
Southern Trinity Groundwater Conservation District

Groundwater Management Plan

Approved by District Board of Directors on July 15, 2021

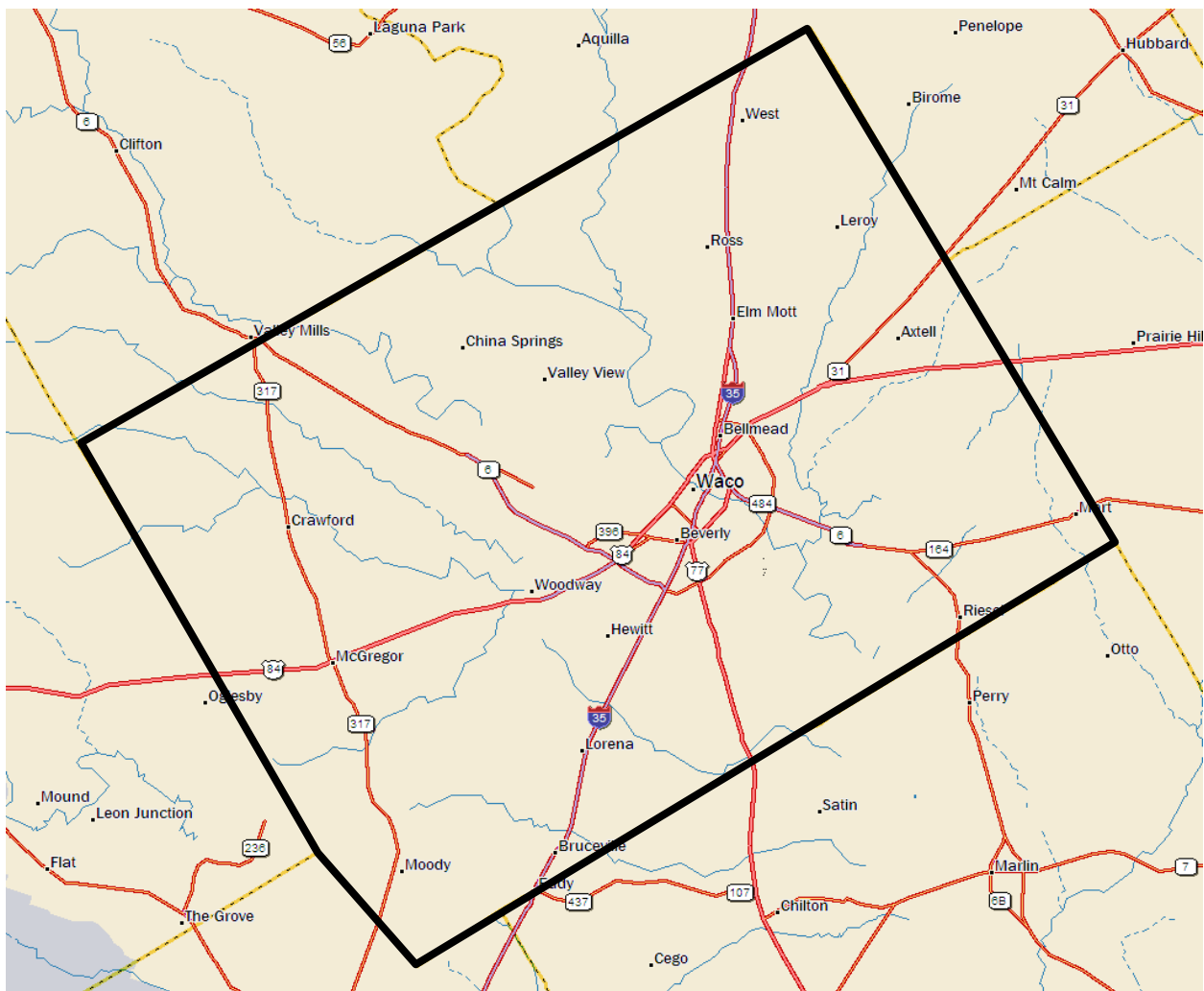


TABLE OF CONTENTS

1.	<i>Introduction</i>	1
1.1.	Background and Purpose.....	1
1.2.	Groundwater Resources	1
1.2.1.	Trinity Aquifer	1
1.2.2.	Brazos River Alluvium Aquifer.....	3
1.2.3.	Woodbine Aquifer	3
1.2.4.	Other Groundwater Resources	4
1.3.	Texas Water Development Board - Groundwater Availability Models (GAMs)	4
1.4.	Priority Groundwater Management Area.....	4
2.	<i>Groundwater Management</i>	4
3.	<i>Estimates of Annual Volumes of Water</i>	5
3.1.	Estimate of the Annual Volume of Water That Discharges from the Aquifers to Springs and any Surface Water Bodies, Including Lakes, Streams and Rivers	6
3.1.1.	Trinity Aquifer (Paluxy, Glen Rose, Hensell, Pearsall/Cow Creek/Hammett, Sligo, and Hosston strata).....	6
3.1.2.	Brazos River Alluvium Aquifer.....	6
3.1.3.	Woodbine Aquifer	6
3.1.4.	All other Aquifers, Formations, or Series.....	6
3.2.	Estimate of the Modeled Available Groundwater in the District Based On The Desired Future Condition of the Aquifers	6
3.2.1.	Trinity Aquifer (Hensell, Pearsall/Cow Creek/Hammett, Sligo, and Hosston Formations).....	6
3.2.2.	Brazos River Alluvium Aquifer.....	6
3.2.3.	Woodbine Aquifer	7
3.3.	Estimate of the Amount of Groundwater Being Used within the District on an Annual Basis	7
3.3.1.	Trinity Aquifer (Paluxy, Glen Rose, Hensell, Pearsall/Cow Creek/Hammett, Sligo, and Hosston Formations)	7
3.3.2.	Brazos River Alluvium Aquifer.....	8
3.3.3.	Woodbine Aquifer	8
3.3.4.	All Other Aquifers and Geological Formations or Series.....	8

3.4.	Estimate of the Annual Amount of Recharge, from Precipitation, to the Groundwater Resources Within The District.....	8
3.4.1.	Trinity Aquifer (Paluxy, Glen Rose, Hensell, Pearsall/Cow Creek/Hammett, Sligo, and Hosston Formations)	8
3.4.2.	Brazos River Alluvium Aquifer.....	8
3.4.3.	Woodbine Aquifer	8
3.4.4.	All Other Aquifers, Formations, or Series	8
3.5.	Estimate of the Annual Volume of Flow Into and Out of the District Within each Aquifer, and Between Aquifers, in the District	8
3.5.1.	Trinity Aquifer	8
3.5.2.	Brazos River Alluvium Aquifer.....	9
3.5.3.	Woodbine Aquifer	9
3.6.	Estimate of the Projected Surface Water Supply within the District According to the Most Recently Adopted 2017 State Water Plan	9
3.7.	Estimate of the Projected Total Demand for Water within the District According to the 2017 State Water Plan.....	9
4.	<i>Performance Standards and Management Objectives to Effectuate the Plan.....</i>	9
5.	<i>Actions, Procedures, Performance and Avoidance Necessary to Effectuate the Management Plan.....</i>	10
5.1.	Socioeconomic Impacts.....	10
5.2.	Interests and Rights in Private Property.....	10
5.3.	Feasibility of Achieving the Desired Future Condition	10
6.	<i>Evidence of Coordination and Adoption of Plan.....</i>	10
6.1.	Certified Copy of The District’s Resolution Adopting The Plan.....	10
6.2.	Evidence that the Plan was adopted after Notice and Hearing	11
6.3.	Coordination of Management Plan with Surface Water Management Entities	11
6.4.	Copy of District’s Current Rules.....	11
7.	<i>Consideration of State Water Plan Water Supply Needs and Water Management Strategies... 11</i>	11
7.1.	Water Supply Needs.....	11
7.2.	Water Management Strategies	11
8.	<i>Management Goals</i>	12
8.1.	Providing the Most Efficient Use of Groundwater	12
8.2.	Controlling and Preventing Waste of Groundwater.....	12

8.3.	Controlling and Preventing Subsidence	13
8.4.	Addressing Conjunctive Surface Water Management Issues	13
8.5.	Addressing Natural Resource Issues that Impact the Use and Availability of Groundwater and which are Impacted by the Use of Groundwater.....	14
8.6.	Addressing Drought Conditions.....	14
8.7.	Addressing Conservation, Recharge Enhancement, Rainwater Harvesting, Precipitation Enhancement, or Brush Control, where Appropriate and Cost Effective.....	15
8.7.1.	Recharge Enhancement.....	16
8.7.2.	Precipitation Enhancement	16
8.8.	Addressing the Desired Future Condition of the Groundwater Resources in the District	16
8.8.1.	Trinity Aquifer (Paluxy, Glen Rose, Hensell, Pearsall/Cow Creek/Hammett, Sligo, and Hosston Formations)	16
8.8.2.	Woodbine Aquifer	17
9.	<i>References</i>	17

10. Appendices.....

10.1 Geological Cross Section Showing the Outcrop and Recharge Area of the Trinity Aquifer.....

10.2 TWDB GAM Run 19-016: STGCD Management Plan

10.3 TCEQ – Designation of Priority Groundwater Management Area.....

10.4 Yelderman - Brazos River Alluvium Aquifer Flow System-Technical Memo.

10.5 TWDB GAM Run 17-029 MAG Trinity, Woodbine, Edwards, Marble Falls, et al Aquifers.....

10.6 TWDB GTA Aquifer Assessment 10-18 Brazos River Alluvium Aquifer

10.7 Copy of Letter of Transmittals to Brazos River Authority and others.....

10.8 STGCD Groundwater Use 2010-2019.....

10.9 STGCD Agricultural Irrigation Groundwater Use 2017 and 2018.....

10.10 Analysis of Historical Groundwater Pumpage Summary

10.11 TWDB Estimated Historical Water Use and 2017 SWP Data Sets for STGCD

10.12 Rules

10.13 Resolution of Adoption of Plan

10.14 Evidence of Notice and Hearing

1. Introduction

This plan will become effective upon adoption by the District's Board of Directors and approval by the Texas Water Development Board. The plan will remain in effect for five (5) years after the date of approval unless amended or replaced sooner.

1.1. Background and Purpose

The District was created by legislation in the 80th Texas Legislature in 2007 (SB1985), and amended by the 81st Texas Legislature in 2009 (SB2513) and by the 82nd Texas Legislature in 2011 (HB801). The purpose of the District is to conserve, preserve, protect, recharge and prevent the waste of groundwater and to control subsidence caused by groundwater withdrawals, consistent with Section 59, Article XVI, Texas Constitution and Chapter 36, Texas Water Code.

1.2. Groundwater Resources

The District has within its boundaries the Trinity, the Woodbine, and the Brazos River Alluvium aquifers. The following paragraphs describe the aquifers and their approximate locations within the District. The relationship to confining units and other groundwater resources within the District are also discussed. Appendix 10.1 contains a chart of showing the geological cross-section passing through the District from Northwest to Southwest. This cross-section shows the out crop and recharge area of the Trinity Aquifer.

1.2.1. Trinity Aquifer

The Trinity Aquifer is located throughout McLennan County as a confined aquifer. Its recharge area occurs outside the District to the north and west. There are a number of named, geologic formations that, collectively, are considered to comprise the Trinity Aquifer. To the west of McLennan County, the aquifer is designated the Twin Mountains formation where the sands crop out on the surface and receive recharge from precipitation. To the north where the Glen Rose formation is absent, the Trinity Aquifer is called the Antlers formation and to the south it is designated the Travis Peak. The portion of the Trinity Aquifer within the District has three water bearing strata: the Paluxy, the Hensell and the Hosston. The aquifer dips to the southeast becoming deeper below the surface in the eastern part of the District. The increase in depth to the southeast is accentuated by the Balcones Fault Zone, which consists primarily of normal faults downthrown to the southeast. As the aquifer dips to the southeast the Hensell and Hosston become divided by several formations including the Pearsall, Cow Creek, Hammett and Sligo. The Paluxy, Glen Rose, Pearsall, Cow Creek, Hammett and Sligo formations are not major contributors to aquifer production but they are included with the Hensell and Hosston formations as the Trinity Aquifer in the District. The Paluxy formation only occurs in the western part of the District. The outcrop of the Paluxy occurs outside of the District boundaries to the north and

west. There is very little or no use of groundwater in the portion of Paluxy within McLennan County.

1.2.2.1 Management Zones

Figure 1.1 below shows the geographic location of the Hensell Management Zone (Hensell MZ) and Figure 1.2 shows the geographic location of the Hosston Management Zone (Hosston MZ). Permitted groundwater wells located in the Hensell MZ predominately withdraw groundwater from the Hensell (upper) stratum of the Trinity Aquifer and wells located in the Hosston MZ predominately withdraw groundwater from the Hosston (lower) stratum of the Trinity Aquifer. Some wells in both management zones may withdraw water from both the upper and lower strata.

The District groundwater level monitoring program has shown that the annual rate of decline for wells located in the Hensell MZ is greater than that in the Hosston MZ and that management of each of the aquifers may require different limitations on the amount of annual production allowed from each respective stratum.

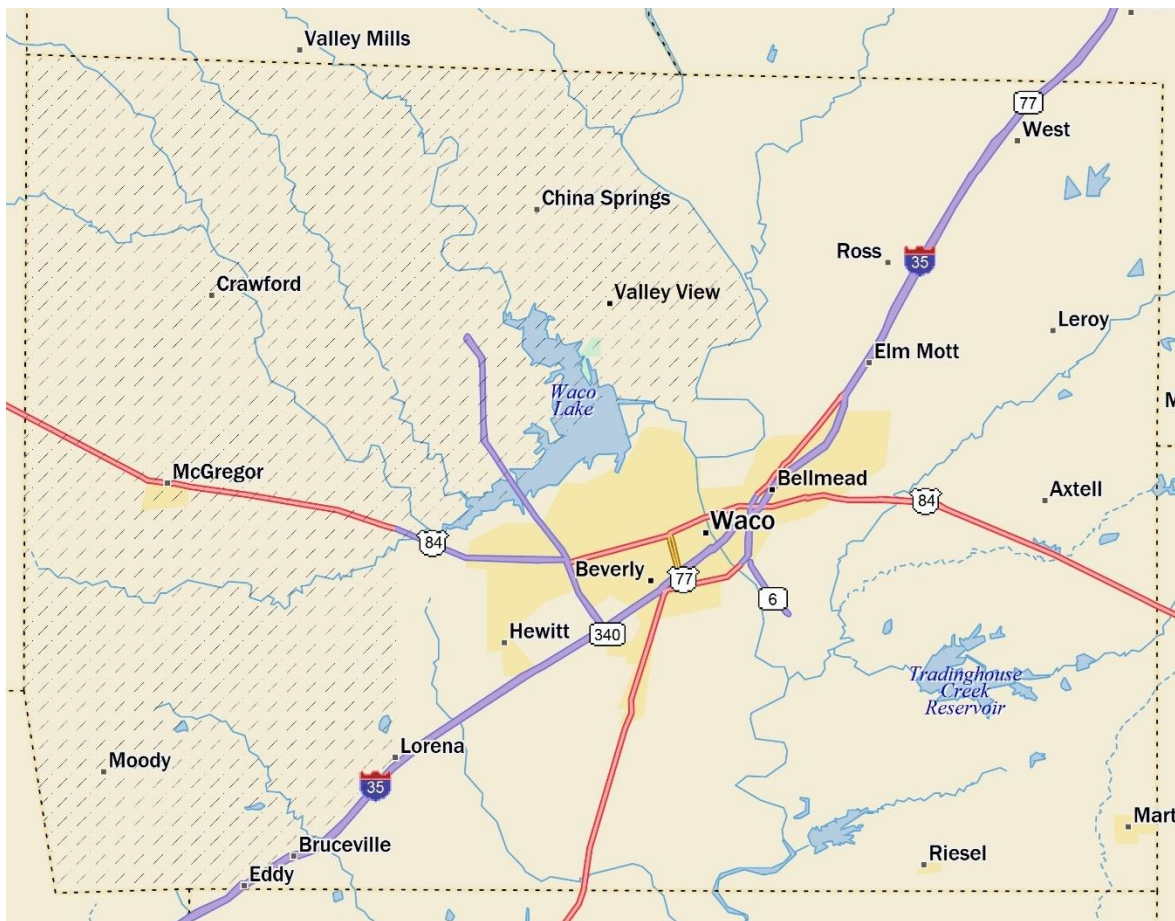


Figure 1.1 Geographic Extent of Hensell Management Zone (shown as hatched area)

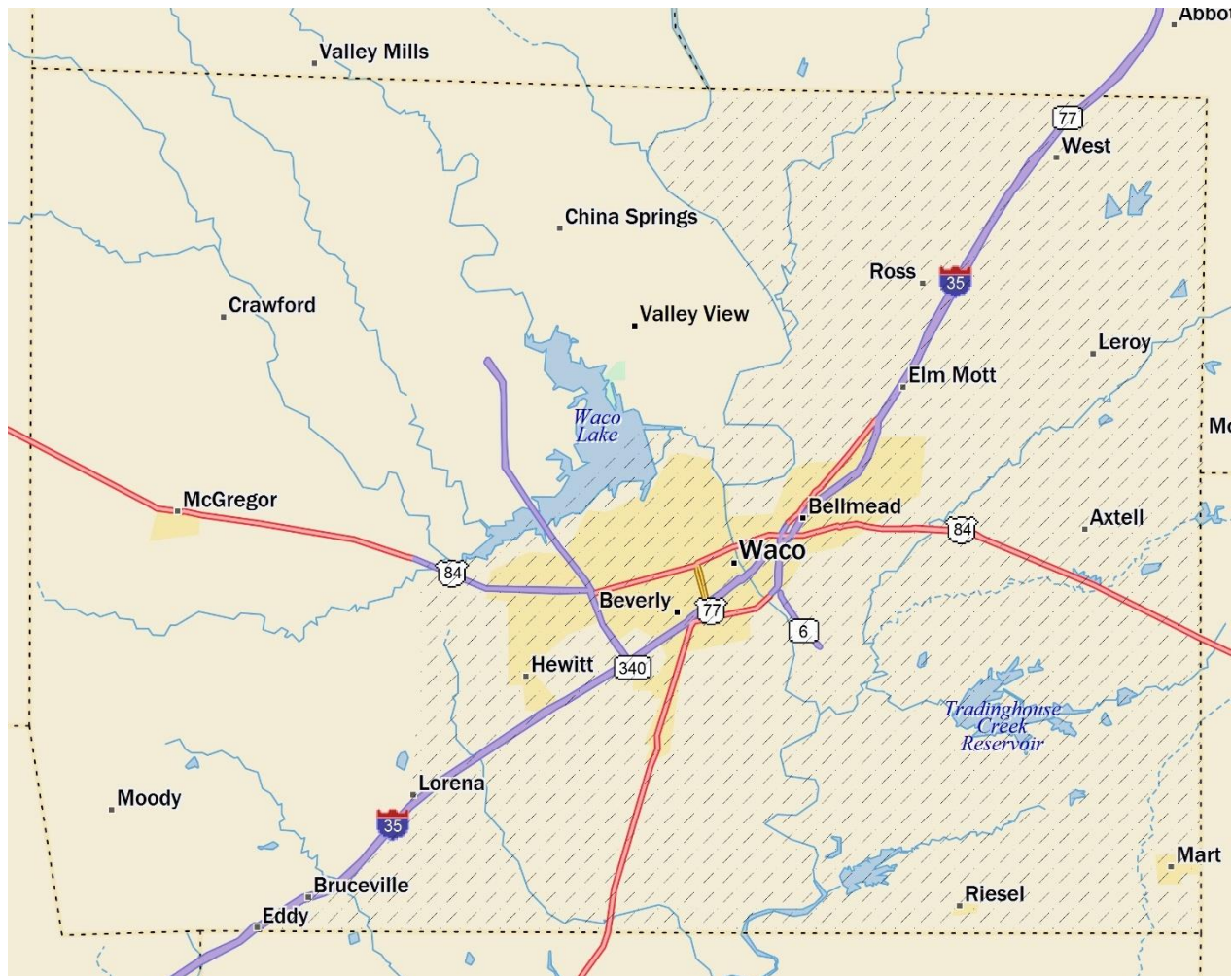


Figure 1.2 Geographic Extent of Hosston Management Zone (shown as hatched area)

1.2.2. Brazos River Alluvium Aquifer

The Brazos River Alluvium Aquifer consists of water bearing alluvial sediments that occur in floodplain and terrace deposits proximate to the Brazos River as it flows through McLennan County. The Brazos River Alluvium Aquifer is an unconfined aquifer that receives recharge primarily from direct precipitation on the floodplain surface but may also be recharged from overbank flows during flood events and from lateral flow from adjacent formations. The aquifer discharges through springs and seeps into the Brazos River and streams within the outcrop of the alluvium.

1.2.3. Woodbine Aquifer

The Woodbine Aquifer is a minor aquifer that extends only into a very limited portion of the northernmost part of McLennan County. The outcrop of the Woodbine occurs within the District boundaries but is covered by alluvium over much of its area. There is no or very little use of the groundwater in the portion of the Woodbine Aquifer within McLennan County. McLennan

County has a desired future condition for the Woodbine Aquifer of 6 feet of decline and a MAG of 0 acre-feet per decade.

1.2.4. Other Groundwater Resources

Shallow or perched groundwater occurs in the fractured weathered veneer of the Fredericksburg and Washita series and in other formations in McLennan County. Little water is produced from this shallow or perched groundwater in McLennan County but it supports small springs and local stream base flow.

1.3. Texas Water Development Board - Groundwater Availability Models (GAMs)

The Trinity and Woodbine aquifers are included in a Texas Water Development Board (TWDB) groundwater availability model run (GAM Run 19-016) for the northern portions of the Trinity Aquifer and Woodbine Aquifer, and the Brazos River Alluvium Aquifer. These models were used as a reference for estimating recharge from precipitation, the amount of flow into and out of the district, and the amount of inflow from overlying or underlying units. The following versions of the groundwater availability models were used GAM Run 19-016:

- 1) Version 2.01 model for the northern portion of the Trinity Aquifer and Woodbine Aquifer (Kelley, V.A., Ewing, J., Jones, T.L., Young, S.C., Deeds, N., and Hamlin, S., 2014); and
- 2) Version 1.01 of the groundwater availability model for the Brazos River Alluvium Aquifer released on December 16, 2016 (Ewing and Jigmond, 2016).

1.4. Priority Groundwater Management Area

The Texas Commission on Environmental Quality (TCEQ) designated portions of the Trinity Aquifer, including that portion within the District, as a Priority Groundwater Management Area (Appendix 10.3). This TCEQ finding indicates that the decline in groundwater levels in the Central Trinity Aquifer is a significant problem and that the decline in groundwater levels will cause groundwater availability and quality problems for the region.

2. Groundwater Management

The District has adopted rules to regulate groundwater withdrawals, primarily by means of well spacing and production limits (Appendix 10.12). The District will make periodic assessments of groundwater conditions within the District and will report those conditions to the Board. The District will undertake investigations and, to the extent appropriate, cooperate with third-party investigations, of the groundwater resources within the District, and the results of the investigations will be made available to the public.

The District has adopted rules designed to achieve the desired future conditions (DFCs) for the groundwater resources within the District, as those DFCs are agreed upon by Groundwater

Management Area 8 (GMA 8). GMA 8 has classified the Brazos River Alluvium Aquifer as non-relevant for the purposes of joint planning and has not adopted any DFCs for that aquifer. The District has designated the Woodbine Aquifer non-relevant for its planning purposes within the District. Nevertheless, due to the significant amounts of groundwater available from the Brazos Alluvium Aquifer and the Trinity Aquifer in the District, the District adopted an historic use period and provided preferential permitting rights to those well owners that can demonstrate beneficial and non-wasteful groundwater usage from the Trinity and Brazos Alluvium aquifers during that period. The District also authorizes groundwater permits to be issued that are not based on withdrawals during the historic use period. Similar approaches might be adopted for other groundwater sources within the District as well. The District may, after notice and hearing, amend or revoke any permit for non-compliance, or reduce the production authorized by permit for the purpose of protecting the aquifer and groundwater availability. The District will enforce the terms and conditions of permits and the rules of the District as authorized by Chapter 36 of the Texas Water Code.

The District will employ reasonable technical resources within its budgetary constraints to evaluate the groundwater resources within the District and to determine the effectiveness of regulatory or conservation measures.

The District will establish and enforce rules that require, among other things, the following:

1. spacing requirements for certain groundwater wells;
2. permits limiting the annual amount of groundwater that can be produced from non-exempt wells;
3. a limit on the maximum amount of groundwater permitted for withdrawal from the Hensell (upper) stratum of the Trinity Aquifer within the District;
4. a limit on the maximum amount of groundwater permitted for withdrawal from the Hosston (lower) stratum of the Trinity Aquifer within the District; and
5. a limit on the maximum amount of groundwater permitted for withdrawal from the Brazos River Alluvium Aquifer within the District.

3. Estimates of Annual Volumes of Water

The estimates of annual volumes of water discussed in this section were obtained from a report prepared by the TWDB (GAM Run 19-016 report). A copy of this report is included in Appendix 10.2. This report contains estimates of the annual amount of recharge from precipitation, annual volumes of water that discharge from aquifers to springs, annual volumes of groundwater inflow and outflow to and from aquifers and volume of flow between aquifers. All values reflect estimated groundwater flow with respect to the District's boundaries. Appendix 10.4 contains a copy of a Technical Memorandum regarding "The Brazos River Alluvium Aquifer Flow System in McLennan County, Texas". The estimates of annual volumes of water

for the Brazos River Alluvium Aquifer cited in this plan were obtained from the GAM Run 19-016 report.

3.1. Estimate of the Annual Volume of Water That Discharges from the Aquifers to Springs and any Surface Water Bodies, Including Lakes, Streams and Rivers

3.1.1. Trinity Aquifer (Paluxy, Glen Rose, Hensell, Pearsall/Cow Creek/Hammett, Sligo, and Hosston strata)

The estimate for discharges from the Trinity Aquifer to springs or surface water bodies is 0 acre-feet per year (Table 1 in Appendix 10.2).

3.1.2. Brazos River Alluvium Aquifer

The estimate of discharge from the Brazos River Alluvium Aquifer to the Brazos River to springs or surface water bodies is 13,177 acre-feet per year in McLennan County (see Table 3 in Appendix 10.2).

3.1.3. Woodbine Aquifer

The estimate of the total annual volume of water that discharges from the Woodbine Aquifer to springs or surface water bodies is 1,334 acre-feet. No discussion was provided in the report regarding the location of the discharge but it is likely much of the discharge is to seeps along the sides and beds of streams (Table 2 in Appendix 10.2).

3.1.4. All other Aquifers, Formations, or Series

The estimate of the total annual volume of water that discharges from all other aquifers, formations, or series is 0 acre-feet per year.

3.2. Estimate of the Modeled Available Groundwater in the District Based On The Desired Future Condition of the Aquifers

3.2.1. Trinity Aquifer (Hensell, Pearsall/Cow Creek/Hammett, Sligo, and Hosston Formations)

Modeled Available Groundwater for the portion of the Trinity Aquifer (Hensel and Hosston formations) within the District has been determined by the Texas Water Development Board for the year 2020 to be 20,691 acre-feet per year (Appendix 10.5).

3.2.2. Brazos River Alluvium Aquifer

In 2017, Groundwater Management Area 8 (GMA8) approved a resolution that stated that the portions of the Brazos River Alluvium, Blossom, and Nacatoch aquifers within the GMA8 planning area are “non-relevant for planning purposes” based on GMA8’s February 10, 2017

“Desired Future Conditions Explanatory Report.” which on page 66-72 states in part that “a non-relevant designation for these aquifers will not affect the desired future conditions for other aquifers in the GMA, the districts in GMA 8 have determined that these aquifers are non-relevant for joint planning.”

Nevertheless, the Brazos River Alluvium Aquifer within the District is an important renewable aquifer and has a significant amount of permitted and exempt groundwater use that, if unavailable, would place an additional burden on, and increase the rate of decline of, the Trinity aquifer. The District manages and permits all non-exempt pumping within the District’s portion of the aquifer.

While there is currently no desired future condition for the Brazos River Alluvium Aquifer, the District still uses the modeled available groundwater estimates as reported in Table 5 in GTA Aquifer Assessment 10-18 MAG (Appendix 10.6) for permitting considerations.

3.2.3. Woodbine Aquifer

Modeled Available Groundwater for the portion of the Woodbine Aquifer within the District has been determined by the Texas Water Development Board to be 0 acre-feet per year (Appendix 10.5)

3.3. *Estimate of the Amount of Groundwater Being Used within the District on an Annual Basis*

Comprehensive groundwater production and consumption data for McLennan County have been accumulated and reported by and to the District since February 2008. The District has worked each year since 2008 to improve the accuracy and completeness of the metering reports and amount of annual groundwater produced in the District. Appendix 10.8 contains records for production for the years 2010 through 2019. Appendix 10.9 contains a report evaluating the amount of agricultural land that was irrigated in 2017 and 2018 in the District (both surface water and groundwater) and was used to verify the amount of groundwater production reported to the District for agricultural use. Appendix 10.11 contains a table of the Estimated Historical Water Use prepared by the TWDB showing groundwater use in McLennan County for 2016 as 15,118 acre-feet, for 2017 as 15,861 acre-feet, and for 2018 as 14,562 acre-feet.

3.3.1. Trinity Aquifer (Paluxy, Glen Rose, Hensell, Pearsall/Cow Creek/Hammett, Sligo, and Hosston Formations)

Exempt production from the Trinity Aquifer is estimated at 200 acre-feet per year. The total amount reported of groundwater pumpage from the wells screened in the Trinity is 13,070, 13,561, 12,706, 12,505, and 13,401 acre-feet per year for 2015 through 2019, respectively (Appendix 10.8, total of Trinity and Brazos River Alluvium pumping).

3.3.2. Brazos River Alluvium Aquifer

The amount of production groundwater production from the Brazos River Alluvium aquifers was 89, 89, 137, 237, 422 acre-feet per year for 2015 through 2019, respectively (Appendix 10.8).

3.3.3. Woodbine Aquifer

There are no known non-exempt wells located in the portion of the Woodbine Aquifer within the District. The exempt use, if any, is likely less than 5 acre-feet per year.

3.3.4. All Other Aquifers and Geological Formations or Series

There is no estimate of the amount of groundwater being used within the District on an annual basis for any other aquifers or geological formations or series.

3.4. Estimate of the Annual Amount of Recharge, from Precipitation, to the Groundwater Resources Within The District

3.4.1. Trinity Aquifer (Paluxy, Glen Rose, Hensell, Pearsall/Cow Creek/Hammett, Sligo, and Hosston Formations)

There is no known recharge from precipitation to the Trinity Aquifer (Paluxy Aquifer, Glen Rose Formation, Hensell Aquifer, Pearsall/Cow Creek/Hammett/Sligo Formations and Hosston Aquifer) within the District.

3.4.2. Brazos River Alluvium Aquifer

Recharge from precipitation to the Brazos River Alluvium Aquifer is estimated to be 7,363 acre-feet per year within the District (Appendix 10.2).

3.4.3. Woodbine Aquifer

The estimate of annual recharge from precipitation to the Woodbine Aquifer within the District is 355 acre-feet (Appendix 10.2).

3.4.4. All Other Aquifers, Formations, or Series

There are no recharge estimates available from precipitation to all other aquifers, formations, or series within the District.

3.5. Estimate of the Annual Volume of Flow Into and Out of the District Within each Aquifer, and Between Aquifers, in the District

3.5.1. Trinity Aquifer

The estimated annual volume of flow into the District for the Trinity Aquifer is 12,513 acre-feet. The estimated annual volume of flow out of the District for the Trinity Aquifer is 1,251 acre-feet.

The estimate of the annual volume of flow from overlying confining units into the Trinity Aquifer (Hensell formation) is 534 acre-feet (Appendix 10.2).

3.5.2. Brazos River Alluvium Aquifer

Estimated annual volume of flow into the District for the Brazos River Alluvium Aquifer is 21 acre-feet per year, the estimated net annual volume of vertical flow between the Brazos from underlying units is 27 acre-feet per year, and the estimated annual volume of flow out of the District for the Brazos River Alluvium Aquifer is 571 acre-feet per year (Appendix 10.2). The Brazos River Alluvium Aquifer is a water table aquifer and has no overlying aquifer. It is underlain in McLennan County by slowly permeable aquitards and therefore there is no measurable vertical inflow between the Brazos River Alluvium Aquifer and overlying or underlying units (Yelderman, 2008). The GAM Run 19-016 (Appendix 10.2) simulation estimates the vertical inflow to be 27 acre-feet per year, which for all practical purposes is the same as “no measurable vertical inflow” reported by Yelderman.

3.5.3. Woodbine Aquifer

The estimated annual volume of flow into the District for the Woodbine Aquifer is 224 acre-feet. The estimated annual volume of flow out of the District for the Woodbine Aquifer is 7 acre-feet. The estimate of the annual volume of flow from the Woodbine Aquifer into the underlying Fredericksburg and Washita groups is 50 acre-feet per year, the estimated amount annual flow into the Woodbine Aquifer from younger overlying units is 76 acre-feet, and annual flow from the Woodbine aquifer to the downpied Woodbine Formation is 1 acre-foot (Appendix 10.2).

3.6. *Estimate of the Projected Surface Water Supply within the District According to the Most Recently Adopted 2017 State Water Plan*

The projected surface water supply for McLennan County ranges from 63,229 acre-feet in 2020 to 53,408 acre-feet in 2070 (see Appendix 10.11).

3.7. *Estimate of the Projected Total Demand for Water within the District According to the 2017 State Water Plan*

The 2017 State Water Plan lists the water demands within the District as 72,092 acre-feet in 2020 and increasing to 98,392 acre-feet in 2070 (Appendix 10.11).

4. Performance Standards and Management Objectives to Effectuate the Plan

The District will prepare and present an annual report to the Board of Directors on the performance of the District in regards to achieving management goals and objectives. The Board

will maintain the adopted report on file, for public inspection, at the District’s office. This methodology will apply to all management goals contained within this plan.

5. Actions, Procedures, Performance and Avoidance Necessary to Effectuate the Management Plan

The District’s rules relating to permitting, well spacing, production limits, and transportation of groundwater outside of the District will be developed consistent with this plan and in consideration of the best technical data that are reasonably available regarding the groundwater resources within the District.

The District will seek cooperation with other agencies in the implementation of this plan and the management of groundwater supplies within the District. Activities of the District will be undertaken in cooperation and coordination with the appropriate state, regional or local water management entity.

5.1. Socioeconomic Impacts

The TWDB has prepared reports on the socioeconomic impacts of not meeting the water needs identified for each of the Regional Water Planning Groups for the 2016 Regional Water Plans as adopted in the 2017 State Water Plan. The District has evaluated the development of its DFCs in the context of the recommended water management strategies proposed in the 2016 Regional Water Plan.

5.2. Interests and Rights in Private Property

The District has considered the potential impact on private property, including the ownership and rights of landowners and their lessees and assigns in groundwater within the GMA as recognized under Texas Water Code Section 36.002.

5.3. Feasibility of Achieving the Desired Future Condition

The District monitors groundwater level conditions in aquifers within the District’s boundaries, accurately obtains and measures the amount of groundwater production, and is currently meeting its “district averaged” desired future conditions

6. Evidence of Coordination and Adoption of Plan

6.1. Certified Copy of The District’s Resolution Adopting The Plan

Appendix 10.13 contains a copy of the District resolution adopting this plan.

6.2. Evidence that the Plan was adopted after Notice and Hearing

Documentation demonstrating that the plan was adopted after appropriate public notice and hearing are located at Appendix 10.14 - Evidence of Notice and Hearing.

6.3. Coordination of Management Plan with Surface Water Management Entities

The District provided a draft copy of this Management Plan to the following surface water management entities within its boundaries: the City of Waco, the City of Crawford, the City of Mart, the City of Robinson, and the Brazos River Authority and invited comments from those entities. This Management Plan was adopted on July 15, 2021 by the District's Board of Directors after a public hearing and a copy of the final plan was emailed to the City of Waco, the City of Crawford, the City of Mart, the City of Robinson, and the Brazos River Authority (see Appendix 10.7).

6.4. Copy of District's Current Rules

A copy of the District's current, existing rules is included in Appendix 10.12 or can be downloaded at <https://southerntrinitygcd.org/announcements/>.

7. Consideration of State Water Plan Water Supply Needs and Water Management Strategies

7.1. Water Supply Needs

Appendix 10.11 contains a list of the Water Supply Needs adopted in the 2017 State Water Plan for McLennan County showing a supply need (deficit) of 6,569 acre-feet per year in 2020 and 13,830 acre-feet per year in 2070. The 2017 State Water Plan lists the specific water supply needs for irrigation, manufacturing, mining, and the cities of Crawford, Elm Creek, Hewitt, Mart, Riesel, Robinson, Waco, and Woodway, and for other water supply entities such as Tri-County SUD, and North Bosque WSC, West Brazos WSC, and the City of Woodway. The District has reviewed and considered all water supply needs and information contained in the 2017 State Water Plan for McLennan County in the development of this plan.

7.2. Water Management Strategies

Appendix 10.11 contains a list of the Water Management Strategies adopted in the 2017 State Water Plan for the Region G Regional Water Planning Area and lists water management strategies including demand reduction, direct reuse, Trinity Aquifer storage and recovery (ASR), development of Carrizo-Wilcox Aquifer groundwater from Falls and Limestone counties, increased Brazos River Alluvium Aquifer groundwater within McLennan County, and increased surface water use. All of these strategies were reviewed and considered in the development of this plan.

8. Management Goals

For each of the following management goals, except to the extent that a goal is not applicable or not cost-effective, the District has identified specific objectives and listed performance standards to assess the progress of those objectives. The Board will evaluate the District's progress for attaining its management goals by periodically reviewing the performance standards and possibly modifying the management plan.

8.1. Providing the Most Efficient Use of Groundwater

In order to meet this goal, the District has established the following Management Objectives:

1. The District will continue its District Aquifer Water Level Observation Well Program with one or more observation well(s) located within the portions of the Trinity and Brazos River Alluvium aquifers within the District, and measure the depth to groundwater in each well or wells at least once annually.
2. The District will provide educational leadership to citizens within the District concerning the efficient use of groundwater. The activity will be accomplished annually through at least one printed publication, such as a brochure, and one public presentation at service organizations and/or public schools.

In order to assess the progress of the objectives listed above, the District has designated the following Performance Standards:

1. The District will continue its aquifer water level measurement program.
2. Water levels at observation wells will be measured a minimum of once annually.
3. The number of publications and speaking appearances by the District each year will be included in an annual report to the Board.

8.2. Controlling and Preventing Waste of Groundwater

In order to meet this goal, the District has established the following Management Objectives:

1. The District will provide educational leadership to citizens within the District identifying ways to minimize and avoid the waste of groundwater. This will be accomplished annually through at least one printed or on-line publication, such as a brochure, and one public presentation at service organizations and/or public schools.
2. The District will continue its Well Closure Program. The objective of the well closure program is to obtain the closure and plugging of derelict and abandoned wells in a manner that is consistent with state law, for the protection of the aquifers, the environment, and public safety. The District will conduct a program to identify, inspect, categorize and cause abandoned and derelict or deteriorated wells to be closed and plugged.

In order to assess the progress of the objective listed above, the District has designated the following Performance Standard:

1. The number of publications and speaking appearances by the District each year will be included in the annual report to the Board.
2. When applicable, the annual funding for the District's Well Closure Program, and the number of wells closed and plugged as a result of the Well Closure Program will be included in the annual report to the Board.

8.3. *Controlling and Preventing Subsidence*

This management goal is not applicable to the District. Because subsidence is not likely to affect the District, the District has not established any Management Objectives or Performance Standards for this conservation goal. Subsidence is unlikely to occur in the District. The geologic formations in the District range in age from Cretaceous (sandstones, limestones and shales of the Hosston, Hensell, Paluxy and Woodbine formations) to Quaternary (floodplain deposits of the Brazos River Alluvium). The Cretaceous formations are generally consolidated to semi-consolidated, and have little potential for compaction and subsidence due to groundwater withdrawals. The Brazos River Alluvium is poorly consolidated, but generally too thin to experience measurable (if any) subsidence due to groundwater withdrawals.

The District has reviewed the TWDB subsidence risk report "*Identification of the Vulnerability of the Major and Minor Aquifers of Texas to Subsidence with Regard to Groundwater Pumping*" (<http://www.twdb.texas.gov/groundwater/models/research/subsidence/subsidence.asp>). This report found four locations with Texas with observed subsidence and none of these areas were within STGCD. Figure 4.49 on page 4.79 shows the Trinity Aquifer to have a subsidence risk ranging from low-medium to high-medium, and Figure 4.68 on page 4.110 shows the Brazos River Alluvium Aquifer to have a subsidence risk ranging from medium to high-medium. Both the Trinity and the Brazos Alluvium aquifer underly vast areas of Texas with significant differences in subsidence potential. For the reasons discussed the risk of any subsidence caused by groundwater pumping of the Trinity and Brazos Alluvium aquifers within the District's boundaries is very low. If any subsidence should be reported to the District the District will investigate, and if warranted, update its management plan to include a management objective to address such subsidence.

8.4. *Addressing Conjunctive Surface Water Management Issues*

In order to meet this goal, the District has established the following Management Objective:

Each year the District will participate in one or more meetings of the McLennan County Water Resources Group except for years when the group does not meet. The McLennan

County Water Resources Group is administrated by McLennan County (<https://www.co.mclennan.tx.us>).

In order to assess the progress of the objective listed above, the District has designated the following Performance Standard:

The number of meetings and other information regarding the McLennan County Water Resource Group will be included in the annual report to the Board.

8.5. Addressing Natural Resource Issues that Impact the Use and Availability of Groundwater and which are Impacted by the Use of Groundwater

In order to meet this goal, the District has established the following Management Objectives:

1. At least once per year, the District will contact a representative of the Texas Railroad Commission (RRC) to confer on the impact of oil and gas production on groundwater availability and quality, as well as the impact of groundwater production on the production of oil and gas in the District.
2. Also, during each year the District will evaluate permit applications for new wells, if any are filed, and the information submitted by the applicants on those wells prior to drilling, in order to assess the impact of these wells on the groundwater resources in the District.
3. The District reviewed the Texas and Wildlife endangered species list for McLennan County (<https://tpwd.texas.gov/gis/rtest/>) and found no species that would be affected by the District's groundwater management plan or rules.

In order to assess the progress of the objectives listed above, the District has designated the following Performance Standards:

1. The number of conferences with a representative of the RRC each year will be included in an annual report to the Board.
2. Annual reports to the District's Board of Directors on the number of new well permit applications on file, the number of evaluations and the possible impacts of those new wells on the groundwater resources in the District.

8.6. Addressing Drought Conditions

In order to meet this goal, the District has established the following Management Objective:

The District will track rainfall records from nearby weather stations on an ongoing basis. This data will be compared to hydrographs in monitoring wells used by the District. Additionally, the District will monitor the drought reports provided at the following internet sites:

<https://www.waterdatafortexas.org/drought>.

<https://www.drought.gov/drought/data-maps-tools/current-conditions>

The District staff will provide in its annual report in January the precipitation amounts, water levels and any apparent associated trends. Upon Board approval, the District's web site and/or local newspapers will disseminate information to the public.

In order to assess the progress of the objective listed above, the District has designated the following Performance Standard:

Report on precipitation amounts as compared to water levels within the District; and, manner and timing of distribution of precipitation and water level data to the public.

8.7. *Addressing Conservation, Recharge Enhancement, Rainwater Harvesting, Precipitation Enhancement, or Brush Control, where Appropriate and Cost Effective*

In order to meet this goal, the District has established the following Management Objective:

The District will provide educational leadership to citizens within the District concerning groundwater conservation, rainwater harvesting, and brush control. The educational efforts will be through at least one printed publication, such as a brochure, and at least one public speaking program at a service organization and/or public school. Each of the following topics will be addressed:

A. Conservation of groundwater

The District will provide educational leadership to citizens within the District concerning groundwater conservation. The educational efforts will be through at least one printed publication, such as a brochure, annually and at least one public speaking program at a service organization and/or public school annually.

B. Rainwater Harvesting

The District will provide educational leadership to citizens within the District concerning, rainwater harvesting. The educational efforts will be through at least one printed publication, such as a brochure, annually and at least one public speaking program at a service organization and/or public school annually.

C. Brush Control

The District will provide educational leadership to citizens within the District concerning brush control. The educational efforts will be through at least one printed publication, such as a brochure, annually and at least one public speaking program at a service organization and/or public school annually.

In order to assess the progress of the objectives listed above, the District has designated the following Performance Standard:

The number of brochures issued and the number of public speaking programs regarding water conservation, rainwater harvesting, and brush control will be included in the annual report to the District's Board.

8.7.1. Recharge Enhancement

The District has opted to not include in this plan any management objectives related to recharge enhancement because the District does not consider these measures to be appropriate or cost effective for the District. Therefore, this goal is not applicable to the District at this time.

8.7.2. Precipitation Enhancement

The District has opted to not include in this plan any management objectives related to precipitation enhancement because the District does not consider these measures to be appropriate or cost effective for the District. Therefore, this goal is not applicable to the District at this time.

8.8. *Addressing the Desired Future Condition of the Groundwater Resources in the District*

Groundwater Management Area 8 has established Desired Future Conditions (DFC) for the Trinity and Woodbine aquifers within the District.

8.8.1. Trinity Aquifer (Paluxy, Glen Rose, Hensell, Pearsall/Cow Creek/Hammett, Sligo, and Hosston Formations)

Currently there is no significant use of water from the Paluxy or Glen Rose formations in McLennan County. Groundwater wells in the Trinity Aquifer are completed in a variety of ways and may be open, perforated, or screened in both the Hensell and Hosston formations. The DFC for the planning period of 2010 through 2070 (61 years) of is 542 feet of drawdown for the Hosston formation and 220 feet of drawdown for the Hensell formation (GMA8 2017, Table 4). The District will limit the total amount of groundwater produced or withdrawn from the portion of the Trinity Aquifer within the District as necessary to limit the drawdown in such formations to achieve the respective DFC.

In order to meet this goal, the District has established the following Management Objective:

The District will measure the water level in one or more wells open, perforated, or screened in the portion of the Paluxy, Glen Rose, Hensell and/or Hosston formations within the District and shall calculate the annual and cumulative drawdown and provide such information to the District's Board of Directors.

In order to assess the progress of the objectives listed above, the District has designated the following Performance Standard:

The District will provide a report analyzing of the effects of pumping on groundwater levels, including the annual and cumulative drawdown statistics, in the annual report to the District's Board of Directors.

8.8.2. Woodbine Aquifer

The Woodbine Aquifer is a minor aquifer that extends only into a very small portion of the northernmost part of McLennan County. The outcrop of the Woodbine occurs within the District boundaries but is covered by alluvium over much of its area. There is no or very little use of the groundwater in the portion of the Woodbine Aquifer within McLennan County and currently the District is not aware of any well that is operational in the portion of the Woodbine Aquifer that is located within the District. The average DFC for the Woodbine formation is 6 feet of drawdown per 50 years. The District will limit the total amount of groundwater produced or withdrawn from the Woodbine Aquifer as necessary to meet the DFCs.

In order to meet this goal, the District has established the following Management Objective:

The District will locate a well screened in the Woodbine Aquifer and will annually collect the water level in one or more wells open, perforated or screened in the Woodbine Aquifer, and shall calculate the annual and cumulative drawdown and provide such information to the District's Board of Directors.

In order to assess the progress of the objectives listed above, the District has designated the following Performance Standard:

The District will provide an analysis report of the effects from pumping on groundwater levels, including the annual and cumulative drawdown statistics in the annual report to the District's Board of Directors.

9. References

Byrd, C. Leon, 2011, Texas Commission on Environmental Quality, Updated Evaluation for the Central Texas Trinity Aquifer Priority Groundwater Management Area, 154 p.

Cronin, James G. and Wilson, Clyde A., 1967, Ground Water in the Flood-plain Alluvium of the Brazos River, Whitney Dam to vicinity of Richmond, Texas, Texas Water Development Board, Report 41, 206 p.

Ewing, John E. and Jigmond, M., 2016, Final Numerical Model Report for the Brazos River Alluvium Aquifer Groundwater Availability Model, Intera Inc., 357 p.

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 – Final Model Report, 984 p.,

GMA 8, 2017, Desired Future Condition Explanatory Report.

Nordstrom, Phillip, 1982, Texas Water Development Board Report 269, Occurrence, Availability, and Quality of Groundwater in the Cretaceous Aquifers of North-Central Texas. 61 p.

Turco, M. J., East, J. W. and Milburn, M. S., 2011, Baseflow (1966-2005) and streamflow gain and loss (2006) of the Brazos River, McLennan County to Fort Bend County, Texas: U. S. Geological Survey Scientific Investigations report 2011-5286, 27p.

Yelderman, Joe, October, 2008, Brazos River Alluvium Flow System – Technical Memorandum and Personal Communications Regarding the Hydrology of the Portion of the Brazos River Alluvium Aquifer within McLennan County (see Appendix 10.4).