	1,514	1,514	1,514	1,514	1,514	1,514
		Colorado	68	68	68	68	68	68
	K	Brazos	157	157	157	157	157	157
		Colorado	61	61	61	61	61	61
Wise	C	Trinity	9,282	9,282	9,282	9,282	9,282	9,282
Total			**261,061**	**261,061**	**261,061**	**261,061**	**261,061**	**261,061**

Table 3. Modeled available groundwater for the Paluxy unit of the Trinity Aquifer summarized by county in Groundwater Management Area 8 for each decade between 2010 and 2060. Results are in acre-feet per year.

County	Year					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Bell	96	96	96	96	96	96
Bosque	1,013	1,013	1,013	1,013	1,013	1,013
Brown	18	18	18	18	18	18
Burnet	182	182	182	182	182	182
Collin	1,762	1,762	1,762	1,762	1,762	1,762
Comanche	2,292	2,292	2,292	2,292	2,292	2,292
Cooke	3,528	3,528	3,528	3,528	3,528	3,528
Coryell	254	254	254	254	254	254
Dallas	433	433	433	433	433	433
Delta	0	0	0	0	0	0
Denton	9,822	9,822	9,822	9,822	9,822	9,822
Eastland	4	4	4	4	4	4
Ellis	400	400	400	400	400	400
Erath	13,614	13,614	13,614	13,614	13,614	13,614
Falls	0	0	0	0	0	0
Fannin	288	288	288	288	288	288
Grayson	4,708	4,708	4,708	4,708	4,708	4,708
Hamilton	291	291	291	291	291	291
Hill	1,254	1,254	1,254	1,254	1,254	1,254
Hood	942	942	942	942	942	942
Hunt	551	551	551	551	551	551
Johnson	9,493	9,493	9,493	9,493	9,493	9,493
Kaufman	102	102	102	102	102	102
Lamar	0	0	0	0	0	0
Lampasas	13	13	13	13	13	13
Limestone	0	0	0	0	0	0
McLennan	231	231	231	231	231	231
Milam	0	0	0	0	0	0
Mills	5	5	5	5	5	5
Montague	505	505	505	505	505	505
Navarro	413	413	413	413	413	413
Parker	9,800	9,800	9,800	9,800	9,800	9,800
Red River	473	473	473	473	473	473
Rockwall	958	958	958	958	958	958
Somervell	120	120	120	120	120	120
Tarrant	10,544	10,544	10,544	10,544	10,544	10,544
Travis	3	3	3	3	3	3
Williamson	11	11	11	11	11	11
Wise	2,559	2,559	2,559	2,559	2,559	2,559
Total	**76,682**	**76,682**	**76,682**	**76,682**	**76,682**	**76,682**

Table 4. Modeled available groundwater for the Glen Rose unit of the Trinity Aquifer summarized by county in Groundwater Management Area 8 for each decade between 2010 and 2060. Results are in acre-feet per year.

County	Year					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Bell	880	880	880	880	880	880
Bosque	258	258	258	258	258	258
Brown	0	0	0	0	0	0
Burnet	205	205	205	205	205	205
Collin	0	0	0	0	0	0
Comanche	0	0	0	0	0	0
Cooke	0	0	0	0	0	0
Coryell	784	784	784	784	784	784
Dallas	0	0	0	0	0	0
Delta	0	0	0	0	0	0
Denton	0	0	0	0	0	0
Eastland	0	0	0	0	0	0
Ellis	0	0	0	0	0	0
Erath	41	41	41	41	41	41
Falls	2	2	2	2	2	2
Fannin	0	0	0	0	0	0
Franklin	0	0	0	0	0	0
Grayson	0	0	0	0	0	0
Hamilton	46	46	46	46	46	46
Hill	10	10	10	10	10	10
Hood	4	4	4	4	4	4
Hunt	0	0	0	0	0	0
Johnson	24	24	24	24	24	24
Kaufman	0	0	0	0	0	0
Lamar	0	0	0	0	0	0
Lampasas	773	773	773	773	773	773
Limestone	4	4	4	4	4	4
McLennan	265	265	265	265	265	265
Milam	149	149	149	149	149	149
Mills	66	66	66	66	66	66
Montague	0	0	0	0	0	0
Navarro	0	0	0	0	0	0
Parker	192	192	192	192	192	192
Red River	0	0	0	0	0	0
Rockwall	0	0	0	0	0	0
Somervell	134	134	134	134	134	134
Tarrant	112	112	112	112	112	112
Travis	2,612	2,612	2,612	2,612	2,612	2,612
Williamson	760	760	760	760	760	760
Wise	5	5	5	5	5	5
Total	**7,326**	**7,326**	**7,326**	**7,326**	**7,326**	**7,326**

Table 5. Modeled available groundwater for the Hensell unit of the Trinity Aquifer summarized by county in Groundwater Management Area 8 for each decade between 2010 and 2060. Results are in acre-feet per year.

County	Year					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Bell	1,099	1,099	1,099	1,099	1,099	1,099
Bosque	1,749	1,749	1,749	1,749	1,749	1,749
Brown	79	79	79	79	79	79
Burnet	690	690	690	690	690	690
Callahan	123	123	123	123	123	123
Collin	103	103	103	103	103	103
Comanche	2,995	2,995	2,995	2,995	2,995	2,995
Cooke	1,611	1,611	1,611	1,611	1,611	1,611
Coryell	1,765	1,765	1,765	1,765	1,765	1,765
Dallas	1,121	1,121	1,121	1,121	1,121	1,121
Delta	181	181	181	181	181	181
Denton	3,112	3,112	3,112	3,112	3,112	3,112
Eastland	79	79	79	79	79	79
Ellis	1,142	1,142	1,142	1,142	1,142	1,142
Erath	6,745	6,745	6,745	6,745	6,745	6,745
Falls	22	22	22	22	22	22
Fannin	203	203	203	203	203	203
Grayson	2,345	2,345	2,345	2,345	2,345	2,345
Hamilton	1,109	1,109	1,109	1,109	1,109	1,109
Hill	933	933	933	933	933	933
Hood	3,595	3,595	3,595	3,595	3,595	3,595
Hunt	0	0	0	0	0	0
Johnson	1,065	1,065	1,065	1,065	1,065	1,065
Kaufman	240	240	240	240	240	240
Lamar	661	661	661	661	661	661
Lampasas	885	885	885	885	885	885
Limestone	15	15	15	15	15	15
McLennan	4,190	4,190	4,190	4,190	4,190	4,190
Milam	36	36	36	36	36	36
Mills	946	946	946	946	946	946
Montague	362	362	362	362	362	362
Navarro	256	256	256	256	256	256
Parker	1,441	1,441	1,441	1,441	1,441	1,441
Red River	19	19	19	19	19	19
Rockwall	0	0	0	0	0	0
Somervell	741	741	741	741	741	741
Tarrant	2,535	2,535	2,535	2,535	2,535	2,535
Travis	156	156	156	156	156	156
Williamson	415	415	415	415	415	415
Wise	1,480	1,480	1,480	1,480	1,480	1,480
Total	**46,244**	**46,244**	**46,244**	**46,244**	**46,244**	**46,244**

Table 6. Modeled available groundwater for the Hosston unit of the Trinity Aquifer summarized by county in Groundwater Management Area 8 for each decade between 2010 and 2060. Results are in acre-feet per year.

County	Year					
	2010	2020	2030	2040	2050	2060
Bell	4,993	4,993	4,993	4,993	4,993	4,993
Bosque	2,829	2,829	2,829	2,829	2,829	2,829
Brown	1,948	1,948	1,948	1,948	1,948	1,948
Burnet	2,469	2,469	2,469	2,469	2,469	2,469
Callahan	3,654	3,654	3,654	3,654	3,654	3,654
Collin	239	239	239	239	239	239
Comanche	26,948	26,948	26,948	26,948	26,948	26,948
Cooke	1,711	1,711	1,711	1,711	1,711	1,711
Coryell	913	913	913	913	913	913
Dallas	3,904	3,904	3,904	3,904	3,904	3,904
Delta	181	181	181	181	181	181
Denton	6,399	6,399	6,399	6,399	6,399	6,399
Eastland	4,637	4,637	4,637	4,637	4,637	4,637
Ellis	2,417	2,417	2,417	2,417	2,417	2,417
Erath	12,526	12,526	12,526	12,526	12,526	12,526
Falls	145	145	145	145	145	145
Fannin	209	209	209	209	209	209
Franklin	0	0	0	0	0	0
Grayson	2,347	2,347	2,347	2,347	2,347	2,347
Hamilton	698	698	698	698	698	698
Hill	950	950	950	950	950	950
Hood	6,604	6,604	6,604	6,604	6,604	6,604
Hunt	0	0	0	0	0	0
Johnson	2,289	2,289	2,289	2,289	2,289	2,289
Kaufman	839	839	839	839	839	839
Lamar	661	661	661	661	661	661
Lampasas	1,446	1,446	1,446	1,446	1,446	1,446
Limestone	50	50	50	50	50	50
McLennan	16,004	16,004	16,004	16,004	16,004	16,004
Milam	103	103	103	103	103	103
Mills	1,384	1,384	1,384	1,384	1,384	1,384
Montague	1,807	1,807	1,807	1,807	1,807	1,807
Navarro	1,204	1,204	1,204	1,204	1,204	1,204
Parker	3,815	3,815	3,815	3,815	3,815	3,815
Red River	38	38	38	38	38	38
Rockwall	0	0	0	0	0	0
Somervell	1,490	1,490	1,490	1,490	1,490	1,490
Tarrant	5,556	5,556	5,556	5,556	5,556	5,556
Taylor	431	431	431	431	431	431
Travis	1,119	1,119	1,119	1,119	1,119	1,119
Williamson	614	614	614	614	614	614
Wise	5,238	5,238	5,238	5,238	5,238	5,238
Total	**130,809**	**130,809**	**130,809**	**130,809**	**130,809**	**130,809**

Table 7. Modeled available groundwater for the Paluxy unit of the Trinity Aquifer summarized by regional water planning area in Groundwater Management Area 8 for each decade between 2010 and 2060. Results are in acre-feet per year.

Regional Water Planning Area	Year					
	2010	2020	2030	2040	2050	2060
B	505	505	505	505	505	505
C	45,317	45,317	45,317	45,317	45,317	45,317
D	1,024	1,024	1,024	1,024	1,024	1,024
F	18	18	18	18	18	18
G	29,628	29,628	29,628	29,628	29,628	29,628
K	190	190	190	190	190	190
Total	**76,682**	**76,682**	**76,682**	**76,682**	**76,682**	**76,682**

Table 8. Modeled available groundwater for the Glen Rose unit of the Trinity Aquifer summarized by regional water planning area in Groundwater Management Area 8 for each decade between 2010 and 2060. Results are in acre-feet per year.

Regional Water Planning Area	Year					
	2010	2020	2030	2040	2050	2060
B	0	0	0	0	0	0
C	309	309	309	309	309	309
D	0	0	0	0	0	0
F	0	0	0	0	0	0
G	4,016	4,016	4,016	4,016	4,016	4,016
K	3,001	3,001	3,001	3,001	3,001	3,001
Total	**7,326**	**7,326**	**7,326**	**7,326**	**7,326**	**7,326**

Table 9. Modeled available groundwater for the Hensell unit of the Trinity Aquifer summarized by regional water planning area in Groundwater Management Area 12 for each decade between 2010 and 2060. Results are in acre-feet per year.

Regional Water Planning Area	Year					
	2010	2020	2030	2040	2050	2060
B	362	362	362	362	362	362
C	15,589	15,589	15,589	15,589	15,589	15,589
D	861	861	861	861	861	861
F	79	79	79	79	79	79
G	27,514	27,514	27,514	27,514	27,514	27,514
K	1,839	1,839	1,839	1,839	1,839	1,839
Total	**46,244**	**46,244**	**46,244**	**46,244**	**46,244**	**46,244**

Table 10. Modeled available groundwater for the Hosston unit of the Trinity Aquifer summarized by regional water planning area in Groundwater Management Area 8 for each decade between 2010 and 2060. Results are in acre-feet per year.

Regional Water Planning Area	**Year**					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
B	1,807	1,807	1,807	1,807	1,807	1,807
C	33,878	33,878	33,878	33,878	33,878	33,878
D	880	880	880	880	880	880
F	1,948	1,948	1,948	1,948	1,948	1,948
G	87,271	87,271	87,271	87,271	87,271	87,271
K	5,025	5,025	5,025	5,025	5,025	5,025
Total	**130,809**	**130,809**	**130,809**	**130,809**	**130,809**	**130,809**

Table 11. Modeled available groundwater for the Paluxy unit of the Trinity Aquifer summarized by river basin in Groundwater Management Area 8 for each decade between 2010 and 2060. Results are in acre-feet per year.

River Basin	**Year**					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Brazos	23,223	23,223	23,223	23,223	23,223	23,223
Colorado	193	193	193	193	193	193
Red	4,943	4,943	4,943	4,943	4,943	4,943
Sabine	4	4	4	4	4	4
Sulphur	267	267	267	267	267	267
Trinity	48,052	48,052	48,052	48,052	48,052	48,052
Total	**76,682**	**76,682**	**76,682**	**76,682**	**76,682**	**76,682**

Table 12. Modeled available groundwater for the Glen Rose unit of the Trinity Aquifer summarized by river basin in Groundwater Management Area 8 for each decade between 2010 and 2060. Results are in acre-feet per year.

River Basin	**Year**					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Brazos	4,263	4,263	4,263	4,263	4,263	4,263
Colorado	2,753	2,753	2,753	2,753	2,753	2,753
Red	0	0	0	0	0	0
Sabine	0	0	0	0	0	0
Sulphur	0	0	0	0	0	0
Trinity	310	310	310	310	310	310
Total	**7,326**	**7,326**	**7,326**	**7,326**	**7,326**	**7,326**

Table 13. Modeled available groundwater for the Hensell unit of the Trinity Aquifer summarized by river basin in Groundwater Management Area 8 for each decade between 2010 and 2060. Results are in acre-feet per year.

River Basin	Year					
	2010	2020	2030	2040	2050	2060
Brazos	29,030	29,030	29,030	29,030	29,030	29,030
Colorado	585	585	585	585	585	585
Red	3,129	3,129	3,129	3,129	3,129	3,129
Sabine	9	9	9	9	9	9
Sulphur	182	182	182	182	182	182
Trinity	13,309	13,309	13,309	13,309	13,309	13,309
Total	**46,244**	**46,244**	**46,244**	**46,244**	**46,244**	**46,244**

Table 14. Modeled available groundwater for the Hosston unit of the Trinity Aquifer summarized by river basin in Groundwater Management Area 8 for each decade between 2010 and 2060. Results are in acre-feet per year.

River Basin	Year					
	2010	2020	2030	2040	2050	2060
Brazos	87,971	87,971	87,971	87,971	87,971	87,971
Colorado	7,254	7,254	7,254	7,254	7,254	7,254
Red	3,263	3,263	3,263	3,263	3,263	3,263
Sabine	32	32	32	32	32	32
Sulphur	182	182	182	182	182	182
Trinity	32,107	32,107	32,107	32,107	32,107	32,107
Total	**130,809**	**130,809**	**130,809**	**130,809**	**130,809**	**130,809**

Table 15. Modeled available groundwater for the Paluxy unit of the Trinity Aquifer summarized by groundwater conservation district (GCD) in Groundwater Management Area 8 for each decade between 2010 and 2060. Results are in acre-feet per year. UWCD refers to Underground Water Conservation District. WD refers to Water District.

Groundwater Conservation District	Year					
	2010	2020	2030	2040	2050	2060
Central Texas GCD	182	182	182	182	182	182
Clearwater UWCD	96	96	96	96	96	96
Fox Crossing WD	5	5	5	5	5	5
Middle Trinity GCD	17,173	17,173	17,173	17,173	17,173	17,173
North Texas GCD	15,112	15,112	15,112	15,112	15,112	15,112
Northern Trinity GCD	10,544	10,544	10,544	10,544	10,544	10,544
Post Oak Savannah GCD	0	0	0	0	0	0
Prairielands GCD	11,267	11,267	11,267	11,267	11,267	11,267
Red River GCD	4,996	4,996	4,996	4,996	4,996	4,996
Saratoga UWCD	13	13	13	13	13	13
Southern Trinity GCD	231	231	231	231	231	231
Upper Trinity GCD	13,806	13,806	13,806	13,806	13,806	13,806
Total (excluding non-district areas)	**73,425**	**73,425**	**73,425**	**73,425**	**73,425**	**73,425**
No District	3,257	3,257	3,257	3,257	3,257	3,257
Total (including non-district areas)	**76,682**	**76,682**	**76,682**	**76,682**	**76,682**	**76,682**

Table 16. Modeled available groundwater for the Glen Rose unit of the Trinity Aquifer summarized by groundwater conservation district (GCD) in Groundwater Management Area 8 for each decade between 2010 and 2060. Results are in acre-feet per year. UWCD refers to Underground Water Conservation District. WD refers to Water District.

Groundwater Conservation District	**Year**					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Central Texas GCD	205	205	205	205	205	205
Clearwater UWCD	880	880	880	880	880	880
Fox Crossing WD	66	66	66	66	66	66
Middle Trinity GCD	1,083	1,083	1,083	1,083	1,083	1,083
North Texas GCD	0	0	0	0	0	0
Northern Trinity GCD	112	112	112	112	112	112
Post Oak Savannah GCD	149	149	149	149	149	149
Prairielands GCD	168	168	168	168	168	168
Red River GCD	0	0	0	0	0	0
Saratoga UWCD	773	773	773	773	773	773
Southern Trinity GCD	265	265	265	265	265	265
Upper Trinity GCD	201	201	201	201	201	201
Total (excluding non-district areas)	**3,902**	**3,902**	**3,902**	**3,902**	**3,902**	**3,902**
No District	3,424	3,424	3,424	3,424	3,424	3,424
Total (including non-district areas)	**7,326**	**7,326**	**7,326**	**7,326**	**7,326**	**7,326**

Table 17. Modeled available groundwater for the Hensell unit of the Trinity Aquifer summarized by groundwater conservation district (GCD) in Groundwater Management Area 8 for each decade between 2010 and 2060. Results are in acre-feet per year. UWCD refers to Underground Water Conservation District. WD refers to Water District.

Groundwater Conservation District	**Year**					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Central Texas GCD	690	690	690	690	690	690
Clearwater UWCD	1,099	1,099	1,099	1,099	1,099	1,099
Fox Crossing WD	946	946	946	946	946	946
Middle Trinity GCD	13,254	13,254	13,254	13,254	13,254	13,254
North Texas GCD	4,826	4,826	4,826	4,826	4,826	4,826
Northern Trinity GCD	2,535	2,535	2,535	2,535	2,535	2,535
Post Oak Savannah GCD	36	36	36	36	36	36
Prairielands GCD	3,881	3,881	3,881	3,881	3,881	3,881
Red River GCD	2,548	2,548	2,548	2,548	2,548	2,548
Saratoga UWCD	885	885	885	885	885	885
Southern Trinity GCD	4,190	4,190	4,190	4,190	4,190	4,190
Upper Trinity GCD	6,878	6,878	6,878	6,878	6,878	6,878
Total (excluding non-district areas)	**41,768**	**41,768**	**41,768**	**41,768**	**41,768**	**41,768**
No District	4,476	4,476	4,476	4,476	4,476	4,476
Total (including non-district areas)	**46,244**	**46,244**	**46,244**	**46,244**	**46,244**	**46,244**

Table 18. Modeled available groundwater for the Hosston unit of the Trinity Aquifer summarized by groundwater conservation district (GCD) in Groundwater Management Area 8 for each decade between 2010 and 2060. Results are in acre-feet per year. UWCD refers to Underground Water Conservation District. WD refers to Water District.

Groundwater Conservation District	Year					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Central Texas GCD	2,469	2,469	2,469	2,469	2,469	2,469
Clearwater UWCD	4,993	4,993	4,993	4,993	4,993	4,993
Fox Crossing WD	1,384	1,384	1,384	1,384	1,384	1,384
Middle Trinity GCD	43,216	43,216	43,216	43,216	43,216	43,216
North Texas GCD	8,349	8,349	8,349	8,349	8,349	8,349
Northern Trinity GCD	5,556	5,556	5,556	5,556	5,556	5,556
Post Oak Savannah GCD	103	103	103	103	103	103
Prairielands GCD	7,146	7,146	7,146	7,146	7,146	7,146
Red River GCD	2,556	2,556	2,556	2,556	2,556	2,556
Saratoga UWCD	1,446	1,446	1,446	1,446	1,446	1,446
Southern Trinity GCD	16,004	16,004	16,004	16,004	16,004	16,004
Upper Trinity GCD	17,464	17,464	17,464	17,464	17,464	17,464
Total (excluding non-district areas)	**110,686**	**110,686**	**110,686**	**110,686**	**110,686**	**110,686**
No District	20,123	20,123	20,123	20,123	20,123	20,123
Total (including non-district areas)	**130,809**	**130,809**	**130,809**	**130,809**	**130,809**	**130,809**

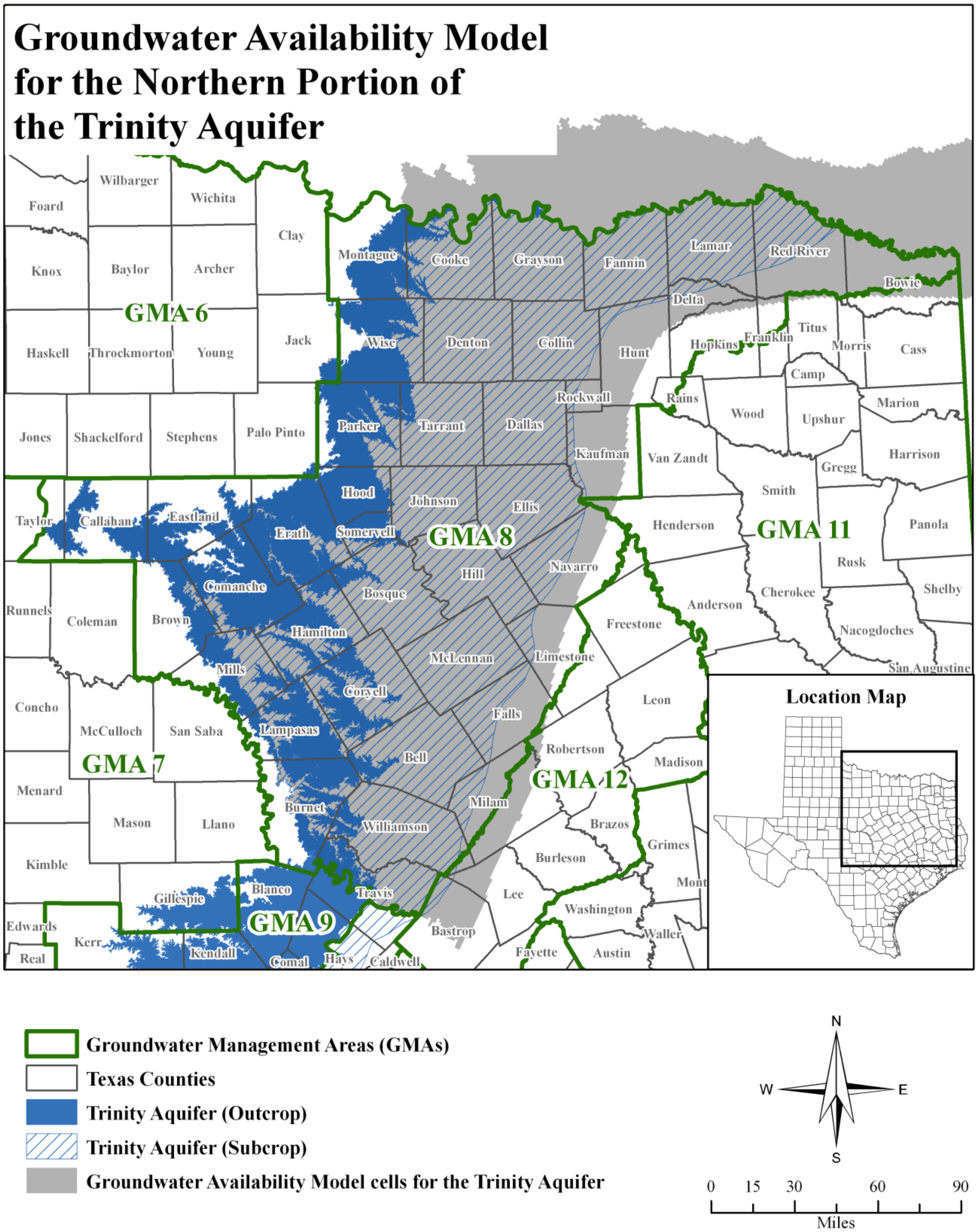


Figure 1. Map showing the areas of the groundwater availability model representing the northern portion of the Trinity Aquifer and the boundary of Groundwater Management Area 8.

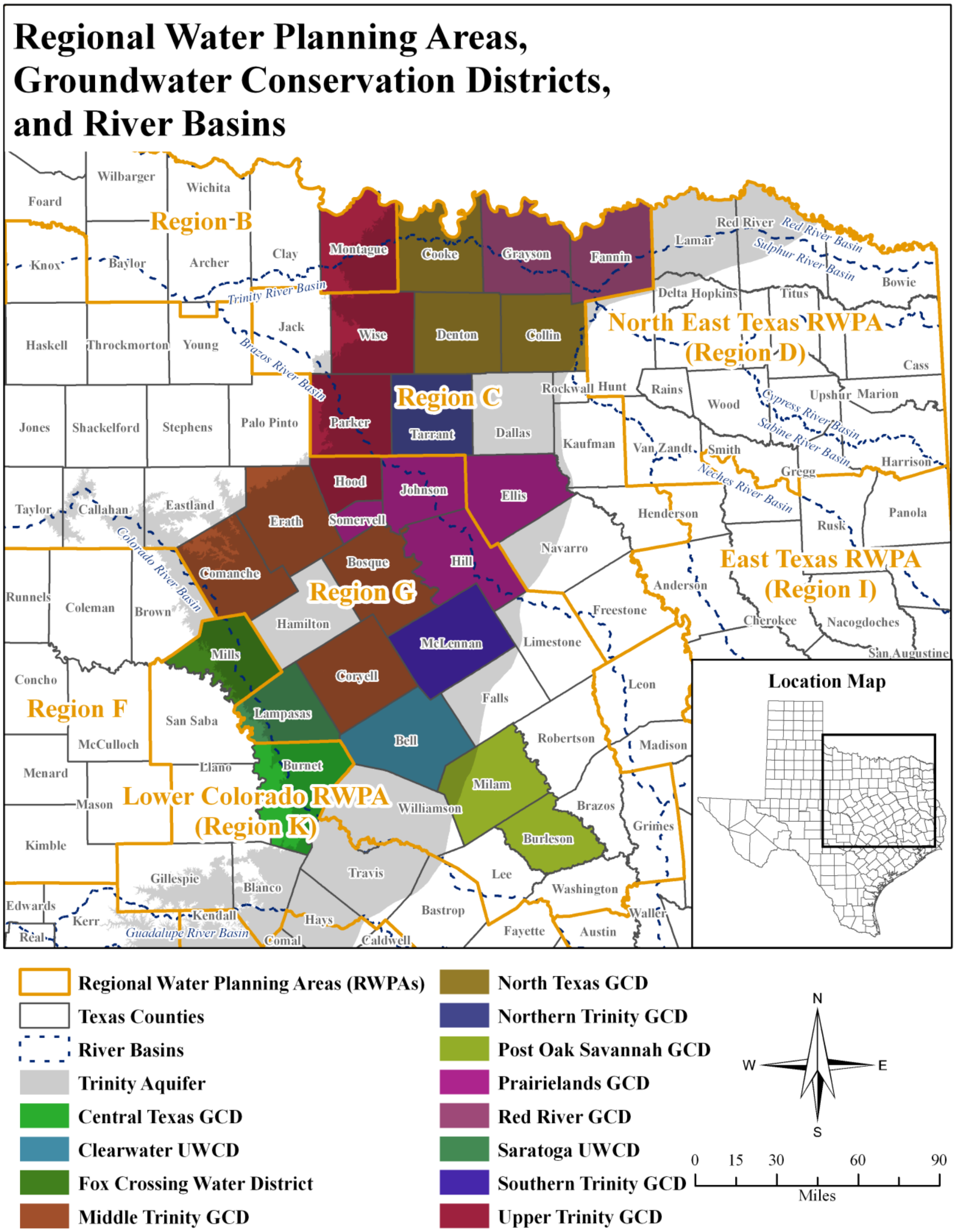
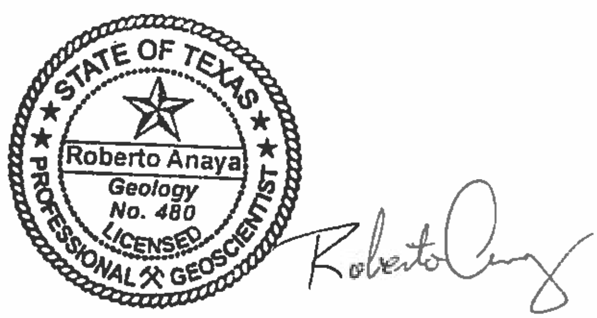


Figure 2. Map showing regional water planning areas (RWPAs), groundwater conservation districts (GCDs), counties, and river basins in and neighboring Groundwater Management Area 8.

<u>APPENDIX K</u>

GAM Run 15-003: Clearwater Underground Water Conservation District Management Plan

by Roberto Anaya, P.G.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-6115
November 24, 2015



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GAM RUN 15-003: CLEARWATER UNDERGROUND WATER CONSERVATION DISTRICT MANAGEMENT PLAN

by Roberto Anaya, P.G.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-6115
November 24, 2015

EXECUTIVE SUMMARY:

Texas State Water Code, Section 36.1071, Subsection (h), states that, in developing its groundwater management plan, a groundwater conservation district shall use groundwater availability modeling information provided by the executive administrator of the Texas Water Development Board (TWDB) in conjunction with any available site-specific information provided by the district for review and comment to the executive administrator. Information derived from groundwater availability models that shall be included in the groundwater management plan includes:

- the annual amount of recharge from precipitation to the groundwater resources within the district, if any;
- 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
- the annual volume of flow into and out of the district within each aquifer and between aquifers in the district.

This report — Part 2 of a two-part package of information from the TWDB to Clearwater Underground Water Conservation District — fulfills the requirements noted above. Part 1 of the two-part package is the Estimated Historical Water Use/State Water Plan data report. The district will receive, or received, this data report from the TWDB Groundwater Technical Assistance Section. Questions about the data report can be directed to Mr. Stephen Allen, Stephen.Allen@twdb.texas.gov, (512) 463-7317.

The groundwater management plan for the Clearwater Underground Water Conservation District should be adopted by the district on or before January 14, 2016 and submitted to the executive administrator of the TWDB on or before February 13, 2016. The current management plan for the Clearwater Underground Water Conservation District expires on April 13, 2016.

This report discusses the methods, assumptions, and results from a model run using the most current groundwater availability models for the Trinity (northern portion) and Woodbine aquifers, version 2.01 (Kelley and others, 2014) and the northern segment of the Edwards (Balcones Fault Zone) Aquifer (Jones, 2003). This model run replaces the results of GAM Run 10-009 (Hassan, 2010) that used version 1.01 of the groundwater availability model for the Trinity (northern portion) and Woodbine aquifers (Bené and others, 2004). Tables 1 and 2 summarize the groundwater availability model data required by statute to be included in the district's groundwater conservation management plan, and Figures 1 and 2 show the areas of the model from which the values in the table were extracted. If after review of the figures, Clearwater Underground Water Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the TWDB at your earliest convenience.

METHODS:

In accordance with the provisions of the Texas State Water Code, Section 36.1071, Subsection (h), the updated groundwater availability model for the northern portion of the Trinity and Woodbine aquifers (Kelley and others, 2014) and the original groundwater availability model for the northern segment of the Edwards (Balcones Fault Zone) Aquifer (Jones, 2003) was used for this analysis. Water budgets for the Clearwater Underground Water Conservation District were extracted for the historical model calibration periods of 1980-2012 for the Trinity Aquifer and 1980-2000 for the Edwards (Balcones Fault Zone) Aquifer using ZONEBUDGET Version 3.01 (Harbaugh, 2009). The average annual water budget values for recharge, surface water outflow, inflow to the district, outflow from the district, net inter-aquifer flow (upper), and net inter-aquifer flow (lower) for the portion of the aquifers located within the district are summarized in this report.

PARAMETERS AND ASSUMPTIONS:

Northern portion of the Trinity Aquifer and Woodbine Aquifer

- We used the updated groundwater availability model for the northern portion of the Trinity Aquifer and Woodbine Aquifer (Version 2.01). See

Kelley and others (2014) for assumptions and limitations of the updated groundwater availability model.

- The groundwater availability model includes eight layers, that generally correspond to:
    - the surficial outcrop area of the units in layers 2 through 8 and the younger formations overlying the downdip portions of the Woodbine Aquifer and Washita and Fredericksburg groups (Layer 1),
    - the Woodbine Aquifer (Layer 2),
    - the Washita and Fredericksburg groups (Layer 3),
    - the Paluxy Aquifer (Layer 4),
    - the Glen Rose Formation (Layer 5),
    - the Hensell Sand (Layer 6),
    - the Pearsall Formation (Layer 7), and
    - The Hosston Formation (Layer 8).
- The Trinity Aquifer is a major source of groundwater in the Clearwater Underground Water Conservation District. Most of the Trinity Aquifer occurs as subcrop within the district boundaries. A small amount of the aquifer outcrops in the western portion of the district. All of the eight numerical layers in the model are designated as active in the Clearwater Underground Water Conservation District. The Trinity Aquifer is represented by Model Layers 1 through 8 in the outcrop area and by Model Layers 4 through 8 in the subcrop area. These layers were combined to calculate water budget values for the Trinity Aquifer in the district.
- Groundwater in the Trinity Aquifer within the Clearwater Underground Water Conservation District is primarily fresh water, with total dissolved solids concentrations less than 1,000 milligrams per liter (see Figures 4.4.11 through 4.4.15 in Kelley and others (2014)).
- The Woodbine Aquifer does not exist within the Clearwater Underground Water Conservation District and thus water budgets for this aquifer were not calculated or included for this report.

- The model was run with MODFLOW-NWT (Niswonger and others, 2011).

Northern Segment of the Edwards (Balcones Fault Zone) Aquifer

- We used the original groundwater availability model for the northern segment of the Edwards (Balcones Fault Zone) Aquifer (Version 1.01). See Jones (2003) for assumptions and limitations of the groundwater availability model.
- The groundwater availability model includes one layer, that generally corresponds to:
    - The Edwards (Balcones Fault Zone) Aquifer.
- The Edwards (Balcones Fault Zone) Aquifer is a major source of groundwater in the Clearwater Underground Water Conservation District. Most of the Edwards (Balcones Fault Zone) Aquifer occurs as outcrop within the district boundaries (72 percent). The remainder of the aquifer subcrops to the southwest. The single numerical layer in the model is designated as active in the Clearwater Underground Water Conservation District. This layer was used to calculate water budget values for the Edwards (Balcones Fault Zone) Aquifer in the district.
- Groundwater in the Edwards (Balcones Fault Zone) Aquifer within the Clearwater Underground Water Conservation District is primarily fresh water, with total dissolved solids concentrations less than 1,000 milligrams per liter (see pages 37 through 39 in Jones (2003)).
- The model was run with MODFLOW-96 (Harbaugh and McDonald, 1996).

RESULTS:

A groundwater budget summarizes the amount of water entering and leaving the aquifer according to the groundwater availability model. Selected groundwater budget components listed below were extracted from the model results for the Trinity Aquifer and Edwards (Balcones Fault Zone) Aquifer located within the district and averaged over the duration of the calibration and verification portion of the model run, as shown in Tables 1 and 2.

- Precipitation recharge—the areally-distributed recharge sourced from precipitation falling on the outcrop areas of the Trinity Aquifer or Edwards (Balcones Fault Zone) Aquifer (where the aquifers are exposed at land surface) within the district.

- Surface water outflow—the total volume of water discharging from the aquifer (outflow) to surface water features such as streams, reservoirs, and drains (springs).

- Flow into and out of district—the lateral flow within the aquifers between the district and adjacent counties.

- Flow between aquifers—the net vertical flow between aquifers or confining units. This flow is controlled by the relative water levels in each aquifer or confining unit and hydraulic properties of each aquifer or confining unit. In the Clearwater Underground Water Conservation District, this net vertical flow represents the net groundwater flow between the Trinity Aquifer and the immediate geologic unit overlying the aquifer in the subcrop area or the net groundwater flow between the Edwards (Balcones Fault Zone) Aquifer and the immediate geologic units overlying and underlying the aquifer in the subcrop area.

The information needed for the Clearwater Underground Water Conservation District's management plan is summarized in Tables 1 and 2. It is important to note that sub-regional water budgets are approximate. 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 (Figures 1 and 2). Please note that the results of this model run are different from the results of the model run 10-009 that were obtained from the older groundwater availability model for the Trinity Aquifer. The changes can be attributed to several characteristics of the new model, such as differences in model layering, geologic boundaries, hydraulic properties distribution, and the use of different MODFLOW modeling packages.

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

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Trinity Aquifer	2,816
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Trinity Aquifer	11,131
Estimated annual volume of flow into the district within each aquifer in the district	Trinity Aquifer	7230
Estimated annual volume of flow out of the district within each aquifer in the district	Trinity Aquifer	5659
Estimated net annual volume of flow between each aquifer in the district	From younger overlying Washita and Fredericksburg Confining Units into the Trinity Aquifer	5,587

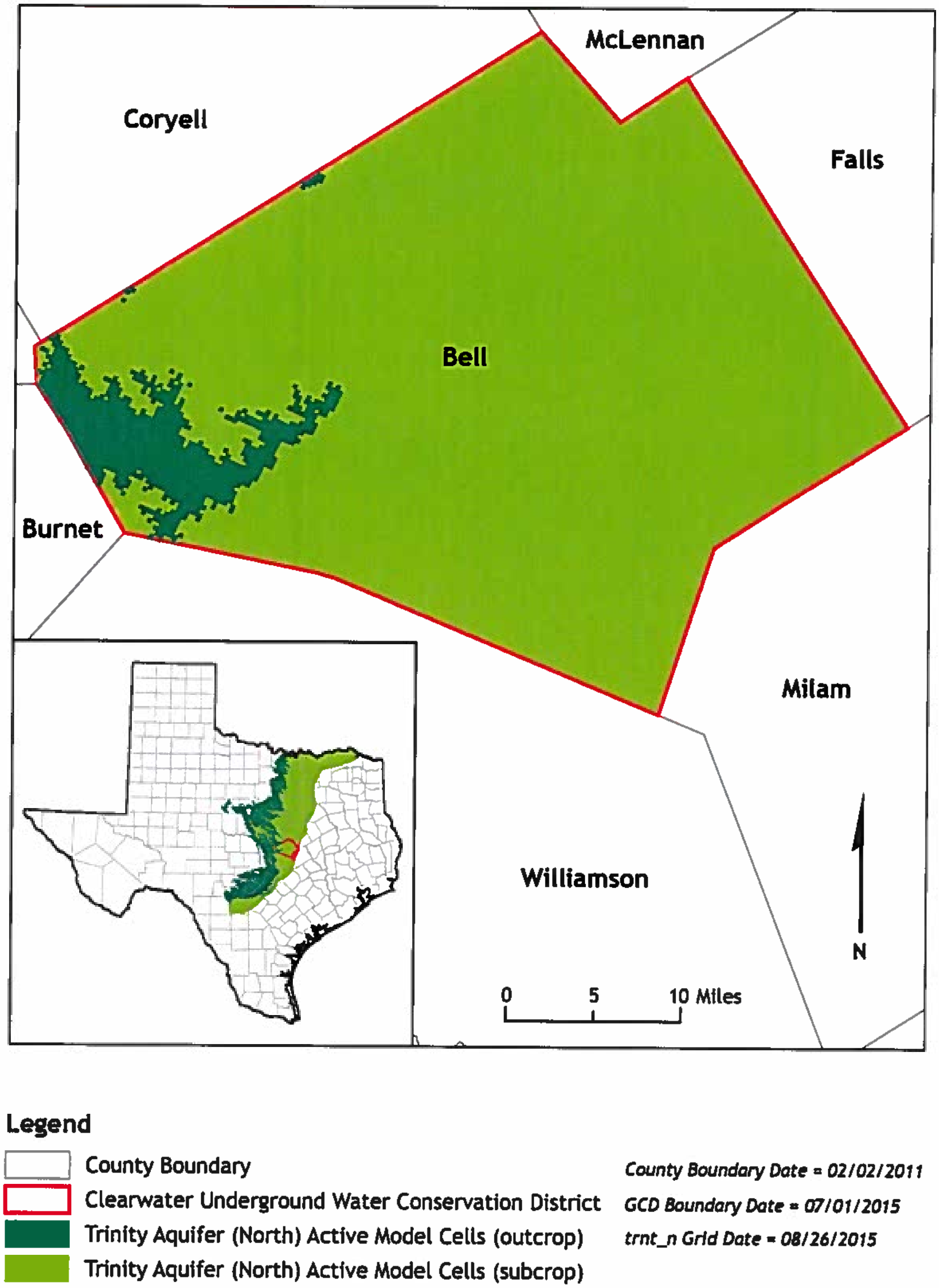

FIGURE 1: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE NORTHERN PORTION OF THE TRINITY AQUIFER AND WOODBINE AQUIFER FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED (THE TRINITY AQUIFER FOOTPRINT EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 2: SUMMARIZED INFORMATION FOR THE EDWARDS (BALCONES FAULT ZONE) AQUIFER THAT IS NEEDED FOR THE CLEARWATER UNDERGROUND WATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Edwards (Balcones Fault Zone) Aquifer	27,565
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Edwards (Balcones Fault Zone) Aquifer	27,566
Estimated annual volume of flow into the district within each aquifer in the district	Edwards (Balcones Fault Zone) Aquifer	5,853
Estimated annual volume of flow out of the district within each aquifer in the district	Edwards (Balcones Fault Zone) Aquifer	1,090
Estimated net annual volume of flow between each aquifer in the district	From Edwards (Balcones Fault Zone) Aquifer to the overlying younger units	121
	From Edwards (Balcones Fault Zone) Aquifer to the downdip portion of the Edwards (Balcones Fault Zone) Aquifer	3,957*

* The model extends beyond the TWDB official Edwards (Balcones Fault Zone) Aquifer boundary. This is the amount of saline groundwater (greater than 1,000 total dissolved solid) that exits in the downdip boundary limit of the aquifer within the district boundaries and into deeper portions of the Edwards Group formations.

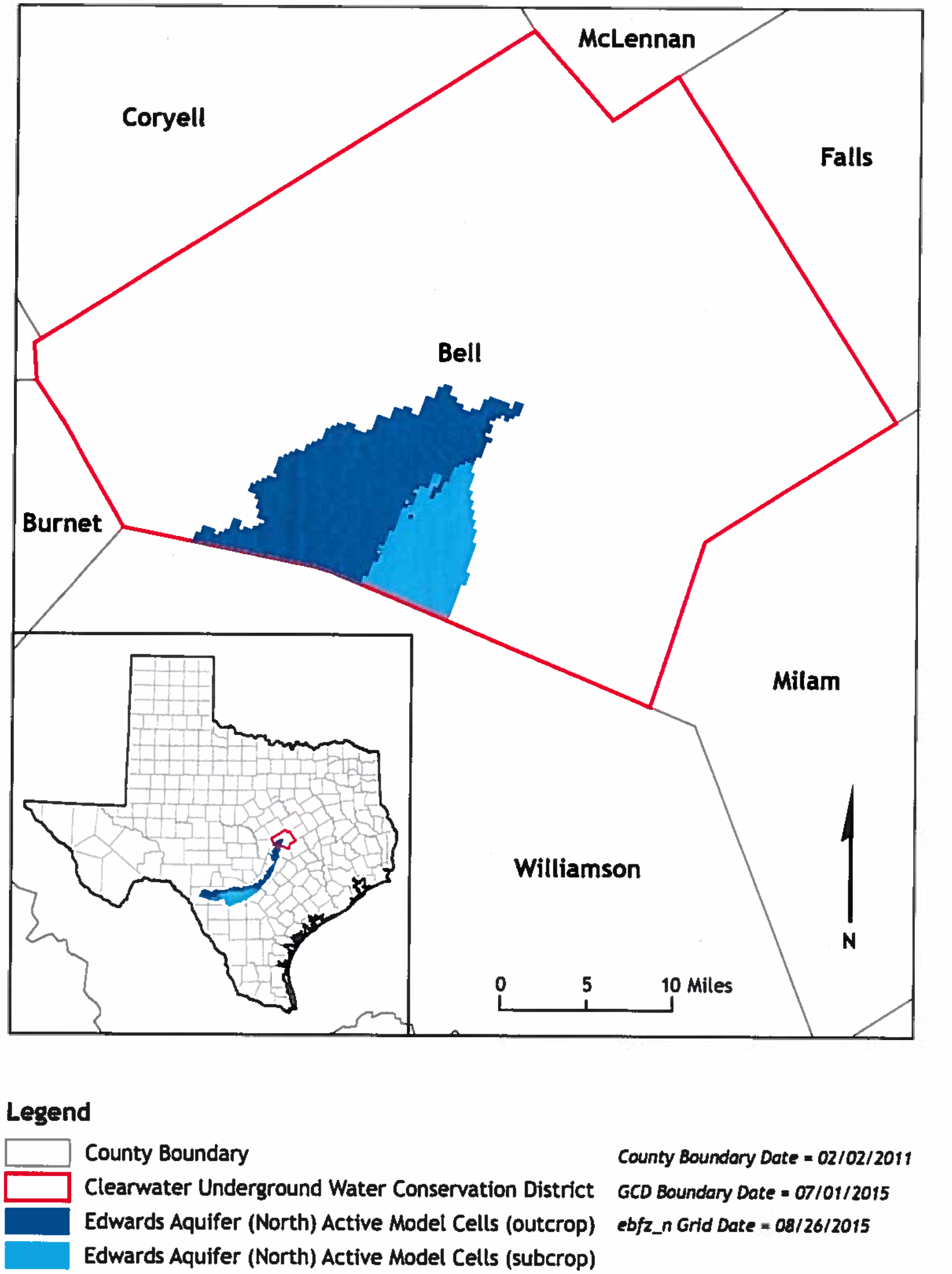

FIGURE 2: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE NORTHERN SEGMENT OF THE EDWARDS (BALCONES FAULT ZONE) AQUIFER FROM WHICH THE INFORMATION IN TABLE 2 WAS EXTRACTED (THE EDWARDS (BALCONES FAULT ZONE) AQUIFER FOOTPRINT EXTENT WITHIN THE DISTRICT BOUNDARY).

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 interaction with streams are specific to particular historic time periods.

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

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

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<u>APPENDIX L</u>

Table 3.1-1. Major Reservoirs[1] of the Brazos River Basin

Reservoir	Water Right Owner	Authorized Storage (acft)	Authorized Diversion (acft)	Priority Date	County	Planning Region
Abilene	City of Abilene	11,868	1,675	1/23/18	Taylor	G
Alcoa Lake	Aluminum Co. of America	15,650	14,000	12/12/51	Milam	G
Alan Henry	Brazos River Authority	115,937	35,200	10/5/81	Garza	O
Allens Creek	Brazos River Authority City of Houston TWDB	145,553	99,650	9/1/99	Austin	H
Aquilla	Brazos River Authority	52,400	13,896	10/25/76	Hill	G
Belton	Brazos River Authority	457,600	100,257	12/16/63	Bell	G
Brazoria Reservoir–Off-Channel	Dow Chemical	21,700	0	4/7/52	Brazoria	H
Brushy Creek	City of Marlin	6,560	0	6/16/86	Falls	G
Camp Creek	Camp Creek Water Co.	8,400	0	6/14/48	Robertson	G
Cisco	City of Cisco	45,000	1,971 56	4/16/20 9/5/78	Eastland	G
Daniel	City of Breckenridge	11,400	2,100	4/26/46	Stephens	G
Dansby Power Plant	City of Bryan	15,227	850	5/30/72	Brazos	G
Davis	League Ranch	4,477 918	2,000	6/13/58 5/15/72	Knox	G
Eagle Nest Lake	T L Smith Trust Et Al	18,000 11,315	4,000 1,800	1/15/48 9/9/93	Brazoria	H
Fort Phantom Hill	City of Abilene	73,960	30,690	3/25/37	Jones	G
GCWA	Gulf Coast Water Auth.	7,308	0	3/17/47	Fort Bend	H
Georgetown	Brazos River Authority	37,100	13,610	2/12/68	Williamson	G
Gibbons Creek Power	Texas Municipal Power	26,824 5,260	9,740	2/22/77 3/9/89	Grimes	G
Graham/Eddleman	City of Graham	4,503 39,000 8,883	5,000 15,000	11/21/27 11/15/54 9/16/57	Young	G
Granbury	Brazos River Authority	155,000	64,712	2/13/64	Hood	G
Granger	Brazos River Authority	65,500	19,840	2/12/68	Williamson	G
Harris Reservoir–Off-Channel	Dow Chemical	10,200	0	2/14/42	Brazoria	H
Hubbard Creek Lake	West Central Texas MWD	317,750	52,800 3,200	5/28/57 8/14/72	Stephens	G
Kirby	City of Abilene	8,500	3,880	10/10/27	Taylor	G
Lake Creek	Luminant Generation Co	8,500	10,000	3/6/1951	McLennan	G
Leon	Eastland Co WSD	28,000	1,265 2,438 2,598	5/17/31 3/21/52 3/25/86	Eastland	G
Limestone	Brazos River Authority	217,494 7,906	65,450	5/1/74 9/4/79	Robertson	G
Mexia	Bistone Municipal WSD	9,600	2,952	4/15/57	Limestone	G
Miller's Creek	North Central Texas MWA	30,696	5,000	10/1/58	Baylor	G / B
Mineral Wells	City of Mineral Wells	7,065	1,680 840	11/15/20 3/22/43	Parker	C
Palo Pinto	Palo Pinto Co. MWD 1	34,250 9,874	10,000 2,500 6,000	7/3/62 9/8/64 7/3/62	Palo Pinto	G
Pat Cleburne Reservoir	City of Cleburne	25,600	5,760 240	8/6/62 3/29/76	Johnson	G

Table 3.1-1 (Concluded)

Reservoir	Water Right Owner	Authorized Storage (acft)	Authorized Diversion (acft)	Priority Date	County	Planning Region
Post	White River MWD	57,420	10,600	1/20/70	Garza	O
Proctor	Brazos River Authority	59,400	19,658	12/16/63	Comanche	G
Somerville	Brazos River Authority	160,110	48,000	12/16/63	Washington	G
Squaw Creek Reservoir	Texas Utilities Electric Co.	151,500	23,180	4/25/73	Somervell	G
Stamford	City of Stamford	60,000	10,000	6/8/49	Haskell	G
Stillhouse Hollow	Brazos River Authority	235,700	67,768	12/16/63	Bell	G
Sweetwater	City of Sweetwater	10,000	3,740	10/17/27	Nolan	G
Tradinghouse Steam	Texas Utilities Electric Co.	37,800	12,000	8/21/26	McLennan	G
			15,000	9/16/66		
Twin Oak Steam Electric	Texas Utilities Electric Co.	30,319	13,200	7/1/74	Robertson	G
Waco	City of Waco	104,100	39,100	1/10/29	McLennan	G
			19,100	4/16/58		
			900	2/21/79		
	City of Waco	87,962	20,770	9/12/86		
Whitney	Brazos River Authority	50,000	18,336	8/30/82	Hill	G
White River Reservoir	White River MWD	33,160	6,000	9/22/58	Crosby	O
		5,072		11/21/60		
		6,665		8/16/71		

[1] A major reservoir is defined as one with an authorized capacity equal to or greater than 5,000 acft.

A number of interbasin transfer permits exist in the Brazos River Basin. These permits include both authorizations for diversions from the Brazos River Basin to adjacent river basins and from adjacent river basins to the Brazos River Basin. Most of the interbasin transfer permits are obviously located along the basin divide. Examples of interbasin transfers that authorize diversions from an adjacent river basin to the Brazos River Basin include: Lake Meredith (Canadian River Basin) to the Lubbock and Plainview areas in Lubbock and Hale County; Oak Creek Reservoir (Colorado River Basin) to the City of Sweetwater in Nolan County; and Lake Travis (Colorado River Basin) to the City of Cedar Park in Williamson County. Interbasin transfers authorized for diversion from the Brazos River Basin to other river basins include: Lake Mexia in Limestone County to part of the City of Mexia that lies in the Trinity River Basin; Teague City Lake in Freestone County to part of the City of Teague that lies in the Trinity River Basin; and Lake Granbury in Hood County to part of Johnson County that lies in the Trinity River Basin. A summary of interbasin transfers (excluding transfers authorized to adjacent coastal basins) associated with the Brazos River Basin is presented in Table 3.1-2.