Hays Trinity Groundwater Conservation District

GROUNDWATER MANAGEMENT PLAN

December 2010

Board of Directors

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David G. Baker, Vice President
Precinct 4
Mark Key, Treasurer/Secretary
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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 as 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 54.4 percent, approximately 370 square miles, of western Hays County (Figure 1). The District is divided into five single member districts for Board of Directors' representation, each with a population of approximately 8,000(Figure 2).

The Board of Directors in fiscal year 2010 is composed of

- Jimmy K. Skipton: President: Represents Single Member District 1
- David G. Baker: Vice president Represents Single Member District 4
- Mark A. Key: Board Treasurer/Secretary Represents Single Member District 3
- Dr. Joan S. Jernigan: Member, Represents Single Member District 5
- Gregory F. Nesbitt: Member, Represents Single Member District 2

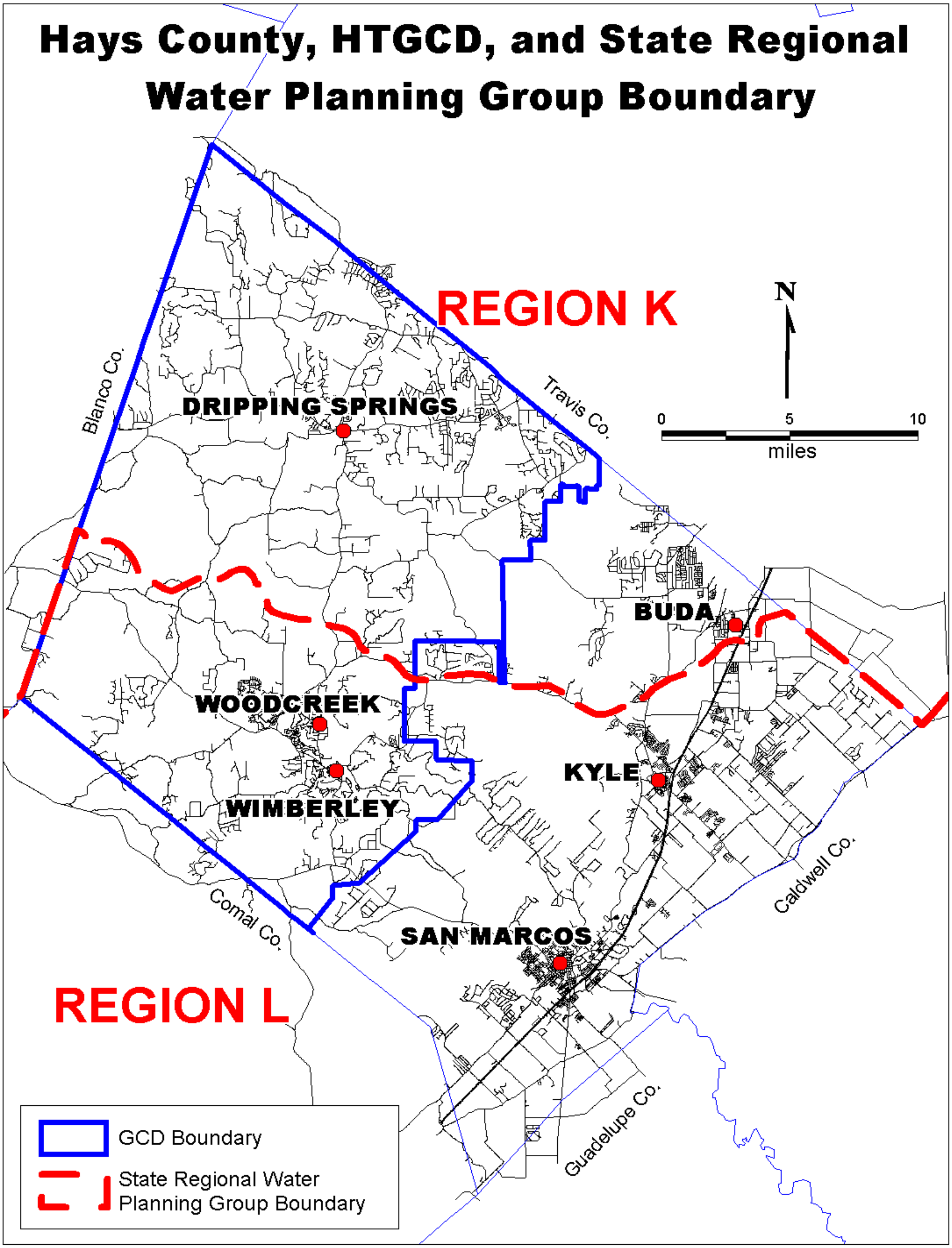

Figure 1: Hays County, District, and State regional water planning group boundaries.

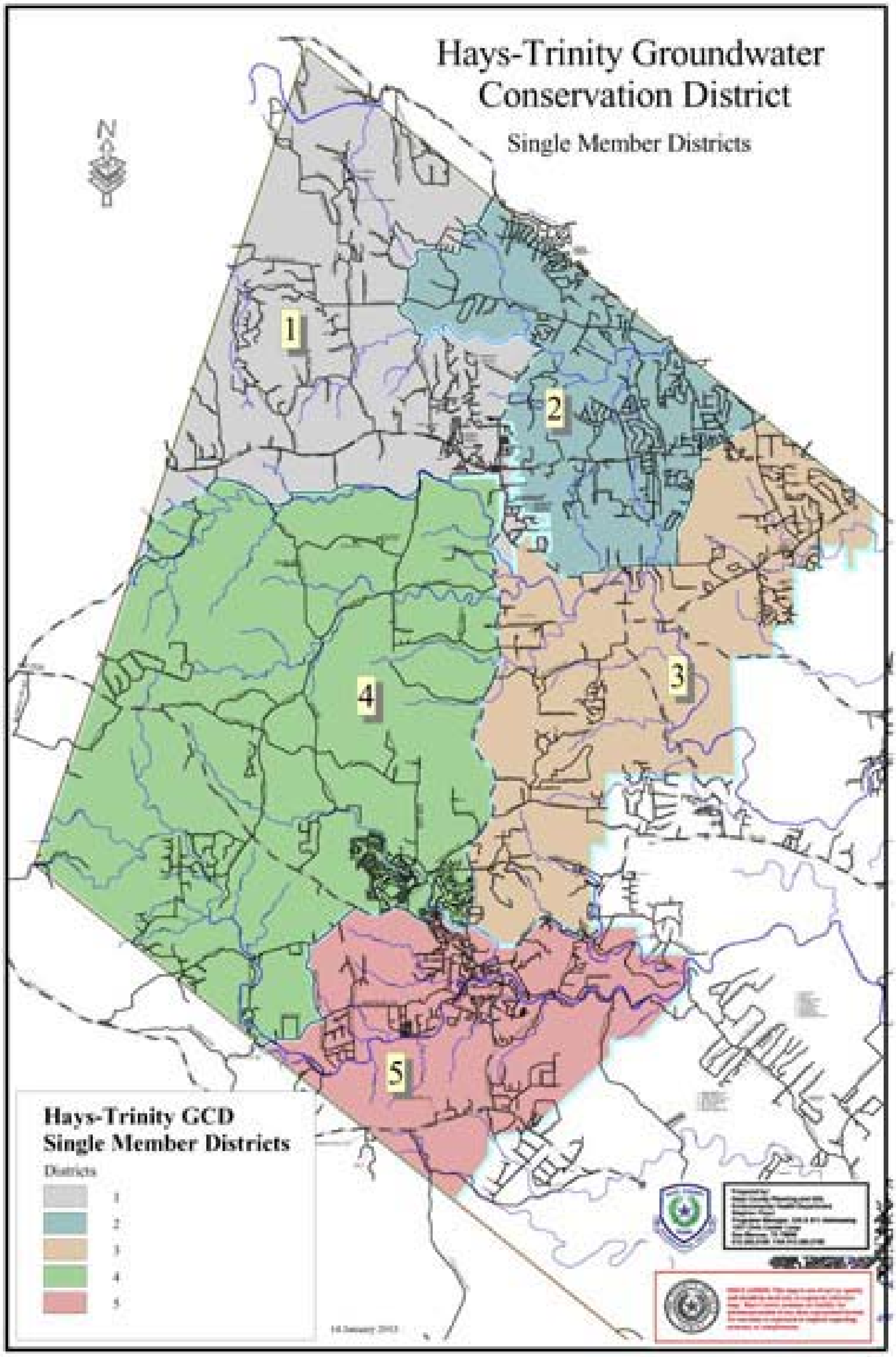

Figure 2: Single member districts within the District.

STATEMENT OF GUIDING PRINCIPLES

The District has a goal of sustainable management of the Trinity Aquifer including maintaining base flow contribution to streams during a repeat of the drought of record and, in critical depletion areas and management zones, at a rate of stream/spring base flow that maintains a sound ecological environment. The guiding principles will serve as a basis for the possible 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 degradation of water quality in surface water and groundwater;
- Consider preservation of historic use of groundwater;
- Prevent waste of groundwater;
- Minimize the reduction of artesian pressure;
- Promote the conservation of groundwater drought response actions through voluntary measures for wells not regulated by the District;
- Encourage the use of rainwater collection systems;
- Cooperate with surface water providers to facilitate the sustainable management of groundwater resources and the equitable distribution of surface and groundwater resources;
- Consider mandatory conservation and drought response actions for wells regulated by the District ("non-exempt wells");
- Promote artificial recharge of the aquifers though such means as proper brush management, re-establishing deep rooted native grasses and creation of surface water runoff collection/infiltration dams; and
- Continue to develop water production limits based on scientific study of the aquifer and establishment of management zones as authorized by Chapter 36 and the District's enabling legislation.

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

The District shall use this plan as a guidepost 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

- The drilling and spacing of wells,
- Water quality in surface water and groundwater,
- Production of groundwater within the District, and
- 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,
- Provide for the District's management and regulation of identified critical groundwater depletion areas and management zones within the District, and
- 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 district website http://haysgroundwater.com/files/Rules/2007_HTGCD_Rules.pdf and http://haysgroundwater.com/files/Rules/RULE9-FINAL.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.

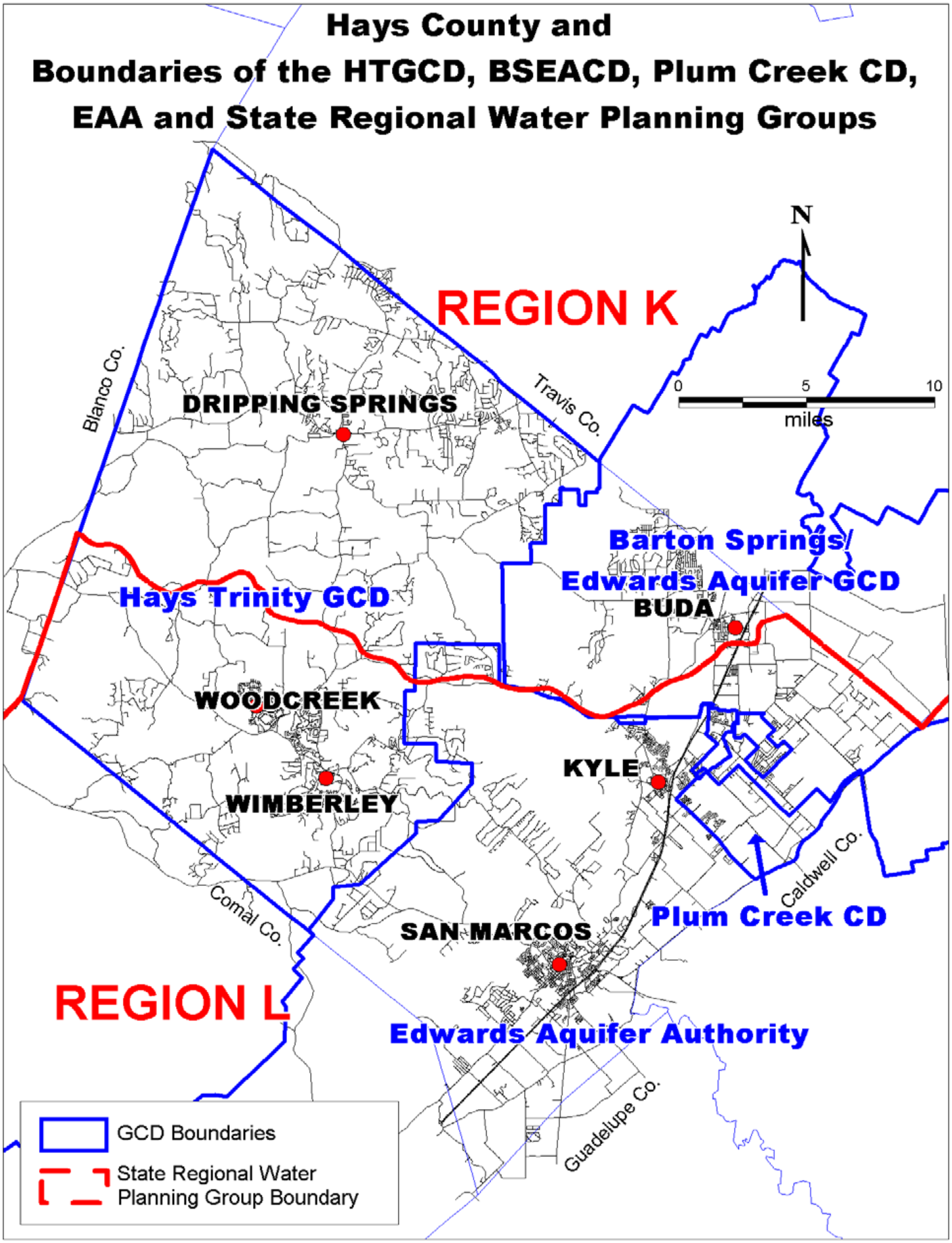

Figure 3: County, groundwater conservation district, and RWPG boundaries in the area of the District.

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 district is located primarily within the GMA9 but has minor portions of overlap into GMA10. 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:

- TWDB, "Groundwater Availability of the Trinity Aquifer, Hill Country Area, Texas: Numerical Simulations through 2050" (T-HC GAM) (Mace *et al.*, 2000);
- TWDB, "Groundwater Availability Model for the Edwards-Trinity (Plateau) and Cenozoic Pecos Alluvium Aquifer System, Texas" (E-T GAM) (Anaya *et al.*, 2004);
- Planning information from the 2006 regional water plans for Region K (LCRWPG, 2006) and Region L (SCTRWPG, 2006) and the 2007 State Water Plan (TWDB, 2007);
- Adjoining groundwater conservation districts' adopted groundwater management plans (BPGCD, 2003; HCUWCD, 2003; BSEACD, 2008; HGCD, 2008);
- Data from regional surface water providers such as the Lower Colorado River Authority and the Guadalupe Blanco River Authority (LCRWPG,2006); and
- Site-specific data developed by the District.
- 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

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.

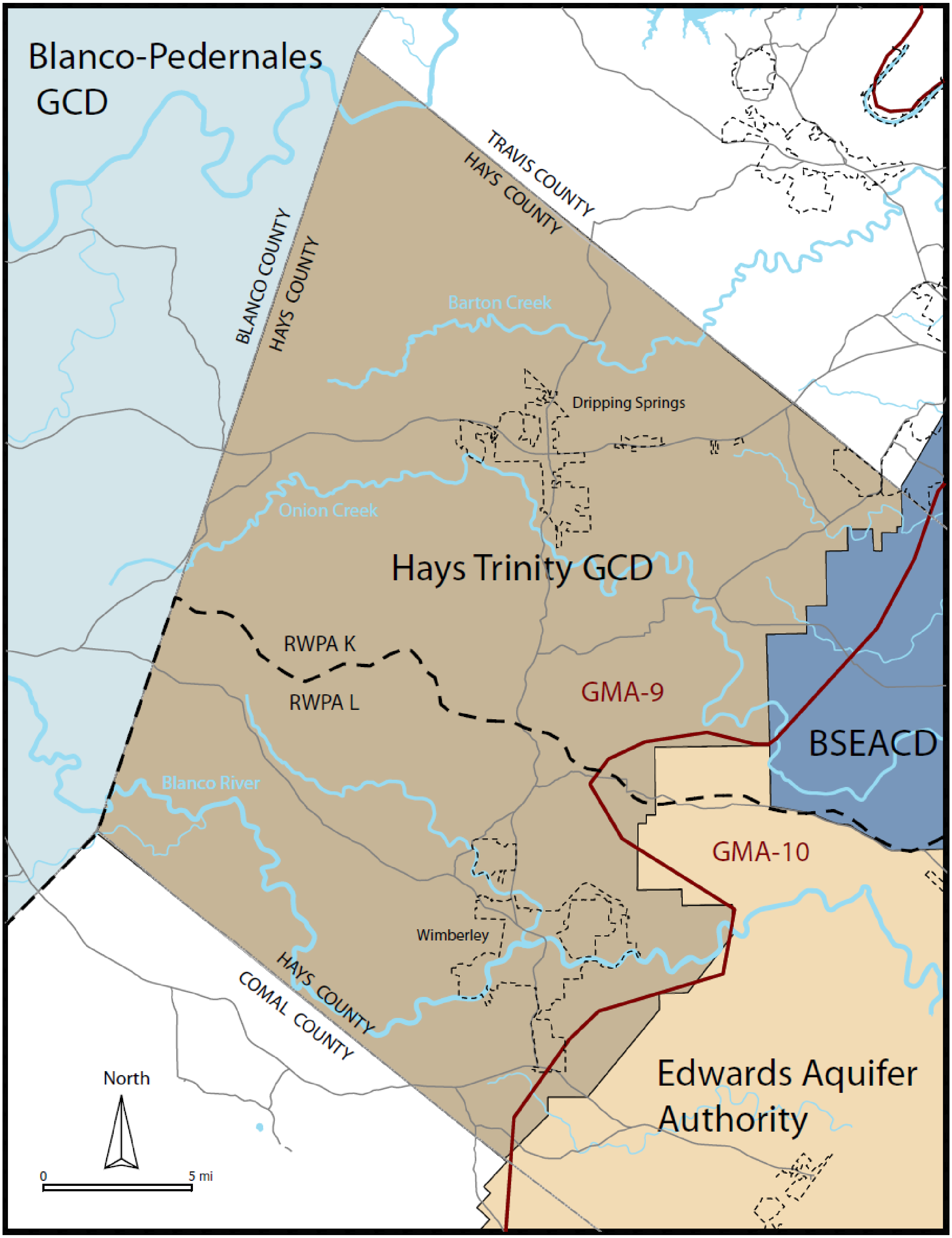

Figure 4: District, Groundwater Management Area & RWPA boundaries within Hays County.

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, 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).

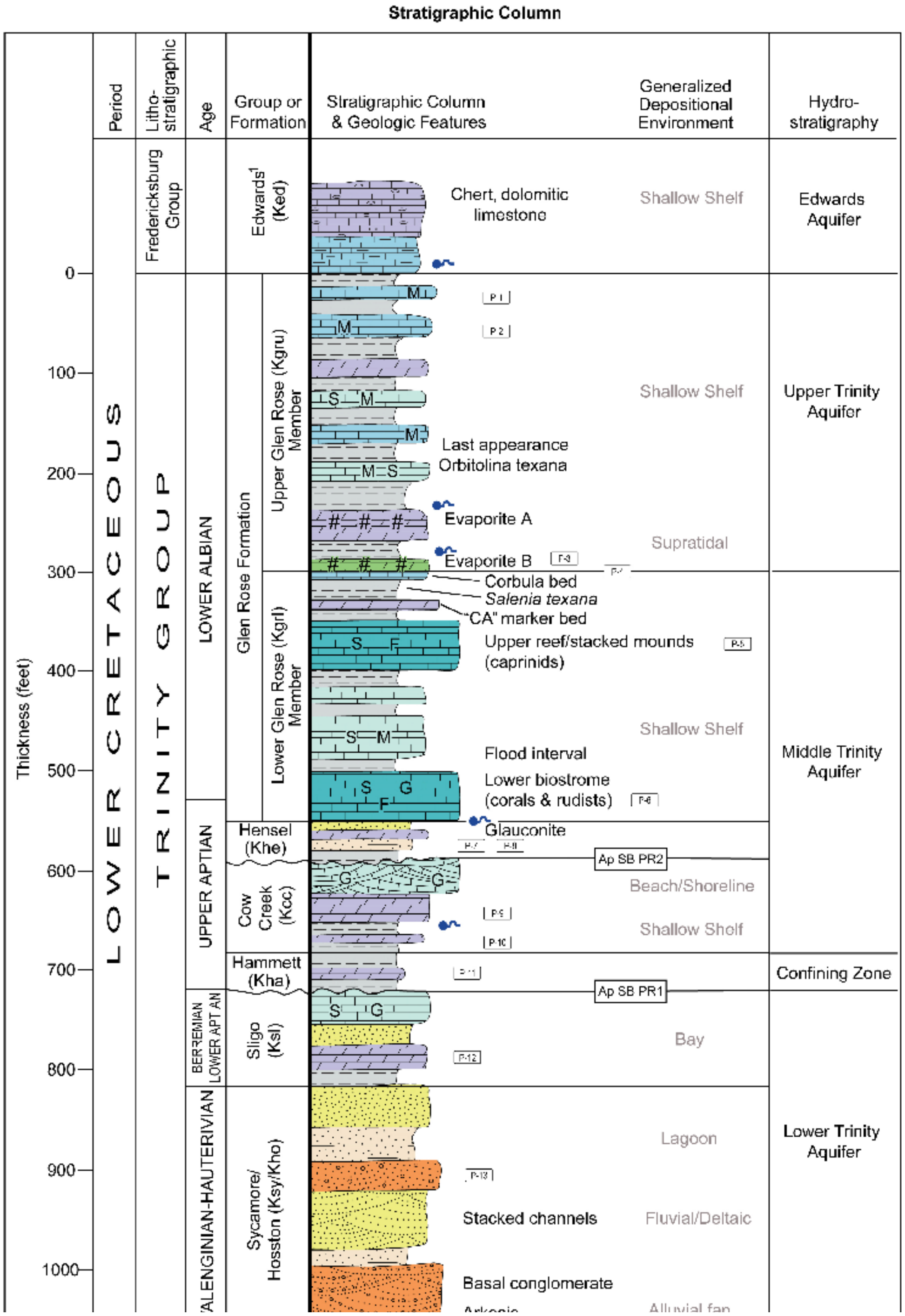

Figure 5: Stratigraphic and hydrostratigraphic section of the Hill Country Trinity (from Hydrogeologic Atlas).

GROUNDWATER RESOURCES OF THE DISTRICT

Trinity Aquifer

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 5). 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).

Upper and Middle Trinity Aquifers

Aquifer thickness for the combined Upper and Middle Trinity Aquifers ranges from 400 to 600 feet, but varies according to topography and geology. 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 a short distances due to heterogeneities in the water bearing formations, fracture controlled flow, and dissolution features as well as lithology (Mace *et al.*, 2000). Groundwater production from Trinity Aquifer wells in the District is used primarily for municipal, rural domestic, and livestock demands.

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 anhydrite (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 5) (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). The extent of the Upper Trinity sub-aquifer is limited aerially and generally behaves as an unconfined aquifer. The Middle Trinity sub-aquifer may behave locally as a confined aquifer, but more typically behaves as an unconfined to semi-confined aquifer.

Ashworth (1983) reports that in some areas, "caverns formed by the solution of limestone and evaporite by ground water 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 5) (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)

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 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 likely contribute groundwater to the Edwards Aquifer along the Balcones Fault Zone (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." The T-HC 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 are included below.

Amount of groundwater being used—The quantity of groundwater withdrawn or flowing from an aquifer naturally or artificially on an annual basis.

Projected water demand—The quantity of water needed per annum for beneficial use during the period covered by the management plan. The demands shall be projected for the types of use that are included in the State Water Plan. Each type of use may be subdivided into sub-types by the District.

Projected water supply—The useable amount of groundwater of acceptable quality that is available per annum as determined by the District using the best available data and the quantity of surface water available per annum during the period covered by the management plan based on full implementation of any applicable, approved regional water plan.

Recharge--The amount of water that infiltrates to the water table of an aquifer (from Chpt 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.

Artificial recharge—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.

Managed Available Groundwater—the amount of water that may be permitted by a district for beneficial use in accordance with the desired future condition of the aquifer.

Managed Available Groundwater (MAG) Estimates

Although interim MAG estimates are available (TWDB) based on proposed DFCs for aquifers located within Groundwater Management Areas 9 and 10, the final approved MAG calculations have not yet been received by the HTGCD. Therefore, it is not possible for the Groundwater District to present any definitive MAG estimates in the Management Plan at this time. When the final MAG calculations become available from the TWDB, District groundwater plans can be amended to reflect these numbers.

The GMA-9 Board adopted a DFC for the Trinity Aquifer on July 26, 2010. The DFC allows for an increase in average drawdown of no more than 30 feet over the period 2010 – 2060.

TWDB GAM Run 09-033, July 2010

METHODS:
“We ran the groundwater availability models for the Edwards-Trinity (Plateau) Aquifer (1980 through 2000) and the Hill Country portion of the Trinity Aquifer (1981 through 1997), which includes the portions of the Edwards-Trinity (Plateau) Aquifer and (1) extracted water budgets for each year of the transient model period and (2) averaged the 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 portions of the aquifers located within the district.”

PARAMETERS AND ASSUMPTIONS:
Edwards-Trinity (Plateau) Aquifer

The Edwards-Trinity (Plateau) Aquifer (Layer 1in the GAM) is not present in the HTGCD and therefore, is not considered in the management plan.

Trinity Aquifer

• “We used version 2.01 of the groundwater availability model for the Hill County portion of the Trinity Aquifer. See Jones and others (2009) 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 County portion of the Trinity Aquifer (Layer 2 to Layer 4 collectively).”

• “The General-Head Boundary (GHB) package of MODFLOW was used to represent flow out of the study area and across the Balcones Fault Zone (BFZ) into the Edwards (BFZ) Aquifer or the deeper Trinity Aquifer units. For simplicity, the GHB that corresponds to the uppermost layer (Layer 2) was used to represent the flow from the Edwards portion of the Edwards-Trinity (Plateau) Aquifer, across the Balcones Fault Zone and into the portion of the Edwards (BFZ) Aquifer within the Edwards Aquifer Authority (EAA) District.

This flow is included in the management plan requirement for "estimated annual volume of flow out of the district within each aquifer in the district." The GHB in Layer 3 was used to represent the flow from the Trinity portion of the Edwards-Trinity (Plateau) Aquifer, across the Balcones Fault Zone and into the deeper Trinity Aquifer units. This flow is not specifically listed in the management plan requirement tables, but it is included in the text for reference. Only the outcrop area of the Hill County portion of the Trinity Aquifer was modeled by the TWDB, and the down-dip extent that underlies the Edwards (Balcones Fault Zone) Aquifer is not included.

RESULTS:

"A groundwater budget summarizes the amount of water entering and leaving the aquifer according to the groundwater availability model. Selected components were extracted from the groundwater budget for the aquifers located within the District and averaged over the duration of the calibration and verification portion of the model runs in the District, as shown in Table 1. The components of the modified budget shown in Table 1 include:

- Precipitation recharge—this is the aerially 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—this is the total water exiting the aquifer (outflow) to surface water features such as streams, reservoirs, and drains (springs).
- Flow into and out of district—this component describes lateral flow within the aquifer between the District and adjacent counties.
- Flow between aquifers—this describes the vertical flow, or leakage, 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 district or county boundaries, 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."

Comparison of the groundwater availability models for the Edwards-Trinity (Plateau) Aquifer and the Hill Country portion of the Trinity Aquifer

The Edwards-Trinity (Plateau) Aquifer and the Hill Country portion of the Trinity Aquifer overlap in the study area. The Edwards Group and associated limestone hydrostratigraphic units (Layer 1) of the Edwards-Trinity (Plateau) Aquifer model and the Edwards Group (Layer 1) of the Hill County portion of the Trinity Aquifer model **are not present in the District**. Therefore, all associated flows for these layers are considered to be zero, and any comparison in flows between the two models is made on the undifferentiated Trinity Group hydrostratigraphic units (Layer 2) from the Edwards-Trinity (Plateau) Aquifer and the Trinity units (Layer 2 to Layer 4 collectively) from the Hill County portion of the Trinity Aquifer .The estimated annual amount of recharge from precipitation to the district from the Edwards-Trinity (Plateau) Aquifer model is 30,702 acre-feet per year, and the estimated annual amount from the Hill County portion of the Trinity Aquifer model is 26,101 acre-feet per year (Layer 2 to Layer 4 collectively). The estimated annual volume of water that discharges from springs and any surface water body to the District from the Edwards-Trinity (Plateau) Aquifer model is 3,149 acre-feet per year, and the estimated annual amount from the Hill County portion of the Trinity Aquifer model is 21,555 acre-feet per year (Layer 2 to Layer 4 collectively).

The estimated annual volume of flow into the District for the Edwards-Trinity (Plateau) Aquifer model is 6,799 acre-feet per year, and the estimated annual amount for the Hill County portion of the Trinity Aquifer model is 16,908 acre-feet per year (Layer 2 to Layer 4 collectively).

The estimated annual volume of flow out of the district from the Edwards-Trinity (Plateau) Aquifer model is 15,405 acre-feet per year. There is no General-Head Boundary (GHB) in Layer 1 of the Edwards-Trinity (Plateau) Aquifer model within the District: therefore, no additional flow is included. The estimated annual volume of flow out of the district from the Hill County portion of the Trinity Aquifer model is 15,145 acre-feet per year (Layer 2 to Layer 4 collectively), which also includes the estimated net flow leaving the district through the GHB in the uppermost layer (Layer 2) and going across the Balcones Fault Zone (BFZ) into the Edwards (BFZ) Aquifer within the Edwards Aquifer Authority (EAA) District.

The GHB in Layer 2 of the Edwards-Trinity (Plateau) Aquifer model was used to represent flow from the undifferentiated Trinity, across the Balcones Fault Zone and into the deeper Trinity Aquifer units. This flow has been estimated to be 14,657 acre-feet per year. The GHB in Layer 3 of the Hill County portion of the Trinity Aquifer model was also used to represent flow from the Trinity across the Balcones Fault Zone within the Trinity Aquifer. This flow has been estimated to be 3,973 acre-feet per year.

While the two models cover the same general area within the district, the Edwards-Trinity (Plateau) Aquifer model calibration is not as focused on targets in the vicinity of the district since the model grid covers a larger area overall. The Hill Country portion of the Trinity Aquifer model is believed to better represent groundwater availability in the district since it is a more localized model and the calibration is more closely tied to the region. **Therefore, the Hill Country portion of the Trinity Aquifer model should be used to meet the management plan requirements (see Table 1 for a summary).**"

Table 1: Summarized groundwater budget information for the Trinity Aquifer, Hays Trinity Groundwater Conservation District. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot. (TWDB GAM Run 09-033)

Management Plan requirement	Aquifer	Results
Estimated annual amount of recharge from precipitation to the district	Trinity Aquifer	26,101
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Trinity Aquifer	21,555
Estimated annual volume of flow into the district within each aquifer in the district	Trinity Aquifer	16,908
Estimated annual volume of flow out of the district within each aquifer in the district	Trinity Aquifer	15,145
Estimated net annual volume of flow between each aquifer in the district	Not applicable	Not applicable

Table 2: Projected Trinity Aquifer availability values for Hays County from the 2006 TWDB-approved regional water plans for regions K and L.

		Water availability for the Trinity Aquifer, Hays County (acre-feet per year)					
RWPG	**River basin**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
K	Colorado	2,500	2,500	2,500	2,500	2,500	2,500
L	Guadalupe	1,213	1,213	1,213	1,213	994	994
	Total availability in Hays County	**3,713**	**3,713**	**3,713**	**3,713**	**3,494**	**3,494**

Source: SRCAvailability table (TWDB, 2007).

Table 3: TWDB Water Use Survey data by water use type for Trinity Aquifer use in Hays County over the TWDB period of record.

River basin	Year	Municipal	Mfg	Power	Mining	Irrigation	Livestock	Basin total	Annual total
Colorado	1980	564	0	0	0	45	142	750	
Guadalupe	1980	717	0	0	0	57	180	955	**1,705**
Colorado	1984	374	0	0	0	22	112	507	
Guadalupe	1984	475	0	0	0	28	142	646	**1,153**
Colorado	1985	649	0	0	0	28	18	695	
Guadalupe	1985	825	0	0	0	36	23	884	**1,579**
Colorado	1986	661	0	0	0	19	17	697	
Guadalupe	1986	842	0	0	0	25	21	888	**1,585**
Colorado	1987	577	0	0	0	15	18	610	
Guadalupe	1987	735	0	0	0	20	22	777	**1,387**
Colorado	1988	577	0	0	0	13	19	609	
Guadalupe	1988	734	0	0	0	16	24	774	**1,383**
Colorado	1989	733	0	0	0	0	19	752	
Guadalupe	1989	934	0	0	0	0	24	958	**1,710**
Colorado	1990	775	0	0	0	0	18	793	
Guadalupe	1990	986	0	0	0	0	24	1,010	**1,803**
Colorado	1991	813	0	0	23	0	19	855	
Guadalupe	1991	1,034	0	0	30	0	25	1,089	**1,944**
Colorado	1992	786	0	0	33	0	14	832	
Guadalupe	1992	1,000	0	0	41	0	17	1,059	**1,891**
Colorado	1993	860	0	0	33	0	16	909	
Guadalupe	1993	1,094	0	0	41	0	21	1,156	**2,065**
Colorado	1994	968	0	0	70	0	18	1,056	
Guadalupe	1994	1,231	0	0	89	0	23	1,343	**2,399**
Colorado	1995	1,010	0	0	70	0	18	1,098	
Guadalupe	1995	1,285	0	0	89	0	23	1,397	**2,495**
Colorado	1996	1,146	0	0	70	0	14	1,230	
Guadalupe	1996	1,458	0	0	89	0	18	1,565	**2,795**
Colorado	1997	1,255	0	0	69	0	12	1,336	
Guadalupe	1997	1,597	0	0	87	0	16	1,700	**3,036**
Colorado	1998	1,403	0	0	65	0	15	1,483	
Guadalupe	1998	1,786	0	0	82	0	19	1,887	**3,370**
Colorado	1999	1,406	0	0	65	0	17	1,487	
Guadalupe	1999	1,789	0	0	82	0	21	1,893	**3,380**
Colorado	2000	926	0	0	65	0	14	1,005	
Guadalupe	2000	1,178	0	0	82	0	18	1,278	**2,283**
Colorado	2001	1,327	0	0	58	0	15	1,400	
Guadalupe	2001	1,689	0	0	74	0	19	1,782	**3,182**
Colorado	2002	1,386	0	0	58	0	13	1,458	
Guadalupe	2002	1,765	0	0	74	0	17	1,855	**3,313**
Colorado	2003	1,035	0	0	76	0	33	1,144	
Guadalupe	2003	1,318	0	0	97	0	41	1,456	**2,600**

Source: TWDB (2008). (Data breakdown: 44% - Colorado Basin; 56% - Guadalupe Basin; HTGCD)

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.

Projected Total Water Supply in the District

The total water supply in the District is projected to increase from 5,466 acre-feet per year in 2010 to 6,274 acre-feet per year in 2040, and then decrease to 4,627 acre-feet per year by 2060 (Table 4). The values shown in Table 4 are based on supply projections in the table WUGSupply in Volume 3 of the 2007 State Water Plan, which are based on supply projections in the 2006 regional water plans for regions K and L (LCRWPG, 2006; SCTRWPG, 2006; TWDB, 2007). These projections are for Hays County within the Colorado and Guadalupe river basins, but are not calculated specifically for the area within District boundaries. For this reason, the supply estimates for the District include (1) all Trinity Aquifer water supply, because the Edwards (BFZ) Aquifer is the primary source of water outside District boundaries; (2) supplies for municipal users in the District; and (3) a portion of supplies for general county-wide uses (such as irrigation) relative to the proportion of area occupied by the District (that is, 76 percent of demand in the Colorado Basin in Hays County and 38 percent of demand in the Guadalupe Basin in Hays County). In addition, Edwards (BFZ) Aquifer supply for the Plum Creek Water Company was excluded because it is assumed that this water supplied a portion of the water user outside District boundaries.

Table 4: Projected Water Supply in the District.

Water user group	RWPG	River basin	Source	Projected water supply (acre-feet per year) 2010	2020	2030	2040	2050	2060
Groundwater sources									
County other	L	Guadalupe	Trinity Aquifer	152	152	152	151	124	124
Dripping Springs WSC	K	Colorado	Trinity Aquifer	240	240	240	240	240	240
Irrigation	K	Colorado	Trinity Aquifer	2	2	2	2	1	1
Livestock	K	Colorado	Trinity Aquifer	30	30	30	30	25	25
Mining	K	Colorado	Trinity Aquifer	12	12	12	12	10	10
Mining	L	Guadalupe	Trinity Aquifer	60	63	65	67	56	56
Wimberley WSC	L	Guadalupe	Trinity Aquifer	599	597	596	595	488	487
Woodcreek	L	Guadalupe	Trinity Aquifer	128	128	128	127	104	104
Woodcreek Utilities Inc	L	Guadalupe	Trinity Aquifer	273	273	272	272	222	222
Surface water sources									
County other	K	Colorado	Highland Lakes Lake/Reservoir System	1,455	1,455	1,455	1,455	0	0
Dripping Springs	K	Colorado	Highland Lakes Lake/Reservoir System	560	560	560	560	0	0
Hill Country WSC	K	Colorado	Highland Lakes Lake/Reservoir System	440	702	980	1,249	1,582	1,844
Hill Country WSC	K	Colorado	Colorado River run-of-river	0	0	0	0	0	0
Irrigation	K	Colorado	Colorado River combined run-of-river irrigation	31	31	31	31	31	31
Irrigation	L	Guadalupe	Guadalupe River combined run-of-river irrigation	131	131	131	131	131	131
Livestock	K	Colorado	Livestock local supply	146	146	146	146	146	146
Livestock	L	Guadalupe	Livestock local supply	53	53	53	53	53	53
Manufacturing	L	Guadalupe	Guadalupe River combined run-of-river manufacturing	217	217	217	217	217	217
Steam electric power	L	Guadalupe	Canyon Lake/Reservoir	936	936	936	936	936	936
			Groundwater total	**1,496**	**1,497**	**1,497**	**1,496**	**1,270**	**1,269**
			Surface water total	**3,970**	**4,232**	**4,510**	**4,779**	**3,096**	**3,358**
			District total	**5,466**	**5,729**	**6,007**	**6,274**	**4,366**	**4,627**

Source: SRC Supply table (TWDB, 2007). The area served by Hill Country WSC is now served by the Lower Colorado River Authority. The district was unable to verify reliable “reuse” data for Table 4. Therefore, the line heading was not included in the table.

As shown on Table 4 the majority of projected water supplies come from surface water sources, primarily from the Highland Lakes and Canyon Lake reservoirs. These water supplies include only water that can be obtained with existing infrastructure and permits. Where needed, additional water supplies are expected to be created by management strategies.

Projected Water Demand

The total water demand for the District is projected to increase from 9,995 acre-feet per year in 2010 to 28,422 acre-feet per year in 2060 (Table 5). The projected water demands shown are from the table WUGNetDemand in Volume 3 of the 2007 State Water Plan, which provides demand projections by county and river basin. These water demand values take into account projected water savings from water conservation measures (Lance Christian, personal communication, 2009). The values in Table 5 include demand projections for cities and water suppliers within the District and estimates of projected demand within the District for general water user groups, such as livestock. In the State Water Plan, projections for these general water user groups are calculated for the portions of the Colorado and Guadalupe river basins within Hays County, but are not calculated for the portions of these areas within District boundaries. Therefore, the demands for these water user groups within the District were estimated by assuming an even spatial distribution of demand and calculating the proportion of demand based on the proportion of area the District within each river basin in Hays County (that is, 76 percent of demand in the Colorado Basin in Hays County and 38 percent of demand in the Guadalupe Basin in Hays County).

Table 5: Projected water demands in the District.

				Projected water demand (acre-feet per year)					
Water user group	**RWPG**	**River basin**	**Use type**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
County other	K	Colorado	Municipal	2,699	3,697	4,718	5,758	7,051	8,067
County other	L	Guadalupe	Municipal	549	625	705	789	897	982
Dripping Springs	K	Colorado	Municipal	1,080	1,856	2,297	2,745	3,300	3,736
Dripping Springs WSC	K	Colorado	Municipal	348	501	660	817	1,013	1,166
Hill Country WSC	K	Colorado	Municipal	440	702	980	1,249	1,582	1,844
Irrigation	K	Colorado	Irrigation	8	8	8	8	8	8
Irrigation	L	Guadalupe	Irrigation	134	133	132	131	130	128
Livestock	K	Colorado	Livestock	167	167	167	167	167	167
Livestock	L	Guadalupe	Livestock	106	106	106	106	106	106
Manufacturing	K	Colorado	Manufacturing	525	615	705	796	879	954
Manufacturing	L	Guadalupe	Manufacturing	81	95	108	122	135	147
Mining	K	Colorado	Mining	9	5	2	0	0	0
Mining	L	Guadalupe	Mining	54	57	60	61	62	62
Steam electric power	L	Guadalupe	Steam-electric	2,025	2,900	3,390	3,988	4,717	5,605
Wimberley WSC	L	Guadalupe	Municipal	776	997	1,224	1,442	1,736	1,966
Woodcreek	L	Guadalupe	Municipal	246	315	385	452	540	610
Woodcreek Utilities Inc.	L	Guadalupe	Municipal	748	1,145	1,564	1,974	2,477	2,873
			District total	**9,995**	**13,924**	**17,212**	**20,607**	**24,799**	**28,422**

Source: WUGNetDemand table (TWDB, 2007). The area served by Hill Country WSC is now served by the Lower Colorado River Authority.

Surface Water Resources and Usage in the District

Northern Hays County—Lower Colorado River Authority (LCRA)

The LCRA "Highway 290 Pipeline" supplies surface water to large developments in the northern Hays County and to the City of Dripping Springs. With improvements to the water treatment plant, the water line has the capacity to serve about 10,000 households. See Figure 6, obtained from the LCRA, for the location of existing and proposed pipelines and developments in eastern and northern parts of the District.

Water service from the "290 line" began in 2002. A little less than half of the 290 line's capacity is available for developments that existed in May 2000. So far, about 180 households in the Sunset Canyon subdivision have connected to the line. LCRA also has a contract to provide the Dripping Springs Water Supply Corporation with enough water for 1,100 households. At the request of private developers, the corporation has extended the "290 pipeline" west of Dripping Springs to County Road 187 (McGregor Lane) and south to a development on Creek Road, adjacent to Onion Creek. The water line's remaining capacity is available for new development. The LCRA Board has approved water service agreements for about 6,000 households in new developments.

The LCRA entered into an agreement in 2003 to serve 1,050 households in Highpoint Development (formerly Sawyer Ranch), just west of the Belterra development. The proposed Headwaters of Barton Creek development along Highway 290 is intending to use surface water from the "290 pipeline". The development includes over 900 households and large commercial area fronting Highway 290.

In 2004, the LCRA signed agreements with developers along Hamilton Pool Road to extend surface water supplies to several southwestern Travis County developments. As shown on Figure 6 published by the LCRA, it is the intent to extend the Hamilton Pool Road Pipeline to Highway 12. The pipeline will enter the District just south of the intersection of Highway 12 and Hamilton Pool Road.

The pipeline will run south along Highway 12 to the City of Dripping Springs where it will tie into the Highway 290 pipeline. LCRA is also proposing to extend the Hamilton Pool Road pipeline south along Crumley Ranch Road that will ultimately tie into the 290 pipeline. Most of this pipeline is within the District.

Southern Hays County—Guadalupe Blanco River Authority

The Guadalupe Blanco River Authority (GBRA) is reportedly in discussions with Wimberley Water Supply Company to possibly pipe water to the Wimberley/Woodcreek area from Canyon Lake.

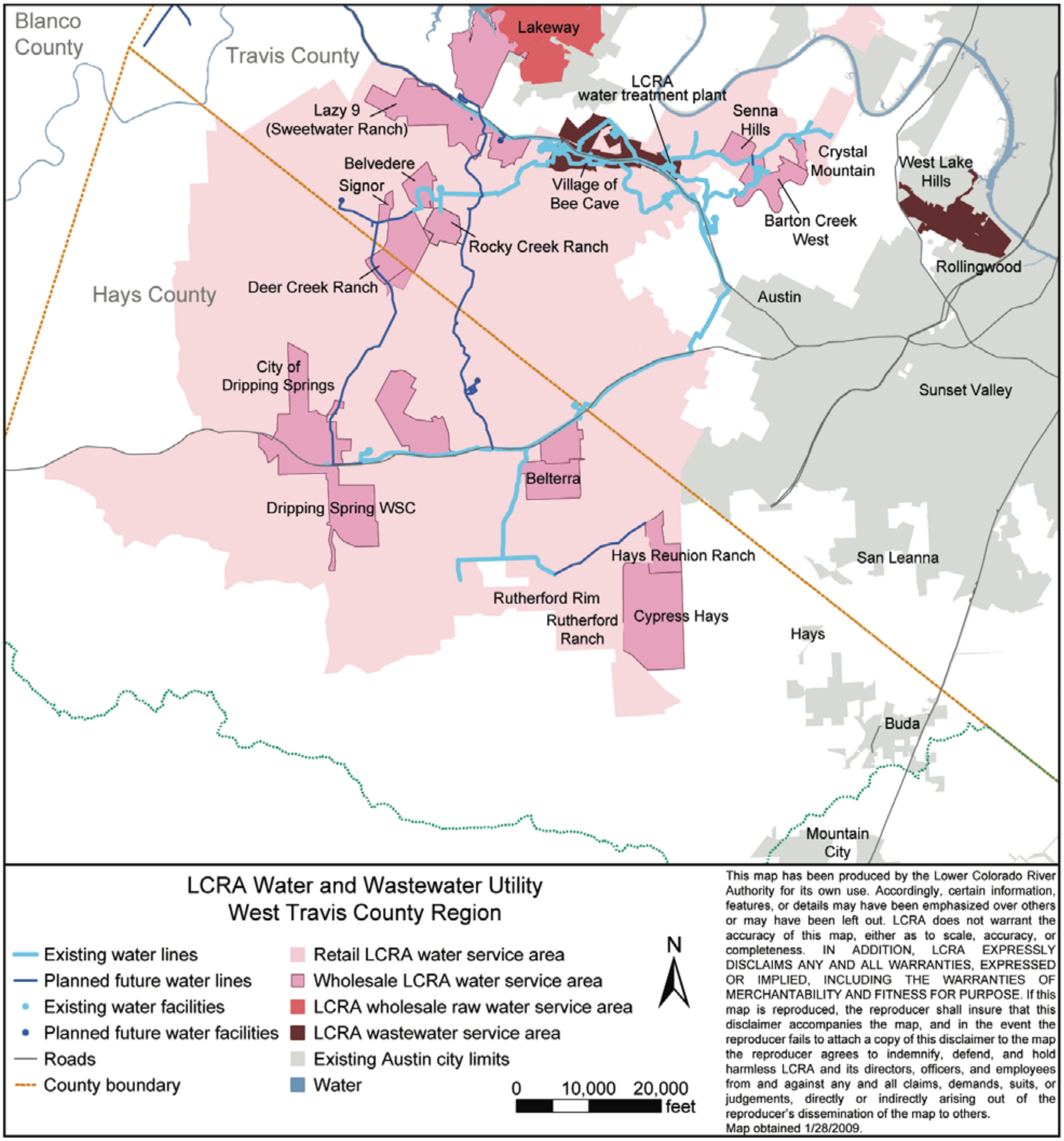

Figure 6: LCRA water infrastructure and service areas, Hays and Travis counties.

Water Needs in the District

Without the development and implementation of innovative water management strategies, it appears that over half of the water user groups in the District will have water demands that exceed their water supplies in coming decades. The resulting water needs are projected to increase from 2,429 acre-feet per year in 2010 to 21,032 acre-feet per year in 2060 (Table 6). These projections are from the 2006 regional water plans for regions K and L and the 2007 State Water Plan (LCRWPG, 2006; SCTRWPG, 2006; TWDB, 2007). In these plans, projections for general water user groups, such as irrigation and livestock, are calculated for the portions of the Colorado and Guadalupe river basins within Hays County, but are not calculated for the portions of these areas within District boundaries.

Therefore, the demands for these water user groups within the District were estimated by assuming an even spatial distribution of demand and calculating the proportion of demand based on the proportion of area the District within each river basin in Hays County (that is, 76 percent of demand in the Colorado Basin in Hays County and 38 percent of demand in the Guadalupe Basin in Hays County).

Table 6: Projected water needs and surpluses within the District. (Positive values reflect a water surplus; negative values reflect a water need).

				Annual water need or surplus (acre-feet per year)					
Water user group	**RWPG**	**River basin**	**Use type**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
County other	K	Colorado	Municipal	-577	-1,575	-2,596	-3,635	-6,384	-7,400
County other	L	Guadalupe	Municipal	-392	-468	-549	-633	-752	-836
Dripping Springs	K	Colorado	Municipal	-520	-1,296	-1,737	-2,185	-3,300	-3,736
Dripping Springs WSC	K	Colorado	Municipal	-108	-261	-420	-577	-773	-926
Hill Country WSC	K	Colorado	Municipal	0	0	0	0	0	0
Irrigation	K	Colorado	Irrigation	732	732	732	732	731	731
Irrigation	L	Guadalupe	Irrigation	187	188	189	190	191	192
Livestock	K	Colorado	Livestock	476	476	476	476	472	472
Livestock	L	Guadalupe	Livestock	-31	-31	-31	-31	-31	-31
Manufacturing	K	Colorado	Manufacturing	176	86	-5	-96	-178	-253
Manufacturing	L	Guadalupe	Manufacturing	802	788	774	760	748	736
Mining	K	Colorado	Mining	7	11	14	16	14	14
Mining	L	Guadalupe	Mining	-31	-33	-35	-36	-40	-41
Steam electric power	L	Guadalupe	Steam-electric	406	-468	-958	-1,556	-2,285	-3,173
Wimberley WSC	L	Guadalupe	Municipal	-177	-400	-628	-847	-1,248	-1,479
Woodcreek	L	Guadalupe	Municipal	-118	-187	-257	-325	-436	-506
Woodcreek Utilities Inc	L	Guadalupe	Municipal	-475	-872	-1,292	-1,702	-2,255	-2,651
	Total water needs within the District			**-2,429**	**-5,591**	**-8,508**	**-11,623**	**-17,682**	**-21,032**

Source: WUGNeedsSurplus table (TWDB, 2007). The area served by Hill Country WSC is now served by the Lower Colorado River Authority.

Water management strategies in the District

As part of the water planning process, RWPGs are required to develop water management strategies that can create new supplies (or decrease demands) to meet projected water needs. A list of water management strategies for selected water user groups in Hays County, developed by Regions K and L for their regional water plans and accepted in the 2007 State Water Plan, is shown in Table 7 (LCRWPG, 2006; SCTRWPG, 2006; TWDB, 2007). This list includes strategies for municipalities within the District and strategies to meet needs for general uses (such as irrigation and livestock) throughout Hays County. As is shown on Table 7, the majority of water needs are expected to be met using surface water supplies—for example, by creating new infrastructure to transport surface water and by renewing and amending contracts with water suppliers. Water conservation strategies are expected to meet the second-largest number of needs. Strategies using groundwater are expected to meet the third-largest number of needs, or about 20 percent of new supplies. The most significant groundwater strategy is the creation of dams along Onion Creek to enhance recharge to the Edwards (BFZ) Aquifer, which is located outside of District boundaries. Strategies involving the use of the Trinity Aquifer include increased use of groundwater for livestock watering and temporary overdrafts (use in excess of groundwater availability) from the aquifer to meet manufacturing demands.

Table 7: Water management strategies proposed to meet projected needs for selected water user groups in Hays County.

Water user group	RWPG	River basin	Water management strategy	Source	New supply from strategy (acre-feet per year) 2010	2020	2030	2040	2050	2060
County other	L	Guadalupe	Canyon Reservoir: downstream diversions	Canyon Lake/Reservoir	4,480	4,480	0	0	0	0
County other	L	Guadalupe	Municipal water conservation	Water conservation (Hays County)	0	0	12	49	112	184
County other	K	Colorado	LCRA contract renewals	Highland Lakes Lake/Reservoir System	0	0	0	0	1,915	1,915
County other	K	Colorado	Onion Creek recharge dams	Edwards (BFZ) Aquifer (Hays County)	0	0	4,000	4,000	4,000	5,043
County other	K	Colorado	Construct GBRA Pipeline	Canyon Lake/Reservoir	1,680	1,680	1,680	1,680	1,680	1,680
County other	K	Colorado	Purchase water from City of Austin	Colorado River run-of-river (Travis County)	1,100	1,100	1,100	1,100	1,100	1,100
Dripping Springs	K	Colorado	Municipal water conservation	Water conservation (Hays County)	81	277	470	549	661	748
Dripping Springs	K	Colorado	LCRA contract renewals	Highland Lakes Lake/Reservoir System	0	0	0	0	560	560
Dripping Springs	K	Colorado	Amend LCRA contract	Highland Lakes Lake/Reservoir System	1,875	1,875	1,875	1,875	2,258	2,428
Dripping Springs WSC	K	Colorado	Amend LCRA contract	Highland Lakes Lake/Reservoir System	1,156	1,156	1,156	1,156	773	926
Livestock	L	Guadalupe	Local groundwater (Trinity Aquifer)	Trinity Aquifer (Hays County)	82	82	82	82	82	82
Manufacturing	K	Colorado	Temporary overdraft of Trinity Aquifer	Trinity Aquifer (Hays County)	0	0	6	126	234	333
Mining	L	Guadalupe	Recycled water programs	Direct reuse (Hays County)	82	88	92	94	106	107
Steam electric power	L	Guadalupe	Industrial, steam-electric power generation, and mining water conservation	Water conservation (Hays County)	0	1,231	2,522	4,095	6,013	8,351
Wimberley WSC	L	Guadalupe	Municipal water conservation	Water conservation (Hays County)	0	0	0	0	19	70
Wimberley WSC	L	Guadalupe	Wimberley and Woodcreek water supply from Canyon Reservoir	Canyon Lake/Reservoir	177	400	628	847	1,248	1,479
Woodcreek	L	Guadalupe	Municipal water conservation	Water conservation (Hays County)	0	0	2	6	20	37
Woodcreek	L	Guadalupe	Wimberley and Woodcreek water supply from Canyon Reservoir	Canyon Lake/Reservoir	118	187	257	325	436	506
Woodcreek Utilities Inc.	L	Guadalupe	Municipal water conservation	Water conservation (Hays County)	56	177	337	455	619	771
Woodcreek Utilities Inc.	L	Guadalupe	Wimberley and Woodcreek water supply from Canyon Reservoir	Canyon Lake/Reservoir	475	872	1,292	1,702	2,255	2,651
Total water projected to be generated by water management strategies for selected water user groups in Hays County					**11,362**	**13,678**	**15,785**	**18,620**	**24,841**	**29,966**

DETAILS ON HOW THE DISTRICT WILL MANAGE GROUNDWATER

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, agreements entered into by the District, and additional planning efforts 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 planning period for this plan is 10 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.

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 spring and surface flow, adjacent landowners and potential future users of groundwater. 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 with the goal of sustainable management of the Trinity Aquifer including maintaining base flow contribution to streams and rivers. To accomplish this
- The District will use the best available scientific data to determine the most effective regulatory and conservation measures.
- Groundwater within the District will be managed using the best available 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.
- The District will monitor groundwater conditions (including available supply and groundwater storage) through its water 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.

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 http://haysgroundwater.com/files/Rules/2007_HTGCD_Rules.pdf and http://haysgroundwater.com/files/Rules/RULE9-FINAL.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 practical and consistent with this plan.

Critical Groundwater Depletion Areas (Management Zones)

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

1. Establish groundwater availability and limit the production of groundwater and
2. Determine and implement the proportional reductions of the use of groundwater 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.

For the purpose of managing the use of groundwater within the District, the District will define sustainable use 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 District's goal of sustainable management of the Trinity Aquifer to maintain base flow contribution to local streams and rivers during a repeat of the drought of record.
2. 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 currently available 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 Mining

- The District is in agreement with the opposition to mining of groundwater expressed in the Region K Plan (ES.6.1).

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 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 during the last monthly Board meeting of each year. The first and subsequent years will commence on the date of approval of this plan by TWDB. The report will include the number of instances in which each of the activities specified in the Districts management objectives was engaged in during the fiscal year. The Board will maintain the report on file, for public inspection at the Districts offices upon adoption. This methodology will apply to all management goals contained within this plan.

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 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 Hydrogeologic skills 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. **The District has a goal to implement measures for managing 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 determine if any amendments to the rules are recommended to prevent the waste of groundwater.

3. **The control and prevention of 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 ground- 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 (Table 6), 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 ground and surface water resources so that these resources can be conjunctively managed and 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 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 hydraulic 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. **The District has a goal to manage the use of the Aquifer such that sufficient groundwater resources are available for high priority uses during drought conditions –** A review of the historical rainfall in Hays County, together with analyses provided by TWDB and regional agencies, demand 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 climatic 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 to the Texas Drought Preparedness Council Situation Report (Situation Report) posted on the Texas Department of Public Safety website: http://www.txdps.state.tx.us/dem/sitrepindex.htm.

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 and Situation Reports 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 7 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 springflow monitoring station at Jacob's Well, a major Trinity Aquifer spring.

Performance Standard

Each year, the District, at a public meeting, 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. The District has a goal to promote conservation of water resources throughout the District.

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. 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. 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. 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. 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. Monitoring Desired Future Conditions (DFC)

The GMA9 and GMA10 DFC's submitted to the TWDB in July 2010 will require a monitoring program to ensure compliance. The District maintains a groundwater-level monitoring program that began in 1999 and records changes in water levels over time throughout the District. The program currently includes 41 wells (Figure 7). The water level in most wells is measured monthly, and several now contain transducers to provide continuous recordings of water-level fluctuation. Examples of well hydrographs in program wells are shown in Figures 8 and 9.

12.1 Management Objective

The HTGCD is currently working with the GMA-9 Technical Committee to develop a well data base-map that will identify all monitor wells in the management area. The committee is also working on an acceptable method to measure and report drawdown levels. Deliverables may include potentiometric surface maps of Trinity sub-aquifers and selected hydrographs

The district will monitor and record water levels on 41 Hays County wells (Figure 7). Measurements will be taken monthly when possible, and posted on the district website. Hydrographs will be constructed for each monitored well. The HTGCD will work within the guidelines of the GMA-9 to determine a "base aquifer level" from which an average drawdown over time may be established. The Management Plan will be revised when the methodology is reviewed and approved.

Performance standard

The district will calculate the average drawdown of the Trinity Aquifer water level utilizing methodology adopted by the GMA-9.The HTGCD shall provide a summary of the average drawdown within the district on its website and in its annual report.

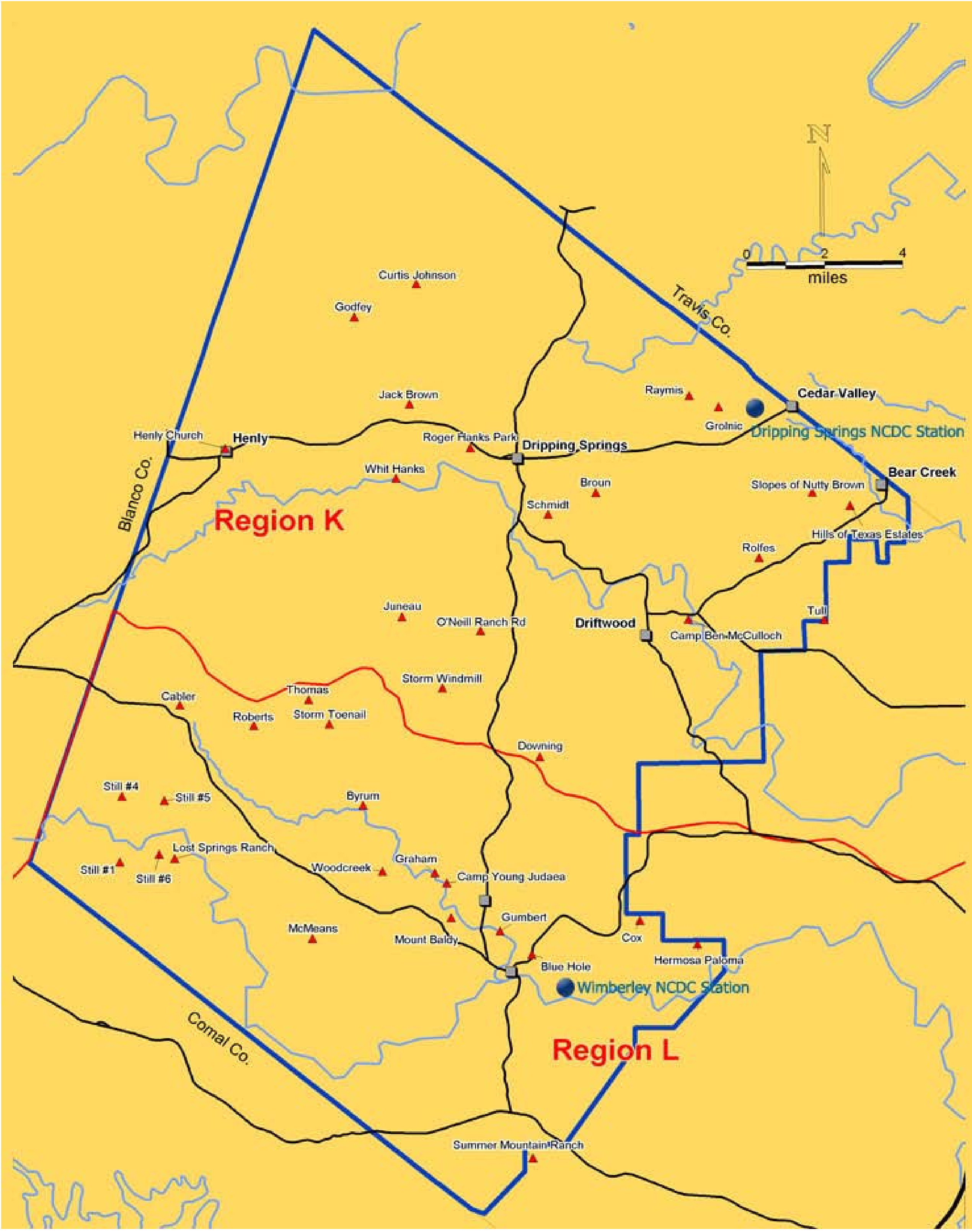

Figure 7: Hays Trinity GCD: monitoring well locations

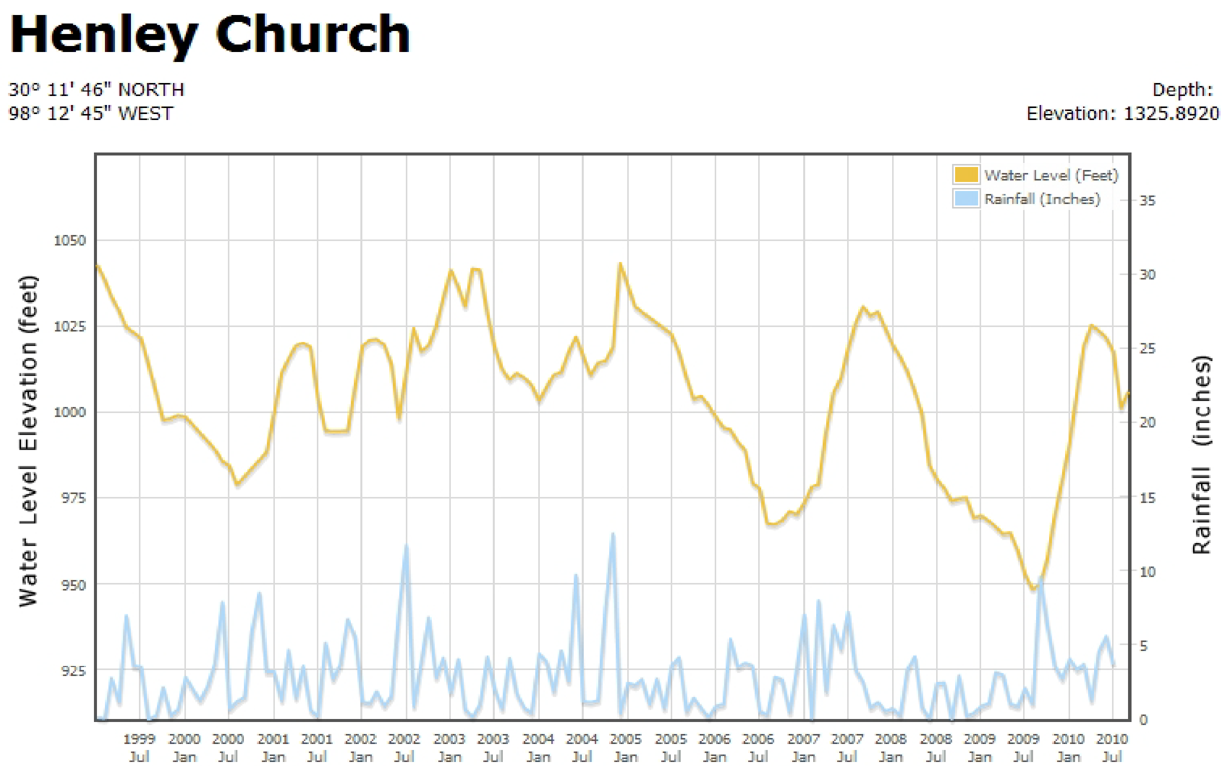

Figure 8: Hydrograph of the water level in the Henly Baptist Church monitoring well.

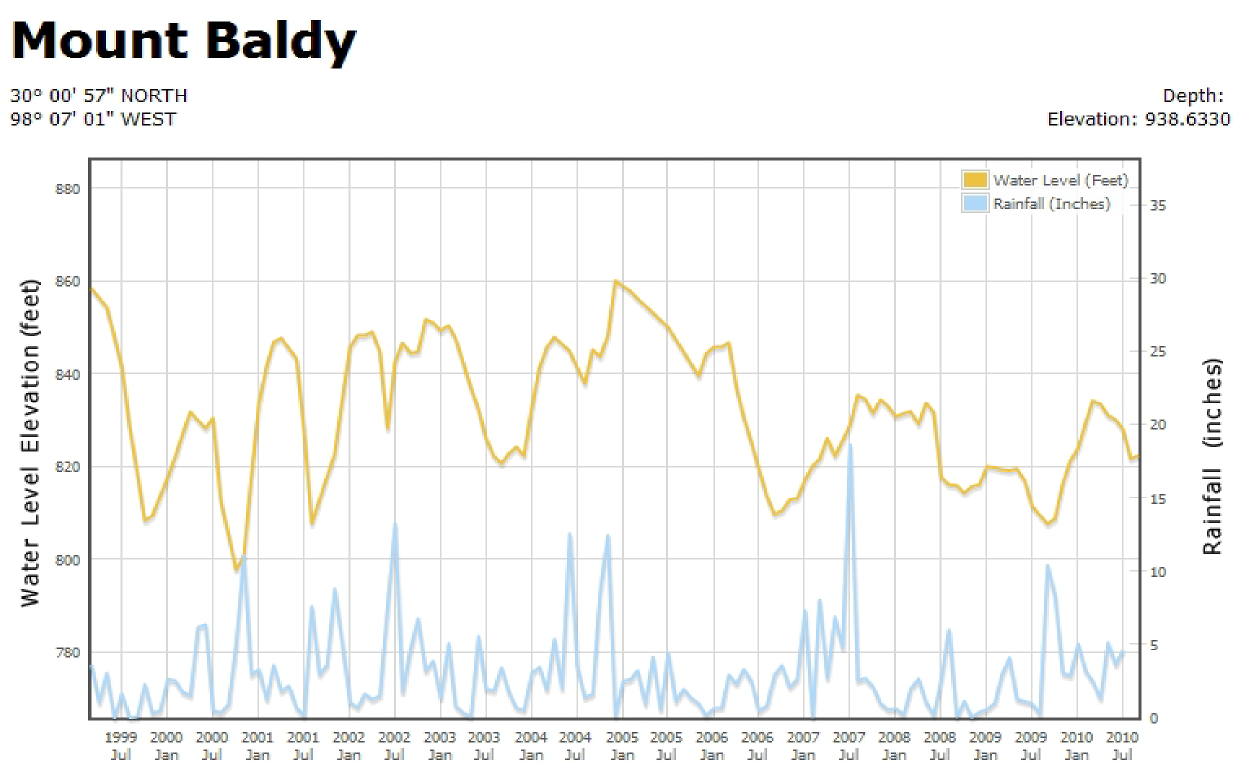

Figure 9: Hydrograph of the water level in the Mount Baldy monitoring well.

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