Evergreen Underground Water Conservation District

Groundwater Management Plan

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Purpose And Intent

It is the purpose and intent of this plan to establish policy in the areas of technical research and studies, water conservation, public information, regulation, permits and enforcement, equity and discretion, and cooperation and coordination. The goal of this plan is to establish a Regulatory Action Plan that will conserve, preserve, protect, and prevent the waste of the groundwater within the District. Due to the present mining of groundwater in the Carrizo aquifer in some areas of the District, the Regulatory Action Plan will also address reducing the mining of groundwater. The regulations and policies in this plan have been established so that the goals, needs and obligations of the District may be accomplished as set forth by the 59th Legislature, Regular Session, 1965, Article 8280-297, and Chapter 36 of the Texas Water Code (TWC).

Time Period Of This Plan

This plan was adopted by resolution of the District Board of Directors after notice and hearing in a public meeting on January 29, 2016. The plan must be readopted with or without changes by the District Board and submitted to the Texas Water Development Board (TWDB) for approval at least once every five years [TWC §36.1072(e)].

Background

The Evergreen Underground Water Conservation District (District) was created in 1965 in accordance with Section 59, Article 16 of the Constitution of the State of Texas, and in accordance with Acts of the 59th Legislature (1965), page 398, Chapter 197, H.B. 116, as amended by Acts of the 60th Legislature (1967), page 1676, Chapter 647, H.B. 1272, Acts of the 68th Legislature (1983), page 2852, Chapter 484, S.B. 194, and Acts of the 69th Legislature (1985), page 2984, Chapter 438, S.B. 1253, here forth to be referred to as the act. The organizational meeting of the Board of Directors was held on September 3, 1965. The Board held two elections in 1967 seeking ratification of a tax rate from which operational funds could be generated. The tax referendum did not pass, and the Board operated on support from counties, cities, organizations, and individuals until 1973, when the Board was forced to discontinue their quarterly meetings as they had no funds to conduct their Directors' election as required by law.

On September 3, 1984, members of the Board, alarmed by groundwater level declines, met to discuss reactivation of the District. At this time representatives of Frio County expressed an interest in adding Frio County to the District. On April 6, 1985, an election was held to ratify the incorporation of Frio County, elect representatives to the Board of Directors, and set a tax rate for the District. The election was successful and a tax rate of $0.005 per $100 valuation was set. In September of 1997, the Karnes County Commissioners Court petitioned the District with a request to be annexed into the District. On January 17, 1998 the District held an election in Karnes County to ratify the petition, and the election passed by an eighty-nine percent margin.

The District encompasses all of Atascosa, Frio, Wilson, and Karnes Counties. This includes 2,461,000 acres or 3,845 square miles. The District's economy is heavily dependent upon agriculture and agriculture related business. Rainfall in the District averages from 24 inches per year in Frio County, to 32 inches per year in Wilson County. Rainfall usually peaks in the late spring, with a secondary peak in early fall. Due to this trend and high summer temperatures, irrigation is required for consistent crop production and yield. Approximately 70% of the total groundwater pumpage in the District is used in Agriculture. Since 1985 the District has engaged in extensive data collection on water well locations, well conditions, static water levels, chemical analysis, and pumpage and use. This data has been instrumental in understanding the dynamics of the underground water resources within the District. The District has worked extensively to promote water conservation through education, and technical assistance in all sectors of the District.

Policy

It is the Policy of the District to continue technical research and studies, promote water conservation, provide public information, maintain and sustain regulation, permits, enforcement, equity and discretion, cooperation and coordination. These policies are designed to support the regulation of groundwater withdrawals to reduce the mining of groundwater resources within the District. The implementation of this plan can only be achieved through a concerted effort by all parties that use groundwater within the District. The District shall maintain an office with regular office hours

Technical Research And Studies

The District conducts technical studies in cooperation with other entities including the TWDB and the Texas Commission on Environmental Quality (TCEQ) in order to identify methods to conserve and protect groundwater resources. Results from the studies have aided in the implementation of more efficient irrigation practices, education, and well head protection. Grants from the TWDB have provided funds for the District to purchase lab equipment for water analysis, and well mapping equipment. The District collects data on water levels, groundwater production, and water quality on a monthly and annual basis from wells throughout the District. The District will continue to gather data and improve the data gathering methods to ensure all future District Plans are based on the best information available.

Water Conservation

Water conservation has become a strong initiative throughout the State of Texas. New buildings are required to use certain water conserving plumbing fixtures as a result of legislation passed by the Texas Legislature in 1991. It has been recognized that fresh water is a vital commodity that can only last through preservation. The District may require a conservation plan for certain well permits in order to be sure that the groundwater produced is put to a beneficial use, and not wasted. The District continues

to work with water utilities, industry and agriculture users to promote the most efficient use of water so that we may preserve one of our most valuable natural resources. The District will continue to explore other conservation methods and options and will adopt new requirements as they become necessary.

Public Information

The District will take the necessary steps to ensure the public is informed and will cooperate with the media and all interested parties. The dissemination of information to the public is vital to create awareness, and the public support that is needed to control and reduce the mining of the groundwater.

The District will also continue to pursue water conservation through a public information and educational program. If used properly, voluntary conservation measures can significantly extend the life of the groundwater, thereby preventing the need for mandatory programs by this District or the State. Voluntary programs are entirely a function of providing the necessary education on conservation methods and habits along with the means to implement those methods. The District will continue to provide information to school districts and the general public in an effort to create voluntary conservation.

Regulation

The primary objective of this Plan is to control groundwater withdrawals to reduce aquifer mining within the District. Groundwater withdrawals can be reduced through conservation of groundwater. In regulating groundwater withdrawals, the District shall take into account several factors, including:

Economic impact of conservation measures;
The degree and effect of aquifer mining in the area; and
Differing hydrological characteristics of the aquifer(s) within the District.

The District will utilize the data and information obtained to evaluate the effectiveness of its regulatory policies and to determine what future action may be needed to achieve the mandate of the act, the District Rules, and the objectives and requirements of this plan.

Management Of Groundwater Supplies

The District will manage the supply of groundwater within the District in order to conserve the resource while seeking to maintain the economic viability of all resource user groups, public and private. In consideration of the economic and cultural activities occurring within the District, the District will identify and promote best management practices of all groundwater resources within the District. An observation network has been established and maintained in order to monitor changing storage conditions of groundwater supplies within the District. The District will make a regular assessment of water supply and groundwater storage conditions and will report those conditions to the

Board and to the public. The District will undertake, as necessary and cooperate with investigations of the groundwater resources within the District and will make the results of investigations available to the public upon adoption by the Board.

The District has adopted rules to regulate groundwater withdrawals by means of spacing and production limits. A copy of the rules may be downloaded at the following link http://www.evergreenuwcd.org/rules.html. The District may deny a well construction permit or limit groundwater withdrawals in accordance with the guidelines stated in the rules of the District. In making a determination to deny a permit or limit groundwater withdrawals, the District will consider the public benefit against individual hardship after considering all appropriate testimony.

The relevant factors to be considered in making a determination to deny a permit or limit groundwater withdrawals will include:

The purposes of the Act;
The District Rules;
The objectives and requirements of this Plan;
The economic impact on the applicant from grant or denial of the permit or terms prescribed by the permit; and
An equitable distribution of available groundwater.

In pursuit of the District's mission of protecting the resource, the District may require reduction of groundwater withdrawals to amounts, which will not cause harm to the aquifer. To achieve this purpose, the District may, at the Board's discretion, amend or revoke any permits after notice and hearing. The determination to seek the amendment or revocation of a permit by the Board will be based on aquifer conditions observed by the Board. The Board will enforce the terms and conditions of permits and the rules of the District by enjoining the permit holder in a court of competent jurisdiction as provided for in Section 36.102 of the Texas Water Code (TWC).

The District will employ all technical resources at its disposal to evaluate the resources available within the District and to determine the effectiveness of regulatory or conservation measures. A public or private user may appeal to the Board for discretion in enforcement of the provisions of the water supply deficit contingency plan on grounds of adverse economic hardship or unique local conditions. The exercise of said discretion by the Board shall not be construed as limiting the power of the Board.

Equity And Discretion

The District recognizes that the burden of reducing the mining of an aquifer should be borne by all users of groundwater. Although a single entity's groundwater withdrawal may not be capable of causing severe problems, the total actions by all users can cause significant mining of groundwater. Therefore, every entity must be regulated.

To achieve the objective, the District must have discretion in permitting groundwater withdrawals. Therefore, temporary exceptions to the general rule for a specific area may be necessary if an economic hardship will be created that is significantly greater for one person than for others in the District, or if required due to hydrological, physical, or geophysical characteristics.

This Plan prescribes a production ratio of groundwater withdrawal based upon the number of acres of land owned by a property owner. Nothing in this Plan, however, should be interpreted to mean that a person is entitled to use groundwater in any amount merely because the Plan prescribes a ratio for production. The number of acres of land that are within the Certificate of Convenience and Need (CCN) of a public or private water utility may be taken into consideration to meet a production ratio, if the well is or will be located within the boundaries of the water utilities CCN, and the utility's number of connections within the CCN justifies the amount of water requested.

Cooperation And Coordination

The District will continue to work with the public, the regulated community, and state local governments to achieve the District's goals. The District will work with all water suppliers, industrial, and agricultural users to help them to preserve groundwater. The TCEQ is the agency charged with protecting the state's water resources, and the Texas Water Development Board is the agency responsible for water resources planning and promotion of water conservation practices. The District will continue to work with both of these agencies throughout the life of this plan.

Actions, Procedures, Performance And Avoidance For Plan Implementation

The District will implement the provisions of this plan and will utilize the provisions of this 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 has adopted rules (see Appendix B) related to the permitting of wells and the production of groundwater. The rules adopted by the District are pursuant to TWC Chapter 36 and the provisions of this plan. All rules will be adhered to and enforced. The promulgation and enforcement of the rules is based on the best technical evidence available.

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 granting of discretion to any rule, the Board shall consider the potential for adverse effect on adjacent landowners. The exercise of said discretion by the Board shall not be construed as limiting the power of the Board.

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

Joint Planning And Desired Future Conditions

The State of Texas has established Groundwater Management Areas (GMA) throughout the State to facilitate regionalized planning for the State's groundwater resources. The District is located in Groundwater Management Areas (GMA) 13 and 15. Chapter 36 Texas Water Code obligates the District to meet annually with the other groundwater conservation districts in its assigned GMAs to conduct joint planning, review management plans, and coordinate management of groundwater resources with other GCDs in GMA 13 and 15.

GMA 13 Districts include:

- Edwards Aquifer Authority
- Evergreen Underground Water Conservation District
- Gonzales County Underground Water Conservation District
- Guadalupe County Groundwater Conservation District
- McMullen Groundwater Conservation District
- Medina County Groundwater Conservation District
- Plum Creek Conservation District
- Uvalde County Underground Water Conservation District
- Wintergarden Groundwater Conservation District

GMA 15 Districts include:

- Aransas County GCD
- Bee GCD
- Coastal Bend GCD
- Coastal Plains GCD
- Colorado County GCD
- Corpus Christi ASR CD
- Evergreen UWCD
- Calhoun County GCD
- Goliad County GCD
- Fayette County GCD
- Pecan Valley GCD
- Refugio GCD
- Texana GCD
- Victoria County GCD

Modeled Available Groundwater In The District Based On The Desired Future Condition Established In Joint Planning (Estimates And Projections)

One of the key coordination goals within each GMA is the development of desired future conditions (DFC) for the aquifers within each GMA, as required by the Texas Administrative Code :

> *"The desired, quantified condition of groundwater resources (such as water levels, water quality, spring flows, or volumes) at a specified time or times in the future or in perpetuity, as defined by participating groundwater conservation districts within a groundwater management area as part of the joint planning process." Desired future conditions have to be physically possible, individually and collectively, if different desired future conditions are stated for different geographic areas overlying an aquifer or subdivision of an aquifer."* [TAC§356.2(8)]

Based on these DFCs, the TWDB uses the appropriate groundwater availability model (GAM) to develop Modeled Available Groundwater (MAG) quantities to determine the annual availability from regional aquifers based on submitted DFCs. Texas Water Code, Section 36.001 defines modeled available groundwater as "the amount of water that the executive administrator determines may be produced on an average annual basis to achieve a desired future condition established under Section 36.108." The Evergreen District is a member of both GMA 13 and GMA 15. The submittal packages to the TWDB for the DFC's in those GMA's can be found here:

www.twdb.texas.gov/groundwater/docs/DFC/GMA13_DFC_Adopted_2010-0812.pdf

www.twdb.texas.gov/groundwater/docs/DFC/GMA15_DFC_Adopted_2010-0714.pdf

The MAG values for the different aquifers in GMA 13 and GMA 15 are documented in the following GAM runs.

Edwards Aquifer, Frio County, GMA 13: Aquifer Assessment 10-40 MAG **(See Appendix H)**

Carrizo-Wilcox Aquifer, GMA 13: GAM Run 10-012 MAG **(See Appendix J)**

Sparta Aquifer, GMA 13: GAM Run 10-012 MAG **(See Appendix J)**

Queen City Aquifer, GMA 13: GAM Run 10-012 MAG **(See Appendix J)**

Yegua-Jackson Aquifer, GMA 13: GAM Run 10-041 MAG **(See Appendix K)**

Gulf Coast Aquifer, GMA 15: GAM Run 10-028 MAG **(See Appendix L)**

Groundwater Availability Model Data (GAM Run 15-004)(See Appendix M)

The data summarized in this section was obtained from the TWDB GAM Run 15-004 (TWDB, 2015) which discusses the methods, assumptions, and results from model runs using the groundwater availability models for the southern parts of the Carrizo-Wilcox, Queen City, and Sparta aquifers, the central part of the Gulf Coast Aquifer, and the San Antonio segment of the Edwards Balcones Fault Zone (BFZ) Aquifer. This section provides estimates of annual amounts of recharge from precipitation to the district aquifers, discharge from the aquifers to springs and any surface bodies, and annual volume of flow between aquifers in the

district. All values in the tables are in acre-feet per year and numbers rounded to the nearest 1 acre-foot.

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 respective calibration and verification portion of each model run, as shown in tables 1 to 6. The components of the modified budgets shown in the tables include:

- Precipitation recharge—This is the areally distributed recharge sourced from precipitation falling on the outcrop areas of the aquifers (where the aquifer is exposed at land surface) within the district.
- Surface water outflow—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 tables 1 to 6. 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 (See Figures 1 to 6)

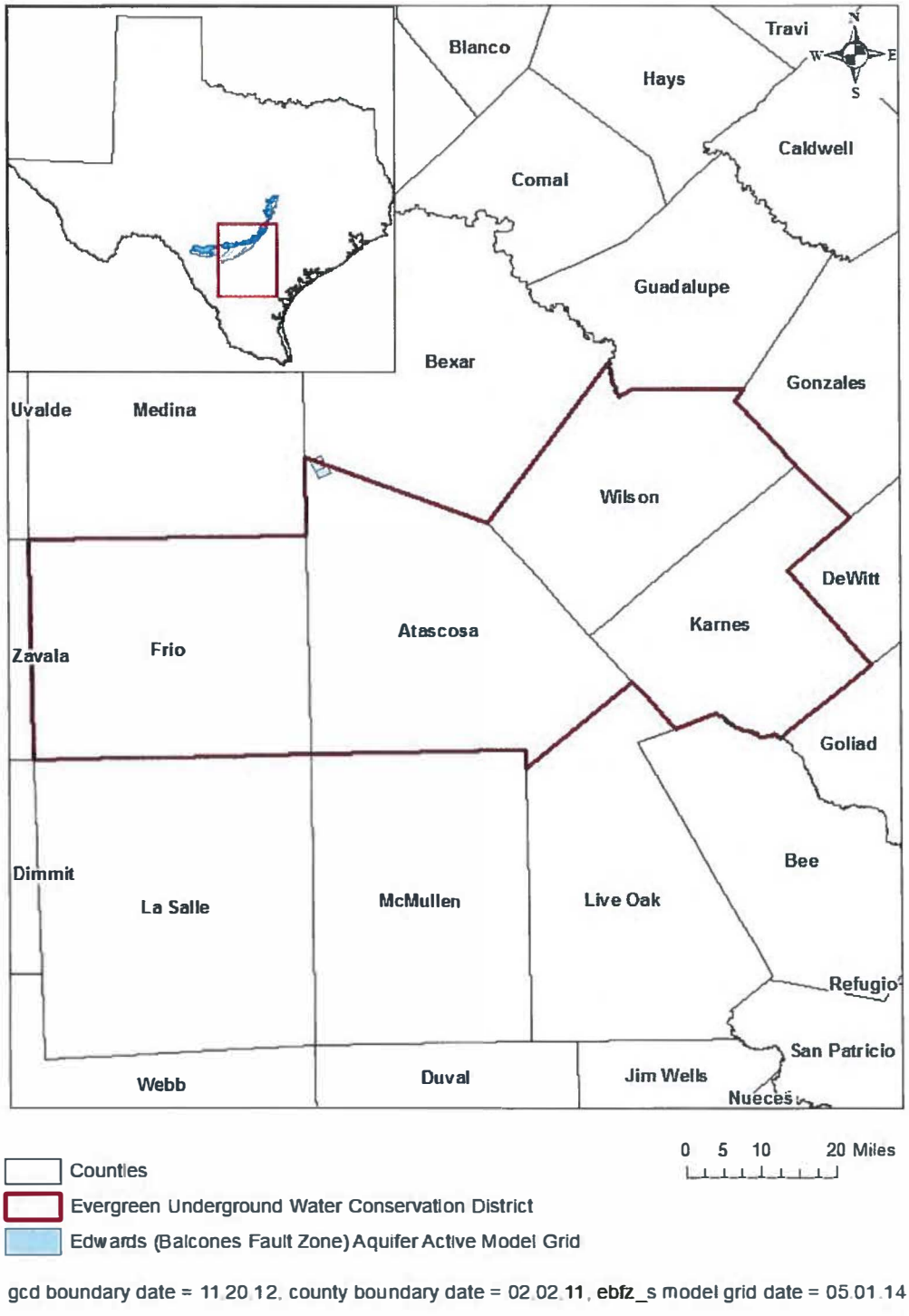
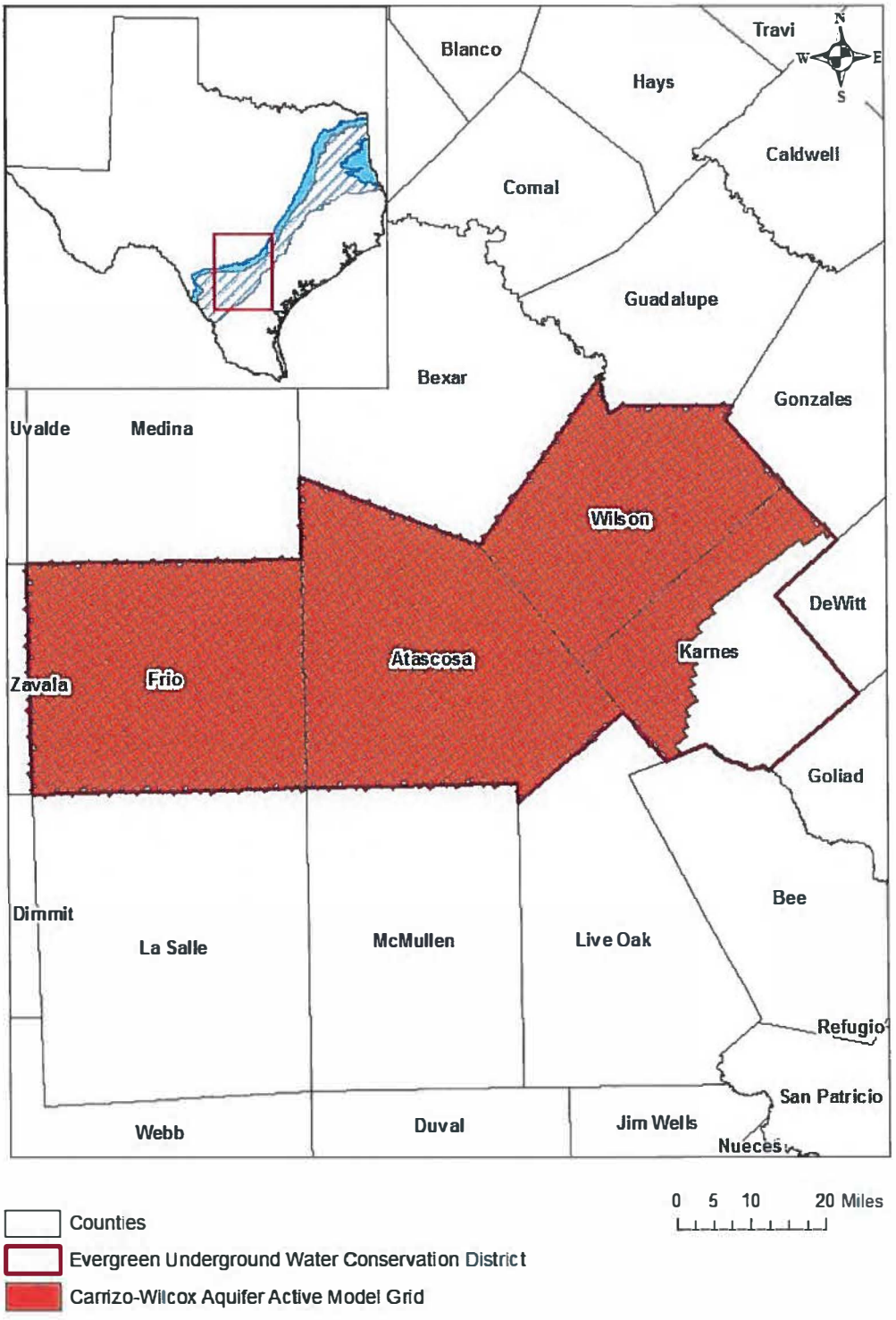


FIGURE 1: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE SAN ANTONIO SEGMENT OF THE EDWARDS (BALCONES FAULT ZONE) AQUIFER FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED [THE EDWARDS (BALCONES FAULT ZONE) AQUIFER EXTENT MODELED WITHIN THE DISTRICT BOUNDARY].

TABLE 1: SUMMARIZED INFORMATION FOR THE EDWARDS (BALCONES FAULT ZONE) AQUIFER THAT IS NEEDED FOR THE EVERGREEN UNDERGROUND WATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Edwards (Balcones Fault Zone) Aquifer	0
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Edwards (Balcones Fault Zone) Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Edwards (Balcones Fault Zone) Aquifer	70
Estimated annual volume of flow out of the district within each aquifer in the district	Edwards (Balcones Fault Zone) Aquifer	0
Estimated net annual volume of flow between each aquifer in the district	Not applicable[1]	Not applicable

[1] The groundwater availability model for the San Antonio portion of the Edwards (Balcones Fault Zone) Aquifer assumes no interaction with other aquifers.



gcd boundary date = 11.20.12, county boundary date = 02.02.11, qcsp_s model grid date = 05.01.14

FIGURE 2: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE SOUTHERN PORTION OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS FROM WHICH THE INFORMATION IN TABLE 2 WAS EXTRACTED (THE CARRIZO-WILCOX AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 2: SUMMARIZED INFORMATION FOR THE CARRIZO-WILCOX AQUIFER THAT IS NEEDED FOR THE EVERGREEN UNDERGROUND WATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Carrizo-Wilcox Aquifer	20,850
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Carrizo-Wilcox Aquifer	3,621
Estimated annual volume of flow into the district within each aquifer in the district	Carrizo-Wilcox Aquifer	72,095
Estimated annual volume of flow out of the district within each aquifer in the district	Carrizo-Wilcox Aquifer	15,083
Estimated net annual volume of flow between each aquifer in the district	From the Reklaw Confining Unit into the Carrizo-Wilcox Aquifer	18,695
	From the Carrizo-Wilcox Aquifer into brackish parts of the same geologic unit	2,312

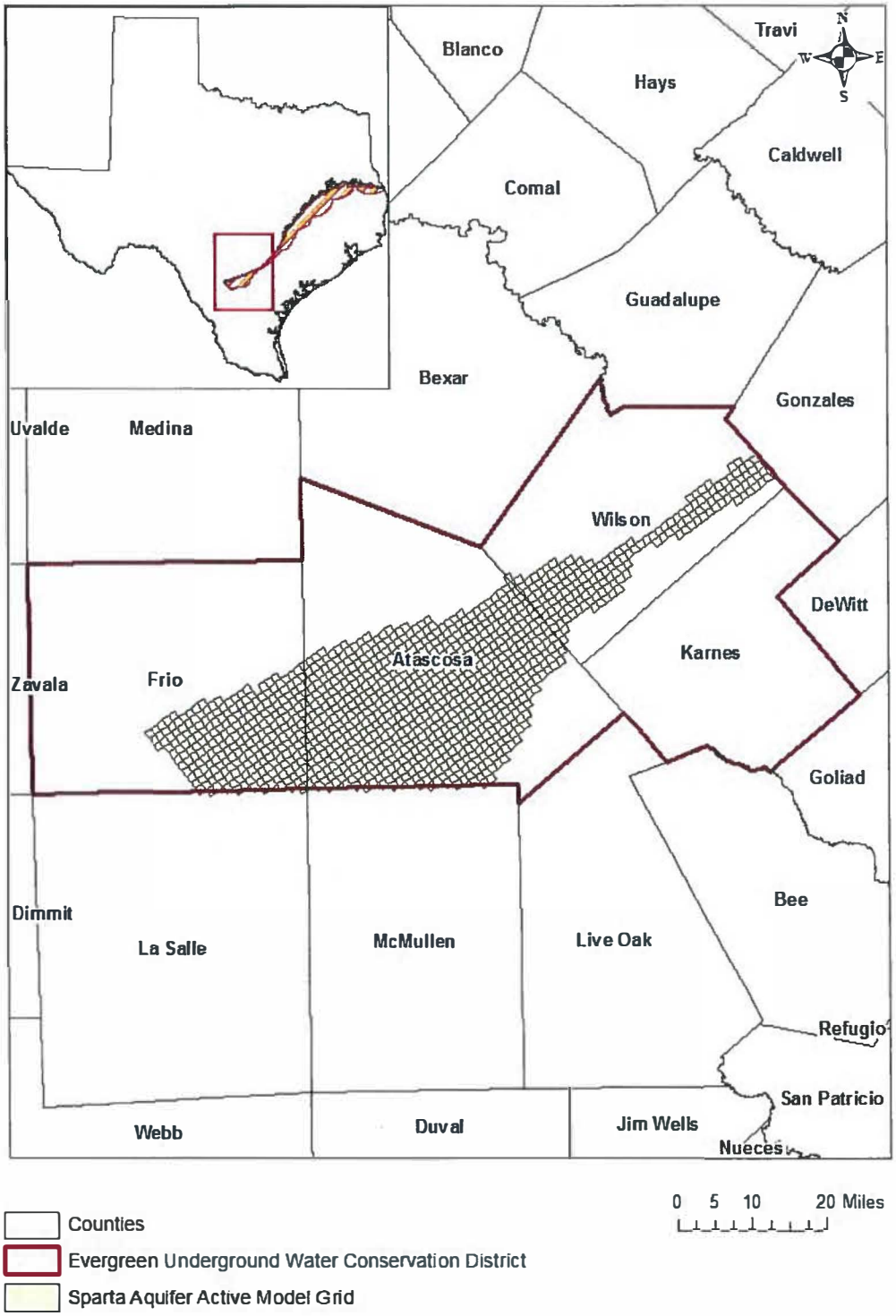


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FIGURE 3: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE SOUTHERN PORTION OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS FROM WHICH THE INFORMATION IN TABLE 3 WAS EXTRACTED (THE SPARTA AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 3: SUMMARIZED INFORMATION FOR THE SPARTA AQUIFER THAT IS NEEDED FOR THE EVERGREEN UNDERGROUND WATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Sparta Aquifer	6,150
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Sparta Aquifer	4,407
Estimated annual volume of flow into the district within each aquifer in the district	Sparta Aquifer	73
Estimated annual volume of flow out of the district within each aquifer in the district	Sparta Aquifer	865
Estimated net annual volume of flow between each aquifer in the district	From the Sparta Aquifer into overlying younger units	970
	From the Sparta Aquifer into the underlying Weches Confining Unit	4,486
	From the Sparta Aquifer into brackish parts of the same geologic unit	1,095

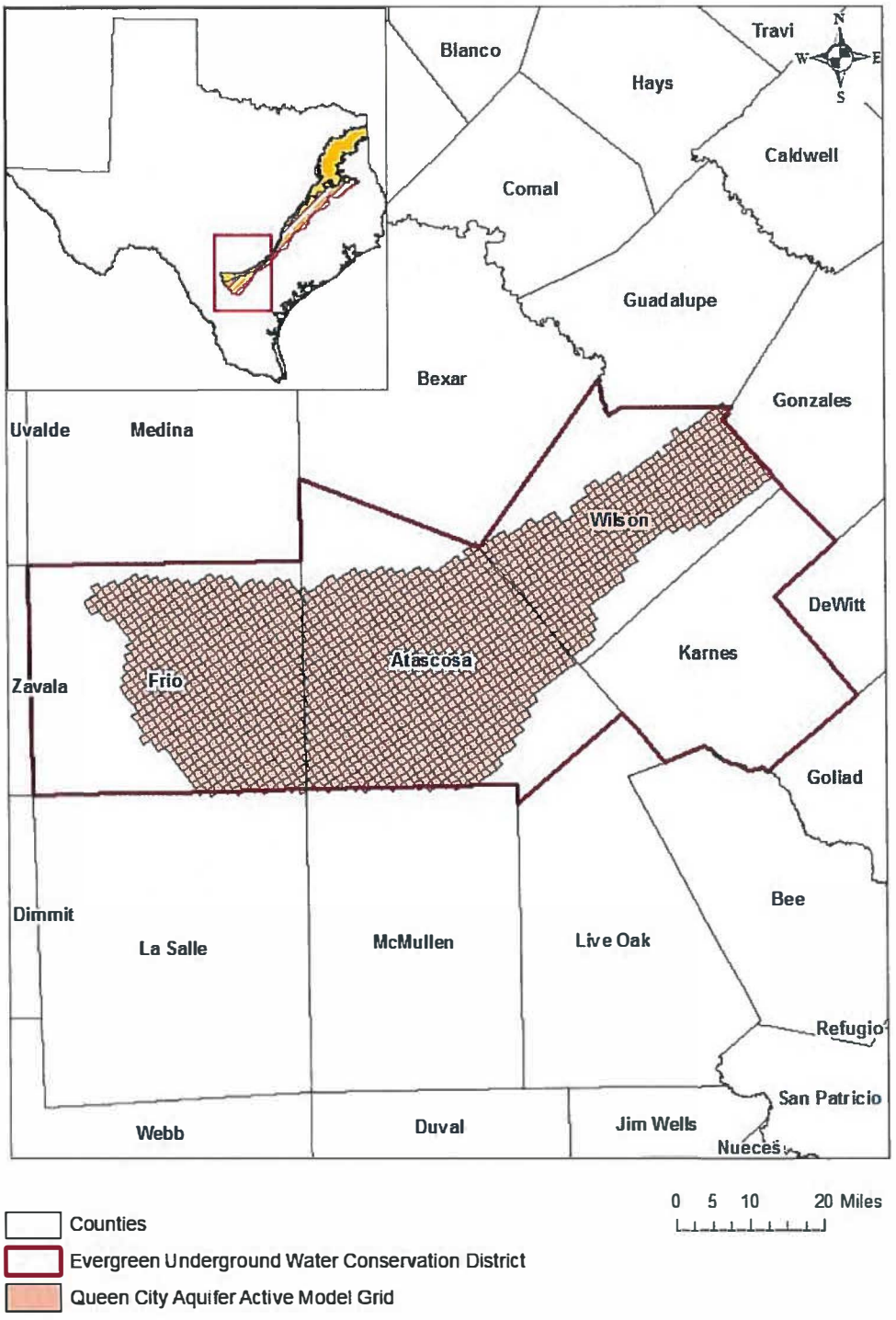


FIGURE 4: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE SOUTHERN PORTION OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS FROM WHICH THE INFORMATION IN TABLE 4 WAS EXTRACTED (THE QUEEN CITY AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 4: SUMMARIZED INFORMATION FOR THE QUEEN CITY AQUIFER THAT IS NEEDED FOR THE EVERGREEN UNDERGROUND WATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Queen City Aquifer	23,084
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Queen City Aquifer	7,097
Estimated annual volume of flow into the district within each aquifer in the district	Queen City Aquifer	80
Estimated annual volume of flow out of the district within each aquifer in the district	Queen City Aquifer	1,717
Estimated net annual volume of flow between each aquifer in the district	From the Weches Confining Unit into the Queen City Aquifer	6,259
	From Queen City Aquifer into the Reklaw Confining Unit	7,282
	From the Queen City Aquifer into brackish parts of the same geologic unit	527

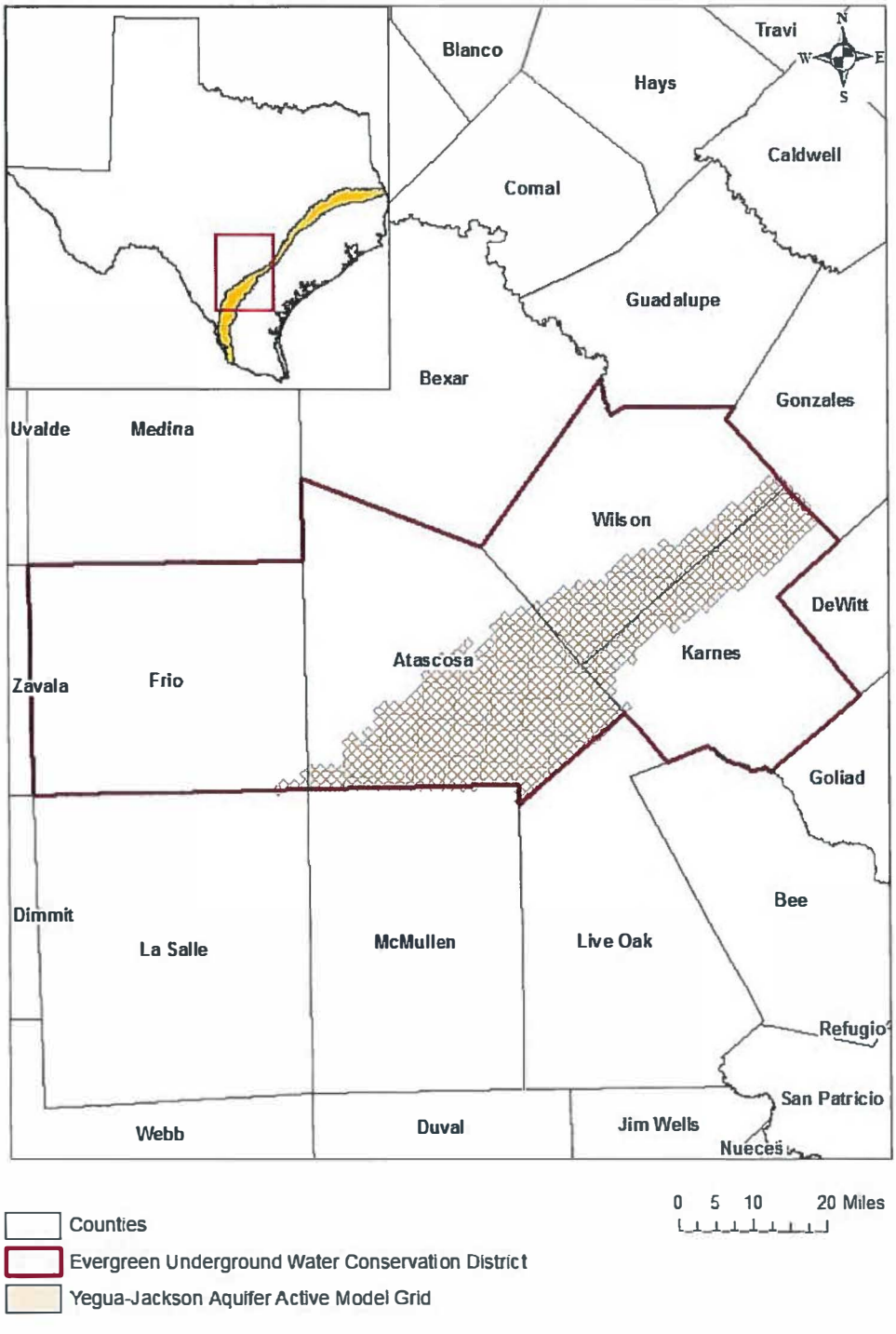
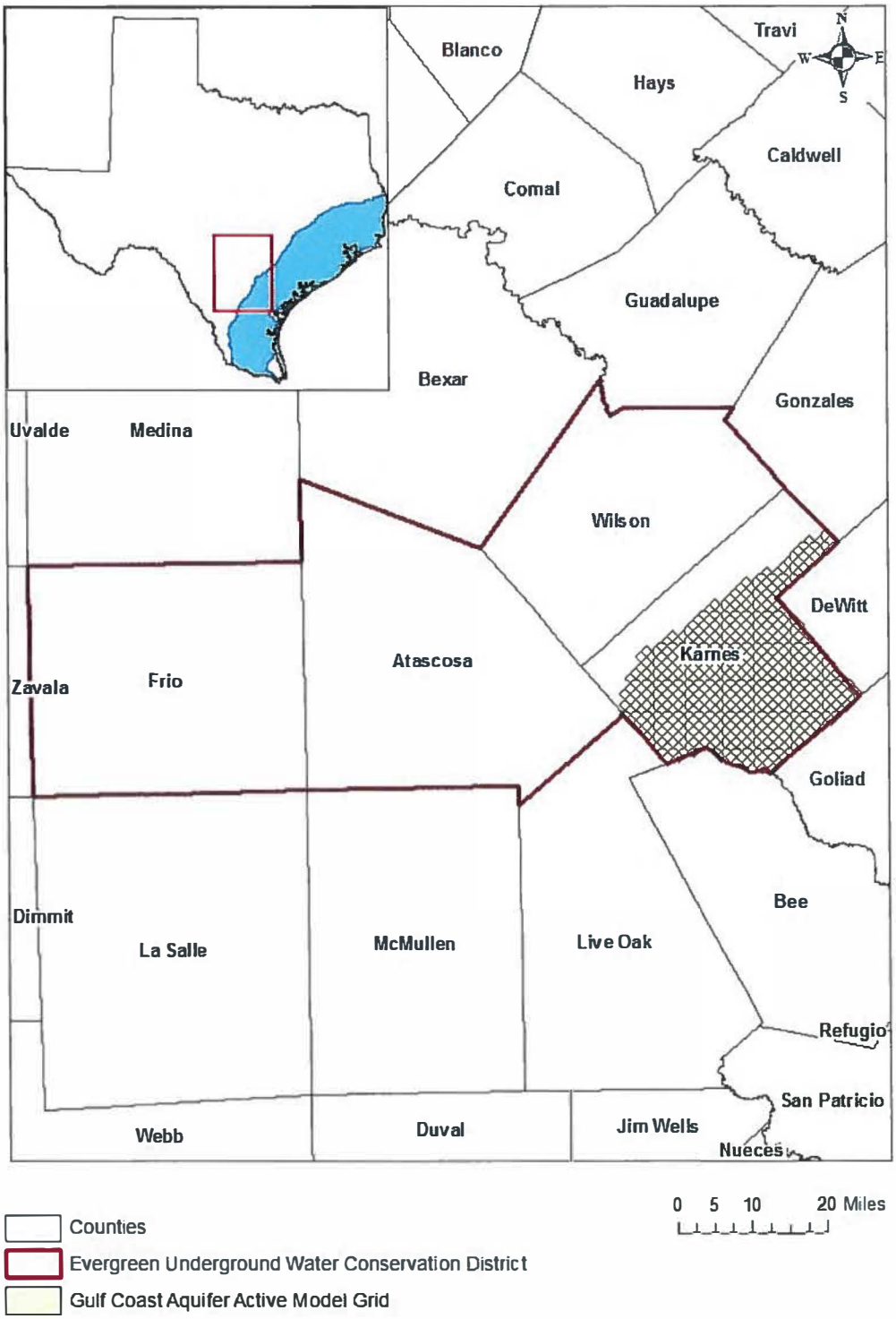


FIGURE 5: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE YEGUA-JACKSON AQUIFER FROM WHICH THE INFORMATION IN TABLE 5 WAS EXTRACTED (THE YEGUA-JACKSON AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 5: SUMMARIZED INFORMATION FOR THE YEGUA-JACKSON AQUIFER THAT IS NEEDED FOR THE EVERGREEN UNDERGROUND WATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Yegua-Jackson Aquifer	42,086
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Yegua-Jackson Aquifer	46,062
Estimated annual volume of flow into the district within each aquifer in the district	Yegua-Jackson Aquifer	2,680
Estimated annual volume of flow out of the district within each aquifer in the district	Yegua-Jackson Aquifer	4,580
Estimated net annual volume of flow between each aquifer in the district	Flow into the brackish portion of the Yegua-Jackson units	269



gcd boundary date = 11.20.12, county boundary date = 02.02.11, glfc_c model grid date = 05.01.14

FIGURE 6: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE CENTRAL PORTION OF THE GULF COAST AQUIFER SYSTEM FROM WHICH THE INFORMATION IN TABLE 6 WAS EXTRACTED (THE GULF COAST AQUIFER SYSTEM EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 6: SUMMARIZED INFORMATION FOR THE GULF COAST AQUIFER SYSTEM THAT IS NEEDED FOR THE EVERGREEN UNDERGROUND WATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Gulf Coast Aquifer System	1,196
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Gulf Coast Aquifer System	1,496
Estimated annual volume of flow into the district within each aquifer in the district	Gulf Coast Aquifer System	746
Estimated annual volume of flow out of the district within each aquifer in the district	Gulf Coast Aquifer System	1,198
Estimated net annual volume of flow between each aquifer in the district	Not applicable[2]	Not applicable

[2] The groundwater availability model for the central portion of the Gulf Coast Aquifer System assumes no-flow conditions at the base of the aquifer.

Details On How Natural Or Artificial Recharge In The District Might Be Increased

The natural or artificial recharge in the District might be feasibly increased by airborne seeding of cumuliform clouds with either glaciogenic, or hygroscopic material. Based on data from the North Dakota Atmospheric Resource Board the District estimates that airborne cloud seeding may increase the rainfall in the District by approximately 10-15 percent.

Estimated Historical Water Use In The District

The District estimates that the amount of groundwater being used within the District on an annual basis for Atascosa, Frio, Karnes and Wilson Counties in the Year 2013 was 164,056 ac-ft per year. This estimate is taken from the TWDB Historical Water Use Survey data. The data for the Year 2013 is the most recent year for which survey data has been released. The TWDB Historical Water Use Survey data is available for the Years 2000 - 2013. The TWDB estimates groundwater use in the District for the entire period of record are presented as supporting documentation. (**See Appendix C)**

Estimate Of Projected Surface Water Supplies In The District

(See Appendix D)

Estimate Of Projected Water Demand In The District

The estimate of total projected water demand in the District for the year 2020 is 165,525 ac-ft per year . This estimate represents water demands that may be met by either ground or surface water and is taken from the 2012 SWP. The complete set of projected water demand estimates by county is presented as supporting documentation.
(See Appendix E)

Estimate Of Projected Water Supply Needs In The District

(See Appendix F)

Water Management Strategies To Meet Needs Of Water User Groups

The South Central Texas Regional Water Planning Group (SCTRWPG) (Region L) developed a water supply plan for the identified water user groups with a projected shortage, or need. The SCTRWPG prepared a diverse set of resource management strategies to meet the water related resource management needs of the region. Management strategies can be integrated in various ways to fit the water management objectives and values of different regions and to achieve multiple

resource benefits. A majority of these strategies are conservation based measures intended to serve a larger amount of people with the same or similar amount of water. The estimate is taken from the SWP 2012. The complete set of recommended strategies is presented as supporting documentation. **(SEE Appendix G)**

Management Goals, Objectives And Performance Standards

GOAL 1.0 – PROVIDING THE MOST EFFICIENT USE OF GROUNDWATER

Management Objective
1.1 - Each month the District will monitor the volume of water produced from 30 municipal and Rural water suppliers in the District.

Performance Standard
1.1 - A table showing the monthly production volumes reported to the District by the Municipal and Rural water suppliers in the District will be included in the Annual Report on District Activities made to the Board of Directors each year.

Management Objective
1.2 - Each year the District will request production reports from the operators of 600 agricultural irrigation wells in the District.

Performance Standard
1.2a - A copy of the request for production reports sent to the operators of agricultural irrigation wells will be included in the Annual Report on District Activities made to the Board of Directors each year.

1.2b – A table showing the production volumes reported to the District from the agricultural irrigation well operators in the District will be included in the Annual Report on District Activities made to the Board of Directors each year.

Management Objective
1.4 - Each month the District will measure the water levels in 60 water wells.

Performance Standard
1.4 - A table showing the monthly water level measurements made by the District will be included in the Annual Report on District Activities made to the Board of Directors each year.

GOAL 2.0 - CONTROLLING AND PREVENTING WASTE OF GROUNDWATER

Management Objective
2.1 - Each year the District will conduct an on-site investigation of all reports of waste of groundwater within two working days of the time of the receipt of the report to the District.

Performance Standard
2.1 – A discussion of the waste of groundwater observed by the District each year, including the number of reports of the waste of groundwater received by the District and the District response to the report will be included in the Annual Report on District Activities made to the Board of Directors each year.

GOAL 3.0 - ADDRESSING CONJUNCTIVE SURFACE WATER MANAGEMENT ISSUES

Management Objective
3.1 – Each year the District will use the Groundwater Availability Model 15-004 to predict the potential effects of different groundwater pumping scenarios on both groundwater and surface water. In addition, each year the District will arrange to meet with the appropriate surface water management entities.

Performance Standard
3.1a – A discussion of the groundwater pumping scenario simulated in the Groundwater Availability Model 15-004 run made by or for the District and a summary of the simulation results will be included in the Annual Report on District Activities made to the Board of Directors each year.

3.1b – A summary of the discussion(s) with the surface water management entities for status on surface water conditions will be relayed in a memorandum to the Board of Directors each year.

GOAL 4.0 - ADDRESSING NATURAL RESOURCE ISSUES THAT IMPACT THE USE AND AVAILABILITY OF GROUNDWATER AND WHICH ARE IMPACTED BY THE USE OF GROUNDWATER.

Management Objective
4.1 – Each year the District will sample at least 40 water wells in the District for chemical analysis of water quality.

Performance Standard
4.1a - A table giving the results of the chemical analyses of the water quality samples taken by the District each year will be included in the Annual Report on District Activities made to the Board of Directors.

4.1b – A discussion of whether any instances of groundwater contamination or issues of concern were noted in the water quality sample analyses will be included in the Annual Report on District Activities made to the Board of Directors.

GOAL 5.0 ADDRESSING CONSERVATION

Management Objective
5.1 – Each year, the District will include an informative flier on water conservation with at least one mail-out distributed in the normal course of business to groundwater use permit holders in the District.

Performance Standard
5.1 - The Annual Report to the Board of Directors will include a copy of the informative

flier regarding water conservation that was distributed to groundwater use permit holders in the District and the number of fliers distributed.

GOAL 6.0 ADDRESSING DROUGHT CONDITIONS

Management Objective
6.1 – Each month, the District will download at least one updated Palmer Drought Severity Index (PDSI) map posted on the National Weather Service website (http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional_monitoring/palmer/2015/) and check for periodic updates to drought conditions as posted on the Texas Water Development Board website (http://waterdatafortexas.org/drought/).

Performance Standard
6.1 - 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.

GOAL 7.0 ADDRESSING THE DESIRED FUTURE CONDITION (DFC)

Management Objective: The District will monitor water levels and evaluate whether the average change in water levels is in conformance with the DFC's. The District will estimate the total annual groundwater production based on water use reports and other relevant information and compare these production estimates to the MAG's.

Performance Standard: Each year the District will summarize the monitoring activities in the annual report including average change in water levels and estimated annual groundwater production.

GOALS THAT ARE NOT APPLICABLE:

At this time, the District has determined that the following goals and objectives are not appropriate or cost-effective and therefore the District has determined them to be not applicable at this time:

Rainwater Harvesting

Precipitation Enhancement

Recharge Enhancement

Brush Control.

Controlling and Preventing Subsidence

Methodology For Tracking District 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 February meeting for the previous year. The report will include the number of instances in which each of the activities specified in the District's management objectives was engaged in during the fiscal year.

Regulatory Action Plan

The objective of the District Rules are to translate the legislative mandate of the District and Chapter 36 of the Texas Water Code into policy and specific objectives and requirements that are needed to effectively manage and preserve the groundwater resources within the District. The Rules set forth the requirements necessary to receive a water well drilling and production permit, and the associated responsibilities of conservation and preservation of the resource. The requirements are written as general guidelines, and each permit will be evaluated based upon the best scientific data available. The current demand on the aquifer and trend of the water levels in the area may be determining factors in the evaluation of a permit application.

Groundwater Protection

Groundwater contamination may result from many sources, including current and past oil and gas production, agricultural activities, industrial and manufacturing processes, commercial and business endeavors, domestic activities, and natural sources that may be influenced or may result from human activities.The District shall take appropriate measures to discontinue activities that are either causing, or are a potential threat to cause groundwater contamination. Due to permeability of aquifer outcrops and recharge zones, there is a greater threat for groundwater contamination from surface pollution in recharge and outcrop regions, and the District will impose more stringent restrictions on those areas.

Address And Office Hours

The Evergreen Underground Water Conservation District Office is located at:
110 Wyoming Blvd.
Pleasanton, TX 78064
Office Hours: Monday - Friday 8:00 a.m.-12:00 p.m. - 1:00 p.m.-5:00 p.m.

Telephone: (830) 569-4186
Fax: (830) 569-4238
E-mail: info@evergreenuwcd.org

Fees

Copies of the District Rules and Management Plan are $5.00.

Water Well Drilling Permit fee is $175.00, of which $75.00 is refundable to the applicant upon receipt of the driller's log and well registration to the District.

Water Well Production Permit fee is $25.00.

Well Registration fee for exempt wells is $10.00.

Transportation Permit fee is $2,000.00

Photocopies of District Documents are $0.10 each.

Sending or receiving Facsimiles is $2.00 for first page and $1.00 there after, including cover sheet.

Document research by a District Employee is $15.00 /hr.
The cost of postage will be added when applicable.

TWDB MAY 2012

Data Definitions*

1. Projected Water Demands*

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

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

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

From the 2012 State Water Plan Glossary: "**RECOMMENDED WATER MANAGEMENT STRATEGY -** Specific project or action to increase water supply or maximize existing supply to meet a specific need." (See 2012 State Water Plan Chapter 7 for more detail.)
Additional explanation: These are the specific water management strategies (with associated water volumes) that were recommended in the 2011 Regional Water Plans.
**Terminology used by TWDB staff in providing data for 'Estimated Historical Water Use And 2012 State Water Plan Datasets' reports issued by TWDB.*

TWDB

Definitions

"Act" means the legislative Act that created the District and governs its operations.

(Act of 1965, 59th Legislature, Ch. 197, H.B. 116, Pg. 398 (amended 1967, 1983, 1985)).

"Area" means a geographical area designated by the Board in which regulatory policy will be applied.

"Beneficial Use" means agricultural, gardening, domestic, stock raising, municipal, mining, manufacturing, industrial, commercial, recreational or pleasure purposes, or any other use that is beneficial and not considered waste.

"Board" means the Board of Directors of the Evergreen Underground Water Conservation District.

"Certificate Of Convenience And Need (CCN)" means the designation of geographical boundaries of the service area of a water utility.

"Groundwater" means water located beneath the earth's surface but does not include water produced with oil in the production of oil and gas.

"Mining of an Aquifer or Aquifer Mining" means to extract groundwater from an aquifer at an annual rate which exceeds the normal annual recharge to the aquifer.

"Outcrop" means an area where an underground stratum or geologic formation is found at the surface of the ground.

"Person" includes corporation, individual, organization, political subdivision or agency, business trust, estate trust, partnership, association, or any other legal entity.

"Plan" means this District Plan.

"Transportation Facility" means any facility constructed for the purpose of transporting groundwater out of the District.

"Water Utility" means any corporation, company, entity, political subdivision, public or private, that sells water to any person within its service area.

"Well" means any excavation, facility, device, or method that could be used to withdraw groundwater.

"Withdraw" means the act of extracting groundwater by any method.

Appendix A - Evidence of the Administrative Processes Required for the Certification of the Groundwater Management Plan as Administratively Complete

Resolution No. 2016-01

RESOLUTION ADOPTING MANAGEMENT PLAN OF THE EVERGREEN UNDERGROUND WATER CONSERVATION DISTRICT

WHEREAS, The Management Plan of the Evergreen Underground Water Conservation District, attached hereto as Attachment A, has been developed for the purpose of conserving, preserving, protecting and recharging the underground water in the District, and this action is taken under the District's authority to prevent waste and protect the rights of owners of interest in groundwater;

WHEREAS, The Management Plan meets the requirements of Senate Bill 1;

WHEREAS, Under no circumstances, and in no particular case will this Management Plan, or any part of it, be construed as a limitation or restriction upon the exercise of any discretion, where such exists; nor will it in any event be construed to deprive the Board of an exercise of powers, duties and jurisdiction conferred by law, nor to limit or restrict the amount and character of data or information which may be required for the proper administration of the law.

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE EVERGREEN UNDERGROUND WATER CONSERVATION DISTRICT THAT:

1) The "Management Plan of the Evergreen Underground Water Conservation District" contained in attachment A is hereby adopted.

2) This Management Plan will take effect upon certification by the Texas Water Development Board, and shall be in effect for a period of ten (10) years from said date.

AND IT IS SO ORDERED

PASSED AND ADOPTED ON THIS 29TH DAY OF JANUARY 2016.

SIGNED _____
Steve Snider, President

ATTEST _____
Clifton Stacy, Vice-President

MINUTES
EVERGREEN UNDERGROUND WATER CONSERVATION DISTRICT
JANUARY 29, 2016 – REGULARLY SCHEDULED BOARD MEETING

The Meeting of the Board of Directors of the Evergreen Underground Water Conservation District, pursuant to notice, at the District Office, 110 Wyoming Blvd., Pleasanton, Atascosa County, Texas.

Directors Present:	Steve Snider, President Clifton L. Stacy, Vice-President Blaine Schorp, Secretary/Treasurer Diane Savage Jay Troell Frank Kruciak Larry Fox Craig Nieschwietz
Directors Absent:	Jason Peeler
Employees Present:	Russell Labus, General Manager Melissa Gonzalez, District Secretary/Bookkeeper Christopher McFarlane, Assistant Manager Matthew Pope, Field Technician
Guests Present:	Attached
Agenda:	Attached.

Declaration of Quorum and Call to Order:

President Snider declared a quorum present and called the meeting to order at 09:06 a.m. The meeting was posted and filed as required by law.

Pledge of Allegiance.

Recess to Public Hearing

PUBLIC HEARING-PROPOSED DISTRICT MANAGEMENT PLAN

a. Call to Order.

President Snider called the Public Hearing to order at 9:07 a.m.

b. Receive Public Comments on the District Management Plan.

Alan Cockerell questioned whether the Management Plan was posted according to the districts rules and said that he had some trouble downloading and printing a copy of the Management Plan from our website.

General Manager, Russell Labus said that we posted the Notice of Public Hearing and Agenda according to the checklist of requirements provided by the Texas Water Development Board.

c. Adjourn.

President Snider declared the Public Hearing adjourned at 9:17 a.m.

Reconvene to Meeting

CONSIDER AND/OR ACTION ON:

Public Comment on Agenda Items:

None.

Resolution #2016-01 Adopting the Management Plan of the Evergreen Underground Water Conservation District:

Director Stacy move to adopt Resolution Number 2016-01 adopting the Management Plan of the Evergreen Underground Water Conservation District. Director Schorp seconded the motion, and there being no further discussion the motion carried unanimously.

Minutes of the December 18, 2015 Board of Directors' Meeting:

The minutes of the December 18th meeting were presented to the Board. Director Stacy moved to approve the minutes with a minor correction. Director Savage seconded the motion, and there being no further discussion the motion carried unanimously.

Report of Bills Paid for December 2015:

The report of bills paid for December was presented to the Board. Director Schorp moved to receive and file the report. Director Nieschwietz seconded the motion, and there being no further discussion the motion carried unanimously.

Bookkeeping and Budget Reports for December 2015:

The bookkeeping and budget reports for December were presented to the Board. Director Schorp moved to receive and file the reports. Director Savage seconded the motion, and there being no further discussion the motion carried unanimously.

Resolution #2016-02 Adoption of the Annual Public Funds Investment Policy:

Director Schorp moved to adopt Resolution #2016-02 adopting the Public Funds Investment Policy. Director Fox seconded the motion, and there being no further discussion the motion carried unanimously.

Approval to Re-Allocate Certain Funds from Existing Certificates of Deposit upon Their Maturity into other Certificates of Deposit by Recommendation of the Evergreen UWCD Finance Committee:

Director Nieschwietz spoke in behalf of the Finance Committee and said the recommendation is to let all certificates of deposit expire and to transfer the funds to the corresponding bank accounts. Once this has been done then reallocate the monies into different banks. The Board gave General Manager, Russell Labus direction to let the certificates of deposit expire, to transfer the funds, and buy other certificates of deposit in other banks.

Discussion and Action on Approval of H2O4 Texas Invoice:

Director Kruciak made the motion to not pay the H2O4 Texas Invoice for the amount of $1,000.00. Director Troell seconded the motion, and there being no further discussion the motion carried unanimously.

Resolution #2016-03 to Designate Russell Labus as the Evergreen UWCD Representative to GMA 15:

Director Troell made the motion to designate Russell Labus as the Evergreen UWCD representative to GMA 15. Director Schorp seconded the motion, and there being no further discussion the motion carried unanimously.

Resolution #2016-04 to Designate Diane Savage as the Evergreen UWCD Alternate Representative to GMA 15:

Director Troell made the motion to designate Diane Savage as the Evergreen UWCD alternate representative to GMA 15. Director Kruciak seconded the motion, and there being no further discussion the motion carried unanimously.

Discussion and Review of the Proposed Desired Future Conditions of GMA 15:

The Board reviewed the proposed desired future conditions for GMA 15 provided by Tim Andruss, GMA 15 Chairman.

Discussion and Consideration of the 9 Factors as Required by Chapter 36.108(d) of the Texas Water Code for Adopting Desired Future Conditions for GMA 15:

The Board considered the 9 factors for desired future conditions taken from the Texas Water Code Chapter 36.108(d).

Uncontested Water Well Drilling and Production Permits:

The Board was presented with one drilling and one production permit application from City of Kenedy for a new well to be located in Karnes County. Director Troell moved to approve the drilling and production permits. Director Kruciak seconded the motion and there being no further discussion the motion carried unanimously.

The Board was presented with two drilling and two production permit applications from J&B Farms for new wells to be located in Frio County. Director Stacy moved to approve the drilling and production permits. Director Savage seconded the motion, Director Schorp abstained, and there being no further discussion the motion carried unanimously.

The Board was presented with one drilling permit application from Jennifer Ross for a well to be located in Frio County. Director Stacy moved to approve the drilling permit. Director Kruciak seconded the motion, and there being no further discussion the motion carried unanimously.

The Board was presented with three production permit applications for the City of Kenedy, for existing wells located in Karnes County. Director Schorp moved to approve the production permits. Director Savage seconded the motion, and there being no further discussion the motion carried unanimously.

Staff Reports/Directors' Discussion:

Director Savage mentioned that she will be attending a Sunko meeting and provide those attending copies of the Scholarship notice. Director Savage said that there will be a Region L meeting on February 11, 2016.

General Manager, Russell Labus stated as far as meetings for the month there was a GMA 13 meeting last week on January 22nd, a TAGD meeting this week on January 27th and 28th and a meeting put on by the Texas Farm Bureau Austin. Mr. Labus mentioned that Chris McFarlane and Matthew Pope will be attending GIS Workshop in March. Mr. Labus said that there will be a Desalination Conference in San Antonio, which Director Troell said he will be attending. Mr. Labus stated that injection well activity in the newspapers is almost nonexistent. Mr. Labus said that there will be a hearing on March 4, 2016 for one injection well located in Karnes County. Mr. Labus said he spoke to Ron Green with Southwest Research and he mentioned that they have completed their technical review and found that there is no technical reason for Evergreen to continue with its protest. Mr. Labus mentioned that he received a letter yesterday stating that there will be a hearing in April for a different injection well also located in Karnes County. Mr. Labus said that Intera had their workshop on January 12th with the Rules Committee. Mr. Labus said the main point of the workshop was to talk about management zones. Gary Westbrook and Greg Sengelmann also attended the workshop and explained how they do their management zones for their districts. Mr. Labus said that Steve Young asked to be on the agenda for February's meeting and asked that if the Board has any questions to please let him know so that they can be answered during his presentation.

Assistant Manager, Christopher McFarlane mentioned that he along with Matthew Pope have attended a couple of presentations given by the Nueces River Authority and feels that it was a great decision for the board to approve and expand the education program. Mr. McFarlane recommended placing the scholarship notice in all four newspapers within the district in order to reach all those who qualify to participate.

Field Technician, Matthew Pope said that Layne Christensen Co., who will be drilling the well for the City of Kenedy, will be drilling a monitor well beforehand to check the quality of the water. The City of Kenedy has given us permission to use that as a new monitor well for the district which is great since we do not have any monitor wells in that location.

Set Date and Time for Next Board Meeting:

The Board agreed to set the next meeting date for Friday, February 19, 2016 at 09:00 a.m. at the District Office in Pleasanton, TX 78064.

Public Comments:

None.

Adjourn:

There being no further business to come before the Board, President Snider declared the meeting adjourned at 10:37 a.m.

Steve Snider

Steve Snider, President

ATTEST:

Blaine Schorp

Blaine Schorp, Secretary/Treasurer

AGENDA

EVERGREEN UNDERGROUND WATER CONSERVATION DISTRICT
NOTICE OF MEETING

Notice is hereby given that a Regular Called Meeting of the Board of Directors which includes a Public Hearing on the Proposed District Management Plan will be held on **Friday, January 29, 2016 at 09:00 a.m.** at the District Office, 110 Wyoming Blvd., Pleasanton, Atascosa County, Texas.

Russell Labus

Russell Labus, General Manager

FILED FOR RECORD
2016 JAN 25 PM 1:50
DIANE GONZALES
ATASCOSA COUNTY CLERK
BY DEPUTY

1. Declaration of Quorum and Call to Order.
2. Pledge of Allegiance.

Recess to Public Hearing

PUBLIC HEARING-PROPOSED DISTRICT MANAGEMENT PLAN

a. *Call to Order.*
b. *Receive Public Comments on the District Management Plan.*
c. *Adjourn.*

Reconvene to Meeting.

CONSIDER AND/OR ACTION ON:

3. Receive Public Comments on Agenda Items.
4. Resolution Number 2016-01 Adopting the Management Plan of the Evergreen Underground Water Conservation District.
5. Minutes of the December 18, 2015 Board of Directors' Meeting.
6. Report of Bills Paid for December 2015.
7. Budget and Bookkeeping Reports for December 2015.
8. Resolution Number 2016-02 Adoption of the Annual Public Funds Investment Policy.
9. Approval to Re-Allocate Certain Funds from Existing Certificates of Deposit Upon Their Maturity into other Certificates of Deposit by Recommendation of the Evergreen UWCD Finance Committee.
10. Discussion and Action on Approval of H2O4 Texas Invoice.
11. Resolution Number 2016-03 to designate Russell Labus as the Evergreen UWCD Representative to GMA 15.
12. Resolution Number 2016-04 to Designate Diane Savage as the Evergreen UWCD Alternate Representative to GMA 15.
13. Discussion and Review of the Proposed Desired Future Conditions of GMA 15.
14. Discussion and Consideration of the 9 Factors as Required by Chapter 36.108(d) Of the Texas Water Code for Adopting Desired Future Conditions for GMA 15.
15. Uncontested Water Well Drilling and Production Permits.
16. Staff Reports/Directors' Discussion.
17. Set Date and Time for Next Board Meeting.
18. Public Comments
19. Adjourn.

The Board of Directors for the Evergreen Underground Water Conservation District reserves the right to adjourn into executive session at any time during the course of this meeting to discuss any of the matters listed above, as authorized by Texas Government Code Sections 551.071 (Consultation with Attorney), 551.072 (Deliberations about Real Property), 551.073 (Deliberations about Gifts and Donations), 551.074 (Personnel Matters), 551.076 (Deliberations about Security Devices) and 551.087 (Deliberations Regarding Economic Development Negotiations).

THE STATE OF TEXAS
COUNTY OF ATASCOSA

Received in duplicate originals, this the _____ day of January 2016, and posted according to laws by posting a duplicate original hereof on a bulletin board convenient to the public 72 hours prior to the scheduled meeting.

COUNTY CLERK'S OFFICE
ATASCOSA COUNTY

_____
Authorized Signature

Evergreen Underground Water Conservation District
Notice of Public Hearing

The Evergreen Underground Water Conservation District will conduct a public hearing on the proposed adoption of the Management Plan of the District. The Board of Directors will take public comments on the proposed Management Plan at 9:00 a.m. on Friday, January 29, 2016 at the Evergreen Underground Water Conservation District office located at 110 Wyoming Blvd., Pleasanton, Texas, 78064. A copy of the proposed Management Plan may be reviewed or copied at the Evergreen Underground Water Conservation District office from 8:00 a.m. to 5:00 p.m., Monday through Friday. A copy is also available for download on the District website at evergreenuwcd.org.

The above Notice of Public Hearing was filed this 25th day of January 2016 at 1:58 a.m. (p.m.) by Russell Labus.

FILED FOR RECORD
2016 JAN 25 PM 1:58
DIANE GONZALES
ATASCOSA COUNTY CLERK
BY: DEPUTY

AGENDA

EVERGREEN UNDERGROUND WATER CONSERVATION DISTRICT
NOTICE OF MEETING

Notice is hereby given that a Regular Called Meeting of the Board of Directors which includes a Public Hearing on the Proposed District Management Plan will be held on **Friday, January 29, 2016 at 09:00 a.m.** at the District Office, 110 Wyoming Blvd., Pleasanton, Atascosa County, Texas.

Russell Labus

Russell Labus, General Manager

1. Declaration of Quorum and Call to Order.
2. Pledge of Allegiance.

Recess to Public Hearing

PUBLIC HEARING-PROPOSED DISTRICT MANAGEMENT PLAN

a. *Call to Order.*
b. *Receive Public Comments on the District Management Plan.*
c. *Adjourn.*

Reconvene to Meeting.

CONSIDER AND/OR ACTION ON:

3. Receive Public Comments on Agenda Items.
4. Resolution Number 2016-01 Adopting the Management Plan of the Evergreen Underground Water Conservation District.
5. Minutes of the December 18, 2015 Board of Directors' Meeting.
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14. Discussion and Consideration of the 9 Factors as Required by Chapter 36.108(d) Of the Texas Water Code for Adopting Desired Future Conditions for GMA 15.
15. Uncontested Water Well Drilling and Production Permits.
16. Staff Reports/Directors' Discussion.
17. Set Date and Time for Next Board Meeting.
18. Public Comments
19. Adjourn.

FILED
At 3:20 o'Clock A M
This 26 day of 1 16
Angie Tullis
Clerk County Court FRIO COUNTY, TX
By: A. Tullis

The Board of Directors for the Evergreen Underground Water Conservation District reserves the right to adjourn into executive session at any time during the course of this meeting to discuss any of the matters listed above, as authorized by Texas Government Code Sections 551.071 (Consultation with Attorney), 551.072 (Deliberations about Real Property), 551.073 (Deliberations about Gifts and Donations), 551.074 (Personnel Matters), 551.076 (Deliberations about Security Devices) and 551.087 (Deliberations Regarding Economic Development Negotiations).

THE STATE OF TEXAS
COUNTY OF FRIO

Received in duplicate originals, this the 26th day of January 2016, and posted according to laws by posting a duplicate original hereof on a bulletin board convenient to the public 72 hours prior to the scheduled meeting.

Frio COUNTY CLERK'S OFFICE
[redacted] COUNTY
A. Tullis
Authorized Signature

Evergreen Underground Water Conservation District
Notice of Public Hearing

The Evergreen Underground Water Conservation District will conduct a public hearing on the proposed adoption of the Management Plan of the District. The Board of Directors will take public comments on the proposed Management Plan at 9:00 a.m. on Friday, January 29, 2016 at the Evergreen Underground Water Conservation District office located at 110 Wyoming Blvd., Pleasanton, Texas, 78064. A copy of the proposed Management Plan may be reviewed or copied at the Evergreen Underground Water Conservation District office from 8:00 a.m. to 5:00 p.m., Monday through Friday. A copy is also available for download on the District website at evergreenuwcd.org.

The above Notice of Public Hearing was filed this 26th day of January 2016

at 8:20 a.m./p.m. by Angie Tullis Frio Co. Clerk

FILED
At 8:20 o'Clock A M
This 26 day of 1 16
Angie Tullis
Clerk County Court FRIO COUNTY, TX
By: A. Tullis

AGENDA

EVERGREEN UNDERGROUND WATER CONSERVATION DISTRICT
NOTICE OF MEETING

Notice is hereby given that a Regular Called Meeting of the Board of Directors which includes a Public Hearing on the Proposed District Management Plan will be held on **Friday, January 29, 2016 at 09:00 a.m.** at the District Office, 110 Wyoming Blvd., Pleasanton, Atascosa County, Texas.

Russell Labus

Russell Labus, General Manager

1. Declaration of Quorum and Call to Order.
2. Pledge of Allegiance.

Recess to Public Hearing

PUBLIC HEARING-PROPOSED DISTRICT MANAGEMENT PLAN

FILED
At 4:25 o'clock P M
JAN 25 2016
CAROL SWIZE, COUNTY CLERK
KARNES COUNTY, TEXAS
Deputy

   a. *Call to Order.*
   b. *Receive Public Comments on the District Management Plan.*
   c. *Adjourn.*

Reconvene to Meeting.

CONSIDER AND/OR ACTION ON:

3. Receive Public Comments on Agenda Items.
4. Resolution Number 2016-01 Adopting the Management Plan of the Evergreen Underground Water Conservation District.
5. Minutes of the December 18, 2015 Board of Directors' Meeting.
6. Report of Bills Paid for December 2015.
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15. Uncontested Water Well Drilling and Production Permits.
16. Staff Reports/Directors' Discussion.
17. Set Date and Time for Next Board Meeting.
18. Public Comments
19. Adjourn.

The Board of Directors for the Evergreen Underground Water Conservation District reserves the right to adjourn into executive session at any time during the course of this meeting to discuss any of the matters listed above, as authorized by Texas Government Code Sections 551.071 (Consultation with Attorney), 551.072 (Deliberations about Real Property), 551.073 (Deliberations about Gifts and Donations), 551.074 (Personnel Matters), 551.076 (Deliberations about Security Devices) and 551.087 (Deliberations Regarding Economic Development Negotiations).

THE STATE OF TEXAS
COUNTY OF KARNES

Received in duplicate originals, this the 25th day of January 2016, and posted according to laws by posting a duplicate original hereof on a bulletin board convenient to the public 72 hours prior to the scheduled meeting.

COUNTY CLERK'S OFFICE
KARNES ~~ATASCOSA~~ COUNTY
Carol Swize by

Authorized Signature

Evergreen Underground Water Conservation District
Notice of Public Hearing

The Evergreen Underground Water Conservation District will conduct a public hearing on the proposed adoption of the Management Plan of the District. The Board of Directors will take public comments on the proposed Management Plan at 9:00 a.m. on Friday, January 29, 2016 at the Evergreen Underground Water Conservation District office located at 110 Wyoming Blvd., Pleasanton, Texas, 78064. A copy of the proposed Management Plan may be reviewed or copied at the Evergreen Underground Water Conservation District office from 8:00 a.m. to 5:00 p.m., Monday through Friday. A copy is also available for download on the District website at evergreenuwcd.org.

The above Notice of Public Hearing was filed this 25th day of January 2016

at 1:25 a.m./(p.m.) by Carol Swize by Debbie

FILED
At 1:25 o'clock P M
JAN 25 2016
CAROL SWIZE, COUNTY CLERK
KARNES COUNTY, TEXAS
Deputy

AGENDA

EVERGREEN UNDERGROUND WATER CONSERVATION DISTRICT
NOTICE OF MEETING

Notice is hereby given that a Regular Called Meeting of the Board of Directors which includes a Public Hearing on the Proposed District Management Plan will be held on **Friday, January 29, 2016 at 09:00 a.m.** at the District Office, 110 Wyoming Blvd., Pleasanton, Atascosa County, Texas.

Russell Labus

Russell Labus, General Manager

1. Declaration of Quorum and Call to Order.
2. Pledge of Allegiance.

Recess to Public Hearing

PUBLIC HEARING-PROPOSED DISTRICT MANAGEMENT PLAN

a. *Call to Order.*
b. *Receive Public Comments on the District Management Plan.*
c. *Adjourn.*

Reconvene to Meeting.

CONSIDER AND/OR ACTION ON:

3. Receive Public Comments on Agenda Items.
4. Resolution Number 2016-01 Adopting the Management Plan of the Evergreen Underground Water Conservation District.
5. Minutes of the December 18, 2015 Board of Directors' Meeting.
6. Report of Bills Paid for December 2015.
7. Budget and Bookkeeping Reports for December 2015.
8. Resolution Number 2016-02 Adoption of the Annual Public Funds Investment Policy.
9. Approval to Re-Allocate Certain Funds from Existing Certificates of Deposit Upon Their Maturity into other Certificates of Deposit by Recommendation of the Evergreen UWCD Finance Committee.
10. Discussion and Action on Approval of H2O4 Texas Invoice.
11. Resolution Number 2016-03 to designate Russell Labus as the Evergreen UWCD Representative to GMA 15.
12. Resolution Number 2016-04 to Designate Diane Savage as the Evergreen UWCD Alternate Representative to GMA 15.
13. Discussion and Review of the Proposed Desired Future Conditions of GMA 15.
14. Discussion and Consideration of the 9 Factors as Required by Chapter 36.108(d) Of the Texas Water Code for Adopting Desired Future Conditions for GMA 15.
15. Uncontested Water Well Drilling and Production Permits.
16. Staff Reports/Directors' Discussion.
17. Set Date and Time for Next Board Meeting.
18. Public Comments
19. Adjourn.

The Board of Directors for the Evergreen Underground Water Conservation District reserves the right to adjourn into executive session at any time during the course of this meeting to discuss any of the matters listed above, as authorized by Texas Government Code Sections 551.071 (Consultation with Attorney), 551.072 (Deliberations about Real Property), 551.073 (Deliberations about Gifts and Donations), 551.074 (Personnel Matters), 551.076 (Deliberations about Security Devices) and 551.087 (Deliberations Regarding Economic Development Negotiations).

THE STATE OF TEXAS
COUNTY OF WILSON

Received in duplicate originals, this the 25th day of January 2016, and posted according to laws by posting a duplicate original hereof on a bulletin board convenient to the public 72 hours prior to the scheduled meeting. @ 3:30pm

EVA S. MARTINEZ, COUNTY CLERK
COUNTY CLERK'S OFFICE
WILSON COUNTY

Authorized Signature

Evergreen Underground Water Conservation District
Notice of Public Hearing

The Evergreen Underground Water Conservation District will conduct a public hearing on the proposed adoption of the Management Plan of the District. The Board of Directors will take public comments on the proposed Management Plan at 9:00 a.m. on Friday, January 29, 2016 at the Evergreen Underground Water Conservation District office located at 110 Wyoming Blvd., Pleasanton, Texas, 78064. A copy of the proposed Management Plan may be reviewed or copied at the Evergreen Underground Water Conservation District office from 8:00 a.m. to 5:00 p.m., Monday through Friday. A copy is also available for download on the District website at evergreenuwcd.org.

The above Notice of Public Hearing was filed this 25th day of January 2016

at 3:30 a.m. (p.m.) by Kristie C Hidalgo.

COUNTY COURT WILSON COUNTY, TEXAS

EVA S. MARTINEZ, COUNTY CLERK

EUWCD

Evergreen Underground Water Conservation District
110 Wyoming Blvd
Pleasanton, TX 78064

February 26, 2016

Mr. W.E. West, Jr., General Manager
Guadalupe-Blanco River Authority
933 East Court Street
Seguin, TX 78155

Re: Transmittal of Evergreen Underground Water Conservation District Management Plan to Surface Water Management Entities

Dear Mr. West:

In accordance with 31 TAC 356.6(a)(4) and TWC 36.1071(a), the Evergreen Underground Water Conservation District (EUWCD) is submitting our amended Management Plan which was adopted by the Board of Directors on January 29, 2016.

If you have any questions concerning the Management Plan please contact me at 830-569-4186.

Sincerely,

Russell Labus

Russell Labus
General Manager
Evergreen UWCD

Enclosure

Phone: 830-569-4186
Fax: 830-569-4238
Email: info@evergreenuwcd.org
Website: Evergeenuwcd.org

EUWCD

Evergreen Underground Water Conservation District
110 Wyoming Blvd
Pleasanton, TX 78064

February 26, 2016

Mr. Con Mims, Executive Director
Nueces River Authority
P.O. Box 349
Uvalde, TX 78802-0349

Re: Transmittal of Evergreen Underground Water Conservation District Management Plan to Surface Water Management Entities

Dear Mr. Mims:

In accordance with 31 TAC 356.6(a)(4) and TWC 36.1071(a), the Evergreen Underground Water Conservation District (EUWCD) is submitting our amended Management Plan which was adopted by the Board of Directors on January 29, 2016.

If you have any questions concerning the Management Plan please contact me at 830-569-4186.

Sincerely,

Russell Labus
General Manager
Evergreen UWCD

Enclosure

Phone: 830-569-4186
Fax: 830-569-4238
Email: info@evergreenuwcd.org
Website: Evergeenuwcd.org

Evergreen Underground Water Conservation District
110 Wyoming Blvd
Pleasanton, TX 78064

February 26, 2016

Mr. Steven J. Raabe, P.E.
South Central Texas Regional Water Planning Group
San Antonio River Authority
P.O. Box 839980
San Antonio, TX 78283-9980

Re: Transmittal of Evergreen Underground Water Conservation District Management Plan to Surface Water Management Entities

Dear Mr. Raabe:

In accordance with 31 TAC 356.6(a)(4) and TWC 36.1071(a), the Evergreen Underground Water Conservation District (EUWCD) is submitting our amended Management Plan which was adopted by the Board of Directors on January 29, 2016.

If you have any questions concerning the Management Plan please contact me at 830-569-4186.

Sincerely,

Russell Labus
General Manager
Evergreen UWCD

Enclosure

Phone: 830-569-4186
Fax: 830-569-4238
Email: info@evergreenuwcd.org
Website: Evergeenuwcd.org

Appendix B - District Rules

EVERGREEN UNDERGROUND WATER
CONSERVATION DISTRICT
DISTRICT RULES

District Rules are available at: http://www.evergreenuwcd.org/rules.html

Appendix C - TWDB Estimated Historical Water Use Survey Estimates for Atascosa, Frio, Karnes and Wilson Counties 2000 - 2013

Estimated Historical Water Use
TWDB Historical Water Use Survey (WUS) Data

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

ATASCOSA COUNTY

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2013	GW	6,876	50	2,106	7,934	31,848	1,056	49,870
	SW	0	0	230	0	0	264	494
2012	GW	7,222	36	2,151	8,427	24,445	1,051	43,332
	SW	0	0	157	0	0	263	420
2011	GW	7,211	48	703	7,954	36,614	1,776	54,306
	SW	0	0	1,124	0	0	444	1,568
2010	GW	6,432	58	473	7,197	27,501	1,709	43,370
	SW	373	0	761	0	0	427	1,561
2009	GW	6,710	57	386	7,879	35,490	1,491	52,013
	SW	386	0	622	0	0	373	1,381
2008	GW	6,077	79	299	6,448	29,661	1,357	43,921
	SW	471	0	482	0	0	340	1,293
2007	GW	5,158	130	0	3,816	21,191	1,116	31,411
	SW	298	0	0	0	0	279	577
2006	GW	8,998	147	0	8,196	21,903	998	40,242
	SW	316	0	0	0	0	249	565
2005	GW	6,102	126	0	7,363	29,353	1,076	44,020
	SW	352	0	0	0	0	269	621
2004	GW	5,527	127	0	7,363	23,638	157	36,812
	SW	323	0	0	0	0	1,538	1,861
2003	GW	5,577	126	0	7,363	20,530	163	33,759
	SW	318	0	0	0	0	1,595	1,913
2002	GW	5,657	129	0	7,363	50,481	142	63,772
	SW	278	0	0	0	0	1,390	1,668
2001	GW	5,972	137	0	7,379	34,848	893	49,229
	SW	301	0	0	0	0	8,716	9,017
2000	GW	6,244	140	0	7,379	35,053	174	48,990
	SW	112	0	0	0	0	1,571	1,683

FRIO COUNTY

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2013	GW	3,470	0	474	88	80,348	535	84,915
	SW	0	0	52	0	0	356	408
2012	GW	3,455	0	525	64	76,210	420	80,674
	SW	0	0	44	0	0	280	324
2011	GW	3,493	0	626	124	104,755	491	109,489
	SW	0	0	125	0	0	328	453
2010	GW	2,771	0	20	50	59,000	484	62,325
	SW	0	0	4	0	0	322	326
2009	GW	3,459	0	21	169	79,212	674	83,535
	SW	0	0	4	0	0	450	454
2008	GW	2,573	0	22	189	83,725	533	87,042
	SW	0	0	4	0	0	356	360
2007	GW	2,636	0	0	121	48,495	522	51,774
	SW	0	0	0	0	0	348	348
2006	GW	3,154	0	0	214	72,151	619	76,138
	SW	0	0	0	0	0	413	413
2005	GW	2,961	0	0	153	83,641	632	87,387
	SW	0	0	0	0	0	422	422
2004	GW	2,576	0	0	62	84,080	101	86,819
	SW	0	0	0	0	0	916	916
2003	GW	2,424	0	0	188	82,548	98	85,258
	SW	0	0	0	0	837	886	1,723
2002	GW	2,577	0	0	217	88,091	126	91,011
	SW	0	0	0	0	890	1,133	2,023
2001	GW	3,194	0	0	204	103,228	82	106,708
	SW	0	0	0	0	1,043	744	1,787
2000	GW	3,169	0	0	327	116,538	121	120,155
	SW	0	0	0	0	560	1,088	1,648

KARNES COUNTY

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2013	GW	3,844	131	5,454	0	587	426	10,442
	SW	0	0	603	0	374	348	1,325
2012	GW	3,468	44	4,904	0	491	475	9,382
	SW	0	0	412	0	284	388	1,084
2011	GW	3,289	53	2,332	0	824	843	7,341
	SW	0	0	1,555	0	439	689	2,683
2010	GW	3,049	48	291	0	656	814	4,858
	SW	0	0	194	0	133	666	993
2009	GW	3,071	35	151	0	773	603	4,633
	SW	0	0	97	0	0	493	590
2008	GW	3,083	47	1	0	1,038	585	4,754
	SW	0	0	0	0	0	479	479
2007	GW	2,989	38	1	0	310	690	4,028
	SW	0	0	0	0	65	564	629
2006	GW	3,078	59	1	0	1,111	637	4,886
	SW	0	0	0	0	0	520	520
2005	GW	2,885	57	0	0	225	696	3,863
	SW	0	0	0	0	100	571	671
2004	GW	2,295	59	0	0	95	83	2,532
	SW	0	0	0	0	111	1,204	1,315
2003	GW	2,292	112	0	0	117	84	2,605
	SW	0	0	0	0	1,394	1,225	2,619
2002	GW	2,450	62	0	0	378	77	2,967
	SW	0	0	0	0	1,609	1,120	2,729
2001	GW	1,747	127	8	0	282	75	2,239
	SW	0	0	0	0	1,204	1,092	2,296
2000	GW	2,309	107	9	0	356	117	2,898
	SW	0	0	0	0	1,560	1,066	2,626

WILSON COUNTY

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2013	GW	6,184	39	389	0	11,387	830	18,829
	SW	290	0	43	0	1,423	553	2,309
2012	GW	6,261	38	390	0	13,159	788	20,636
	SW	368	0	32	0	1,730	526	2,656
2011	GW	6,890	42	359	0	18,507	1,610	27,408
	SW	350	0	80	0	2,726	1,073	4,229
2010	GW	5,487	41	18	0	13,699	1,579	20,824
	SW	119	0	4	0	1,133	1,053	2,309
2009	GW	6,347	22	9	0	13,344	997	20,719
	SW	235	0	2	0	2,153	665	3,055
2008	GW	6,052	9	1	0	12,343	1,038	19,443
	SW	226	0	0	0	1,989	692	2,907
2007	GW	4,836	9	0	0	4,346	1,114	10,305
	SW	194	0	0	0	539	743	1,476
2006	GW	6,082	10	0	0	19,478	988	26,558
	SW	194	0	0	0	0	658	852
2005	GW	5,778	10	0	0	13,876	1,073	20,737
	SW	104	0	0	0	500	715	1,319
2004	GW	4,532	10	0	0	13,834	144	18,520
	SW	145	0	0	0	470	1,688	2,303
2003	GW	4,856	11	0	0	11,232	144	16,243
	SW	23	0	0	0	1,243	1,686	2,952
2002	GW	4,726	9	0	0	9,278	148	14,161
	SW	142	0	0	0	3,260	1,739	5,141
2001	GW	4,544	7	0	0	10,076	132	14,759
	SW	152	0	0	0	3,540	1,547	5,239
2000	GW	4,924	1	0	0	16,346	182	21,453
	SW	20	0	0	0	4,537	1,627	6,184

Appendix D - Estimates of Projected Surface Water Supplies for Atascosa, Frio, Karnes and Wilson Counties by Decade 2010 - 2060

Projected Surface Water Supplies
TWDB 2012 State Water Plan Data

ATASCOSA COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
L	BEXAR MET WATER DISTRICT	NUECES	SAN ANTONIO RIVER RUN-OF-RIVER	186	186	186	186	186	186
L	LIVESTOCK	NUECES	LIVESTOCK LOCAL SUPPLY	914	897	879	861	846	838
L	LIVESTOCK	SAN ANTONIO	LIVESTOCK LOCAL SUPPLY	53	53	52	52	51	50
	Sum of Projected Surface Water Supplies (acre-feet/year)			**1,153**	**1,136**	**1,117**	**1,099**	**1,083**	**1,074**

FRIO COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
L	LIVESTOCK	NUECES	LIVESTOCK LOCAL SUPPLY	605	605	605	605	605	605
	Sum of Projected Surface Water Supplies (acre-feet/year)			**605**	**605**	**605**	**605**	**605**	**605**

KARNES COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
L	IRRIGATION	SAN ANTONIO	SAN ANTONIO RIVER COMBINED RUN-OF-RIVER IRRIGATION	725	725	725	725	725	725
L	LIVESTOCK	GUADALUPE	LIVESTOCK LOCAL SUPPLY	41	41	41	41	41	41
L	LIVESTOCK	NUECES	LIVESTOCK LOCAL SUPPLY	53	53	53	53	53	53
L	LIVESTOCK	SAN ANTONIO	LIVESTOCK LOCAL SUPPLY	468	468	468	468	468	468
L	LIVESTOCK	SAN ANTONIO-NUECES	LIVESTOCK LOCAL SUPPLY	29	29	29	29	29	29
	Sum of Projected Surface Water Supplies (acre-feet/year)			**1,316**	**1,316**	**1,316**	**1,316**	**1,316**	**1,316**

WILSON COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
L	EAST CENTRAL WSC	SAN ANTONIO	CANYON LAKE/RESERVOIR	106	23	23	23	23	23

Projected Surface Water Supplies
TWDB 2012 State Water Plan Data

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
L	IRRIGATION	SAN ANTONIO	SAN ANTONIO RIVER COMBINED RUN-OF-RIVER IRRIGATION	1,770	1,770	1,770	1,770	1,770	1,770
L	LIVESTOCK	GUADALUPE	LIVESTOCK LOCAL SUPPLY	27	27	27	27	27	27
L	LIVESTOCK	NUECES	LIVESTOCK LOCAL SUPPLY	73	73	73	73	73	73
L	LIVESTOCK	SAN ANTONIO	LIVESTOCK LOCAL SUPPLY	805	805	805	805	805	805
Sum of Projected Surface Water Supplies (acre-feet/year)				**2,781**	**2,698**	**2,698**	**2,698**	**2,698**	**2,698**

Appendix E - Estimates of Projected Water Demands for Atascosa, Frio, Karnes and Wilson Counties by Decade 2010 - 2060

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.

ATASCOSA COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
L	BENTON CITY WSC	NUECES	710	963	1,185	1,353	1,506	1,617
L	BEXAR MET WATER DISTRICT	NUECES	505	621	715	780	843	895
L	MCCOY WSC	NUECES	1,065	1,381	1,643	1,851	2,042	2,181
L	MANUFACTURING	NUECES	6	6	6	6	6	6
L	CHARLOTTE	NUECES	296	312	324	332	342	350
L	LYTLE	NUECES	412	423	433	439	448	456
L	PLEASANTON	NUECES	1,906	1,969	2,027	2,063	2,109	2,151
L	POTEET	NUECES	735	741	740	740	745	752
L	COUNTY-OTHER	NUECES	432	328	242	172	124	94
L	STEAM ELECTRIC POWER	NUECES	7,000	4,807	6,101	5,997	7,336	7,672
L	MINING	NUECES	1,298	1,370	1,405	1,439	1,472	1,509
L	IRRIGATION	NUECES	39,782	38,443	37,154	35,915	34,723	33,571
L	LIVESTOCK	NUECES	1,675	1,675	1,675	1,675	1,675	1,675
L	JOURDANTON	NUECES	801	861	914	955	994	1,026
L	LIVESTOCK	SAN ANTONIO	70	70	70	70	70	70
L	BENTON CITY WSC	SAN ANTONIO	62	84	103	118	131	141
L	IRRIGATION	SAN ANTONIO	1,103	1,066	1,031	996	963	931
L	COUNTY-OTHER	SAN ANTONIO	17	13	9	6	4	3
	Sum of Projected Water Demands (acre-feet/year)		**57,875**	**55,133**	**55,777**	**54,907**	**55,533**	**55,100**

FRIO COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
L	BENTON CITY WSC	NUECES	3	4	5	6	6	6
L	DILLEY	NUECES	1,229	1,409	1,555	1,683	1,774	1,825
L	PEARSALL	NUECES	1,443	1,448	1,449	1,435	1,442	1,449
L	LIVESTOCK	NUECES	1,209	1,209	1,209	1,209	1,209	1,209
L	IRRIGATION	NUECES	82,017	79,098	76,302	73,627	71,065	68,592
L	COUNTY-OTHER	NUECES	727	807	881	937	980	1,007
L	MINING	NUECES	109	104	102	100	98	96

Projected Water Demands
TWDB 2012 State Water Plan Data

Please note that the demand numbers presented here include the plumbing code savings found in the Regional and State Water Plans.

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
L	STEAM ELECTRIC POWER	NUECES	289	268	201	192	76	91
	Sum of Projected Water Demands (acre-feet/year)		**87,026**	**84,347**	**81,704**	**79,189**	**76,650**	**74,275**

KARNES COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
L	EL OSO WSC	GUADALUPE	5	5	6	6	6	6
L	COUNTY-OTHER	GUADALUPE	16	20	24	27	30	31
L	LIVESTOCK	GUADALUPE	83	83	83	83	83	83
L	MINING	GUADALUPE	7	7	7	7	7	7
L	EL OSO WSC	NUECES	13	13	14	15	15	16
L	COUNTY-OTHER	NUECES	24	29	35	39	42	44
L	LIVESTOCK	NUECES	107	107	107	107	107	107
L	SUNKO WSC	SAN ANTONIO	49	53	57	61	63	64
L	RUNGE	SAN ANTONIO	195	209	219	227	238	247
L	KARNES CITY	SAN ANTONIO	432	453	474	492	503	512
L	KENEDY	SAN ANTONIO	763	826	874	912	961	993
L	COUNTY-OTHER	SAN ANTONIO	824	933	1,069	1,172	1,214	1,232
L	IRRIGATION	SAN ANTONIO	1,382	1,250	1,131	1,023	925	836
L	MINING	SAN ANTONIO	94	91	90	89	89	88
L	FALLS CITY	SAN ANTONIO	113	122	131	138	142	145
L	MANUFACTURING	SAN ANTONIO	118	122	125	128	130	137
L	LIVESTOCK	SAN ANTONIO	936	936	936	936	936	936
L	EL OSO WSC	SAN ANTONIO	482	514	547	573	590	601
L	LIVESTOCK	SAN ANTONIO-NUECES	59	59	59	59	59	59
L	MINING	SAN ANTONIO-NUECES	5	5	5	5	5	5
L	COUNTY-OTHER	SAN ANTONIO-NUECES	8	10	12	14	15	15
L	EL OSO WSC	SAN ANTONIO-NUECES	3	3	3	3	3	3
	Sum of Projected Water Demands (acre-feet/year)		**5,718**	**5,850**	**6,008**	**6,116**	**6,163**	**6,167**

WILSON COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
L	COUNTY-OTHER	GUADALUPE	28	37	47	57	68	79
L	MINING	GUADALUPE	14	14	13	13	13	13

L	IRRIGATION	GUADALUPE	79	70	63	56	49	45
L	LIVESTOCK	GUADALUPE	54	54	54	54	54	54
L	MCCOY WSC	NUECES	41	61	82	102	124	147
L	COUNTY-OTHER	NUECES	42	56	72	86	103	120
L	IRRIGATION	NUECES	2,847	2,529	2,248	2,001	1,784	1,595
L	LIVESTOCK	NUECES	145	145	145	145	145	145
L	LA VERNIA	SAN ANTONIO	278	367	464	557	658	764
L	POTH	SAN ANTONIO	348	389	434	480	530	585
L	SUNKO WSC	SAN ANTONIO	564	691	826	965	1,107	1,262
L	EAST CENTRAL WSC	SAN ANTONIO	104	124	146	169	194	222
L	FLORESVILLE	SAN ANTONIO	1,805	2,011	2,245	2,475	2,726	3,000
L	COUNTY-OTHER	SAN ANTONIO	539	770	1,027	1,269	1,533	1,807
L	IRRIGATION	SAN ANTONIO	8,370	7,435	6,610	5,883	5,244	4,690
L	STOCKDALE	SAN ANTONIO	350	386	426	466	510	558
L	LIVESTOCK	SAN ANTONIO	1,609	1,609	1,609	1,609	1,609	1,609
L	MINING	SAN ANTONIO	228	220	216	212	208	205
L	MANUFACTURING	SAN ANTONIO	1	1	1	1	1	1
L	OAK HILLS WSC	SAN ANTONIO	693	960	1,251	1,536	1,843	2,160
L	SS WSC	SAN ANTONIO	1,563	2,204	2,886	3,554	4,279	5,030
L	EL OSO WSC	SAN ANTONIO	52	62	71	81	91	102
	Sum of Projected Water Demands (acre-feet/year)		**19,754**	**20,195**	**20,936**	**21,771**	**22,873**	**24,193**

Appendix F - Estimates of Projected Water Supply Needs for Atascosa, Frio, Karnes and Wilson Counties by Decade 2010 - 2060

Projected Water Supply Needs
TWDB 2012 State Water Plan Data

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

ATASCOSA COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
L	BENTON CITY WSC	NUECES	297	44	-178	-346	-499	-610
L	BENTON CITY WSC	SAN ANTONIO	22	0	-19	-34	-47	-57
L	BEXAR MET WATER DISTRICT	NUECES	-319	-435	-529	-594	-657	-709
L	CHARLOTTE	NUECES	296	280	268	260	250	241
L	COUNTY-OTHER	NUECES	183	287	373	443	491	521
L	COUNTY-OTHER	SAN ANTONIO	5	9	13	16	18	19
L	IRRIGATION	NUECES	-5,636	-4,312	-3,025	-1,788	-603	539
L	IRRIGATION	SAN ANTONIO	-459	-422	-388	-353	-321	-290
L	JOURDANTON	NUECES	-112	-172	-225	-267	-306	-338
L	LIVESTOCK	NUECES	2	1	1	1	1	1
L	LIVESTOCK	SAN ANTONIO	1	1	1	1	1	1
L	LYTLE	NUECES	-122	-133	-143	-149	-158	-166
L	MANUFACTURING	NUECES	0	0	0	0	0	0
L	MCCOY WSC	NUECES	404	87	-175	-383	-574	-713
L	MINING	NUECES	31	32	32	32	33	33
L	PLEASANTON	NUECES	747	683	625	589	542	499
L	POTEET	NUECES	298	291	291	293	287	280
L	STEAM ELECTRIC POWER	NUECES	-263	1,927	633	736	-604	-942
	Sum of Projected Water Supply Needs (acre-feet/year)		**-6,911**	**-5,474**	**-4,682**	**-3,914**	**-3,769**	**-3,825**

FRIO COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
L	BENTON CITY WSC	NUECES	2	1	0	-1	-1	-1
L	COUNTY-OTHER	NUECES	293	213	139	83	40	13
L	DILLEY	NUECES	878	698	552	424	333	282
L	IRRIGATION	NUECES	35,081	38,000	40,796	43,471	46,033	48,506
L	LIVESTOCK	NUECES	0	0	0	0	0	0
L	MINING	NUECES	30	35	37	39	41	43
L	PEARSALL	NUECES	1,288	1,283	1,282	1,296	1,289	1,282
L	STEAM ELECTRIC POWER	NUECES	0	21	88	97	213	198
	Sum of Projected Water Supply Needs (acre-feet/year)		**0**	**0**	**0**	**-1**	**-1**	**-1**

Projected Water Supply Needs
TWDB 2012 State Water Plan Data

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

KARNES COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
L	COUNTY-OTHER	GUADALUPE	15	11	7	4	1	0
L	COUNTY-OTHER	NUECES	20	15	9	5	2	0
L	COUNTY-OTHER	SAN ANTONIO	561	452	316	213	171	153
L	COUNTY-OTHER	SAN ANTONIO-NUECES	12	10	8	6	5	5
L	EL OSO WSC	GUADALUPE	2	2	1	1	1	1
L	EL OSO WSC	NUECES	4	4	3	2	2	1
L	EL OSO WSC	SAN ANTONIO	181	149	116	90	73	62
L	EL OSO WSC	SAN ANTONIO-NUECES	1	1	1	1	1	1
L	FALLS CITY	SAN ANTONIO	58	49	40	33	29	26
L	IRRIGATION	SAN ANTONIO	0	132	251	359	457	546
L	KARNES CITY	SAN ANTONIO	-182	-203	-224	-242	-253	-262
L	KENEDY	SAN ANTONIO	112	49	1	-37	-86	-118
L	LIVESTOCK	GUADALUPE	0	0	0	0	0	0
L	LIVESTOCK	NUECES	0	0	0	0	0	0
L	LIVESTOCK	SAN ANTONIO	0	0	0	0	0	0
L	LIVESTOCK	SAN ANTONIO-NUECES	0	0	0	0	0	0
L	MANUFACTURING	SAN ANTONIO	21	17	14	11	9	2
L	MINING	GUADALUPE	0	0	0	0	0	0
L	MINING	SAN ANTONIO	6	9	10	11	11	12
L	MINING	SAN ANTONIO-NUECES	1	1	1	1	1	1
L	RUNGE	SAN ANTONIO	104	90	80	72	61	52
L	SUNKO WSC	SAN ANTONIO	69	65	61	57	55	54
	Sum of Projected Water Supply Needs (acre-feet/year)		**-182**	**-203**	**-224**	**-279**	**-339**	**-380**

WILSON COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
L	COUNTY-OTHER	GUADALUPE	51	42	32	22	11	0
L	COUNTY-OTHER	NUECES	78	64	48	34	17	0
L	COUNTY-OTHER	SAN ANTONIO	1,235	1,004	747	505	241	-33
L	EAST CENTRAL WSC	SAN ANTONIO	122	19	-3	-26	-51	-79
L	EL OSO WSC	SAN ANTONIO	53	43	34	24	14	3

Projected Water Supply Needs
TWDB 2012 State Water Plan Data

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

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
L	FLORESVILLE	SAN ANTONIO	762	556	322	92	-159	-433
L	IRRIGATION	GUADALUPE	35	44	51	58	65	69
L	IRRIGATION	NUECES	272	590	871	1,118	1,335	1,524
L	IRRIGATION	SAN ANTONIO	0	935	1,760	2,487	3,126	3,680
L	LA VERNIA	SAN ANTONIO	777	688	591	498	397	291
L	LIVESTOCK	GUADALUPE	0	0	0	0	0	0
L	LIVESTOCK	NUECES	0	0	0	0	0	0
L	LIVESTOCK	SAN ANTONIO	0	0	0	0	0	0
L	MANUFACTURING	SAN ANTONIO	0	0	0	0	0	0
L	MCCOY WSC	NUECES	8	-12	-33	-53	-76	-99
L	MINING	GUADALUPE	0	0	0	0	0	0
L	MINING	SAN ANTONIO	0	0	0	0	0	0
L	OAK HILLS WSC	SAN ANTONIO	1,169	902	611	326	19	-298
L	POTH	SAN ANTONIO	955	914	869	823	773	718
L	SS WSC	SAN ANTONIO	-223	-864	-1,546	-2,214	-2,939	-3,690
L	STOCKDALE	SAN ANTONIO	1,412	1,376	1,336	1,296	1,252	1,204
L	SUNKO WSC	SAN ANTONIO	628	501	366	227	85	-70
	Sum of Projected Water Supply Needs (acre-feet/year)		**-223**	**-876**	**-1,582**	**-2,293**	**-3,225**	**-4,702**

Appendix G - Water Management Strategies Recommended in South Central Texas Regional Water Plan (SCTRWP) For Atascosa, Frio, Karnes and Wilson Counties By Decade 2010 - 2060

Projected Water Management Strategies
TWDB 2012 State Water Plan Data

ATASCOSA COUNTY

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

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
BENTON CITY WSC, NUECES (L)							
LOCAL GROUNDWATER CARRIZO-WILCOX AQUIFER (INCLUDES OVERDRAFTS)	CARRIZO-WILCOX AQUIFER [ATASCOSA]	0	0	596	596	596	1,193
MUNICIPAL WATER CONSERVATION	CONSERVATION [ATASCOSA]	0	0	0	18	63	113
BENTON CITY WSC, SAN ANTONIO (L)							
LOCAL GROUNDWATER CARRIZO-WILCOX AQUIFER (INCLUDES OVERDRAFTS)	CARRIZO-WILCOX AQUIFER [ATASCOSA]	0	0	56	56	57	113
MUNICIPAL WATER CONSERVATION	CONSERVATION [ATASCOSA]	0	0	0	2	6	11
BEXAR MET WATER DISTRICT, NUECES (L)							
LOCAL GROUNDWATER CARRIZO-WILCOX AQUIFER (INCLUDES OVERDRAFTS)	CARRIZO-WILCOX AQUIFER [BEXAR]	319	435	529	594	657	709
CHARLOTTE, NUECES (L)							
DROUGHT MANAGEMENT	DROUGHT MANAGEMENT [ATASCOSA]	15	0	0	0	0	0
FACILITIES EXPANSION	CARRIZO-WILCOX AQUIFER [ATASCOSA]	0	0	0	0	0	0
MUNICIPAL WATER CONSERVATION	CONSERVATION [ATASCOSA]	20	23	25	26	34	43
COUNTY-OTHER, NUECES (L)							
MUNICIPAL WATER CONSERVATION	CONSERVATION [ATASCOSA]	11	17	11	1	0	0
IRRIGATION, NUECES (L)							
IRRIGATION WATER CONSERVATION	CONSERVATION [ATASCOSA]	5,161	4,312	3,025	1,788	603	0
IRRIGATION, SAN ANTONIO (L)							
IRRIGATION WATER CONSERVATION	CONSERVATION [ATASCOSA]	208	422	388	353	321	290
JOURDANTON, NUECES (L)							
DROUGHT MANAGEMENT	DROUGHT MANAGEMENT [ATASCOSA]	40	0	0	0	0	0
LOCAL GROUNDWATER CARRIZO-WILCOX AQUIFER (INCLUDES OVERDRAFTS)	CARRIZO-WILCOX AQUIFER [ATASCOSA]	403	403	403	403	403	403

Projected Water Management Strategies
TWDB 2012 State Water Plan Data

WUG, Basin (RWPG) / Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
		All values are in acre-feet/year					
MUNICIPAL WATER CONSERVATION	CONSERVATION [ATASCOSA]	60	123	156	173	195	222
LYTLE, NUECES (L)							
DROUGHT MANAGEMENT	DROUGHT MANAGEMENT [ATASCOSA]	24	0	0	0	0	0
EDWARDS TRANSFERS	EDWARDS-BFZ AQUIFER [ATASCOSA]	122	133	143	149	158	166
MUNICIPAL WATER CONSERVATION	CONSERVATION [ATASCOSA]	33	63	72	76	84	95
MCCOY WSC, NUECES (L)							
LOCAL GROUNDWATER CARRIZO-WILCOX AQUIFER (INCLUDES OVERDRAFTS)	CARRIZO-WILCOX AQUIFER [ATASCOSA]	0	700	700	700	700	1,484
MUNICIPAL WATER CONSERVATION	CONSERVATION [ATASCOSA]	0	0	0	12	63	119
PLEASANTON, NUECES (L)							
MUNICIPAL WATER CONSERVATION	CONSERVATION [ATASCOSA]	156	300	448	523	565	615
POTEET, NUECES (L)							
MUNICIPAL WATER CONSERVATION	CONSERVATION [ATASCOSA]	60	116	163	185	198	213
STEAM ELECTRIC POWER, NUECES (L)							
LOCAL GROUNDWATER CARRIZO-WILCOX AQUIFER (INCLUDES OVERDRAFTS)	CARRIZO-WILCOX AQUIFER [ATASCOSA]	807	807	807	807	807	1,613
Sum of Projected Water Management Strategies (acre-feet/year)		**7,439**	**7,854**	**7,522**	**6,462**	**5,510**	**7,402**

FRIO COUNTY

WUG, Basin (RWPG) / Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
		All values are in acre-feet/year					
BENTON CITY WSC, NUECES (L)							
LOCAL GROUNDWATER CARRIZO-WILCOX AQUIFER (INCLUDES OVERDRAFTS)	CARRIZO-WILCOX AQUIFER [ATASCOSA]	0	0	1	1	1	1
COUNTY-OTHER, NUECES (L)							
MUNICIPAL WATER CONSERVATION	CONSERVATION [FRIO]	0	0	0	0	0	18
DILLEY, NUECES (L)							
MUNICIPAL WATER CONSERVATION	CONSERVATION [FRIO]	104	229	362	511	652	772

PEARSALL, NUECES (L)							
MUNICIPAL WATER CONSERVATION	CONSERVATION [FRIO]	116	223	272	271	294	324
Sum of Projected Water Management Strategies (acre-feet/year)		**220**	**452**	**635**	**783**	**947**	**1,115**

KARNES COUNTY

WUG, Basin (RWPG)

All values are in acre-feet/year

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
COUNTY-OTHER, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION	CONSERVATION [KARNES]	68	121	157	193	227	258
EL OSO WSC, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION	CONSERVATION [KARNES]	41	83	92	105	120	139
FALLS CITY, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION	CONSERVATION [KARNES]	8	13	14	16	19	23
KARNES CITY, SAN ANTONIO (L)							
LOCAL GROUNDWATER CARRIZO-WILCOX AQUIFER (INCLUDES OVERDRAFTS)	CARRIZO-WILCOX AQUIFER [KARNES]	323	323	323	323	323	323
MUNICIPAL WATER CONSERVATION	CONSERVATION [KARNES]	0	0	0	0	0	11
KENEDY, SAN ANTONIO (L)							
LOCAL GROUNDWATER (GULF COAST AQUIFER)	GULF COAST AQUIFER [KARNES]	0	0	0	161	161	161
MUNICIPAL WATER CONSERVATION	CONSERVATION [KARNES]	58	121	189	216	242	268
RUNGE, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION	CONSERVATION [KARNES]	15	22	24	26	31	37
SUNKO WSC, SAN ANTONIO (L)							
LOCAL GROUNDWATER CARRIZO-WILCOX AQUIFER (INCLUDES OVERDRAFTS)	CARRIZO-WILCOX AQUIFER [WILSON]	0	0	0	0	0	10
Sum of Projected Water Management Strategies (acre-feet/year)		**513**	**683**	**799**	**1,040**	**1,123**	**1,230**

WILSON COUNTY

WUG, Basin (RWPG)

All values are in acre-feet/year

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
COUNTY-OTHER, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION	CONSERVATION [WILSON]	0	0	0	14	58	116

Projected Water Management Strategies
TWDB 2012 State Water Plan Data

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

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
EAST CENTRAL WSC, SAN ANTONIO (L)							
EDWARDS TRANSFERS	EDWARDS-BFZ AQUIFER [UVALDE]	179	179	179	179	179	179
HAYS/CALDWELL PUA PROJECT (INCL. GONZALES CO.)	CARRIZO-WILCOX AQUIFER [CALDWELL]	0	0	3	26	51	79
LOCAL GROUNDWATER (TRINITY AQUIFER)	TRINITY AQUIFER [BEXAR]	10	10	10	10	10	10
FLORESVILLE, SAN ANTONIO (L)							
LOCAL GROUNDWATER CARRIZO-WILCOX AQUIFER (INCLUDES OVERDRAFTS)	CARRIZO-WILCOX AQUIFER [WILSON]	0	0	0	0	484	484
MUNICIPAL WATER CONSERVATION	CONSERVATION [WILSON]	136	291	433	504	596	714
LA VERNIA, SAN ANTONIO (L)							
CRWA WELLS RANCH PROJECT PHASE I	CARRIZO-WILCOX AQUIFER [GONZALES]	400	0	0	0	0	0
HAYS/CALDWELL PUA PROJECT (INCL. GONZALES CO.)	CARRIZO-WILCOX AQUIFER [CALDWELL]	0	400	400	400	400	400
MUNICIPAL WATER CONSERVATION	CONSERVATION [WILSON]	21	56	105	146	184	227
MCCOY WSC, NUECES (L)							
LOCAL GROUNDWATER CARRIZO-WILCOX AQUIFER (INCLUDES OVERDRAFTS)	CARRIZO-WILCOX AQUIFER [ATASCOSA]	0	107	107	107	107	129
MUNICIPAL WATER CONSERVATION	CONSERVATION [WILSON]	0	0	0	1	5	10
OAK HILLS WSC, SAN ANTONIO (L)							
LOCAL GROUNDWATER CARRIZO-WILCOX AQUIFER (INCLUDES OVERDRAFTS)	CARRIZO-WILCOX AQUIFER [WILSON]	0	0	0	0	0	323
MUNICIPAL WATER CONSERVATION	CONSERVATION [WILSON]	0	0	0	26	76	136
POTH, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION	CONSERVATION [WILSON]	20	22	25	28	46	64
SS WSC, SAN ANTONIO (L)							
BRACKISH GROUNDWATER DESALINATION (WILCOX AQUIFER)	CARRIZO-WILCOX AQUIFER- BRACKISH [WILSON]	0	0	0	1,120	1,120	1,120
DROUGHT MANAGEMENT	DROUGHT MANAGEMENT [WILSON]	78	0	0	0	0	0

Projected Water Management Strategies
TWDB 2012 State Water Plan Data

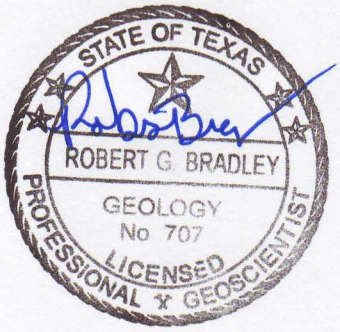
WUG, Basin (RWPG) All values are in acre-feet/year

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
HAYS/CALDWELL PUA PROJECT (INCL. GONZALES CO.)	CARRIZO-WILCOX AQUIFER [CALDWELL]	0	0	0	0	0	690
LOCAL GROUNDWATER CARRIZO-WILCOX AQUIFER (INCLUDES OVERDRAFTS)	CARRIZO-WILCOX AQUIFER [WILSON]	807	1,613	1,613	2,420	3,226	4,033
MUNICIPAL WATER CONSERVATION	CONSERVATION [WILSON]	0	0	0	0	84	221
STOCKDALE, SAN ANTONIO (L)							
MUNICIPAL WATER CONSERVATION	CONSERVATION [WILSON]	27	57	93	128	147	171
SUNKO WSC, SAN ANTONIO (L)							
LOCAL GROUNDWATER CARRIZO-WILCOX AQUIFER (INCLUDES OVERDRAFTS)	CARRIZO-WILCOX AQUIFER [WILSON]	0	0	0	0	0	151
MUNICIPAL WATER CONSERVATION	CONSERVATION [WILSON]	3	6	10	29	54	92
Sum of Projected Water Management Strategies (acre-feet/year)		**1,681**	**2,741**	**2,978**	**5,138**	**6,827**	**9,349**

Appendix H - Aquifer Assessment 10-40 MAG

AQUIFER ASSESSMENT 10-40 MAG: ANALYTICAL MODEL ESTIMATES OF MODELED AVAILABLE GROUNDWATER FOR THE EDWARDS AQUIFER WITHIN FRIO COUNTY IN GROUNDWATER MANAGEMENT AREA 13

by Robert G. Bradley, P.G. and Sarah Backhouse
Texas Water Development Board
Groundwater Resources Division
Groundwater Technical Assistance Section
(512) 936-0870
August 20, 2012



Robert G. Bradley, P.G. 707, authorized the seal appearing on this document on August 20, 2012.

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AQUIFER ASSESSMENT 10-40 MAG: ANALYTICAL MODEL ESTIMATES OF MODELED AVAILABLE GROUNDWATER FOR THE EDWARDS AQUIFER WITHIN FRIO COUNTY IN GROUNDWATER MANAGEMENT AREA 13

by Robert G. Bradley, P.G. and Sarah Backhouse
Texas Water Development Board
Groundwater Resources Division
Groundwater Technical Assistance Section
(512) 936-0870
August 20, 2012

EXECUTIVE SUMMARY:

The estimated modeled available groundwater for the Edwards Aquifer within Frio County as a result of the desired future condition (DFC) adopted by members of Groundwater Management Area (GMA) 13 is 23,213 acre-feet per year from 2010 to 2070.

REQUESTOR:

Mr. Mike Mahoney of the Evergreen Underground Water Conservation District acting on behalf of the member groundwater conservation districts of Groundwater Management Area 13.

DESCRIPTION OF REQUEST:

In a letter received September 2, 2010, Mr. Mahoney provided the Texas Water Development Board (TWDB) with the DFC of the Edwards Aquifer within Frio County adopted by the members of Groundwater Management Area 13. The DFC for the Edwards Aquifer, as described in Resolution No. 2010-02 and adopted August 12, 2010 by the groundwater conservation districts in Groundwater Management Area 13 is described below:

> Maintain a minimum artesian flow of 500 gallons per minute from wells producing from the Edwards Aquifer in Frio County.

In response to receiving the adopted desired future condition, TWDB has estimated the modeled available groundwater that achieves the above desired future condition for Groundwater Management Area 13.

METHODS:

Groundwater Management Area 13, located in South Central Texas, includes part of the Edwards Aquifer. The amount of data for the Edwards Aquifer in Frio County is limited; the Evergreen Underground Water Conservation District provided data for seven permitted wells located in northern Frio County. Data included well records, production rates, and flow rates (EUWCD, 2010).

The Jacob-Lohman flowing well equation (Jacob and Lohman, 1952) is used to simulate the desired future conditions within the Edwards Aquifer within Frio County. Well information supplied by Evergreen Underground Water Conservation District (EUWCD, 2010) and from the Texas Well Report Submission and Retrieval System (TDLR, 2011) support the estimates used in this assessment.

The Jacob and Lohman (1952), as referenced in Kruseman and de Ridder (2000) free flowing well equation was used for determining the modeled available groundwater from the desired future condition. It can be approximated as:

$$Q = \frac{4\pi T s_w}{2.3 Log(\frac{2.25Tt}{r_{ew}^2})}$$

where,

T = Transmissivity

s_w = the constant drawdown measured as the difference between the static shut-in head and the discharge opening of the well.

t = time since discharge started

r_{ew} = effective radius of the well (estimated as the actual well radius)

Q = discharge

PARAMETERS AND ASSUMPTIONS:

Assumptions for the Jacob-Lohman free flowing well method are:

- the aquifer is confined;
- the aquifer has infinite areal extent;
- the aquifer is homogeneous, isotropic, and of uniform thickness over the area;
- prior to pumping, the piezometric surface is horizontal over the area;
- at the beginning of the test (t = O), the water level in the free-flowing well is lowered instantaneously. At t > O, the drawdown in the well is constant, and its discharge is variable;
- the well penetrates the entire thickness of the aquifer and receives water by horizontal flow;
- The flow to the well is in an unsteady state,

For details please refer to Jacob and Lohman (1952) and Kruseman and deRidder (2000).

Additional assumptions for this assessment are:

- Calculations assume there is one well for this assessment;
- Aquifer thickness is assumed to be 700 feet based on well records (EUWCD, 2010);
- Minimum hydraulic conductivity was estimated at 400 ft/day (Lindgren and others, 2004);
- Transmissivity estimated at 280,000 $feet^2$/day based on aquifer thickness and hydraulic conductivity;
- Time is estimated as 60 years to cover the water planning period (the formula is not very sensitive to time, and 50 or 70 years gave similar results);

- To maintain the DFC throughout the period, the constant drawdown (s_w) is estimated at 20 feet or approximately 25% of the measured head in the study area.

RESULTS:

The estimated modeled available groundwater for the Edwards Aquifer within Frio County in Groundwater Management Area 13 consistent with the adopted desired future condition is approximately 23,213 acre-feet per year. Table 1 summarizes the information used to calculate this value.

Table 1. Values used in determining the modeled available groundwater estimate.

Parameter	Value
Aquifer thickness (ft)	700
Hydraulic conductivity (ft/day)	400
Transmissivity (ft^2/day)	280,000
Time (days)	21,900
Effective radius (ft)	0.35
Estimated constant drawdown in well (ft)	20
Total estimated discharge (acre-feet/year)	23,213

This pumping has been divided by county, regional water planning area, and river basin for each decade between 2010 and 2070 for use in the regional water planning process (Table 2). The area is also wholly within the Evergreen Underground Water Conservation District.

Table 2. Modeled available ground by decade for the Edwards Aquifer in groundwater management area 13. Results are in acre-feet per year and are divided by county, regional water planning area, and river basin

County	Region	Basin	Year						
			2010	2020	2030	2040	2050	2060	2070
Frio	L	Nueces	23,213	23,213	23,213	23,213	23,213	23,213	23,213

LIMITATIONS:

Additional data are needed to create improved estimates; these estimates are a basic interpretation of the requested conditions. This analysis assumes homogeneous and isotropic aquifers; however, conditions for the Edwards Aquifer may not behave in a uniform manner as the head declines and flows decrease.

This analysis was determined to be the best method to calculate a modeled available groundwater estimate; however, this method has limitations and should be replaced with better tools, especially including this area in groundwater models and additional data that are not currently available, whenever possible. This analysis assumes that the aquifer is in a state of declining head over the assessment period; however, the aquifer does exhibit rapid recovery of the head after recharge events. This assumption needs to be considered and compared to actual future data when evaluating achievement of the desired future condition.

Given these limitations, users of this information are cautioned that the modeled available groundwater estimates should not be considered a definitive, permanent description of the amount of groundwater that can be pumped to meet the adopted desired future condition. The TWDB makes no warranties or representations relating to the actual conditions of any aquifer at a particular location or at a particular time.

It is important for groundwater conservation districts to monitor future groundwater pumping and water levels to know if they are achieving their desired future conditions. Because of the limitations and assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine these modeled available groundwater numbers given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future.

MODELED AVAILABLE GROUNDWATER AND PERMITTING:

As defined in Chapter 36 of the Texas Water Code, "modeled available groundwater" is the estimated average amount of water that may be produced annually to achieve a desired future condition.

Groundwater conservation districts are required to consider modeled available groundwater, along with several other factors, when issuing permits in order to manage groundwater production to achieve the desired future condition(s).

The other factors districts must consider include annual precipitation and production patterns, the estimated amount of pumping exempt from permitting, existing permits, and a reasonable estimate of actual groundwater production under existing permits. The estimated amount of pumping exempt from permitting, which the Texas Water Development Board is now required to develop after soliciting input from applicable groundwater conservation districts, will be provided in a separate report.

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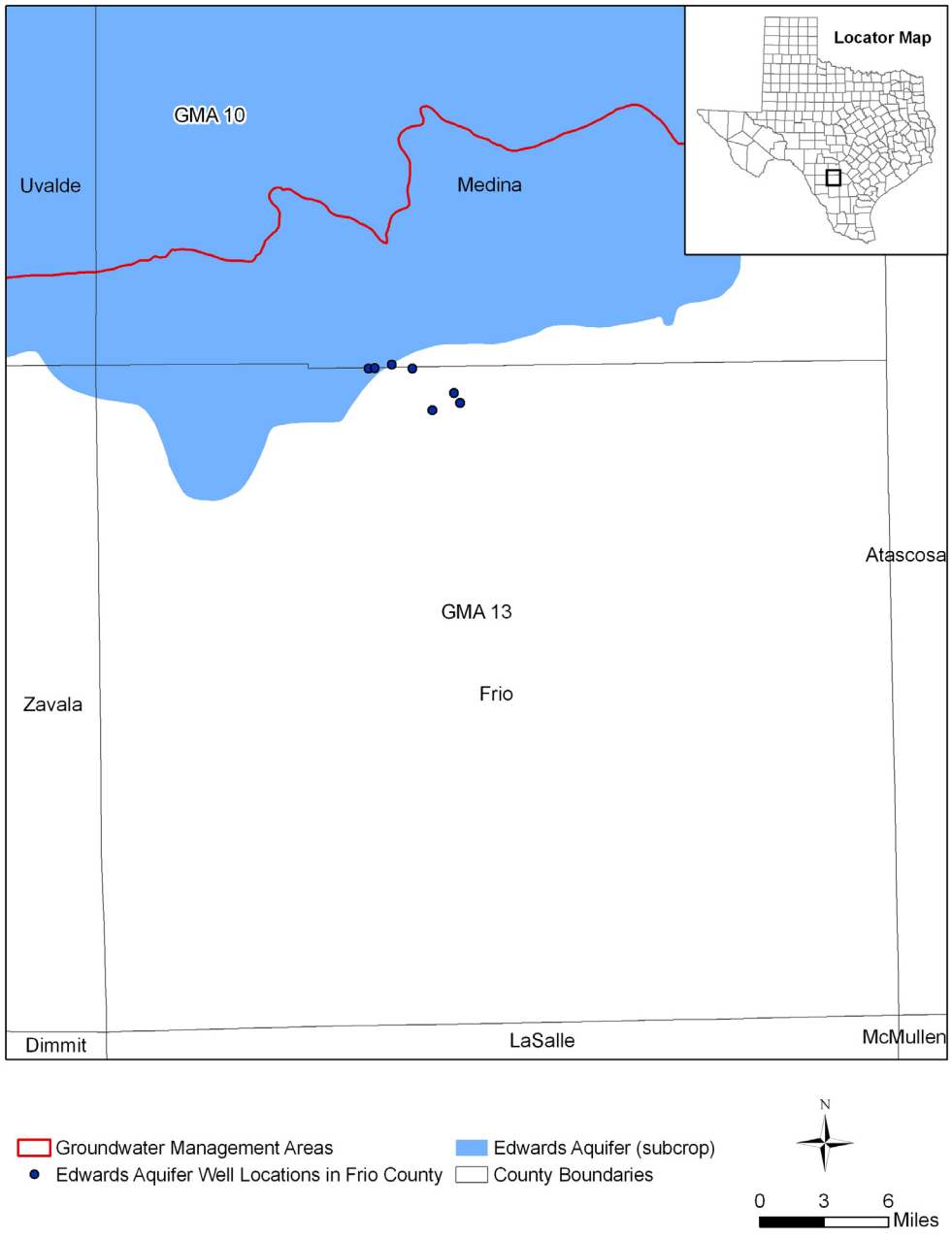


Figure 1. Map showing the groundwater management areas, extent of the Edwards Aquifer as delineated by TWDB and location of the flowing Edwards wells in Frio County. Well locations provided by Evergreen UWCD (2010).

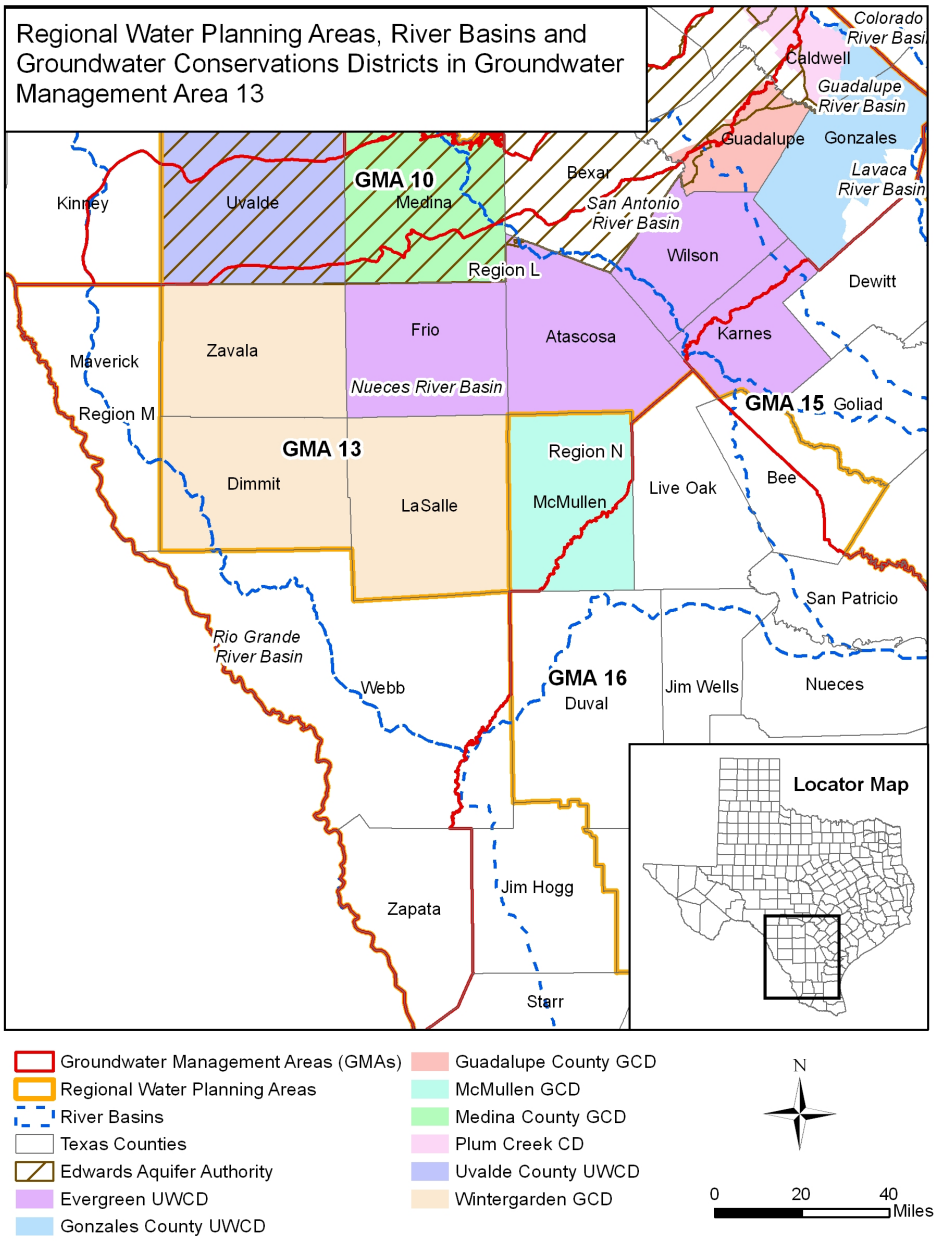
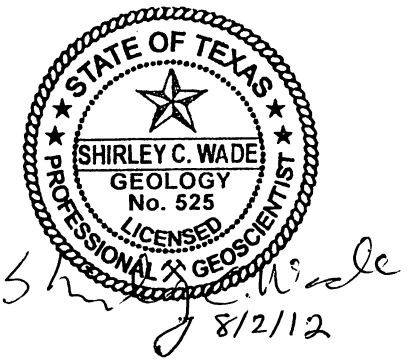


Figure 2. Map showing regional water planning areas, river basins, groundwater conservation districts, and counties in and neighboring groundwater management area 13. CD = conservation district, GCD = groundwater conservation district, UWCD = underground water conservation district.

Appendix J - GAM Run 10-012 MAG

GAM Run 10-012 MAG: Modeled Available Groundwater for the Carrizo-Wilcox, Queen City, and Sparta Aquifers in Groundwater Management Area 13

by Shirley C. Wade, Ph.D., P.G.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 936-0883
August 2, 2012



The seal appearing on this document was authorized by Shirley C. Wade, P.G. 525, on August 2, 2012.

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GAM RUN 10-012 MAG: MODELED AVAILABLE GROUNDWATER FOR THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS IN GROUNDWATER MANAGEMENT AREA 13

by Shirley C. Wade, Ph.D., P.G.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 936-0883
August 2, 2012

EXECUTIVE SUMMARY:

The modeled available groundwater for Groundwater Management Area 13 for the Carrizo-Wilcox, Queen City, and Sparta aquifers is summarized in Table 1, 2, and 3 for use in the regional water planning process. These values are also listed by decade for each aquifer by county (Table 4), river basin (Table 5), regional water planning group (Table 6), and groundwater conservation district (Table 7). The modeled available groundwater estimates for the Queen City, Sparta, and Carrizo-Wilcox aquifers range from approximately 399,000 acre-feet per year in 2010 to 425,000 acre-feet per year in 2060 (Table 4). The estimates were extracted from results of Groundwater Availability Model Run 09-034, scenario 4, which meets the desired future conditions adopted by members of Groundwater Management Area 13.

This report reflects the official release of the revised groundwater district boundaries by the Texas Commission on Environmental Quality (TCEQ). Specifically, this report reflects the division of modeled available groundwater between the Gonzales County Underground Water Conservation District and Plum Creek Conservation District based on the new groundwater conservation district boundaries.

REQUESTOR:

Mr. Mike Mahoney from the Evergreen Underground Water Conservation District acting on behalf of Groundwater Management Area 13.

DESCRIPTION OF REQUEST:

In a letter dated April 13, 2010 and received by the Texas Water Development Board (TWDB) on April 15, 2010, Mr. Mike Mahoney provided the TWDB with the desired future conditions of the Carrizo-Wilcox, Queen City, and Sparta aquifers adopted by the groundwater conservation districts in Groundwater Management Area 13. The desired future conditions for the Carrizo-Wilcox, Queen City, and Sparta aquifers, as described in Resolution R 2010-01 and adopted April 9, 2010 by the groundwater conservation districts within Groundwater Management Area 13, are described below:

- "In reference to GAM Run 09-034, the committee has considered, the base scenario of an average drawdown of 22 feet, scenario 2 an average drawdown of 22 feet, scenario 3 an average drawdown of 23 feet and scenario 4 an average drawdown of 23 feet;"
- "The district members of Groundwater Management Area 13, adopt scenario 4, and an average drawdown of 23 feet for the Sparta, Weches, Queen City, Reklaw, Carrizo, and the Wilcox Aquifers"

In response to receiving the adopted desired future conditions, TWDB has estimated the modeled available groundwater for the Carrizo-Wilcox, Queen City, and Sparta Aquifers in Groundwater Management Area 13.

METHODS:

Groundwater Management Area 13, located in south central Texas, includes the southern part of the Queen City, Sparta, and Carrizo-Wilcox aquifers (Figure 1). For the previously completed Groundwater Availability Model Run 09-034 (Wade and Jigmond, 2010) average recharge and evapotranspiration rates and initial streamflows based on the historical calibration-verification runs, representing 1981 to 1999 were summarized. These averages were then used for each year of the 61-year predictive simulations along with pumping specified by Groundwater Management Area 13 members in four scenarios. The results of the pumping scenarios were reviewed by members of Groundwater Management Area 13 to develop their desired future conditions. Model scenario 4 resulted in an overall average drawdown of 23 feet for the Queen City, Sparta, and Carrizo-Wilcox aquifers and for the Weches and Reklaw confining units. The pumping for scenario 4 was extracted from the model results and divided by county, river basin, regional water planning area and groundwater conservation district within Groundwater Management Area 13 (Figure 2).

Modeled Available Groundwater and Permitting

As defined in Chapter 36 of the Texas Water Code, "modeled available groundwater" is the estimated average amount of water that may be produced annually to achieve a desired future condition. Groundwater conservation districts are required to consider modeled available groundwater, along with several other factors, when issuing permits in order to manage groundwater production to achieve the desired future condition(s). The other factors districts must consider include annual precipitation and production patterns, the estimated amount of pumping exempt from permitting, existing permits, and a reasonable estimate of actual groundwater production under existing permits. The estimated amount of pumping exempt from permitting, which the Texas Water Development Board is required to develop after soliciting input from applicable groundwater conservation districts, will be provided in a separate report.

PARAMETERS AND ASSUMPTIONS:

The parameters and assumptions for the groundwater availability model for the southern part of the Queen City, Sparta, and Carrizo-Wilcox aquifers are described below:

- Version 2.01 of the groundwater availability model for the southern part of the Queen City, Sparta, and Carrizo-Wilcox aquifers was used for this analysis
- See Deeds and others (2003) and Kelley and others (2004) for assumptions and limitations of the groundwater availability model for the southern part of the Queen City, Sparta, and Carrizo-Wilcox aquifers.
- The model includes eight layers representing:
- the Sparta Aquifer (layer 1),
- the Weches Formation (layer 2),
- the Queen City Aquifer (layer 3),
- the Reklaw Formation (layer 4),
- the Carrizo Aquifer (layer 5),
- the upper and where the upper is missing, the middle Wilcox Aquifer (layer 6),
- the middle Wilcox Aquifer (layer 7), and
- the lower Wilcox Aquifer (layer 8).

- Groundwater in the groundwater availability model for the southern portion of the Queen City, Sparta, and Carrizo-Wilcox aquifers ranges from fresh to saline (Kelley and others, 2004).

- The root mean square error (a measure of the difference between simulated and measured water levels during model calibration) in the entire model for 1999 is 23 feet for the Sparta Aquifer, 18 feet for the Queen City aquifer, and 33 feet for the Carrizo aquifer (Kelley and others, 2004).

- Recharge rates, evapotranspiration rates, and initial streamflows are averages of historic estimates from 1981 to 1999.

RESULTS:

The modeled available groundwater for the Carrizo-Wilcox Aquifer that achieves the desired future conditions adopted by Groundwater Management Area 13 increases from 375,654 to 404,000 acre-feet per year between 2010 and 2060 (Table 1). The modeled available groundwater for the Queen City Aquifer in Groundwater Management Area 13 declines from 16,311 to 14,538 acre-feet per year over the same time period (Table 2). The modeled available groundwater for the Sparta Aquifer in Groundwater Management Area 13 declines from 6,800 to 6,365 acre-feet per year (Table 3). The modeled available groundwater in tables 1, 2, and 3 has been summarized by county, river basin, and regional water planning area for use in the regional water planning process.

The modeled available groundwater is also summarized by county (Table 4), river basin (Table 5), regional water planning area (Table 6), and groundwater conservation district (Table 7). In Table 7, the modeled available groundwater among all districts has been calculated both excluding and including areas outside the jurisdiction of a groundwater conservation district.

LIMITATIONS:

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

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

A key aspect of using the groundwater model to evaluate historic groundwater flow conditions includes the assumptions about the location in the aquifer where historic pumping was placed. Understanding the amount and location of historic pumping is as important as evaluating the volume of groundwater flow into and out of the district, between aquifers within the district (as applicable), interactions with surface water (as applicable), recharge to the aquifer system (as applicable), and other metrics that describe the impacts of that pumping. In addition, assumptions regarding precipitation, recharge, and streamflow are specific to a particular historic time period.

Because the application of the groundwater model was designed to address regional scale questions, the results are most effective on a regional scale. The TWDB makes no warranties or representations relating to the actual conditions of any aquifer at a particular location or at a particular time.

It is important for groundwater conservation districts to monitor groundwater pumping and overall conditions of the aquifer. Because of the limitations of the groundwater model and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine this analysis in the future given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future. Historic precipitation patterns also need to be placed in context as future climatic conditions, such as dry and wet year precipitation patterns, may differ and affect groundwater flow conditions.

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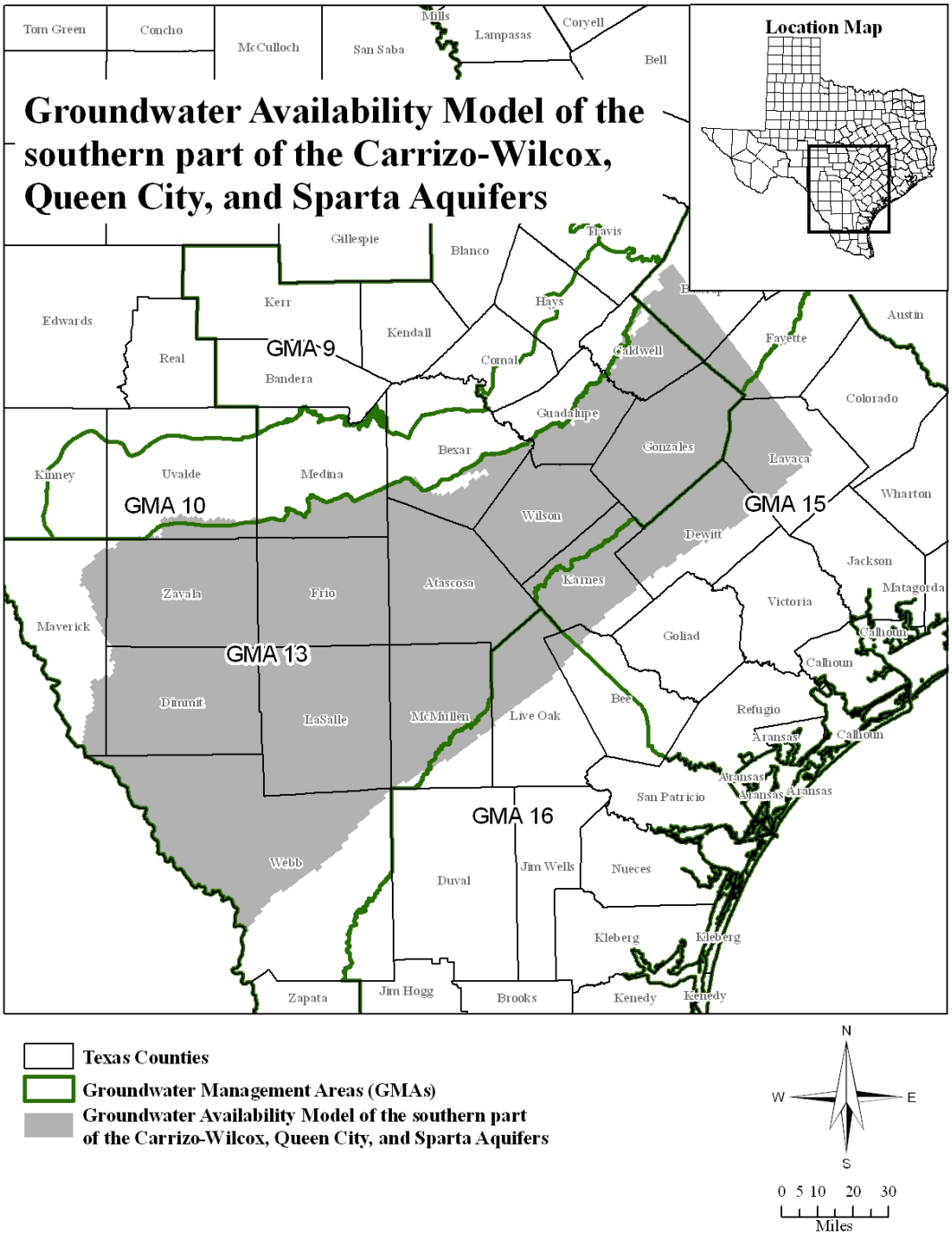


FIGURE 1.MAP SHOWING THE AREAS COVERED BY THE GROUNDWATER AVAILABILITY MODEL FOR THE SOUTHERN PART OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS.

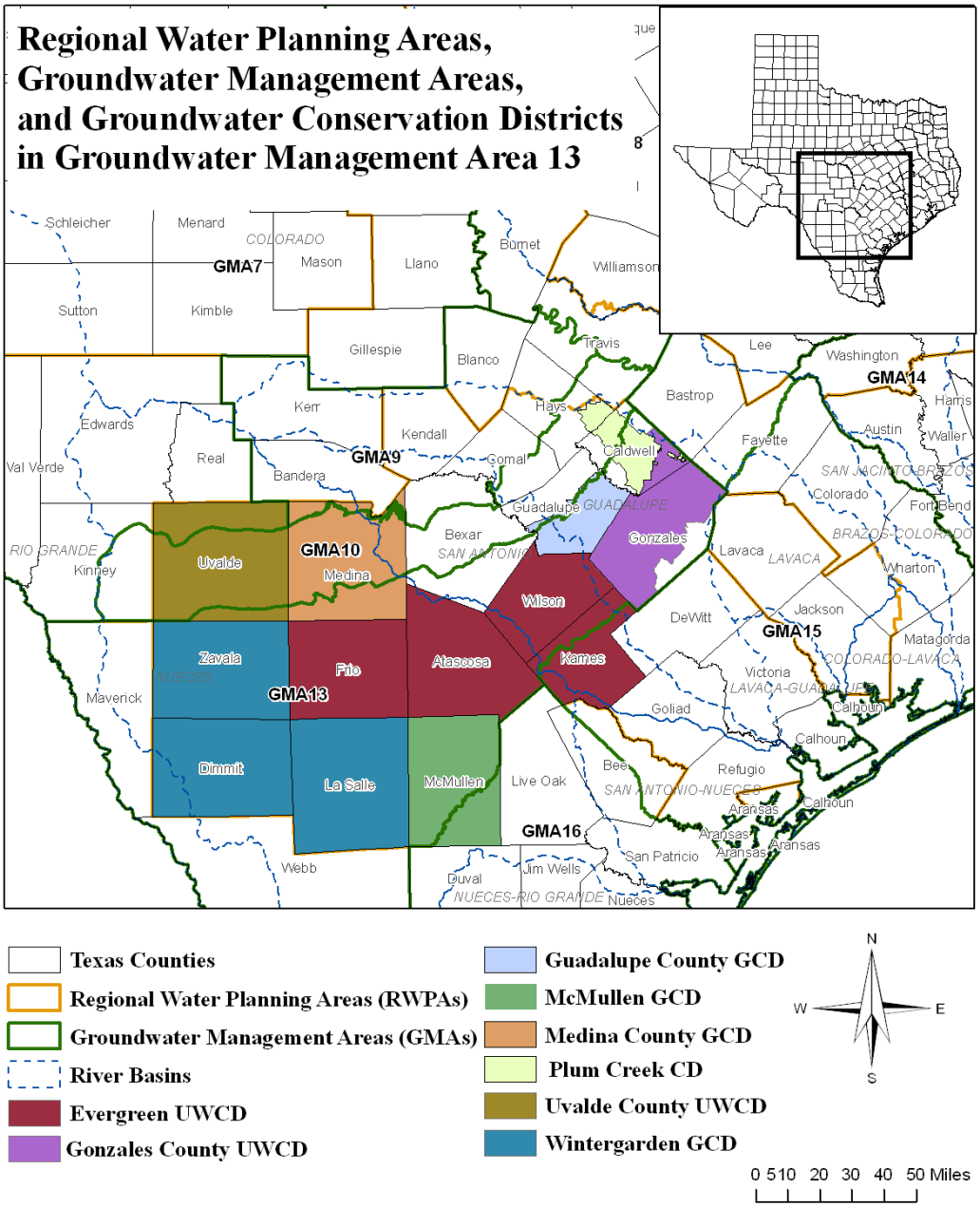


FIGURE 2.MAP SHOWING REGIONAL WATER PLANNING AREAS, GROUNDWATER MANAGEMENT AREAS, GROUNDWATER CONSERVATION DISTRICTS (GCDS), COUNTIES, AND RIVER BASINS IN AND NEIGHBORING GROUNDWATER MANAGEMENT AREA 13. UWCD REFERS TO UNDERGROUND WATER CONSERVATION DISTRICT.

TABLE 1. MODELED AVAILABLE GROUNDWATER BY DECADE FOR THE CARRIZO-WILCOX AQUIFER IN GROUNDWATER MANAGEMENT AREA 13. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE DIVIDED BY COUNTY, RIVER BASIN, AND REGIONAL WATER PLANNING AREA.

County	Regional Water Planning Area	Basin	Year					
			2010	2020	2030	2040	2050	2060
Atascosa	L	Nueces	67,829	68,656	70,249	71,827	73,666	75,688
		San Antonio	120	120	120	120	120	120
Bexar	L	Nueces	14,198	14,198	14,198	14,198	14,198	14,198
		San Antonio	12,080	12,080	12,080	12,080	12,080	11,909
Caldwell	L	Colorado	593	593	593	593	593	593
		Guadalupe	43,951	43,951	43,543	43,543	42,967	42,967
Dimmit	L	Nueces	3,253	3,253	3,253	3,253	3,253	3,253
		Rio Grande	106	106	106	106	106	106
Frio	L	Nueces	81,551	79,089	76,734	74,439	72,222	70,030
Gonzales	L	Guadalupe	52,268	62,101	70,102	75,576	75,755	75,755
		Lavaca	215	215	215	215	215	215
Guadalupe	L	Guadalupe	8,868	9,460	9,910	11,648	12,168	12,668
		San Antonio	1,373	1,373	1,373	1,373	1,373	1,373
Karnes	L	Guadalupe	185	195	207	215	220	224
		Nueces	87	92	97	101	103	105
		San Antonio	787	830	878	915	936	951
La Salle	L	Nueces	6,454	6,454	6,454	6,454	6,454	6,454
Maverick	M	Nueces	777	777	777	472	472	472
		Rio Grande	1,266	1,266	1,247	1,205	1,098	1,060
McMullen	N	Nueces	1,819	1,819	1,819	1,819	1,819	1,819
Medina	L	Nueces	2,542	2,519	2,507	2,507	2,507	2,507
		San Antonio	26	26	26	26	26	26
Uvalde	L	Nueces	2,971	1,230	828	828	828	828
Webb	M	Nueces	92	92	92	92	92	92
		Rio Grande	824	824	824	824	824	824
Wilson	L	Guadalupe	624	672	731	791	861	938
		Nueces	7,151	7,311	7,505	7,703	7,932	8,185
		San Antonio	27,785	29,003	30,481	31,992	33,738	35,671
Zavala	L	Nueces	35,859	35,859	35,521	35,388	35,288	34,969
Total			**375,654**	**384,164**	**392,470**	**400,303**	**401,914**	**404,000**

TABLE 2. MODELED AVAILABLE GROUNDWATER BY DECADE FOR THE QUEEN CITY AQUIFER IN GROUNDWATER MANAGEMENT AREA 13. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE DIVIDED BY COUNTY, RIVER BASIN, AND REGIONAL WATER PLANNING AREA.

County	Regional Water Planning Area	Basin	Year					
			2010	2020	2030	2040	2050	2060
Atascosa	L	Nueces	4,546	4,546	4,513	4,405	4,300	4,202
Caldwell	L	Guadalupe	306	306	306	306	306	306
Dimmit	L	Nueces	0	0	0	0	0	0
		Rio Grande	0	0	0	0	0	0
Frio	L	Nueces	4,748	4,582	4,422	4,270	4,124	3,983
Gonzales	L	Guadalupe	5,030	5,030	5,030	5,030	5,030	5,030
		Lavaca	35	35	35	35	35	35
Guadalupe	L	Guadalupe	0	0	0	0	0	0
Karnes	L	Guadalupe	0	0	0	0	0	0
		Nueces	0	0	0	0	0	0
		San Antonio	0	0	0	0	0	0
La Salle	L	Nueces	1	1	1	1	1	1
McMullen	N	Nueces	136	136	136	136	136	136
Webb	M	Nueces	0	0	0	0	0	0
		Rio Grande	0	0	0	0	0	0
Wilson	L	Guadalupe	128	114	101	90	80	72
		Nueces	148	132	117	104	93	83
		San Antonio	1,233	1,094	973	866	772	690
Zavala	L	Nueces	0	0	0	0	0	0
Total			**16,311**	**15,976**	**15,634**	**15,243**	**14,877**	**14,538**

TABLE 3. MODELED AVAILABLE GROUNDWATER BY DECADE FOR THE SPARTA AQUIFER IN GROUNDWATER MANAGEMENT AREA 13. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE DIVIDED BY COUNTY, RIVER BASIN, AND REGIONAL WATER PLANNING AREA.

County	Regional Water Planning Area	Basin	Year					
			2010	2020	2030	2040	2050	2060
Atascosa	L	Nueces	1,191	1,130	1,082	1,042	1,013	994
Dimmit	L	Nueces	0	0	0	0	0	0
Frio	L	Nueces	729	698	674	650	624	601
Gonzales	L	Guadalupe	3,529	3,529	3,529	3,529	3,529	3,529
		Lavaca	23	23	23	23	23	23
Karnes	L	Guadalupe	0	0	0	0	0	0
		Nueces	0	0	0	0	0	0
		San Antonio	0	0	0	0	0	0
La Salle	L	Nueces	987	987	987	987	987	987
McMullen	N	Nueces	90	90	90	90	90	90
Webb	M	Nueces	0	0	0	0	0	0
		Rio Grande	0	0	0	0	0	0
Wilson	L	Guadalupe	23	20	18	16	14	13
		Nueces	55	49	44	39	34	31
		San Antonio	173	154	137	121	108	97
Zavala	L	Nueces	0	0	0	0	0	0
Total			**6,800**	**6,680**	**6,584**	**6,497**	**6,422**	**6,365**

TABLE 4. MODELED AVAILABLE GROUNDWATER FOR THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS SUMMARIZED BY COUNTY IN GROUNDWATER MANAGEMENT AREA 13 FOR EACH DECADE BETWEEN 2010 AND 2060. RESULTS ARE IN ACRE-FEET PER YEAR.

County	Year					
	2010	2020	2030	2040	2050	2060
Atascosa	73,686	74,452	75,964	77,394	79,099	81,004
Bexar	26,278	26,278	26,278	26,278	26,278	26,107
Caldwell	44,850	44,850	44,442	44,442	43,866	43,866
Dimmit	3,359	3,359	3,359	3,359	3,359	3,359
Frio	87,028	84,369	81,830	79,359	76,970	74,614
Gonzales	61,100	70,933	78,934	84,408	84,587	84,587
Guadalup	10,241	10,833	11,283	13,021	13,541	14,041
Karnes	1,059	1,117	1,182	1,231	1,259	1,280
La Salle	7,442	7,442	7,442	7,442	7,442	7,442
Maverick	2,043	2,043	2,024	1,677	1,570	1,532
McMullen	2,045	2,045	2,045	2,045	2,045	2,045
Medina	2,568	2,545	2,533	2,533	2,533	2,533
Uvalde	2,971	1,230	828	828	828	828
Webb	916	916	916	916	916	916
Wilson	37,320	38,549	40,107	41,722	43,632	45,780
Zavala	35,859	35,859	35,521	35,388	35,288	34,969
Total	**398,765**	**406,820**	**414,688**	**422,043**	**423,213**	**424,903**

TABLE 5. MODELED AVAILABLE GROUNDWATER FOR THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS SUMMARIZED BY RIVER BASIN IN GROUNDWATER MANAGEMENT AREA 13 FOR EACH DECADE BETWEEN 2010 AND 2060. RESULTS ARE IN ACRE-FEET PER YEAR.

Basin	Year					
	2010	2020	2030	2040	2050	2060
Colorado	593	593	593	593	593	593
Guadalupe	114,912	125,378	133,477	140,744	140,930	141,502
Lavaca	273	273	273	273	273	273
Nueces	237,214	233,700	232,100	230,805	230,236	229,708
Rio Grande	2,196	2,196	2,177	2,135	2,028	1,990
San Antonio	43,577	44,680	46,068	47,493	49,153	50,837
Total	**398,765**	**406,820**	**414,688**	**422,043**	**423,213**	**424,903**

TABLE 6. MODELED AVAILABLE GROUNDWATER FOR THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS SUMMARIZED BY REGIONAL WATER PLANNING AREA IN GROUNDWATER MANAGEMENT AREA 13 FOR EACH DECADE BETWEEN 2010 AND 2060. RESULTS ARE IN ACRE-FEET PER YEAR.

Regional Water	Year					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
L	393,761	401,816	409,703	417,405	418,682	420,410
M	2,959	2,959	2,940	2,593	2,486	2,448
N	2,045	2,045	2,045	2,045	2,045	2,045
Total	**398,765**	**406,820**	**414,688**	**422,043**	**423,213**	**424,903**

TABLE 7. MODELED AVAILABLE GROUNDWATER FOR THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) IN GROUNDWATER MANAGEMENT AREA 13 FOR EACH DECADE BETWEEN 2010 AND 2060. RESULTS ARE IN ACRE-FEET PER YEAR. UWCD REFERS TO UNDERGROUND WATER CONSERVATION DISTRICT.

Groundwater Conservation District	Year					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Evergreen UWCD	199,093	198,487	199,083	199,706	200,960	202,678
Gonzales County UWCD*	86,846	96,679	104,680	110,154	110,333	110,333
Guadalupe County	10,241	10,833	11,283	13,021	13,541	14,041
McMullen	2,045	2,045	2,045	2,045	2,045	2,045
Medina County	2,568	2,545	2,533	2,533	2,533	2,533
Plum Creek	18,122	18,122	17,714	17,714	17,138	17,138
Uvalde County UWCD	2,971	1,230	828	828	828	828
Wintergarden	46,660	46,660	46,322	46,189	46,089	45,770
Total (excluding non-district areas)	**368,546**	**376,601**	**384,488**	**392,190**	**393,467**	**395,366**
No District	30,219	30,219	30,200	29,853	29,746	29,537
Total (including non-district areas)	**398,765**	**406,820**	**414,688**	**422,043**	**423,213**	**424,903**

*Note: Gonzales County UWCD includes area in Caldwell County

Appendix A

Estimates of total pumping split by aquifer layers for Groundwater Conservation Districts

Evergreen Underground Water Conservation District		Year					
	Unit or Layer	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Pumping	Sparta	2,171	2,051	1,955	1,868	1,793	1,736
	Queen City	10,803	10,468	10,126	9,735	9,369	9,030
	Carrizo	151,373	151,222	152,256	153,357	155,052	157,166
	Wilcox (Layer 6)	375	375	375	375	375	375
	Wilcox (Layer 7)	371	371	371	371	371	371
	Wilcox (Layer 8)	34,000	34,000	34,000	34,000	34,000	34,000
	Total	**199,093**	**198,487**	**199,083**	**199,706**	**200,960**	**202,678**

Gonzales County Underground Water Conservation District		Year					
	Unit or Layer	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Pumping	Sparta	3,552	3,552	3,552	3,552	3,552	3,552
	Queen City	5,349	5,349	5,349	5,349	5,349	5,349
	Carrizo	45,884	55,717	63,718	69,192	69,371	69,371
	Wilcox (Layer 6)	0	0	0	0	0	0
	Wilcox (Layer 7)	12,159	12,159	12,159	12,159	12,159	12,159
	Wilcox (Layer 8)	19,902	19,902	19,902	19,902	19,902	19,902
	Total	**86,846**	**96,679**	**104,680**	**110,154**	**110,333**	**110,333**

Guadalupe County Groundwater Conservation District		Year					
	Unit or Layer	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Pumping	Carrizo	5,500	6,239	6,689	8,427	9,000	9,500
	Wilcox (Layer 6)	0	0	0	0	0	0
	Wilcox (Layer 7)	3,194	3,047	3,047	3,047	2,994	2,994
	Wilcox (Layer 8)	1,547	1,547	1,547	1,547	1,547	1,547
	Total	**10,241**	**10,833**	**11,283**	**13,021**	**13,541**	**14,041**

McMullen Groundwater Conservation District		Year					
	Unit or Layer	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Pumping	Sparta	90	90	90	90	90	90
	Queen City	136	136	136	136	136	136
	Carrizo	1,819	1,819	1,819	1,819	1,819	1,819
	Total	**2,045**	**2,045**	**2,045**	**2,045**	**2,045**	**2,045**

Medina County Groundwater Conservation District		Year					
	Unit or Layer	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Pumping	Carrizo	400	400	400	400	400	400
	Wilcox (Layer 6)	0	0	0	0	0	0
	Wilcox (Layer 7)	1,248	1,248	1,248	1,248	1,248	1,248
	Wilcox (Layer 8)	920	897	885	885	885	885
	Total	**2,568**	**2,545**	**2,533**	**2,533**	**2,533**	**2,533**

Plum Creek Conservation District		Year					
	Unit or Layer	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Pumping	Queen City	22	22	22	22	22	22
	Carrizo	3,498	3,498	3,498	3,498	3,498	3,498
	Wilcox (Layer 6)	0	0	0	0	0	0
	Wilcox (Layer 7)	4,869	4,869	4,869	4,869	4,293	4,293
	Wilcox (Layer 8)	9,733	9,733	9,325	9,325	9,325	9,325
	Total	**18,122**	**18,122**	**17,714**	**17,714**	**17,138**	**17,138**

Uvalde County Underground Water Conservation District		Year					
	Unit or Layer	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Pumping	Carrizo	828	828	828	828	828	828
	Wilcox (Layer 6)	2,143	402	0	0	0	0
	Total	**2,971**	**1,230**	**828**	**828**	**828**	**828**

Wintergarden Groundwater Conservation District		Year					
	Unit or Layer	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Pumping	Sparta	987	987	987	987	987	987
	Queen City	1	1	1	1	1	1
	Carrizo	31,990	31,990	31,652	31,519	31,419	31,100
	Wilcox (Layer 6)	9,259	9,259	9,259	9,259	9,259	9,259
	Wilcox (Layer 7)	4,007	4,007	4,007	4,007	4,007	4,007
	Wilcox (Layer 8)	416	416	416	416	416	416
	Total	**46,660**	**46,660**	**46,322**	**46,189**	**46,089**	**45,770**

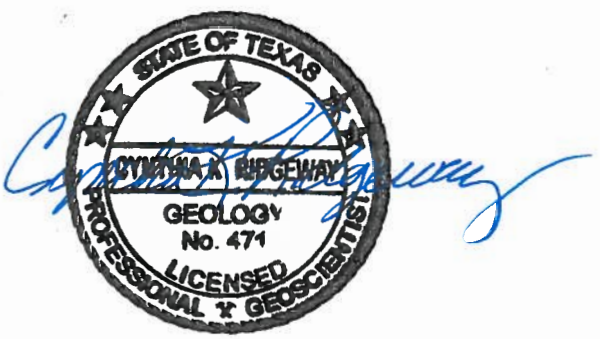
Appendix K - GAM Run 10-041 MAG

GAM Run 10-041 MAG

By Mohammad Masud Hassan, P.E.

Edited and finalized by Marius Jigmond to reflect statutory changes effective September 1, 2011

Texas Water Development Board
Groundwater Availability Modeling Section
(512) 463-8499
December 8, 2011



Cynthia K. Ridgeway, the Manager of the Groundwater Availability Modeling Section and Interim Director of the Groundwater Resources Division, is responsible for oversight of work performed by employees under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G. 471 on December 8, 2011.

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EXECUTIVE SUMMARY:

The modeled available groundwater for the Yegua-Jackson Aquifer as a result of the desired future condition adopted by the members of Groundwater Management Area 13 is approximately 31,700 acre-feet per year. This is shown divided by county, regional water planning area, and river basin in Table 1 for use in the regional water planning process. Modeled available groundwater is summarized by county, regional water planning area, river basin, and groundwater conservation district in tables 2 through 5. The estimates were extracted from Groundwater Availability Modeling Task 10-012, Scenario 4, which Groundwater Management Area 13 used as the basis for developing their desired future condition for the Yegua-Jackson Aquifer.

REQUESTOR:

Mr. Mike Mahoney of Evergreen Underground Water Conservation District on behalf of Groundwater Management Area 13

DESCRIPTION OF REQUEST:

In a letter dated August 31, 2010 and received September 2, 2010, Mr. Mike Mahoney provided the Texas Water Development Board (TWDB) with the desired future condition of the Yegua-Jackson Aquifer adopted by the members of Groundwater Management Area 13. The desired future condition for the Yegua-Jackson Aquifer in Groundwater Management Area 13, as shown in Resolution No. R 2010-02, is as follows:

> *"In reference to* [Groundwater Availability Model] *Run T10-012, Table C-1, the committee has considered, the base scenario of an average drawdown of 0.0 feet, Scenario 2.5 an average drawdown of 1 foot, Scenario 3.0 an average drawdown of 1 foot, and Scenario 4.0 an average drawdown of 2 feet for the Yegua-Jackson Aquifer; and*
>
> [...] *the district members of the Groundwater Management Area 13, adopt Scenario 4.0, and an average drawdown of 2 feet for the Yegua-Jackson Aquifer."*

In response to receiving the adopted desired future condition, the Texas Water Development Board has estimated the modeled available groundwater for the Yegua-Jackson Aquifer in Groundwater Management Area 13.

METHODS:

The Texas Water Development Board previously completed several predictive groundwater availability model simulations of the Yegua-Jackson Aquifer to assist the members of Groundwater Management Area 13 in developing a desired future condition for this aquifer. The location of Groundwater Management Area 13, the Yegua-Jackson Aquifer, and the groundwater availability model cells that represent the aquifer are shown in Figure 1. As described in Resolution No. R 2010-02, the management area considered Scenario 4 of Groundwater Availability Modeling (GAM) Task 10-012 when developing a desired future condition for the

Yegua-Jackson Aquifer (Oliver, 2010). Since the above desired future condition is met in Scenario 4 of GAM Task 10-012, the estimated pumping for Groundwater Management Area 13 presented here was taken directly from this simulation. The pumping was then divided by county, regional water planning area, river basin, and groundwater conservation district (Figure 2).

PARAMETERS AND ASSUMPTIONS:

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

- The results presented in this report are taken from Scenario 4 in GAM Task 10-012 (Oliver, 2010). See GAM Task 10-012 for a full description of the methods, assumptions, and results for the groundwater availability model run.

- Version 1.01 of the groundwater availability model for the Yegua-Jackson Aquifer was used for this analysis. See Deeds and others (2010) for assumptions and limitations of the groundwater availability model.

- Cells were assigned to individual counties, river basins, regional water planning areas, and groundwater conservation districts as shown in the March 23, 2010 version of the file that associates the model grid to political and natural boundaries for the Yegua-Jackson Aquifer.

- The model results presented in this report were extracted from all areas of the model representing the units comprising the Yegua-Jackson Aquifer. This includes some areas outside the "official" boundary of the aquifer shown in the 2007 State Water Plan (TWDB, 2007).

Modeled Available Groundwater and Permitting

As defined in Chapter 36 of the Texas Water Code, "modeled available groundwater" is the estimated average amount of water that may be produced annually to achieve a desired future condition. This is distinct from "managed available groundwater," shown in the draft version of this report dated December 15, 2010, which was a permitting value and accounted for the estimated use of the aquifer exempt from permitting. This change was made to reflect changes in statute by the 82nd Texas Legislature, effective September 1, 2011.

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

RESULTS:

The modeled available groundwater for the Yegua-Jackson Aquifer in Groundwater Management Area 13 consistent with the desired future condition is approximately 31,700 acre-feet per year. This has been divided by county, regional water planning area, and river basin for each decade between 2010 and 2060 for use in the regional water planning process (Table 1).

The modeled available groundwater is also summarized by county, regional water planning area, river basin, and groundwater conservation district as shown in tables 2 through 5. In Table 5, the modeled available groundwater both excluding and including areas outside of a groundwater conservation district is shown.

LIMITATIONS:

The groundwater model used in developing estimates of modeled available groundwater is the best available scientific tool that can be used to estimate the pumping that will achieve the desired future conditions. Although the groundwater model used in this analysis is the best available scientific tool for this purpose, it, like all models, has limitations. In reviewing the use of models in environmental regulatory decision-making, the National Research Council (2007) noted:

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

A key aspect of using the groundwater model to develop estimates of modeled available groundwater is the need to make assumptions about the location in the aquifer where future pumping will occur. As actual pumping changes in the future, it will be necessary to evaluate the amount of that pumping as well as its location in the context of the assumptions associated with this analysis. Evaluating the amount and location of future pumping is as important as evaluating the changes in groundwater levels, spring flows, and other metrics that describe the condition of the groundwater resources in the area that relate to the adopted desired future condition(s).

Given these limitations, users of this information are cautioned that the modeled available groundwater numbers should not be considered a definitive, permanent description of the amount of groundwater that can be pumped to meet the adopted desired future condition. Because the application of the groundwater model was designed to address regional scale questions, the results are most effective on a regional scale. The TWDB makes no warranties or representations relating to the actual conditions of any aquifer at a particular location or at a particular time.

It is important for groundwater conservation districts to monitor future groundwater pumping as well as whether or not they are achieving their desired future conditions. Because of the limitations of the model and the assumptions in this analysis, it is important that the groundwater

conservation districts work with the TWDB to refine the modeled available groundwater numbers given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future.

REFERENCES:

Oliver, W., 2010, GAM Task 10-012 Model Run Report: Texas Water Development Board, GAM Task 10-012 Report, 48 p.

Deeds, N.E., Yan, T., Singh, A., Jones, T.L., Kelley, V.A., Knox, P.R., Young, S.C., 2010, Groundwater availability model for the Yegua-Jackson Aquifer: Final report prepared for the Texas Water Development Board by INTERA, Inc., 582 p.

National Research Council, 2007, Models in Environmental Regulatory Decision Making. Committee on Models in the Regulatory Decision Process, National Academies Press, Washington D.C., 287 p.

Texas Water Development Board, 2007, Water for Texas – 2007—Volumes I-III; Texas Water Development Board Document No. GP-8-1, 392 p.

Table 1: Modeled available groundwater for the Yegua-Jackson Aquifer in Groundwater Management Area 13. Results are in acre-feet per year and are divided by county, regional water planning area, and river basin.

County	Regional Water Planning Area	River Basin	Year					
			2010	2020	2030	2040	2050	2060
Atascosa	L	Nueces	855	855	855	855	855	855
Frio	L	Nueces	0	0	0	0	0	0
Gonzales	L	Guadalupe	980	980	980	980	980	980
		Lavaca	3	3	3	3	3	3
Karnes	L	Guadalupe	112	112	112	112	112	112
		Nueces	34	34	34	34	34	34
		San Antonio	628	628	628	628	628	628
La Salle	L	Nueces	91	91	91	91	91	91
McMullen	N	Nueces	179	179	179	179	179	179
Webb	M	Nueces	11,969	11,969	11,969	11,969	11,969	11,969
		Rio Grande	8,030	8,030	8,030	8,030	8,030	8,030
Wilson	L	Guadalupe	48	48	48	48	48	48
		Nueces	184	184	184	184	184	184
		San Antonio	606	606	606	606	606	606
Zapata	M	Rio Grande	7,999	7,999	7,999	7,999	7,999	7,999
Total			**31,718**	**31,718**	**31,718**	**31,718**	**31,718**	**31,718**

Table 2: Modeled available groundwater for the Yegua-Jackson Aquifer summarized by county in Groundwater Management Area 13 for each decade between 2010 and 2060. Results are in acre-feet per year.

County	Year					
	2010	2020	2030	2040	2050	2060
Atascosa	855	855	855	855	855	855
Frio	0	0	0	0	0	0
Gonzales	983	983	983	983	983	983
Karnes	774	774	774	774	774	774
La Salle	91	91	91	91	91	91
McMullen	179	179	179	179	179	179
Webb	19,999	19,999	19,999	19,999	19,999	19,999
Wilson	838	838	838	838	838	838
Zapata	7,999	7,999	7,999	7,999	7,999	7,999
Total	**31,718**	**31,718**	**31,718**	**31,718**	**31,718**	**31,718**

Table 3: Modeled available groundwater for the Yegua-Jackson Aquifer summarized by regional water planning area in Groundwater Management Area 13 for each decade between 2010 and 2060. Results are in acre-feet per year.

Regional Water Planning Area	Year					
	2010	2020	2030	2040	2050	2060
L	3,541	3,541	3,541	3,541	3,541	3,541
M	27,998	27,998	27,998	27,998	27,998	27,998
N	179	179	179	179	179	179
Total	**31,718**	**31,718**	**31,718**	**31,718**	**31,718**	**31,718**

Table 4: Modeled available groundwater for the Yegua-Jackson Aquifer summarized by river basin in Groundwater Management Area 13 for each decade between 2010 and 2060. Results are in acre-feet per year.

River Basin	Year					
	2010	2020	2030	2040	2050	2060
Guadalupe	1,140	1,140	1,140	1,140	1,140	1,140
Lavaca	3	3	3	3	3	3
Nueces	13,312	13,312	13,312	13,312	13,312	13,312
Rio Grande	16,029	16,029	16,029	16,029	16,029	16,029
San Antonio	1,234	1,234	1,234	1,234	1,234	1,234
Total	**31,718**	**31,718**	**31,718**	**31,718**	**31,718**	**31,718**

Table 5: Modeled available groundwater for the Yegua-Jackson Aquifer summarized by groundwater conservation district (GCD) in Groundwater Management Area 13 for each decade between 2010 and 2060. Results are in acre-feet per year. UWCD refers to Underground Water Conservation District.

Groundwater Conservation District	Year					
	2010	2020	2030	2040	2050	2060
Evergreen UWCD	2,467	2,467	2,467	2,467	2,467	2,467
Gonzales County UWCD	865	865	865	865	865	865
McMullen GCD	179	179	179	179	179	179
Wintergarden GCD	91	91	91	91	91	91
Total (excluding non-district areas)	**3,602**	**3,602**	**3,602**	**3,602**	**3,602**	**3,602**
No District	28,116	28,116	28,116	28,116	28,116	28,116
Total (including non-district areas)	**31,718**	**31,718**	**31,718**	**31,718**	**31,718**	**31,718**

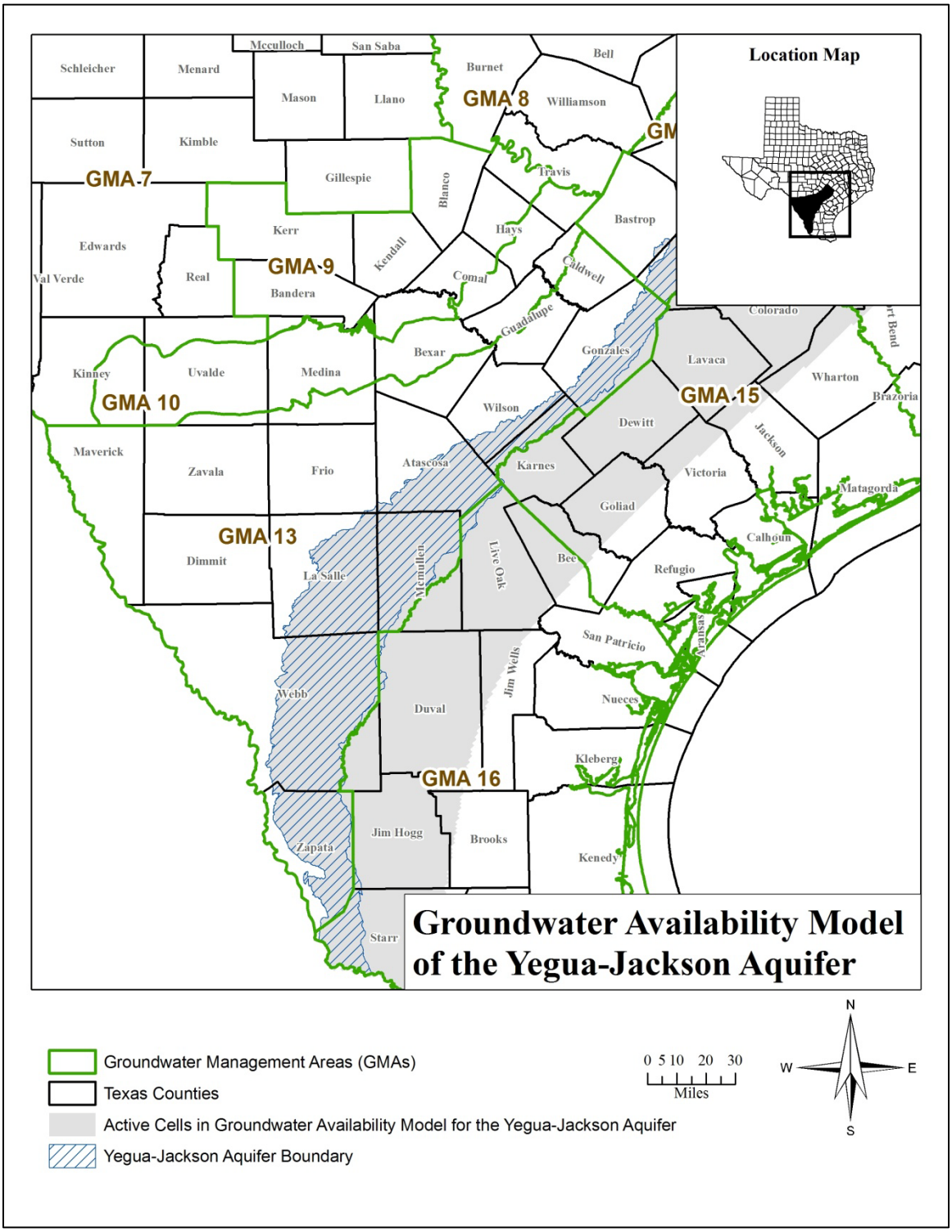


Figure 1: Map showing the areas covered by the groundwater availability model for the Yegua-Jackson Aquifer.

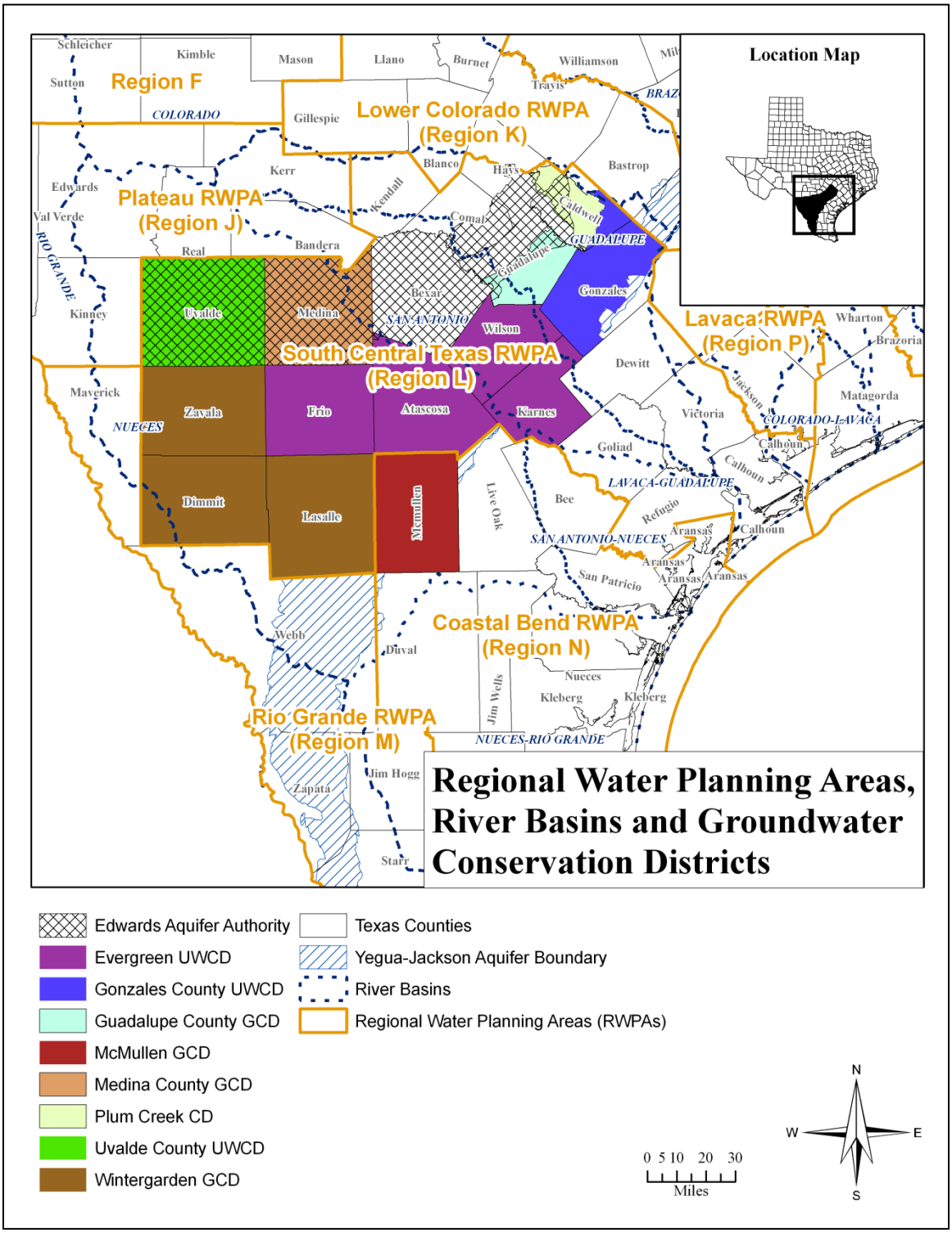


Figure 2: Map showing regional water planning areas (RWPAs), groundwater conservation districts (GCDs), counties, and river basins in Groundwater Management Area 13.

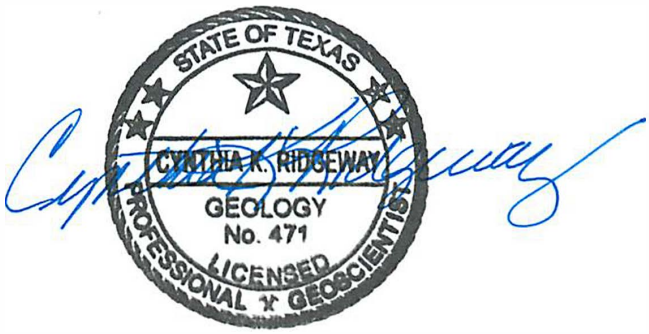
Appendix L - GAM Run 10-028 MAG

GAM Run 10-028 MAG

by Melissa E. Hill, Ph.D., P.G. and Wade Oliver

Edited and finalized by Shirley Wade to reflect statutory changes effective September 1, 2011

Texas Water Development Board
Groundwater Availability Modeling Section
(512) 936-0883
November 18, 2011



Cynthia K. Ridgeway, the Manager of the Groundwater Availability Modeling Section and Interim Director of the Groundwater Resources Division, is responsible for oversight of work performed by employees under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G. 471 on November 18, 2011.

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EXECUTIVE SUMMARY:

The modeled available groundwater for the Gulf Coast Aquifer as a result of the desired future conditions adopted by the members of Groundwater Management Area 15 is approximately 488,000 acre-feet per year. This is shown divided by county, regional water planning area, and river basin in Table 1 for use in the regional water planning process. Modeled available groundwater is summarized by county, regional water planning area, river basin, and groundwater conservation district in tables 2 through 5. The estimates were extracted from the simulation documented in Table 7 of Groundwater Availability Model Run 10-008 Addendum, which meets the desired future conditions adopted by Groundwater Management Area 15.

REQUESTOR:

Mr. Neil Hudgins of the Coastal Bend Groundwater Conservation District on behalf of Groundwater Management Area 15

DESCRIPTION OF REQUEST:

In a letter dated July 15th, 2010 and received July 30th, 2010, Mr. Neil Hudgins provided the Texas Water Development Board (TWDB) with the desired future condition (DFC) of the Gulf Coast Aquifer for Groundwater Management Area 15. The desired future condition for the Gulf Coast Aquifer, as described in Resolution 2010-01 and adopted July 14, 2010 by the groundwater conservation districts (GCDs) within Groundwater Management Area 15, are described below:

> *An average drawdown of the Gulf Coast Aquifer within the* [Groundwater Management Area] *15 boundary of 12 feet relative to year 1999 starting conditions in accordance with Table 7* of [Groundwater Availability Model] *Run 10-008 Addendum.*

In response to receiving the adopted future condition, the Texas Water Development Board estimated the modeled available groundwater for each groundwater conservation district within Groundwater Management Area 15.

METHODS:

Groundwater Management Area 15 lies within the domain of the groundwater availability model for the central portion of the Gulf Coast Aquifer in Texas. The location of Groundwater Management Area 15, the Gulf Coast Aquifer, and the groundwater availability model cells that represent the aquifer are shown in Figure 1. The Gulf Coast Aquifer System is comprised of the Chicot, Evangeline, and Jasper aquifers. The Burkeville Confining Unit lies between the Evangeline and Jasper aquifers (Waterstone Engineering Inc. and others, 2003).
The previously completed Groundwater Availability Model (GAM) Run 10-008 (Hutchison, 2010), its addendum GAM Run 10-008 Addendum (Wade, 2010), GAM Run 09-010 (Anaya, 2010), GAM Run 08-56 (Anaya, 2009), GAM Run 07-43 (Donnelly, 2008b), and GAM Run 07-42 (Donnelly, 2008a) document the model results reviewed by members of Groundwater Management Area 15 when developing the desired future condition. The results presented in this

report are based on the model simulation shown as the "12 foot scenario" shown in Table 7 of GAM Run 10-008 Addendum (Wade, 2010).

PARAMETERS AND ASSUMPTIONS:

The parameters and assumptions for the model run using the groundwater availability model for the central portion of the Gulf Coast Aquifer are described below:

- Version 1.01 of the groundwater availability model for the central portion of the Gulf Coast Aquifer was used for this analysis. See Chowdhury and others (2004) and Waterstone Engineering Inc. and others (2003) for assumptions and limitations of the groundwater availability model.
- The model includes four layers representing: the Chicot Aquifer and shallow surface alluvial deposits (layer 1), the Evangeline Aquifer (layer 2), the Burkeville Confining Unit (layer 3), and the Jasper Aquifer including portions of the Catahoula Formation (layer 4) as described in Waterstone Engineering Inc. and others (2003).
- The mean absolute error (a measure of the difference between simulated and measured water levels during model calibration) in the entire model for 1999 is 26 feet, which is 4.8 percent of the hydraulic head drop across the model area (Chowdhury and others, 2004).
- The recharge, evapotranspiration, and streamflows for the model run represent average conditions between 1981 and 1999 in the historical-calibration period of the model (Chowdhury and others, 2004).
- See Wade (2010) for a full description of the methods, assumptions, and results of the groundwater availability model run.

Modeled Available Groundwater and Permitting

As defined in Chapter 36 of the Texas Water Code, "modeled available groundwater" is the estimated average amount of water that may be produced annually to achieve a desired future condition. This is distinct from "managed available groundwater," shown in the draft version of this report dated November 10, 2010, which was a permitting value and accounted for the estimated use of the aquifer exempt from permitting. This change was made to reflect changes in statute by the 82nd Texas Legislature, effective September 1, 2011.

Groundwater conservation districts are required to consider modeled available groundwater, along with several other factors, when issuing permits in order to manage groundwater production to achieve the desired future condition(s). The other factors districts must consider include annual precipitation and production patterns, the estimated amount of pumping exempt from permitting, existing permits, and a reasonable estimate of actual groundwater production under existing permits. The estimated amount of pumping exempt from permitting, which the

Texas Water Development Board is now required to develop after soliciting input from applicable groundwater conservation districts, will be provided in a separate report

RESULTS:

The modeled available groundwater for the Gulf Coast Aquifer in Groundwater Management Area 15 consistent with the desired future conditions is approximately 488,000 acre-feet per year. This has been divided by county, regional water planning area, and river basin for each decade between 2010 and 2060 for use in the regional water planning process (Table 1).

The modeled available groundwater is also summarized by county (Table 2), regional water planning area (Table 3), river basin (Table 4), and groundwater conservation district (Table 5). Note that some small differences exist between the results shown in Table 2 of this report and Table 7 of Wade (2010) due to a re-assignment of grid cells to be more consistent with previous and known interpretations of political boundaries. The most significant of these adjustments is in Fayette County, where 339 acre-feet per year of pumping from the Gulf Coast Aquifer was previously reported as existing in Groundwater Management Area 12 (Wade, 2010). Since the groundwater management area boundary was originally delineated along the Gulf Coast Aquifer boundary in this area, this pumping is now associated with Groundwater Management Area 15.

In Table 5, the modeled available groundwater among all districts has been calculated both excluding and including areas outside the jurisdiction of a groundwater conservation district. Though a small portion of Corpus Christi Aquifer Storage and Recovery Conservation District falls within Groundwater Management Area 15, results are not shown for this area below because no model cells representing the Gulf Coast Aquifer fall within the district.

LIMITATIONS:

The groundwater model used in developing estimates of modeled available groundwater is the best available scientific tool that can be used to estimate the pumping that will achieve the desired future conditions. Although the groundwater model used in this analysis is the best available scientific tool for this purpose, it, like all models, has limitations. In reviewing the use of models in environmental regulatory decision-making, the National Research Council (2007) noted:

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

A key aspect of using the groundwater model to develop estimates of modeled available groundwater is the need to make assumptions about the location in the aquifer where future pumping will occur. As actual pumping changes in the future, it will be necessary to evaluate the amount of that pumping as well as its location in the context of the assumptions associated with

this analysis. Evaluating the amount and location of future pumping is as important as evaluating the changes in groundwater levels, spring flows, and other metrics that describe the condition of the groundwater resources in the area that relate to the adopted desired future condition(s).

Given these limitations, users of this information are cautioned that the modeled available groundwater numbers should not be considered a definitive, permanent description of the amount of groundwater that can be pumped to meet the adopted desired future condition. Because the application of the groundwater model was designed to address regional scale questions, the results are most effective on a regional scale. The TWDB makes no warranties or representations relating to the actual conditions of any aquifer at a particular location or at a particular time.

It is important for groundwater conservation districts to monitor future groundwater pumping as well as whether or not they are achieving their desired future conditions. Because of the limitations of the model and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine the modeled available groundwater numbers given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future.

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Table 1. Modeled available groundwater for the Gulf Coast Aquifer in Groundwater Management Area 15. Results are in acre-feet per year and are summarized by county, regional water planning area, and river basin.

County	Regional Water Planning Area	Basin	Year					
			2010	2020	2030	2040	2050	2060
Aransas	N	San Antonio-Nueces	1,862	1,862	1,862	1,862	1,862	1,862
Bee	N	Nueces	30	30	30	30	30	30
		San Antonio-Nueces	9,484	9,484	9,460	9,460	9,408	9,408
Calhoun	L	Colorado-Lavaca	361	361	361	361	361	361
		Guadalupe	17	17	17	17	17	17
		Lavaca	2	2	2	2	2	2
		Lavaca-Guadalupe	2,574	2,574	2,574	2,574	2,574	2,574
		San Antonio-Nueces	41	41	41	41	41	41
Colorado	K	Brazos-Colorado	10,464	10,464	10,464	10,464	10,464	10,464
		Colorado	16,058	16,058	16,058	16,058	16,058	16,058
		Lavaca	22,431	22,431	22,431	22,431	22,431	22,431
Dewitt	L	Guadalupe	10,613	10,548	10,548	10,548	10,548	10,548
		Lavaca	2,932	2,932	2,926	2,915	2,912	2,912
		Lavaca-Guadalupe	417	417	417	417	417	417
		San Antonio	739	739	739	739	739	739
Fayette	K	Brazos	17	17	17	17	17	17
		Colorado	6,254	6,123	5,961	5,956	5,952	5,924
		Lavaca	2,933	2,933	2,927	2,922	2,917	2,915
Goliad	L	Guadalupe	4,417	4,417	4,417	4,417	4,417	4,417
		San Antonio	6,121	6,121	6,121	6,121	6,121	6,121
		San Antonio-Nueces	1,161	1,161	1,161	1,161	1,161	1,161
Jackson	P	Colorado-Lavaca	23,615	23,615	23,615	23,615	23,615	23,615
		Lavaca	41,927	41,927	41,927	41,927	41,927	41,927
		Lavaca-Guadalupe	10,844	10,844	10,844	10,844	10,844	10,844
Karnes	L	Guadalupe	12	12	12	12	12	12
		Nueces	78	78	78	78	78	78
		San Antonio	3,069	3,061	3,056	3,052	3,048	2,944
		San Antonio-Nueces	84	84	84	84	84	82
Lavaca	P	Guadalupe	41	41	41	41	41	41
		Lavaca	19,944	19,944	19,944	19,944	19,937	19,932
		Lavaca-Guadalupe	400	400	400	400	400	400
Matagorda	K	Brazos-Colorado	23,055	23,055	23,055	23,055	23,055	23,055
		Colorado	4,179	4,179	4,179	4,179	4,179	4,179
		Colorado-Lavaca	18,662	18,662	18,662	18,662	18,662	18,662
Refugio	L	San Antonio	1,522	1,522	1,522	1,522	1,522	1,522
		San Antonio-Nueces	27,806	27,806	27,806	27,806	27,806	27,806

Table 1. Continued.

County	Regional Water Planning Area	Basin	Year					
			2010	2020	2030	2040	2050	2060
Victoria	L	Guadalupe	14,617	14,617	14,617	14,617	14,617	14,617
		Lavaca	217	217	217	217	217	217
		Lavaca-Guadalupe	19,924	19,924	19,924	19,924	19,924	19,924
		San Antonio	936	936	936	936	936	936
Wharton	K	Brazos-Colorado	34,020	34,020	34,020	34,020	34,020	34,020
		Colorado	31,406	31,406	31,406	31,406	31,406	31,406
		Colorado-Lavaca	11,624	11,624	11,624	11,624	11,624	11,624
		Lavaca	1,690	1,690	1,690	1,690	1,690	1,690
	P	Colorado	441	441	441	441	441	441
		Colorado-Lavaca	11,549	11,549	11,549	11,549	11,549	11,549
		Lavaca	87,763	87,763	87,763	87,763	87,763	87,763
Total			**488,353**	**488,149**	**487,946**	**487,921**	**487,846**	**487,705**

Table 2. Modeled available groundwater for the Gulf Coast Aquifer summarized by county in Groundwater Management Area 15. Results are in acre-feet per year.

County	Year					
	2010	2020	2030	2040	2050	2060
Aransas	1,862	1,862	1,862	1,862	1,862	1,862
Bee	9,514	9,514	9,490	9,490	9,438	9,438
Calhoun	2,995	2,995	2,995	2,995	2,995	2,995
Colorado	48,953	48,953	48,953	48,953	48,953	48,953
Dewitt	14,701	14,636	14,630	14,619	14,616	14,616
Fayette	9,204	9,073	8,905	8,895	8,886	8,856
Goliad	11,699	11,699	11,699	11,699	11,699	11,699
Jackson	76,386	76,386	76,386	76,386	76,386	76,386
Karnes	3,243	3,235	3,230	3,226	3,222	3,116
Lavaca	20,385	20,385	20,385	20,385	20,378	20,373
Matagorda	45,896	45,896	45,896	45,896	45,896	45,896
Refugio	29,328	29,328	29,328	29,328	29,328	29,328
Victoria	35,694	35,694	35,694	35,694	35,694	35,694
Wharton	178,493	178,493	178,493	178,493	178,493	178,493
Total	**488,353**	**488,149**	**487,946**	**487,921**	**487,846**	**487,705**

Table 3. Modeled available groundwater for the Gulf Coast Aquifer summarized by regional water planning area in Groundwater Management Area 15. Results are in acre-feet per year.

Regional Water Planning Area	Year					
	2010	2020	2030	2040	2050	2060
K	182,793	182,662	182,494	182,484	182,475	182,445
L	97,660	97,587	97,576	97,561	97,554	97,448
N	11,376	11,376	11,352	11,352	11,300	11,300
P	196,524	196,524	196,524	196,524	196,517	196,512
Total	**488,353**	**488,149**	**487,946**	**487,921**	**487,846**	**487,705**

Table 4. Modeled available groundwater for the Gulf Coast Aquifer summarized by river basin in Groundwater Management Area 15. Results are in acre-feet per year.

Basin	Year					
	2010	2020	2030	2040	2050	2060
Brazos	17	17	17	17	17	17
Brazos-Colorado	67,539	67,539	67,539	67,539	67,539	67,539
Colorado	58,338	58,207	58,045	58,040	58,036	58,008
Colorado-Lavaca	65,811	65,811	65,811	65,811	65,811	65,811
Guadalupe	29,717	29,652	29,652	29,652	29,652	29,652
Lavaca	179,839	179,839	179,827	179,811	179,796	179,789
Lavaca-Guadalupe	34,159	34,159	34,159	34,159	34,159	34,159
Nueces	108	108	108	108	108	108
San Antonio	12,387	12,379	12,374	12,370	12,366	12,262
San Antonio-Nueces	40,438	40,438	40,414	40,414	40,362	40,360
Total	**488,353**	**488,149**	**487,946**	**487,921**	**487,846**	**487,705**

Table 5. Modeled available groundwater for the Gulf Coast Aquifer summarized by groundwater conservation district (GCD) in Groundwater Management Area 15. Results are in acre-feet per year. UWCD refers to Underground Water Conservation District.

Goundwater Conservation District	Year					
	2010	2020	2030	2040	2050	2060
Bee GCD	9,504	9,504	9,480	9,480	9,428	9,428
Calhoun County GCD*	2,995	2,995	2,995	2,995	2,995	2,995
Coastal Bend GCD	178,493	178,493	178,493	178,493	178,493	178,493
Coastal Plains GCD	45,896	45,896	45,896	45,896	45,896	45,896
Colorado County GCD	48,953	48,953	48,953	48,953	48,953	48,953
Evergreen UWCD	3,243	3,235	3,230	3,226	3,222	3,116
Fayette County GCD	9,204	9,073	8,905	8,895	8,886	8,856
Goliad County GCD	11,699	11,699	11,699	11,699	11,699	11,699
Lavaca County GCD*	20,385	20,385	20,385	20,385	20,378	20,373
Pecan Valley GCD	14,701	14,636	14,630	14,619	14,616	14,616
Refugio GCD	29,328	29,328	29,328	29,328	29,328	29,328
Texana GCD	76,386	76,386	76,386	76,386	76,386	76,386
Victoria County GCD	35,694	35,694	35,694	35,694	35,694	35,694
Total (excluding non-district areas)	**483,486**	**483,282**	**483,079**	**483,054**	**482,979**	**482,838**
No District	1,872	1,872	1,872	1,872	1,872	1,872
Total (including non-district areas)	**488,353**	**488,149**	**487,946**	**487,921**	**487,846**	**487,705**

*Lavaca County and Calhoun County GCDs are pending confirmation as of the date of this report

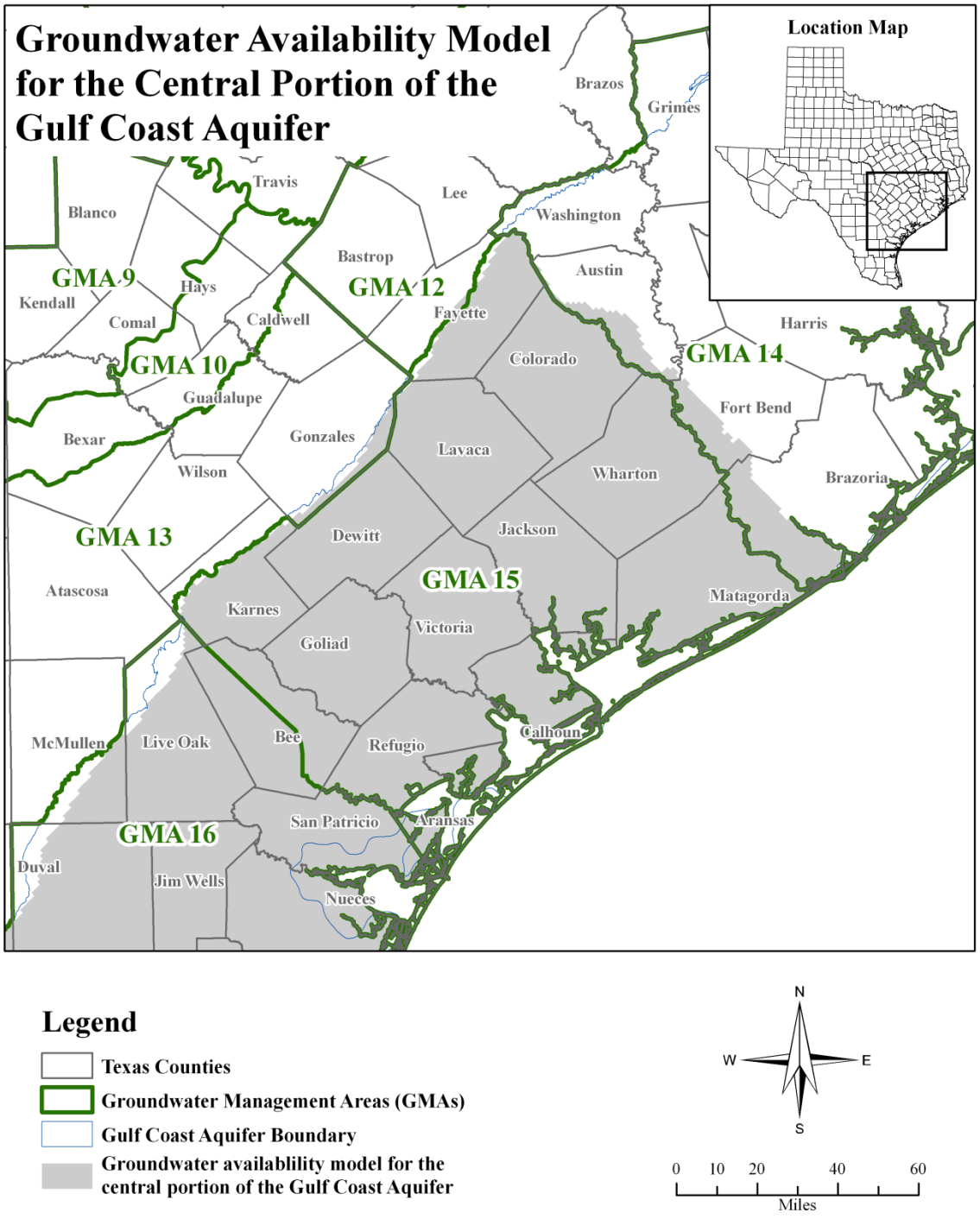

Figure 1. Map showing the areas covered by the groundwater availability model for the central portion of the Gulf Coast Aquifer in Groundwater Management Area 15.

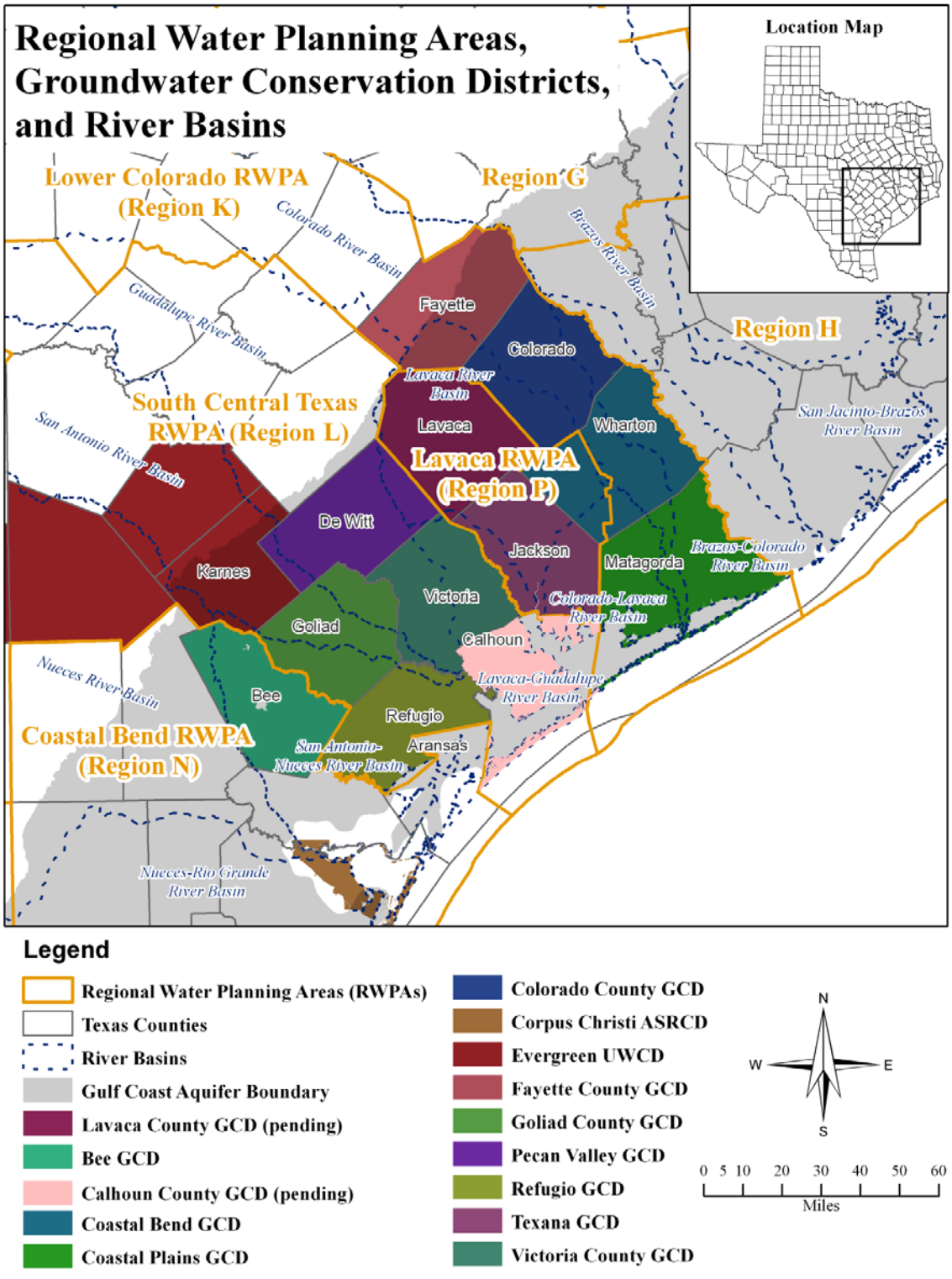

Figure 2. Map showing regional water planning areas, counties, river basins, and groundwater conservation districts (GCD) in and neighboring Groundwater Management Area 15.

Appendix M - GAM Run 15-004

GAM Run 15-004: Evergreen Underground Water Conservation District Management Plan

by Rohit R. Goswami, Ph.D.
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June 30, 2015

Cynthia K. Ridgeway is the Manager of the Groundwater Availability Modeling Section and is responsible for oversight of work performed by Rohit R. Goswami under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G. 471 on June 30, 2015.

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GAM RUN 15-004: EVERGREEN UNDERGROUND WATER CONSERVATION DISTRICT MANAGEMENT PLAN

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June 30, 2015

EXECUTIVE SUMMARY:

Texas State Water Code, Section 36.1071, Subsection (h) (Texas Water Code, 2011), states that, in developing its groundwater management plan, a groundwater conservation district shall use groundwater availability modeling information provided by the executive administrator of the Texas Water Development Board (TWDB) in conjunction with any available site-specific information provided by the district for review and comment to the executive administrator. Information derived from groundwater availability models that shall be included in the groundwater management plan includes:

- the annual amount of recharge from precipitation to the groundwater resources within the district, if any;
- for each aquifer within the district, the annual volume of water that discharges from the aquifer to springs and any surface water bodies, including lakes, streams, and rivers; and
- the annual volume of flow into and out of the district within each aquifer and between aquifers in the district.

This report—Part 2 of a two-part package of information from the TWDB to the Evergreen Underground Water Conservation District—fulfills the requirements noted above. Part 1 of the two-part package is the Estimated Historical Water Use/State Water Plan data report. The District will receive this data report from the TWDB Groundwater Technical Assistance Section. Questions about the data report can be directed to Mr. Stephen Allen, stephen.allen@twdb.texas.gov, (512) 463-7317.

The groundwater management plan for the Evergreen Underground Water Conservation District should be adopted by the district on or before February 2, 2016 and submitted to the executive administrator of the TWDB on or before March 03, 2016. The current management plan for the Evergreen Underground Water Conservation District expires on May 02, 2016.

This report discusses the methods, assumptions, and results from model runs using the groundwater availability models for the Edwards (Balcones Fault Zone) Aquifer (Thorkildsen and McElhaney,1992; Klemt and others, 1979; Lindgren and others, 2004),the southern portion of the Carrizo-Wilcox, Queen City and Sparta aquifers (Kelley and others, 2004), the Yegua-Jackson Aquifer (Deeds and others, 2010), and the central portion of the Gulf Coast Aquifer System (Chowdhury and others, 2004). This model run replaces the results of GAM Run 10-015 (Aschenbach, 2010). GAM Run 15-004 meets current standards set after the release of GAM Run 10-015.

Tables 1 through 6 summarize the groundwater availability model data required by statute, and Figures 1 through 6 show the area of the models from which the values in the tables were extracted. If after review of the figures, the Evergreen Underground Water Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the TWDB at your earliest convenience.

METHODS:

In accordance with the provisions of the Texas State Water Code, Section 36.1071, Subsection (h), the groundwater availability models for the Edwards (Balcones Fault Zone) Aquifer (Thorkildsen and McElhaney,1992; Klemt and others, 1979; Lindgren and others, 2004), the southern portion of the Carrizo-Wilcox, Queen City and Sparta aquifers (Kelley and others, 2004), the Yegua-Jackson Aquifer (Deeds and others, 2010), and the central portion of the Gulf Coast Aquifer (Chowdhury and others, 2004) were run for this analysis. Evergreen Underground Water Conservation District water budgets were extracted for the historical model period used for calibration of the models using ZONEBUDGET Version 3.01 (Harbaugh, 2009). The average annual water budget values for recharge, surface water outflow, inflow to the district, outflow from the district, net inter-aquifer flow (upper), and net inter-aquifer flow (lower) for the portion of the aquifers located within the district are summarized in this report.

PARAMETERS AND ASSUMPTIONS:

Edwards (Balcones Fault Zone) Aquifer using the model initially developed for the Edwards Aquifer Authority

- Version 1.01 of the groundwater availability model for San Antonio segment of the Edwards (Balcones Fault Zone) Aquifer initially developed for the Edwards Aquifer Authority. See Lindgren and others (2004) for assumptions and limitations of the model.

- The groundwater availability model for the San Antonio segment of the Edwards (Balcones Fault Zone) Aquifer contains only one layer representing the Edwards (Balcones Fault Zone) Aquifer and the associated limestone.

- This model was run to analyze the groundwater flow entering and leaving Evergreen Underground Water Conservation District.

- Conduit flow was simulated in the model by an increase in hydraulic conductivity as described in Lindgren and others (2004). The locations of these conduits caused inflation in the values for the lateral inflow and outflow as discussed in the Results section.

- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).

Edwards (Balcones Fault Zone) Aquifer using the GWSIM-IV model

- See Thorkildsen and McElhaney (1992) and Klemt and others (1979) for assumptions and limitations of the GWSIM-IV groundwater availability model for the San Antonio segment of the Edwards (Balcones Fault Zone) Aquifer.

- The GWSIM-IV groundwater availability model for the San Antonio segment of the Edwards (Balcones Fault Zone) Aquifer contains only one layer representing the Edwards (Balcones Fault Zone) Aquifer and the associated limestone.

- This model was run to analyze the groundwater flow entering and leaving Evergreen Underground Water Conservation District.

- The model does a good job of reproducing spring flow at Comal Springs, but underestimates spring flow at San Marcos Springs. This is because San Marcos Springs is fed by a regional component of groundwater flow and a local component of groundwater flow, with the local component of flow being the dominant component. The model includes the regional component of flow but only approximates the local component of flow.

- Recharge rates are based on U.S. Geological Survey estimates of historical recharge from 1934 to 1989.

- The pumping for each of the 56 years in the model is based on estimates of historical pumping.

- For the GWSIM-IV water budget terms, recharge and pumping volumes are from the model input files. Lateral flows, leakage, and reduction in recharge volumes are taken from the model output files. GWSIM-IV reduces recharge when calculated heads exceed the elevation of the top of the aquifer.

Carrizo-Wilcox, Queen-City, and Sparta aquifers

- Version 2.01 of the groundwater availability model for the southern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers was used for this analysis. See Deeds and others (2003) and Kelley and others (2004) for assumptions and limitations of the groundwater availability model for the southern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers.

- This groundwater availability model includes eight layers which generally represent the Sparta Aquifer (Layer 1), the Weches Confining Unit (Layer2), the Queen City Aquifer (Layer 3), the Reklaw Confining Unit (Layer 4), the Carrizo Aquifer (Layer 5), the Upper Wilcox Aquifer and top of the Middle Wilcox Aquifer where the Upper Wilcox is missing (Layer 6), the Middle Wilcox Aquifer (Layer 7), and the Lower Wilcox Aquifer (Layer 8). Individual water budgets for the District were determined for the Sparta Aquifer (Layer 1), the Queen City Aquifer (Layer 3), and the Carrizo-Wilcox Aquifer (Layer 5 to Layer 8 collectively).

- Groundwater in the Carrizo-Wilcox, Queen City, and Sparta aquifers ranges from fresh to brackish in composition (Kelley and others, 2004). Groundwater with total dissolved solids of less than 1,000 milligrams per liter are considered fresh and total dissolved solids of 1,000 to 10,000 milligrams per liter are considered brackish.

- The model was run with MODFLOW-96 (Harbaugh and McDonald, 1996).

Yegua-Jackson Aquifer

- Version 1.01 of the groundwater availability model for the Yegua-Jackson Aquifer was used for this analysis. See Deeds and others (2010) for assumptions and limitations of the groundwater availability model.
- This groundwater availability model includes five layers which represent the outcrop section for the Yegua-Jackson Aquifer and younger overlying units

(Layer 1), the upper portion of the Jackson Group (Layer 2), the lower portion of the Jackson Group (Layer 3), the upper portion of the Yegua Group (Layer 4), and the lower portion of the Yegua Group (Layer 5).

- An overall water budget for the district was determined for the Yegua-Jackson Aquifer (Layer 1 to Layer 5 collectively for the portions that represent the Yegua-Jackson Aquifer).

- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).

Gulf Coast Aquifer System

- Version 1.01 of the groundwater availability model for the central part of the Gulf Coast Aquifer System was used for this analysis. See Chowdhury and others (2004) and Waterstone and others (2003) for assumptions and limitations of the groundwater availability model.

- The model for the central portion of the Gulf Coast Aquifer System assumes partially penetrating wells in the Evangeline Aquifer due to lack of data for aquifer properties in the deeper, lower section of the aquifer. This means the areas where wells are drilled into the Evangeline Aquifer are represented using data collected and the deeper portions of the aquifer need future studies to understand the aquifer properties in more detail.

- This groundwater availability model includes four layers which generally represent the Chicot Aquifer (Layer 1), the Evangeline Aquifer (Layer 2), the Burkeville Confining Unit (Layer 3), and the Jasper Aquifer including parts of the Catahoula Formation (Layer 4).

- The model was run with MODFLOW-96 (Harbaugh and McDonald, 1996).

RESULTS:

A groundwater budget summarizes the amount of water entering and leaving the aquifer according to the groundwater availability model. Selected groundwater budget components listed below were extracted from the model results for the aquifers located within the district and averaged over the duration of the calibration and verification portion of the model run in the district, as shown in Tables 1 through 6.

- Precipitation recharge—The areally distributed recharge sourced from precipitation falling on the outcrop areas of the aquifers (where the aquifer is exposed at land surface) within the district.

- Surface water outflow—The total water discharging from the aquifer (outflow) to surface water features such as streams, reservoirs, and springs.

- Flow into and out of district—The lateral flow within the aquifer between the district and adjacent counties.

- Flow between aquifers—The net vertical flow between the aquifer and adjacent 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.

The information needed for the District's management plan is summarized in Tables 1 through 6. It is important to note that sub-regional water budgets are not exact. This is due to the size of the model cells and the approach used to extract data from the model. To avoid double accounting, a model cell that straddles a political boundary, such as a district or county boundary, is assigned to one side of the boundary based on the location of the centroid of the model cell. For example, if a cell contains two counties, the cell is assigned to the county where the centroid of the cell is located.

Comparison of the Edwards Aquifer Authority and the GWSIM-IV groundwater availability models conducted on the San Antonio segment of the Edwards (Balcones Fault Zone) Aquifer

The Edwards Aquifer Authority and the GWSIM-IV groundwater availability models cover the same general area in the northwestern part of the district.

Conduit flows represent the major flow paths in karst aquifers, such as the Edwards (Balcones Fault Zone) Aquifer, and were simulated in the Edwards Aquifer Authority model of the Edwards (Balcones Fault Zone) Aquifer by increasing hydraulic conductivity (typically to a range between 2,000 and 300,000 feet per day) as described in Lindgren and others (2004). A simulated conduit in the Edwards Aquifer Authority model crosses the northwestern tip of Atascosa County and enters north-central Frio County based on the conduit locations from Figure 7 in Lindgren and others (2004), which were based on those inferred in Worthington (2004). The result of the conduits passing in and out of the district is that values for lateral inflow and outflow are highly inflated and appear unreasonable.

The GWSIM-IV model of the Edwards (Balcones Fault Zone) Aquifer is a regional groundwater model mainly calibrated to regional spring discharge such as Comal and San Marcos springs. The model was not originally designed to be used for subregional county or groundwater conservation district level flow budgets. However, the recharge and pumping volumes from the model input files and lateral flows, leakage,

and reduction in recharge volumes from the model output files have been joined to the model grid in ArcGIS based on the cell ID for the data point. This enables the calculation of the parameters required for the management plan on a subregional basis.

Because the aquifer is not exposed at land surface within the district boundaries, the estimated annual amount of recharge from precipitation to the district for both models is zero. In addition, the estimated annual volume of water that discharges from springs and any surface water body to the district for both models is zero.

The estimated annual volume of flow into the district for the Edwards Aquifer Authority model is 273,625 acre-feet per year for both Atascosa and Frio counties. The estimated annual volume of flow into the district for the GWSIM-IV model is 70 acre-feet per year, and this flow is solely for Atascosa County based on the extent of the GWSIM-IV model grid (see Figure 1).

The estimated annual volume of flow out of the district for the Edwards Aquifer Authority model is 273,663 acre-feet per year for both Atascosa and Frio counties. The estimated annual volume of flow out of the district for the GWSIM-IV model is zero.

The Edwards Aquifer Authority model simulates flow between the Trinity Aquifer using the MODFLOW Well Package. However, the Trinity Aquifer is barely mapped within the Evergreen Underground Water Conservation District boundaries, and any interaction is not applicable in this case. Therefore, the estimated net annual volume of flow between aquifers in the district for the San Antonio segment of the Edwards (Balcones Fault Zone) Aquifer using the Edwards Aquifer Authority model is considered to be zero. The GWSIM-IV model does not incorporate a flow component to other aquifers, so the estimated net annual volume of flow between aquifers in the San Antonio segment of the Edwards (Balcones Fault Zone) Aquifer using the GWSIM-IV model is also zero.

Since the two models cover the same general area, and the GWSIM-IV model does not include conduits, the lateral flows are not inflated as occurs in the Edwards Aquifer Authority model. Therefore, the GWSIM-IV model is believed to be more appropriate than the Edwards Aquifer Authority model and should be used to meet the management plan requirements (see Table 1).

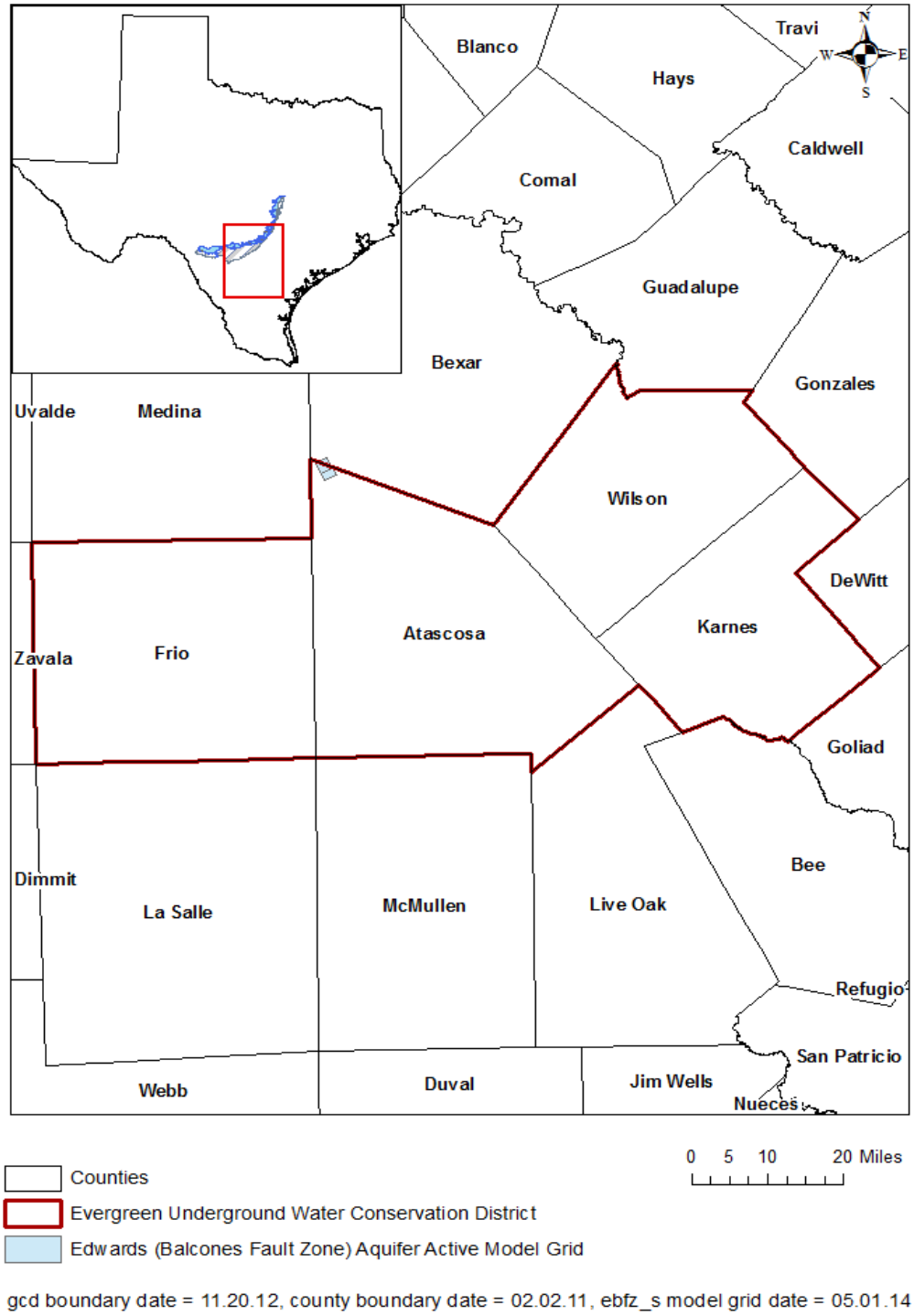
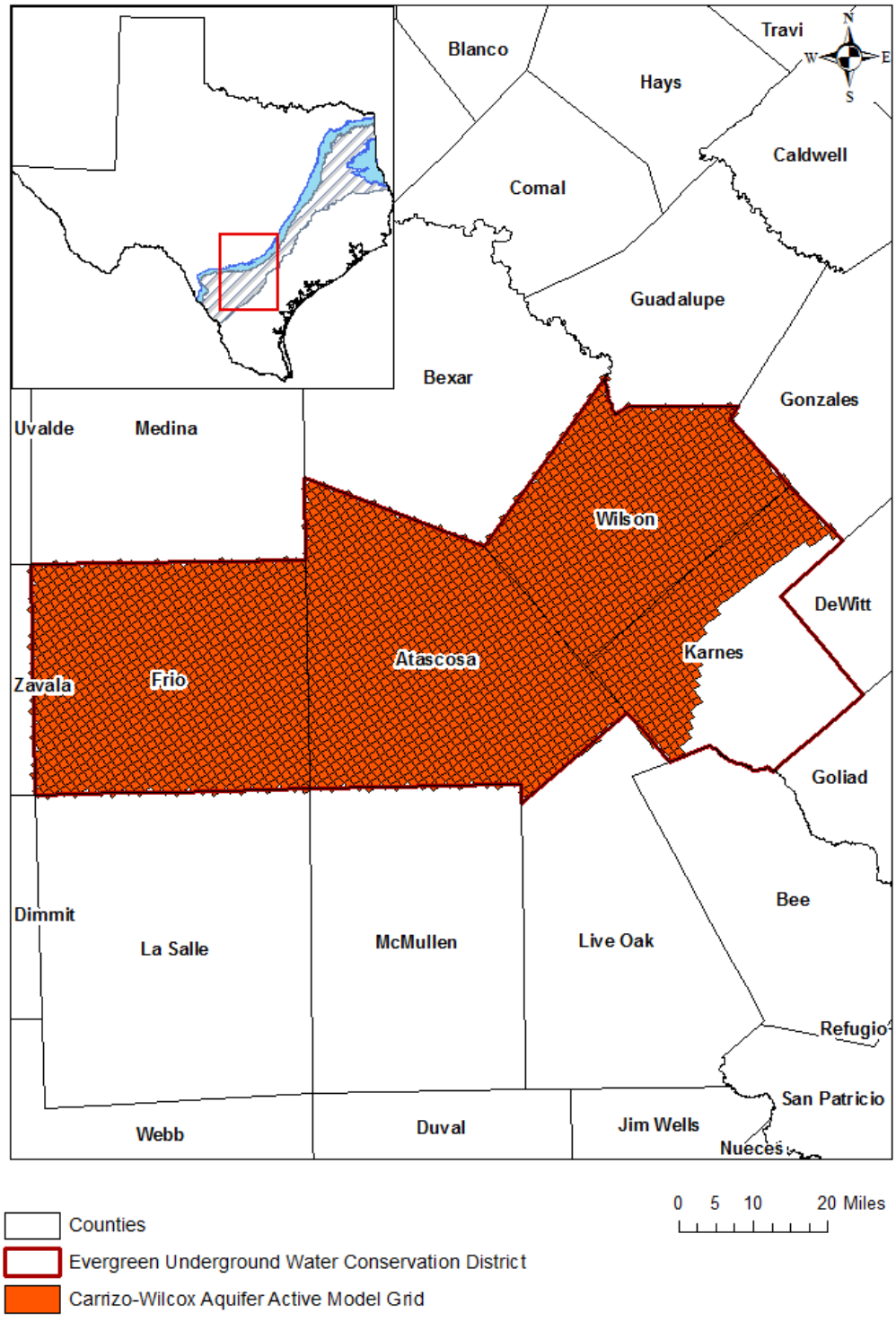


FIGURE 1: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE SAN ANTONIO SEGMENT OF THE EDWARDS (BALCONES FAULT ZONE) AQUIFER FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED [THE EDWARDS (BALCONES FAULT ZONE) AQUIFER EXTENT MODELED WITHIN THE DISTRICT BOUNDARY].

TABLE 1: SUMMARIZED INFORMATION FOR THE EDWARDS (BALCONES FAULT ZONE) AQUIFER THAT IS NEEDED FOR THE EVERGREEN UNDERGROUND WATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Edwards (Balcones Fault Zone) Aquifer	0
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Edwards (Balcones Fault Zone) Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Edwards (Balcones Fault Zone) Aquifer	70
Estimated annual volume of flow out of the district within each aquifer in the district	Edwards (Balcones Fault Zone) Aquifer	0
Estimated net annual volume of flow between each aquifer in the district	Not applicable[1]	Not applicable

[1] The groundwater availability model for the San Antonio portion of the Edwards (Balcones Fault Zone) Aquifer assumes no interaction with other aquifers.



gcd boundary date = 11.20.12, county boundary date = 02.02.11, qcsp_s model grid date = 05.01.14

FIGURE 2: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE SOUTHERN PORTION OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS FROM WHICH THE INFORMATION IN TABLE 2 WAS EXTRACTED (THE CARRIZO-WILCOX AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 2: SUMMARIZED INFORMATION FOR THE CARRIZO-WILCOX AQUIFER THAT IS NEEDED FOR THE EVERGREEN UNDERGROUND WATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Carrizo-Wilcox Aquifer	20,850
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Carrizo-Wilcox Aquifer	3,621
Estimated annual volume of flow into the district within each aquifer in the district	Carrizo-Wilcox Aquifer	72,095
Estimated annual volume of flow out of the district within each aquifer in the district	Carrizo-Wilcox Aquifer	15,083
Estimated net annual volume of flow between each aquifer in the district	From the Reklaw Confining Unit into the Carrizo-Wilcox Aquifer	18,695
	From the Carrizo-Wilcox Aquifer into brackish parts of the same geologic unit	2,312

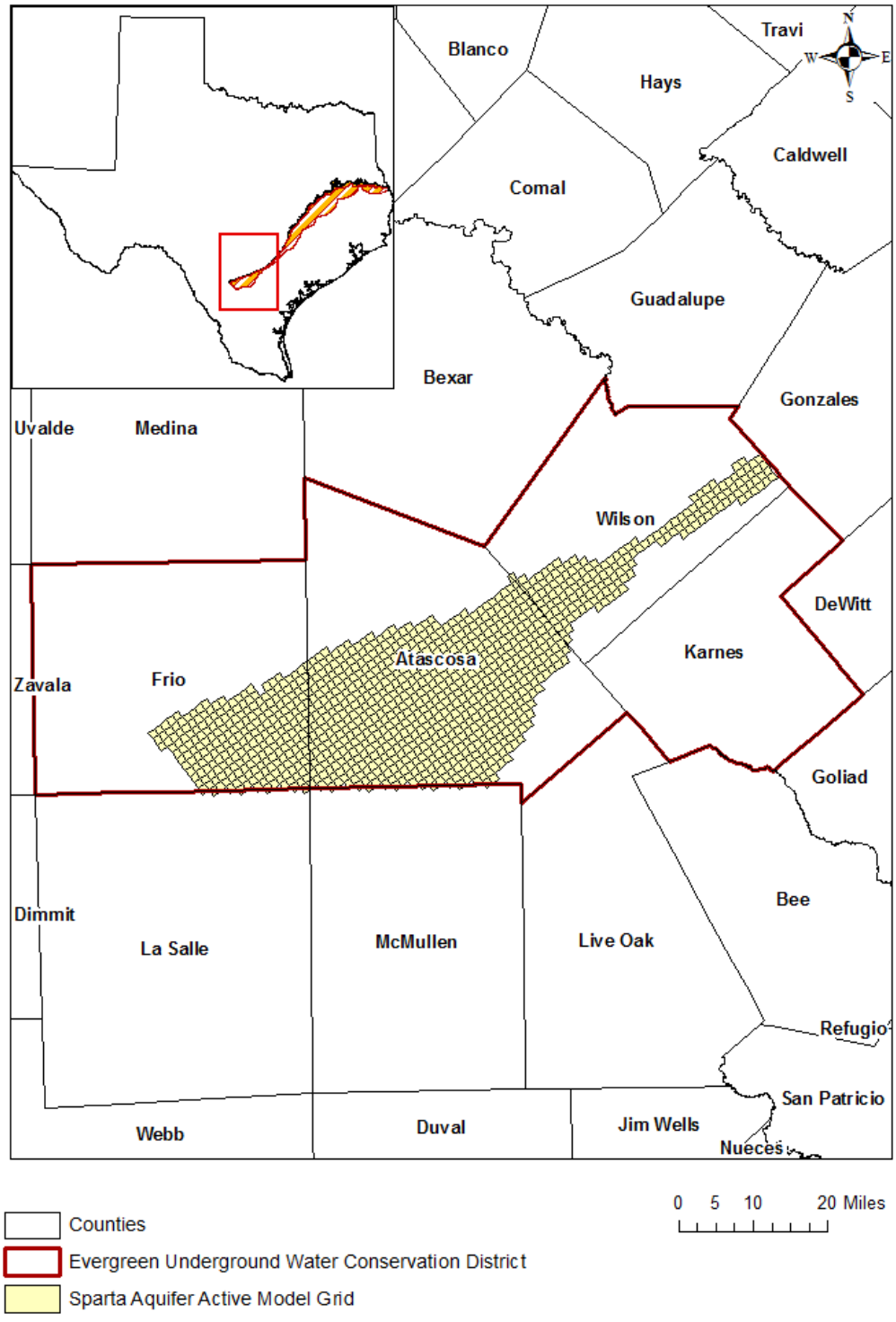


FIGURE 3: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE SOUTHERN PORTION OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS FROM WHICH THE INFORMATION IN TABLE 3 WAS EXTRACTED (THE SPARTA AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 3: SUMMARIZED INFORMATION FOR THE SPARTA AQUIFER THAT IS NEEDED FOR THE EVERGREEN UNDERGROUND WATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Sparta Aquifer	6,150
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Sparta Aquifer	4,407
Estimated annual volume of flow into the district within each aquifer in the district	Sparta Aquifer	73
Estimated annual volume of flow out of the district within each aquifer in the district	Sparta Aquifer	865
Estimated net annual volume of flow between each aquifer in the district	From the Sparta Aquifer into overlying younger units	970
	From the Sparta Aquifer into the underlying Weches Confining Unit	4,486
	From the Sparta Aquifer into brackish parts of the same geologic unit	1,095

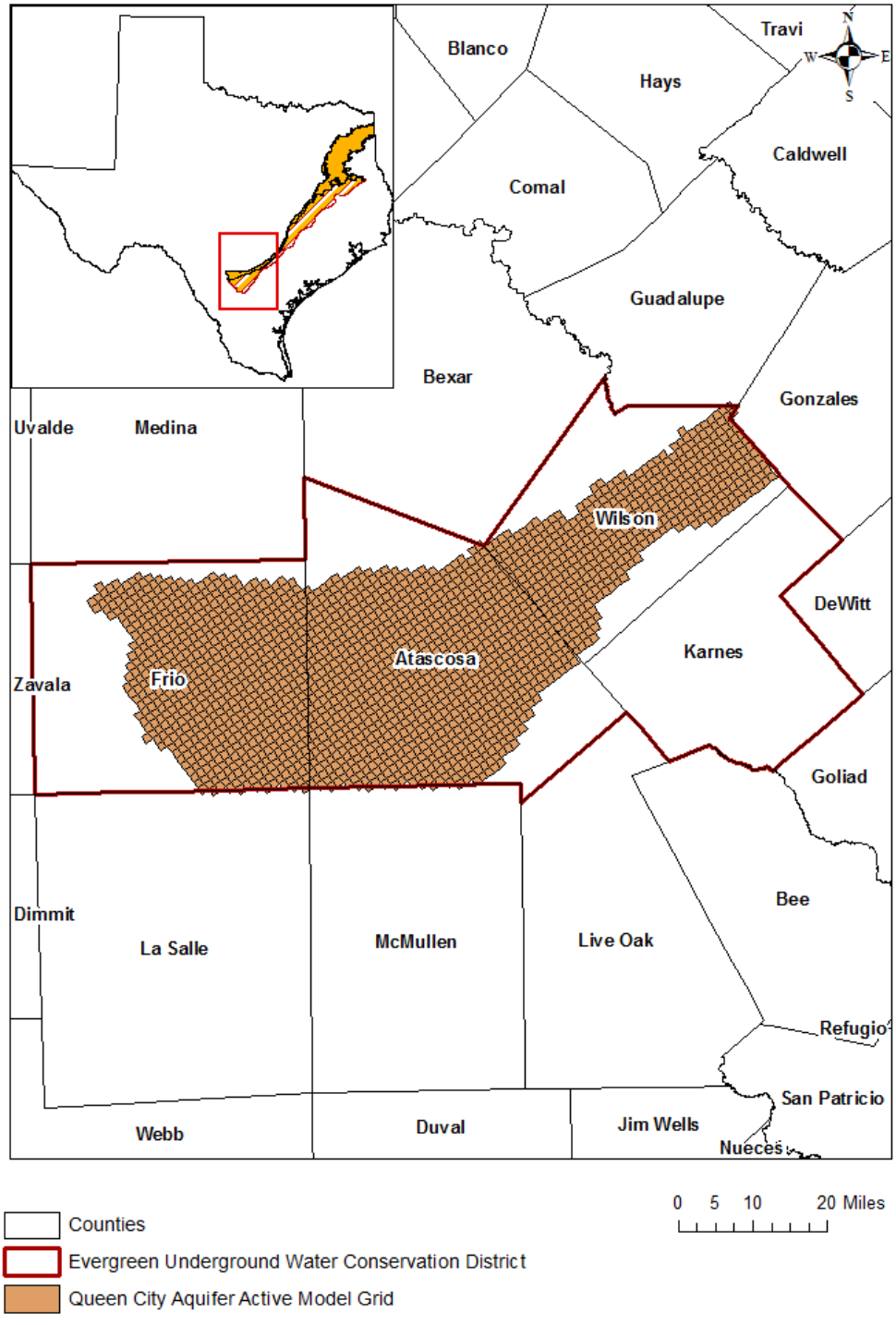


FIGURE 4: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE SOUTHERN PORTION OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS FROM WHICH THE INFORMATION IN TABLE 4 WAS EXTRACTED (THE QUEEN CITY AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 4: SUMMARIZED INFORMATION FOR THE QUEEN CITY AQUIFER THAT IS NEEDED FOR THE EVERGREEN UNDERGROUND WATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Queen City Aquifer	23,084
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Queen City Aquifer	7,097
Estimated annual volume of flow into the district within each aquifer in the district	Queen City Aquifer	80
Estimated annual volume of flow out of the district within each aquifer in the district	Queen City Aquifer	1,717
Estimated net annual volume of flow between each aquifer in the district	From the Weches Confining Unit into the Queen City Aquifer	6,259
	From Queen City Aquifer into the Reklaw Confining Unit	7,282
	From the Queen City Aquifer into brackish parts of the same geologic unit	527

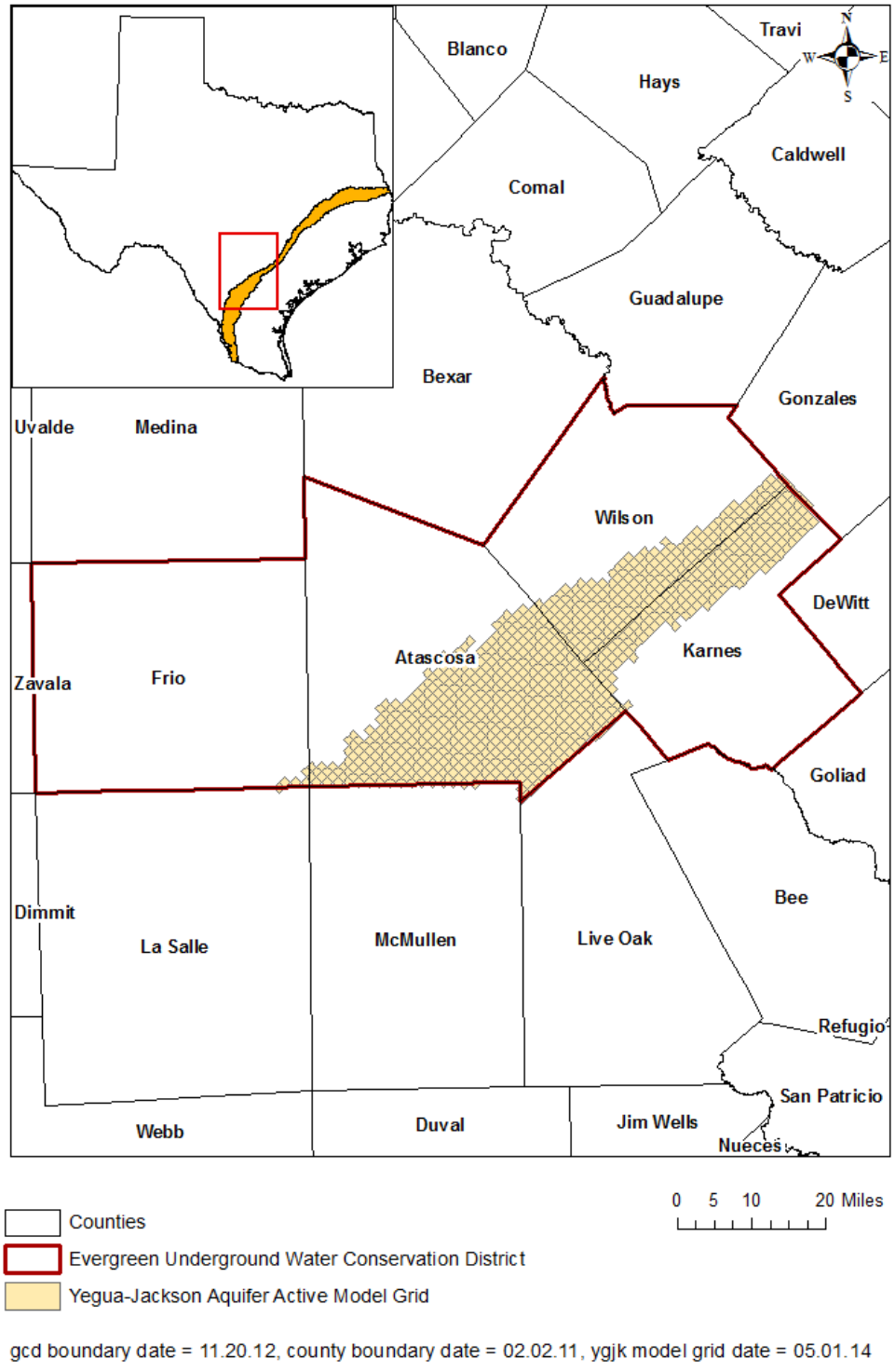


FIGURE 5: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE YEGUA-JACKSON AQUIFER FROM WHICH THE INFORMATION IN TABLE 5 WAS EXTRACTED (THE YEGUA-JACKSON AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 5: SUMMARIZED INFORMATION FOR THE YEGUA-JACKSON AQUIFER THAT IS NEEDED FOR THE EVERGREEN UNDERGROUND WATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Yegua-Jackson Aquifer	42,086
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Yegua-Jackson Aquifer	46,062
Estimated annual volume of flow into the district within each aquifer in the district	Yegua-Jackson Aquifer	2,680
Estimated annual volume of flow out of the district within each aquifer in the district	Yegua-Jackson Aquifer	4,580
Estimated net annual volume of flow between each aquifer in the district	Flow into the brackish portion of the Yegua-Jackson units	269

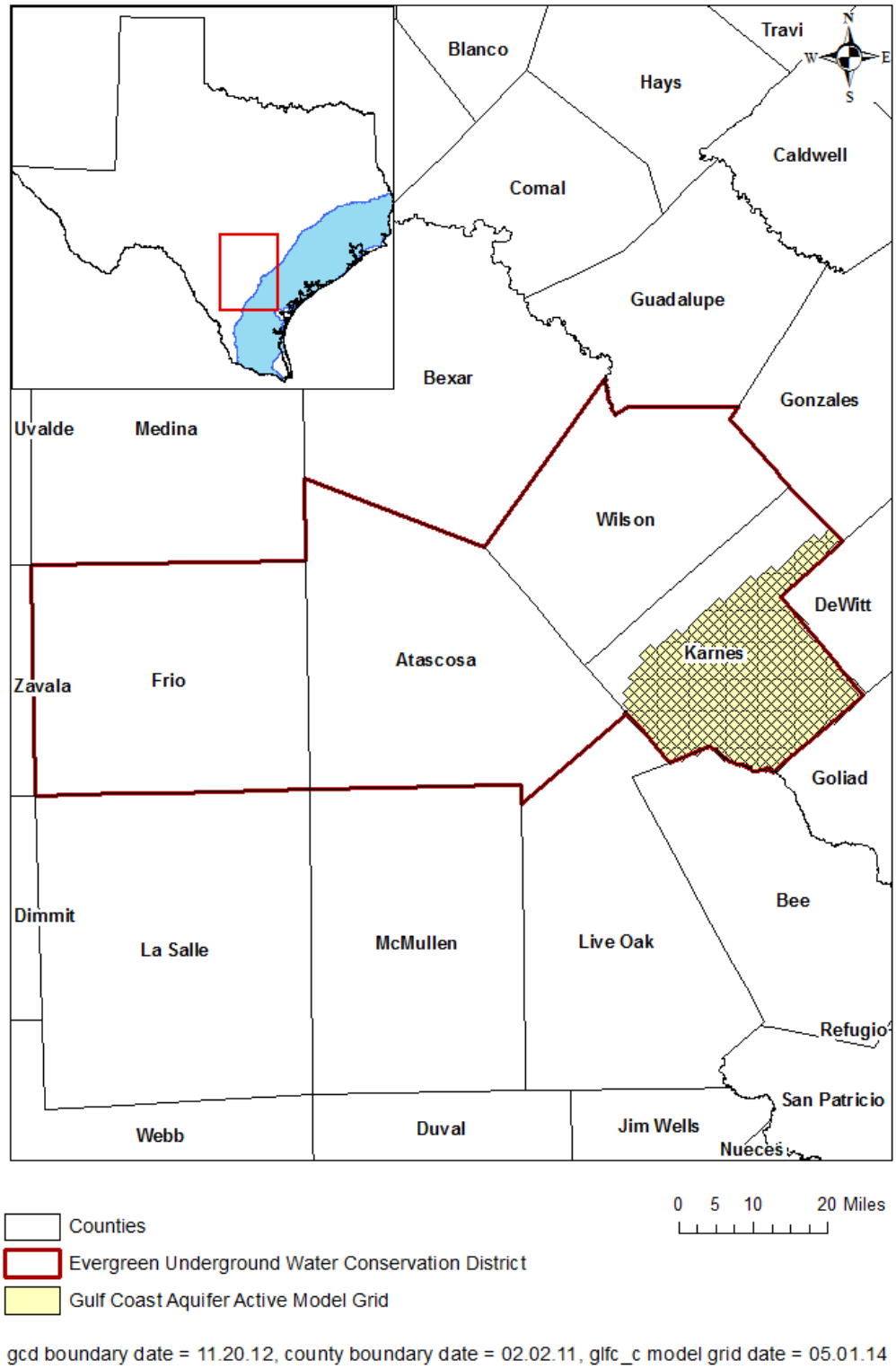


FIGURE 6: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE CENTRAL PORTION OF THE GULF COAST AQUIFER SYSTEM FROM WHICH THE INFORMATION IN TABLE 6 WAS EXTRACTED (THE GULF COAST AQUIFER SYSTEM EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 6: SUMMARIZED INFORMATION FOR THE GULF COAST AQUIFER SYSTEM THAT IS NEEDED FOR THE EVERGREEN UNDERGROUND WATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Gulf Coast Aquifer System	1,196
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Gulf Coast Aquifer System	1,496
Estimated annual volume of flow into the district within each aquifer in the district	Gulf Coast Aquifer System	746
Estimated annual volume of flow out of the district within each aquifer in the district	Gulf Coast Aquifer System	1,198
Estimated net annual volume of flow between each aquifer in the district	Not applicable[2]	Not applicable

[2] The groundwater availability model for the central portion of the Gulf Coast Aquifer System assumes no-flow conditions at the base of the aquifer.

LIMITATIONS:

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

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

A key aspect of using the groundwater model to evaluate historic groundwater flow conditions includes the assumptions about the location in the aquifer where historic pumping was placed. Understanding the amount and location of historic pumping is as important as evaluating the volume of groundwater flow into and out of the district, between aquifers within the district (as applicable), interactions with surface water (as applicable), recharge to the aquifer system (as applicable), and other metrics that describe the impacts of that pumping. In addition, assumptions regarding precipitation, recharge, and interaction with streams are specific to particular historic time periods.

Because the application of the groundwater models was designed to address regional scale questions, the results are most effective on a regional scale. The TWDB makes no warranties or representations related to the actual conditions of any aquifer at a particular location or at a particular time.

It is important for groundwater conservation districts to monitor groundwater pumping and overall conditions of the aquifer. Because of the limitations of the groundwater model and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine this analysis in the future given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future. Historic precipitation patterns also need

to be placed in context as future climatic conditions, such as dry and wet year precipitation patterns, may differ and affect groundwater flow conditions.

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