Plateau Underground Water Conservation & Supply District

Management Plan

2014-2024

Plateau Underground Water Conservation & Supply District

Management Plan

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Plateau Underground Water

Conservation & Supply District

Management Plan

Mission Statement

The Plateau Underground Water Conservation & Supply District was created by Acts of the 59th Texas Legislature in 1965. The District was created to provide for the conservation, preservation, protection, recharge and prevention of waste of the underground water reservoirs located under the District , consistent with Article XVI, Section 59, of the Texas Constitution, and Chapter 36 of the Texas Water Code. The District strives to bring about conservation, preservation, and the efficient, beneficial and wise use of water for the benefit of the citizens and economy of the District through monitoring and protecting the quality of the groundwater. The District also strives to maintain groundwater ownership and rights of landowners as provided in Texas Water Code 36.002.

Time Period for This Plan

This plan becomes effective upon certification by the Texas Water Development Board and replaces the existing management plan adopted by the Board of Directors. The new plan remains in effect until a revised plan is certified. This plan will be reviewed and amended at least once every five years.

General Description

The District is governed by a Board of five Directors elected by local voters. Serving on the current Board are Ray Lewis Ballew, Chairman, Phil McCormick, Vice-Chairman, Cindy Cawley, Secretary, Johnny Powell, and Steve Williams. District rules have been in effect since 1992 which will effectuate the management plan. The District encompasses Schleicher County, Texas. Schleicher County's economy is based in agriculture with a significant contribution from the oil and gas industry.

Management of Groundwater Supplies

The District aids in the management of groundwater 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 engage in such activities and practices that could result in a reduction of groundwater use. An observation network shall be maintained in order to monitor changing quality and storage conditions of groundwater supplies within the District. The District will employ all technical resources at its disposal to evaluate the resources available within the District and to determine the effectiveness of management or conservation measures.

The District has adopted rules to manage groundwater withdrawals by means of spacing and production limits. 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 decision to approve or deny a permit or limit groundwater withdrawals, the District will consider 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 include: the purpose of District rules, legal rights, equitable distribution of resource, and economic hardship to both individual surface owners and surrounding community.

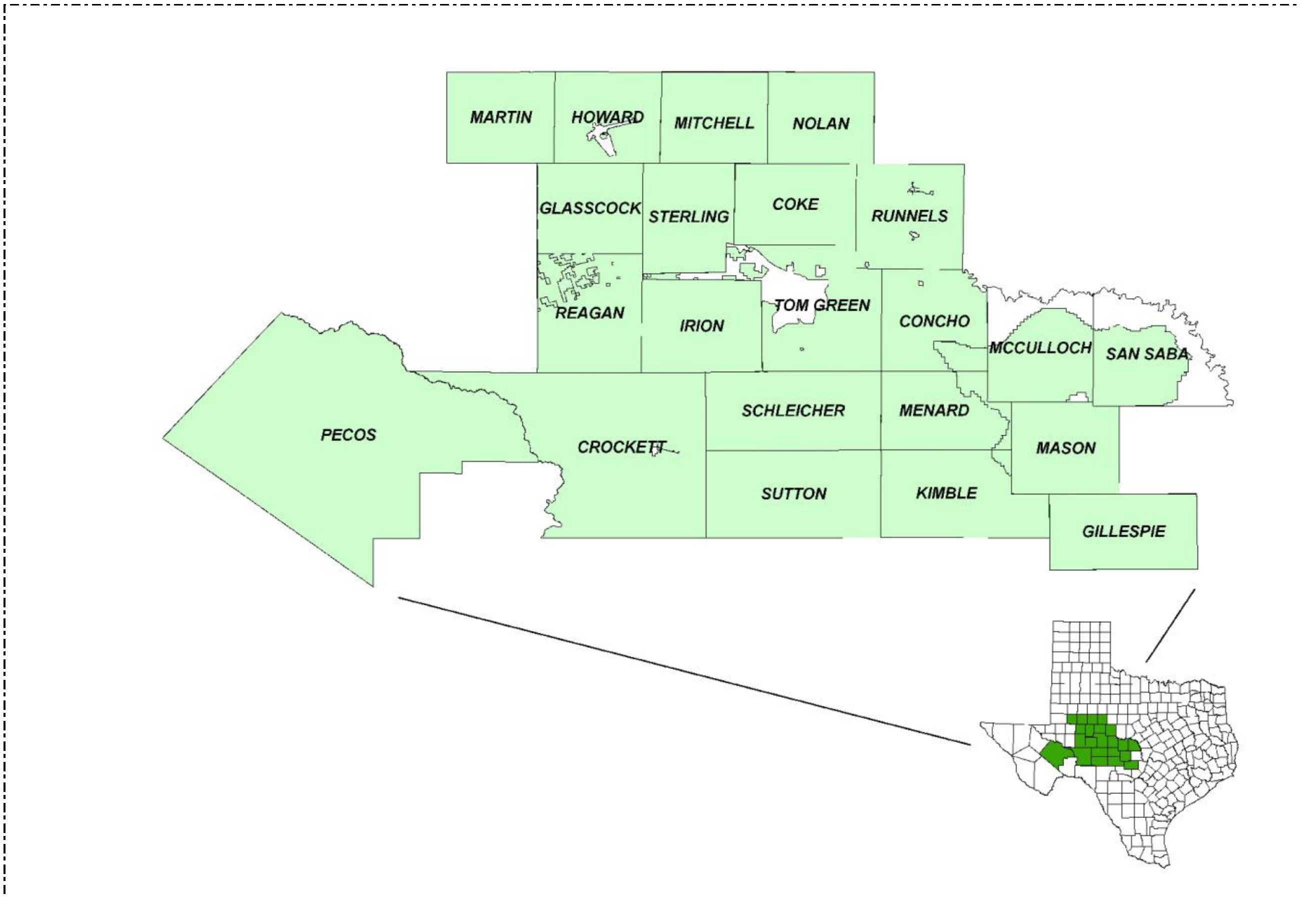
Regional Cooperation and Coordination

In 1988, four groundwater conservation districts, Coke County UWCD, Glasscock County UWCD, Irion County WCD, and Sterling County UWCD signed an original Cooperative Agreement. More districts came in and signed this agreement, and in the fall of 1996, the original Cooperative Agreement was redrafted and the West Texas Regional Groundwater Alliance was created. The WTRGA now consists of eighteen locally created and locally funded groundwater conservation districts that encompass twenty-nine thousand eight hundred square miles of West Texas. Due to the diversity of the region, each member district provides its own unique programs to best serve its constituents.

The following districts are currently members of the WTRGA: Coke County UWCD, Crockett

County GCD, Glasscock GCD, Hill Country UWCD, Hickory UWCD, Irion County WCD, Jeff Davis County UWCD, Kimble County GCD, Lipan-Kickapoo WCD, Lone Wolf GCD, Menard County UWD, Middle Pecos GCD, Permian Basin UWCD, Plateau UWC&SD, Santa Rita UWCD, Sterling County UWCD, Sutton County UWCD, and Wes-Tex GCD.

This Alliance was created because the local districts have a common objective to facilitate the conservation, preservation, and beneficial use of water and related resources. Local districts monitor water-related activities of the state's largest industries, such as farming and ranching, oil and gas, and municipalities. The Alliance provides coordination essential to effect region wide planning in an area which has common water resource allocation problems that are unique to this part of Texas.



West Texas Regional Groundwater Alliance

Geographical Information

The District lies within the Edwards Plateau and consists of approximately 838,000 acres in Schleicher County, Texas.

Groundwater Resources

The Edwards-Trinity (Plateau) aquifer underlies the Edwards Plateau east of the Pecos River and the Stockton Plateau west of the Pecos River, extending from the Hill Country of Central Texas to the Trans-Pecos region of West Texas, providing water to all or parts of 38 counties. The aquifer consists of saturated sediments of lower Cretaceous age Trinity Group formations and overlying limestone and dolomites of the Comanche Peak, Edwards, and Georgetown formations. (1)

The Edwards-Trinity (Plateau) aquifer is the fresh water source for Schleicher County and includes all rocks from the base of the Antlers to the top of the Georgetown Formation (Washita Group). Limestone is the predominant rock underlying the Edwards Plateau soils. The permeability of the limestone is not necessarily due to inter granular pore space as in sandstones, but more to joints, crevices, and solution openings that have been enlarged by solvent action of water charged with carbon dioxide.

Permian limestone contains fresh to slightly saline water in the area of the common corners of Kimble, Menard, Schleicher, and Sutton Counties. The Permian is overlain by the Edwards and associated limestone in this area and is recharged by water from the Cretaceous. (2)

Technical Information Required by Texas Administrative Code

Estimate of Modeled Available Groundwater in District Based on Desired Future Conditions

The Desired Future Conditions for the aquifers located within the District boundaries and Groundwater Management Area 7 were adopted on July 29, 2010. Texas Water Code 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 Lipan aquifer was deemed by GMA 7 as not relevant for planning purposes in the Plateau UWC&SD. The adopted DFCs were forwarded to the TWDB for development of the MAG calculations. The submittal package for the DFCs can be found here: http://www.twdb.texas.gov/groundwater/docs/DFC/GMA7_DFC_Adopted_2010-0729.pdf

A summary of the desired future conditions and the modeled available groundwater are summarized below.

Edwards-Trinity (Plateau) Aquifer. An average drawdown of 7 feet for the Edwards-Trinity (Plateau) Aquifer, except for the Kinney County GCD, based on scenario 10 of the TWDB GAM Run 09-35.

Lipan Aquifer-not relevant for planning purposes within the boundaries of Plateau UWC&SD.

Estimated Modeled Available Groundwater for Plateau UWCSD In acre feet/year:

County	Year					
	2010	2020	2030	2040	2050	2060
Schleicher	8,050	8,050	8,050	8,050	8,050	8,050

Modeled Available Groundwater in the District

Please refer to appendix A

Amount of Groundwater being used within the District on an Annual Basis

Please refer to Appendix B

Annual Amount of Recharge from Precipitation to the Groundwater Resources within the District

Please refer to Appendix C

Annual Amount of Water that Discharges from the Aquifer to Springs and Surface Water Bodies

Please refer to Appendix C

Estimate of the Annual volume of flow into the District, out of the District, and between Aquifers in the District

Please refer to Appendix C

Projected Surface Water Supplies within the District

Please refer to Appendix B

Projected total Demand for Water within the District

Please refer to Appendix B

Water Supply Needs

Please refer to Appendix B

Water Management Strategies

Please refer to Appendix B

Additional Recharge

Methods of additional recharge:

1. **Flood Prevention Sites - In 1962, Public Law 566 mandated the construction of thirteen dam sites on the Dry Devil's River Draw for the prevention of flooding in Sonora, Texas. Of the two site located within Schleicher County, site #1 is capable of detaining 4,866 acre feet, and site #2 is capable of detaining 5000 acre feet.(1) The dams were designed to regulate flow of floodwater, thereby releasing water at a predetermined rate to prevent flooding. Since construction of the sites, the only storm event to produce enough water to fill structures 9, 10, 11, and 12 occurred in 1990. Structures 1-8 have never been filled to capacity.**

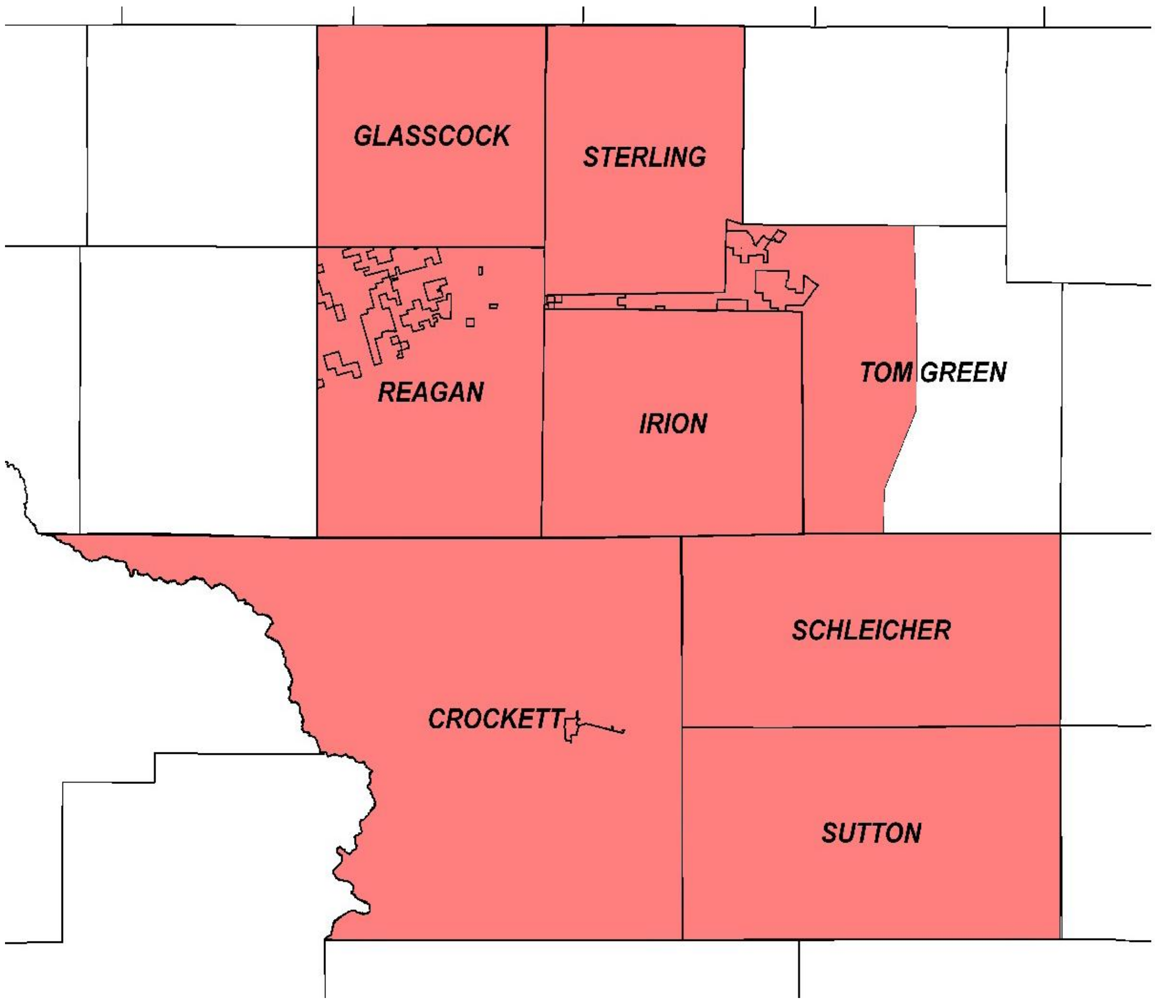
Site 1


N
Image © 2009 DigitalGlobe
©2008 Google
30°46'40.82" N 100°39'52.28" W
elev 2317 ft
Jun 28, 2005
Eye alt 9609 ft

Site 2

2.Weather Modification - Weather modification is another tool considered effective for increased aquifer recharge. The Colorado River Municipal Water District Weather Modification Program indicates a 23% increase in rainfall within the target area over a 26 year period. San Angelo conducted a weather enhancement program from 1985 to 1989 with a result of 15% increase in rainfall. The Plateau UWC&SD has been a member of the West Texas Weather Modification Association since the initial season of 1996. The average rainfall for the District is 19.0 in/yr and 11.2 from May to September when weather modification activities occur.(2)

A 10% increase of one inch of rainfall during the growing season results on a reduction of pumping for all users, potential increase in runoff, increases productivity of crops and rangeland, provides additional moisture infiltration below root depth available for recharge and increases spring flow. One inch of rainfall distributed over the entire District is equal to 69,833 ac-ft of rainwater.



Area covered by West Texas Weather Modification Association

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(1) Workplan for Watershed Protection and Flood Protection, U.S. Department of Agriculture Soil Conservation Service, 1958.

(2)Texas Almanac, 2007

Under ideal conditions, with 20% of rainfall infiltrating beyond the root zone for potential recharge, increased rainfall would result in additional potential recharge from May 1 to Sept. 30 as follows:

10% Increase	15% Increase	23% Increase
1.12 inches	1.68 inches	2.58 inches
15,642 ac-ft	23,464 ac-ft	36,034 ac-ft

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 and all agreements entered into by the District will be consistent with this plan.

The District has adopted and will amend as necessary rules relating to the permitting of wells and the production of groundwater. The rules adopted by the District shall be 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 will be based on the best technical evidence available.

The District shall treat all citizens equally. Citizens may apply to the District for discretion in enforcement of the rules on grounds of adverse economic effect or unique local character. 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.

In an effort to recognize all potential contamination sources, the District will work to promote capping and plugging of abandoned water wells. The District will also coordinate efforts with the Railroad Commission in identifying abandoned oil and gas wells that pose potential threats to the integrity of the groundwater.

District Rules: http://www.plateauuwcsd.com/files/RULES.pdf

Methodology for Tracking Progress

The methodology that the District will use to track its progress on an annual basis in achieving its management goals will be as follows: 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 annual report will be maintained at the District office.

Coordination with Surface Water Entities

There are three adjudication certificates held by water users within the District. The District has no authority over surface water.

Goals

1.0 To provide for the most efficient use of groundwater.

Management Objective (1.1) The District realizes the importance of public education of groundwater use and conservation practices. Each year, the District will publish at least one educational article identifying conservation practices for the efficient use of groundwater. Each year, the District will respond to invitations to speak on groundwater topics to at least one group, if requested.

Performance Effectiveness Standard (1.1a) Number of articles published identifying conservation practices for the efficient use of groundwater each year.

Performance Effectiveness Standard (1.1b) Number of requests for speaking engagements and the number of speaking engagements responded to on groundwater topics each year.

Management Objective (1.2) According to District Rules, wells within the District are required to be registered and/or permitted. As part of daily operations, all wells will be registered with the District upon notification by well drillers or landowners. The District will permit all wells after determination by District personnel that all well construction criteria have been met. Upon request by the Board, District personnel shall evaluate total water usage on the requested section(s) including permitted wells and exempt wells.

Performance Effectiveness Standard (1.2a) Number of wells registered annually will be reported in the annual report to the District Board.

Performance Effectiveness Standard (1.2b) Number of wells permitted annually will be reported in the annual report to the District Board.

Performance Effectiveness Standard (1.2c) Number of evaluations performed will be reported in the annual report to the District Board.

Management Objective (1.3) The District is included in Region F Regional Planning Group. Each year that District personnel serve on the Region f RWPG Board, any committee, or office, the District will actively participate in Region F Regional Planning and attend at least 50% of meetings.

Performance Effectiveness Standard (1.3a) Percentage of Region F Regional Planning meetings attended each year.

Performance Effectiveness Standard (1.3b) Number of committees, offices, duties performed by the District each year will be reported in the annual report to the District Board.

Management Objective (1.4) The District has entered into a Cooperative Management Agreement with the West Texas Regional Groundwater Alliance. The purpose of the WTRGA is to facilitate the conservation, preservation, protection, and most efficient use of groundwater. Each year, the District will attend at least 80% of WTRGA meetings.
Performance Effectiveness Standard (1.4a) Percentage of West Texas Regional Groundwater Alliance meetings attended each year.

Management Objective (1.5) A water quality baseline will be established for the District through a monitor well program of approximately sixty wells. At least 33% of these wells will be sampled
each year. All test results will be entered into the database and a copy mailed to landowners within 30 days of testing.

Performance Effectiveness Standard(1.5a) Percentage of monitor wells sampled each year.

Performance Effectiveness Standard (1.5b) Number of days required to enter data into database and mail lab results to landowner each year.

Management Objective (1.6) The district realizes the importance of monitoring the aquifer level. An established groundwater level program of selected wells will be maintained by the District. If a well cannot be measured, the reason shall be stated in the water level report.

Performance Effectiveness Standard (1.6a) Number of water well levels obtained on an annual basis from selected monitor wells each year will be reported in the annual report to the District Board.

2.0 Implement strategies to control and prevent waste of groundwater.

Management Objective (2.1) Each year the District will identify and respond to reports of wasteful practices within five working days. Each year at least one article will be published on wasteful practices.

Performance Effectiveness Standard (2.1a) Number of reported wasteful practices identified and responded to each year will be reported in the annual report to the District Board .

Performance Effectiveness Standard (2.1b) Number of articles published on wasteful practices each year.

Management Objective (2.2) As a service to water well owners within the District, a field lab service for water analysis is available. Annually, at least, one article will be published advertising the availability of water analysis service performed by the District. Each year the District will continue to perform water quality analysis for residents of the District upon all requests.

Performance Effectiveness Standard (2.2a) Number of articles published advertising the availability of water analysis service performed by the District each year.

Performance Effectiveness Standard (2.2b) Number of water analyses requested and performed each year will be reported in the annual report to the District Board.

Management Objective(2.3) In order to prevent waste of groundwater within the District, the Board shall review annually all long term detected contamination sites to determine status and further needed activity by the District.

Performance Effectiveness Standard (2.3a) A report summarizing the annual review of contamination sites by the Board will be reported in the annual report to the District Board.

3.0 Control and prevent subsidence

The rigid geological framework of the region precludes significant subsidence from occurring. This goal is not applicable to operations of the District.

4.0 Address conjunctive surface water management issues

All surface water impoundments located within the District are used to supply water fro livestock consumption. There are no surface water management entities with surface water storage located within the District. This management goal is not applicable to the operations of the District.

5.0 Address natural resources that impact the use and availability of groundwater or are impacted by the use of groundwater within the District.

The District has no documented occurrences of endangered or threatened species dependent on groundwater. Other issues related to resources - air, water, soil, etc. supplied by nature that are useful to life are likewise not documented. Therefore, this management goal is not applicable.

6.0 Address drought conditions

Management Objective The District will monitor the Palmer Drought Severity Index by Texas Climatic Divisions at least once a month by downloading the PDSI map. If PDSI indicates that the District will experience severe drought conditions, the District will notify all public water suppliers within the District. TWDB drought information: http://waterdatafortexas.org/drought/

Performance Effectiveness Standard Number of months the PDSI map was downloaded each year.

Performance Effectiveness Standard Number of times the district experienced severe drought according to the monthly PDSI downloaded maps and the number of times that notification was sent to public water suppliers will be included in the annual report to the District Board.

7.0 Address conservation

Management Objective The District personnel will meet with Eldorado personnel at least once annually to discuss water usage and conservation techniques implemented.

Performance Effectiveness Standard The number of annual meetings with Eldorado personnel to discuss water usage and conservation techniques implemented. TWDB conservation page: http://www.twdb.texas.gov/conservation/BMPs/index.asp

Management Objective The Board shall review the District rules and determine if there is a need to update rules at least every two years. The outcome of rule reviews and the determination for any needed rule updates will be provided in a statement included in the annual report every two years.

Performance Effectiveness Standard Number of rule review determination statements in the annual report every two years.

8.0 Address in a quantitative manner the desired future conditions of the groundwater resources

Management Objective To address the desired future conditions adopted by GMA 7, the District will measure water levels in at least 25 monitor wells in the District at least 5 times per year and evaluate whether the average change in water levels conforms with the DFCs adopted by the District. The District will estimate total annual groundwater production based on water use reports, estimated exempt use, and other relevant information and compare these production estimates to the MAG.

Performance Effectiveness Standard To record the water level data and average annual change in water levels and compare to the DFCs, and to include this information in the District's Annual Report. Also, to record the total estimated annual production and compare this to the MAG and include this information in the District's Annual Report.

9.0 Precipitation Enhancement The District will participate in weather enhancement for the purpose of aquifer recharge, reduction in groundwater use and economic benefit. Each year, at least one article will be published on weather modification. All flight paths, if provided by the West Texas Weather Modification Association, will be available at the District Office for public view. All rainfall data will be recorded on a monthly basis during the program schedule. An annual report of all program results will be given to the Board of Directors.

Performance Effectiveness Standard 9.1a Number of articles written on weather modification each year.

Performance Effectiveness Standard 9.1b Number of flight paths available for public view each year.

Performance Effectiveness Standard 9.1c Number of gauges with recorded rainfall each month.

Performance Effectiveness Standard 9.1d An Annual report of program results to the Board of Directors.

Management Goals Determined Non-Applicable

1. Recharge Enhancement is not within the District's ability to be cost effective.
2. Rainwater Harvesting is not within the District's ability to be cost effective.

3. Brush Control is not within the District's ability to be cost effective.

4. Controlling and Preventing Subsidence. Because of the rigid geological framework in this area, no significant subsidence occurs.

5. Addressing Natural Resource Issues. The District has no documented occurrence of endangered or threatened species dependent on groundwater.

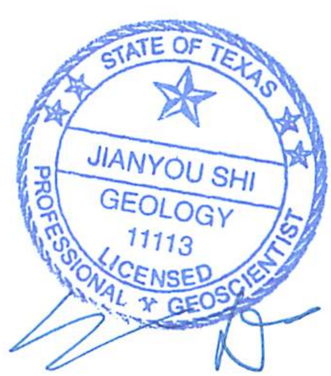
6. Addressing conjunctive Surface Water Management Issues. There are no surface water management entities within the District.

APPENDIX A

https://www.twdb.texas.gov/groundwater/docs/GAMruns/GR10-043_MAG_v2.pdf

GAM Run 10-043 MAG (Version 2): Modeled Available Groundwater for the Edwards-Trinity (Plateau), Trinity, and Pecos Valley Aquifers in Groundwater Management Area 7

by Jerry Shi, Ph.D., P.G.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-5076
November 12, 2012



The seal appearing on this document was authorized by Jianyou (Jerry) Shi, P.G. 11113 on November 12, 2012.

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GAM RUN 10-043 MAG (VERSION 2): MODELED AVAILABLE GROUNDWATER FOR THE EDWARDS-TRINITY (PLATEAU), TRINITY, AND PECOS VALLEY AQUIFERS IN GROUNDWATER MANAGEMENT AREA 7

by Jerry Shi, Ph.D., P.G.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-5076
November 12, 2012

EXECUTIVE SUMMARY:

The modeled available groundwater values for Groundwater Management Area 7 for the Edwards-Trinity (Plateau), Trinity, and Pecos Valley aquifers are summarized in Table 1. These values are also listed by county (Table 2), river basin (Table 3), and regional water planning area (Table 3). The modeled available groundwater values for the relevant aquifers in Groundwater Management Area 7 were initially based on Scenario 10 of GAM Run 09-035. In GAM Run 09-035, the Edwards-Trinity (Plateau), Trinity, and Pecos Valley aquifers were simulated and reported together. Though the desired future condition statement, specifying an average drawdown of 7 feet, only explicitly references the Edwards-Trinity (Plateau) Aquifer, it is the intent of the districts to also incorporate the Trinity and Pecos Valley aquifers. This was confirmed by Ms. Caroline Runge of Menard Underground Water District acting on behalf of Groundwater Management Area 7 in an e-mail to Ms. Sarah Backhouse at the Texas Water Development Board on June 6, 2012. The results here, therefore, contain information for each of these three aquifers. The modeled available groundwater from the Edwards-Trinity (Plateau), Trinity, and Pecos Valley aquifers in Groundwater Management Area 7 that achieves the requested desired future conditions is approximately 449,400 acre-feet per year from 2010 to 2060.

Earlier draft versions of this report showed modeled available groundwater for portions of the Edwards-Trinity (Plateau) Aquifer within the Lipan-Kickapoo Water Conservation District, the Lone Wolf Groundwater Conservation District, the Hickory Underground Water Conservation District No. 1, and the portion of the Trinity Aquifer within the Uvalde Underground Water Conservation District. However, Groundwater Management Area 7 declared those counties “not relevant” for joint planning purposes. Since modeled available groundwater only applies to areas with a specified desired future condition, we updated this report to depict modeled available groundwater only in counties with specified desired future conditions.

The modeled available groundwater for Kinney County Groundwater Conservation District previously reported in Draft GAM Run 10-043 MAG (Shi and Oliver, 2011) dated January 26, 2011, has been updated in a new model run and is presented in this report. The new model run is an update of Scenario 3 of Groundwater Availability Modeling Task 10-027, which meets the desired future conditions for the area adopted by the districts of Groundwater Management Area 7.

REQUESTOR:

Mr. Allan Lange of Lipan-Kickapoo Water Conservation District on behalf of Groundwater Management Area 7.

DESCRIPTION OF REQUEST:

In a letter dated August 13, 2010, Mr. Lange provided the Texas Water Development Board (TWDB) with the desired future conditions of the Edwards-Trinity (Plateau) Aquifer in Groundwater Management Area 7. On June 6, 2012 TWDB clarified through e-mail with Ms. Caroline Runge of Menard Underground Water District acting on behalf of Groundwater Management Area 7 that the intent of the districts within Groundwater Management Area 7 was to also incorporate the Trinity and Pecos Valley aquifers, except where explicitly stated as non-relevant in the desired future conditions of the Edwards-Trinity (Plateau) Aquifer. The desired future conditions for the aquifer[s], as described in Resolution # 07-29-10-9 and adopted July 29, 2010 by the groundwater conservation districts within Groundwater Management Area 7, are described below:

1) An average drawdown of 7 feet for the Edwards-Trinity (Plateau)[, Pecos Valley, and Trinity] aquifer[s], except for the Kinney County [Groundwater Conservation District], based on Scenario 10 of the TWDB [Groundwater Availability Model] run 09-35 which is incorporated in its entirety into this resolution; and

2) In Kinney County, that drawdown which is consistent with maintaining, at Las Moras Springs, an annual average flow of 23.9 [cubic feet per second] and a median flow of 24.4 [cubic feet per second] based on Scenario 3 of the Texas Water Development Board's flow model presented on July 27, 2010; and

3) the Edwards-Trinity [Aquifer] is not relevant for joint planning purposes within the boundaries of the Lipan-Kickapoo [Water Conservation District], the Lone Wolf [Groundwater Conservation District], and the Hickory Underground Water Conservation District No. 1; and

4) the Trinity (Hill Country) portion of the aquifer is not relevant for joint planning purposes within the boundaries of the Uvalde [Underground Water Conservation District] in [Groundwater Management Area] 7.

METHODS, PARAMETERS AND ASSUMPTIONS:

The desired future condition for Kinney County was evaluated in a new model run (Shi and others, 2012). The new model run is an update of Scenario 3 of Groundwater Availability Modeling (GAM) Task 10-027 (Hutchison, 2010a). Both model runs were based on the MODFLOW-2000 model developed by the TWDB to assist with the joint planning process regarding the Kinney County Groundwater Conservation District (Hutchison and others, 2011b). In both model runs, the total pumping in Kinney County, which lies within Groundwater Management Areas 7 and 10, was maintained at approximately 77,000 acre-feet per year to achieve the desired future conditions at Las Moras Springs. Details regarding this new model run are summarized in Shi and others (2012).

The desired future condition for the remaining areas in Groundwater Management Area 7 was based on Scenario 10 of GAM Run 09-035 using a MODFLOW-2000 model developed by the TWDB (Hutchison and others, 2011a). Details regarding this scenario can be found in Hutchison (2010b). In GAM Run 09-035, the Edwards-Trinity (Plateau), Trinity, Pecos Valley, and Trinity aquifers were simulated and reported together. The desired future condition statement specifying of an average drawdown of 7 feet, which is achieved in the above simulation, only explicitly references the Edwards-Trinity (Plateau) Aquifer. By stating that the above simulation is "incorporated in its entirety" into the resolution, it is the intent of the districts to also incorporate the Trinity and Pecos Valley aquifers. The results below, therefore, contain information on the Trinity and Pecos Valley aquifers in addition to the Edwards-Trinity (Plateau) Aquifer. This interpretation has been confirmed by Ms. Caroline Runge on behalf of Groundwater Management Area 7 to Ms. Sarah Backhouse at the Texas Water Development Board.

The locations of the Edwards-Trinity (Plateau), Trinity, and Pecos Valley aquifers are shown in Figure 1.

RESULTS:

The modeled available groundwater values from aquifers in Groundwater Management Area 7 that achieve the desired future conditions is approximately 445,000 acre-feet per year for the Edwards-Trinity (Plateau) aquifer, 2,500 acre-feet per year for the Trinity Aquifer, and 1,600 acre-feet per year for the Pecos Valley Aquifer (Tables 1, 2, and 3). These tables contain the modeled available groundwater for the aquifers subdivided by county, regional water planning area, and river basin for use in the regional water planning process. These areas are shown in Figure 2.

Tables 4, 5, and 6 show the modeled available groundwater for the Edwards-Trinity (Plateau), Trinity, and Pecos Valley aquifers summarized by county, regional water planning area, and river basin, respectively, within Groundwater Management Area 7.

The modeled available groundwater for the aquifers within and outside the groundwater conservation districts in Groundwater Management Area 7 where they were determined to be relevant for the purposes of joint planning are presented in Table 7. As shown in Table 7, the modeled available groundwater within the groundwater conservation districts in Groundwater Management Area 7 is approximately 370,000 acre-feet per year from 2010 to 2060.

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.

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. Texas Water Development Board 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 groundwater model and the assumptions in this analysis, it is important that the groundwater conservation districts work with Texas Water Development Board 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.

REFERENCES:

Hutchison, William R., 2010a, GAM Task 10-027: Texas Water Development Board, GAM Task 10-027 Report, 7 p.

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TABLE 1. MODELED AVAILABLE GROUNDWATER FOR THE EDWARDS-TRINITY (PLATEAU) AQUIFER IN GROUNDWATER MANAGEMENT AREA 7. 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
Coke	F	Colorado	998	998	998	998	998	998
Crockett	F	Colorado	19	19	19	19	19	19
		Rio Grande	5,407	5,407	5,407	5,407	5,407	5,407
Ector	F	Colorado	4,918	4,918	4,918	4,918	4,918	4,918
		Rio Grande	504	504	504	504	504	504
Edwards	J	Colorado	2,306	2,306	2,306	2,306	2,306	2,306
		Nueces	1,632	1,632	1,632	1,632	1,632	1,632
		Rio Grande	1,700	1,700	1,700	1,700	1,700	1,700
Gillespie	K	Colorado	2,378	2,378	2,378	2,378	2,378	2,378
		Guadalupe	136	136	136	136	136	136
Glasscock	F	Colorado	65,213	65,213	65,213	65,213	65,213	65,213
Irion	F	Colorado	2,293	2,293	2,293	2,293	2,293	2,293
Kimble	F	Colorado	1,283	1,283	1,283	1,283	1,283	1,283
Kinney	J	Nueces	12	12	12	12	12	12
		Rio Grande	70,326	70,326	70,326	70,326	70,326	70,326
McCulloch	F	Colorado	4	4	4	4	4	4
Menard	F	Colorado	2,194	2,194	2,194	2,194	2,194	2,194
Midland	F	Colorado	23,251	23,251	23,251	23,251	23,251	23,251
Nolan	G	Brazos	302	302	302	302	302	302
		Colorado	391	391	391	391	391	391
Pecos	F	Rio Grande	115,938	115,938	115,938	115,938	115,938	115,938
Reagan	F	Colorado	68,250	68,250	68,250	68,250	68,250	68,250
		Rio Grande	28	28	28	28	28	28
Real	J	Colorado	278	278	278	278	278	278
		Guadalupe	3	3	3	3	3	3
		Nueces	7,196	7,196	7,196	7,196	7,196	7,196
Schleicher	F	Colorado	6,410	6,410	6,410	6,410	6,410	6,410
		Rio Grande	1,640	1,640	1,640	1,640	1,640	1,640
Sterling	F	Colorado	2,497	2,497	2,497	2,497	2,497	2,497
Sutton	F	Colorado	386	386	386	386	386	386
		Rio Grande	6,052	6,052	6,052	6,052	6,052	6,052

TABLE 1. MODELED AVAILABLE GROUNDWATER FOR THE EDWARDS-TRINITY (PLATEAU) AQUIFER IN GROUNDWATER MANAGEMENT AREA 7. 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
Taylor	G	Brazos	331	331	331	331	331	331
		Colorado	158	158	158	158	158	158
Terrell	E	Rio Grande	1,421	1,421	1,421	1,421	1,421	1,421
Tom Green	F	Colorado	426	426	426	426	426	426
Upton	F	Colorado	21,257	21,257	21,257	21,257	21,257	21,257
		Rio Grande	1,122	1,122	1,122	1,122	1,122	1,122
Uvalde	L	Nueces	1,635	1,635	1,635	1,635	1,635	1,635
Val Verde	J	Rio Grande	24,988	24,988	24,988	24,988	24,988	24,988
Grand Total			**445,283**	**445,283**	**445,283**	**445,283**	**445,283**	**445,283**

TABLE 2. MODELED AVAILABLE GROUNDWATER FOR THE TRINITY AQUIFER IN GROUNDWATER MANAGEMENT AREA 7. 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
Gillespie	K	Colorado	2,482	2,482	2,482	2,482	2,482	2,482
Real	J	Nueces	52	52	52	52	52	52
Total			**2,534**	**2,534**	**2,534**	**2,534**	**2,534**	**2,534**

TABLE 3. MODELED AVAILABLE GROUNDWATER FOR THE PECOS VALLEY AQUIFER IN GROUNDWATER MANAGEMENT AREA 7. 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
Crockett	F	Rio Grande	31	31	31	31	31	31
Ector	F	Rio Grande	113	113	113	113	113	113
Pecos	F	Rio Grande	1,448	1,448	1,448	1,448	1,448	1,448
Upton	F	Rio Grande	2	2	2	2	2	2
Total			**1,594**	**1,594**	**1,594**	**1,594**	**1,594**	**1,594**

TABLE 4. MODELED AVAILABLE GROUNDWATER FOR THE EDWARDS-TRINITY (PLATEAU), TRINITY, AND PECOS VALLEY AQUIFERS IN GROUNDWATER MANAGEMENT AREA 7 BY COUNTY FOR EACH DECADE BETWEEN 2010 AND 2060. RESULTS ARE IN ACRE-FEET PER YEAR.

County	2010	2020	2030	2040	2050	2060
Coke	998	998	998	998	998	998
Crockett	5,457	5,457	5,457	5,457	5,457	5,457
Ector	5,535	5,535	5,535	5,535	5,535	5,535
Edwards	5,638	5,638	5,638	5,638	5,638	5,638
Gillespie	4,996	4,996	4,996	4,996	4,996	4,996
Glasscock	65,213	65,213	65,213	65,213	65,213	65,213
Irion	2,293	2,293	2,293	2,293	2,293	2,293
Kimble	1,283	1,283	1,283	1,283	1,283	1,283
Kinney	70,338	70,338	70,338	70,338	70,338	70,338
Mcculloch	4	4	4	4	4	4
Menard	2,194	2,194	2,194	2,194	2,194	2,194
Midland	23,251	23,251	23,251	23,251	23,251	23,251
Nolan	693	693	693	693	693	693
Pecos	117,386	117,386	117,386	117,386	117,386	117,386
Reagan	68,278	68,278	68,278	68,278	68,278	68,278
Real	7,529	7,529	7,529	7,529	7,529	7,529
Schleicher	8,050	8,050	8,050	8,050	8,050	8,050
Sterling	2,497	2,497	2,497	2,497	2,497	2,497
Sutton	6,438	6,438	6,438	6,438	6,438	6,438

TABLE 4. MODELED AVAILABLE GROUNDWATER FOR THE EDWARDS-TRINITY (PLATEAU), TRINITY, AND PECOS VALLEY AQUIFERS IN GROUNDWATER MANAGEMENT AREA 7 BY COUNTY FOR EACH DECADE BETWEEN 2010 AND 2060. RESULTS ARE IN ACRE-FEET PER YEAR.

County	2010	2020	2030	2040	2050	2060
Taylor	489	489	489	489	489	489
Terrell	1,421	1,421	1,421	1,421	1,421	1,421
Tom Green	426	426	426	426	426	426
Upton	22,381	22,381	22,381	22,381	22,381	22,381
Uvalde	1,635	1,635	1,635	1,635	1,635	1,635
Val Verde	24,988	24,988	24,988	24,988	24,988	24,988
Total	**449,411**	**449,411**	**449,411**	**449,411**	**449,411**	**449,411**

TABLE 5. MODELED AVAILABLE GROUNDWATER FOR THE EDWARDS-TRINITY (PLATEAU), TRINITY, AND PECOS VALLEY AQUIFERS IN GROUNDWATER MANAGEMENT AREA 7 BY REGIONAL WATER PLANNING AREA 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
E	1,421	1,421	1,421	1,421	1,421	1,421
F	331,684	331,684	331,684	331,684	331,684	331,684
G	1,182	1,182	1,182	1,182	1,182	1,182
J	108,493	108,493	108,493	108,493	108,493	108,493
K	4,996	4,996	4,996	4,996	4,996	4,996
L	1,635	1,635	1,635	1,635	1,635	1,635
Total	**449,411**	**449,411**	**449,411**	**449,411**	**449,411**	**449,411**

TABLE 6. MODELED AVAILABLE GROUNDWATER FOR THE EDWARDS-TRINITY (PLATEAU), TRINITY, AND PECOS VALLEY AQUIFERS IN GROUNDWATER MANAGEMENT AREA 7 BY RIVER BASIN FOR EACH DECADE BETWEEN 2010 AND 2060. RESULTS ARE IN ACRE-FEET PER YEAR.

River Basin	Year					
	2010	2020	2030	2040	2050	2060
Brazos	633	633	633	633	633	633
Colorado	207,392	207,392	207,392	207,392	207,392	207,392
Guadalupe	139	139	139	139	139	139
Nueces	10,527	10,527	10,527	10,527	10,527	10,527
Rio Grande	230,720	230,720	230,720	230,720	230,720	230,720
Total	**449,411**	**449,411**	**449,411**	**449,411**	**449,411**	**449,411**

TABLE 7. MODELED AVAILABLE GROUNDWATER FOR THE EDWARDS-TRINITY (PLATEAU), TRINITY, AND PECOS VALLEY AQUIFERS IN GROUNDWATER MANAGEMENT AREA 7 BY GROUNDWATER CONSERVATION DISTRICT FOR EACH DECADE BETWEEN 2010 AND 2060. RESULTS ARE IN ACRE-FEET PER YEAR.

Groundwater Conservation District	Year					
	2010	2020	2030	2040	2050	2060
Coke County UWCD	998	998	998	998	998	998
Crockett County GCD	4,685	4,685	4,685	4,685	4,685	4,685
Glasscock GCD	106,075	106,075	106,075	106,075	106,075	106,075
Hill Country UWCD	4,996	4,996	4,996	4,996	4,996	4,996
Irion County WCD	2,435	2,435	2,435	2,435	2,435	2,435
Kimble County GCD	1,283	1,283	1,283	1,283	1,283	1,283
Kinney County GCD	70,338	70,338	70,338	70,338	70,338	70,338
Menard County UWD	2,194	2,194	2,194	2,194	2,194	2,194
Middle Pecos GCD	117,386	117,386	117,386	117,386	117,386	117,386
Plateau UWC and SD	8,050	8,050	8,050	8,050	8,050	8,050
Real-Edwards CRD	13,167	13,167	13,167	13,167	13,167	13,167
Santa Rita UWCD	27,416	27,416	27,416	27,416	27,416	27,416
Sterling County UWCD	2,497	2,497	2,497	2,497	2,497	2,497
Sutton County UWCD	6,438	6,438	6,438	6,438	6,438	6,438
Uvalde County UWCD (Edwards-Trinity Plateau)	1,635	1,635	1,635	1,635	1,635	1,635
Wes-Tex GCD	693	693	693	693	693	693

TABLE 7. MODELED AVAILABLE GROUNDWATER FOR THE EDWARDS-TRINITY (PLATEAU), TRINITY, AND PECOS VALLEY AQUIFERS IN GROUNDWATER MANAGEMENT AREA 7 BY GROUNDWATER CONSERVATION DISTRICT FOR EACH DECADE BETWEEN 2010 AND 2060. RESULTS ARE IN ACRE-FEET PER YEAR.

Groundwater Conservation District	Year					
	2010	2020	2030	2040	2050	2060
Total (areas in districts relevant for joint planning)	**370,286**	**370,286**	**370,286**	**370,286**	**370,286**	**370,286**
No District	79,125	79,125	79,125	79,125	79,125	79,125
Total (all areas)	**449,411**	**449,411**	**449,411**	**449,411**	**449,411**	**449,411**

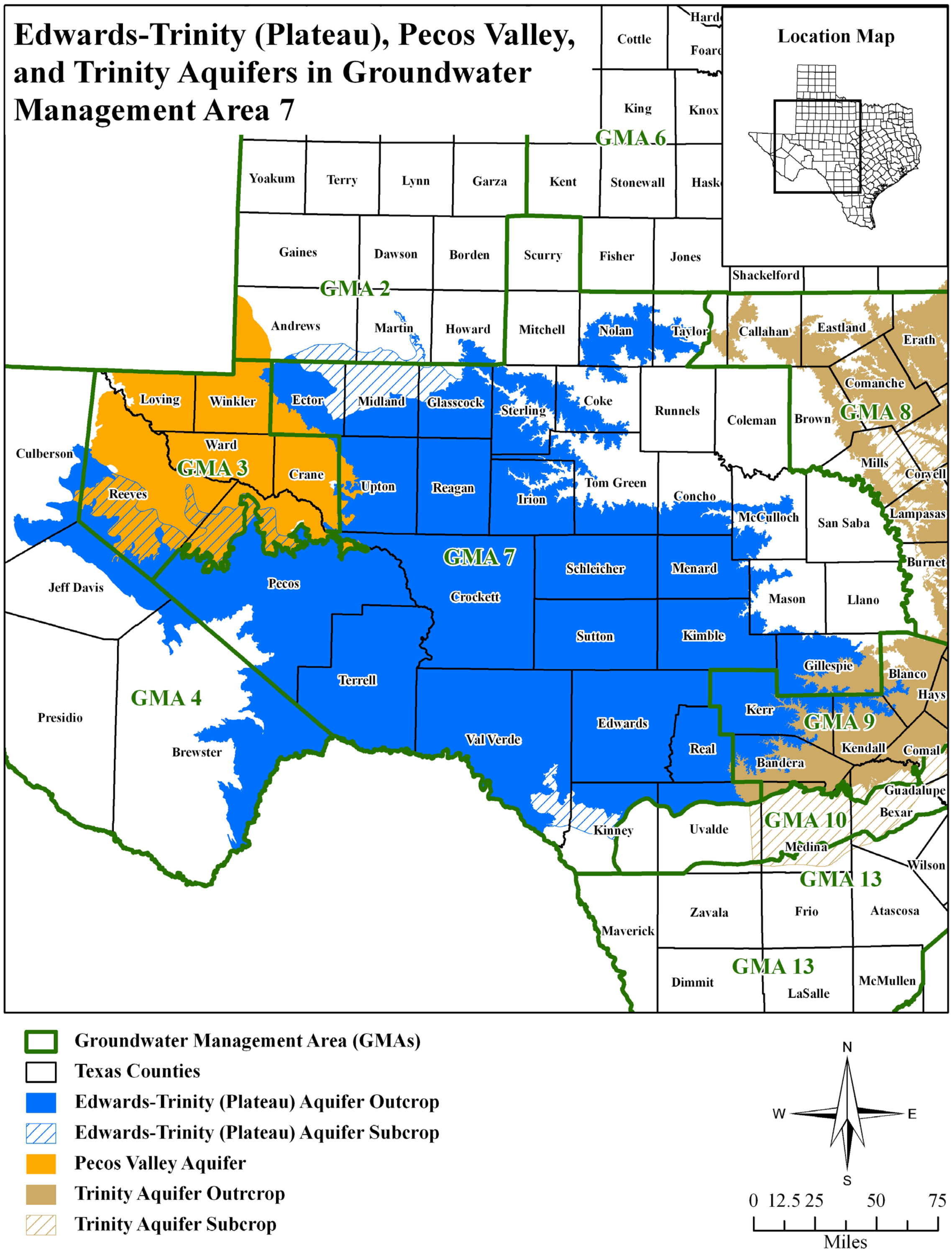

FIGURE 1. MAP SHOWING THE BOUNDARY OF THE EDWARDS-TRINITY (PLATEAU), PECOS VALLEY, AND TRINITY AQUIFERS ACCORDING TO THE 2007 STATE WATER PLAN (TWDB, 2007).

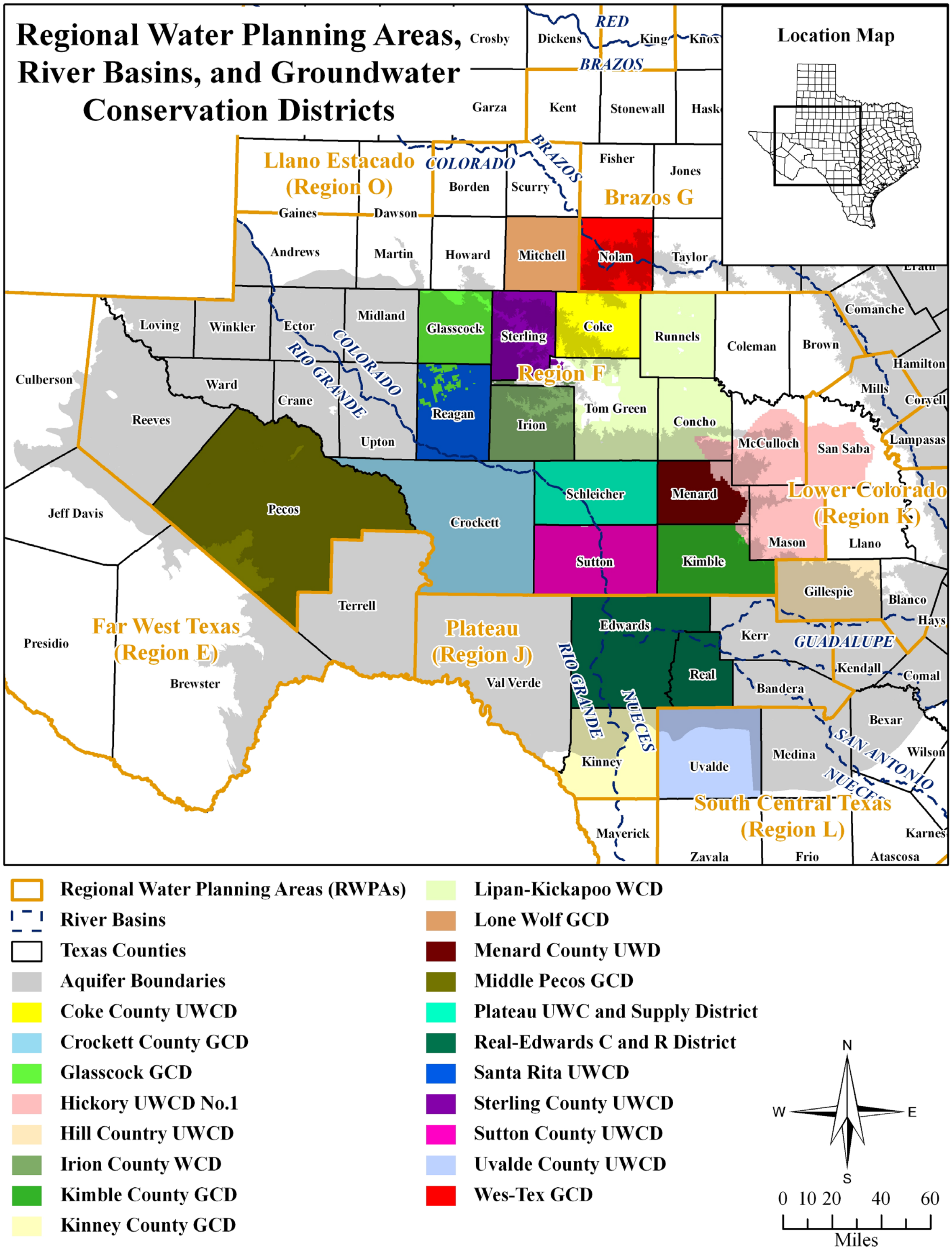

FIGURE 2. MAP SHOWING REGIONAL WATER PLANNING AREAS, GROUNDWATER CONSERVATION DISTRICTS, COUNTIES, AND RIVER BASINS IN AND NEIGHBORING GROUNDWATER MANAGEMENT AREA 7.

APPENDIX B

Plateau GW Management Plan Data (4).pdf

Estimated Historical Water Use And 2012 State Water Plan Datasets:

Plateau Underground Water Conservation And Supply District

by Stephen Allen
Texas Water Development Board
Groundwater Resources Division
Groundwater Technical Assistance Section
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(512) 463-7317
February 12, 2014

GROUNDWATER MANAGEMENT PLAN DATA:

This package of water data reports (part 1 of a 2-part package of information) is being provided to groundwater conservation districts to help them meet the requirements for approval of their five-year groundwater management plan. Each report in the package addresses a specific numbered requirement in the Texas Water Development Board's groundwater management plan checklist. The checklist can be viewed and downloaded from this web address:

http://www.twdb.texas.gov/groundwater/docs/GCD/GMPChecklist0113.pdf

The five reports included in part 1 are:

1. Estimated Historical Water Use (checklist Item 2)

   from the TWDB Historical Water Use Survey (WUS)

2. Projected Surface Water Supplies (checklist Item 6)
3. Projected Water Demands (checklist Item 7)
4. Projected Water Supply Needs (checklist Item 8)
5. Projected Water Management Strategies (checklist Item 9)

   reports 2-5 are from the 2012 Texas State Water Plan (SWP)

Part 2 of the 2-part package is the groundwater availability model (GAM) report. The District should have received, or will receive, this report from the Groundwater Availability Modeling Section. Questions about the GAM can be directed to Dr. Shirley Wade, shirley.wade@twdb.texas.gov, (512) 936-0883.

DISCLAIMER:

The data presented in this report represents the most up-to-date WUS and 2012 SWP data available as of 2/12/2014. Although it does not happen frequently, neither of these datasets are static so they are subject to change pending the availability of more accurate WUS data or an amendment to the 2012 SWP. District personnel must review these datasets and correct any discrepancies in order to ensure approval of their groundwater management plan.

The WUS dataset can be verified at this web address:

http://www.twdb.texas.gov/waterplanning/waterusesurvey/estimates/

The 2012 SWP dataset can be verified by contacting Sabrina Anderson (sabrina.anderson@twdb.texas.gov or 512-936-0886).

For additional questions regarding this data, please contact Stephen Allen (stephen.allen@twdb.texas.gov or 512-463-7317) or Rima Petrossian (rima.petrossian@twdb.texas.gov or 512-936-2420).

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

Groundwater and surface water historical use estimates are currently unavailable for calendar year 2012. TWDB staff anticipates the calculation and posting of these estimates at a later date.

SCHLEICHER COUNTY

All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2011	GW	807	0	160	0	1,941	414	3,322
	SW	0	0	27	0	0	22	49
2010	GW	617	0	72	0	1,442	422	2,553
	SW	0	0	12	0	0	22	34
2009	GW	614	0	58	0	1,432	463	2,567
	SW	0	0	9	0	0	24	33
2008	GW	611	0	44	0	1,095	467	2,217
	SW	0	0	7	0	0	24	31
2007	GW	484	0	17	0	500	508	1,509
	SW	0	0	0	0	0	27	27
2006	GW	481	0	18	0	1,005	506	2,010
	SW	0	0	0	0	0	27	27
2005	GW	473	0	18	0	762	477	1,730
	SW	0	0	0	0	0	25	25
2004	GW	485	0	18	0	734	247	1,484
	SW	0	0	0	0	0	253	253
2003	GW	461	0	18	0	964	222	1,665
	SW	0	0	0	0	0	228	228
2002	GW	591	0	17	0	1,300	243	2,151
	SW	0	0	0	0	0	249	249
2001	GW	552	0	18	0	1,294	273	2,137
	SW	0	0	0	0	0	279	279
2000	GW	657	0	18	0	2,150	438	3,263
	SW	0	0	0	0	0	109	109

Projected Surface Water Supplies
TWDB 2012 State Water Plan Data

SCHLEICHER COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
F	IRRIGATION	COLORADO	SAN SABA RIVER RUN-OF-RIVER IRRIGATION	0	0	0	0	0	0
F	LIVESTOCK	COLORADO	LIVESTOCK LOCAL SUPPLY	83	83	83	83	83	83
F	LIVESTOCK	RIO GRANDE	LIVESTOCK LOCAL SUPPLY	29	29	29	29	29	29
F	MINING	COLORADO	SAN SABA RIVER RUN-OF-RIVER MINING	0	0	0	0	0	0
	Sum of Projected Surface Water Supplies (acre-feet/year)			**112**	**112**	**112**	**112**	**112**	**112**

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.

SCHLEICHER COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
F	COUNTY-OTHER	COLORADO	117	108	102	98	95	93
F	LIVESTOCK	COLORADO	583	583	583	583	583	583
F	IRRIGATION	COLORADO	1,750	1,716	1,680	1,645	1,609	1,575
F	MINING	COLORADO	125	134	139	144	149	154
F	ELDORADO	COLORADO	581	644	671	675	691	711
F	COUNTY-OTHER	RIO GRANDE	25	23	22	21	20	20
F	IRRIGATION	RIO GRANDE	358	351	344	337	330	322
F	LIVESTOCK	RIO GRANDE	204	204	204	204	204	204
	Sum of Projected Water Demands (acre-feet/year)		**3,743**	**3,763**	**3,745**	**3,707**	**3,681**	**3,662**

Projected Water Supply Needs
TWDB 2012 State Water Plan Data

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

SCHLEICHER COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
F	COUNTY-OTHER	COLORADO	0	0	0	0	0	0
F	COUNTY-OTHER	RIO GRANDE	0	0	0	0	0	0
F	ELDORADO	COLORADO	129	66	39	35	19	0
F	IRRIGATION	COLORADO	536	570	606	641	677	711
F	IRRIGATION	RIO GRANDE	488	495	502	509	516	524
F	LIVESTOCK	COLORADO	0	0	0	0	0	0
F	LIVESTOCK	RIO GRANDE	0	0	0	0	0	0
F	MINING	COLORADO	25	16	11	6	1	0
	Sum of Projected Water Supply Needs (acre-feet/year)		**0**	**0**	**0**	**0**	**0**	**0**

Projected Water Management Strategies
TWDB 2012 State Water Plan Data

SCHLEICHER COUNTY

WUG, Basin (RWPG)

All values are in acre-feet/year

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
IRRIGATION, COLORADO (F)							
IRRIGATION CONSERVATION	CONSERVATION [SCHLEICHER]	0	89	178	178	178	178
IRRIGATION, RIO GRANDE (F)							
IRRIGATION CONSERVATION	CONSERVATION [SCHLEICHER]	0	18	36	36	36	36
Sum of Projected Water Management Strategies (acre-feet/year)		**0**	**107**	**214**	**214**	**214**	**214**

APPENDIX C

https://www.twdb.texas.gov/groundwater/docs/GAMruns/GR13-009.pdf

GAM Run 13-009: Plateau Underground Water Conservation And Supply District Management Plan

by Radu Boghici, P.G.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-5808
July 3, 2013

STATE OF TEXAS
RADU BOGHICI
GEOLOGY
No. 482
LICENSED
PROFESSIONAL GEOSCIENTIST

Radu Boghici
7/3/2013

The seal appearing on this document was authorized by Radu Boghici, P.G. 482 on July 3, 2013.

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GAM Run 13-009: Plateau Underground Water Conservation And Supply District Management Plan

by Radu Boghici, P.G.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-5808
July 3, 2013

EXECUTIVE SUMMARY:

Texas State Water Code, Section 36.1071, Subsection (h), states that, in developing its groundwater management plan, a groundwater conservation district shall use groundwater availability modeling information provided by the executive administrator of the 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 Plateau Underground Water Conservation and Supply District) fulfills the requirements noted above. Part 1 of the 2-part package is the 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 Plateau Underground Water Conservation and Supply District should be adopted by the district on or before January 24, 2014 and submitted to the executive administrator of the TWDB on or before February 23, 2014. The current management plan for the Plateau Underground Water Conservation and Supply District expires on April 24, 2014.

This report discusses the methods, assumptions, and results from model runs using the groundwater availability model (version 1.01) for the Edwards-Trinity (Plateau) and Pecos Valley aquifers (Anaya and Jones, 2009), and the groundwater availability model (version 1.01) for the Lipan Aquifer (Beach and others, 2004). Tables 1 and 2 summarize the groundwater availability model data required by the statute for each aquifer, and Figures 1 and 2 show the areas of the models from which the values in the tables were extracted. This model run replaces the results of GAM Run 08-051. GAM Run 13-009 meets current standards set after the release of GAM Run 08-051 including a refinement of using the extent of the official aquifers boundaries within the district. The water budget values listed in the two model runs may differ because of this change in methodology. If, after review of the figures, Plateau Underground Water Conservation and Supply District determines that the district boundaries used in the assessment do not reflect current conditions, the District should notify the Texas Water Development Board immediately. Per statute, TWDB is required to provide the districts with data from the official groundwater availability models; however, the TWDB has also approved, for planning purposes, an alternative model for the Edwards-Trinity (Plateau) Aquifer that can have water budget information extracted for the district. The alternative model is the 1-layer alternative model for the Edwards-Trinity (Plateau) and Pecos Valley aquifers (Hutchison and others, 2011). Please contact the author of this report if a comparison table using this model is desired.

METHODS:

In accordance with the provisions of the Texas State Water Code, Section 36.1071, Subsection (h), the groundwater availability model for the Edwards-Trinity (Plateau) and Pecos Valley aquifers and the groundwater availability model for the Lipan Aquifer were run for this analysis. Plateau Underground Water Conservation and Supply District Water budgets for the historical model periods were extracted 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 portions of the aquifers located within the district are summarized in this report.

PARAMETERS AND ASSUMPTIONS:

Edwards-Trinity (Plateau) Aquifer

- We used version 1.01 of the groundwater availability model for the Edwards-Trinity (Plateau) and Pecos Valley aquifers. See Anaya and Jones (2009) for assumptions and limitations of the groundwater availability model for the Edwards-Trinity (Plateau) and Pecos Valley aquifers. The Pecos Valley Aquifer does not occur within the boundaries of the Plateau Underground Water and Supply District, and therefore no groundwater budget values are included for it in this report.

- This groundwater availability model includes two layers within the boundaries of the Plateau Underground Water and Supply District, which generally represent the Edwards Group (Layer 1) and the Trinity Group (Layer 2) of the Edwards-Trinity (Plateau) Aquifer. Individual water budgets for the District were determined for the Edwards-Trinity (Plateau) Aquifer (Layer 1 and Layer 2 combined).

- For Plateau Underground Water and Supply District, groundwater in the Edwards-Trinity (Plateau) Aquifer ranges from fresh to saline, with total dissolved solids of less than 1,000 milligrams per liter in nearly 99 percent of the wells in the TWDB groundwater database. (TWDB Groundwater Database, queried June 2013).

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

Lipan Aquifer

- We used version 1.01 of the groundwater availability model for the Lipan Aquifer for this analysis. See Beach and others (2004) for assumptions and limitations of the model.

- The Lipan Aquifer model includes one layer representing the Quaternary Leona Formation, portions of the underlying Permian Formations, and the Edwards-Trinity (Plateau) Aquifer to the west, south, and north.

- There are no groundwater quality data in the TWDB groundwater database for Plateau Underground Water and Supply District. Twenty miles north of the district, in Tom Green County, groundwater in the Lipan Aquifer is brackish, with total dissolved solids ranging from 1,200 to 2,900 milligrams per liter. (TWDB Groundwater Database, queried June 2013).

- 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 runs in the district, as shown in Table 1.

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

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

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

- Flow between aquifers—The net vertical flow between aquifers or confining units. This flow is controlled by the relative water levels in each aquifer or confining unit and aquifer properties of each aquifer or confining unit that define the amount of leakage that occurs. “Inflow” to an aquifer from an overlying or underlying aquifer will always equal the “Outflow” from the other aquifer.

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

TABLE 1: SUMMARIZED INFORMATION FOR THE EDWARDS-TRINITY (PLATEAU) AQUIFER THAT IS NEEDED FOR THE PLATEAU UNDERGROUND WATER CONSERVATION AND SUPPLY 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-Trinity (Plateau) Aquifer	22,337
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Edwards-Trinity (Plateau) Aquifer	8,317
Estimated annual volume of flow into the district within each aquifer in the district	Edwards-Trinity (Plateau) Aquifer	7,791
Estimated annual volume of flow out of the district within each aquifer in the district	Edwards-Trinity (Plateau) Aquifer	28,701
Estimated net annual volume of flow between each aquifer in the district	Edwards-Trinity (Plateau) Aquifer into/from adjacent formations	Not applicable

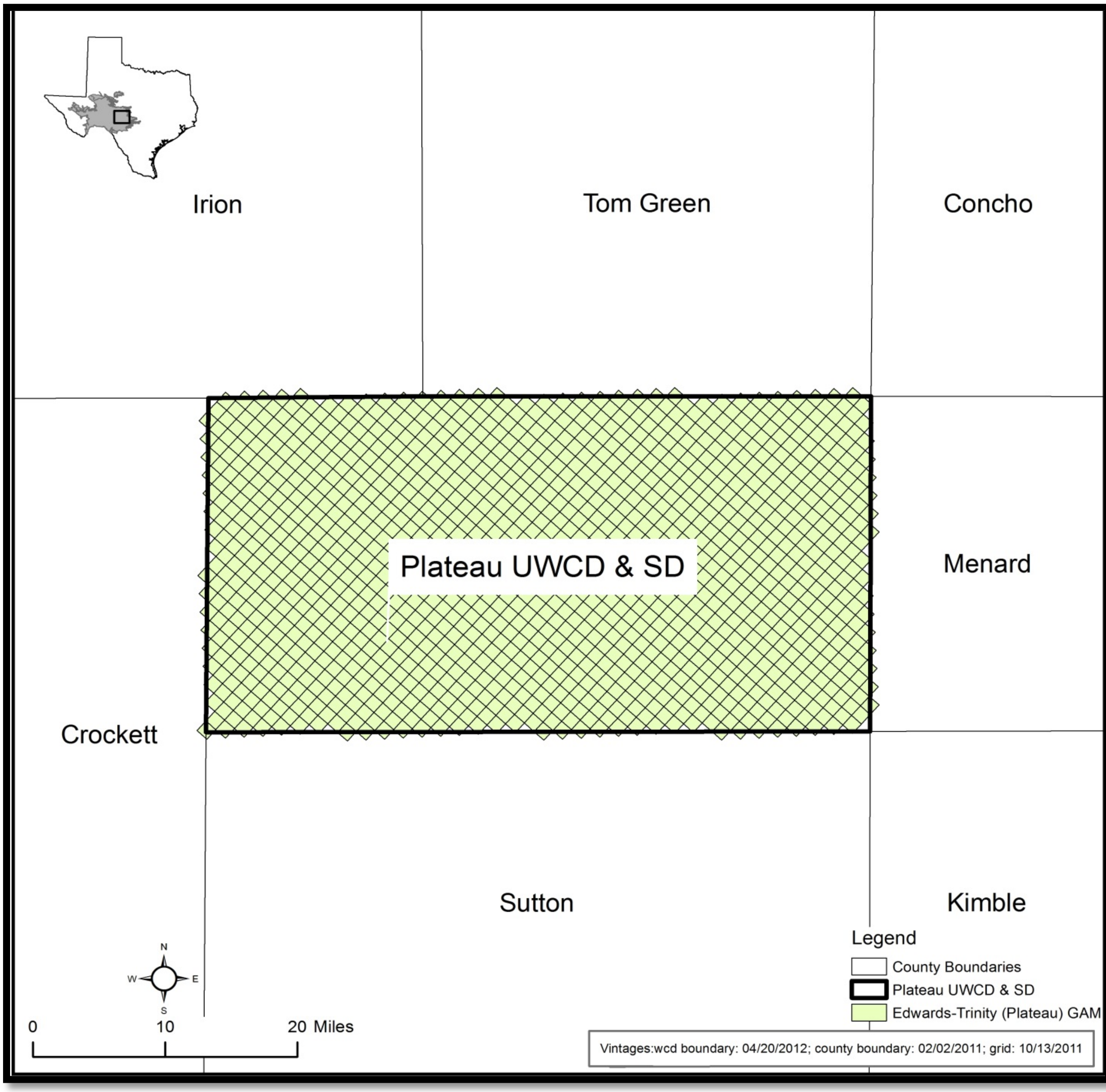

FIGURE 1: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE EDWARDS-TRINITY (PLATEAU) AND PECOS VALLEY AQUIFERS FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED FORTHE EDWARDS-TRINITY (PLATEAU) AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY.

TABLE 2: SUMMARIZED INFORMATION FOR THE LIPAN AQUIFER THAT IS NEEDED FOR THE PLATEAU UNDERGROUND WATER CONSERVATION AND SUPPLY 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	Lipan Aquifer	397
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Lipan Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Lipan Aquifer	18
Estimated annual volume of flow out of the district within each aquifer in the district	Lipan Aquifer	413
Estimated net annual volume of flow between each aquifer in the district	Lipan Aquifer into/from the underlying formations	Not Applicable

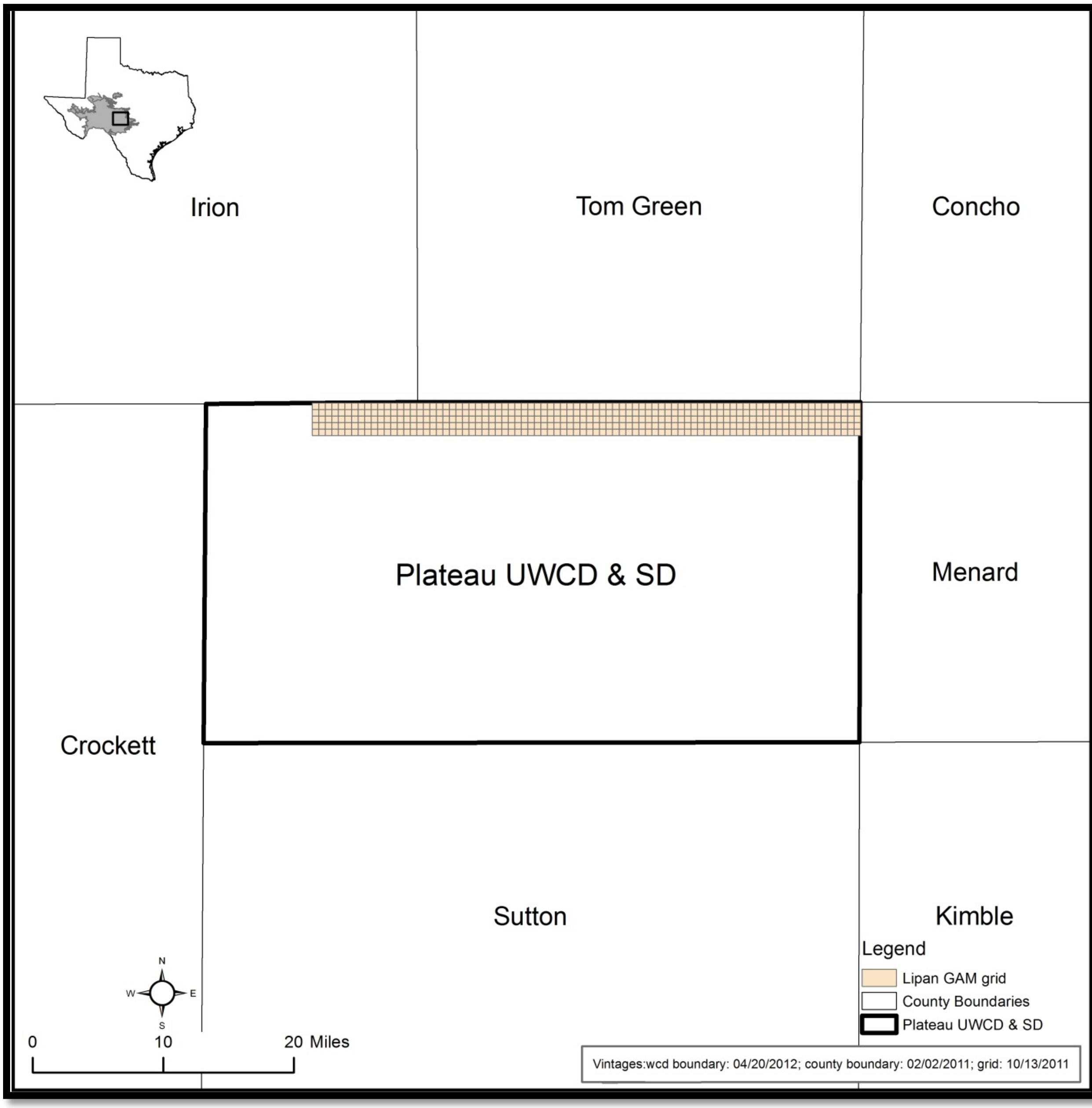

FIGURE 2: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE LIPAN AQUIFER FROM WHICH THE INFORMATION IN TABLE 2 WAS EXTRACTED FORTHE EXTENT OF THE LIPAN AQUIFER WITHIN THE DISTRICT BOUNDARY.

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.

REFERENCES:

Anaya, R., and Jones, I., 2009, Groundwater Availability Model for the Edwards-Trinity (Plateau) and Pecos Valley Aquifers, 103 p., http://www.twdb.texas.gov/groundwater/models/gam/eddt_p/ET-Plateau_Full.pdf

Beach, James A., Burton, Stuart, and Kolarik, Barry, 2004, Groundwater availability model for the Lipan Aquifer in Texas: final report prepared for the Texas Water Development Board by LBG-Guyton Associates, 246 p., http://www.twdb.texas.gov/groundwater/models/gam/lipn/lipn.asp

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Hutchison, W. R., Jones, I., and Anaya, R., 2011, Update of the Groundwater Availability Model for the Edwards-Trinity (Plateau) and Pecos Valley Aquifers of Texas, 60 p., http://www.twdb.texas.gov/groundwater/models/alt/eddt_p_2011/alt1_eddt_p.asp

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TWDB Groundwater Database, 2013, Texas Water Development Board, http://www.twdb.texas.gov/groundwater/data/index.asp.