Hays Trinity Groundwater Conservation District

GROUNDWATER MANAGEMENT PLAN

January 28, 2016

Board of Directors
Linda Kaye Rogers, President: *Precinct 4*
Jimmy Skipton, Vice President: *Precinct 1*
Mark Hastings, Treasurer/Secretary: *Precinct 3*
Doc Jones, Board Member: *Precinct 5*
Greg Nesbitt, Board Member: *Precinct 2*

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Prepared by the Hays Trinity Groundwater Conservation District with valuable assistance from
The Texas Water Development Board

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TIME PERIOD FOR THIS PLAN

This plan complies with the requirements of Texas Administrative Code (TAC): Title 31 Natural Resources and Conservation, Part 10 Texas Water Development Board, Chapter 356 Groundwater Management, Subchapter A Groundwater Management Plan approval 31 TAC §356. This plan becomes effective upon adoption by the Hays Trinity Groundwater Conservation District Board of Directors (Board) and approval as administratively complete by the Texas Water Development Board (TWDB). This plan will be in effect for five years from the date of TWDB approval in accordance with 31 TAC §356.5(a). After five years, this plan will be reviewed for conflict with the applicable regional water plans and the State Water Plan and shall be readopted with or without amendments. The plan may be revised at any time in order to avoid conflict or as necessary to address any new or revised data, GAM updates, or District management strategies.

DISTRICT MISSION

Given the critical importance of water to life and of that part of the water cycle called groundwater to local families, agriculture, commerce, stream flows and wildlife habitat, the Hays Trinity Groundwater Conservation District works to conserve, preserve, recharge and prevent waste of groundwater within western Hays County. To help accomplish these goals, the District is charged to gather information needed for sound decisions, to provide that information to citizens and local agencies, and to ensure that groundwater is used efficiently and at sustainable rates.

GENERAL DESCRIPTION OF THE DISTRICT

The Hays Trinity Groundwater Conservation District (District) is a political subdivision of the State of Texas. It was created in Chapter 1331, Acts of the 76th Legislature, Regular Session, 1999 and in Act of May 27, 2001, 77th Legislature, Regular Session, Chapter 966, Part 3, 2001 Texas General Laws 1880 (S.B. 2) (collectively, enabling legislation). The District was confirmed by popular election on May 3, 2003. The District's enabling legislation and Texas Water Code Chapter 36 authorize the District to make and enforce rules that are reasonably consistent with this management plan and the District's guiding principles. The District encompasses the western 55.15 percent (from TWDB), approximately 370 square miles, of Hays County (Figure 1). The District is divided into five single member districts for Board of Directors' representation, each with a population, according to the 2010 Census, of approximately 7,300 (Figure 2).

The District is bounded in the west by Blanco County (BPGCD), to the southwest by Comal County (CTGCD, a recently created groundwater district), to the north by Travis County (no groundwater conservation district) and to the southeast by eastern Hays County (BSEACD). It should be noted that the Edwards Aquifer Authority (EAA) overlays the southern portion of eastern Hays County with authority over the Edwards Aquifer (Figure 3). Boundaries and drilling development in neighboring counties or districts are critical to HTGCD groundwater management. Unregulated pumping in Travis County for example has lowered the water table in Hays County and may be responsible for dewatering the Middle Trinity Aquifer along the northeast margin of the HTGCD.

SINGLE MEMBER BOARD DISTRICTS AND TERM EXPIRATION DATES

The Board of Directors in fiscal year 2016 is composed of

- Linda Kaye Rogers: President: Single Member District 4: ………..Term expires November 2016
- Jimmy Skipton: Vice president: Single Member District 1…..……..Term expires November 2018
- Mark Hastings: Treasurer/Secretary: Single Member District 3…..Term expires November 2018
- Doc Jones: Board Member: Single Member District 5……………..Term expires November 2018
- Gregory Nesbitt: Board Member: Single Member District 2…..…Term expires November 2016

Special District Local Laws Code – Chapter 8843 Sec.8843.051, Composition of Board; Terms (b):
Directors serve staggered four-year terms
Effective September 1, 2013

Special District Local Laws Code – Chapter 8843 Sec.8843.053, Election Date
On the uniform election date in November of each even-numbered year, the appropriate number of directors shall be elected
Effective September 1, 2013

Groundwater Management Plan - Record

HTGCD Board Adoption	TWDB Approval
2005 Plan: August 4, 2005	October 7, 2005
2011 Plan: March 20, 2011	May 23, 2011
2016 Plan: January 21, 2016	XXXX, 2016

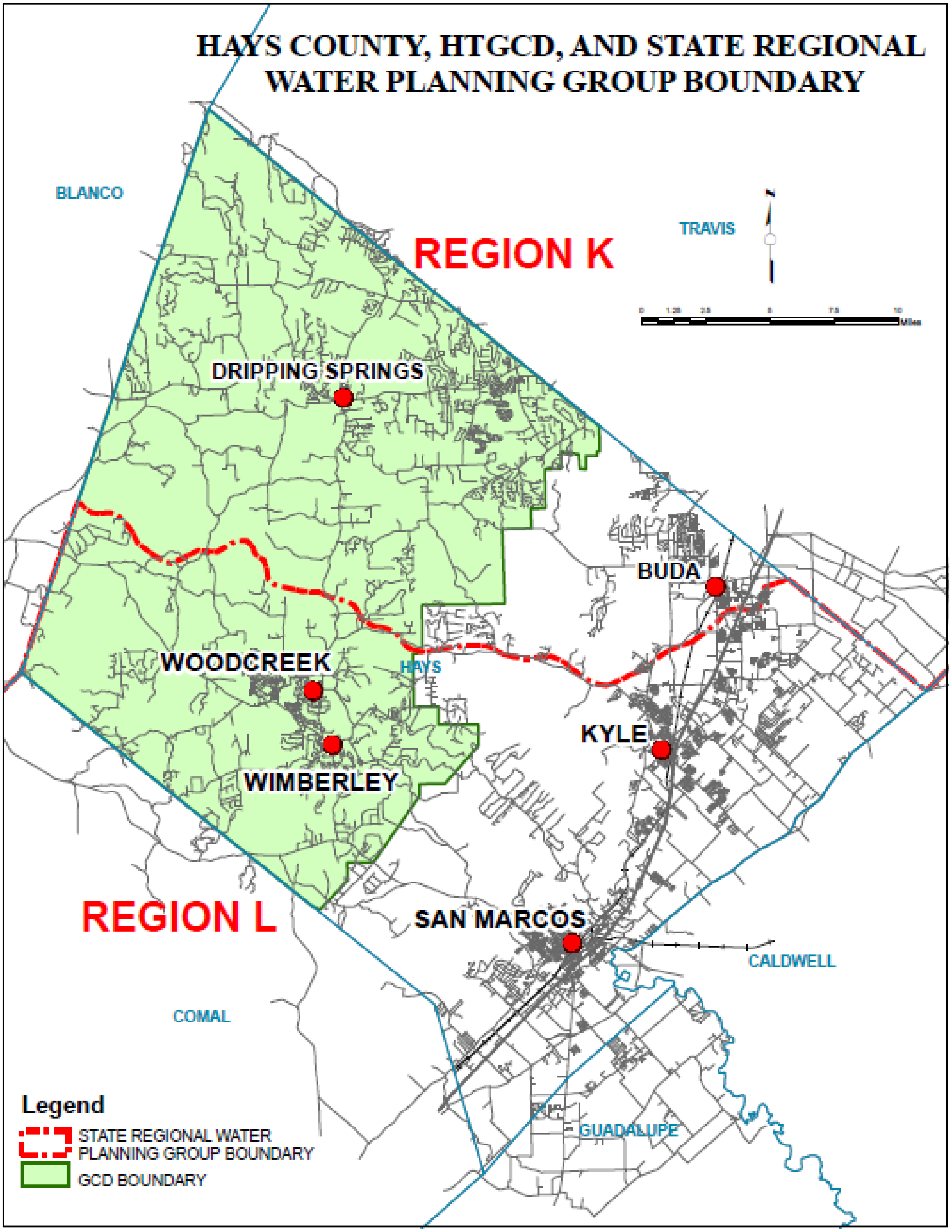

Figure 1: Hays County, HTGCD, and State Regional Water Planning Group boundaries.
Map provided by Hays County Development Services / GIS, Marty Munoz

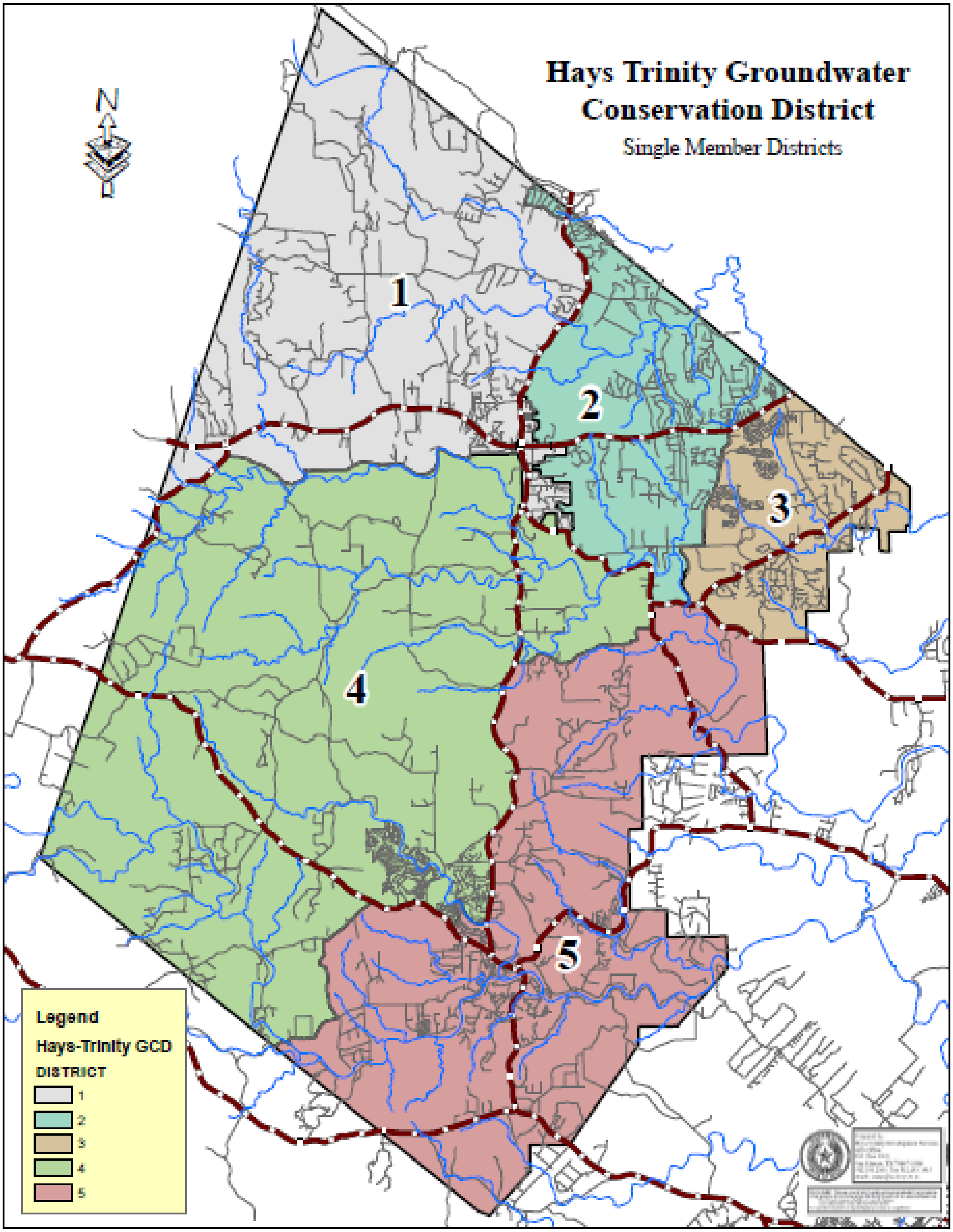

Figure 2: Single member districts within the District. (Major roads indicated by red dashed lines)
Map Provided by Hays County Development Services / GIS, Marty Munoz

STATEMENT OF GUIDING PRINCIPLES

The District has a goal of sustainable management of the Trinity Aquifer including a reasonable balance between groundwater supply for the community and maintaining base flow contribution to streams that preserve a sound ecological environment. The guiding principles will serve as a basis for the development and adoption of District policies and rules to achieve these goals. Guiding principles include but may not be limited to:

- Manage the use of the aquifer for the benefit of the people of the District while maintaining sufficient quantity of water in the sub-aquifers to maintain spring and stream flows during periods of drought
- Maintain and prevent water quality degradation in surface water and groundwater
- Consider preservation of historic use of groundwater
- Prevent waste of groundwater
- Minimize the reduction of artesian pressure
- Promote groundwater conservation and drought-response action through voluntary measures for exempt wells not regulated by the District
- HTGCD Rules with applicable penalties to enforce well production curtailment and conservation for non-exempt permit holders during declared drought stages
- Encourage the use of rainwater collection systems and other collection and retention systems
- Cooperate with surface water providers to facilitate the economically sustainable management of groundwater resources and the equitable distribution of surface and groundwater resources
- Consider mandatory conservation and drought response actions for non-exempt wells regulated by the District specifically designed for action during “drought of record”
- Promote artificial recharge of the aquifer through such means as proper brush management, re-establishing deep rooted native grasses and creation of surface water runoff collection/infiltration dams
- Continue to develop groundwater production limits based on scientific study of the aquifer, modeled available groundwater, and a focus on areas/zones of critical depletion

ACTIONS, PROCEDURES, PERFORMANCE AND AVOIDANCE NECESSARY TO EFFECTUATE THE GROUNDWATER MANAGEMENT PLAN

The District shall use this plan as a guide for policies and actions undertaken by the District. To address potential groundwater quantity and quality issues, the District is committed to, and will actively pursue, the groundwater management strategies identified in this groundwater management plan. The District Rules, policies, and activities will be coordinated with the management plan in order to effectively manage and regulate:

- Well drilling and spacing
- Groundwater production within the District
- Water quality in groundwater and surface water
- The potential transfer of water out of the District

In following this management plan the District may develop rules, policies and activities to:

- Encourage conservation practices and efficient water use
- Guide the development of drought contingency and management plans
- Collect and interpret water level, hydrogeologic and drilling data
- Provide for the District's management and regulation of identified critical groundwater depletion areas within the District
- Promote the development and use of rainwater systems to relieve demands on groundwater

To the greatest extent practical, while upholding the intent of the District's Mission, Management Plan and Rules, (posted on HTGCD website http://haysgroundwater.com/files/Rules/2014RuleUpdate_Final2.pdf), the District will strive to cooperate with and coordinate its management plan and regulatory policies with adjacent groundwater districts, regional water planning groups, TWDB, Hays County, local municipalities, and adjacent counties with aquifers that are hydraulically connected to aquifers within the District's jurisdiction.

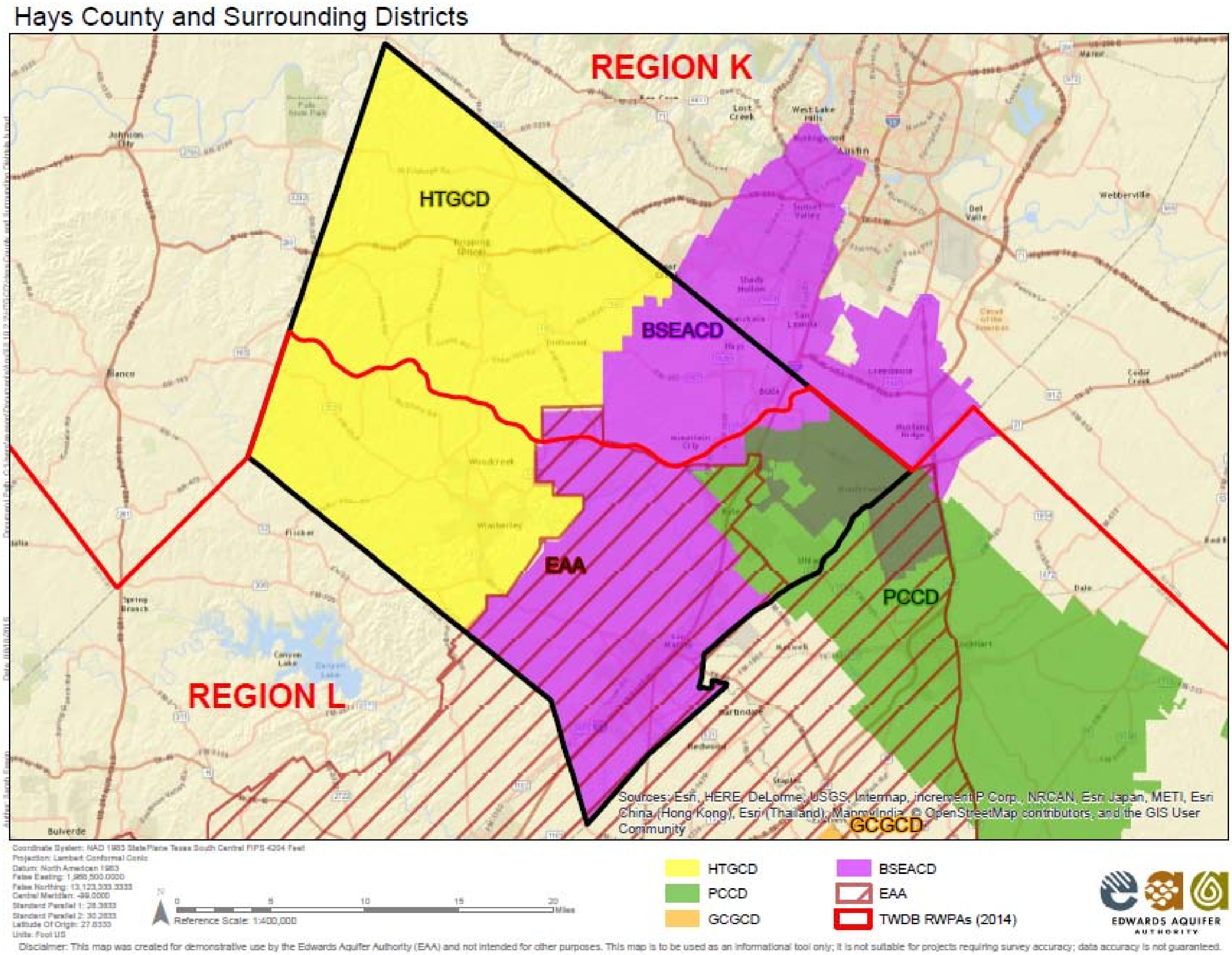

Figure 3: Hays County, local groundwater districts, and Regional Water Planning Group boundaries.
Map Provided by EAA, GISP / Sarah Eason

DISTRICT PLANNING APPROACH

Hays County is one of the few counties divided by two RWPGs: the Lower Colorado Region (Region K) in the north, and the South Central Texas Region (Region L) in the south. The County is also divided by two groundwater management areas: Groundwater Management Area 9 in the west and Groundwater Management 10 in the east. In addition to the Hays Trinity Groundwater Conservation District, the County also includes three other groundwater conservation districts: the Edwards Aquifer Authority, the Plum Creek Conservation District and the Barton Springs Edwards Aquifer Conservation District (Figure 3). The drainage divide between the Colorado and Guadalupe River basins defines the shared boundary of regions K and L within Hays County. Based on GIS analysis conducted by Turner, Collier and Braden during the original 2005 preparation of this plan, the jurisdiction of the District covers approximately 76 percent of the Region K area and 38 percent of the Region L area within Hays County (Figure 1). In contrast to the whole county, the area of the District itself (370 square miles) is divided between Region K and L in the following ratio: 61 percent (226 square miles) Region K and 39 percent (144 square miles) Region L (Figure 4). The HTGCD is a participating member of Groundwater Management Area 9 (GMA9) and its regional planning approach is in consultation with the other member districts. In addition, the District is located within the Hill Country Priority Groundwater Management Area, which is an area designated under Texas Water Code Chapter 35 as an area experiencing or expected to experience critical groundwater shortages (Cross and Bluntzer, 1990).

The District is required to use the best available data in developing the Management Plan. Accordingly, in the adoption of this plan the District has used:

- Groundwater Management Plan Data Package:
  1) Estimated Historical Groundwater Use & 2012 State Water Plan Datasets (June 2015), TWDB
  2) GAM Run 15-005, HTGCD Management Plan (March 2015), TWDB
- TWDB, "GAM Task 10-005" (GMA9, Trinity Aquifer), 2010, Hutchison
- Groundwater Availability Model for the Hill Country Portion of the Trinity Aquifer System, Texas, 2011, Jones, Anaya and Wade, TWDB 337
- Planning information from the 2016 regional water plans for Region K (LCRWPG, 2015) and Region L (SCTRWPG, 2015) and the 2012 State Water Plan (TWDB);
- Adjoining groundwater conservation districts' adopted groundwater management plans (BPGCD, 2014; CCGCD, 2010; HCUWCD, 2013; BSEACD, 2013; HGCD, 2013);
- Hydrogeological Atlas of the Hill Country Trinity Aquifer, Blanco, Hays and Travis Counties Central Texas, D.A. Wierman, A.S. Broun and B.B. Hunt, July 2010
- Data from regional surface water providers such as the West Travis County PUA and the LCRA; and
- Site-specific data developed by the District.

This plan serves as a basis for the development and revision of existing rules and adoption of new District rules. The Board adopted District rules on August 8, 2001, which were amended on March 29, 2004, March 9, 2005 and May 5, 2005, June 14, 2007, September 17, 2009, December 17, 2014.

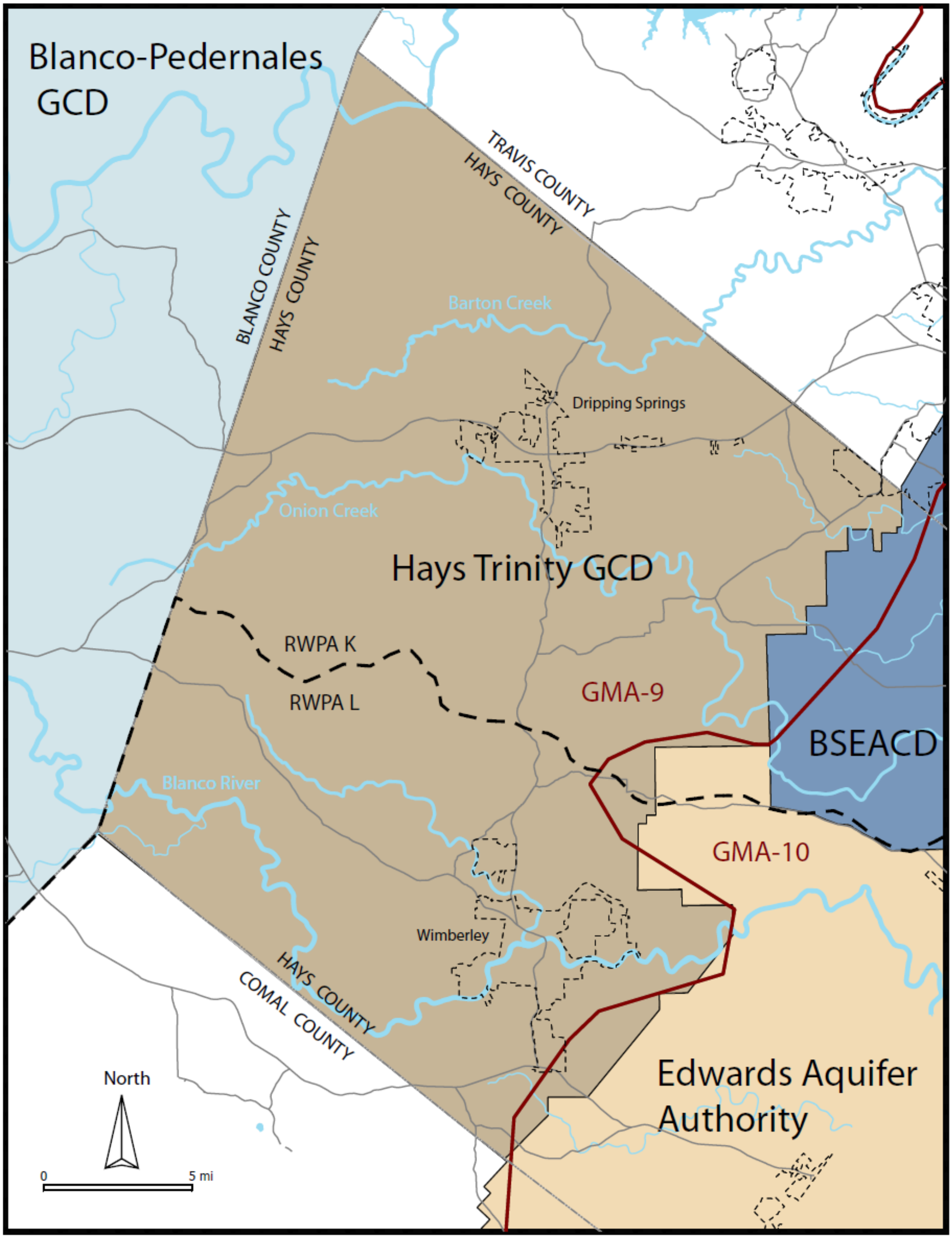

Figure 4: HTGCD, Groundwater Management Areas & RWPA boundaries within Hays County, 2014. BSEACD Boundary now overlays the EAA Boundary within Hays County, 2015 (Figure 3).

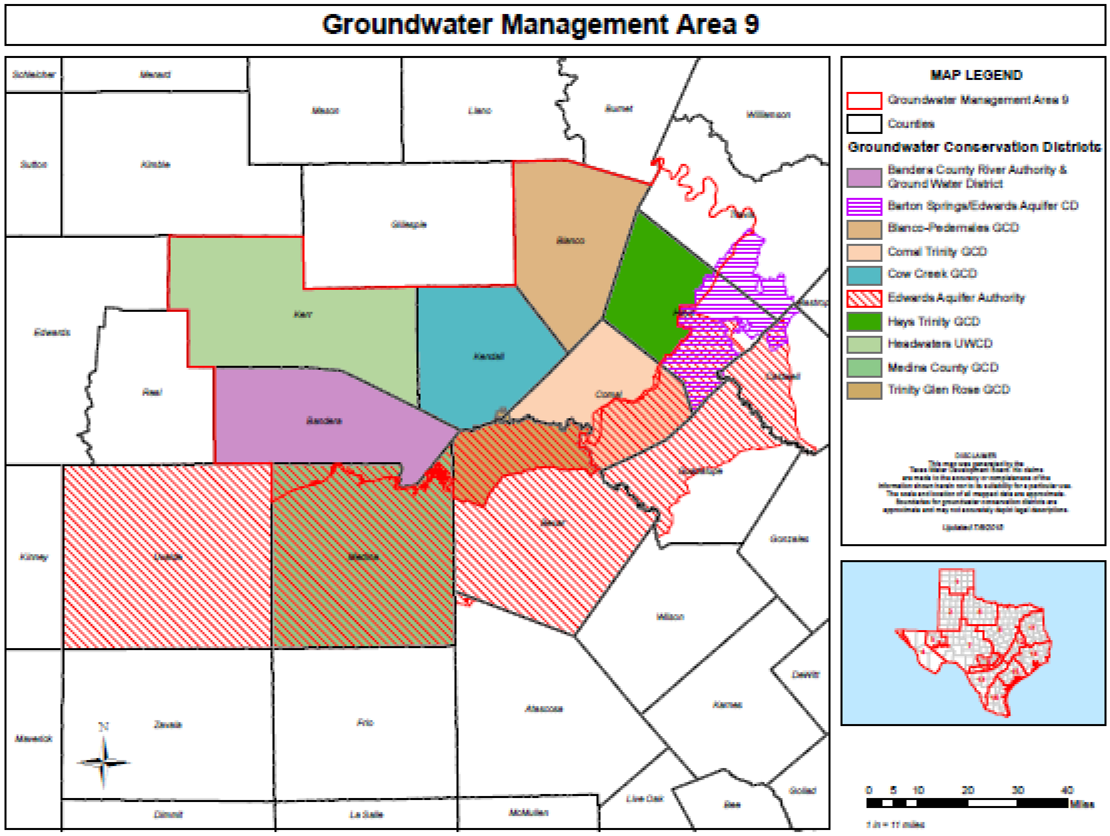

Figure 5: GMA9 Map Boundaries.

Topography and Drainage

Elevation in the District ranges from a low of about 700 feet above sea level where the Blanco River leaves the District to approximately 1,600 feet above sea level, along ridge summits of the Guadalupe River-Colorado River drainage divide.

The District is drained by two major river basins, the Colorado River basin in the north and the Guadalupe River basin in the south. Several smaller watersheds, including the Pedernales River, which drains the northern tip of the county, and Barton Creek and Onion Creek, which drain the north-central part of the county, comprise the Colorado River watershed. The Blanco River basin is located within the Guadalupe River basin. The Blanco River joins the San Marcos River approximately three miles east of San Marcos before joining the Guadalupe River near Gonzales, Texas.

The District's major geomorphic feature is the eroded margin of the Edwards Plateau: an elevated structure comprised of Cretaceous age limestone, marl, and dolomite extending from the Balcones escarpment to the high western interior plains of Texas. The eroded margin of the plateau is bounded by the Balcones Escarpment to the southeast and the undisturbed portions of the plateau to the west. The District's major structural geologic feature is the San Marcos Arch, a SE-NW plunging antiform nose of the Llano Uplift (Adkins, 1932). The Llano Uplift is a positive Paleozoic feature located northwest of the District that influenced the deposition of Lower Cretaceous sediments (Sellards, 1932).

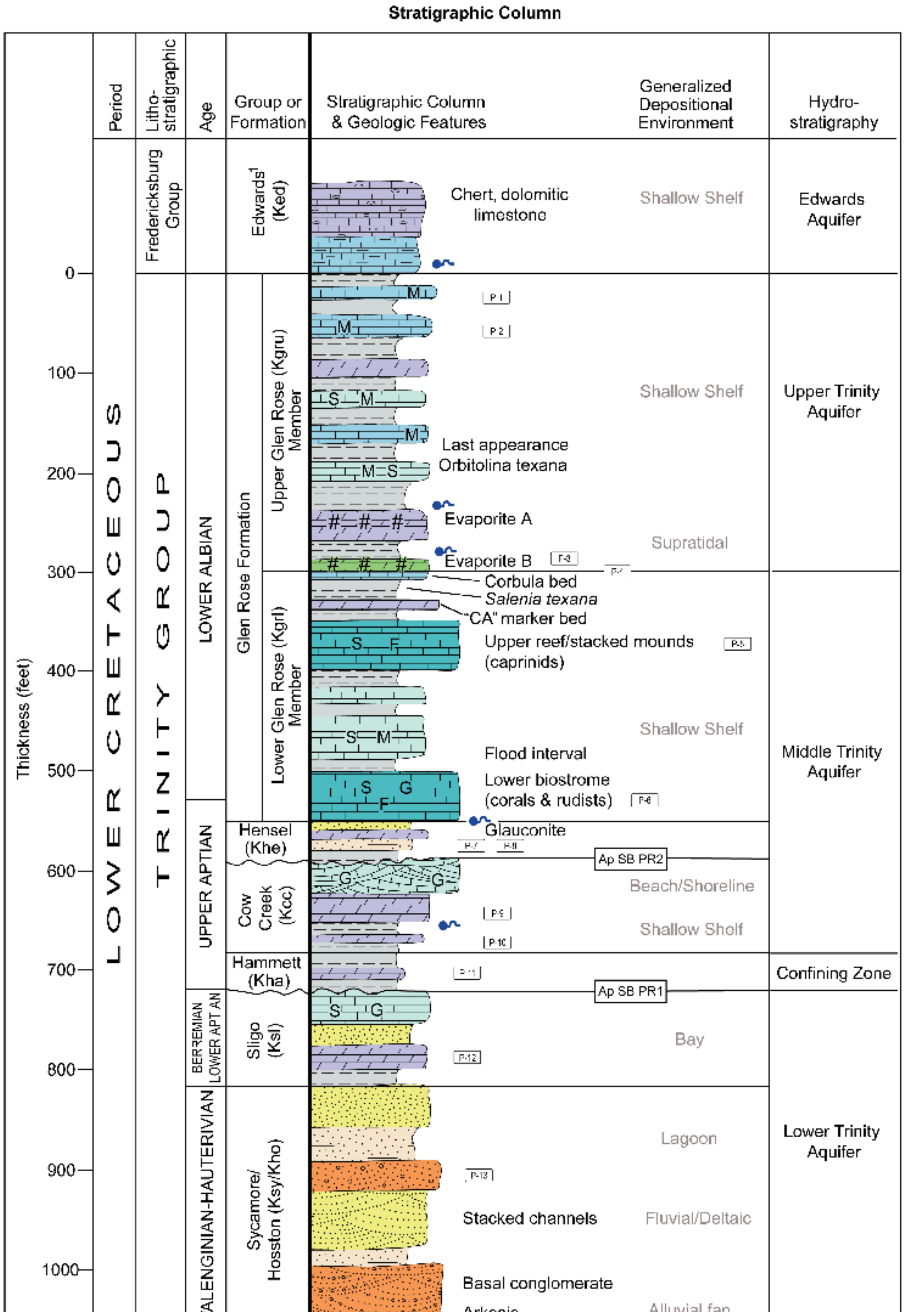

Figure 6: Stratigraphic and hydrostratigraphic section of the Hill Country Trinity (from Hydrogeologic Atlas).

GROUNDWATER RESOURCES OF THE DISTRICT

Trinity Aquifer System

The Trinity Aquifer is the sole aquifer providing groundwater to District residents. It is divided into three hydrostratigraphic units, the Upper, Middle, and Lower Trinity (Figure 6). Together, these aquifers behave as a more or less semi-confined or leaky aquifer system (Ashworth, 1983; Muller and McCoy, 1987). Each of these aquifers has a characteristic hydrostatic pressure head (water level). The Lower Trinity Aquifer has the lowest hydrostatic head while the Middle and Upper Trinity aquifers have respectively higher heads. This relationship of water levels can be interpreted to mean that groundwater moves downward at a very slow rate through the low-permeability strata (aquitards) to the aquifers below, while typically moving laterally at higher rates (Muller and McCoy, 1987; Muller, 1990).

The Trinity Aquifer is recognized as a major aquifer by TWDB (Ashworth and Hopkins, 1995). A major aquifer produces large quantities of water over a large area. In local areas, the Trinity Aquifer acts like a minor aquifer in that it yields a small amount of water over a large area or a large amount of water over a small area. Yields in the aquifer can vary considerably over short distances due to heterogeneities in the water bearing formations, fracture controlled flow, and dissolution features, as well as lithology (Mace *et al.*, 2000). The Middle Trinity Cow Creek formation is the primary groundwater producer in western Hays County. Two important artesian springs, Pleasant Valley Spring and Jacobs Well Spring, are believed to be sourced from the Cow Creek. Groundwater production from Trinity Aquifer wells in the District is used primarily for municipal, rural domestic, and livestock demands although there has been a marked increase in use for vineyard cultivation over the past decade.

Upper and Middle Trinity Aquifers

Aquifer thickness for the combined Upper and Middle Trinity Aquifers within the District ranges from 400 to 600 feet, but varies according to topography and geology. The section thickens basinwards, from west to east.

The Upper Trinity Aquifer is composed of the upper member of the Glen Rose Limestone (Ashworth, 1983). In Hays County, the upper member consists of alternating beds of marl, dolomitic shale, dolomite and nodular limestone. In addition, the basal section contains two distinct evaporite zones composed of dolomite, dolomitic mudstone and anhydrite beds (Stricklin *et al.*, 1971; Bluntzer, 1992). The Middle Trinity Aquifer in Hays County is composed of (from youngest to oldest) the lower member of the Glen Rose Limestone, the Hensel formation, and the Cow Creek formation (Figure 6) (Ashworth, 1983). The division between the Upper and Lower Glen Rose Limestone / Upper and Middle Trinity Aquifers, is defined by a laterally continuous limestone bed of "*Corbula martinae*" fossils (Whitney, 1952; Stricklin *et al.*, 1971; Bluntzer, 1992). In some hill-top areas, the Upper Trinity Aquifer (Upper Glen Rose member) is capped by an erosional remnant of the Edwards Group. The primary sources of recharge to the Trinity Aquifer are from rainfall on the outcrop and infiltration through creek bottoms along losing sections of headwater creeks (DeCook, 1960; Mace *et al.*, 2000). The outcrops that receive the most direct recharge are composed of the Glen Rose Limestone and Hensel formation. Beds of relatively low-permeability marl sediments within the upper member of the Glen Rose Limestone impede downward percolation of interstream recharge and provide for baseflow and springflow to the mostly gaining perennial streams that drain the Hill Country (Mace *et al.*, 2000). Recent surface studies have identified fracturing in the more competent limestone and dolomite units. These structural features may provide pathways for vertical fluid migration (Onion Creek Project, in progress). The extent of the Upper Trinity sub-aquifer is limited areally and generally behaves as an unconfined aquifer. The Middle Trinity sub-aquifer may behave locally as an unconfined aquifer, but more typically the Lower Glen Rose and Cow Creek, behave as confined to semi-confined aquifers.

Ashworth (1983) reports that in some areas, "caverns formed by the solution of limestone and evaporite by groundwater are common in the Trinity formations, particularly in the Glen Rose Limestone. These caverns are characteristically influenced by the jointing structure of the limestone and may extend both vertically and laterally for great distances and provide major conduits for the flow of ground water. When caverns grow to such a size as to no longer support their overburden, they collapse thus forming sinkholes that are visible from the surface as circular depressions that may transmit large quantities of surface water to a passage below ground. Sinkholes are a common occurrence in streambeds flowing over the Glen Rose Limestone and provide a passageway for a substantial amount of recharge to the aquifer."

Lower Trinity Aquifer

The Lower Trinity Aquifer in Hays County is a confined aquifer separated from the Middle Trinity Aquifer by the Hammett formation, which acts as a confining bed (aquitard) and typically ranges in thickness from 30 to 60 feet. Below the Hammett shale are the Lower Trinity Aquifer members: the Sligo formation, a sandy, dolomitic limestone of 50 to 70 feet in thickness; and the Hosston/Sycamore, sandstone, shale, dolomite and conglomerate formation of 150 to 250 feet in thickness (Figure 6) (Stricklin *et al.*, 1971). The Lower Trinity yields small to large quantities of fresh to slightly saline water (Bluntzer, 1992). Isotope age dating of waters from the different sub-aquifers in the Trinity have shown the Lower Trinity water to be much older than the Middle Trinity water (HTGCD Isotope Study press release 2009). Over the past 10-15 years the Lower Trinity Aquifer has taken on a greater role in providing groundwater to residents of western Hays County. Production is primarily from Hosston coarse, siliciclastic conglomerate. Water quality may be poor with high total dissolved solids (TDS) concentrations and sulfate concentrations.

Regional Groundwater Flow

According to Ashworth (1983), "Water entering the Trinity Aquifers generally moves slowly down-dip to the south and southeast. Regional water-level measurements indicate an average water-table gradient of 20 to 25 feet per mile. In areas of continuous pumpage, however, the groundwater will flow towards these points of discharge. Locally, groundwater movement is also toward the points of natural discharge through springs."

Groundwater flow in the District generally follows the structural dip of the Trinity rocks from northwest to southeast until intersecting the northeast striking Balcones Fault Zone (BFZ). Down-dropped fault blocks along the BFZ created a juxtaposition of younger Edwards Aquifer bedrock against older Trinity rocks. (after Hydrogeologic Atlas of the Trinity Aquifer, 2010).

Along the District's eastern boundary, the Upper and Middle Trinity aquifers contribute groundwater to the Edwards Aquifer along the BFZ. Hydraulic and chemical studies have focused on the Glen Rose Limestone as the main source of Trinity Aquifer flow to the Edwards (BFZ) Aquifer (Long, 1962; Walker, 1979; Senger and Kreitler, 1984; Veni, 1994; Mace *et al.*, 2000). The volume of Trinity Aquifer water that recharges the Edwards (BFZ) Aquifer is not well understood, but most estimates indicate that it constitutes a small percentage of total recharge to the Edwards (BFZ) Aquifer (Lowry, 1955; Woodruff and Abbott, 1986; LBJ-Guyton Associates, 1995; Mace *et al.*, 2000). Mace *et al.* (2000) note that "part of this groundwater moves into the Edwards through faults, and part continues to flow in the Trinity Aquifer beneath the Edwards." Recent exploration drilling in the area (2013-2015) has encountered substantial flows of groundwater in the Middle Trinity, Cow Creek formation. The Trinity Hill Country GAM (TWDB) was calibrated with 12 percent and 14 percent of the precipitation recharge to the Upper and Middle Trinity aquifers, respectively, discharging to the Edwards (BFZ) Aquifer (Mace, 2003).

Definitions of Planning Estimates and Projections

TWDB rules require that groundwater conservation district management plans address specifically defined estimates and projections relating to present and projected water use. Definitions of these categories of estimates and projections taken from 31 TAC §356.1–356.10 and from the TWDB planning division data table definitions.

<u>Amount of groundwater being used</u>
The quantity of groundwater withdrawn or flowing from an aquifer naturally or artificially on an annual basis.

<u>Artificial recharge</u>
Increased recharge accomplished by the modification of the land surface, streams, or lakes to increase seepage or infiltration rates or by the direct injection of water into the subsurface through wells.

<u>Projected Water Demands</u>
From the 2012 State Water Plan Glossary: "**WATER DEMAND-** Quantity of water projected to meet the overall necessities of a water user group in a specific future year." (See 2012 State Water Plan Chapter 3 for more detail.)
Additional explanation: These are water demand volumes as projected for specific Water User Groups in the 2011 Regional Water Plans. This is NOT groundwater pumpage or demand based on any existing water source. This demand is how much water each Water User Group is projected to require in each decade over the planning horizon.

<u>Projected Surface Water Supplies</u>
From the 2012 State Water Plan Glossary: "**EXISTING [surface] WATER SUPPLY-** Maximum amount of [surface] water available from the existing sources for use during drought of record conditions that is physically and legally available for use." (See 2012 State Water Plan Chapter 5 for more detail.)
Additional explanation: These are the existing surface water supply volumes that, without implementing any recommended WMSs, could be used during a drought (in each planning decade) by Water User Groups located within the specific geographic area.

<u>Project Water Supply Needs</u>
From the 2012 State Water Plan Glossary: "**NEEDS-** Projected water demands in excess of existing water supplies for a water user group or a wholesale provider." (See 2012 State Water Plan Chapter 6 for more detail.)
Additional explanation: These are the volumes of water that result from comparing each Water User Group's projected existing water supplies to its projected water demands. If the volume listed is a negative number, then the Water User Group shows a projected need during a drought if they do not implement any water management strategies. If the volume listed is a positive number, then the Water User Group shows a projected surplus. Note that if a Water User Group shows a need in any decade, then they are considered to have a potential need during the planning horizon, even if they show a surplus elsewhere.

<u>Project Water Management Strategies</u>
From the 2012 State Water Plan Glossary: "**RECOMMEDED WATER MANAGEMENT STRATEGY-** Specific project or action to increase water supply or maximum existing supply to meet a specific need." (See 2012 State Water Plan Chapter 7 for more detail.)
Additional explanation: These are the specific water management strategies (with associated water volumes) that were recommended in the 2011 Regional Water Plans.

Modeled Available Groundwater
The total amount of groundwater including both permitted and exempt uses, that can be produced from the aquifer in an average year, which achieves a "desired future condition".

Recharge
The amount of water that infiltrates to the water table of an aquifer (from Chapter 36 – Subchapter A - Rule 356.2) Recharge may originate from various sources including precipitation directly onto a formation, seepage or infiltration to an aquifer from the land surface, streams, or lakes or indirectly by way of leakage from another formation.

Modeled Available Groundwater (MAG) Estimates

Code/statute: The following review of the HTGCD MAG complies with 31 TAC 356.52 (a)(S)(A) and TWC 36.1071 (e)(3)(A); DFC established under Section 36.108.

Desired Future Conditions: Desired Future Conditions are defined in Title 31, Part 10, 356.10 (6) of the Texas Administrative Code as "the desired, quantified condition of groundwater resources (such as water levels, spring flows, or volumes) within a management area at one or more specified future times as defined by participating groundwater conservation districts within a groundwater management area as part of the joint planning process" (TWDB Groundwater Resources Division). The Hays Trinity Groundwater Conservation District is part of Groundwater Management Area 9; The Hill Country Trinity Aquifer is the sole aquifer within the District. On July 26, 2010 the GMA 9 adopted the following Desired Future Conditions (DFC): "…allow for an increase in average regional drawdown of approximately 30 feet through 2060 consistent with Scenario 6 in TWDB Draft GAM Task 10-005." Within the District, average drawdown is calculated at 19.2 feet.

Resulting Average Water Level Decline in All Layers of Trinity after 50 years (from 387 simulations)

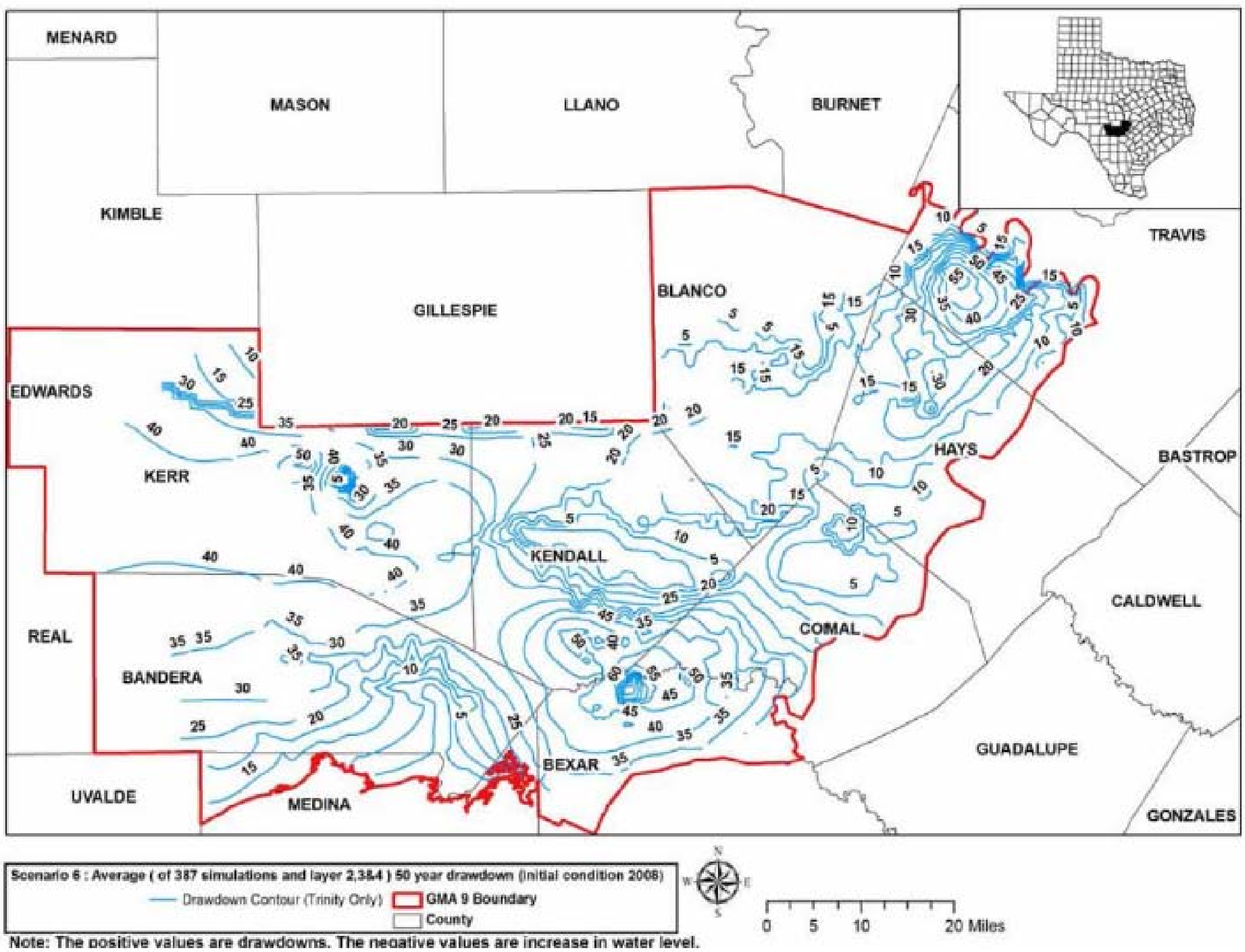

Figure 7: Average Water Level Drawdown Contour Map: Scenario 6, GMA9

Modeled Available Groundwater: The MAG is the total amount of groundwater, including both permitted and exempt uses that can be produced from the aquifer in an average year that achieves a DFC. The MAG for the HTGCD was derived from the Hill Country Trinity Groundwater Availability Model (Version 2.01) run by the TWDB. A groundwater model is a regional groundwater flow model based on the USGS MODFLOW codes that has been accepted by the TWDB for groundwater planning purposes. MODFLOW is the most widely used program in the world for simulating groundwater flow.

GR10-050 MAG v. 2, (TWDB, March 2012 update) establishes the Modeled Available Groundwater for the HTGCD. A copy of the complete MAG report can be found in Appendix B with values for years 2010, 2020, 2030, 2040, 2050 and 2060. For 2010, the Trinity MAG for the District was 9,109 ac-ft/year. This amounts to about 10% of the GMA 9 MAG of 93,000 ac-ft/year for the Trinity Aquifer; for 2060 the District figure is 9,094 ac-ft/year. As the totals vary slightly with each model run, the HTGCD Board adopted 9,100 ac-ft/year as the District MAG.

The District has a goal of sustainable management of the Trinity Aquifer. Sustainability in a desired future condition is expressed as maintaining a certain DFC in perpetuity (TWDB 2007, Petrossian et al). Sustainability is defined by the USGS as "… the development and use of groundwater in a manner that can be maintained for an indefinite time without causing unacceptable environmental, economic or social consequences". The HTGCD undertakes the management of the modeled available groundwater over the planning period as a sustainable goal.

The following table (Table 1) shows total estimated pumpage over a six year period, 2009 – 2014, compared with the MAG. The table is divided into estimated exempt and reported non-exempt pumping for the period. In addition the District has added "non-reported" non-exempt pumping in an attempt to approximate actual groundwater production by recognizing multiple small, "non-permitted" users. Year-end 2014 indicates an estimated "Net Available Groundwater" (MAG-Total pumpage) value of 3,973 ac-ft/year. By 2060 or earlier, the table projects that the DFC is achieved with total pumpage reaching 9,100 ac-ft/year.

Table 1: Available Groundwater HTGCD-Trinity Aquifer System: All values are reported in acre feet per year

	2009	2010	2011	2012	2013	2014	2060
Modeled Available Groundwater (1)	9,100	9,100	9,100	9,100	9,100	9100	9,100
Exempt Use: Domestic/Agricultural	3,300 (2)	3,322	3,358	3,398	3,448	3,495 (4)	5,784 (3)
Non-Exempt Use: Reported Pumpage	1,987	1,796	2,004	1,691	1,599	1,532	3,316
Non-Exempt Use Estimated Pumpage (5)	100	100	100	100	100	100	0
Total Pumpage	5,387	5,218	5,462	5,189	5,147	5,127	9,100 *
Net Available Groundwater: MAG-Total Pumpage	3,713	3,882	3,638	3,911	3,953	3,973	0

(1) 9,100 AF/YR is an average value of values provided by the TWDB for years 2010 - 2060. GAM Run 10-050 MAG calculations.
(2) Approved by the HTGCD Board of Directors on April 25, 2011.
(3) Used HDR's NA Case 5,784 (Water-Wastewater Plan for Hays County, 2011); Not reserved for exempt use
(4) Registered Exempt Use wells in 2014 (126 x 330 gpd x 365) / 325,851
(5) Non-Exempt Use: not permitted and not reporting; Goal: permit users and move 100 AF towards 0 AF
(6) * Achieved DFC

TWDB GAM Run 15-005, March 6, 2015

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 TWDB.." In compliance with the Texas State Water Code, the HTGCD received GAM Run 15-005 (Jones), from the TWDB in May 2015. The following sections of the GAM Run are specific to the Trinity Aquifer and the 2016 HTGCD Management Plan. Summarized information covering annual recharge from precipitation, volume of water discharged and volume of flow into and out of the district within each aquifer and between aquifers can be found in Table 2 at the end of this section.

Methods:

"…the groundwater availability model – version 2.01 - for the Hill Country portion of the Trinity Aquifer was run for this analysis. The water budget for HTGCD was extracted for the historical model period (1981-1997) using ZONEBUDGET Version 3.01 (Harbaugh, 2009). "

Parameters and Assumptions:

"The GAM includes four layers, representing (from top to bottom):

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

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

- "The General-Head Boundary (GHB) package of MODFLOW was used to represent flow out of the study area between the Hill Country portion of the Trinity Aquifer and the Edwards (Balcones Fault Zone) Aquifer or the confined parts of the Trinity Aquifer underlying the Edwards (Balcones Fault Zone) Aquifer." This is an important point in the analysis as it has implications regarding potential recharge to the deep Trinity section in Eastern Hays County
- "Only the outcrop area of the Hill Country portion of the Trinity Aquifer was modeled, and the down-dip extent that underlies the Edwards (Balcones Fault Zone) Aquifer is not included."
- "The model was run with MODFLOW-96 (Harbaugh and McDonald, 1996)." The TWDB "… used Processing MODFLOW Pro (PMWIN) version 7.0.18 (Chiang, 2005) as the interface to process model output."

Results:

"A **groundwater budget** summarizes the amount of water entering and leaving the aquifer according to the GAM. Selected groundwater budget components listed below (Table 2) were extracted from…" the Trinity Aquifer model results "…and averaged over the duration of the calibration and verification portion of the model run…"

- "Precipitation recharge-The areally distributed recharge sourced from precipitation falling on the outcrop area of the aquifers-where the aquifer is exposed at land surface-within the district."
- "Surface water outflow- The total 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 aquifer properties of each aquifer or confining unit that define the amount of leakage that occurs. "Inflow" to an aquifer from an overlying or underlying aquifer will always equal the "Outflow" from the other aquifer."

Table 2: Summarized information for the Hill Country portion of the Trinity Aquifer. All values are reported in acre feet per year and rounded to the nearest 1 acre foot. (TWDB GAM Run 15-005)

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Trinity Aquifer	26,105
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Trinity Aquifer	22,439
Estimated annual volume of flow into the district within each aquifer in the district	Trinity Aquifer	17,716
Estimated annual volume of flow out of the district within each aquifer in the district	Trinity Aquifer	11,610
Estimated net annual volume of flow between each aquifer in the district	From the Trinity Aquifer to the Edwards (Balcones Fault Zone) Aquifer	7,440*

* in the Hays Trinity Groundwater Conservation District, groundwater generally flows east from the Trinity Aquifer to the Edwards (Balcones Fault Zone) Aquifer and the confined parts of the Trinity Aquifer that underlie the Edwards (Balcones Fault Zone) Aquifer.

Limitations:

"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." "Understanding the amount and location of historic pumping is as important as evaluating the volume of groundwater flow…" "Because the application of the groundwater models was designed to address regional-scale questions, the results are most effective on a regional scale." (Dr. Ian C. Jones, TWDB, Groundwater Resources Division, 2015)

"They –models- can best be viewed as tools to help inform decisions rather than as machines to generate truth or make decisions." (The National Research Council, 2007)

Estimated Historical Water Use in the District - HTGCD

The TWDB provided Historical Water Use Survey (WUS) data (Appendix A). The data for years 2000 – 2013 was taken from total Hays County numbers (county-based) and modified by the TWDB with an apportioning multiplier (55.15%) to create new values that represent district geographic boundaries (HTGCD was calculated to include 55.15% of Hays County).

Groundwater Use in the District

The District has compared the detailed WUS dataset (available online) with in-house values taken from reported non-exempt well pumpage and estimated exempt well pumpage. The TWDB yearly totals, shown in Report 1, are high for the following suggested causes:

1. WUS dataset includes Hays County-based data from aquifers that do not occur within HTGCD boundaries – Edwards and Trinity/Edwards Plateau. The apportionment inflates actual water use in the District where pumpage is limited to the Trinity Aquifer.
2. WUS distributes values for Mining and Steam Electric activities that do not occur within the District.

The HTGCD concludes that the WUS county-wide data is appropriate for Hays County and regional planning but that values taken from local pumpage reports and estimates is more representative of District historical groundwater use. Estimated District pumpage for the period 2009-2014 is shown in Table 1. Total 2013 groundwater pumpage for example, is estimated at 5,147 acre feet/year. TWDB water use for 2013 is 7,670 acre feet/year as shown in the WUS report.

Surface Water Use in the District

The sole provider of raw surface water to the District during 2014 was LCRA. All of the surface water initiated from the Highland Lakes. The sole agency transporting treated surface water to customers in the District was West Travis County Public Utility Agency (WTCPUA). Only that portion of western Hays County within Region K planning area is served by surface water. There were no surface water supplies provided to the local Region L planning area although there may have been minor amounts taken from the Blanco River for limited use. There are several major providers in eastern Hays County that service communities along the "I-35 corridor".

The Lower Colorado River Authority (LCRA) "290 Pipeline" began water service to the Dripping Springs area in 2002. At that time the LCRA purchased the Hill Country Water Supply Corporation. In November 2010, the LCRA announced its intent to divest itself of 32 water and wastewater systems, including the West Travis Co. Systems. In 2011-2012, the system was purchased by the newly formed West Travis County Public Utility Agency. The WTCPUA is a publically owned Water and Wastewater Utility that serves western Travis and northern Hays Counties. They provide service for 6,400 retail water customers and 13 wholesale water customers. In 2014 the WTCPUA had one retail customer and six wholesale customers either partly or entirely within the HTGCD boundary.

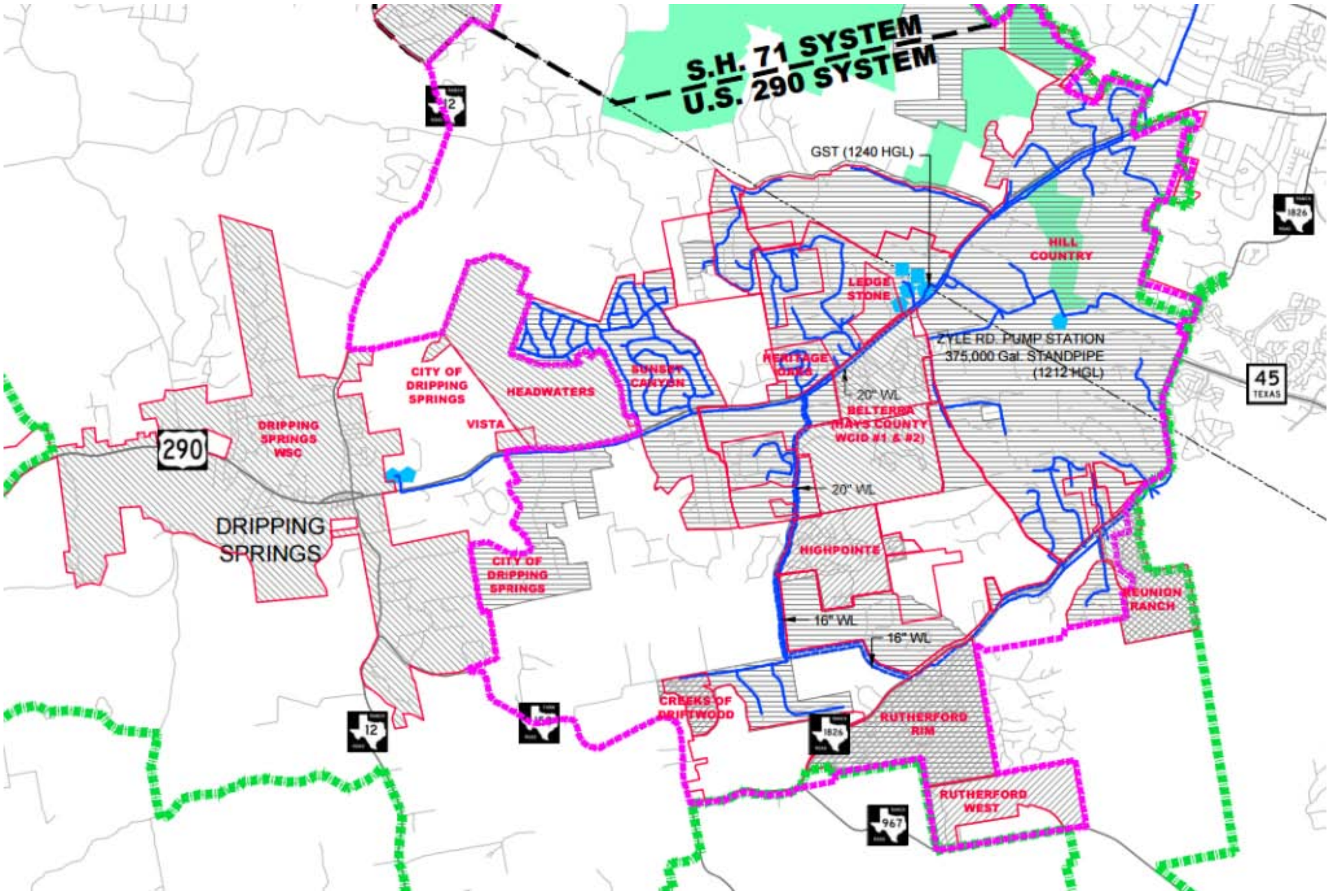

Figure 8: WTCPUA U.S. 290 System in Hays County, (WTCPUA website)

Table 3 shows total surface water usage reported in the District during 2014. The data was obtained from the WTCPUA. Although listed as a customer, the City of Dripping Springs used no surface water in 2014. The 1,700 acre feet (rounded up) total surface water used in the District during 2014 is far less than the values listed in TWBD's Historical Water Use Survey (Appendix A). The discrepancy may be due to the large volume of surface water supplied to customers in eastern Hays County. An apportionment based on geographic area (55.15%) would not be a true accounting of surface water use.

Table 3: WTCPUA – 2014 Summary of Total Billed Consumption by Customer: Acre Feet / Year

	Total (1)	Estimate within District (2)
Retail Water		
HPR/290……………………………………	807.50	646
Wholesale Water		
City of Dripping Springs…………….………..	0	0
Deer Creek…………………………………	151.6	15
DSWSC……………………………………..	385.7	385.7
Hays WCID 1………………………………	379	379
Hays WCID 2……………………………........	255	255
Reunion Ranch……………………………..	87	17.5
Total Acre Feet/Year……………………………..	**2,065.8**	**1,698.2**

(1) Data from West Travis County Public Utility Agency, Billing Summary Report by customer, courtesy of Donald G. Rauschuber, P.E., General Manager
(2) Estimated Percentage within HTGCD from Agency maps.

For data on historical surface water use in the District, Dripping Springs Water Supply Corporation (DSWSC) provided **Table 4**. The table covers the period 2009 – 2014 and identifies "Surface Water Supplier" and "Total Water Used". Prior to 2012 the LCRA provided both raw and treated water to DSWSC. After 2012, treated water was provided by WTCPUA. During 2013 for example, DSWSC's contract for firm water was for 1120 acre feet/year; they used only 403 acre feet.

Table 4: DSWSC Surface Water Use

	Surface Water Supplier	**Total Used- gallons**	**Acre Feet**
2009	**LCRA raw, LCRA treated**	**87,786,163**	**269**
2010	**LCRA raw, LCRA treated**	**105,898,201**	**325**
2011	**LCRA raw, LCRA treated**	**154,318,719**	**474**
2012	**LCRA raw, WTCPUA treated**	**155,340,050**	**477**
2013	**LCRA raw, WTCPUA treated**	**131,360,239**	**403**
2014	**LCRA raw, WTCPUA treated**	**146,797,396**	**450**
Note: above data provided by DSWSC			
Plans			
2015	**LCRA raw, WTCPUA treated**	**186,470,200**	**572**
2020	**LCRA raw, WTCPUA treated**	**310,400,000**	**952**

Projected Surface Water Supplies within the District - HTGCD

TWDB Report 2, Appendix A shows projected surface water supplies derived from the TWDB 2012 State Water Plan covering the period 2010 – 2060. These values are the maximum amount of surface water available from existing sources for use during drought of record conditions that are physically and legally available for use ("Definitions" page 14). Values for water user groups outside District boundaries are not included in Report 2. For this report, Hays County-wide water user group (WUG) data values (county-other, irrigation and livestock) are modified using the multiplier (55.15%). WUG values for municipalities, water supply corporations, and utility districts represent projected District supplies. Surface water supplies for the Colorado WUG Basin are primarily from Highland Lakes reservoirs. There are no supplies indicated for the Guadalupe WUG Basin other than minor amounts for irrigation and livestock. Total projected surface water supplies for the District are 2,567 acre-feet/year for 2010 and 3,971 acre-feet/year for 2060.

Projected Total Demand for Water within the District - HTGCD

TWDB Report 3, Appendix A, is derived from the TWDB 2012 State Water Plan data covering the period 2010 – 2060. Hays County-wide data was apportioned to the District by the TWDB using the multiplier described above. Total water demand within the District is projected to increase from 7,345 acre feet/year in 2010 to 20,936 acre feet/year in 2060. The water demand is the "quantity of water projected to meet the overall necessities of a water user group in a specific future year"… "This demand is how much water each water user group is projected to require in each decade over the planning horizon." (Definitions)

Projected Water Supply Needs - Hays County

Report 4, Appendix A, is derived from the TWDB 2012 State Water Plan data. All values are shown as Hays County totals and are not broken out by surface and groundwater. As stated in the report, "negative values (in red) reflect a projected water supply need, positive values a surplus."2010 total values are shown as a negative 1,674 acre-feet/year and increase to a negative 36,273 acre-feet/year by 2060. District-specific water users: City of Dripping Springs, DSWSC, Wimberley Water Supply Corporation (WWSC), Woodcreek, and Woodcreek Utilities Inc., are all shown in negative values by 2040.

Projected Water Management Strategies – Hays County

The TWDB supplied Report 5 is included in Appendix A. It is derived by the TWDB from the 2012 State Water Plan data and covers the period 2010 - 2060. All values are reported as Hays County totals. The source or origin of the water is broken out by each user. Within the HTGCD all listed users incorporate strategies that specify: drought management, conservation, or surface water supplies. The only reference to the Trinity Aquifer in Hays County is in county-wide user group "Manufacturing, Colorado (Region K). The sum of water management strategies in Hays County is 4,581 acre-feet/year for 2010 increasing to 52,954 acre-feet/year by 2060.

Given the projected population increase (Table 5), economic growth and water demand in Hays County, it will require innovative water management strategies to meet future community needs. Groundwater supply in western Hays County is limited to the Trinity Aquifer. The Modeled Available Groundwater for the Trinity Aquifer in the District is estimated at 9,100 acre feet/year. Current pumpage (Table 1) and projected exempt and non-exempt forecast pumpage, leave no room for additional groundwater resources without a revision of the Hill Country Trinity GAM or the DFC. Groundwater can play an important role in rural domestic and agricultural water supply and in providing adequate base flow to streams and springs; it cannot satisfy the water supply requirements of projected growth. "Primary concern with the Trinity Aquifer is anticipated water-level decline during drought conditions due to increased demand… water levels in the Dripping Springs area of Hays County could decline more than 100' by 2040." (Region K, 2016 Initially Prepared Plan)

Table 5: **Capital Area Metropolitan Planning Organization (CAMPO) Population Forecast Hays County**

2010	2020	2030	2040
156,966	257,643	406,051	628,309

Rainwater collection, land management, water reuse, conservation and drought management planning are necessary District, municipal, and community strategies. Other strategies, such as desalination, aquifer storage and recovery, and weather modification may have to come from other Districts. Overdrafting the Trinity Aquifer during a severe drought by temporarily mining aquifer storage is a "slippery slope" given uncertain recharge and possible head-loss. The aquifer may not recover to pre-drought levels. Referring to the 2012 State Water Plan and the 2016 preliminary plans for Regions K and L, added surface water supplies appear to be the primary water management strategy. For western Hays County the additional supplies could include transferring groundwater from "underutilized" neighboring aquifers to local municipal growth centers.

"Hays County is currently securing water agreements for future supply to meet the needs of the Wimberley/Woodcreek area (Region L), the Dripping Springs area (Region K), and the Hays County-Other category (both Regions L and K)… The County is including a Hays County Pipeline Project as a facilities expansion in order to help move these future supplies into and around the county… There are two pipeline route options being considered" (SCTRWPA Region L, 2016 Initially Prepared Plan, Vol.2, 2015):

1) Option A: 19 mile, 36" diameter………15,314 acre feet/year
2) Option B: 18 mile, 36" diameter transmission pipeline…….15,321 acre feet/year

How Recharge to the Groundwater Resources of the District May Be Increased

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

Figure 9A: Guadalupe-Blanco River Basin, from GBRA.

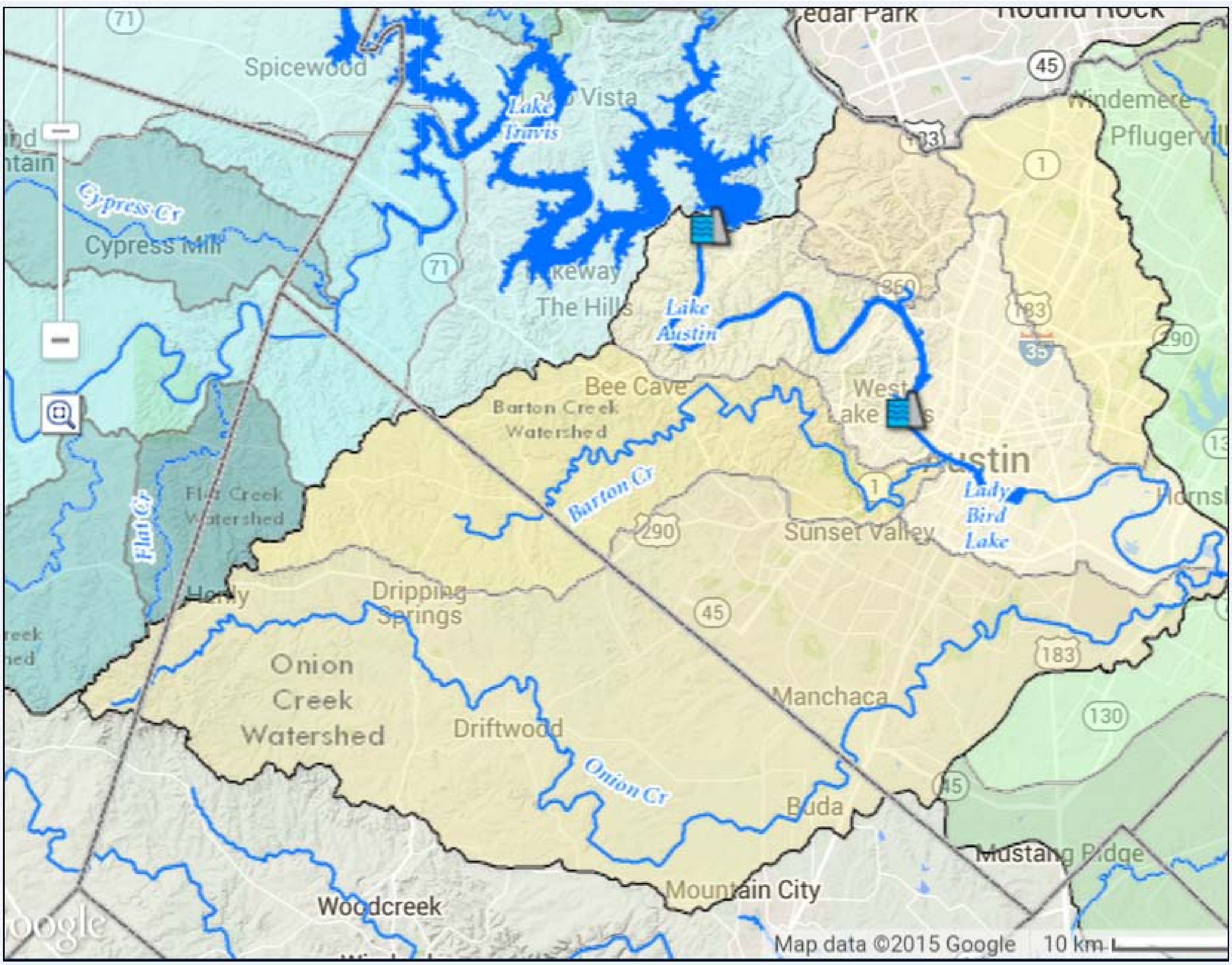

Figure 9B: Colorado River Basin: Onion Creek Watershed, from LCRA website

DETAILS ON HOW THE DISTRICT WILL MANAGE GROUNDWATER SUPPLIES

Implementing the Plan

- The District will work to implement the provisions of this plan and will use the plan as a guide for making policy and shaping District activities.
- Planning and operations of the District and agreements entered into by the District will be consistent with this plan.
- The District will cooperate with appropriate state, regional and local water management agencies, and other governmental entities in managing groundwater resources in accord with this plan.
- The management period for this plan is five years. The District shall review and re-adopt this plan, with or without revisions, at least once every five years in accordance with Texas Water Code Chapter 36.1072(e). Any amendment to this plan shall be in accordance with Chapter 36.1073.

District Rules

- The District will adopt rules relating to the prevention of waste, permitting of wells and the production of groundwater for wells within the District. Rules are posted on district's website; hold down the Control key and click on the following link: www.haysgroundwater.com/files/Rules/2014RuleUpdate_Final2.pdf
- Any rules adopted by the District shall be pursuant to the District's enabling legislation, Texas Water Code Chapter 36, and the provisions of this plan. All rules will be adhered to and enforced. The promulgation and enforcement of the rules will be based on the best technical evidence available.
- In regulating or limiting groundwater production, the District may consider preserving historic use prior to August 8, 2001 (the effective date of the District's formation) to the extent practicable and consistent with this plan.
- Rules will be critically reviewed and revised to remain current with management plans and direction.

Enforcing Rules

- The District will encourage cooperative and voluntary Rule compliance, but if Rule enforcement becomes necessary, the enforcement will be legal, fair, and impartial.
- The District shall treat all citizens fairly.
- Citizens may apply to the District for discretion in enforcement of the rules on grounds of adverse economic effect or unique local conditions. In granting of discretion to any rule, the Board shall consider the potential for adverse effect on adjacent landowners spring and surface flow and potential future groundwater users. The exercise of said discretion by the Board shall not be construed as limiting the power of the Board.

Managing Groundwater

- The District will administer groundwater supplies with the goal of sustainable management of the Trinity Aquifer MAG, based on the approved DFC, and including a specific focus on base flow contribution to streams and springs. To accomplish this:
- The District will collect, interpret and use the best available scientific data to determine the most effective regulatory and conservation measures.
- Groundwater within the District will be managed using the most current aquifer data on water availability and groundwater storage conditions.
- During its decision making process, the District will use information from GAMs, including later versions developed by the TWDB for the Trinity Aquifer system.
- The District will monitor groundwater conditions through its groundwater level monitoring program and will continue to maintain and update the District's database.
- The District will undertake and cooperate with investigations of the groundwater resources within the District as necessary and will make the results of investigations available to the public.
- The District will participate in regional water quality activities with other governmental agencies.
- The District will provide information and promote activities and studies with the goal of conserving and preventing waste of groundwater.

Groundwater Priorities

The District understands that to effectively manage the quantity of groundwater available for future use consistent with the District's guiding principles, groundwater use must be prioritized. The following list of priorities will be used to guide decision making when developing conservation measures, drought contingency planning, and future new groundwater use permitting. Highest priority uses are listed first, followed by lesser priority uses. It must be noted that the list is not absolute and site-specific factors may be considered in the decision making process.

1. Emergency Locations—Emergency locations include hospitals, critical care facilities, emergency clinics, nursing homes, police and fire departments, and Emergency Medical Services.
2. Domestic Use—The use of groundwater for personal needs or for household purposes such as drinking, bathing, heating, cooking, sanitation, household pets, or cleaning excluding pools/ponds and in-ground sprinkler systems.
3. Livestock—Domesticated horses, cattle, goats, sheep, swine, poultry, ostriches, emus, rheas, exotic deer and antelope, and other similar animals involved in farming or ranching operations.
4. Crop Irrigation—Crop irrigation utilizing drip irrigation systems or other water conserving irrigation practices that minimize evaporative losses (may include nurseries).
5. Commercial—The use of groundwater to supply water to properties or establishments that are in business to
    a. build, supply, or sell products; provide goods, services, or repairs; and that use water in those processes; or

   b. supply water to the business establishment primarily for employee and customer conveniences (i.e. flushing of toilets, sanitary purposes, or limited landscape watering).

6. Industrial w/o Mining—Use of groundwater primarily in the building, production, manufacturing, or alteration of products or goods, or to wash, cleanse, cool, or heat such goods or products.
7. Crop Irrigation—Crop irrigation utilizing spray irrigation systems.
8. Irrigation - Ornamental—Use of groundwater to supply water for application to plants or land in order to promote growth of ornamental plants, turf, or trees.
9. Irrigation – Recreation—Use of groundwater to supply water for golf courses and recreation/sports fields.
10. Car Washes—Use of groundwater for car washes or other high water use cleaning applications.
11. Vanity Ponds/Non-Commercial Fish Pond—Use of groundwater to supplement water levels in vanity ponds and non-commercial fish ponds.
12. Water quality treatment ponds where other sources of water are available.
13. Mining/Quarry—Dewatering and/or washing activities using groundwater at mining and/or quarry operations.

Critical Groundwater Depletion Areas (Management Zones)

In order to better manage groundwater resources the District may establish critical groundwater depletion areas, or management zones, for all sources of groundwater within the District. In each management zone the District may

1. Develop a DFC, specific to the area, that is responsive to the depletion issue
2. Calculate modeled available groundwater for the specific area
3. Determine and implement the proportional reduction of groundwater use for all classes of groundwater use that are established by the District.

Section 36.116 of the Texas Water Code provides that the District may use the management zones to adopt different rules for each:

1. Aquifer,
2. Aquifer subdivision,
3. Geologic formation, or
4. Geographic area in which any part of 1 through 3 above may occur within the District.

Aquifer Management

For the purpose of managing groundwater use within the District, HTGCD will define sustainable use of the Trinity Aquifer as the use of an amount of groundwater in the District as a whole or any management zone established by the District that does not exceed:

1. The approved Hill Country Trinity Modeled Available Groundwater (MAG)
2. The District's management goal to maintain base flow contribution to local streams and rivers during a repeat of the drought of record.
3. Any other criteria established by the District as being a threshold of use beyond which further use of the aquifer or aquifer subdivision may result in a specified undesirable or injurious condition.

The District will use the latest TWBD estimates of groundwater recharge, movement and availability within the District in exercising the statutory responsibility of managing the groundwater in the District. As more information on groundwater conditions in the District becomes available, the District may use that information to refine the specific methodology by which the District will seek to sustainably manage the groundwater in the District.

Groundwater Depletion vs. Sustainability

"To determine groundwater availability, planning groups used one of two policies: sustainability, in which an aquifer can be pumped indefinitely; or planned depletion in which an aquifer is drained over a period of time" (Water for Texas, 2012 State Water Plan)

- The District is opposed to planned depletion (mining) of the Trinity Aquifer as a groundwater management policy. The HTGCD reaffirms its goal of sustainable groundwater management based on an approved and publically reviewed DFC.

Analysis of Existing and New Data

- Development or analysis of new or existing surface water, groundwater or aquifer data may result in changes to the groundwater availability volumes, with a corresponding change in production limits from the affected aquifers.

Drought Contingency

- A contingency plan to cope with the effects of water supply deficits due to climatic or other conditions has been developed by the District and will be updated by the Board as new data becomes available.
- In developing revisions to the drought contingency plan, the District will consider the economic effect of conservation measures upon all water resource user groups, the local implications of the degree and effect of changes in water storage conditions, the unique Hydrogeologic conditions of the Aquifer and the appropriate conditions under which to implement the contingency plan.

METHODOLOGY FOR TRACKING PROGRESS IN ACHIEVING MANAGEMENT GOALS

The District General Manager will prepare and present an Annual Report to the Board of Directors on District performance in regards to achieving management goals and objectives. The presentation of the report will occur annually during a Board meeting once the year's data has been collected and processed. The first and subsequent years will commence on the date of approval of this management plan by TWDB. The report will include the number of instances in which each of the activities specified in the District's management objectives was engaged in during the fiscal year. The Board will maintain the Annual Report on file for public inspection at the District's offices upon adoption. This methodology will apply to all management goals contained within this plan. Note that a shortened version (District Goals, Management Objectives and Performance Standards) of the Annual Report will be available on the HTGCD website.

DISTRICT GOALS, MANAGEMENT OBJECTIVES AND PERFORMANCE STANDARDS

1. **Providing the most efficient use of groundwater.**
   The District will educate the general public on the most efficient uses of groundwater. A District education, outreach, and information-sharing program, covering local groundwater issues, will be continued and strengthened. It will be designed to inform the public and public officials in Hays County and to add to the geotechnical database of the local water well drilling industry. The program will cover all listed Management goals.
   1.1. Management Objective
   Each year the Distinct will hold at least one educational event
   Performance Standard
   Each year a summary of the District educational event will be included in the Annual Report.
2. **Controlling and preventing waste of groundwater**
   2.1. Management Objectives
   Each year the District will take complaints from any concerned citizen or entity in the district on cases of waste or possible waste.
   Performance Standard
   In each Annual Report, the District will include a discussion of the recent issues with waste and recommend any amendments to the rules to prevent the waste of groundwater.
3. **Controlling and preventing subsidence.**
   The rigid geologic framework of the region precludes significant subsidence from occurring. Therefore, this goal is not applicable to the operations of this District.
4. **Addressing conjunctive surface water management issues.**
   The HTGCD supports conjunctive use of groundwater and surface-water throughout the District. The recently published, “Hydrogeologic Atlas of the Hill Country Trinity Aquifer” demonstrates the strong interconnection of groundwater and surface water. From a review of the tables prepared by the TWDB and contained in this management plan (Appendix A), it appears clear that there are not sufficient groundwater resources to support the projected population growth projection in Hays County. Therefore, conservation measures and alternative supplies such as rainwater collection, surface water, reservoir construction, desalinization and water reuse must be studied and developed. The District will cooperate with surface water providers that wish to provide water to portions of the District that have insufficient groundwater resources. State water law, policy and management frameworks do not recognize the interconnectedness of ground and surface water resources. Texas regulations, laws, and institutions will have to evolve in order to recognize the interconnectedness of groundwater and surface water resources so that these resources can be conjunctively managed to sustain Texas and its economies. District rules and policies concerning conjunctive use will evolve as State water law, policies and management frameworks evolve.

4.1. Management Objective

To promote the use of surface water or other alternatives to groundwater in growing areas where groundwater demand is projected to lower the water tables and to reduce stream and spring flow to unacceptable levels.

Performance Standard

The District will strive to meet with the planning departments of major surface water providers within the District at least once per year. The District will summarize these meetings and their outcomes in the Annual Report.

5. **Addressing natural resource issues that impact the use and availability of groundwater or are impacted by the use of groundwater.**

The District recognizes that the residents of the Hill Country take great pride in the rural character of the land and insist on the protection of the environment and related ecosystems. For this reason the District has a goal of sustainable management of the Trinity Aquifer contribution to stream leakage and stream/spring baseflow during a repeat of the drought of record and, in critical depletion areas, a rate of stream/spring baseflow that maintains a sound ecological environment. The District will plan, develop, and participate in studies related to groundwater quality, availability, and the environment. This will include working jointly with universities, government agencies, private groups, and the public to collect and interpret data from area springs and streams.

5.1. Management Objective

Each year the District will make at least one endorsement or contribution to ongoing studies of geologic, environmental, or hydrogeologic studies being performed in the district area.

Performance Standard

Each year a summary of the District's contributions or endorsements of ongoing studies will be included in the Annual Report

6. **Addressing drought conditions** – A review of the historical rainfall in Hays County, together with analyses provided by TWDB and regional agencies, require effective planning and management of groundwater resources.

6.1 Management Objective

The District has developed a Drought Contingency Plan to protect and conserve groundwater during critical drought conditions. The plan will be updated as additional data becomes available.

Performance Standard

The District will post a copy of the plan on the HTGCD website and will include an updated Drought Contingency plan, available to end-users, in the Annual Report.

6.2 Management Objective

Each quarter the District will check the National Weather Service-Climate Prediction Center website http://www.cpc.ncep.noaa.gov/products/monitoring_and_data/drought.shtml for updates of the Palmer Drought Index. The District will download the updated Palmer Drought Severity Index (PDSI) map and check for periodic updates on www.waterdatafortexas.org/drought

Performance Standard

Quarterly, the District will make an assessment of the status of drought in the District and prepare a quarterly briefing to the Board of Directors. The downloaded PDSI maps will be included with copies of the quarterly briefing in the District Annual Report to the Board of Directors.

6.3 Management Objective

Each year the District will collect monthly water level data from a network of monitoring wells. See Figure 10 for HTGCD monitoring well locations.

Performance Standard

Each year a report of the District water level collection activities including a table of the water levels measured in District monitoring wells will be included in the Annual Report.

6.4 Management Objective

Each year the District will monitor data collected from the U.S. Geological Survey water-flow monitoring stations on the Blanco River, Pedernales River, Onion Creek and at Jacob's Well.

Performance Standard

Each year, the District will review the prior year's monitoring data with local, state or federal organizations and prepare a summary to be included in the Annual Report.

7. **Addressing conservation.**

The 2012 State Water Plan identifies drought management and conservation as projected management strategies for western Hays County.

7.1 Management Objective

Each year the District will submit one article for publication regarding water conservation to at least one newspaper of general circulation in Hays County.

Performance Standard

Each year copy of the article submitted for publication will be included in the Annual Report**.**

8. **Addressing recharge enhancement.**

Due to the geologic and hydrostratigraphic structure of the Trinity sub-aquifers, the implementation of significantly effective recharge enhancement to the primary source aquifer may not be practical. Current interpretation of geologic data suggest that downward leakage within the Trinity Group is limited and the majority of recharge takes place west of the bounds of the HTGCD near the sedimentary wedge-edge of the water bearing rock units through diffuse infiltration. Given the location of suspected recharge and its nature, neither general land management nor focused enhancement practices may be feasible. Therefore, until additional hydrogeologic data is available, this goal is not applicable to the operations of this District.

9. **Addressing rainwater harvesting.**

The District is committed to promoting water sources that reduce demand on groundwater in the central Texas region. As such the HTGCD is committed to promoting rainwater harvesting as a source of municipal and residential use.

9.1 Management Objective

Each year the District will make at least one endorsement or contribution to programs that encourage, install, educate or assist individuals in the implementation of rainwater harvesting systems in the District area.

Performance Standard

Each year the District will provide records of contributions or promotions of rainwater harvesting events or companies in its Annual Report.

10. **Addressing precipitation enhancement.**

The HTGCD does not have the expertise or the funding capacity to pursue rainfall enhancement practices. Therefore, this goal is not applicable to the operations of this District.

11. **Addressing brush control.**

The District encourages proper land management practices in accordance with current agricultural extension standards. Proper land management promotes recharge and protects against surface water quality degradation. As such the District will promote and educate the public on proper land management practices.

11.1 Management Objective

The District will attend or contribute to at least one event each year that promotes and educates the public on proper land management practices.

Performance Standard

Each year the District will provide records of contributions or promotions of land management events or companies in its Annual Report.

12. **Addressing Desired Future Conditions (DFC)**

The HTGCD is an active member of the GMA9 and a participant in the group's DFC planning and monitoring program. The GMA9 DFC was approved by the TWDB in July, 2010 and is currently under review by Blanton & Associates, Inc., a consulting company contracted by the GMA9. Until the review and recommendations are completed and approved, all references in this management plan will be to the 2010 approved DFC.

An ongoing monitoring program is essential to ensure DFC compliance. HTGCD maintains an aggressive groundwater-level monitoring program that began in 1999 and records changes in water levels over time throughout western Hays County. The program currently includes 46 wells (Figure 10). Water levels are measured monthly in most wells and there are 10 wells with transducers and 5 with a telemetry system to provide continuous and real-time recordings of water level fluctuations. Hydrographs are created for each well and are posted online. Examples of hydrographs in program wells are shown in figures 11 and 12. The well monitor data-base was made available to Blanton & LBG Guyton Associates for their analyses of DFC conditions.

12.1 Management Objective

The HTGCD is working within the framework of GMA9 to upgrade and maintain a well database map and files that will identify all District monitoring wells in the management area. The District will work with GMA9 and their consultants on an acceptable method to analyze and report drawdown levels relative to the DFC. Deliverables may include potentiometric surface maps of the Middle and Lower Trinity Aquifers and selected hydrographs plus other documents generated by the consultants.

Performance standard

Each year the District will review the average drawdown of at least two Trinity Aquifer monitor wells, one in each Planning Region, against the DFC projected average regional drawdown for western Hays County. The HTGCD shall provide a summary in its Annual Report.

12.2 Management Objective

The MAG for the Trinity Aquifer in the District is derived from the DFC and requires frequent review against estimated pumpage.

Performance standard

The HTGCD shall prepare an annual report of MAG estimated pumpage to monitor District compliance. A summary shall be presented to the HTGCD Board and made available to the public and included in the Annual Report.

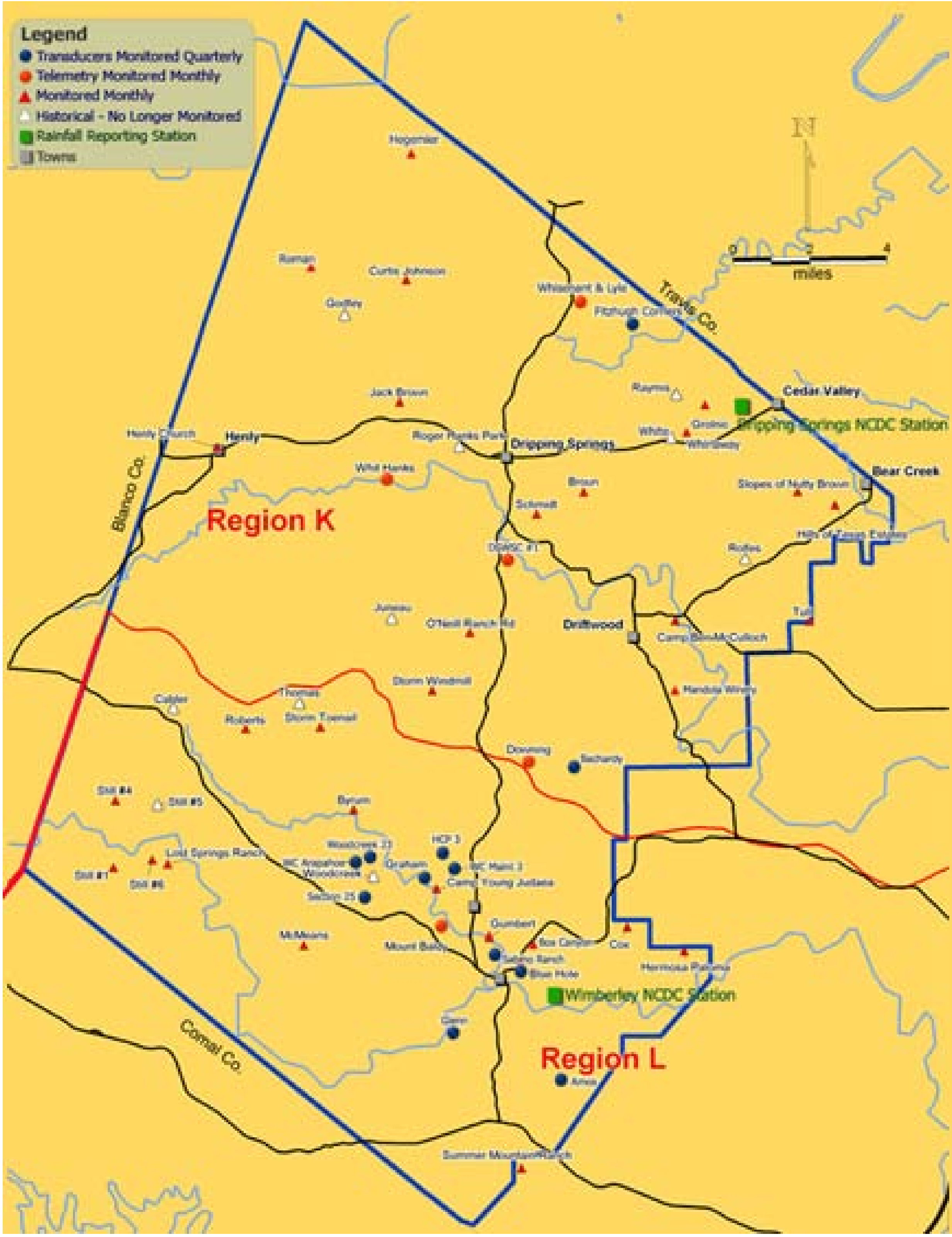

Figure 10: Hays Trinity GCD: 2015 monitoring well locations

Henly Church

30° 11' 46" NORTH
98° 12' 45" WEST

Total Well Depth: 460
Elevation: 1325.8920

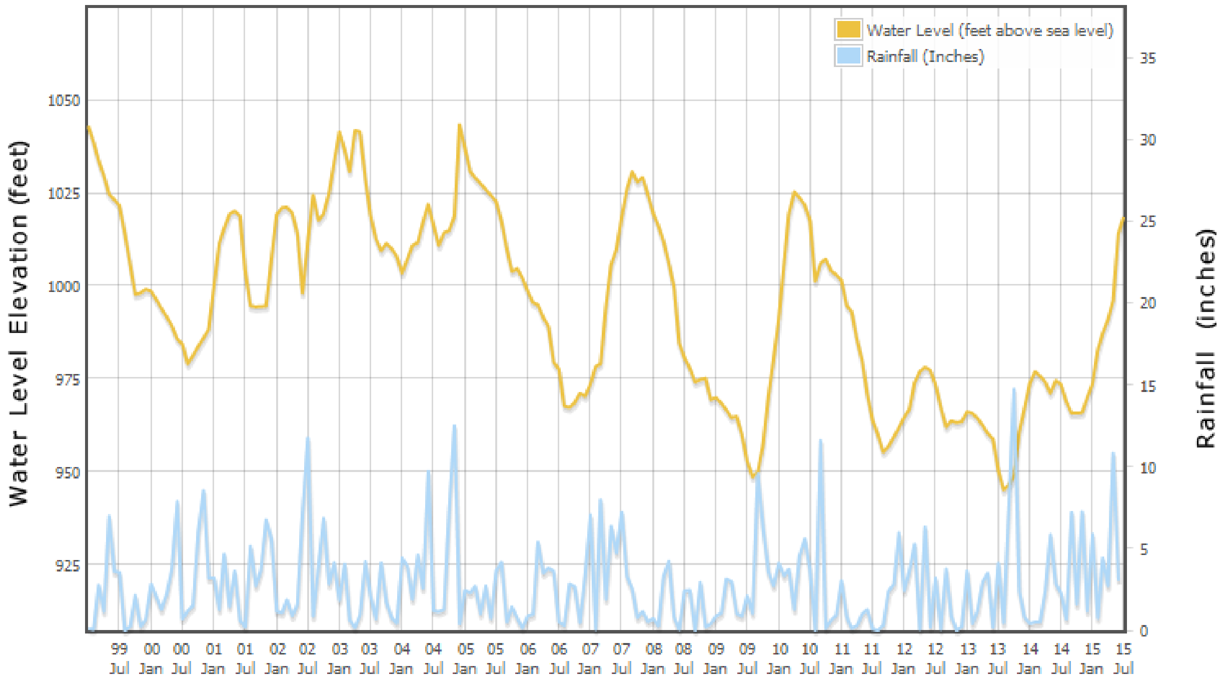

Figure 11: Hydrograph of the water level in the Henly Baptist Church monitoring well.

Mount Baldy

30° 00' 57" NORTH
98° 07' 01" WEST

Total Well Depth: 400
Elevation: 938.6330

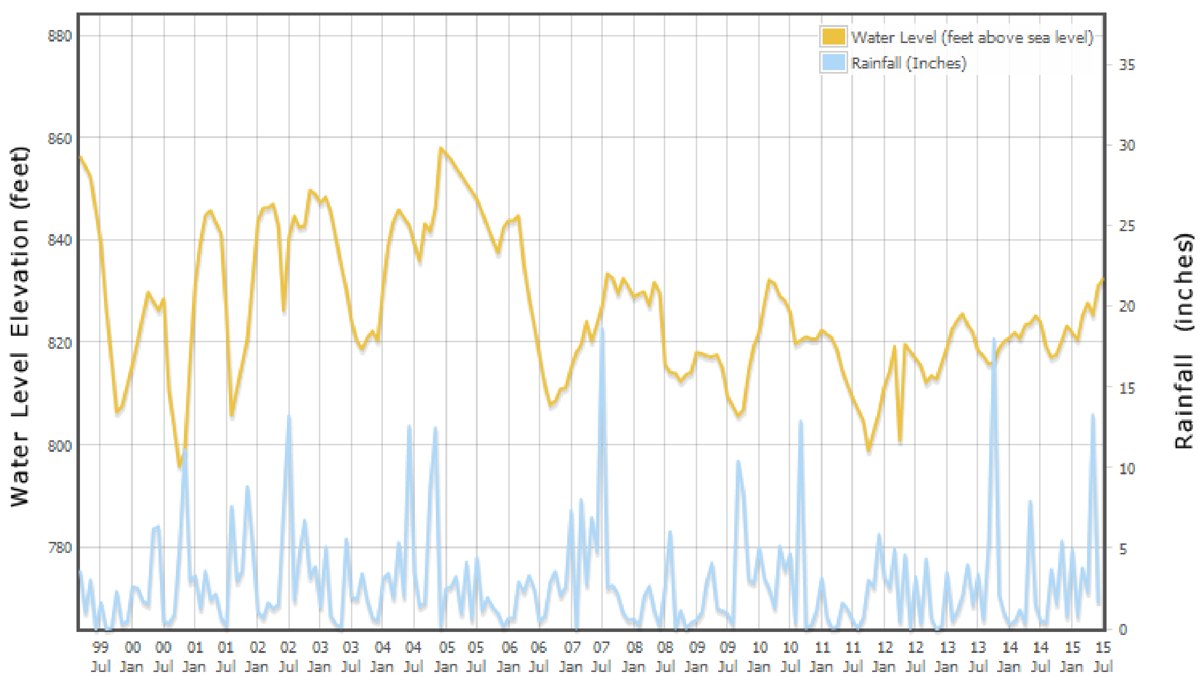

Figure 12: Hydrograph of the water level in the Mount Baldy monitoring well.

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APPENDIX A

Report 1: Estimated Historical Water Use
TWDB Historical Water Use Survey (WUS) Data

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

HAYS COUNTY *55.15 % (multiplier)* All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2013	GW	6,519	99	206	549	253	44	7,670
	SW	6,931	0	0	0	3	1,536	8,470
2012	GW	7,167	107	272	0	360	39	7,945
	SW	7,137	2	0	0	45	1,351	8,535
2011	GW	7,673	94	358	0	487	55	8,667
	SW	7,173	2	179	0	5	1,289	8,648
2010	GW	7,141	84	372	0	362	55	8,014
	SW	4,816	0	194	0	5	1,511	6,526
2009	GW	6,634	86	365	0	404	167	7,656
	SW	4,826	0	188	0	0	1,573	6,587
2008	GW	6,676	97	358	0	395	165	7,691
	SW	4,385	1	181	0	15	3,517	8,099
2007	GW	5,699	77	185	0	676	173	6,810
	SW	3,845	3	5	0	111	2,137	6,101
2006	GW	6,597	103	191	0	133	169	7,193
	SW	3,516	1	0	0	2	1,891	5,410
2005	GW	5,845	99	191	0	78	155	6,368
	SW	2,913	3	0	0	15	1,871	4,802
2004	GW	5,675	87	191	0	69	108	6,130

	SW	2,650	5	0	0	174	2,324	5,153
2003	GW	5,744	83	309	0	55	107	6,298
	SW	3,394	0	0	0	137	1,314	4,845
2002	GW	5,667	87	402	0	8	127	6,291
	SW	2,757	1	0	0	118	1,324	4,200
2001	GW	5,767	116	336	0	8	112	6,339
	SW	2,500	0	0	0	118	2,025	4,643
2000	GW	5,495	132	244	0	6	95	5,972
	SW	2,506	0	0	0	91	2,002	4,599

Report 2: Projected Surface Water Supplies
TWDB 2012 State Water Plan Data

HAYS COUNTY *55.15 % (multiplier)* All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
K	BUDA	COLORADO	CANYON LAKE/RESERVOIR						
K	COUNTY-OTHER	COLORADO	CANYON LAKE/RESERVOIR						
K	COUNTY-OTHER	COLORADO	HIGHLAND LAKES LAKE/RESERVOIR SYSTEM	786	786	786	786	786	786
K	DRIPPING SPRINGS	COLORADO	HIGHLAND LAKES LAKE/RESERVOIR SYSTEM	506	506	506	506	506	506
K	DRIPPING SPRINGS WSC	COLORADO	HIGHLAND LAKES LAKE/RESERVOIR SYSTEM	560	560	560	560	560	560
K	HILL COUNTRY WSC	COLORADO	COLORADO RIVER RUN-OF-RIVER	0	0	0	0	0	0
K	HILL COUNTRY WSC	COLORADO	HIGHLAND LAKES LAKE/RESERVOIR SYSTEM	440	702	980	1,249	1,582	1,844
K	IRRIGATION	COLORADO	COLORADO RIVER COMBINED RUN-OF-RIVER IRRIGATION	23	23	23	23	23	23
K	LIVESTOCK	COLORADO	LIVESTOCK LOCAL SUPPLY	106	106	106	106	106	106
L	COUNTY LINE WSC	GUADALUPE	CANYON LAKE/RESERVOIR						
L	COUNTY LINE WSC	GUADALUPE	GUADALUPE RIVER RUN-OF-RIVER						
L	COUNTY-OTHER	GUADALUPE	CANYON LAKE/RESERVOIR						
L	CRYSTAL CLEAR WSC	GUADALUPE	CANYON LAKE/RESERVOIR						
L	CRYSTAL CLEAR WSC	GUADALUPE	GUADALUPE RIVER RUN-OF-RIVER						
L	GOFORTH WSC	GUADALUPE	CANYON LAKE/RESERVOIR						
L	IRRIGATION	GUADALUPE	GUADALUPE RIVER COMBINED RUN-OF-RIVER IRRIGATION	69	69	69	69	69	69
L	KYLE	GUADALUPE	CANYON LAKE/RESERVOIR						
L	LIVESTOCK	GUADALUPE	LIVESTOCK LOCAL SUPPLY	77	77	77	77	77	77

L	MAXWELL WSC	GUADALUPE	CANYON LAKE/RESERVOIR						
L	MAXWELL WSC	GUADALUPE	GUADALUPE RIVER RUN-OF-RIVER						
L	PLUM CREEK WATER COMPANY	GUADALUPE	CANYON LAKE/RESERVOIR						
L	SAN MARCOS	GUADALUPE	CANYON LAKE/RESERVOIR						
L	STEAM ELECTRIC POWER	GUADALUPE	CANYON LAKE/RESERVOIR						
	Sum of Projected Surface Water Supplies (acre-feet/year)			**2,567**	**2,829**	**3,107**	**3,376**	**3,709**	**3,971**

Report 3: 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.

HAYS COUNTY *55.15 % (multiplier)* All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
K	CIMARRON PARK WATER COMPANY	COLORADO						
K	DRIPPING SPRINGS WSC	COLORADO	348	501	660	817	1,013	1,166
K	HILL COUNTRY WSC	COLORADO	440	702	980	1,249	1,582	1,844
K	MOUNTAIN CITY	COLORADO						
K	DRIPPING SPRINGS	COLORADO	1,080	1,856	2,297	2,745	3,300	3,736
K	BUDA	COLORADO						
K	MANUFACTURING	COLORADO	381	446	512	578	638	692
K	COUNTY-OTHER	COLORADO	1,852	2,682	3,424	4,178	5,116	5,854
K	MINING	COLORADO	7	3	1	0	0	0
K	IRRIGATION	COLORADO	6	6	6	6	6	6
K	LIVESTOCK	COLORADO	121	121	121	121	121	121
L	COUNTY-OTHER	GUADALUPE	796	907	1,023	1,145	1,302	1,425
L	CRYSTAL CLEAR WSC	GUADALUPE						
L	GOFORTH WSC	GUADALUPE						
L	WOODCREEK UTILITIES INC	GUADALUPE	748	1,145	1,564	1,974	2,477	2,873
L	CREEDMOOR-MAHA WSC	GUADALUPE						
L	COUNTY LINE WSC	GUADALUPE						
L	MAXWELL WSC	GUADALUPE						
L	PLUM CREEK WATER COMPANY	GUADALUPE						
L	MINING	GUADALUPE	78	83	87	89	89	90
L	IRRIGATION	GUADALUPE	195	193	191	190	188	186
L	LIVESTOCK	GUADALUPE	154	154	154	154	154	154
L	MOUNTAIN CITY	GUADALUPE						
L	NIEDERWALD	GUADALUPE						
L	STEAM ELECTRIC POWER	GUADALUPE						
L	WIMBERLEY WSC	GUADALUPE	776	997	1,224	1,442	1,736	1,966
L	WOODCREEK	GUADALUPE	246	315	385	452	540	610

L	MANUFACTURING	GUADALUPE	117	137	157	178	196	213
L	SAN MARCOS	GUADALUPE						
L	KYLE	GUADALUPE						
	Sum of Projected Water Demands (acre-feet/year)		**7,345**	**10,248**	**12,786**	**15,318**	**18,458**	**20,936**

Report 4: Projected Water Supply Needs
TWDB 2012 State Water Plan Data

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

HAYS COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
K	BUDA	COLORADO	257	143	-332	-817	-1,395	-1,869
K	CIMARRON PARK WATER COMPANY	COLORADO	-150	-236	-329	-423	-536	-629
K	COUNTY-OTHER	COLORADO	760	-838	-2,072	-3,440	-5,144	-6,482
K	DRIPPING SPRINGS	COLORADO	-574	-1,350	-1,791	-2,239	-2,794	-3,230
K	DRIPPING SPRINGS WSC	COLORADO	452	299	140	-17	-213	-366
K	HILL COUNTRY WSC	COLORADO	0	0	0	0	0	0
K	IRRIGATION	COLORADO	42	42	42	42	41	41
K	LIVESTOCK	COLORADO	2	2	2	2	0	0
K	MANUFACTURING	COLORADO	-93	-211	-330	-450	-558	-657
K	MINING	COLORADO	0	6	10	12	10	10
K	MOUNTAIN CITY	COLORADO	-25	-23	-23	-22	-22	-22
L	COUNTY LINE WSC	GUADALUPE	3	-1,049	-1,369	-1,443	-1,662	-2,032
L	COUNTY-OTHER	GUADALUPE	1,829	1,629	1,418	1,196	912	689
L	CREEDMOOR-MAHA WSC	GUADALUPE	-3	-5	-8	-10	-13	-16
L	CRYSTAL CLEAR WSC	GUADALUPE	181	27	-140	-293	-499	-661
L	GOFORTH WSC	GUADALUPE	398	30	-334	-705	-1,175	-1,544
L	IRRIGATION	GUADALUPE	316	319	322	325	328	331
L	KYLE	GUADALUPE	764	-436	-713	-873	-1,370	-1,699
L	LIVESTOCK	GUADALUPE	0	0	0	0	0	0
L	MANUFACTURING	GUADALUPE	1,353	1,316	1,280	1,243	1,210	1,179
L	MAXWELL WSC	GUADALUPE	120	77	28	-17	-77	-125
L	MINING	GUADALUPE	-82	-91	-97	-101	-102	-103
L	MOUNTAIN CITY	GUADALUPE	4	-22	-49	-75	-108	-134
L	NIEDERWALD	GUADALUPE	-50	-93	-140	-184	-240	-284
L	PLUM CREEK WATER COMPANY	GUADALUPE	407	211	10	-195	-454	-657
L	SAN MARCOS	GUADALUPE	5,014	1,854	-1,319	-4,772	-8,507	-11,387
L	STEAM ELECTRIC POWER	GUADALUPE	5,151	5,442	5,211	4,211	3,497	2,533
L	WIMBERLEY WSC	GUADALUPE	-219	-440	-667	-885	-1,179	-1,409
L	WOODCREEK	GUADALUPE	-23	-92	-162	-229	-317	-387
L	WOODCREEK UTILITIES INC	GUADALUPE	-455	-852	-1,271	-1,681	-2,184	-2,580

Sum of Projected Water Supply Needs (acre-feet/year)	**-1,674**	**-5,738**	**-11,146**	**-18,871**	**-28,549**	**-36,273**

HAYS COUNTY

WUG, Basin (RWPG)

All values are in acre-feet/year

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
BUDA, COLORADO (K)							
DEVELOPMENT OF CARRIZO-WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER [CALDWELL]	0	1,687	1,687	1,687	1,687	1,687
DEVELOPMENT OF SALINE ZONE OF EDWARDS-BFZ AQUIFER	EDWARDS-BFZ AQUIFER [TRAVIS]	0	0	0	0	0	500
CIMARRON PARK WATER COMPANY, COLORADO (K)							
DEVELOPMENT OF SALINE ZONE OF EDWARDS-BFZ AQUIFER	EDWARDS-BFZ AQUIFER [TRAVIS]	0	0	250	350	500	600
DROUGHT MANAGEMENT	DROUGHT MANAGEMENT [HAYS]	109	109	109	109	109	109
MUNICIPAL CONSERVATION	CONSERVATION [HAYS]	24	17	13	9	5	7
WATER ALLOCATION	EDWARDS-BFZ AQUIFER [HAYS]	17	110	0	0	0	0
COUNTY-OTHER, COLORADO (K)							
DEVELOPMENT OF SALINE ZONE OF EDWARDS-BFZ AQUIFER	EDWARDS-BFZ AQUIFER [TRAVIS]	0	250	2,500	2,500	5,000	6,000
PURCHASE WATER FROM COA	COLORADO RIVER RUN-OF-RIVER [TRAVIS]	1,100	1,100	1,100	1,100	1,100	1,100
DRIPPING SPRINGS, COLORADO (K)							
AMEND LCRA CONTRACT	COLORADO RIVER COMBINED RUN-OF-RIVER - LCRA SUPPLY REALLOCATION [TRAVIS]	493	1,073	1,321	1,690	2,133	2,482
MUNICIPAL CONSERVATION	CONSERVATION [HAYS]	81	277	470	549	661	748
DRIPPING SPRINGS WSC, COLORADO (K)							
AMEND LCRA CONTRACT	COLORADO RIVER COMBINED RUN-OF-RIVER - LCRA SUPPLY REALLOCATION [TRAVIS]	0	0	0	17	213	366

MANUFACTURING, COLORADO (K)

DEVELOPMENT OF TRINITY AQUIFER	TRINITY AQUIFER [HAYS]	0	0	75	200	301	400
DROUGHT MANAGEMENT	DROUGHT MANAGEMENT [HAYS]	257	257	257	257	257	257

MOUNTAIN CITY, COLORADO (K)

DROUGHT MANAGEMENT	DROUGHT MANAGEMENT [HAYS]	39	39	39	39	39	39
MUNICIPAL CONSERVATION	CONSERVATION [HAYS]	2	0	0	0	0	0

COUNTY LINE WSC, GUADALUPE (L)

DROUGHT MANAGEMENT	DROUGHT MANAGEMENT [HAYS]	58	0	0	0	0	0
HAYS/CALDWELL PUA PROJECT (INCL. GONZALES CO.)	CARRIZO-WILCOX AQUIFER [CALDWELL]	0	285	285	285	285	285
LOCAL GROUNDWATER (TRINITY AQUIFER)	TRINITY AQUIFER [CALDWELL]	0	1,119	1,442	1,603	1,926	2,410
MUNICIPAL WATER CONSERVATION	CONSERVATION [HAYS]	43	110	112	67	85	119

COUNTY-OTHER, GUADALUPE (L)

MUNICIPAL WATER CONSERVATION	CONSERVATION [HAYS]	0	0	12	49	112	184

CREEDMOOR-MAHA WSC, GUADALUPE (L)

GBRA MID BASIN (SURFACE WATER)	GBRA MID BASIN OFF-CHANNEL LAKE/RESERVOIR [RESERVOIR]	0	5	8	10	13	16
PURCHASE FROM WWP (GUADALUPE-BLANCO RIVER AUTHORITY)	GUADALUPE RIVER RUN-OF-RIVER [CALHOUN]	3	0	0	0	0	0

CRYSTAL CLEAR WSC, GUADALUPE (L)

BRACKISH GROUNDWATER DESALINATION (WILCOX AQUIFER)	CARRIZO-WILCOX AQUIFER- BRACKISH [GUADALUPE]	0	0	130	130	259	259
BRACKISH GROUNDWATER DESALINATION (WILCOX AQUIFER)	CARRIZO-WILCOX AQUIFER- BRACKISH [WILSON]	0	0	206	206	1,469	1,469
CRWA WELLS RANCH PROJECT PHASE I	CARRIZO-WILCOX AQUIFER [GONZALES]	434	0	0	0	0	0
GBRA MID BASIN (SURFACE WATER)	GBRA MID BASIN OFF-CHANNEL LAKE/RESERVOIR [RESERVOIR]	0	865	0	0	0	0
HAYS/CALDWELL PUA PROJECT	CARRIZO-WILCOX	0	0	530	530	0	0

(INCL. GONZALES CO.)	AQUIFER [CALDWELL]						
LOCAL GROUNDWATER CARRIZO-WILCOX AQUIFER (INCLUDES OVERDRAFTS)	CARRIZO-WILCOX AQUIFER [GUADALUPE]	0	0	140	293	499	661

GOFORTH WSC, GUADALUPE (L)

GBRA MID BASIN (SURFACE WATER)	GBRA MID BASIN OFF-CHANNEL LAKE/RESERVOIR [RESERVOIR]	0	0	300	300	300	300
HAYS/CALDWELL PUA PROJECT (INCL. GONZALES CO.)	CARRIZO-WILCOX AQUIFER [GONZALES]	0	1,613	1,540	1,465	1,387	1,311
MUNICIPAL WATER CONSERVATION	CONSERVATION [HAYS]	0	0	0	0	22	111

KYLE, GUADALUPE (L)

DROUGHT MANAGEMENT	DROUGHT MANAGEMENT [HAYS]	137	0	0	0	0	0
HAYS/CALDWELL PUA PROJECT (INCL. GONZALES CO.)	CARRIZO-WILCOX AQUIFER [GONZALES]	0	500	1,000	2,416	5,144	9,355
MUNICIPAL WATER CONSERVATION	CONSERVATION [HAYS]	0	27	96	167	302	443

MAXWELL WSC, GUADALUPE (L)

HAYS/CALDWELL PUA PROJECT (INCL. GONZALES CO.)	CARRIZO-WILCOX AQUIFER [CALDWELL]	0	100	200	300	400	500

MINING, GUADALUPE (L)

INDUSTRIAL, STEAM-ELECTRIC POWER GENERATION, AND MINING WATER CONSERVATION	CONSERVATION [HAYS]	82	91	97	101	102	103

MOUNTAIN CITY, GUADALUPE (L)

HAYS/CALDWELL PUA PROJECT (INCL. GONZALES CO.)	CARRIZO-WILCOX AQUIFER [CALDWELL]	0	150	150	150	150	150
MUNICIPAL WATER CONSERVATION	CONSERVATION [HAYS]	1	3	6	10	16	22

NIEDERWALD, GUADALUPE (L)

DROUGHT MANAGEMENT	DROUGHT MANAGEMENT [HAYS]	7	0	0	0	0	0
GBRA MID BASIN (SURFACE WATER)	GBRA MID BASIN OFF-CHANNEL LAKE/RESERVOIR [RESERVOIR]	0	93	140	184	240	284
MUNICIPAL WATER CONSERVATION	CONSERVATION [HAYS]	0	1	8	15	27	42
PURCHASE FROM WWP (GUADALUPE-BLANCO RIVER	CANYON LAKE/RESERVOIR	50	0	0	0	0	0

AUTHORITY)	[RESERVOIR]						

PLUM CREEK WATER COMPANY, GUADALUPE (L)

GBRA MID BASIN (SURFACE WATER)	GBRA MID BASIN OFF-CHANNEL LAKE/RESERVOIR [RESERVOIR]	0	0	0	195	454	657
MUNICIPAL WATER CONSERVATION	CONSERVATION [HAYS]	0	0	0	0	12	54

SAN MARCOS, GUADALUPE (L)

HAYS/CALDWELL PUA PROJECT (INCL. GONZALES CO.)	CARRIZO-WILCOX AQUIFER [GONZALES]	0	0	1,548	4,953	8,675	11,910
MUNICIPAL WATER CONSERVATION	CONSERVATION [HAYS]	417	554	815	1,282	1,875	2,656

WIMBERLEY WSC, GUADALUPE (L)

DROUGHT MANAGEMENT	DROUGHT MANAGEMENT [HAYS]	39	0	0	0	0	0
MUNICIPAL WATER CONSERVATION	CONSERVATION [HAYS]	0	0	0	0	19	70
WIMBERLEY AND WOODCREEK WATER SUPPLY PROJECT	CANYON LAKE/RESERVOIR [RESERVOIR]	336	1,425	1,425	1,425	1,425	1,425

WOODCREEK, GUADALUPE (L)

DROUGHT MANAGEMENT	DROUGHT MANAGEMENT [HAYS]	12	0	0	0	0	0
MUNICIPAL WATER CONSERVATION	CONSERVATION [HAYS]	0	0	2	6	20	37
WIMBERLEY AND WOODCREEK WATER SUPPLY PROJECT	CANYON LAKE/RESERVOIR [RESERVOIR]	112	400	400	400	400	400

WOODCREEK UTILITIES INC, GUADALUPE (L)

MUNICIPAL WATER CONSERVATION	CONSERVATION [HAYS]	56	177	337	455	619	771
WIMBERLEY AND WOODCREEK WATER SUPPLY PROJECT	CANYON LAKE/RESERVOIR [RESERVOIR]	672	2,655	2,655	2,655	2,655	2,655

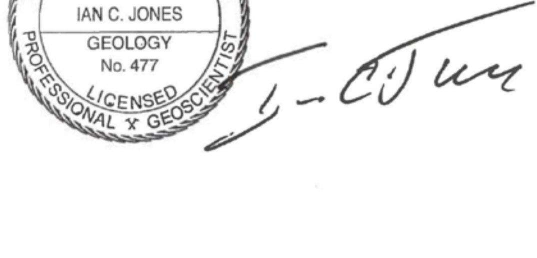
Sum of Projected Water Management Strategies (acre-feet/year)	**4,581**	**15,092**	**21,405**	**28,159**	**40,897**	**52,954**

APPENDIX B

GAM RUN 15-005: HTGCD MANAGEMENT PLAN, JONES

GAM Run 15-005: Hays Trinity Groundwater Conservation District Management Plan

by Ian C. Jones, Ph.D., P.G.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-6641
March 6, 2015



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GAM RUN 15-005: HAYS TRINITY GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN

by Ian C. Jones, Ph.D., P.G. Texas Water Development Board Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-6641
March 6, 2015

EXECUTIVE SUMMARY:

Texas State Water Code, Section 36.1071, Subsection (h) (Texas Water Code, 2011), states that, in developing its groundwater management plan, a groundwater conservation district shall use groundwater availability modeling information provided by the executive administrator of the Texas Water Development Board (TWDB) in conjunction with any available site-specific information provided by the district for review and comment to the executive administrator. 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 Hays Trinity Groundwater Conservation District—fulfills the requirements noted above. Part 1 of the two-part package is the Historical Water Use/State Water Plan data report. The district will receive the Historical Water Use/State Water Plan 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 Hays Trinity Groundwater Conservation District should be adopted by the district on or before February 23, 2016 and submitted to the executive administrator of the TWDB on or before March 24, 2016. The current management plan for Hays Trinity Groundwater Conservation District expires on May 23, 2016.

This report discusses the methods, assumptions, and results from a model run using the groundwater availability model for the Hill Country portion of the Trinity Aquifer. This model run replaces the results of GAM Run 09-033 (Aschenbach, 2010). GAM Run 15-005 meets current standards set after the release of GAM Run 09-033 including use of the official aquifer boundaries within the district rather than the entire active area of the model within the district. The Hickory and Edwards (Balcones Fault Zone) aquifers also occur within Hays Trinity Groundwater Conservation District but are not included because (1) there currently is no groundwater availability model for the Hickory Aquifer and (2) Hays Trinity Groundwater Conservation District does not have jurisdiction over the Edwards (Balcones Fault Zone) Aquifer. Table 1 summarizes the groundwater availability model data required by statute, and Figure 1 shows the area of the model from which the values in the table were extracted. If after review of the figure, Hays Trinity Groundwater Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the TWDB immediately.

METHODS:

In accordance with the provisions of the Texas State Water Code, Section 36.1071, Subsection (h), the groundwater availability model for the Hill Country portion of the Trinity Aquifer was run for this analysis. The water budget for Hays Trinity Groundwater Conservation District was extracted for the historical model period (1981-1997) using ZONEBUDGET Version 3.01 (Harbaugh, 2009). The average annual water budget values for recharge, surface water outflow, inflow to the district, outflow from the district, net inter-aquifer flow (upper), and net inter-aquifer flow (lower) for the portion of each aquifer located within the district is summarized in this report.

PARAMETERS AND ASSUMPTIONS:

Trinity Aquifer

- ☐ We used version 2.01 of the groundwater availability model for the Hill Country portion of the Trinity Aquifer System. See Jones and others (2011) for assumptions and limitations of the groundwater availability model.

- The groundwater availability model includes four layers, representing (from top to bottom):

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

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

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

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

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

- The model was run with MODFLOW-96 (Harbaugh and McDonald, 1996). We used Processing MODFLOW Pro (PMWIN) version 7.0.18 (Chiang, 2005) as the interface to process model output.

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 respective aquifers located 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 aquifers—where the aquifer is exposed at land surface—within the district.
- ☐ Surface water outflow—The total 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 aquifer properties of each aquifer or confining unit that define the amount of leakage that occurs. "Inflow" to an aquifer from an overlying or underlying aquifer will always equal the "Outflow" from the other aquifer.

The information needed for the district's management plan is summarized in Table 1. It is important to note that sub-regional water budgets are not exact. This is due to the size of the model cells and the approach used to extract data from the model. To avoid double accounting, a model cell that straddles a political boundary, such as a district or county boundary, is assigned to one side of the boundary based on the location of the centroid of the model cell. For example, if a cell contains two counties, the cell is assigned to the county where the centroid of the cell is located (Figure 1).

TABLE 1: SUMMARIZED INFORMATION FOR THE HILL COUNTRY PORTION OF THE TRINITY AQUIFER THAT IS NEEDED FOR HAYS 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	26,105
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Trinity Aquifer	22,439
Estimated annual volume of flow into the district within each aquifer in the district	Trinity Aquifer	17,716
Estimated annual volume of flow out of the district within each aquifer in the district	Trinity Aquifer	11,610
Estimated net annual volume of flow between each aquifer in the district	From the Trinity Aquifer to the Edwards (Balcones Fault Zone) Aquifer	7,440*

* in the Hays Trinity Groundwater Conservation District, groundwater generally flows east from the Trinity Aquifer to the Edwards (Balcones Fault Zone) Aquifer and the confined parts of the Trinity Aquifer that underlie the Edwards (Balcones Fault Zone) Aquifer.

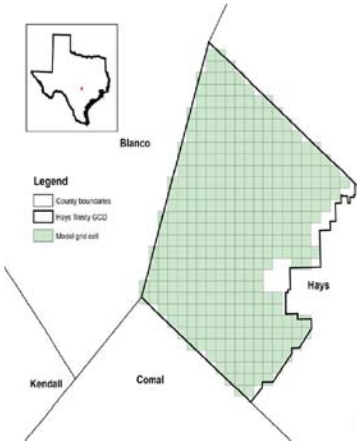

FIGURE 1: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE HILL COUNTRY PORTION OF THE TRINITY AQUIFER SYSTEM FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED.

LIMITATIONS:

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

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

A key aspect of using the groundwater model to evaluate 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., 2010, GAM Run 09-033: Texas Water Development Board, GAM Run 09-033 Report, 7 p., http://www.twdb.texas.gov/groundwater/docs/GAMruns/GR09-33.pdf.

Chiang, W., 2005, 3D-groundwater modeling with PMWIN—A simulation system for modeling groundwater flow and transport processes (2nd ed.): Springer, New York, NY, 398 p.

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.

Harbaugh, A. W., and McDonald, M. G., 1996, User’s documentation for MODFLOW-96, an update to the U.S. Geological Survey modular finite-difference ground-water flow model: U.S. Geological Survey Open-File Report 96–485, 56 p.

Jones, I. C., Anaya, R., and Wade, S. C., 2011, Groundwater availability model: Hill Country portion of the Trinity Aquifer of Texas: Texas Water Development Board Report 377, 165 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.

Texas Water Code, 2011, http://www.statutes.legis.state.tx.us/docs/WA/pdf/WA.36.pdf.

GAM Run 10-050 MAG version 2

By Mohammad Masud Hassan, P.E.

Edited and finalized by Radu Boghici to reflect statutory changes effective September 1, 2011

Texas Water Development Board
Groundwater Availability Modeling Section
(512) 463-5808
March 30, 2012

Cynthia K. Ridgeway, the Manager of the Groundwater Availability Modeling Section is responsible for oversight of work performed by employees under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G. 471 on March 30, 2012

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EXECUTIVE SUMMARY:

The modeled available groundwater for the Trinity Aquifer as a result of the desired future condition adopted by the members of Groundwater Management Area 9 declines from approximately 93,000 acre-feet per year to approximately 90,500 acre-feet per year between 2010 and 2060. This is shown divided by county, regional water planning area, and river basin in Table 1 for use in the regional water planning process. Modeled available groundwater is summarized by county, regional water planning area, river basin, and groundwater conservation district in tables 2 though 5. The estimates were extracted from Scenario 6 of Groundwater Availability Modeling Task 10-005 (Hutchison, 2010), which meets the desired future condition adopted by the members of Groundwater Management Area 9.

REQUESTOR:

Mr. Ronald G. Fieseler of the Blanco Pedernales Groundwater Conservation District on behalf of Groundwater Management Area 9

DESCRIPTION OF REQUEST:

In a letter dated August 26, 2010 and received August 30, 2010, Mr. Ronald G. Fieseler provided the Texas Water Development Board (TWDB) with the desired future condition of the Trinity Aquifer adopted by the members of Groundwater Management Area 9. The desired future condition for the Trinity Aquifer in Groundwater Management Area 9, as described in Resolution No. 07-26-10-1, is:

"Hill Country Trinity Aquifer - allow for an increase in average drawdown of approximately 30 feet through 2060 consistent with "Scenario 6" in TWDB Draft GAM Task 10-005"
The TWDB has used this adopted desired future condition to estimate the modeled available groundwater for the Trinity Aquifer for each groundwater conservation district within Groundwater Management Area 9.

METHODS:

The TWDB previously completed several predictive groundwater availability model simulations of the Trinity Aquifer to assist the members of Groundwater Management Area 9 in developing a desired future condition. The location of Groundwater Management Area 9, the Trinity Aquifer, and the groundwater availability model cells that represent the aquifer are shown in Figure 1. As stated in Resolution No. 07-26-10-1, the management area considered Groundwater Availability Modeling (GAM) Task 10-005 (Hutchison, 2010) when developing a desired future condition for the Trinity Aquifer. Since the desired future condition above is met in Scenario 6 of GAM Task 10-005, the modeled available groundwater for Groundwater Management Area 9 presented here was taken directly from that simulation. Please note that in GAM Task 10-005 the pumping was presented as an average of all years (2010 to 2060). We have reported this pumping by decade in the results shown in tables 1-5. The modeled available groundwater was then divided by county, regional water planning area, river basin, and groundwater conservation district (Figure 2).

PARAMETERS AND ASSUMPTIONS:

The parameters and assumptions for the model run using the groundwater availability model for the Trinity Aquifer are described below:

- The results presented in this report are based on Scenario 6 of GAM Task 10-005 (Hutchison, 2010). See Hutchison (2010) for a full description of the methods, assumptions, and results of the model simulations.

- The recently updated groundwater availability model (version 2.01) for the Hill Country portion of the Trinity Aquifer developed by Jones and others (2009) was used for the simulations in GAM Task 10-005. See Mace and others (2000) and Jones and others (2009) for details on model construction, recharge, discharge, assumptions, and limitations.

- The model has four layers: Layer 1 represents the Edwards Group of the Edwards-Trinity (Plateau) Aquifer, Layer 2 represents the Upper Trinity Aquifer, Layer 3 represents the Middle Trinity Aquifer, and Layer 4 represents the Lower Trinity Aquifer. Each scenario in GAM Task 10-005 consisted of a series of 387 separate 50-year model simulations, each with a different recharge configuration. Though the pumping input to the model was the same for each of the 387 simulations, the pumping output differed depending on the occurrence of inactive (or dry) cells. The results below represent the average pumping for the year shown among the simulations comprising Scenario 6 in Hutchison (2010).

Modeled Available Groundwater and Permitting

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

Groundwater conservation districts are required to consider modeled available groundwater, along with several other factors, when issuing permits in order to manage groundwater production to achieve the desired future condition(s). The other factors the districts must consider include annual precipitation and production patterns, the estimated amount of pumping exempt from permitting, existing permits, and a reasonable estimate of actual groundwater production under existing permits. The estimated amount of pumping exempt from permitting, which the Texas Water Development Board is now required to develop after soliciting input from applicable groundwater conservation districts, will be provided in a separate report.

RESULTS:

The modeled available groundwater for the Trinity Aquifer in Groundwater Management Area 9 consistent with the desired future condition decreases from 93,052 acre-feet per year in 2010 to 90,503 acre-feet per year in 2060. The modeled available groundwater has been divided by county, regional water planning area, and river basin for each decade between 2010 and 2060 for use in the regional water planning process (Table 1).

The modeled available groundwater is also summarized by county, regional water planning area, river basin, and groundwater conservation district as shown in tables 2, 3, 4, and 5, respectively. In Table 5, note that modeled available groundwater is totaled for both groundwater conservation district areas and areas without groundwater conservation districts.

REFERENCES:

Hutchison, William R., 2010, GAM Task 10-005, Texas Water Development Board GAM Task 10-005 Report, 13 p.

Jones, I.C., Anaya, R. and Wade, S., 2009, Groundwater Availability Model for the Hill Country portion of the Trinity Aquifer System, Texas, Texas Water Development Board unpublished report,193 p.

Mace, R.E., Chowdhury, A.H., Anaya, R., and Way, S-C., 2000, Groundwater availability of the Trinity Aquifer, Hill Country Area, Texas—Numerical simulations through 2050: Texas Water Development Board Report 353, 119 p.

TABLE 1. MODELED AVAILABLE GROUNDWATER FOR THE TRINITY AQUIFER IN GROUNDWATER MANAGEMENT AREA 9 DIVIDED BY COUNTY, REGIONAL WATER PLANNING AREA, AND RIVER BASIN. RESULTS ARE IN ACRE-FEET PER YEAR.

County	Regional Water Planning Area	River Basin	Year					
			2010	2020	2030	2040	2050	2060
Bandera	J	Guadalupe	76	76	76	76	76	76
		Nueces	903	903	903	903	903	903
		San Antonio	6,305	6,305	6,305	6,305	6,305	6,305
Bexar	L	San Antonio	24,856	24,856	24,856	24,856	24,856	24,856
Blanco	K	Colorado	1,322	1,322	1,322	1,322	1,322	1,322
		Guadalupe	1,251	1,251	1,251	1,251	1,251	1,251
Comal	L	Guadalupe	6,906	6,906	6,906	6,906	6,906	6,906
		San Antonio	3,308	3,308	3,308	3,308	3,308	3,308
Hays	K	Colorado	4,721	4,710	4,707	4,706	4,706	4,706
	L	Guadalupe	4,410	4,410	4,410	4,410	4,410	4,410
Kendall	L	Colorado	135	135	135	135	135	135
		Guadalupe	6,028	6,028	6,028	6,028	6,028	6,028
		San Antonio	4,976	4,976	4,976	4,976	4,976	4,976
Kerr	J	Colorado	318	318	318	318	318	318
		Guadalupe	15,646	14,129	14,056	13,767	13,450	13,434
		Nueces	0	0	0	0	0	0
		San Antonio	471	471	471	471	471	471
Medina	L	Nueces	1,575	1,575	1,575	1,575	1,575	1,575
		San Antonio	925	925	925	925	925	925
Travis	K	Colorado	8,920	8,672	8,655	8,643	8,627	8,598
Total			**93,052**	**91,276**	**91,183**	**90,881**	**90,548**	**90,503**

TABLE 2: MODELED AVAILABLE GROUNDWATER FOR THE TRINITY AQUIFER SUMMARIZED BY COUNTY IN GROUNDWATER MANAGEMENT AREA 9 FOR EACH DECADE BETWEEN 2010 AND 2060. RESULTS ARE IN ACRE-FEET PER YEAR.

County	Year					
	2010	2020	2030	2040	2050	2060
Bandera	7,284	7,284	7,284	7,284	7,284	7,284
Bexar	24,856	24,856	24,856	24,856	24,856	24,856
Blanco	2,573	2,573	2,573	2,573	2,573	2,573
Comal	10,214	10,214	10,214	10,214	10,214	10,214
Hays	9,131	9,120	9,117	9,116	9,116	9,116
Kendall	11,139	11,139	11,139	11,139	11,139	11,139
Kerr	16,435	14,918	14,845	14,556	14,239	14,223
Medina	2,500	2,500	2,500	2,500	2,500	2,500
Travis	8,920	8,672	8,655	8,643	8,627	8,598
Total	**93,052**	**91,276**	**91,183**	**90,881**	**90,548**	**90,503**

TABLE 3: MODELED AVAILABLE GROUNDWATER FOR THE TRINITY AQUIFER SUMMARIZED BY REGIONAL WATER PLANNING AREA IN GROUNDWATER MANAGEMENT AREA 9 FOR EACH DECADE BETWEEN 2010 AND 2060. RESULTS ARE IN ACRE-FEET PER YEAR.

Regional Water Planning Area	Year					
	2010	2020	2030	2040	2050	2060
J	23,719	22,202	22,129	21,840	21,523	21,507
K	16,214	15,955	15,935	15,922	15,906	15,877
L	53,119	53,119	53,119	53,119	53,119	53,119
Total	**93,052**	**91,276**	**91,183**	**90,881**	**90,548**	**90,503**

TABLE 4: MODELED AVAILABLE GROUNDWATER FOR THE TRINITY AQUIFER SUMMARIZED BY RIVER BASIN IN GROUNDWATER MANAGEMENT AREA 9 FOR EACH DECADE BETWEEN 2010 AND 2060. RESULTS ARE IN ACRE-FEET PER YEAR.

River Basin	Year					
	2010	2020	2030	2040	2050	2060
Colorado	15,416	15,157	15,137	15,124	15,108	15,079
Guadalupe	34,317	32,800	32,727	32,438	32,121	32,105
Nueces	2,478	2,478	2,478	2,478	2,478	2,478
San Antonio	40,841	40,841	40,841	40,841	40,841	40,841
Total	**93,052**	**91,276**	**91,183**	**90,881**	**90,548**	**90,503**

TABLE 5: MODELED AVAILABLE GROUNDWATER FOR THE TRINITY AQUIFER SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) IN GROUNDWATER MANAGEMENT AREA 9 FOR EACH DECADE BETWEEN 2010 AND 2060. RESULTS ARE IN ACRE-FEET PER YEAR. RA REFERS TO RIVER AUTHORITY. GWD REFERS TO GROUNDWATER DISTRICT.

Groundwater Conservation District	Year					
	2010	2020	2030	2040	2050	2060
Bandera County RA & GWD	7,284	7,284	7,284	7,284	7,284	7,284
Blanco-Pedernales GCD	2,573	2,573	2,573	2,573	2,573	2,573
Cow Creek GCD	10,622	10,622	10,622	10,622	10,622	10,622
Hays Trinity GCD	9,109	9,098	9,095	9,094	9,094	9,094
Headwaters GCD	16,435	14,918	14,845	14,556	14,239	14,223
Medina County GCD	2,500	2,500	2,500	2,500	2,500	2,500
Trinity Glen Rose GCD	25,511	25,511	25,511	25,511	25,511	25,511
Total (district areas)	**74,034**	**72,506**	**72,430**	**72,140**	**71,823**	**71,807**
No District	19,018	18,770	18,753	18,741	18,725	18,696
Total (including non-district areas)	**93,052**	**91,276**	**91,183**	**90,881**	**90,548**	**90,503**

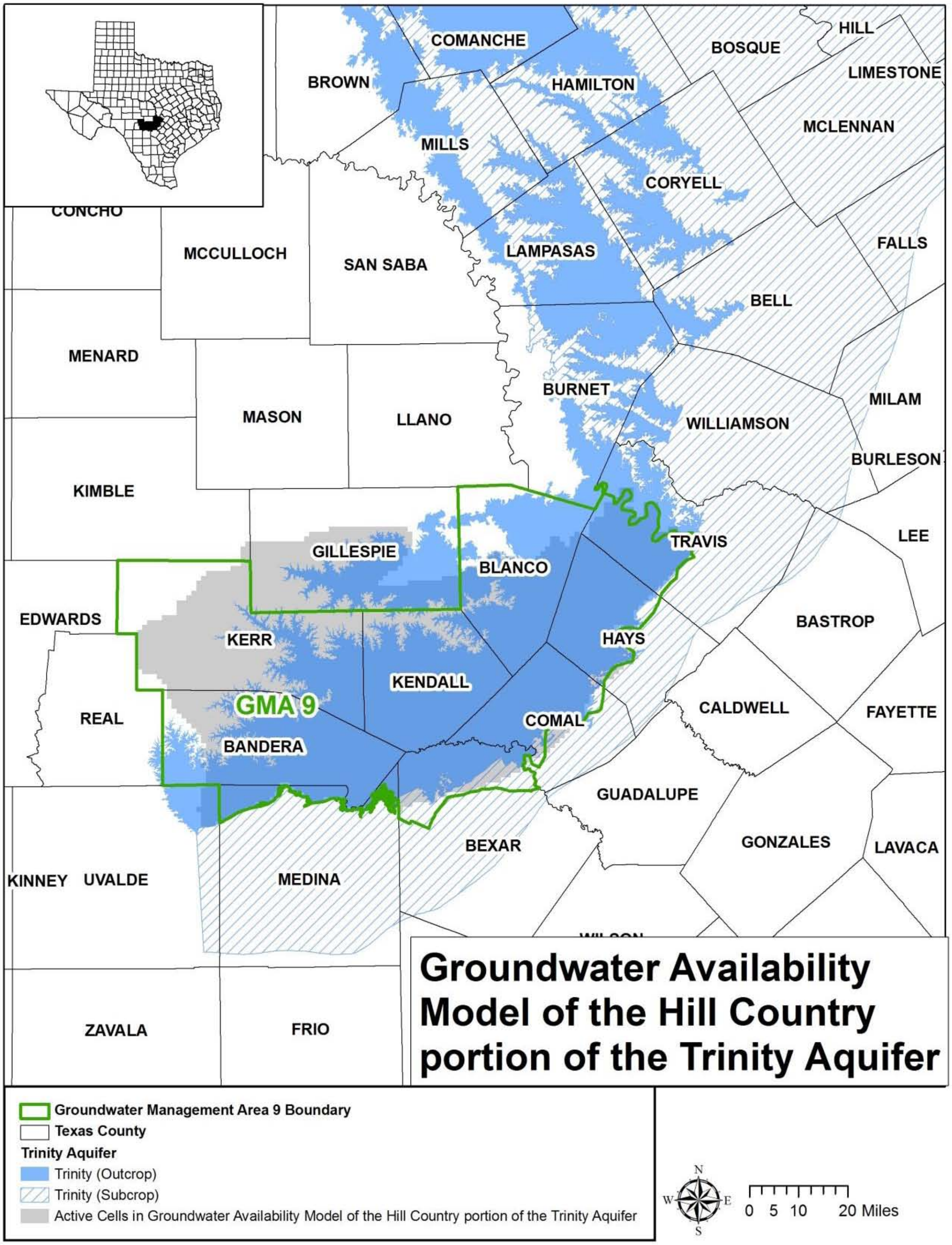

Figure 1: Map showing the areas covered by the groundwater availability model for the Trinity Aquifer.

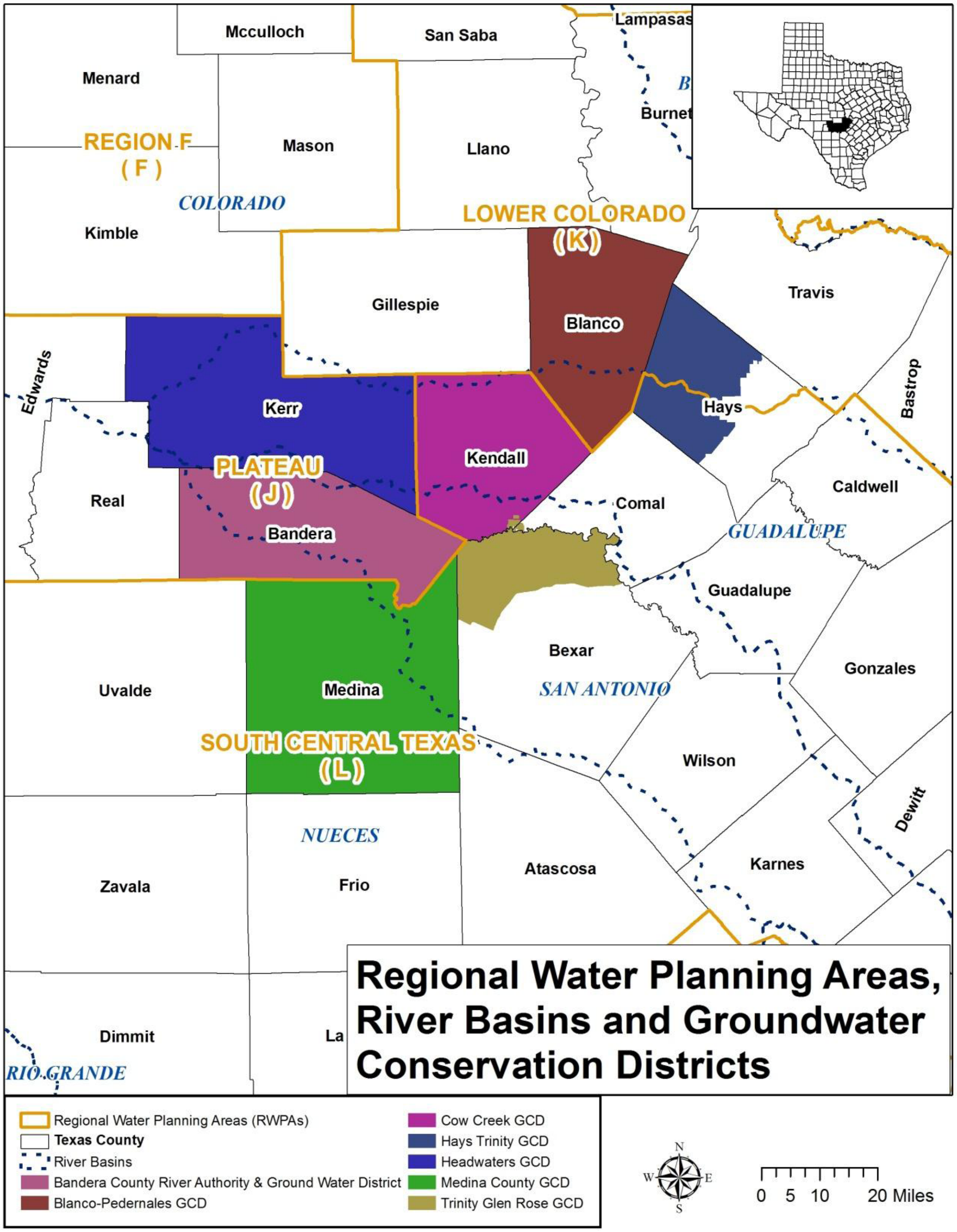

Figure 2: Map showing regional water planning areas (RWPAs), groundwater conservation districts (GCDs), counties, and river basins in Groundwater Management Area 9.

Texas Water Development Board

Groundwater Conservation District Management Plan Checklist, effective December 6, 2012

District name: ☐ **Official review** ☐ **Prereview**

Reviewing staff:

Date plan received:

Date plan reviewed:

A management plan shall contain, unless explained as not applicable, the following elements, 31 TAC §356.52(a):

	Citation of rule	Citation of statute	Present in plan and administratively complete	Source of data	Evidence that best available data was used	Notes
Is a paper hard copy of the plan available?	31 TAC §356.53(a)(1)					
Is an electronic copy of the plan available?	31 TAC §356.53(a)(2)					
1. Is an estimate of the modeled available groundwater in the District based on the desired future condition established under Section 36.108 included?	31 TAC §356.52(a)(5)(A)	TWC §36.1071(e)(3)(A)				p.
2. Is an estimate of the amount of groundwater being used within the District on an annual basis for at least the most recent five years included?	31 TAC §356.52(a)(5)(B); §356.10(2)	TWC §36.1071(e)(3)(B)				p.

For sections 3-5 below, each district must use the groundwater availability modeling information provided by the TWDB in conjunction with available site-specific information provided by the district when developing the required estimates, 31 TAC §356.52(c):

	Citation of rule	Citation of statute	Present in plan and administratively complete	Source of data	Evidence that best available data was used	Notes
3. Is an estimate of the annual amount of recharge, from precipitation, if any, to the groundwater resources within the District included?	31 TAC §356.52(a)(5)(C)	TWC §36.1071(e)(3)(C)				p.
4. For each aquifer in the district, is an estimate of the annual volume of water that discharges from the aquifer to springs and any surface water bodies, including lakes, streams and rivers, included?	31 TAC §356.52(a)(5)(D)	TWC §36.1071(e)(3)(D)				p.
5. Is an estimate of the annual volume of flow	31 TAC §356.52(a)(5)(E)	TWC §36.1071(e)(3)(E)				
a) into the District within each aquifer,						p.
b) out of the District within each aquifer,						p.
c) and between aquifers in the District,						p.
if a groundwater availability model is available, included?						
6. Is an estimate of the projected surface water supply within the District according to the most recently adopted state water plan included?	31 TAC §356.52(a)(5)(F)	TWC §36.1071(e)(3)(F)				p.
7. Is an estimate of the projected total demand for water within the District according to the most recently adopted state water plan included?	31 TAC §356.52(a)(5)(G)	TWC §36.1071(e)(3)(G)				p.
8. Did the District consider and include the water supply needs from the adopted state water plan?		TWC §36.1071(e)(4)				p.
9. Did the District consider and include the water management strategies from the adopted state water plan?		TWC §36.1071(e)(4)				p.
10. Did the district include details of how it will manage groundwater supplies in the district	31 TAC §356.52(a)(4)					p.
11. Are the actions, procedures, performance, and avoidance necessary to effectuate the management plan, including specifications and proposed rules, all specified in as much detail as possible, included in the plan?		TWC §36.1071(e)(2)				p.
12. Was evidence that the plan was adopted, after notice and hearing, included? Evidence includes the posted agenda, meeting minutes, and copies of the notice printed in the newspaper(s) and/or copies of certified receipts from the county courthouse(s).	31 TAC §356.53(a)(3)	TWC §36.1071(a)				p.
13. Was evidence that, following notice and hearing, the District coordinated in the development of its management plan with regional surface water management entities?	31 TAC §356.51	TWC §36.1071(a)				p.
14. Has any available site-specific information been provided by the district to the executive administrator for review and comment before being used in the management plan when developing the estimates required in subsections 31 TAC §356.52(a)(5)(C), (D), and (E) ?	31 TAC §356.52(c)	TWC §36.1071(h)				p.

Mark an affirmative response with YES
Mark a negative response with NO
Mark a non-applicable checklist item with N/A

Management goals required to be addressed unless declared not applicable	**Management goal** (time-based and quantifiable) 31 TAC §356.51	**Methodology for tracking progress** 31TAC §356.52(a)(4)	**Management objective(s)** (specific and time-based statements of future outcomes) 31 TAC §356.52 (a)(2)	**Performance standard(s)** (measures used to evaluate the effectiveness of district activities) 31 TAC §356.52 (a)(3)	**Notes**
Providing the most efficient use of groundwater 31 TAC 356.52(a)(1)(A); TWC §36.1071(a)(1)	15)	16)	17)	18)	p.
Controlling and preventing waste of groundwater 31 TAC 356.52(a)(1)(B); TWC §36.1071(a)(2)	19)	20)	21)	22)	p.
Controlling and preventing subsidence 31 TAC 356.52(a)(1)(C); TWC §36.1071(a)(3)	23)	24)	25)	26)	p.
Addressing conjunctive surface water management issues 31 TAC 356.52(a)(1)(D); TWC §36.1071(a)(4)	27)	28)	29)	30)	p.
Addressing natural resource issues that impact the use and availability of groundwater and which are impacted by the use of groundwater 31 TAC 356.52(a)(1)(E); TWC §36.1071(a)(5)	31)	32)	33)	34)	p.
Addressing drought conditions 31 TAC 356.52(a)(1)(F); TWC §36.1071(a)(6)	35)	36)	37)	38)	p.
Addressing	39)	40)	41)	42)	
a) conservation,	39a)	40a)	41a)	42a)	p.
b) recharge enhancement,	39b)	40b)	41b)	42b)	p.
c) rainwater harvesting,	39c)	40c)	41c)	42c)	p.
d) precipitation enhancement, and	39d)	40d)	41d)	42d)	p.
e) brush control	39e)	40e)	41e)	42e)	p.
where appropriate and cost effective 31 TAC 356.52(a)(1)(G); TWC §36.1071(a)(7)					
Addressing the desired future conditions established under TWC §36.108. 31 TAC 356.52(a)(1)(H); TWC §36.1071(a)(8)	43)	44)	45)	46)	p.
Does the plan identify the performance standards and management objectives for effecting the plan? 31 TAC §356.52(a)(2)&(3); TWC §36.1071(e)(1)			47)	48)	

Mark required elements that are present in the plan with YES
Mark any required elements that are missing from the plan with NO
Mark plan elements that have been indicated as not applicable to the district with N/A