Upper Trinity Groundwater Conservation District

District Management Plan

Adopted – 2015

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I. DISTRICT MISSION

The Mission of the Upper Trinity Groundwater Conservation District ("District") is to develop rules to provide protection to existing wells, prevent waste, promote conservation, provide a framework that will allow availability and accessibility of groundwater for future generations, protect the quality of the groundwater in the recharge zone of the aquifer, insure that the residents of Montague, Wise, Parker, and Hood counties maintain local control over their groundwater, and operate the District in a fair and equitable manner for all residents of the District.

II. PURPOSE OF THE MANAGEMENT PLAN

The 75th Texas Legislature established a comprehensive regional and statewide water planning process in 1997. A critical component of that far-reaching overhaul of the Texas' water planning process included a requirement that each groundwater conservation district develop a management plan that defines the water needs and supply within each District and defines the goals the District will use to manage the groundwater in order to meet the stated needs or demonstrate that the needs exceed available groundwater supplies. Information from each District's management plan is incorporated into the regional and state water plans. The management plan is also used as the basis for the development of the District's permitting and groundwater management rules.

The time period for this plan is five years from the date of approval by the TWDB. This plan will be reviewed and readopted with or without amendments at least once every five years, or more frequently if deemed necessary or appropriate by the District Board. This management plan will remain in effect until it is replaced by a revised management plan approved by the TWDB

In addition, Chapter 36, Texas Water Code ("Chapter 36"), requires joint planning among Districts located within the same Groundwater Management Area ("GMA"). Among other activities conducted pursuant to this joint planning process, the Districts within each GMA must establish desired future conditions for all aquifers located in whole or in part within the GMA. The desired future conditions established through this process are then submitted to the Texas Water Development Board ("TWDB"), which is required to provide each District with estimates concerning the amount of groundwater that can be produced from each aquifer annually within each county located in the GMA in order to achieve the desired future conditions established for each aquifer. This quantified annual water budget for each aquifer is known as the "Modeled Available Groundwater" or "MAG" amount. Chapter 36 requires that technical information, such as the desired future conditions of the aquifers within a District's jurisdiction and the amount of modeled available groundwater from such aquifers, be included in the District's management plan. This technical information is used as a guide for a District's regulatory and management policies. This groundwater management plan for the District is required by Chapter 36 and was developed in accordance with the administrative rules of the TWDB. Chapter 36 and the TWDB require use of projections of future water demands, surface water availability, water management strategies, and groundwater use provided to the District by the TWDB from the

State Water Plan in the management plan. This management plan will be used to: (1) serve as a planning tool for the District in its management and operations; (2) provide general information about the District and its groundwater resources; (3) provide technical information concerning groundwater resources, water supply, and demand; (4) establish goals, management objectives, and performance standards for the District; (5) serve as a resource to help guide the District's development of additional technical information on local groundwater resources, use, and demand; and (5) support the District's development of its well permitting and regulatory program. The District considers the collection and development of site-specific data on groundwater use in Hood, Montague, Parker, and Wise counties and the groundwater sources of these counties to be a high priority. This plan will be updated as the District develops the site-specific data on local groundwater use and aquifer conditions. Although the District must review and readopt the plan at least once every five years, it is not restricted from doing so more frequently if deemed appropriate by the District.

III. DISTRICT INFORMATION

A. Creation

The Upper Trinity Groundwater Conservation District (the "District") was created by the passage of Senate Bill 1983 by the 80th Texas Legislature under the authority of Section 59, Article XVI, of the Texas Constitution, and in accordance with Chapter 36, by the Act of May 25, 2007, 80th Leg., R.S., Ch. 1343, 2007 Tex. Gen. Laws 4583, codified at TEX. SPEC. DIST. LOC. LAWS CODE ANN. Ch. 8830, as amended ("the District Act"). The creation of the District was overwhelmingly confirmed by the citizens of Hood, Montague, Parker, and Wise counties on November 6, 2007, in an election called for that purpose. The District was created to serve a public use and benefit, and is essential to accomplish the objectives set forth in Section 59, Article XVI, of the Texas Constitution. The purpose of the District is to provide for the conservation, preservation, protection, recharging, and prevention of waste of groundwater, and of groundwater reservoirs or their subdivisions, consistent with the objectives of Chapter 36 and Section 59, Article XVI, Texas Constitution.

B. Directors

The Board of Directors consists of eight members, two from each of the following four counties: Hood, Montague, Parker, and Wise. The directors for each county are appointed by their respective commissioners' courts, and serve staggered four-year terms. Each Director is eligible for multiple consecutive terms.

C. Location, Topography and Drainage

The area encompassed by the District is approximately 3,200 square miles and is coextensive with the boundaries of Hood, Montague, Parker and Wise counties. The topography of the District can be generally classified as high to gently rolling prairies with elevations ranging from approximately 850 to 1,300 feet above mean sea level in Montague County, an average of 800 feet in Wise County, 700 to 1,200 feet in Parker County and 600 to 1,000 feet above sea level in Hood County.

The District falls in the drainage area of three separate major river basins. The northern part of Montague County is drained by the Red River, while the Denton-Elm and West forks of the Trinity River drain the east-central and southern parts of the county, respectively. Tributaries of the Trinity River drain Wise County, the northeastern part of Parker County, and the very northeastern corner of Hood County. The southwestern part of Parker County and the vast majority of Hood County are drained by the Brazos River and its tributaries.

Figure 1.   Locations and boundaries of the District.

D. Groundwater Resources in the District

Groundwater resources in the four counties making up the District include the Cretaceous-age Trinity Aquifer, several water-bearing units of Pennsylvanian- and Permian-age, referred to as the Paleozoic aquifers, and alluvial deposits. The Trinity Aquifer is recognized by the TWDB as a major aquifer in Texas. The Paleozoic aquifers are not recognized by the TWDB as either major or minor aquifers. No minor aquifers, as defined by the TWDB, are located in the District. The TWDB defines a major aquifer as one that supplies large quantities of water over large areas of the state and defines a minor aquifer as one that supplies relatively small quantities of water over large areas of the state or supplies large quantities of water over small areas of the state (Ashworth and Hopkins, 1995). A generalized stratigraphic section representative of the hydrogeology of the District is provided in **Table 1**.

Major Aquifer – the Trinity Aquifer

The Trinity Aquifer, shown in **Figure 2**, is defined by the TWDB as a major aquifer composed of several individual aquifers contained within the Trinity Group. In the District, the Trinity Aquifer consists of the aquifers of the Paluxy Sand, the Glen Rose Formation, the Twin Mountains Formation, and the Antlers Formation. The Antlers Formation is the coalescence of the Paluxy and Twin Mountains formations north of the line where the Glen Rose Formation thins to extinction. This occurs approximately in central Wise County (**Figure 3**). The Cretaceous-age Fredericksburg and Washita Groups are generally considered confining units and they overlie the subcrop portion of the Trinity Aquifer in the easternmost areas of the District.

The Paluxy Sand consists of sand, silt, and clay, with sand dominating. The sand and silts in the aquifer are primarily fine-grained, well sorted, and poorly cemented (Bené and others, 2004). Coarse-grained sand is found in the lower sections grading up to fine-grained sand with shale and clay in the upper section (Nordstrom, 1982). In general, natural groundwater flow in the Paluxy Sand is east to southeast (Langley, 1999). Wells completed into the Paluxy Sand typically yield small to moderate quantities of water that is fresh to slightly saline (Nordstrom, 1982). Where the Glen Rose Formation is absent, the Paluxy Sand is equivalent to the upper sands of the Antlers Formation (Baker and others, 1990).

The Glen Rose Formation consists primarily of limestone with some shale, sandy-shale, and anhydrite. In general, the aquifer yields small quantities of water in localized areas (Baker and others, 1990). Groundwater flow in the Glen Rose Formation is generally to the east and southeast.

Table 1. General Stratigraphy (Bené and others 2004; McGowen and others, 1967; 1972; Brown and others, 1972).

<table>
<tr><th rowspan="2">System</th><th rowspan="2">Hydrogeologic Characteristic</th><th rowspan="2">Group</th><th colspan="2">Formation</th></tr>
<tr><th>North</th><th>South</th></tr>
<tr><td></td><td>Water-Bearing</td><td></td><td colspan="2">alluvial deposits</td></tr>
<tr><td rowspan="7">Cretaceous</td><td>Confining Units (locally productive)</td><td>Washita</td><td colspan="2">Weno
Denton
Fort Worth
Duck Creek
Kiamichi</td></tr>
<tr><td rowspan="3">Confining Units (locally productive)</td><td rowspan="3">Fredericksburg</td><td rowspan="2">Goodland</td><td>Edwards</td></tr>
<tr><td>Comanche Peak</td></tr>
<tr><td>Walnut Clay</td><td>Walnut Clay</td></tr>
<tr><td rowspan="3">Aquifer</td><td rowspan="3">Trinity</td><td rowspan="3">Antlers</td><td>Paluxy</td></tr>
<tr><td>Glen Rose</td></tr>
<tr><td>Twin Mountains</td></tr>
<tr><td>Permian</td><td>Water-Bearing</td><td>Bowie</td><td colspan="2">Nocona
Archer City
Markley
Thrifty and Graham, undivided</td></tr>
<tr><td rowspan="13">Pennsylvanian</td><td rowspan="7">Water-Bearing</td><td rowspan="7">Canyon</td><td colspan="2">Colony Creek Shale</td></tr>
<tr><td colspan="2">Ranger</td></tr>
<tr><td colspan="2">Ventioner</td></tr>
<tr><td colspan="2">Jasper Creek</td></tr>
<tr><td colspan="2">Chico Ridge Limestone</td></tr>
<tr><td colspan="2">Willow Point</td></tr>
<tr><td colspan="2">Palo Pinto</td></tr>
<tr><td rowspan="6">Water-Bearing</td><td rowspan="6">Strawn</td><td colspan="2">Mineral Wells</td></tr>
<tr><td colspan="2">Brazos River</td></tr>
<tr><td colspan="2">Mingus</td></tr>
<tr><td colspan="2">Buck Creek Sandstone</td></tr>
<tr><td colspan="2">Grindstone Creek</td></tr>
<tr><td colspan="2">Lazy Bend</td></tr>
</table>

Figure 2. Outcrop and subcrop of the Trinity Aquifer in the District.

Figure 3. Groundwater resources in the District.

The Twin Mountains Formation consists predominantly of medium- to coarse-grained sand, silty clay, and conglomerates. A massive sand is found in the lower portion of the formation while less sand is found in the upper portion of the aquifer due to increased interbedding of shale and clay (Nordstrom, 1982). In general, wells are primarily completed into the lower part of the aquifer. Where the Glen Rose Formation is absent, the Twin Mountains Formation is equivalent to the lower sands of the Antlers Formation (Baker and others, 1990). Typically, wells completed into the Twin Mountains Formation yield fresh and slightly saline water in moderate to large quantities (Nordstrom, 1982). Groundwater flow in this formation is generally to the east and southeast.

Typically, the Antlers Formation consists of a basal conglomerate and sand overlain by poorly consolidated sand interbedded with discontinuous clay layers (Nordstrom, 1982). Considerably more clay is found in the middle portion of the formation than in the upper and lower portions. Limestone is also found in the middle portion near the updip limit of the Glen Rose Formation. Generally, groundwater flow in the Antlers Formation is to the east and southeast. Well yield in the Antlers Formation is similar to that in the Twin Mountains Formation with subcrop wells generally more productive than those in the outcrop areas.

<u>Minor Aquifer</u>

No minor aquifers, as defined by the TWDB, are located in the District. However, the Paleozoic strata outcropping to the west of the Trinity Group are used as a source of groundwater within the District.

<u>Other Water-Bearing Formations</u>

Paleozoic Aquifers

Several Pennsylvanian- and Permian-age formations in the District are capable of producing usable quantities of groundwater. These formations are referred to collectively as the Paleozoic aquifers (see **Figure 3**). Literature regarding these formations is very limited and, therefore, information regarding their hydrologic characteristics is also limited. The Paleozoic aquifers are a significant source of groundwater in northern and western portions of Montague County, west-central Wise County, and western Parker County where the Trinity Aquifer is absent. Based on information in the TWDB groundwater database (TWDB, b) as of November 2009, the percentage of wells in the District completed into the Paleozoic aquifers is 78.2, 14.8, 5.4, and 0.0 percent for Montague, Wise, Parker, and Hood counties, respectively.

From youngest to oldest, the formations of the Bowie, Canyon, and Strawn groups make up the Paleozoic aquifers. The Bowie Group consists of the Nocona Formation (mudstone with sandstone and siltstone in thin lenticular beds throughout), the Archer City Formation (predominantly mudstone with thin siltstone beds and sandstone), the Markley Formation (mudstone with local thin beds of sandstone in upper portion and mudstone and shale with some coal and limestone below), and the undivided Thrifty and

Graham formations (predominantly mudstone and shale with thin sandstone beds and some sandstone sheets locally and two limestone members).

The underlying Canyon Group is comprised of the Colony Creek Shale (shale with some siltstone, local thin to medium beds of sandstone, and limestone lentils), the Ranger Limestone (predominantly limestone with local thin shale beds), the Ventioner Formation (shale and mudstone with numerous sandy and silty lenses and thin to medium beds), the Jasper Creek Formation (upper portion predominantly shale with thin siltstone beds throughout and isolated massive sandstone lenses and lower portion shale with thin limestone lentils and local thin and lenticular thick sandstone beds), the Chico Ridge Limestone (predominantly limestone with local shale beds), the Willow Point Formation (shale and claystone locally silty and sandy with local thin beds of sandstone and several limestone beds in lower portion and a single coal bed), and the Palo Pinto Formation (predominantly limestone and marl with some sandstone and shale). Sandstone lenses found in the Canyon Group are locally important to the occurrence of groundwater (Bayha, 1967).

The Strawn Group consists of the Mineral Wells Formation (shale containing local sandstone beds and a few limestone beds), the Brazos River Formation (sandstone with local lenses of conglomerate and mudstone), the Mingus Formation (sandy shale with one thin coal seam and some limestone beds), the Buck Creek Sandstone (sandstone), the Grindstone Creek Formation (shale, in part sandy, with local thin coal beds and sandstone lentils and limestone beds with some shale), and the Lazy Bend Formation (shale, in part sandy or silty, with local coal beds and limestone beds).

The Paleozoic aquifers are the primary source of water in Montague County (Bayha, 1967) as indicated by the high percentage of wells completed into these aquifers in the county. Bayha (1967) indicates that groundwater is difficult to trace in these aquifers due to the complex depositional sequence.

Alluvial Deposits

Some alluvial deposits of Pleistocene to Recent age are capable of producing water in the District, especially along the Red River in Montague County and the Brazos River in Parker County. The majority of these sediments are stream deposits but some are of windblown origin. The alluvial deposits, consisting of sand, gravel, silt, and clay, yield small to large quantities of fresh water. Based on information in the TWDB groundwater database (TWDB, 2009b) as of November 2009, the percentage of wells in the District completed into alluvial deposits is 10.0, 0.4, 3.0, and 0.1 percent for Montague, Wise, Parker, and Hood counties, respectively.

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

A. Modeled Available Groundwater in the District based on adopted Desired Future Conditions – 31TAC 356.52(a)(5)(A)/TWC §36.1071(e)(3)(A)

The Texas Legislature has established that the preferred method of managing groundwater in Texas is through rules developed by a groundwater conservation district. A groundwater conservation district is a district created under Texas Constitution, Article III, Section 52 or Article XVI, Section 59, which has the authority to regulate the spacing of water wells, the production from water wells, or both. Many groundwater conservation districts boundaries are consistent with political boundaries such as county boundaries and, as such, are not consistent with hydrologic boundaries which would need to be considered in the cohesive management of an aquifer.

Modeled available groundwater is defined as: "the amount of water that the executive administrator determines may be produced on an average annual basis to achieve a desired future condition established under Section 36.108."

In 2005 the Texas legislature recognized that aquifers may need to be managed based on hydrologic boundaries, and not just the political boundaries, such as county boundaries, that defined many groundwater conservation districts. That year legislation was passed requiring joint planning among groundwater conservation districts within a common groundwater management area (GMA). These GMAs are required to meet at least annually, and are charged with developing desired future conditions (DFCs) by which any aquifer deemed relevant by a GMA will be managed. The District only has one TWDB-designated major or minor aquifer within its boundaries—the northern Trinity Aquifer, which is a major aquifer. GMA 8 readopted DFC's for the northern Trinity and Woodbine aquifers on April 27, 2011 that submittal package can be found here: http://www.twdb.texas.gov/groundwater/docs/DFC/GMA8_DFC_Adopted_2011-0427.pdf. The TWDB MAG report has been provided in Table 3, and can be found here: http://www.twdb.texas.gov/groundwater/docs/GAMruns/GR10-063_MAG.pdf

Selected Management Conditions

The selected management conditions for the District are based upon results from the Northern Trinity GAM. In the GAM the Trinity Aquifer is divided into four model layers generally representing the dominant hydrostratigraphy of the Trinity Aquifer in North-Central and North Texas; the Upper Trinity (Paluxy and Glen Rose aquifers), the Middle Trinity (Hensell aquifer) and the Lower Trinity (Hosston aquifer). The GAM models the Paluxy aquifer as model layer 3, the Glen Rose aquifer as model layer 4, the Hensell aquifer as model layer 5, and the Hosston aquifer as model layer 7. Model layer 6 represents the Pearsall/Cow Creek/Hammett members of the Travis Peak Formation, which are conceptualized as a confining unit. The relationship between these model layers and the formations in the District is illustrated in **Table** 2.

Table 2. Relationship Between Model Layers in Trinity Aquifer GAM and Formations in the District

District (North and West)		South		GAM Model	
Montague and northern Wise counties	Hood, Parker, southern Wise counties			Model Stratigraphy	Model Layer
Antlers Formation	Paluxy Sand	Paluxy Sand	Paluxy Sand	Paluxy aquifer	3
	Glen Rose Formation	Glen Rose Formation	Glen Rose Formation	Glen Rose aquifer	4
	Twin Mountains Formation	Travis Peak Formation	Hensell Member	Hensell aquifer	5
			Pearsall Member	Pearsall/Cow Creek/Hammett/ Sligo confining unit	6
			Cow Creek Member		
			Hammett Member		
			Sligo Member		
			Hosston Member	Hosston aquifer	7

Because the GAM was used as a means of defining desired future conditions as well as estimating the managed available groundwater, the following discussion is couched in terms of hydrostratigraphic nomenclature and model layers consistent with the GAM.

The desired future conditions were specified based upon average drawdown from the year 2000 through the year 2050 on a county and aquifer (model layer) basis. **Table 3** summarizes the desired future conditions for the four counties comprising the District for the Northern Trinity Aquifer. For example, for the Hosston aquifer in Hood County, the specified management goal (desired future condition) is defined "from estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 56 feet after 50 years" (Oliver, 2011). All of the desired future conditions are specified in (Oliver, 2011) in a similar format.

Table 3. Desired Future Conditions and Modeled Available Groundwater for the northern Trinity Aquifer in the District.

County	Trinity Sub-Aquifer	Desired Future Condition(1)	Modeled Available Groundwater (2) (AFY)
Hood	Paluxy	1	942
	Glen Rose	2	4
	Hensell	16	3,595
	Hosston	56	6,604
Hood County Total		NA	11,145
Parker	Paluxy	5	9,800
	Glen Rose	6	192
	Hensell	16	1,441
	Hosston	40	3,815
Parker County Total		NA	15,248
Wise	Paluxy	4	2,559
	Glen Rose	14	5
	Hensell	23	1,480
	Hosston	53	5,238
Wise County Total		NA	9,282
Montague	Paluxy	0	505
	Glen Rose	1	0
	Hensell	3	362
	Hosston	12	1,807
Montague County Total		NA	2,674
District Total		**NA**	**38,349**

(1) Average drawdown in feet after 50 years from the year 2000 (DFC Report dated 04/27/2011)

(2) from GAM Run 10-063 MAG (Oliver, 2011)

Other Aquifers

The TWDB currently identifies groundwater use within two aquifers which are not classified by the State as either major or minor aquifers; the Paleozoic Formations west of the northern Trinity Aquifer outcrop and the Alluvial Aquifers described in Section F of this plan and shown in **Figure 3**. These units are lumped as “other” aquifers within the TWDB water use system. Within the outcrop of the Trinity Aquifer, it is reasonable to assume that the Trinity Aquifer and the Alluvial Aquifers are in hydraulic contact and could be considered grouped. Other aquifer usage which may be attributable to the Paleozoic Aquifers is very minor in Parker and Wise counties. However, in Montague County, use is dominantly from the Paleozoic Aquifer relative to the total pumping in the county. GMA-8 has not proposed a desired future condition for the Paleozoic aquifers However, due to its importance as a source within their boundaries, the District has contracted with Intera to develop a model of the Paleozoic aquifer to be used as a management tool.

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

See Appendix A

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

See Appendix B

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 – 31 TAC 356.52(a)(5)(D)/TWC §36.1071(e)(3)(D)

See Appendix B

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 – 31 TAC 356.52(a)(5)(E)/TWC §36.1071(e)(3)(E)

See Appendix B

F. Projected surface water supply in the District, according to the most recently adopted State Water Plan – 31 TAC 356.52(a)(5)(F)/TWC §36.1071(e)(3)(F)

See Appendix A

G. Projected total demand for water in the District according to the most recently adopted State Water Plan – 31 TAC 356.52(a)(5)(G)/TWC §36.1071(e)(3)(G)

See Appendix A

H. Consider the Water supply needs included in the most recently adopted State Water Plan – TWC §36.1071(E)(4)

See Appendix A

I. Consider the Water Management Strategies included in the most recently adopted State Water Plan – TWC §36.1071(E)(4)

See Appendix A

Figure 4. Documented springs in the District.

V. Details on the District Management of Groundwater

The District is acutely aware that its decisions regarding the possible permitting and regulation of water wells may have a significant impact on the manner in which water is provided to support human, animal, and plant life, land development, public water supplies, commercial and industrial operations, agriculture, and other economic growth in the District. The District Board takes its responsibilities very seriously with regard to these decisions and the impacts they may have on the property rights of the citizens of the District, and desires to undertake its approach to the development of a regulatory system in a careful, measured, and deliberate manner. In that regard, the District is determined to accumulate as much data and information as is practicable on the groundwater resources located within its boundaries before developing permanent rules and regulations that may impose permitting or groundwater production regulations on water wells.

The District began its initial studies and analysis of the aquifers and groundwater use patterns within its boundaries in early 2008 in an attempt to both catch up with then-ongoing discussions regarding the development of desired future conditions of the aquifers by the existing groundwater conservation districts in GMA-8, and to develop some baseline information on which decisions could be made for the development of temporary rules governing water wells. In August 2008, the District adopted its first set of temporary rules, which pioneer the District's information-gathering initiative. A copy of the District's temporary rules is available on the District's website at http://www.uppertrinitygcd.com/pdf/temprules.pdf. The District is currently working to develop permanent rules, but is likely 1 to 2 years from adoption. Among other things, the rules require non-exempt wells to be registered with the District, have meters installed to record the amount of groundwater produced, and submit records of the amounts produced to the District. These well owners are also required to submit fee payments to the District based upon the amount of groundwater produced.

In addition, all new wells are required to be registered with the District and comply with the minimum well spacing requirements of the District. The minimum well spacing requirements were developed by the District to try to limit the off-property impacts of new wells to existing registered wells and adjoining landowners. They include minimum tract size requirements, spacing requirements from the property line on the tract where the well is drilled, and spacing requirements from registered wells in existence at the time the new well is proposed. The spacing distances were developed through hydrogeologic modeling of the varying sizes of the cones of depression of various well capacities, and such distances naturally increase with increases in well capacities. Well interference problems caused by wells being located too close to each other have historically been one of the predominant problems for wells completed in the Trinity Aquifer in the District and throughout GMA-8 and GMA-9. The District's spacing requirements should go a long way toward prospectively limiting such well interference problems between new wells and between new and existing wells.

The District has also established a monitoring well network at key locations throughout the four counties to monitor water levels and aquifer conditions over time. Information from the well network will be assimilated along with groundwater production and use reports and estimates, well location and completion data, information on aquifer recharge rates and other hydrogeologic properties, and other information in a database in order to better understand and manage the groundwater resources of the area. Information gleaned from these efforts will be used by the District in the future in the establishment of desired future conditions for the aquifers, in the monitoring of actual conditions of the aquifers and calibration of modeled conditions, in making planning decisions, and in the development of permanent District rules that may include a permitting system for water wells.

Chapter 36 requires the District to both adopt and enforce rules that will achieve the desired future conditions established for the aquifers in the District. Ideally, the District will be able to establish desired future conditions and implement rules that will promote and provide for sustainable groundwater production throughout the District for the current and future generations of citizens of the District. However, the science and information to be developed by the District may ultimately indicate that such a goal of sustainability, or perhaps even some less idealistic goal, is not achievable without reductions in groundwater production. Once again, if the District determines that groundwater production must be reduced in the future in order to achieve the desired future conditions, it will do so extremely cautiously and with due care and consideration for the possible economic impacts and other effects on the citizens and businesses of the District and their property rights and interests.

Chapter 36 and the District Act afford the District a number of options and tools for the management of groundwater and possible approaches to the regulation of production. Chapter 36 allows the District to be more protective of existing or historic wells and their use than it is of wells that have not yet been drilled. It allows the District to adopt dissimilar regulatory approaches for wells completed in separate aquifers or in different geographic regions of the District, in order to address critical areas or to otherwise tailor-make regulations that are more suitable for a particular aquifer or area. Groundwater management strategies employed for the outcrop of the aquifer may differ from those utilized in subcrop areas. The District may adopt production regulations that authorize production from a well based upon its past or existing use, the acreage or size of the tract of the property on which it is located, the level of decline in the aquifer where the well is located, or other reasonable and appropriate criteria as authorized by law.

Because the District is in a high-density growth area near the Dallas-Fort Worth Metroplex, the District will thoroughly investigate groundwater-to-surface-water conversion management strategies similar to those that have been or are being implemented in the Harris, Galveston, and Montgomery counties growth corridor along Interstate 45 in the Gulf Coast region of Texas. These regulatory approaches, which have been studied for decades as a method to fairly reduce groundwater production in high-growth suburban and urban regions, may prove to be the most appropriate for the District to pursue if it is required to reduce groundwater in order to achieve the desired future conditions established for the aquifers. However, groundwater reduction and surface water conversion management strategies can take many years to implement and represent a considerable capital investment for water users, as securing alternate sources of water supply by economically feasible means is an arduous endeavor that typically involves a very large number of stakeholders and overcoming numerous technical, legal, and financial hurdles. The District will ensure that it has thoroughly evaluated the alternatives and implications of pursuing such management strategies before opting for them, and has allowed a reasonable and sufficient amount of time for them to be implemented. This may necessitate the short-term allowance of groundwater production in excess of annual pumping goals or limits designed to achieve desired future conditions, and nothing in this plan shall be construed to limit the ability of the District to utilize that regulatory flexibility.

The District has and will continue to promote water conservation and public awareness in its management efforts and may investigate and pursue conservation incentive-based management strategies that encourage or reward conservation. In many cases, conservation and public awareness strategies can be among the most cost-efficient means to reduce water use, and thus groundwater production, and will be thoroughly investigated and promoted by the District.

Water quantity issues are only part of the District's concern and regulatory purview. Water quality issues are equally important. The District is very concerned about protection of the quality of the groundwater resources in the four counties and will continue to pursue management strategies to protect those resources from contamination, which can threaten to undermine groundwater conservation efforts by rendering the resource unusable. The District has implemented an injection well monitoring program to monitor and evaluate permit applications submitted to the Railroad Commission of Texas and the Texas Commission on Environmental Quality for injection of various types of waste into the geologic formations underlying the freshwater aquifers in the District. The District works with injection well permit applicants to insure that any concerns it may have regarding threats to groundwater resources are addressed and, if necessary, will vigorously protest an injection application before those state agencies to ensure such resource protection. The District also has adopted and will enforce well completion standards for the drilling and completion of water wells, as well as standards for the capping and plugging of abandoned or deteriorated water wells.

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

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

Rules adopted by the District for the permitting of wells and the use of groundwater shall comply with Chapter 36, the District Act, and the provisions of this management plan. All rules will be adhered to and enforced. The development and enforcement of the rules will be based on the best technical evidence available to the District. A copy of the rules is included in Appendix C, and can be found here: http://www.uppertrinitygcd.com/pdf/temprules.pdf.

The District will encourage cooperation and coordination in the implementation of this plan. All operations and activities of the District will be performed in a manner that best encourages and fosters cooperation with state, regional, and local water entities.

VII. METHODOLOGY FOR TRACKING DISTRICT PROGRESS IN ACHIEVING MANAGEMENT GOALS

The general manager of the District will prepare and submit an annual report which will include an update on the District's performance in regards to achieving management goals and objectives set forth herein. The general manager of the District will annually present the annual report to the board of directors after its completion. The District will maintain a copy of the annual report on file at the District's offices for members of the public to inspect upon adoption of the report by the board.

VIII. GOALS, MANAGEMENT OBJECTIVES AND PERFORMANCE STANDARDS

Management Goals

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

A1. Objective - Each year the District will require registration of all new wells within the District.

A.1 Performance Standard - Annual reporting of well registration statistics will be included in the Annual Report provided to the Board of Directors.

A.2 Objective - Each year the District will monitor annual production from all non-exempt wells within the District.

A.2 Performance Standard - The District will require installation of meters on all non-exempt wells and reporting of production to the District. The annual production of groundwater from non-exempt wells will be included in the Annual Report provided to the Board of Directors.

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

B.1 Objective - Annual evaluation of the rules to determine if any amendments are recommended to decrease waste of groundwater within the District.

B.1 Performance Standard - Annual discussion of the evaluation of the rules and a reporting of whether any of the District rules require amendment to prevent waste of groundwater to be included in the Annual Report provided to the Board of Directors.

B.2 Objective - The District will encourage the elimination and reduction of groundwater waste through the collection of a water-use fee for non-exempt production wells within the District.

B.2 Performance Standard - Annual reporting of the total fees paid and total groundwater used by non-exempt wells will be included in the Annual Report provided to the Board of Directors.

B.3 Objective - Each year, the District will provide information to the public on eliminating and reducing wasteful practices in the use of groundwater by including information on groundwater waste reduction on the District's website.

B.3 Performance Standard - Each year, a copy of the information provided on the groundwater waste reduction page of the District's website will be included in the District's Annual Report to be given to the District's Board of Directors.

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

C.1 Objective - Each year the District will participate in the regional water planning process by attending at least one of the Region B, C or G Regional Water Planning Group Meetings to encourage the development of surface water supplies to meet the needs of water user groups within the District.

C.1 Performance Standard - The attendance of a District representative at any Regional Water Planning Group meeting will be noted in the Annual Report provided to the Board of Directors.

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

D.1 Objective - Monthly review of drought conditions within the District using the Texas Water Development Board's Monthly Drought Conditions Presentation available at: http://waterdatafortexas.org/drought/drought-monitor)

D.1 Performance Standard – An annual review of drought conditions within the District will be included in the Annual Report provided to the Board of Directors and on the District website.

E. Addressing Conservation, Recharge Enhancement, Rainwater Harvesting, Precipitation Enhancement, or Brush Control, where Appropriate and Cost Effective – 31TAC 356.52 (a)(1)(G)/TWC §36.1071(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. Given the relative youth of the District, development and running of a District-wide precipitation enhancement program is not considered a priority. The District has determined that addressing precipitation enhancement is not applicable to the District at this time.

Recharge enhancement is not an appropriate or cost-effective program for the District at this time. The District has determined that addressing recharge enhancement is not applicable to the District at this time.

Brush Control is not an appropriate or cost-effective program for the District at this time. The District has determined that addressing brush control is not applicable to the District at this time.

E.1 Objective - The District will annually submit an article regarding water conservation for publication to at least one newspaper of general circulation in the District counties.

E.1 Performance Standard - Each year, a copy of the conservation article will be included in the District's Annual Report to be given to the District's Board of Directors.

E.2 Objective - The District will annually submit an article regarding rain water harvesting for publication to at least one newspaper of general circulation in the District counties.

E.2 Performance Standard - Each year, a copy of the rain water harvesting article will be included in the District's Annual Report to be given to the District's Board of Directors.

E.3 Objective - Each year, the District will include an informative flier on water conservation within at least one mail out to groundwater non-exempt water users distributed in the normal course of business for the District.

E.3 Performance Standard - Each year, a copy of the water conservation mail-out flyer will be included in the District's Annual Report to be given to the District's Board of Directors.

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

F.1 Objective - Within 3 years of Groundwater Management Plan adoption develop a Groundwater Monitoring Program within the District.

F.1 Performance Standard - Upon development, attachment of the District Groundwater Monitoring Program to the District's Annual Report to be given to the District's Board of Directors.

F.2 Objective - Upon approval of the District Monitoring Program – conduct water level measurements at least annually on groundwater resources within the District.

F.2 Performance Standard - Annual evaluation of water-level trends and the adequacy of the monitoring network to monitor aquifer conditions within the District and comply with the aquifer resources desired future conditions. The evaluation will be included in the District's Annual Report to be given to the District's Board of Directors. The District may also take into consideration any measurements made by the TWDB groundwater measurement team.

F.3 Objective - Monitor non-exempt pumping within the District for use in evaluating District compliance with aquifer desired future conditions.

F.3 Performance Standard - Annual reporting of groundwater used by non-exempt wells will be included in the Annual Report provided to the District's Board of Directors.

IX. MANAGEMENT GOALS DETERMINED NOT-APPLICABLE TO THE DISTRICT

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

The District has not been advised as to any threatened or endangered species that exist within the boundaries of the District and are significantly impacted by groundwater usage. At this time, this goal is not considered applicable to the District.

B. Controlling and Preventing Subsidence – 31TAC 356.52 (a)(1)(C)/ TWC §36.1071(a)(3)

This category of management goal is not considered applicable to the District because the formations making up the aquifers of use are consolidated with little potential for subsidence within the District as a result of groundwater withdrawal. Mace and others (1994) studied the potential for subsidence resulting from the significant historical water-level declines observed in the northern Trinity Aquifer in central Texas. They concluded that even in the confined portions of the aquifer, where the largest declines have occurred, the subsidence expected would be only a small amount and would take a very long time to manifest itself.

BIBLIOGRAPHY

Aschenbach, E., 2009, GAM Run 09-022: Texas Water Development Board, http://www.twdb.state.tx.us/gam/GAMruns/GR09-22.pdf.

Ashworth, J.B., and Hopkins, J., 1995, Aquifers of Texas: Texas Water Development Baord, Report No. 345.

Baker, B., Duffin, G., Flores, R., and Lynch, T., 1990, Evaluation of Water Resources in Part of North-Central Texas: Texas Water Development Board, Report 318.

Bayha, D.C., 1967, Occurrence and Quality of Ground Water in Montague County, Texas: Texas Water Development Board, Report 58.

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

Bené, J., Harden, B., Griffin, S., and Nicot, J-P., 2007, NorthernTrinity/Woodbine Groundwater Availability Model: Assessment of Groundwater Use in the Northern Trinity Aquifer Due to Urban Growth and Barnett Shale Development. Contract report to the Texas Water Development Board, 278 p.

Brown, Jr., L.F., Goodson, J.L., Harwood, P., and Barnes, V.E., 1972, Geologic Atlas of Texas, Abilene Sheet, Scale: 1:250,000, Frederick Byron Plummer Memorial Edition: The University of Texas at Austin, Bureau of Economic Geology.

Brune, G., 2002, Springs of Texas, Volume I, Second Edition: Texas A&M University Press, College Station, TX.

Heitmuller, F.T., and Reece, B.D., 2003, Database of historical documented springs and spring flow measurements in Texas: United States Geological Survey, Open-File Report 03-315.

Langley, L., 1999, Updated Evaluation of Water Resources in Part of North-Central Texas, 1990-1999: Texas Water Development Board, Report 349.

Mace, R.E., Dutton, A.R., and Nance, H.S., 1994, Water-Level Declines in the Woodbine, Paluxy, and Trinity Aquifers of North-Central Texas: Transactions of the Gulf Coast Association of Geological Societies, Vol. XLIV, pages 412-402.

McGowen, J.H., Hentz, T.F., Owen, D.E., Pieper, M.K., Shelby, C.A., and Barnes, V.E., 1967, Geologic Atlas of Texas, Sherman Sheet, Scale: 1:250,000, Walter Scott Adkins Memorial Edition: The University of Texas at Austin, Bureau of Economic Geology.

McGowen, J.H., Proctor, Jr., C.V., Haenggi, W.T., Reaser, D.F., and Barnes, V.E., 1972, Geologic Atlas of Texas, Dallas Sheet, Scale: 1:250,000, Gayle Scott Memorial Edition: The University of Texas at Austin, Bureau of Economic Geology.

Norstrom, P.L., 1982, Occurrence, Availability, and Chemical Quality of Ground Water in the Cretaceous Aquifers of North-Central Texas, Volume 1: Texas Department of Water Resources, Report 269.

Oliver, W., Bradley, R.G., 2011, GAM Run 10-63 MAG: Texas Water Development Board, http://www.twdb.texas.gov/groundwater/docs/GAMruns/GR10-063_MAG.pdf.

TWDB, 2009a, Desired Future Conditions Submitted by the Groundwater Conservation Districts: Attachment A to letter from J. Kevin Ward with the TWDB to Cheryl Maxwell with the Clearwater Underground Water Conservation District dated March 31, 2009, http://www.gma8.org/images/stories/pdf/MAG/trinity%20mag%20final%2031mar09.pdf.

TWDB, 2009b, Groundwater database: http://www.twdb.state.tx.us/publications/reports/GroundWaterReports/GWDatabaseReports/GWdatabaserpt.htm, accessed November 2009.

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Appendix A

Estimated Historical Water Use And 2012 State Water Plan Datasets:

Upper Trinity Groundwater Conservation District

by Stephen Allen
Texas Water Development Board
Groundwater Resources Division
Groundwater Technical Assistance Section
stephen.allen@twdb.texas.gov
(512) 463-7317
June 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 6/19/2015. 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 2013. TWDB staff anticipates the calculation and posting of these estimates at a later date.

HOOD COUNTY

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2013	GW	6,848	12	27	13	3,102	207	10,209
	SW	840	0	325	3,056	5,000	255	9,476
2012	GW	6,859	14	96	9	3,640	197	10,815
	SW	903	0	496	563	5,355	240	7,557
2011	GW	7,083	13	700	9	397	246	8,448
	SW	1,602	0	876	439	10,916	300	14,133
2010	GW	6,708	6	1,216	6	675	240	8,851
	SW	664	0	1,522	485	7,500	293	10,464
2009	GW	5,823	12	1,313	26	404	247	7,825
	SW	917	0	1,643	593	8,298	301	11,752
2008	GW	5,337	20	1,410	41	0	238	7,046
	SW	1,533	0	1,765	487	6,083	292	10,160
2007	GW	5,085	25	0	150	498	184	5,942
	SW	919	0	0	1,652	5,044	225	7,840
2006	GW	5,232	25	0	77	2,776	260	8,370
	SW	1,667	0	0	39	5,641	317	7,664
2005	GW	5,276	22	0	93	0	245	5,636
	SW	1,329	0	0	293	7,960	299	9,881
2004	GW	4,704	17	0	53	0	275	5,049
	SW	545	0	0	302	5,540	281	6,668
2003	GW	4,782	15	0	44	0	255	5,096
	SW	762	0	0	1,489	8,726	261	11,238
2002	GW	4,145	16	0	39	0	361	4,561
	SW	1,920	0	0	3,070	2,691	371	8,052
2001	GW	3,807	24	0	46	0	299	4,176
	SW	1,988	0	0	3,339	2,691	307	8,325
2000	GW	3,362	20	0	47	10	311	3,750
	SW	2,142	0	0	3,884	3,230	311	9,567

MONTAGUE COUNTY

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2013	GW	1,188	0	507	0	465	56	2,216
	SW	1,435	0	2,031	0	0	1,066	4,532
2012	GW	1,393	0	690	0	530	50	2,663
	SW	1,675	1	2,130	0	0	958	4,764
2011	GW	1,526	0	1,644	0	739	59	3,968
	SW	1,801	1	1,919	0	0	1,127	4,848
2010	GW	1,354	0	616	0	695	59	2,724
	SW	1,751	1	719	0	0	1,110	3,581
2009	GW	1,261	0	530	0	874	66	2,731
	SW	1,593	1	620	0	0	1,255	3,469
2008	GW	1,131	0	444	0	131	63	1,769
	SW	1,594	1	520	0	0	1,204	3,319
2007	GW	983	0	0	0	91	76	1,150
	SW	1,426	1	0	0	0	1,442	2,869
2006	GW	1,255	0	0	0	387	67	1,709
	SW	1,829	1	0	0	12	1,272	3,114
2005	GW	1,195	0	0	0	172	69	1,436
	SW	1,697	1	0	0	0	1,310	3,008
2004	GW	1,091	0	0	0	158	72	1,321
	SW	1,884	1	0	0	0	1,345	3,230
2003	GW	1,139	0	0	0	57	75	1,271
	SW	1,725	1	0	0	0	1,393	3,119
2002	GW	1,124	0	0	0	268	74	1,466
	SW	1,426	1	0	0	0	1,370	2,797
2001	GW	1,159	0	0	0	147	83	1,389
	SW	1,539	1	0	0	0	1,528	3,068
2000	GW	1,212	0	0	0	60	150	1,422
	SW	1,460	6	0	0	0	1,351	2,817

PARKER COUNTY

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2013	GW	7,103	16	123	0	919	115	8,276
	SW	10,480	30	1,190	0	152	1,048	12,900
2012	GW	8,798	20	341	0	28	97	9,284
	SW	7,850	49	1,773	565	156	869	11,262
2011	GW	9,047	25	989	0	185	229	10,475
	SW	8,102	62	2,198	604	77	2,060	13,103
2010	GW	7,938	16	2,450	0	182	226	10,812
	SW	6,756	54	3,414	464	27	2,035	12,750
2009	GW	7,285	16	1,926	0	44	157	9,428
	SW	6,536	53	3,009	741	88	1,408	11,835
2008	GW	6,196	15	1,401	0	73	129	7,814
	SW	7,476	40	2,393	2	117	1,164	11,192
2007	GW	6,508	7	0	0	60	177	6,752
	SW	6,578	89	887	2	20	1,591	9,167
2006	GW	7,130	14	0	0	474	178	7,796
	SW	8,542	98	887	9	16	1,601	11,153
2005	GW	5,901	11	0	0	206	132	6,250
	SW	7,818	73	698	3	190	1,185	9,967
2004	GW	5,192	10	0	0	130	65	5,397
	SW	7,182	78	840	0	124	1,242	9,466
2003	GW	5,365	8	0	0	39	74	5,486
	SW	6,676	85	1,269	703	381	1,389	10,503
2002	GW	5,302	8	0	0	64	89	5,463
	SW	6,568	72	2,431	703	293	1,685	11,752
2001	GW	5,257	12	0	0	64	90	5,423
	SW	2,977	91	1,466	10,970	293	1,693	17,490
2000	GW	5,277	21	0	0	74	185	5,557
	SW	6,151	182	403	4,568	348	1,670	13,322

WISE COUNTY

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2013	GW	4,206	179	440	1	1,261	224	6,311
	SW	3,768	43	2,874	2,593	39	899	10,216
2012	GW	4,550	160	613	0	1,516	210	7,049
	SW	3,989	44	2,808	2,879	46	841	10,607
2011	GW	4,873	162	3,662	0	1,458	257	10,412
	SW	3,854	292	5,126	0	10	1,027	10,309
2010	GW	4,383	176	5,135	0	830	254	10,778
	SW	3,642	53	6,821	0	761	1,017	12,294
2009	GW	3,263	187	4,454	0	692	321	8,917
	SW	2,215	97	6,090	0	831	1,285	10,518
2008	GW	2,218	418	3,773	0	0	267	6,676
	SW	2,141	121	5,316	0	1,070	1,067	9,715
2007	GW	2,085	120	14	0	130	405	2,754
	SW	2,016	52	966	0	1,220	1,618	5,872
2006	GW	2,280	93	1	0	290	288	2,952
	SW	2,443	70	977	0	1,000	1,150	5,640
2005	GW	2,196	99	1	0	62	295	2,653
	SW	2,103	62	977	0	1,323	1,178	5,643
2004	GW	1,934	69	12	0	128	713	2,856
	SW	1,774	72	1,003	0	152	713	3,714
2003	GW	1,767	283	1	0	45	780	2,876
	SW	1,946	235	266	0	430	780	3,657
2002	GW	1,810	66	1	0	129	782	2,788
	SW	1,436	456	8,298	0	316	782	11,288
2001	GW	1,721	391	1	0	116	841	3,070
	SW	1,168	928	24,627	0	284	841	27,848
2000	GW	1,704	220	1	0	147	857	2,929
	SW	1,652	553	14,699	0	355	857	18,116

Projected Surface Water Supplies
TWDB 2012 State Water Plan Data

HOOD COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
G	ACTON MUD	BRAZOS	BRAZOS RIVER AUTHORITY MAIN STEM LAKE/RESERVOIR SYSTEM	3,733	3,734	3,735	3,734	3,729	3,717
G	COUNTY-OTHER	BRAZOS	BRAZOS RIVER AUTHORITY MAIN STEM LAKE/RESERVOIR SYSTEM	949	949	949	949	949	949
G	DECORDOVA	BRAZOS	BRAZOS RIVER AUTHORITY MAIN STEM LAKE/RESERVOIR SYSTEM	593	592	591	592	597	608
G	GRANBURY	BRAZOS	BRAZOS RIVER AUTHORITY MAIN STEM LAKE/RESERVOIR SYSTEM	226	226	226	226	226	226
G	IRRIGATION	BRAZOS	BRAZOS RIVER COMBINED RUN-OF-RIVER IRRIGATION	12,644	12,648	12,651	12,655	12,658	12,662
G	LIVESTOCK	BRAZOS	LIVESTOCK LOCAL SUPPLY	617	617	617	617	617	617
G	LIVESTOCK	TRINITY	LIVESTOCK LOCAL SUPPLY	6	6	6	6	6	6
G	MANUFACTURING	BRAZOS	BRAZOS RIVER AUTHORITY MAIN STEM LAKE/RESERVOIR SYSTEM	10,000	10,000	10,000	10,000	10,000	10,000
G	MINING	BRAZOS	BRAZOS RIVER AUTHORITY MAIN STEM LAKE/RESERVOIR SYSTEM	300	300	300	300	300	300
G	STEAM ELECTRIC POWER	BRAZOS	BRAZOS RIVER AUTHORITY MAIN STEM LAKE/RESERVOIR SYSTEM	43,447	43,447	43,447	43,447	43,447	43,447
	Sum of Projected Surface Water Supplies (acre-feet/year)			**72,515**	**72,519**	**72,522**	**72,526**	**72,529**	**72,532**

Projected Surface Water Supplies
TWDB 2012 State Water Plan Data

MONTAGUE COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
B	BOWIE	TRINITY	AMON G. CARTER LAKE/RESERVOIR	1,302	1,229	1,160	1,092	1,027	961
B	COUNTY-OTHER	RED	FARMERS CREEK/NOCONA LAKE/RESERVOIR	52	55	56	56	55	56
B	COUNTY-OTHER	TRINITY	AMON G. CARTER LAKE/RESERVOIR	131	137	139	140	138	139
B	IRRIGATION	RED	FARMERS CREEK/NOCONA LAKE/RESERVOIR	100	100	100	100	100	100
B	IRRIGATION	RED	RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	108	108	108	108	108	108
B	IRRIGATION	TRINITY	TRINITY RIVER COMBINED RUN-OF-RIVER IRRIGATION	0	0	0	0	0	0
B	LIVESTOCK	RED	LIVESTOCK LOCAL SUPPLY	949	949	949	949	949	949
B	LIVESTOCK	TRINITY	LIVESTOCK LOCAL SUPPLY	716	716	716	716	716	716
B	MANUFACTURING	RED	FARMERS CREEK/NOCONA LAKE/RESERVOIR	11	14	18	23	29	29
B	MINING	RED	AMON G. CARTER LAKE/RESERVOIR	0	0	0	0	0	0
B	MINING	TRINITY	AMON G. CARTER LAKE/RESERVOIR	0	0	0	0	0	0
B	NOCONA	RED	FARMERS CREEK/NOCONA LAKE/RESERVOIR	1,097	1,091	1,086	1,081	1,076	1,075
	Sum of Projected Surface Water Supplies (acre-feet/year)			**4,466**	**4,399**	**4,332**	**4,265**	**4,198**	**4,133**

PARKER COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
C	AZLE	TRINITY	TRWD LAKE/RESERVOIR SYSTEM	332	305	272	241	222	218
C	COUNTY-OTHER	BRAZOS	PALO PINTO LAKE/RESERVOIR	479	479	479	479	479	479
C	COUNTY-OTHER	BRAZOS	TRWD LAKE/RESERVOIR SYSTEM	0	145	129	113	95	81

Projected Surface Water Supplies

TWDB 2012 State Water Plan Data

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
C	COUNTY-OTHER	BRAZOS	WEATHERFORD LAKE/RESERVOIR	0	86	74	64	53	43
C	FORT WORTH	TRINITY	TRWD LAKE/RESERVOIR SYSTEM	3,016	12,161	15,886	15,942	15,476	14,546
C	HUDSON OAKS	TRINITY	TRWD LAKE/RESERVOIR SYSTEM	109	178	230	265	290	302
C	IRRIGATION	BRAZOS	BRAZOS RIVER COMBINED RUN-OF-RIVER IRRIGATION	117	117	117	117	117	117
C	IRRIGATION	TRINITY	TRINITY RIVER COMBINED RUN-OF-RIVER IRRIGATION	122	122	122	122	122	122
C	LIVESTOCK	BRAZOS	LIVESTOCK LOCAL SUPPLY	903	903	903	903	903	903
C	LIVESTOCK	TRINITY	LIVESTOCK LOCAL SUPPLY	1,019	1,019	1,019	1,019	1,019	1,019
C	MANUFACTURING	BRAZOS	OTHER LOCAL SUPPLY	0	0	0	0	0	0
C	MANUFACTURING	BRAZOS	PALO PINTO LAKE/RESERVOIR	25	25	25	24	25	25
C	MANUFACTURING	BRAZOS	TRWD LAKE/RESERVOIR SYSTEM	185	192	180	171	161	152
C	MANUFACTURING	BRAZOS	WEATHERFORD LAKE/RESERVOIR	45	45	45	45	45	45
C	MANUFACTURING	TRINITY	TRWD LAKE/RESERVOIR SYSTEM	423	453	428	406	383	362
C	MANUFACTURING	TRINITY	WEATHERFORD LAKE/RESERVOIR	191	221	207	197	185	174
C	MINERAL WELLS	BRAZOS	MINERAL WELLS LAKE/RESERVOIR	0	0	0	0	0	0
C	MINERAL WELLS	BRAZOS	PALO PINTO LAKE/RESERVOIR	756	734	719	703	697	694
C	MINING	BRAZOS	BRAZOS RIVER AUTHORITY MAIN STEM LAKE/RESERVOIR SYSTEM	2,000	2,000	2,000	2,000	2,000	2,000
C	MINING	BRAZOS	OTHER LOCAL SUPPLY	16	16	15	15	14	14
C	MINING	TRINITY	OTHER LOCAL SUPPLY	4	4	5	5	6	6
C	RENO	TRINITY	TRWD LAKE/RESERVOIR SYSTEM	148	141	121	104	95	88

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
C	SANCTUARY	TRINITY	TRWD LAKE/RESERVOIR SYSTEM	90	198	245	250	252	246
C	SPRINGTOWN	TRINITY	TRWD LAKE/RESERVOIR SYSTEM	246	388	445	489	518	534
C	STEAM ELECTRIC POWER	TRINITY	WEATHERFORD LAKE/RESERVOIR	24	20	22	38	44	53
C	WALNUT CREEK SUD	TRINITY	TRWD LAKE/RESERVOIR SYSTEM	2,259	2,264	1,862	1,557	1,308	1,133
C	WEATHERFORD	BRAZOS	TRWD LAKE/RESERVOIR SYSTEM	106	151	172	185	198	207
C	WEATHERFORD	BRAZOS	WEATHERFORD LAKE/RESERVOIR	94	113	116	116	117	117
C	WEATHERFORD	TRINITY	TRWD LAKE/RESERVOIR SYSTEM	2,214	3,240	3,515	3,673	3,801	3,910
C	WEATHERFORD	TRINITY	WEATHERFORD LAKE/RESERVOIR	1,982	2,372	2,325	2,267	2,223	2,175
	Sum of Projected Surface Water Supplies (acre-feet/year)			**16,905**	**28,092**	**31,678**	**31,510**	**30,848**	**29,765**

WISE COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
C	BOLIVAR WSC	TRINITY	CHAPMAN/COOPER LAKE/RESERVOIR NON-SYSTEM PORTION	49	24	21	23	26	34
C	BOLIVAR WSC	TRINITY	RAY ROBERTS LAKE/RESERVOIR NON-SYSTEM PORTION	15	0	0	0	0	0
C	BOLIVAR WSC	TRINITY	RAY ROBERTS-LEWISVILLE-GRAPEVINE LAKE/RESERVOIR SYSTEM	31	65	69	72	75	89
C	BOYD	TRINITY	TRWD LAKE/RESERVOIR SYSTEM	62	117	147	167	183	159
C	BRIDGEPORT	TRINITY	TRWD LAKE/RESERVOIR SYSTEM	1,337	1,700	1,700	1,700	1,700	1,700
C	CHICO	TRINITY	TRWD LAKE/RESERVOIR SYSTEM	81	102	111	111	111	111
C	COMMUNITY WSC	TRINITY	TRWD	18	16	13	11	9	8

			LAKE/RESERVOIR SYSTEM						
C	COUNTY-OTHER	TRINITY	TRWD LAKE/RESERVOIR SYSTEM	1,863	1,955	1,646	1,398	1,212	1,057
C	DECATUR	TRINITY	TRWD LAKE/RESERVOIR SYSTEM	1,614	1,754	1,754	1,754	1,754	1,754
C	FORT WORTH	TRINITY	TRWD LAKE/RESERVOIR SYSTEM	503	2,339	2,780	3,119	3,537	3,794
C	IRRIGATION	TRINITY	TRINITY RIVER COMBINED RUN-OF-RIVER IRRIGATION	139	139	139	139	139	139
C	IRRIGATION	TRINITY	TRWD LAKE/RESERVOIR SYSTEM	212	195	165	143	125	109
C	LIVESTOCK	TRINITY	LIVESTOCK LOCAL SUPPLY	1,117	1,117	1,117	1,117	1,117	1,117
C	MANUFACTURING	TRINITY	OTHER LOCAL SUPPLY	0	0	0	0	0	0
C	MANUFACTURING	TRINITY	TRWD LAKE/RESERVOIR SYSTEM	2,299	2,429	2,313	2,202	2,083	1,981
C	MINING	TRINITY	OTHER LOCAL SUPPLY	0	0	0	0	0	0
C	MINING	TRINITY	TRINITY RIVER COMBINED RUN-OF-RIVER MINING	51	51	51	51	51	51
C	MINING	TRINITY	TRWD LAKE/RESERVOIR SYSTEM	7,943	7,961	7,395	6,961	6,603	6,175
C	PARADISE	TRINITY	TRWD LAKE/RESERVOIR SYSTEM	71	82	85	90	98	104
C	RHOME	TRINITY	TRWD LAKE/RESERVOIR SYSTEM	330	654	1,012	1,130	1,130	1,130
C	RUNAWAY BAY	TRINITY	TRWD LAKE/RESERVOIR SYSTEM	293	327	335	330	323	313
C	STEAM ELECTRIC POWER	TRINITY	TRWD LAKE/RESERVOIR SYSTEM	1,751	1,143	948	1,267	1,207	1,416
C	WALNUT CREEK SUD	TRINITY	TRWD LAKE/RESERVOIR SYSTEM	289	296	243	198	169	151
C	WEST WISE RURAL SUD	TRINITY	TRWD LAKE/RESERVOIR SYSTEM	478	481	442	417	402	390
	Sum of Projected Surface Water Supplies (acre-feet/year)			**20,546**	**22,947**	**22,486**	**22,400**	**22,054**	**21,782**

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.

HOOD COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
G	COUNTY-OTHER	BRAZOS	2,854	3,290	3,677	4,081	4,582	5,167
G	DECORDOVA	BRAZOS	593	592	591	592	597	608
G	LIPAN	BRAZOS	171	239	333	467	656	924
G	TOLAR	BRAZOS	143	179	213	246	289	342
G	GRANBURY	BRAZOS	2,795	3,456	4,058	4,708	5,524	6,485
G	CRESSON	BRAZOS	37	44	53	63	77	94
G	OAK TRAIL SHORES SUBDIVISION	BRAZOS	511	504	492	484	480	480
G	ACTON MUD	BRAZOS	2,425	2,912	3,363	3,851	4,464	5,204
G	MANUFACTURING	BRAZOS	25	28	30	32	34	37
G	STEAM ELECTRIC POWER	BRAZOS	4,000	5,862	6,853	8,062	9,535	11,331
G	LIVESTOCK	BRAZOS	617	617	617	617	617	617
G	IRRIGATION	BRAZOS	3,179	3,120	3,062	3,005	2,948	2,893
G	MINING	BRAZOS	162	161	160	159	158	157
G	CRESSON	TRINITY	6	8	9	11	13	16
G	COUNTY-OTHER	TRINITY	9	11	12	13	15	17
G	LIVESTOCK	TRINITY	6	6	6	6	6	6
	Sum of Projected Water Demands (acre-feet/year)		**17,533**	**21,029**	**23,529**	**26,397**	**29,995**	**34,378**

MONTAGUE COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
B	COUNTY-OTHER	RED	441	463	469	473	467	469
B	LIVESTOCK	RED	1,054	1,054	1,054	1,054	1,054	1,054
B	IRRIGATION	RED	59	59	59	59	59	59
B	MANUFACTURING	RED	9	12	15	19	24	24
B	MINING	RED	491	467	459	463	476	476
B	NOCONA	RED	693	681	671	664	657	660
B	SAINT JO	TRINITY	99	101	98	97	96	96
B	COUNTY-OTHER	TRINITY	866	909	920	927	917	920
B	BOWIE	TRINITY	1,027	987	966	952	941	943
B	LIVESTOCK	TRINITY	796	796	796	796	796	796

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.

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
B	MINING	TRINITY	14	14	14	14	14	14
B	IRRIGATION	TRINITY	238	238	238	238	238	238
		Sum of Projected Water Demands (acre-feet/year)	**5,787**	**5,781**	**5,759**	**5,756**	**5,739**	**5,749**

PARKER COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
C	WEATHERFORD	BRAZOS	251	302	361	418	479	547
C	LIVESTOCK	BRAZOS	872	872	872	872	872	872
C	IRRIGATION	BRAZOS	408	408	408	408	408	408
C	COUNTY-OTHER	BRAZOS	2,252	2,389	2,703	2,931	2,888	2,867
C	MANUFACTURING	BRAZOS	231	261	289	317	341	370
C	MINERAL WELLS	BRAZOS	766	753	744	730	726	726
C	MINING	BRAZOS	5,628	1,641	1,623	1,638	1,640	1,651
C	CRESSON	BRAZOS	28	34	42	51	62	76
C	AZLE	TRINITY	353	438	533	614	708	811
C	ANNETTA	TRINITY	218	265	305	339	374	416
C	COUNTY-OTHER	TRINITY	2,483	2,169	1,888	1,616	1,364	1,129
C	WALNUT CREEK SUD	TRINITY	2,310	3,355	5,215	6,407	6,757	6,990
C	WEATHERFORD	TRINITY	5,258	6,315	7,246	8,136	9,082	10,194
C	SPRINGTOWN	TRINITY	504	659	807	961	1,113	1,272
C	RENO	TRINITY	319	321	322	321	327	337
C	HUDSON OAKS	TRINITY	394	475	576	674	771	867
C	ALEDO	TRINITY	455	957	1,532	2,106	2,213	2,213
C	ANNETTA SOUTH	TRINITY	91	105	116	124	135	147
C	FORT WORTH	TRINITY	3,328	14,576	22,773	26,034	28,518	30,423
C	CRESSON	TRINITY	28	34	41	50	61	75
C	SANCTUARY	TRINITY	92	216	314	370	426	478
C	LIVESTOCK	TRINITY	984	984	984	984	984	984
C	IRRIGATION	TRINITY	14	14	14	14	14	14
C	WILLOW PARK	TRINITY	681	934	1,298	1,557	1,731	1,855
C	MINING	TRINITY	240	61	69	64	72	69
C	STEAM ELECTRIC POWER	TRINITY	24	22	28	56	75	102
C	MANUFACTURING	TRINITY	548	618	685	751	809	878
		Sum of Projected Water Demands (acre-feet/year)	**28,760**	**39,178**	**51,788**	**58,543**	**62,950**	**66,771**

WISE COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
C	PARADISE	TRINITY	73	89	109	134	165	202
C	WEST WISE RURAL SUD	TRINITY	483	524	567	618	681	756
C	WALNUT CREEK SUD	TRINITY	296	439	680	815	874	932
C	RUNAWAY BAY	TRINITY	296	356	430	489	547	608
C	FORT WORTH	TRINITY	555	2,803	3,985	5,094	6,518	7,936
C	COMMUNITY WSC	TRINITY	18	17	17	16	16	16
C	BOLIVAR WSC	TRINITY	187	238	303	440	612	918
C	IRRIGATION	TRINITY	502	502	502	502	502	502
C	LIVESTOCK	TRINITY	1,714	1,714	1,714	1,714	1,714	1,714
C	MINING	TRINITY	26,477	28,924	31,620	34,393	37,258	39,956
C	STEAM ELECTRIC POWER	TRINITY	1,751	1,245	1,216	1,878	2,042	2,748
C	COUNTY-OTHER	TRINITY	3,776	4,261	4,221	4,142	4,103	4,103
C	MANUFACTURING	TRINITY	2,313	2,660	2,979	3,277	3,539	3,858
C	BOYD	TRINITY	215	278	339	397	459	459
C	BRIDGEPORT	TRINITY	1,361	1,899	2,702	3,187	3,713	4,444
C	AURORA	TRINITY	187	218	237	253	292	338
C	ALVORD	TRINITY	199	214	228	243	263	287
C	NEWARK	TRINITY	154	232	301	418	564	787
C	NEW FAIRVIEW	TRINITY	201	272	340	409	488	579
C	RHOME	TRINITY	590	955	1,541	2,151	2,760	3,369
C	CHICO	TRINITY	208	235	276	333	405	495
C	DECATUR	TRINITY	1,639	2,011	2,748	3,537	4,580	5,385
	Sum of Projected Water Demands (acre-feet/year)		**43,195**	**50,086**	**57,055**	**64,440**	**72,095**	**80,392**

Projected Water Supply Needs
TWDB 2012 State Water Plan Data

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

HOOD COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
G	ACTON MUD	BRAZOS	2,833	2,341	1,885	1,390	764	1
G	COUNTY-OTHER	BRAZOS	2,655	2,219	1,832	1,428	927	342
G	COUNTY-OTHER	TRINITY	15	13	12	11	9	7
G	CRESSON	BRAZOS	63	56	47	37	23	6
G	CRESSON	TRINITY	34	32	31	29	27	24
G	DECORDOVA	BRAZOS	0	0	0	0	0	0
G	GRANBURY	BRAZOS	-1,806	-2,467	-3,109	-3,799	-4,615	-5,576
G	IRRIGATION	BRAZOS	9,478	9,541	9,602	9,663	9,723	9,782
G	LIPAN	BRAZOS	68	0	-94	-228	-417	-685
G	LIVESTOCK	BRAZOS	0	0	0	0	0	0
G	LIVESTOCK	TRINITY	0	0	0	0	0	0
G	MANUFACTURING	BRAZOS	10,015	10,012	10,010	10,008	10,006	10,003
G	MINING	BRAZOS	347	348	349	350	351	352
G	OAK TRAIL SHORES SUBDIVISION	BRAZOS	-364	-357	-345	-337	-333	-333
G	STEAM ELECTRIC POWER	BRAZOS	39,506	37,644	36,653	35,444	33,971	32,175
G	TOLAR	BRAZOS	52	16	-18	-51	-94	-147
	Sum of Projected Water Supply Needs (acre-feet/year)		**-2,170**	**-2,824**	**-3,566**	**-4,415**	**-5,459**	**-6,741**

MONTAGUE COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
B	BOWIE	TRINITY	275	242	194	140	86	18
B	COUNTY-OTHER	RED	-89	-108	-113	-117	-112	-113
B	COUNTY-OTHER	TRINITY	-135	-172	-181	-187	-179	-181
B	IRRIGATION	RED	154	154	154	154	154	154
B	IRRIGATION	TRINITY	1	1	1	1	1	1
B	LIVESTOCK	RED	1	1	1	1	1	1
B	LIVESTOCK	TRINITY	0	0	0	0	0	0
B	MANUFACTURING	RED	2	2	3	4	5	5
B	MINING	RED	-163	-139	-131	-135	-148	-148
B	MINING	TRINITY	-14	-14	-14	-14	-14	-14
B	NOCONA	RED	404	410	415	417	419	415

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

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
B	SAINT JO	TRINITY	112	110	113	114	115	115
	Sum of Projected Water Supply Needs (acre-feet/year)		**-401**	**-433**	**-439**	**-453**	**-453**	**-456**

PARKER COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
C	ALEDO	TRINITY	46	-456	-1,031	-1,605	-1,712	-1,712
C	ANNETTA	TRINITY	22	-25	-65	-99	-134	-176
C	ANNETTA SOUTH	TRINITY	9	-5	-16	-24	-35	-47
C	AZLE	TRINITY	-21	-133	-261	-373	-486	-593
C	COUNTY-OTHER	BRAZOS	145	239	0	0	0	0
C	COUNTY-OTHER	TRINITY	1,464	1,778	1,956	1,974	2,240	2,472
C	CRESSON	BRAZOS	55	49	41	32	21	7
C	CRESSON	TRINITY	55	49	42	33	22	8
C	FORT WORTH	TRINITY	-122	-1,754	-6,048	-9,305	-12,332	-15,255
C	HUDSON OAKS	TRINITY	-4	-16	-65	-128	-200	-284
C	IRRIGATION	BRAZOS	232	232	232	232	232	232
C	IRRIGATION	TRINITY	119	119	119	119	119	119
C	LIVESTOCK	BRAZOS	31	31	31	31	31	31
C	LIVESTOCK	TRINITY	248	248	248	248	248	248
C	MANUFACTURING	BRAZOS	24	1	-39	-77	-110	-148
C	MANUFACTURING	TRINITY	84	74	-32	-130	-223	-324
C	MINERAL WELLS	BRAZOS	-10	-19	-25	-27	-29	-32
C	MINING	BRAZOS	2,020	6,186	6,196	6,186	6,176	6,168
C	MINING	TRINITY	0	0	0	0	0	0
C	RENO	TRINITY	-4	-13	-34	-50	-65	-82
C	SANCTUARY	TRINITY	-2	-18	-69	-120	-174	-232
C	SPRINGTOWN	TRINITY	-206	-219	-310	-420	-543	-686
C	STEAM ELECTRIC POWER	TRINITY	0	-2	-6	-18	-31	-49
C	WALNUT CREEK SUD	TRINITY	-51	-1,091	-3,353	-4,850	-5,449	-5,857
C	WEATHERFORD	BRAZOS	-51	-38	-73	-117	-164	-223
C	WEATHERFORD	TRINITY	-1,062	-703	-1,406	-2,196	-3,058	-4,109
C	WILLOW PARK	TRINITY	76	-177	-541	-800	-974	-1,098
	Sum of Projected Water Supply Needs (acre-feet/year)		**-1,533**	**-4,669**	**-13,374**	**-20,339**	**-25,719**	**-30,907**

WISE COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
C	ALVORD	TRINITY	117	102	88	73	53	29
C	AURORA	TRINITY	65	34	15	-1	-40	-86
C	BOLIVAR WSC	TRINITY	74	-24	-120	-264	-431	-700
C	BOYD	TRINITY	-3	-11	-42	-80	-126	-150
C	BRIDGEPORT	TRINITY	-24	-199	-1,002	-1,487	-2,013	-2,744
C	CHICO	TRINITY	-3	-9	-41	-98	-170	-260
C	COMMUNITY WSC	TRINITY	0	-1	-4	-5	-7	-8
C	COUNTY-OTHER	TRINITY	1,071	678	409	240	93	-62
C	DECATUR	TRINITY	-25	-257	-994	-1,783	-2,826	-3,631
C	FORT WORTH	TRINITY	-20	-337	-1,058	-1,821	-2,819	-3,980
C	IRRIGATION	TRINITY	139	122	92	70	52	36
C	LIVESTOCK	TRINITY	210	210	210	210	210	210
C	MANUFACTURING	TRINITY	0	-217	-652	-1,061	-1,442	-1,863
C	MINING	TRINITY	0	-4,285	-9,469	-14,185	-18,815	-23,116
C	NEW FAIRVIEW	TRINITY	20	-51	-119	-188	-267	-358
C	NEWARK	TRINITY	15	-63	-132	-249	-395	-618
C	PARADISE	TRINITY	-2	-7	-24	-44	-67	-98
C	RHOME	TRINITY	-17	-58	-286	-778	-1,387	-1,996
C	RUNAWAY BAY	TRINITY	-3	-29	-95	-159	-224	-295
C	STEAM ELECTRIC POWER	TRINITY	0	-102	-268	-611	-835	-1,332
C	WALNUT CREEK SUD	TRINITY	-7	-143	-437	-617	-705	-781
C	WEST WISE RURAL SUD	TRINITY	-5	-43	-125	-201	-279	-366
	Sum of Projected Water Supply Needs (acre-feet/year)		**-109**	**-5,836**	**-14,868**	**-23,632**	**-32,848**	**-42,444**

Projected Water Management Strategies
TWDB 2012 State Water Plan Data

HOOD COUNTY

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

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
GRANBURY, BRAZOS (G)							
INCREASE TREATMENT CAPACITY	BRAZOS RIVER AUTHORITY MAIN STEM LAKE/RESERVOIR SYSTEM [RESERVOIR]	3,920	3,920	3,920	3,920	7,840	7,840
MUNICIPAL WATER CONSERVATION	CONSERVATION [HOOD]	55	158	148	156	165	193
LIPAN, BRAZOS (G)							
ADDITIONAL TRINITY AQUIFER DEVELOPMENT (INCLUDES OVERDRAFTING)	TRINITY AQUIFER [HOOD]	0	0	100	227	418	685
MUNICIPAL WATER CONSERVATION	CONSERVATION [HOOD]	5	16	19	23	31	44
OAK TRAIL SHORES SUBDIVISION, BRAZOS (G)							
VOLUNTARY REDISTRIBUTION	BRAZOS RIVER AUTHORITY MAIN STEM LAKE/RESERVOIR SYSTEM [RESERVOIR]	390	390	390	390	390	390
TOLAR, BRAZOS (G)							
ADDITIONAL TRINITY AQUIFER DEVELOPMENT (INCLUDES OVERDRAFTING)	TRINITY AQUIFER [HOOD]	0	0	100	100	100	150
MUNICIPAL WATER CONSERVATION	CONSERVATION [HOOD]	6	15	16	14	13	15
Sum of Projected Water Management Strategies (acre-feet/year)		**4,376**	**4,499**	**4,693**	**4,830**	**8,957**	**9,317**

MONTAGUE COUNTY

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

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
BOWIE, TRINITY (B)							
MUNICIPAL CONSERVATION	CONSERVATION [MONTAGUE]	8	34	34	61	69	72
WASTEWATER REUSE	AMON G. CARTER LAKE/RESERVOIR [RESERVOIR]	0	0	0	171	171	171
COUNTY-OTHER, RED (B)							
DEVELOP OTHER AQUIFER SUPPLIES	OTHER AQUIFER [MONTAGUE]	160	160	160	160	160	160

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

WUG, Basin (RWPG)	Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
	DEVELOP TRINITY AQUIFER SUPPLIES (INCLUDES OVERDRAFTING)	TRINITY AQUIFER [MONTAGUE]	68	68	68	68	68	68
	MUNICIPAL CONSERVATION	CONSERVATION [MONTAGUE]	9	46	47	47	48	48
COUNTY-OTHER, TRINITY (B)								
	DEVELOP OTHER AQUIFER SUPPLIES	OTHER AQUIFER [MONTAGUE]	85	85	85	85	85	85
	DEVELOP TRINITY AQUIFER SUPPLIES	TRINITY AQUIFER [MONTAGUE]	271	271	271	271	271	271
	MUNICIPAL CONSERVATION	CONSERVATION [MONTAGUE]	9	32	33	33	33	33
MINING, RED (B)								
	PURCHASE WATER FROM LOCAL PROVIDER	FARMERS CREEK/NOCONA LAKE/RESERVOIR [RESERVOIR]	163	163	163	163	163	163
MINING, TRINITY (B)								
	PURCHASE WATER FROM LOCAL PROVIDER	AMON G. CARTER LAKE/RESERVOIR [RESERVOIR]	14	14	14	14	14	14
Sum of Projected Water Management Strategies (acre-feet/year)			**787**	**873**	**875**	**1,073**	**1,082**	**1,085**

PARKER COUNTY

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

WUG, Basin (RWPG)	Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
ALEDO, TRINITY (C)								
	CONVEYANCE PROJECT (3)	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	96	322	472	454
	MUNICIPAL CONSERVATION-BASIC	CONSERVATION [PARKER]	5	54	108	167	193	212
	MUNICIPAL CONSERVATION-EXPANDED	CONSERVATION [PARKER]	5	14	24	33	35	35
	OKLAHOMA WATER TO NTMWD, TRWD, UTRWD	OKLAHOMA LAKE/RESERVOIR [RESERVOIR - OKLAHOMA]	0	0	0	0	0	129
	PURCHASE FROM WATER PROVIDER (1)	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	419	804	1,083	1,012	882
	SUPPLEMENTAL WELLS	TRINITY AQUIFER [PARKER]	0	0	0	0	0	0
ANNETTA, TRINITY (C)								
	CONVEYANCE PROJECT (2)	INDIRECT REUSE	0	14	49	80	89	112

	[NAVARRO]						
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [PARKER]	3	11	16	19	23	27
PURCHASE FROM WATER PROVIDER (1)	TOLEDO BEND LAKE/RESERVOIR [RESERVOIR]	0	0	0	0	22	37
SUPPLEMENTAL WELLS	TRINITY AQUIFER [PARKER]	0	0	0	0	0	0
ANNETTA SOUTH, TRINITY (C)							
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [PARKER]	1	4	6	8	9	10
PURCHASE FROM WATER PROVIDER (2)	INDIRECT REUSE [NAVARRO]	0	1	10	16	26	37
SUPPLEMENTAL WELLS	TRINITY AQUIFER [PARKER]	0	0	0	0	0	0
AZLE, TRINITY (C)							
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [PARKER]	18	15	21	27	34	41
MUNICIPAL CONSERVATION-EXPANDED	CONSERVATION [PARKER]	3	4	4	5	6	7
PURCHASE FROM WATER PROVIDER (1)	TOLEDO BEND LAKE/RESERVOIR [RESERVOIR]	0	0	0	0	0	12
PURCHASE FROM WATER PROVIDER (1)	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	96	144	175	196	201
PURCHASE FROM WATER PROVIDER (2)	INDIRECT REUSE [NAVARRO]	79	18	0	3	0	13
PURCHASE FROM WATER PROVIDER (3)	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	92	165	250	321
COUNTY-OTHER, BRAZOS (C)							
CONVEYANCE PROJECT (1)	BRAZOS RIVER AUTHORITY MAIN STEM LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	500	500	500	500	500
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [PARKER]	21	87	137	163	172	180
PURCHASE FROM WATER PROVIDER (3)	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	38	61	74	83
COUNTY-OTHER, TRINITY (C)							
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [PARKER]	23	79	96	90	81	71
SUPPLEMENTAL WELLS	TRINITY AQUIFER [PARKER]	0	0	0	0	0	0
CRESSON, BRAZOS (C)							
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [PARKER]	1	2	2	3	4	5
CRESSON, TRINITY (C)							
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [PARKER]	0	1	2	2	3	4
FORT WORTH, TRINITY (C)							
DIRECT REUSE	DIRECT REUSE [TARRANT]	30	627	1,354	1,268	1,147	1,003
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [PARKER]	92	675	1,319	1,735	2,141	2,537

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

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
MUNICIPAL CONSERVATION-EXPANDED	CONSERVATION [PARKER]	0	37	108	148	162	172
PURCHASE FROM WATER PROVIDER (1)	OKLAHOMA LAKE/RESERVOIR [RESERVOIR - OKLAHOMA]	0	0	0	0	0	2,551
PURCHASE FROM WATER PROVIDER (1)	TOLEDO BEND LAKE/RESERVOIR [RESERVOIR]	0	0	0	0	0	0
PURCHASE FROM WATER PROVIDER (1)	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	0	0	0
PURCHASE FROM WATER PROVIDER (2)	INDIRECT REUSE [NAVARRO]	0	415	0	135	0	0
PURCHASE FROM WATER PROVIDER (3)	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	3,267	6,019	8,882	8,992
HUDSON OAKS, TRINITY (C)							
MARVIN NICHOLS RESERVOIR	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	29	79	139	208
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [PARKER]	4	23	36	49	61	76
SUPPLEMENTAL WELLS	TRINITY AQUIFER [PARKER]	0	0	0	0	0	0
IRRIGATION, TRINITY (C)							
SUPPLEMENTAL WELLS	TRINITY AQUIFER [PARKER]	0	0	0	0	0	0
LIVESTOCK, TRINITY (C)							
SUPPLEMENTAL WELLS	TRINITY AQUIFER [PARKER]	0	0	0	0	0	0
MANUFACTURING, BRAZOS (C)							
MANUFACTURING CONSERVATION	CONSERVATION [PARKER]	0	1	2	3	3	3
PURCHASE FROM WATER PROVIDER (1)	TOLEDO BEND LAKE/RESERVOIR [RESERVOIR]	0	0	0	0	0	4
PURCHASE FROM WATER PROVIDER (3)	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	37	74	107	141
MANUFACTURING, TRINITY (C)							
MANUFACTURING CONSERVATION	CONSERVATION [PARKER]	0	0	4	6	7	7
PURCHASE FROM WATER PROVIDER (1)	TOLEDO BEND LAKE/RESERVOIR [RESERVOIR]	0	0	0	0	0	9

WUG, Basin (RWPG)

All values are in acre-feet/year

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
PURCHASE FROM WATER PROVIDER (3)	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	28	124	216	308
SUPPLEMENTAL WELLS	TRINITY AQUIFER [PARKER]	0	0	0	0	0	0
MINERAL WELLS, BRAZOS (C)							
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [PARKER]	10	19	25	27	29	32
MINING, TRINITY (C)							
SUPPLEMENTAL WELLS	TRINITY AQUIFER [PARKER]	0	0	0	0	0	0
RENO, TRINITY (C)							
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [PARKER]	4	13	17	19	21	22
PURCHASE FROM WATER PROVIDER (1)	TOLEDO BEND LAKE/RESERVOIR [RESERVOIR]	0	0	0	0	0	0
PURCHASE FROM WATER PROVIDER (3)	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	17	32	44	60
SUPPLEMENTAL WELLS	TRINITY AQUIFER [PARKER]	0	0	0	0	0	0
SANCTUARY, TRINITY (C)							
MARVIN NICHOLS RESERVOIR	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	53	101	149	203
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [PARKER]	2	10	16	20	25	29
TRWD THIRD PIPELINE AND REUSE	INDIRECT REUSE [NAVARRO]	0	8	0	0	0	0
SPRINGTOWN, TRINITY (C)							
CONVEYANCE PROJECT (3)	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	53	137	236	351
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [PARKER]	20	48	71	94	117	144
MUNICIPAL CONSERVATION-EXPANDED	CONSERVATION [PARKER]	3	4	4	5	6	7
NEW WELLS - TRINITY AQUIFER	TRINITY AQUIFER [PARKER]	184	184	184	184	184	184
SUPPLEMENTAL WELLS	TRINITY AQUIFER [PARKER]	0	0	0	0	0	0
WATER TREATMENT PLANT - EXPANSION	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	0	0	0
WATER TREATMENT PLANT - NEW	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	0	0	0

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

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
STEAM ELECTRIC POWER, TRINITY (C)							
CONVEYANCE PROJECT (3)	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	6	18	31	50
PURCHASE FROM WATER PROVIDER (2)	INDIRECT REUSE [NAVARRO]	0	2	0	0	0	0
WALNUT CREEK SUD, TRINITY (C)							
CONVEYANCE PROJECT (1)	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	0	0	0
MARVIN NICHOLS RESERVOIR	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	838	1,618	2,313	2,614
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [PARKER]	35	141	272	361	404	440
MUNICIPAL CONSERVATION-EXPANDED	CONSERVATION [PARKER]	17	24	37	46	48	50
PURCHASE FROM WATER PROVIDER (1)	TOLEDO BEND LAKE/RESERVOIR [RESERVOIR]	0	0	0	0	0	138
PURCHASE FROM WATER PROVIDER (1)	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	816	2,206	2,767	2,684	2,469
PURCHASE FROM WATER PROVIDER (2)	INDIRECT REUSE [NAVARRO]	0	111	0	58	0	146
WATER TREATMENT PLANT - EXPANSION	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	0	0	0
WATER TREATMENT PLANT - NEW	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	0	0	0
WEATHERFORD, BRAZOS (C)							
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [PARKER]	8	17	25	33	42	52
MUNICIPAL CONSERVATION-EXPANDED	CONSERVATION [PARKER]	2	3	5	6	7	8
PURCHASE FROM WATER PROVIDER (1)	TOLEDO BEND LAKE/RESERVOIR [RESERVOIR]	0	0	0	0	63	68
PURCHASE FROM WATER PROVIDER (2)	INDIRECT REUSE [NAVARRO]	68	127	122	133	117	129
PURCHASE FROM WATER PROVIDER (3)	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	0	0	0	0
WEATHERFORD, TRINITY (C)							
FACILITY IMPROVEMENTS	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	0	0	0
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [PARKER]	165	353	502	637	791	975
MUNICIPAL CONSERVATION-EXPANDED	CONSERVATION [PARKER]	48	72	95	117	131	146

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

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
PURCHASE FROM WATER PROVIDER (1)	TOLEDO BEND LAKE/RESERVOIR [RESERVOIR]	0	0	0	0	1,188	1,269
PURCHASE FROM WATER PROVIDER (2)	INDIRECT REUSE [NAVARRO]	1,323	2,556	2,400	2,543	2,210	2,396
PURCHASE FROM WATER PROVIDER (3)	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	413	1,066	1,798	2,497
WATER TREATMENT PLANT - EXPANSION	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	0	0	0
WILLOW PARK, TRINITY (C)							
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [PARKER]	8	51	57	74	88	100
MUNICIPAL CONSERVATION-EXPANDED	CONSERVATION [PARKER]	4	8	8	9	10	11
PURCHASE FROM WATER PROVIDER (1)	TOLEDO BEND LAKE/RESERVOIR [RESERVOIR]	0	0	0	0	0	20
PURCHASE FROM WATER PROVIDER (1)	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	118	422	540	576	566
PURCHASE FROM WATER PROVIDER (2)	INDIRECT REUSE [NAVARRO]	0	0	0	0	0	19
PURCHASE FROM WATER PROVIDER (3)	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	54	177	307	382
SUPPLEMENTAL WELLS	TRINITY AQUIFER [PARKER]	0	0	0	0	0	0
Sum of Projected Water Management Strategies (acre-feet/year)		**2,186**	**7,782**	**16,235**	**23,384**	**29,685**	**34,961**

WISE COUNTY

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

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
ALVORD, TRINITY (C)							
CONVEYANCE PROJECT (1)	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	0	0	0
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [WISE]	2	7	10	12	14	17
PURCHASE FROM WATER PROVIDER (3)	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	23	37	47	56
SUPPLEMENTAL WELLS	TRINITY AQUIFER [WISE]	0	0	0	0	0	0
TRWD THIRD PIPELINE AND REUSE	INDIRECT REUSE [HENDERSON]	0	5	0	0	0	0

AURORA, TRINITY (C)

	MUNICIPAL CONSERVATION-BASIC	CONSERVATION [WISE]	3	9	13	15	18	22
	PURCHASE FROM WATER PROVIDER (2)	INDIRECT REUSE [NAVARRO]	0	50	50	50	50	86
	SUPPLEMENTAL WELLS	TRINITY AQUIFER [WISE]	0	0	0	0	0	0
BOLIVAR WSC, TRINITY (C)								
	LAKE RALPH HALL - INDIRECT REUSE	INDIRECT REUSE [DENTON]	0	2	16	48	64	85
	MUNICIPAL CONSERVATION-BASIC	CONSERVATION [WISE]	3	10	15	23	34	54
	MUNICIPAL CONSERVATION-EXPANDED	CONSERVATION [WISE]	2	2	2	4	5	7
	PURCHASE FROM WATER PROVIDER (1)	CHAPMAN/COOPER LAKE/RESERVOIR NON-SYSTEM PORTION [RESERVOIR]	0	3	10	19	25	30
	PURCHASE FROM WATER PROVIDER (1)	OKLAHOMA LAKE/RESERVOIR [RESERVOIR - OKLAHOMA]	0	0	0	0	0	69
	PURCHASE FROM WATER PROVIDER (1)	RAY ROBERTS-LEWISVILLE-GRAPEVINE LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	12	51	104	148	254
	PURCHASE FROM WATER PROVIDER (2)	INDIRECT REUSE [DENTON]	0	2	6	10	14	17
	PURCHASE FROM WATER PROVIDER (3)	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	0	0	62	81
	PURCHASE FROM WATER PROVIDER (3)	RALPH HALL LAKE/RESERVOIR [RESERVOIR]	0	13	45	88	120	158
	SUPPLEMENTAL WELLS	TRINITY AQUIFER [WISE]	0	0	0	0	0	0
BOYD, TRINITY (C)								
	MARVIN NICHOLS RESERVOIR	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	26	60	101	123
	MUNICIPAL CONSERVATION-BASIC	CONSERVATION [WISE]	3	10	16	20	25	27
	PURCHASE FROM WATER PROVIDER (2)	INDIRECT REUSE [NAVARRO]	0	1	0	0	0	0
	SUPPLEMENTAL WELLS	TRINITY AQUIFER [WISE]	0	0	0	0	0	0
BRIDGEPORT, TRINITY (C)								
	MARVIN NICHOLS RESERVOIR	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	407	784	1,195	1,729
	MUNICIPAL CONSERVATION-BASIC	CONSERVATION [WISE]	11	83	150	205	270	360
	MUNICIPAL CONSERVATION-EXPANDED	CONSERVATION [WISE]	13	23	38	47	55	65
	TRWD THIRD PIPELINE AND REUSE	INDIRECT REUSE [NAVARRO]	0	50	0	0	0	0
	WATER TREATMENT PLANT - EXPANSION	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	0	0	0
	WATER TREATMENT PLANT - NEW	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	43	407	451	494	590

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
CHICO, TRINITY (C)							
MARVIN NICHOLS RESERVOIR	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	19	50	92	150
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [WISE]	2	8	13	16	21	28
MUNICIPAL CONSERVATION-EXPANDED	CONSERVATION [WISE]	1	1	1	2	2	2
PURCHASE FROM WATER PROVIDER (1)	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	8	30	55	80
SUPPLEMENTAL WELLS	TRINITY AQUIFER [WISE]	0	0	0	0	0	0
COMMUNITY WSC, TRINITY (C)							
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [WISE]	0	1	1	1	2	2
PURCHASE FROM WATER PROVIDER (1)	TOLEDO BEND LAKE/RESERVOIR [RESERVOIR]	0	0	0	0	0	0
PURCHASE FROM WATER PROVIDER (3)	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	3	4	5	6
COUNTY-OTHER, TRINITY (C)							
MARVIN NICHOLS RESERVOIR	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	356	557	717	865
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [WISE]	49	166	216	232	245	259
PURCHASE FROM WATER PROVIDER (1)	TOLEDO BEND LAKE/RESERVOIR [RESERVOIR]	0	0	0	0	0	0
PURCHASE FROM WATER PROVIDER (2)	INDIRECT REUSE [NAVARRO]	149	92	0	0	0	0
PURCHASE FROM WATER PROVIDER (3)	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	356	557	717	865
SUPPLEMENTAL WELLS	TRINITY AQUIFER [WISE]	0	0	0	0	0	0
TRWD THIRD PIPELINE AND REUSE	INDIRECT REUSE [NAVARRO]	0	92	0	0	0	0
DECATUR, TRINITY (C)							
MARVIN NICHOLS RESERVOIR	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	416	872	1,476	2,096
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [WISE]	13	88	158	234	342	446
MUNICIPAL CONSERVATION-EXPANDED	CONSERVATION [WISE]	12	20	32	45	58	68
PURCHASE FROM WATER PROVIDER (1)	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	92	389	633	952	1,021

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

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
PURCHASE FROM WATER PROVIDER (2)	INDIRECT REUSE [NAVARRO]	0	57	0	0	0	0
WATER TREATMENT PLANT - EXPANSION	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	0	0	0
FORT WORTH, TRINITY (C)							
DIRECT REUSE	DIRECT REUSE [TARRANT]	5	120	236	249	263	262
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [WISE]	15	130	231	339	489	662
MUNICIPAL CONSERVATION-EXPANDED	CONSERVATION [WISE]	0	7	19	29	37	45
PURCHASE FROM WATER PROVIDER (1)	OKLAHOMA LAKE/RESERVOIR [RESERVOIR - OKLAHOMA]	0	0	0	0	0	665
PURCHASE FROM WATER PROVIDER (1)	TOLEDO BEND LAKE/RESERVOIR [RESERVOIR]	0	0	0	0	0	0
PURCHASE FROM WATER PROVIDER (1)	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	0	0	0
PURCHASE FROM WATER PROVIDER (2)	INDIRECT REUSE [NAVARRO]	0	80	0	26	0	0
PURCHASE FROM WATER PROVIDER (3)	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	572	1,178	2,030	2,346
IRRIGATION, TRINITY (C)							
GOLF COURSE CONSERVATION	CONSERVATION [WISE]	0	5	10	13	15	18
PURCHASE FROM WATER PROVIDER (2)	INDIRECT REUSE [NAVARRO]	21	17	0	0	0	0
PURCHASE FROM WATER PROVIDER (3)	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	47	69	87	103
SUPPLEMENTAL WELLS	TRINITY AQUIFER [WISE]	0	0	0	0	0	0
LIVESTOCK, TRINITY (C)							
SUPPLEMENTAL WELLS	TRINITY AQUIFER [WISE]	0	0	0	0	0	0
MANUFACTURING, TRINITY (C)							
MANUFACTURING CONSERVATION	CONSERVATION [WISE]	0	1	12	18	19	21
MARVIN NICHOLS RESERVOIR	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	640	1,043	1,423	1,842
PURCHASE FROM WATER PROVIDER (2)	INDIRECT REUSE [HENDERSON]	0	216	0	0	0	0
SUPPLEMENTAL WELLS	OTHER AQUIFER [WISE]	0	0	0	0	0	0

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
MINING, TRINITY (C)							
DIRECT REUSE	DIRECT REUSE [WISE]	0	3,569	7,378	10,828	14,241	17,304
PURCHASE FROM WATER PROVIDER (2)	INDIRECT REUSE [NAVARRO]	0	716	0	0	0	0
PURCHASE FROM WATER PROVIDER (3)	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	2,091	3,357	4,574	5,812
SUPPLEMENTAL WELLS	TRINITY AQUIFER [WISE]	0	0	0	0	0	0
NEW FAIRVIEW, TRINITY (C)							
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [WISE]	4	13	20	26	32	40
PURCHASE FROM WATER PROVIDER (1)	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	47	93	127	158	184
PURCHASE FROM WATER PROVIDER (3)	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	6	36	77	134
SUPPLEMENTAL WELLS	TRINITY AQUIFER [WISE]	0	0	0	0	0	0
NEWARK, TRINITY (C)							
CONVEYANCE PROJECT (2)	INDIRECT REUSE [NAVARRO]	0	0	0	0	0	0
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [WISE]	2	9	15	22	32	47
MUNICIPAL CONSERVATION-EXPANDED	CONSERVATION [WISE]	1	2	3	4	5	7
PURCHASE FROM WATER PROVIDER (1)	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	58	103	168	233	318
PURCHASE FROM WATER PROVIDER (3)	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	12	55	125	246
SUPPLEMENTAL WELLS	TRINITY AQUIFER [WISE]	0	0	0	0	0	0
PARADISE, TRINITY (C)							
MARVIN NICHOLS RESERVOIR	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	18	37	57	86
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [WISE]	2	4	6	7	10	12
PURCHASE FROM WATER PROVIDER (2)	INDIRECT REUSE [NAVARRO]	0	3	0	0	0	0
RHOME, TRINITY (C)							
MARVIN NICHOLS RESERVOIR	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	201	483	831	1,155
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [WISE]	17	43	85	137	199	270

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
PURCHASE FROM WATER PROVIDER (1)	TOLEDO BEND LAKE/RESERVOIR [RESERVOIR]	0	0	0	0	0	44
PURCHASE FROM WATER PROVIDER (1)	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	158	357	481
PURCHASE FROM WATER PROVIDER (2)	INDIRECT REUSE [NAVARRO]	0	15	0	0	0	47
SUPPLEMENTAL WELLS	TRINITY AQUIFER [WISE]	0	0	0	0	0	0
RUNAWAY BAY, TRINITY (C)							
MARVIN NICHOLS RESERVOIR	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	70	127	183	245
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [WISE]	3	16	25	32	41	50
PURCHASE FROM WATER PROVIDER (1)	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	0	0	0
PURCHASE FROM WATER PROVIDER (2)	INDIRECT REUSE [NAVARRO]	0	13	0	0	0	0
WATER TREATMENT PLANT - EXPANSION	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	0	0	0
STEAM ELECTRIC POWER, TRINITY (C)							
CONVEYANCE PROJECT (2)	DIRECT REUSE [WISE]	0	0	0	0	0	0
PURCHASE FROM WATER PROVIDER (2)	INDIRECT REUSE [NAVARRO]	1,098	102	0	0	0	0
PURCHASE FROM WATER PROVIDER (3)	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	268	611	835	1,332
WALNUT CREEK SUD, TRINITY (C)							
MARVIN NICHOLS RESERVOIR	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	109	206	299	349
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [WISE]	5	19	36	46	53	60
MUNICIPAL CONSERVATION-EXPANDED	CONSERVATION [WISE]	2	3	5	6	6	7
PURCHASE FROM WATER PROVIDER (1)	TOLEDO BEND LAKE/RESERVOIR [RESERVOIR]	0	0	0	0	0	18
PURCHASE FROM WATER PROVIDER (1)	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	107	288	352	347	329
PURCHASE FROM WATER PROVIDER (2)	INDIRECT REUSE [NAVARRO]	0	14	0	7	0	19

Projected Water Management Strategies
TWDB 2012 State Water Plan Data

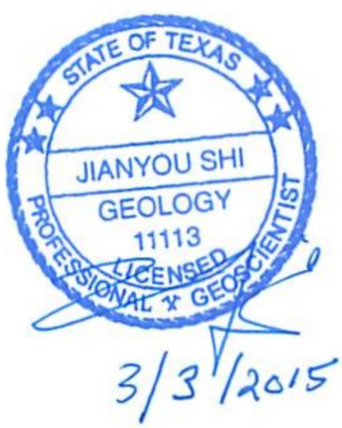
WUG, Basin (RWPG) All values are in acre-feet/year

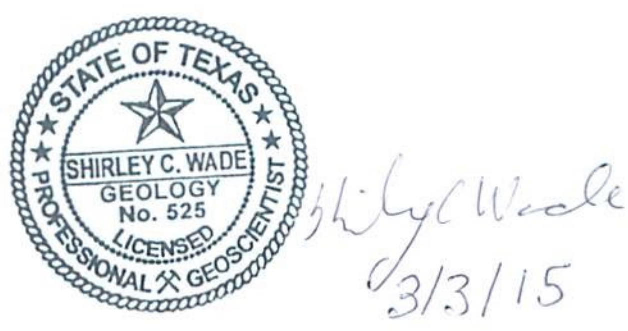
Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
WEST WISE RURAL SUD, TRINITY (C)							
MARVIN NICHOLS RESERVOIR	MARVIN NICHOLS LAKE/RESERVOIR [RESERVOIR]	0	0	98	169	241	321
MUNICIPAL CONSERVATION-BASIC	CONSERVATION [WISE]	5	18	27	32	38	45
PURCHASE FROM WATER PROVIDER (2)	INDIRECT REUSE [NAVARRO]	0	25	0	0	0	0
WATER TREATMENT PLANT - EXPANSION	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	0	0	0
WATER TREATMENT PLANT - NEW	TRWD LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	0	0	0
Sum of Projected Water Management Strategies (acre-feet/year)		**1,443**	**6,314**	**15,977**	**25,207**	**34,762**	**44,644**

Appendix B

GAM RUN 14-008: UPPER TRINITY GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN

by Jianyou(Jerry) Shi, Ph.D., P.G. and Shirley C. Wade, Ph.D., P.G.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-5076
March 3, 2015





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GAM RUN 14-008: UPPER TRINITY GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN

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Texas Water Development Board
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March 3, 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 Upper Trinity Groundwater 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 Upper Trinity Groundwater Conservation District should be adopted by the district on or before July 29, 2015 and submitted to the executive administrator of the TWDB on or before August 28, 2015. The current management plan for the Upper Trinity Groundwater Conservation District expires on October 27, 2015.

This report discusses the methods, assumptions, and results from a model run using the recently adopted groundwater availability model (approved by the TWDB executive administrator on November 21, 2014) for the Trinity (northern portion) and Woodbine aquifers, version 2.01 (Kelley and others, 2014). This model run replaces the results of GAM Run 09-022 (Aschenbach, 2009) that used version 1.01 of the groundwater availability model for the Trinity (northern portion) and Woodbine aquifers (Bené and others, 2004). Table 1 summarizes the groundwater availability model data required by statute to be included in the district's groundwater conservation management plan, and Figure 1 shows the areas of the model from which the values in the table were extracted. If after review of the figure, Upper Trinity Groundwater Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the TWDB at your earliest convenience.

METHODS:

In accordance with the provisions of the Texas State Water Code, Section 36.1071, Subsection (h), the updated groundwater availability model for the northern portion of the Trinity Aquifer and Woodbine Aquifer (Kelley and others, 2014) was used for this analysis. Water budgets for the Upper Trinity Groundwater Conservation District were extracted for the historical model periods (1980-2012) using ZONEBUDGET Version 3.01 (Harbaugh, 2009). The average annual water budget values for recharge, surface water outflow, inflow to the district, outflow from the district, net interaquifer 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. See Kelley and others (2014) for assumptions and limitations of the updated groundwater availability model for the northern portion of the Trinity Aquifer and Woodbine Aquifer.

- The groundwater availability model includes eight layers, that generally correspond to:
  - the surficial outcrop area and the younger formations overlying the subcrop 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 the major source of groundwater in the Upper Trinity Groundwater District. Most of the Trinity Aquifer occurs in a north-south trending outcrop through the central portion of the district. A lesser amount of the aquifer is present as subcrop to the east. All of the eight numerical layers in the model are designated as active in the Upper Trinity Groundwater 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 Upper Trinity Groundwater 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 model was run with MODFLOW-NWT (Niswonger and others, 2011).

RESULTS:

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

- Precipitation recharge—the areally-distributed recharge sourced from precipitation falling on the outcrop areas of the Trinity Aquifer (where the aquifer is 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 aquifer 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 Upper Trinity Groundwater 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.

The information needed for the Upper Trinity Groundwater Conservation District's management plan is summarized in Table 1. 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 (Figure 1). Please note that the results of this model run are different from the results of the model run 09-022 that were obtained from the older groundwater availability model. 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 MODFLOW modeling packages.

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

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Trinity Aquifer	129,020

Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Trinity Aquifer	121,643
Estimated annual volume of flow into the district within each aquifer in the district	Trinity Aquifer	13,083
Estimated annual volume of flow out of the district within each aquifer in the district	Trinity Aquifer	35,508
Estimated net annual volume of flow between each aquifer in the district	From overlying Washita and Fredericksburg Confining Units into the Trinity Aquifer	25,672

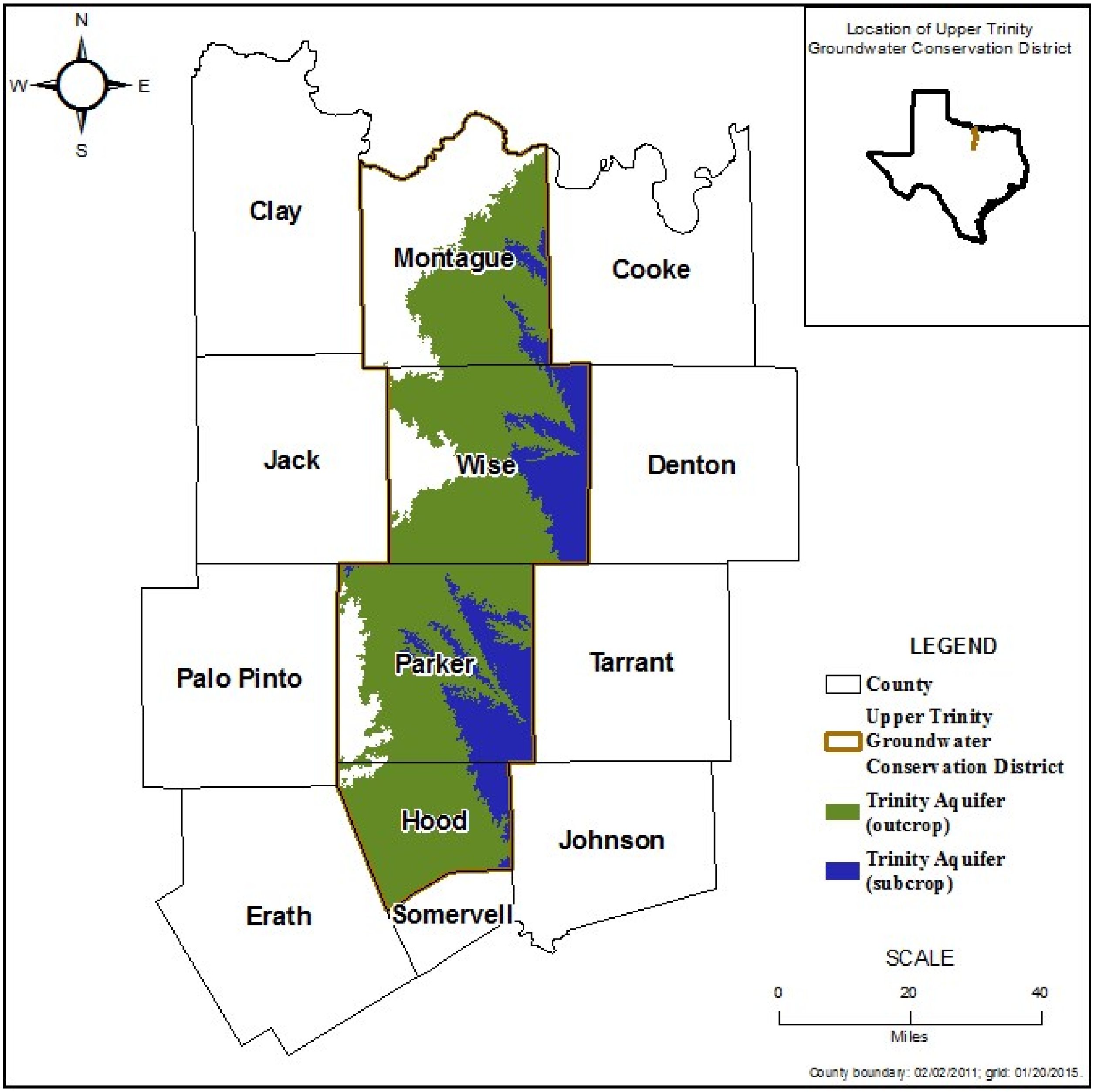

FIGURE 1: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE NORTHERN PORTION OF THE TRINITY AQUIFER AND WOODBINE AQUIFER FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED (THE TRINITY AQUIFER FOOTPRINT EXTENT WITHIN THE DISTRICT BOUNDARY).

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.

REFERENCES:

Aschenbach, E., 2009, GAM Run 09-022: Texas Water Development Board, GAM Run 09-022 Management plan data for Upper Trinity GCD Report, 6 p., http://www.twdb.texas.gov/groundwater/docs/GAMruns/GR09-22.pdf.

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., http://www.twdb.texas.gov/groundwater/models/gam/trnt_n/TRNT_N_Model _Report.pdf.

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

Kelley, V.A., Ewing. J., Jones, T.L., Young, S.C., Deeds, N., and Hamlin, S., 2014, Updated Groundwater Availability Model of the Northern Trinity and Woodbine Aquifers: contract report prepared for North Texas GCD, Northern Trinity GCD, Prairielands GCD, and Upper Trinity GCD by INTERA Incorporated, Bureau of Economic Geology, and LBG-Guyton Associates, 990 p., http://www.twdb.texas.gov/groundwater/models/gam/trnt_n/Final_NTGAM_Vol%20I%20Aug%202014_Report.pdf.

Niswonger, R.G., Panday, S., and Ibaraki, M., 2011, MODFLOW-NWT, a Newton formulation for MODFLOW-2005: USGS, Techniques and Methods 6-A37, 44 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., http://www.nap.edu/catalog.php?record_id=11972.

Appendix C

Temporary Rules

http://uppertrinitygcd.com/wp-content/uploads/2014/12/UTGCD-Rules-as-Amended-December-16-2013-CORRECTED.pdf

Appendix D

Resolution Adopting the Management Plan

Appendix E

Evidence that the Management Plan was Adopted after Notice and Hearing

Appendix F

Evidence that the District Coordinated Development of the Management Plan with Surface Water Entities