Cow Creek Groundwater Conservation District
GROUNDWATER MANAGEMENT PLAN

Originally Adopted
September 7, 2004

Board of Directors
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Precinct 4
W. K. "Skip" Shumpes, Vice-President
Precinct 2
Bill Haas, Secretary
Precinct 3
Dalton F. Neill, Treasurer
At Large
Stan Scott, Asst. Secretary/Treasurer
Precinct 1

Revision, Adopted
December 14, 2009

Board of Directors
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John Kight, Vice-President
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Precinct 2
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Precinct 3

Revision, Adopted
January 20, 2015

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Precinct 1
Bobby Schwab, Treasurer
Precinct 3
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Precinct 4

General Manager
Micah Voulgaris
Cow Creek Groundwater Conservation District
201 East San Antonio Avenue, Suite 100
Boerne, Texas 78006
(830) 816-2504

GROUNDWATER MANAGEMENT PLAN
REVISION RECORD

Date Adopted	Effective Date	Affected Sections or General Comments
9/7/04	9/7/04	Original Adoption, CCGCD Board Resolution 090704-1
12/14/09	12/14/09	Revision, Re-adoption, CCGCD Board Resolution 2009-019
1/20/15	1/20/15	Revision, Re-adoption, CCGCD Board Resolution 2015-01

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TIME PERIOD FOR THIS PLAN

This plan becomes effective upon adoption by the Cow Creek Groundwater Conservation District Board of Directors (District Board) and subsequent approval by the Texas Water Development Board (TWDB). This plan incorporates a planning period of 50 years. After five years, the plan will be reviewed for consistency with the applicable Regional Water Plans, the State Water Plan and Groundwater Management Area 9's Desired Future Conditions (DFC) and shall be readopted with or without amendments. The plan may be revised at anytime in order to maintain such consistency or as necessary to address any new or revised data, Groundwater Availability Models, Desired Future Conditions in GMA 9, or District management strategies.

DISTRICT MISSION

The Cow Creek Groundwater Conservation District (CCGCD or District) was created for the purpose of conserving, preserving, recharging, protecting and preventing waste of groundwater from the aquifers within the District. The District will conduct administrative and technical activities and programs to achieve these purposes. The District will collect and archive water well and aquifer data, regulate water well drilling and production from permitted, non-exempt wells, promote the capping or plugging of abandoned wells, provide information and educational material to local property owners, interact with other governmental or organizational entities, and undertake other groundwater-related activities that may help meet the purposes of the District. The Texas Hill Country Area, which includes the Cow Creek GCD, was declared a Critical Groundwater Area by the then Texas Water Commission in 1990. This declaration, now known as the Hill Country Priority Groundwater Management Area (PGMA), gave notice to the residents of the area that water availability and quality will be at risk within the next 25 years.

STATEMENT OF GUIDING PRINCIPLES FOR AQUIFER MANAGEMENT

The CCGCD was created in order that appropriate groundwater management techniques and strategies could be implemented at the local level to address groundwater issues or problems within the District. The District will continue to incorporate the best and most current site-specific data available in the development of this plan to ensure the sustainability of the aquifers and achievement of the DFC's. This plan serves as a guideline the District can follow to ensure greater understanding of local aquifer conditions, development of groundwater management concepts and strategies, and subsequent implementation of appropriate groundwater management policies.

COMMITMENT TO IMPLEMENT GROUNDWATER MANAGEMENT PLAN

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 management plan will be coordinated with District Rules, policies, and

activities in order to effectively manage and regulate the drilling of wells, production of groundwater within the District, protection of recharge features, prevention of pollution and waste, the transfer of groundwater into and out of the District, and encouragement of conservation practices and efficient water use within the District. This includes the evaluation of the impact(s) of conjunctive use of surface and groundwater. A conjunctive water source is the combined use of groundwater and surface water sources to optimize the beneficial characteristics of each. The term "conjunctive use" means the combined use of groundwater and surface water sources that optimizes the beneficial characteristics of each source (Texas Water Code, Chapter 36).

Three basic terms form the basis of water planning. The key terms that need to be understood are available water, existing water supplies and drought. Note there is a critical distinction between available water and existing water supplies.

As the agency responsible for the State Water Plan, the Texas Water Development Board (TWDB) defines available water as "the maximum amount of water available during the drought of record, regardless of whether the supply is physically or legally available." The existing water supply is defined by the TWDB as the "maximum amount of water available from existing sources for use during drought of record conditions that is physically and legally available for use."

Texas water planning requires both must be managed under a worst-case scenario - the drought of record. By TWDB definition, this is "the period of time during recorded history when natural hydrological conditions provided the least amount of water supply. For Texas as a whole, the drought of record is generally considered to be from about 1950 to 1957."

The District will cooperate with and coordinate its management plan and regulatory policies with adjacent groundwater districts, Regional Water Planning Groups, and Groundwater Management Area 9 (GMA9).

An electronic copy of the management plan is available online at www.ccgcd.org. A paper copy may be requested at the CCGCD office, located at 201 E. San Antonio Ave., Ste. 100 Boerne, Texas 78006.

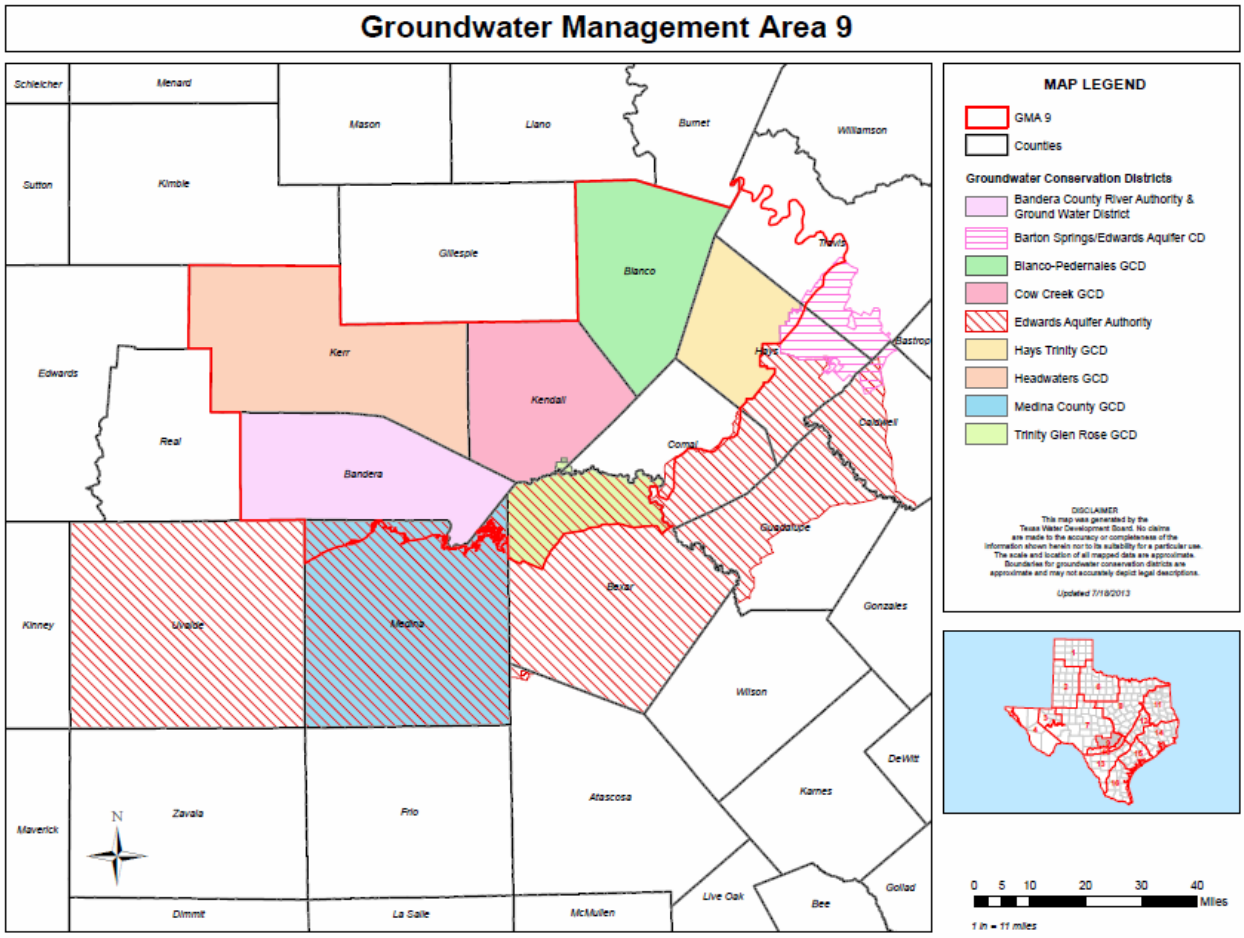
JOINT PLANNING IN MANAGEMENT AREA

Every five years, the districts in GMA 9 shall consider groundwater availability models and other data or information for the management area and shall establish desired future conditions for the relevant aquifers within the management area. In establishing the desired future conditions of the aquifers under this section, the districts shall consider uses or conditions of an aquifer within the management area that differ substantially from one geographic area to another.

The GMA may establish different desired future conditions for each aquifer, subdivision of an aquifer, or geologic strata located in whole or in part within the boundaries of the management area; or each geographic area overlying an aquifer in whole or in part or subdivision of an aquifer within the boundaries of the management area. The Texas Water Development Board

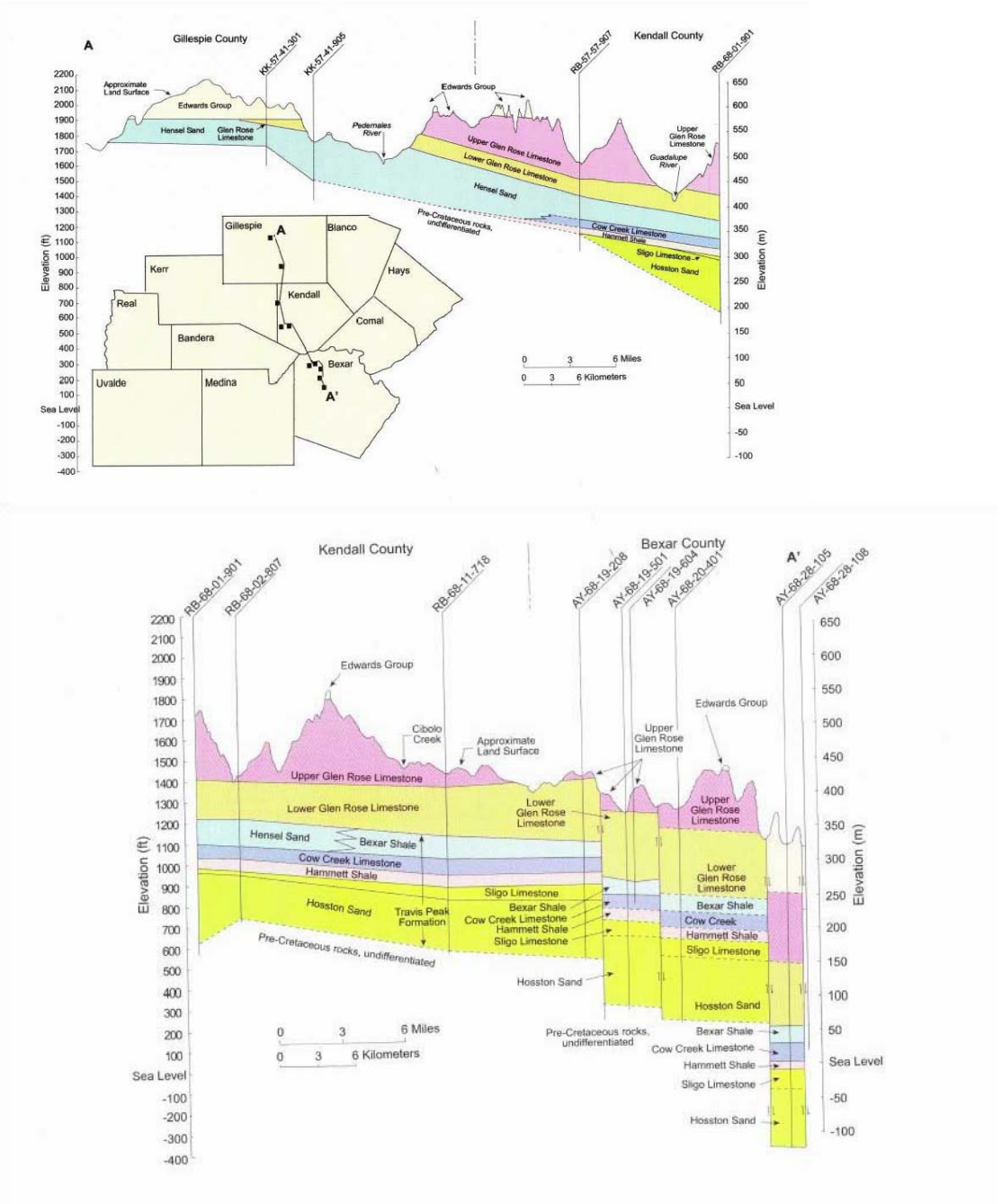
will calculate the Modeled Available Groundwater (MAG) from the adopted Desired Future Conditions (DFC) of the management area.

Map of Groundwater Management Area 9:



Source: TWDB GMA9 website:
http://www.twdb.state.tx.us/groundwater/management_areas/maps/GMA9_GCD.pdf

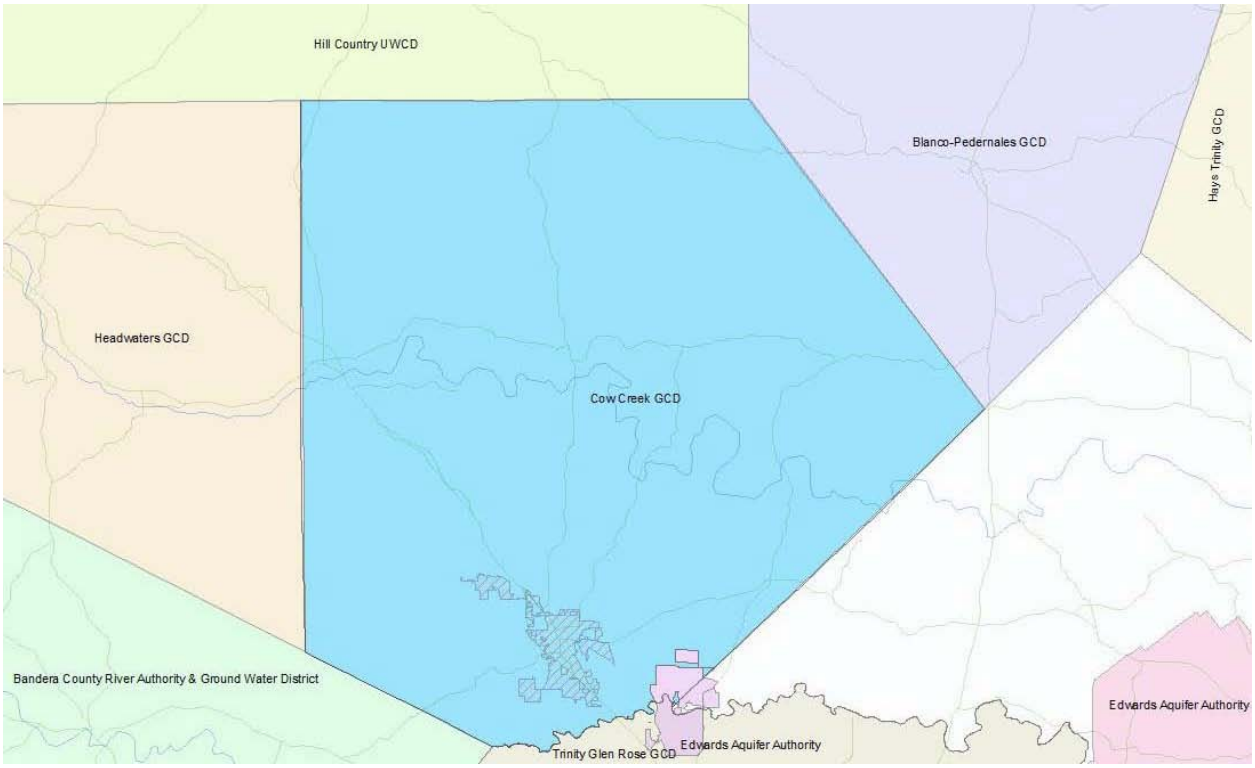
Stratigraphic cross-sections of the Hill Country Area:



Source: modified from Ashworth, 1983; Mace and others, 2000

GENERAL DESCRIPTION OF THE DISTRICT

The Cow Creek Groundwater Conservation District includes all of Kendall County and encompasses roughly 663 square miles (424,320 acres), excluding the incorporated area of the City of Fair Oaks Ranch. The CCGCD was created in accordance with Chapter 36, HB 3544 and SB 2 of the 77th Legislature. On November 5, 2002, Kendall County voters approved the creation of the District and elected five Directors to govern the District. The District is currently funded through ad valorem property taxes and fees. The District's authority and duties are derived primarily from Chapter 36 of the Texas Water Code, Vernon's Texas Civil Statues.



Source: CCGCD

The current District Board of Directors is comprised of Board President Milan J. Michalec, Director District 2; Vice President Don Dietzmann, Director At Large; Secretary Bob Webster, Director District 1; Treasurer R.K. "Bobby" Schwab, Director District 3; and Asst. Secretary/Treasurer Curt Campbell, Director District 4. The District General Manager is Micah Voulgaris.

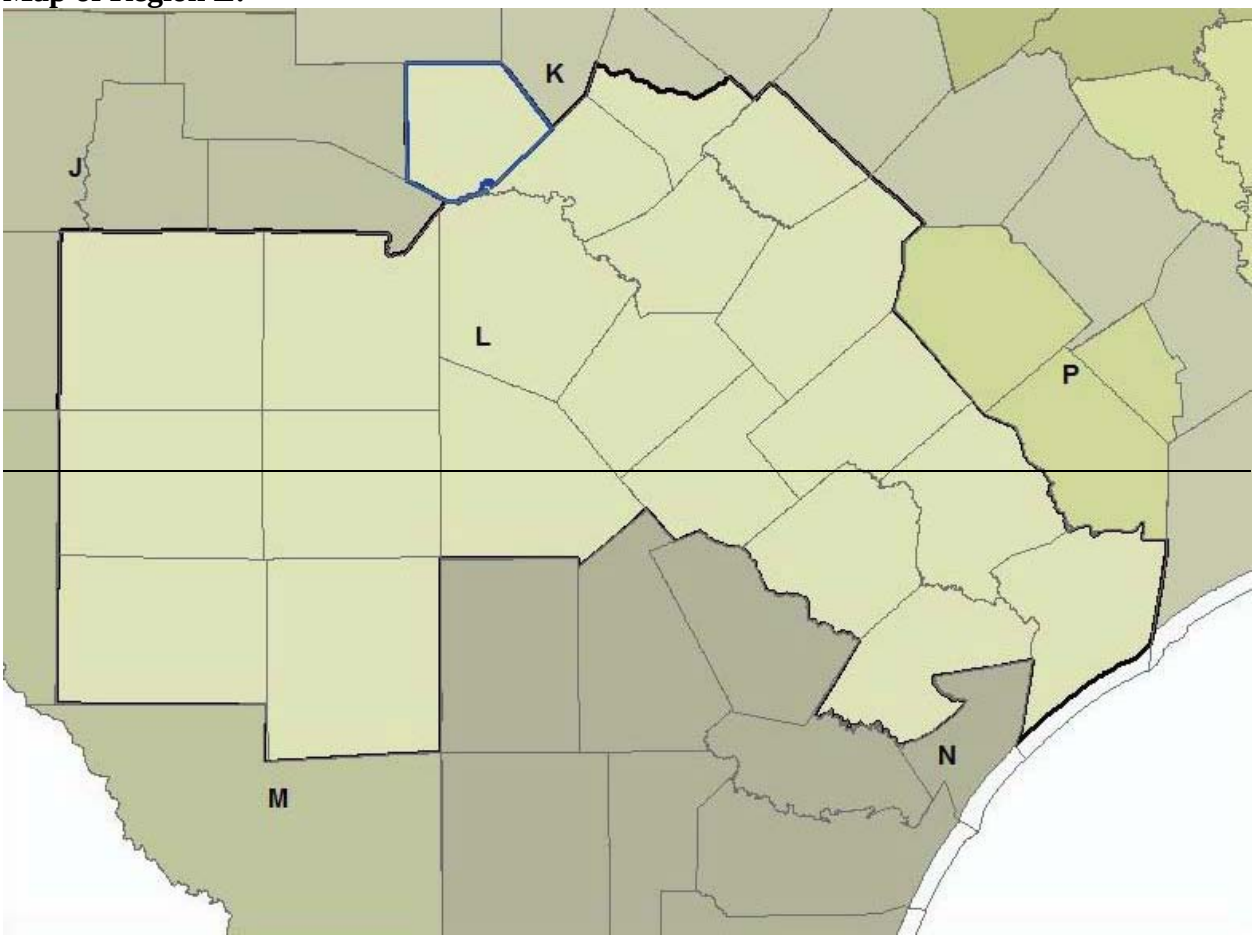
The District's current economy is best characterized as a service oriented, bedroom community tied closely to San Antonio, the Interstate 10 corridor, and to a lesser extent, U.S. 281 and Interstate 35 corridors. Originally considered an area relying primarily on an agricultural-based economy, the District still retains that same rural flavor, but may be even better known for its shopping, antique stores, restaurants, small industries, and tourist facilities. Wildlife hunting, some fishing, and other outdoor activities also contribute significantly to the local economy.

Tourists visiting nearby State Parks and other attractions also contribute revenues to the local economy.
Over the past few decades, Kendall County and other Hill Country counties in close proximity to the cities of Austin or San Antonio have seen rapid growth in population due to subdivision of large tracts of land into smaller acreage.

The City of Boerne and the townships of Comfort, Sisterdale, Waring, Bergheim, Kendalia, and Welfare are located in the District.

The District lies primarily within the Guadalupe River basin and for statewide water planning purposes is part of the 21 county South Central Texas Regional Water Planning Group (Region L).

Map of Region L:

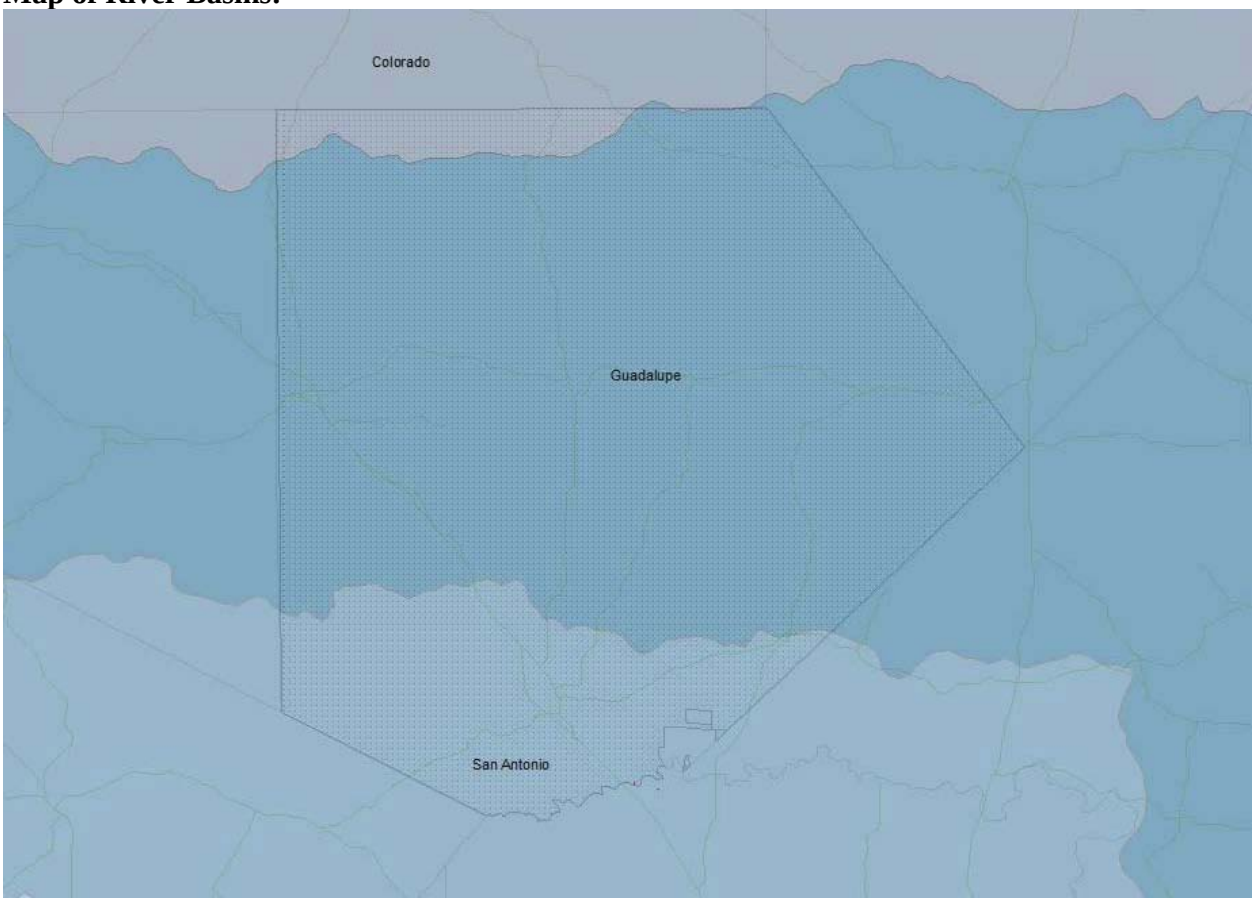


Source: CCGCD

DRAINAGE AND TOPOGRAPHY

The District's primary drainage is the Guadalupe River, which flows through the central part of the county. Secondary watersheds include the Cibolo Creek, the Blanco, Pedernales, and the Medina Rivers. Surface drainage within the District is generally from northwest to southeast.

Map of River Basins:



Source: CCGCD

The topography of the District is predominantly rough and hilly. The primary geologic feature in the area, the Edwards Plateau, is dominated by stream-dissected hills grading into rolling terrain and shallow valleys. This is an elevated structure made up of Cretaceous age limestone, dolomite and marl. The Edwards Plateau extends westward from the Balcones Fault Zone and covers many West Texas counties. The District lies near the southeastern edge of the Plateau. Elevation within the District ranges from a low of approximately 1,000 feet above sea level where Curry Creek leaves southeastern Kendall County to approximately 2,081 feet above sea level in the northwestern part of the District.

WATER RESOURCES WITHIN THE COW CREEK GROUNDWATER CONSERVATION DISTRICT

Groundwater Resources and Usage in the Cow Creek GCD

Estimated groundwater usage in Cow Creek GCD between 2009 and 2013 has been compiled by the District. The District's estimates are provided below in Table 1.

TABLE 1
Last 5 years groundwater use in acre feet

	2009	2010	2011	2012	2013
Municipal	926	1,172	1,476	1,238	1,013
Manufacturing	1	1	1	1	1
Steam/Electric	0	0	0	0	0
Irrigation	78	66	116	98	81
Mining	6	6	6	6	6
Livestock (exempt)	329	397	408	408	408
Domestic (exempt)	3,387	3,452	3,499	3,545	3,592
Total	**4,727**	**5,094**	**5,506**	**5,296**	**5,101**

Source: CCGCD

The TWDB Estimated Historical Groundwater Use Values for Kendall County/CCGCD are included in the Appendix as Table A.

Within the CCGCD there are two primary aquifers, the Trinity and the Edwards Group of the Edwards-Trinity (Plateau) Aquifer, which provide groundwater to county residents. Well depths vary from shallow, hand-dug wells 20-30 feet deep to drilled wells that are up to 1,200 feet deep. Depths are highly variable even within the same aquifer and depend entirely on site-specific topography and geology. Water quality and water quantity also vary greatly throughout the District. Water quality within a specific aquifer can often be defined or characterized in a general sense, but can still be affected by local geology and hydrology. The District will consider new data as it becomes available and will amend this plan as appropriate.

Current groundwater availability for the Trinity Aquifer in the CCGCD has been estimated by the TWDB using GR10-050 MAG version 2 at 10,622 acre feet per year. The Edwards Group of the Edwards-Trinity (Plateau) Aquifer (318 acre feet) availability numbers are based on a Desired Future Condition (DFC) adopted by GMA 9 and corresponding Modeled Available Groundwater (MAG) provided by the TWDB.

Modeled Available Groundwater (Based on Desired Future Conditions)

Groundwater Management Area 9 has adopted Desired Future Conditions for the Aquifers located within the planning area. The total Modeled Available Groundwater for the Edwards Group of the Edwards-Trinity (Plateau) Aquifer is 318 acre feet per year (2010-2060) for the District (GR 10-049 MAG v. 2) . The total Modeled Available Groundwater for the Trinity Aquifer is 10,622 acre feet per year (2010-2060) for the District (GR 10-050 MAG v. 2). Desired Future Conditions were also adopted for the Hickory Aquifer, the Ellenburger-San Saba Aquifer, and the Marble Falls Aquifers. The MAG numbers for the Edwards Group of the Edwards-Trinity (Plateau) and the Trinity Aquifers are provided below in Table 2.

Table 2
MAG Estimates

Aquifer	River Basin	MAG (in acre feet/year)	Source Citation
Edwards Group of the Edwards-Trinity (Plateau)	Colorado	46	GAM run 10-049mag V2
Edwards Group of the Edwards-Trinity (Plateau)	Guadalupe	103	GAM run 10-049mag V2
Edwards Group of the Edwards-Trinity (Plateau)	San Antonio	169	GAM run 10-049mag V2
Trinity	Colorado	135	GAM run 10-050mag V2
Trinity	Guadalupe	6,028	GAM run 10-050mag V2
Trinity	San Antonio	4,976	GAM run 10-050mag V2

Modeled Available Groundwater figures were also calculated for the Hickory (AA10-02 MAG), the Ellenburger-San Saba (AA10-01 MAG), and the Marble Falls Aquifers (AA10-14 MAG). These numbers were small and resulted in draft MAG numbers of nine (9) acre feet annually for the Ellenburger-San Saba Aquifer and two (2) acre feet annually for the Hickory Aquifer. The Marble Falls Aquifer does not exist within the District. Therefore, no estimates for the Hickory, the Ellenburger-San Saba, and the Marble Falls Aquifers are presented in Table 2. The GMA9

Committee will adopt DFC's for the Hickory, Ellenburger-San Saba, Trinity and Edwards Group of the Edwards-Trinty (Plateau) Aquifers in the next round of planning.

On November 30th, 2009, GMA 9 determined that the Ellenburger-San Saba and the Hickory were not relevant currently since no wells were known to produce from these aquifers at this time. Subsequently, on July 14th, 2014, the GMA 9 voted to declare the Ellenburger,-San Saba and the Hickory Aquifers relevant for regional planning. No Desired Future Conditions have been adopted as of the adoption of this plan

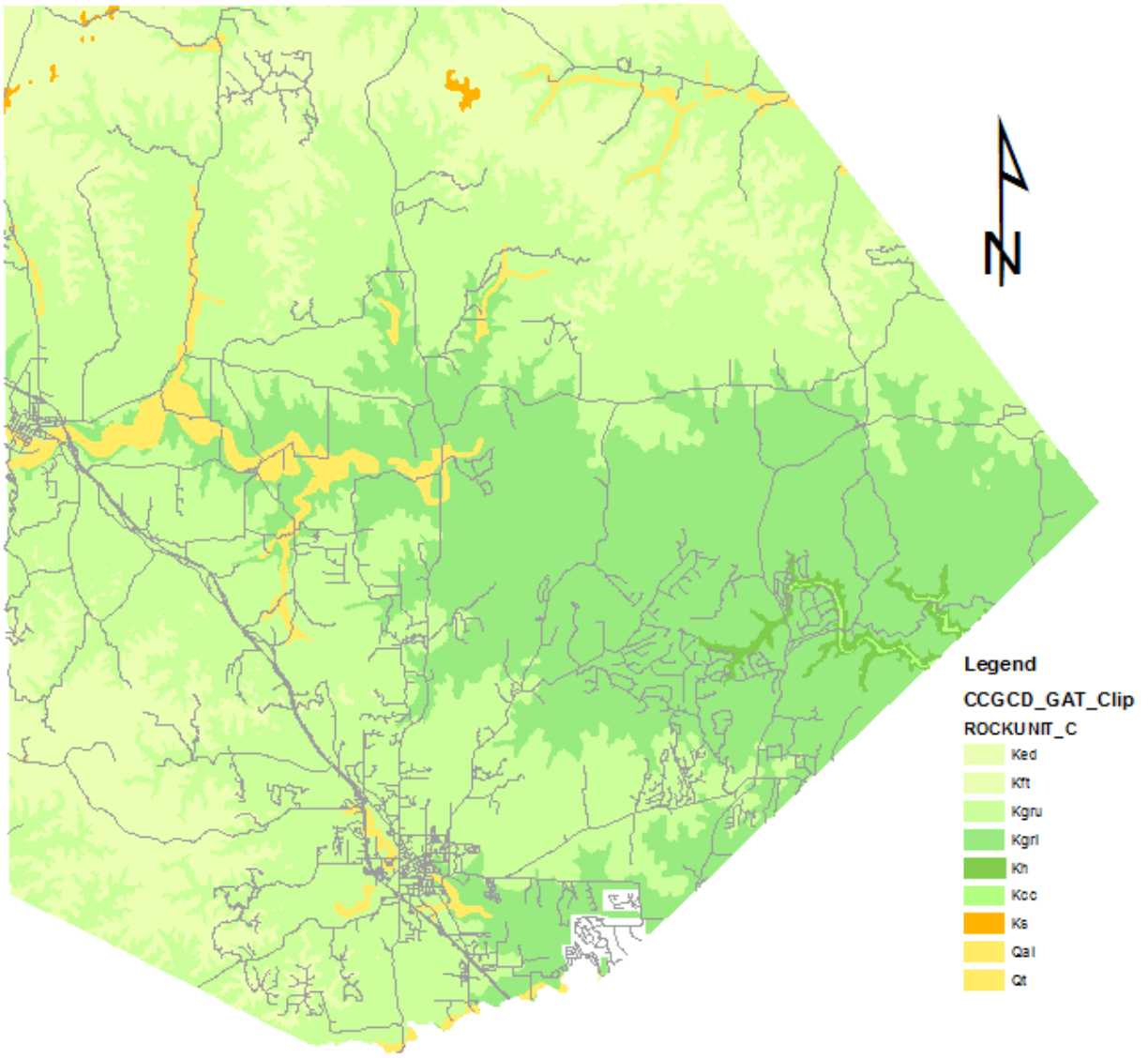
Aquifer Descriptions

The Trinity aquifer in the District is comprised primarily of the Upper Glen Rose (Upper Trinity), Lower Glen Rose Limestone, Hensell Sand, and the Cow Creek Limestone (Middle Trinity), and to a lesser extent, the Hosston and Sligo Formations (Lower Trinity). It extends across the majority of the District. The Trinity aquifer is recharged primarily from local precipitation on its outcrop and through fracturing and porosity in the overlying units where the Trinity is in the subsurface. Most recharge originates from outside of the District and flows down gradient into and through the District. Well yields vary greatly and are highly dependent on local subsurface hydro-geological characteristics. Yields are generally low, less than 20 gpm, but can occasionally be higher, with yields of 200-275 gpm being reported. Production from Trinity wells is primarily used for municipal, rural domestic, and livestock demands. A small amount of irrigation occurs for golf courses, nurseries, vegetables, hay crops, peaches, pecans, grapes and grains.

The Edwards Group of the Edwards-Trinity (Plateau) Aquifer within the District is located at higher elevations along ridges in the northern and southwestern portions of the county. It is comprised of relatively thin layers of limestone and dolomite that is an extension of the Edwards Plateau into the District from the west. In general, yields from the aquifer are low (less than 20 gpm) and the water is used occasionally for rural domestic and livestock demands. The Edwards Group of the Edwards-Trinity (Plateau) Aquifer in the District exists in an unconfined condition. Recharge is solely from local precipitation occurring over the outcrop. Water not pumped from wells will generally discharge from small seeps and springs at the base of the Edwards outcrop and provides some base flow to small streams within the county.

Several minor aquifers occur in the District. These include alluvial aquifers, the Ellenburger, the Hickory, and the Marble Falls Aquifers.

Geologic Map of the District:



Surface Water Resources and Usage in CCGCD

Groundwater supplies in the District are augmented by several other water sources. The City of Boerne has a firm supply of 833 acre feet per year of surface water from Boerne Lake and 3,611 acre feet per year of surface water from Canyon Lake (GBRA). Rural water systems (Kendall West Utility, Cordillera Ranch, and Lerin Hills) supplies have a total of 3,000 acre feet per year of surface water from Canyon Lake (GBRA). Other adjudicated surface water withdrawals total approximately 3,624 acre feet per year (Guadalupe River, other surface water streams, and reservoirs).

In summary, annual surface water availability in the District totals approximately 2,208 acre feet per year in 2010 increasing to 7,444 acre feet per year in 2060. This is based on contracted amounts of surface water from GBRA and Boerne Lake. Total County Supply in Table 3 does not include the

adjudicated surface water withdrawals/run of the river rights (approximately 3,624 acre feet per year).

Projected Total Water Supply in CCGCD

As shown in the Table 3 below, the projected total water supply in the Cow Creek GCD currently stands at about 12,830 acre feet per year and is expected to increase to 18,066 acre feet per year in 2060 due to the increase in GBRA surface water (which includes all sources except adjudicated surface water withdrawals/run of the river rights). The District's projected estimates of surface water supplies are based on actual contracted amounts between the water providers and the GBRA. The most recently adopted state water plan projected surface water supply is included as Table B in the appendix.

TABLE 3
District's projected total supply in acre feet per year

	2010	2020	2030	2040	2050	2060
Available **Groundwater**	10,622	10,622	10,622	10,622	10,622	10,622
Projected Available **Surface Water**	2,208	4,063	5,588	6,493	6,943	7,444
Run of the River Rights	3,624	3,624	3,624	3,624	3,624	3,624
Total (excluding Run of the River)	12,830	14,685	16,210	17,115	17,565	18,066

Source: CCGCD

Based on the District's estimated projected supply from Table 3 and the estimated demands from Table 7, the District has compiled Table 4 to illustrate projected surpluses and shortages.

TABLE 4
Projected Supply, Demand, and Surplus/Shortage in acre feet per year

	2010	2020	2030	2040	2050	2060
Total County Supply (all sources)	12,830	14,685	16,210	17,115	17,565	18,066
Total Demand (all sources)	**7,027**	**9,819**	**12,461**	**14,508**	**16,107**	**17,668**
Surplus/Shortage	5,803	4,866	3,749	2,607	1,458	398

Source: CCGCD

The Texas Water Development Board (TWDB) defines available water as "the maximum amount of water available during the drought of record, regardless of whether the supply is physically or legally available."

The existing water supply is defined by the TWDB as the "maximum amount of water available from existing sources for use during drought of record conditions that is physically and legally available for use."

Projected Population and Water Demands in CCGCD

Population projections for the District were derived from the Region L Plan. Tables 5, 6, and 7 incorporate those numbers and provide updated District populations and water demand projections for every ten years beginning in 2010 and ending with 2060. Note- the City of Fair Oaks Ranch is not included.

TABLE 5
CCGCD Population Summary

Water User Group	2010	2020	2030	2040	2050	2060
Boerne	12,126	17,457	25,924	27,480	29,129	30,877
PWS other	313	383	457	519	570	620
Aqua Texas	1,700	1,800	1,900	1,900	1,900	1,900
KCWCID #1	2,700	3,200	3,750	4,400	5,150	6,000
KWU	3,238	3,715	4,390	5,060	5,740	6,750
Cordillera Ranch (GBRA water)	440	2,500	3,750	5,000	5,000	5,000
Lerin Hills		1,000	2,000	3,000	4,000	5,200
County – Other (Exempt Domestic Wells)	13,969	18,946	22,273	29,996	36,461	41,962
Kendall County/District Total Population excluding Fair Oaks Ranch	**34,486**	**49,001**	**64,444**	**77,355**	**87,950**	**98,309**

Source: Region L, modified by CCGCD

Table 6 shows projected per capita use per day. GPCD (Gallons per capita per day) determined by the methodology prescribed by TWDB pursuant to SB181, 82nd Regular session, 2011.

TABLE 6
CCGCD Per Capita Water Use Summary
in average gallons per capita per day

Water User Group	2010	2020	2030	2040	2050	2060
Boerne	163	160	158	156	156	156
PWS other	123	121	119	119	117	117
Aqua Texas	149	160	160	169	169	169
KCWCID #1	140	135	130	125	120	120
KCUC	133	133	133	133	133	133
Cordillera Ranch (GBRA)	406	268	268	268	268	268
Lerin Hills		140	135	130	130	125
County - Other (Exempt Domestic wells)	142	140	138	136	136	136
Kendall County/District Average Per Capita Use	**183**	**163**	**161**	**160**	**159**	**159**

Source: CCGCD

Table 7 illustrates the District's estimated water needs through 2060. The most recently adopted state water plan projected total demand for water is included as Table C in the appendix.

TABLE 7
CCGCD Water Demand
in acre feet per year

Water User Group	2010	2020	2030	2040	2050	2060
Municipal						
Boerne	2,214	3,129	4,588	4,802	5,090	5,396
PWS Other	43	52	61	69	75	81
Aqua Texas	284	322	341	360	360	360
KCWCID #1	340	484	546	616	692	807
KWU	320	550	650	750	850	1000
Cordillera Ranch	200	750	1125	1500	1500	1500
Lerin Hills	0	157	303	437	582	728
County Other	2222	2971	3443	4570	5554	6392
Total Municipal	**5,623**	**8,415**	**11,057**	**13,104**	**14,703**	**16,264**
Industrial	1	1	1	1	1	1
Steam -Electric	0	0	0	0	0	0
Mining	6	6	6	6	6	6
Irrigation	975	975	975	975	975	975
Livestock	422	422	422	422	422	422
Total	**7,027**	**9,819**	**12,461**	**14,508**	**16,107**	**17,668**

Growth Patterns and Groundwater Impacts in CCGCD

Between 2010 and 2060, total District-wide water demand is estimated to increase by approximately 1.5 times or an additional 151% from 7,027 acre feet per year in 2010 to 17,668 acre feet per year in 2060 (Table 7). The estimated amount of groundwater currently available within the District is approximately 10,940 acft/yr per year, based on the Trinity GAM run 10-050mag V2 and the Edwards Group of the Edwards-Trinity (Plateau) GAM run 10-049mag V2.

In the absence of new surface water sources, groundwater may have to be completely allocated to partially meet increased demands and water shortages that will occur in the District sometime between 2040 and 2060. As the demand increases, aquifers with areas of low production capability will probably experience a stressed condition sooner than anticipated and may not be able to meet higher demands. This may be particularly true in those areas where development is more intense. The most recently adopted state water plan water supply needs are included as Table E in the appendix. The 2012 State Water Plan projects needs (shortages) in 2010. The State Water Plan also addresses Projected Water Management Strategies adopted by Region L. These strategies are included as Table F in the appendix.

Much of the growth now occurring in the District is focused on the southern end of the District. This area is served primarily by private water wells producing from various stratigraphic units of the Trinity Aquifer. This aquifer is known for low yield wells and water quality concerns involving hardness and other factors. TWDB PGMA studies and the Trinity GAM indicate that with continued growth, this particular aquifer will be over extended by 2015 to the point where quantity and quality problems are likely.

The Edwards Group of the Edwards-Trinity (Plateau) Aquifer is located in areas that are expected to slowly undergo development. The Edwards Group of the Edwards-Trinity (Plateau) Aquifer will be unlikely to provide enough water to support extensive growth. Therefore, any growth that does occur during the 50 year planning horizon will more than likely have to rely on some other water source such as the Trinity, and may have to take in consideration the associated water quantity or quality problems.

Recharge of Groundwater in CCGCD

The annual natural recharge occurring in the Cow Creek GCD is thought to be primarily through percolation of rainfall. More localized recharge, along with potentially higher rates of recharge, is probably occurring in the beds of rivers, creeks, and tributaries, particularly if associated with cave entrances or fracture zones. Recharge also occurs from flow through fracturing and porosity in the overlying units where the Trinity is in the subsurface. Most recharge originates from areas outside of the District and flows into and through the District. The District is aware of several significant recharge features in the area that are providing a major avenue for recharge.

Initial studies of the Trinity Aquifer calculated an annual recharge coefficient of approximately 4% of annual rainfall. This was documented in the September 2000 TWDB report on "Groundwater Availability of the Trinity Aquifer, Hill Country Area, and Texas: Numerical

simulations through 2050" by Robert E. Mace, et. al. John Ashworth also developed a similar annual effective recharge coefficient (also 4% of average annual rainfall…about 30 inches) for the Trinity aquifer in the Texas Department of Water Resources Report 273, Ground-Water Availability of the Lower Cretaceous Formations in the Hill Country of South-Central Texas, January 1983. A subsequent 2008 study, funded by the District, indicated more realistic recharge rates to range between 6% and 9% for the Guadalupe River Basin portion of the District. This was documented in Wet Rock Groundwater Services report "An Evaluation of the Trinity Aquifer Within Kendall County and Analysis of the Trinity (Hill Country) GAM", June 25, 2008, Kaveh Khorzad.

Table 8 provides a flow budget and recharge variables for the District based on version 2.01 of the GAM for the Hill Country portion of the Trinity Aquifer (2009). Table 8 addresses some of the flow variables that affect recharge calculations and is derived from GAM Run 13-029.

Table 8
TWDB GAM Run 13-029

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Trinity Aquifer System	48,037
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Trinity Aquifer System	29,249
Estimated annual volume of flow into the district within each aquifer in the district	Trinity Aquifer System	7,908
Estimated annual volume of flow out of the district within each aquifer in the district	Trinity Aquifer System	30,880
Estimated net annual volume of flow between each aquifer in the district	From Edwards-Trinity (Plateau) Aquifer into Trinity Aquifer	6,414
	From Edwards Group into Trinity Aquifer	58

Table 9
TWDB GAM Run 13-029

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Edwards-Trinity (Plateau)	6,046
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Edwards-Trinity (Plateau)	3,061
Estimated annual volume of flow into the district within each aquifer in the district	Edwards-Trinity (Plateau)	4,099
Estimated annual volume of flow out of the district within each aquifer in the district	Edwards-Trinity (Plateau)	384
Estimated net annual volume of flow between each aquifer in the district	From Edwards-Trinity (Plateau) Aquifer into Trinity Aquifer	6,414

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 is shown here.

Estimated maximum annual recharge for the Edwards Group of the Edwards-Trinity (Plateau) Aquifer, the Upper Trinity, the Middle Trinity, and the Lower Trinity aquifers in the District based on the Recharge Flow Variables is also shown in Table 8. The District will review future and/or updated calculations being investigated and/or prepared by TWDB for the Hill County portion of the Trinity aquifer model. The District will consider this and other new data as it becomes available and will amend this plan as appropriate. Estimated recharge and estimated groundwater availability clearly need further study and refinement.

These recharge potentials are not to be confused with “recoverable” groundwater. Not all groundwater is recoverable. Some is lost to spring flow and seeps, some is used by plant life while the water is still near the surface, while some is almost permanently retained within the rock itself. For instance, much of the Trinity is a rather “tight” formation, particularly in the vertical direction. The Trinity is known for its low porosity and permeability, limited fracturing and faulting, and a complicated stratigraphy that includes layers of rock that reduce transmissivity and retard downward-moving recharge water. As a result, individual well yields are often quite low and, though large quantities of water may be present in the subsurface in

specific local sites and in certain wells, much of the groundwater in the Cow Creek GCD as a whole may be unrecoverable due to local hydro-geologic conditions.

Whereas, significant recharge occurs within the District for the Edwards Trinity (Plateau) and the Upper and Lower Glen Rose, formations underlying these are predominantly recharged from outside the District's Boundary

As previously mentioned, considerable amounts of water recharging the Trinity aquifer will be lost, some through biologic uptake and a significant amount through discharge at springs and seeps that provide relatively reliable base flow to local rivers and tributaries. Thus, much of the annual recharge may enter the ground, only to leave it again as base flow to surface streams. This is water that the aquifer rejects on an average annual basis and is potentially available and can theoretically be retrieved (at least on a short-term basis) without diminishing the average volume of groundwater being recharged to storage or, in other words, without creating a mining situation within the aquifer. However, if extensive pumping of this available water occurs, then base flow to area springs and streams will be greatly reduced and the effects of this reduction may be undesirable. Extensive pumping will also reduce the pressure head and may result in a significantly smaller quantity of recharge water actually percolating downward through the complex geology before providing deeper aquifer recharge that would be available for more reliable, long-term well production. Once pumping exceeds average annual recharge, then an aquifer mining condition will clearly exist and groundwater availability will decline.

Recharge Enhancement Potential

The District has yet to assess potential recharge projects in the area. The District may solicit ideas and information and may investigate any potential recharge enhancement opportunities, natural or artificial, 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/water enhancement projects, 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.

GROUNDWATER MANAGEMENT POLICIES
(Actions, Procedures, Performance and Avoidance for Plan Implementation)

The District will manage the supply of groundwater within the District based on the District's best available data and its assessment of water availability and groundwater storage conditions. The Groundwater Availability Model (including subsequent runs) and the Modeled Available Groundwater developed by the TWDB for the Trinity Aquifer will also aid in the decision making process of the District.

The District has adopted Rules that require the permitting of wells and groundwater production limits for non-exempt wells within the District consistent with this Groundwater Management Plan, the provisions of Chapter 36.113 and other pertinent sections of Chapter 36.

The District is in agreement with the commonly accepted groundwater management principle that opposes the mining of groundwater. Therefore, it shall be the policy of the District to limit withdrawal of groundwater from all current and future wells producing from the District's aquifers to no more than the current existing supply. Development or analysis of new or existing groundwater or aquifer data (MAG revisions) may result in changes to the groundwater availability volumes, with a corresponding change in production limits from the affected aquifers. It may also necessitate an increase in well spacing.

The District has adopted Rules that regulate the spacing of wells and the production of groundwater consistent with the provisions Chapter 36.116. The District wishes to emphasize that in regulating or limiting groundwater production, it shall be the policy of the District to preserve historic use to the greatest extent practical and consistent with this plan. A copy of the District's Rules is available at http://www.ccgcd.org/Rules/CCGCDRULES%20eff%2012-12-2012.pdf.

The District will implement and utilize the provisions of this groundwater management plan as a guidepost for determining the direction or priority for all District activities. All operations of the District, all agreements entered into by the District, and any additional planning efforts in which the District may participate will be consistent with the provisions of this plan. The District's current and future Rules will be promulgated pursuant to the provisions of Texas Water Code Chapter 36 shall be based on the best technical evidence available, and will address, implement, and be consistent with the provisions and policies of this plan.

The District shall review and re-adopt this plan, with or without revisions, at least once every five years in accordance with Chapter 36.1072(e). Any amendment to this plan shall be in accordance with Chapter 36.1073.

The District shall treat all citizens with equality. Citizens may apply to the District for discretion in enforcement of the Rules on grounds of adverse economic effect or unique local conditions. In the granting of discretion to any rule, the District Board shall consider the potential for adverse effect on adjacent landowners. The exercise of said discretion by the District Board shall not be construed as limiting the power of the District Board.

The District will seek cooperation and coordination in the development and implementation of this plan, management of groundwater resources, and appropriate District activities with the appropriate state, regional and local water management or planning entities.

The District will encourage cooperative and voluntary Rule compliance, but if Rule enforcement becomes necessary, the enforcement will be legal, fair, and impartial. The promulgation and enforcement of the Rules will be based on the best technical evidence available.

METHODOLOGY FOR TRACKING PROGRESS IN ACHIEVING MANAGEMENT GOALS

The District will use the following methodology to track its progress toward achieving its management goals:

The District General Manager, District Board President, or a Contracting Consultant will present an annual report to the District's Board of Directors on District performance and progress in achieving management goals and objectives at the last regular District Board meeting of the fiscal year (September meeting)

GROUNDWATER MANAGEMENT GOALS

1.0 Implement management strategies that will provide for the most efficient use of groundwater.

1.1 Management Objective

Implement and maintain a program of issuing well operating permits for non-exempt wells within the District.

Performance Standard(s)

Ongoing program of issuance or re-issuance of one or more well operating permits each year. The number of well operating permit applications and the number of permits issued will be included in the annual report to the District Board of Directors.

1.2 Management Objective

Ongoing program of collecting and maintaining actual meter readings from permitted non-exempt wells within the District.

Performance Standard(s)

Annual report submitted to the District Board outlining the previous year's water use from at least 25% of the District's permitted non-exempt wells.

1.3 Management Objective

Implement and maintain a program of issuing registrations for exempt domestic and livestock wells within the District.

Performance Standard(s)

Annual report submitted to the District Board outlining the previous year's registration program.

2.0 Implement strategies that will control and prevent waste of groundwater.

2.1 Management Objective

Each year the District will provide to local media articles describing groundwater waste prevention practices available for implementation by groundwater users.

Performance Standard(s)

Each year provide at least one article to the local media related to groundwater waste prevention practices.

2.2 Management Objective

Provide to the public water efficient literature handouts.

Performance Standard(s)

Each year provide water efficient literature handouts at a public event on at least one occasion. The District will also maintain a supply of water efficient literature at the office.

2.3 Management Objective

Have District personel available to speak at a local club or organization or a display booth at public events.

Performance Standard(s)

Each year the District will provide a speaker at a local club or organization or a display booth at public events a minimum of twice a year.

3.0 Implement strategies that will control and prevent 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.

4.0 Implement management strategies that will address conjunctive surface water management issues.

4.1 Management Objective

Meet with Kendall County, City of Boerne and Retail Water Utility Officials regarding water availability reports, City/County development requirements, and District Rules.

Performance Standard(s)

Meet with Kendall County, City of Boerne and Retail Water Utility Officials regarding water availability reports, City/County development requirements, and District Rules at least once a year and submit a comparative analysis of the Rules and requirements.

4.2 Management Objective

Maintain ongoing studies regarding correlations between spring flow, surface stream elevations/flows, rainfall, and groundwater levels.

Performance Standard(s)

An annual report submitted to the District Board will include a review of the ongoing studies and the number of "Aquifer Watch" reports submitted to local media.

4.3 Management Objective

Meet with the local entities responsible for surface water management.

Performance Standard(s)

Meet with the Guadalupe Blanco River Authority and appropriate local entities responsible for surface water management at least once a year.

5.0 Implement strategies that will address natural resource issues which impact the use and availability of groundwater, or which are impacted by the use of groundwater.

5.1 Management Objective

Within one year of adoption of this Management Plan, initiate and maintain an ongoing spring flow monitoring program in the District.

Performance Standard(s)

Within one year of adoption of this Management Plan, the District will identify at least one spring and begin taking at least one annual flow rate measurement.

6.0 Implement strategies that will address drought conditions.

6.1 Management Objective

Review the District's monitor well data, the Palmer Drought Severity Index, stream flow and rainfall data to determine status of drought condition and, if necessary, report to District Board on need to implement drought contingency plan.

Performance Standards(s)

The District Board will conduct a review of the current drought stage status on a monthly basis. A copy of the review will be included in the annual report to the District Board of Directors.

6.2 Management Objective

Provide to the public drought-orientated literature handouts.

Performance Standards(s)

Each year provide drought-oriented literature handouts on at least one occasion. The District will also maintain a supply of drought-oriented literature at the office. http://www.waterdatafortexas.org/drought/

6.3 Management Objective

To evaluate groundwater availability the District will monitor water levels on selected wells representative of the Edwards Trinity (Plateau) Aquifer and the Trinity aquifers within the District in accordance with the water level monitoring schedule in Table 10.

Table 10

Water Level Monitoring Schedule

Aquifer	# of Wells	Minimum Frequencies
Edwards Trinity	1	1 time per month
Upper Trinity	1	1 time per month
Middle Trinity	25	1 time per month
Lower Trinity	3	1 time per month

Performance Standard(s)

The District will take a minimum of 250 well readings annually and report the findings to the District Board.

7.0 Implement strategies to address:

Conservation

7.1 Management Objective

Each year the District will provide to local media articles identifying the importance of groundwater conservation and various groundwater conservation methods available for implementation by groundwater users.

Performance Standards(s)

Each year provide at least one article to the local media related to the importance of groundwater conservation and various groundwater conservation methods available for implementation by groundwater users.

7.2 Management Objective

Provide to the public water conservation literature handouts.

Performance Standards(s)

Each year provide water conservation literature handouts at a public event on at least one occasion and will maintain a supply which will be available at the District Office.

Recharge Enhancement

7.3 Management Objective

The District will investigate potential recharge enhancement sites either natural or artificial.

Performance Standard(s)

Annually, the General Manager will include a report to the District's Board on the District's findings related to recharge enhancement.

7.4 Management Objective

The District will investigate, identify, and catalog existing recharge features and adopt Best Management Practices to protect these features.

Performance Standard(s)

Annually, the District will conduct a review of the policies related to the identification of and Best Management Strategies for existing recharge features. A copy of the review will be included in the annual report to the District Board of Directors.

Rainwater Harvesting

7.5 Management Objective

The District will encourage rain-water harvesting and provide to the public literature related to rain-water harvesting.

Performance Standard(s)

Annually, the District will provide rainwater harvesting literature at a public event on at least one occasion.

Precipitation Enhancement

7.6 Not applicable to include since this objective is not cost effective at this time.

Brush Control

7.7 Management Objective

The District will encourage brush control and Best Management Practices related to the same where appropriate

Performance Standard(s)

Annually, the District will conduct a review of the policies adopted by the District Board related to brush control practices and/or the progression of brush control within the District. A copy of the review will be included in the annual report to the District Board of Directors. If it is found from review that no policies that relate to brush control practices were adopted by the District Board of Directors during the previous year, then a statement of such will be included in the annual report to the District Board of Directors.

8.0 Addressing Desired Future Conditions in a quantitative manner

8.1 Management Objective

The District will monitor the static water level in the Edwards Group of the Edwards-Trinity (Plateau) Aquifer to ensure the achievement of the adopted DFC.

Performance Standard(s)

The District will monitor the static water level in the Edwards Group of the Edwards-Trinity (Plateau) Aquifer on a bi-monthly basis. The data will be presented to the District Board of Directors in an annual report.

8.2 Management Objective

The District will monitor the static water level in the Trinity Aquifer to ensure the achievement of the adopted DFC.

Performance Standard(s)

The District will monitor the static water level in the Trinty Aquifer on a bi-monthly basis. The data will be presented to the District Board of Directors in an annual report.

Appendix

TABLE A

Historical Groundwater Use Values TWDB - Water Use Survey

KENDALL COUNTY *99.51 % (multiplier)* All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2011	GW	4,103	0	0	0	820	408	5,331
	SW	2,010	0	0	0	65	72	2,147
2010	GW	3,466	0	0	0	540	397	4,403
	SW	1,684	0	0	0	150	70	1,904
2009	GW	2,975	0	0	0	732	329	4,036
	SW	1,646	0	0	0	166	58	1,870
2008	GW	3,174	0	0	0	12	299	3,485
	SW	1,590	0	0	0	175	53	1,818
2007	GW	2,764	0	0	0	113	347	3,224
	SW	1,354	0	0	0	0	61	1,415
2006	GW	3,473	0	0	0	137	364	3,974
	SW	1,251	0	0	0	0	64	1,315
2005	GW	3,817	0	0	0	134	335	4,286
	SW	788	0	0	0	0	59	847
2004	GW	3,149	0	0	0	115	170	3,434
	SW	679	0	0	0	104	157	940
2003	GW	3,050	0	0	0	130	164	3,344
	SW	629	0	0	0	356	151	1,136
2002	GW	3,119	0	0	0	722	201	4,042
	SW	468	0	0	0	281	185	934
2001	GW	3,438	0	0	0	722	230	4,390
	SW	60	0	0	0	281	211	552
2000	GW	2,791	0	0	0	285	356	3,432
	SW	764	0	0	0	109	89	962

TABLE B

Projected Surface Water Supplies
TWDB 2012 State Water Plan Data

KENDALL COUNTY *99.51 % (multiplier)* All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
L	BOERNE	SAN ANTONIO	BOERNE LAKE/RESERVOIR	0	0	0	0	0	0
L	BOERNE	SAN ANTONIO	CANYON LAKE/RESERVOIR	3,611	3,611	3,611	3,611	3,611	3,611
L	COUNTY-OTHER	SAN ANTONIO	CANYON LAKE/RESERVOIR	2,062	2,062	2,062	2,062	2,062	2,062
L	FAIROAKS RANCH	SAN ANTONIO	CANYON LAKE/RESERVOIR	389	389	389	389	389	389
L	IRRIGATION	GUADALUPE	GUADALUPE RIVER COMBINED RUN-OF-RIVER IRRIGATION	18	18	18	18	18	18
L	LIVESTOCK	COLORADO	LIVESTOCK LOCAL SUPPLY	7	7	7	7	7	7
L	LIVESTOCK	GUADALUPE	LIVESTOCK LOCAL SUPPLY	176	176	176	176	176	176
L	LIVESTOCK	SAN ANTONIO	LIVESTOCK LOCAL SUPPLY	40	40	40	40	40	40
	Sum of Projected Surface Water Supplies (acre-feet/year)			**6,303**	**6,303**	**6,303**	**6,303**	**6,303**	**6,303**

TABLE C

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.

KENDALL COUNTY

99.51 % (multiplier)

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
L	LIVESTOCK	COLORADO	13	13	13	13	13	13
L	MINING	COLORADO	6	6	6	6	6	6
L	COUNTY-OTHER	COLORADO	35	49	63	75	86	96
L	COUNTY-OTHER	GUADALUPE	1,627	2,268	2,922	3,470	3,947	4,412
L	IRRIGATION	GUADALUPE	518	508	498	488	478	469
L	LIVESTOCK	GUADALUPE	351	351	351	351	351	351
L	IRRIGATION	SAN ANTONIO	192	188	184	180	177	174
L	LIVESTOCK	SAN ANTONIO	80	80	80	80	80	80
L	WATER SERVICES INC	SAN ANTONIO	43	52	61	69	75	81
L	COUNTY-OTHER	SAN ANTONIO	1,075	1,499	1,929	2,293	2,607	2,916
L	BOERNE	SAN ANTONIO	1,570	2,188	2,843	3,370	3,831	4,282
L	FAIROAKS RANCH	SAN ANTONIO	286	296	300	305	310	316
	Sum of Projected Water Demands (acre-feet/year)		**5,796**	**7,498**	**9,250**	**10,700**	**11,961**	**13,196**

TABLE D

Projected Water Supply Needs
TWDB 2012 State Water Plan Data

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

KENDALL COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
L	BOERNE	SAN ANTONIO	2,435	1,817	1,162	635	175	-276
L	COUNTY-OTHER	COLORADO	50	36	22	10	-1	-11
L	COUNTY-OTHER	GUADALUPE	-221	-865	-1,522	-2,073	-2,725	-3,503
L	COUNTY-OTHER	SAN ANTONIO	1,365	939	506	141	0	0
L	FAIROAKS RANCH	SAN ANTONIO	137	127	123	118	107	101
L	IRRIGATION	GUADALUPE	27	38	48	58	68	77
L	IRRIGATION	SAN ANTONIO	1	5	9	13	4	7
L	LIVESTOCK	COLORADO	0	0	0	0	0	0
L	LIVESTOCK	GUADALUPE	0	0	0	0	0	0
L	LIVESTOCK	SAN ANTONIO	0	0	0	0	9	9
L	MINING	COLORADO	0	0	0	0	0	0
L	WATER SERVICES INC	SAN ANTONIO	-41	-50	-59	-67	-73	-79
	Sum of Projected Water Supply Needs (acre-feet/year)		**-262**	**-915**	**-1,581**	**-2,140**	**-2,799**	**-3,869**

TABLE E

Projected Water Management Strategies
TWDB 2012 State Water Plan Data

KENDALL COUNTY

WUG, Basin (RWPG)

All values are in acre-feet/year

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
BOERNE, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION	CONSERVATION [KENDALL]	98	280	394	502	652	816
WESTERN CANYON WTP EXPANSION	CANYON LAKE/RESERVOIR [RESERVOIR]	0	0	0	0	0	276
COUNTY-OTHER, COLORADO (L)							
MUNICIPAL WATER CONSERVATION	CONSERVATION [KENDALL]	0	0	0	0	1	11
COUNTY-OTHER, GUADALUPE (L)							
MUNICIPAL WATER CONSERVATION	CONSERVATION [KENDALL]	0	0	0	0	72	253
PURCHASE FROM WWP (GUADALUPE-BLANCO RIVER AUTHORITY)	CANYON LAKE/RESERVOIR [RESERVOIR]	221	0	0	0	0	0
STORAGE ABOVE CANYON RESERVOIR (ASR)	GUADALUPE RIVER RUN-OF-RIVER [KENDALL]	0	3,140	3,140	3,140	3,140	3,140
WESTERN CANYON WTP EXPANSION	CANYON LAKE/RESERVOIR [RESERVOIR]	0	0	0	0	0	374
FAIROAKS RANCH, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION	CONSERVATION [BEXAR]	26	51	75	97	101	107
WATER SERVICES INC, SAN ANTONIO (L)							
EDWARDS TRANSFERS	EDWARDS-BFZ AQUIFER [MEDINA]	41	50	59	67	73	79
Sum of Projected Water Management Strategies (acre-feet/year)		**386**	**3,521**	**3,668**	**3,806**	**4,039**	**5,056**