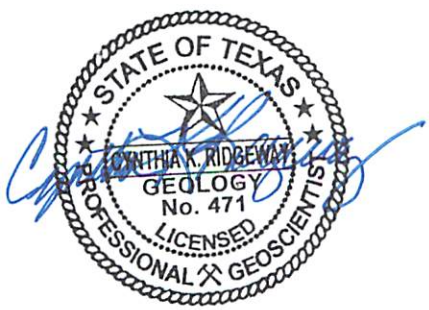
GAM Run 10-060 MAG: Modeled Available Groundwater for the Yegua-Jackson Aquifer in Groundwater Management Area 12

by Wade Oliver

Edited and Finalized by Shirley Wade, Ph.D., P.G.

Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 936-0883
July 9, 2012



Cynthia K. Ridgeway, the Manager of the Groundwater Availability Modeling Section, is responsible for oversight of work performed by employees under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G. 471 on July 9, 2012.

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EXECUTIVE SUMMARY:

The modeled available groundwater for the Yegua-Jackson Aquifer as a result of the desired future conditions adopted by the districts of Groundwater Management Area 12 is approximately 27,000 acre-feet per year and is summarized by county, river basin, and regional water planning area in Table 1. Using the groundwater availability model for the Yegua-Jackson Aquifer, The Texas Water Development Board confirmed that this pumping estimate, developed by LBG-Guyton Associates, meets the desired future conditions.

REQUESTOR:

Mr. Gary Westbrook of Post Oak Savannah Groundwater Conservation District on behalf of Groundwater Management Area 12

DESCRIPTION OF REQUEST:

In a letter dated July 26, 2011, Mr. Westbrook provided the Texas Water Development Board (TWDB) with the desired future conditions of the Yegua-Jackson Aquifer in Groundwater Management Area 12 (Groundwater Management Area 12, 2011). The desired future conditions for the Yegua-Jackson Aquifer, as

adopted June 30, 2011 and shown in Appendix B of the resolution by the groundwater conservation districts within Groundwater Management Area 12, are described below:

Brazos Valley Groundwater Conservation District (Yegua portion):
Average drawdown between 2010 and 2060 of 70 feet.

Brazos Valley Groundwater Conservation District (Jackson portion):
Average drawdown between 2010 and 2060 of 110 feet.

Fayette County Groundwater Conservation District (Yegua-Jackson):
Average drawdown between 2010 and 2060 of 75 feet.

Lost Pines Groundwater Conservation District (Yegua-Jackson):
Declared as non-relevant.

Mid-East Texas Groundwater Conservation District (Yegua-Jackson):
Average drawdown between 2010 and 2060 of 5 feet.

Post Oak Savannah Groundwater Conservation District (Yegua-Jackson):
Average drawdown between 2010 and 2060 of 100 feet.

As described in the resolution, the districts consider the desired future conditions to be compatible and physically possible if the drawdowns simulated in the groundwater availability model are within 5 feet or 5 percent of the adopted values above (Groundwater Management Area 12, 2011).

METHODS:

The locations of Groundwater Management Area 12, the Yegua-Jackson Aquifer, and the groundwater availability model cells that represent the aquifer are shown in Figure 1. Figure 2 shows the location of the Yegua-Jackson Aquifer relative to regional water planning areas, river basins, and groundwater conservation districts.

LBG-Guyton Associates assisted with the development of the desired future conditions of the Yegua-Jackson Aquifer for Groundwater Management Area 12 using the groundwater availability model for the Yegua-Jackson Aquifer. On May 20, 2011, Mr. David O'Rourke of LBG-Guyton Associates delivered a MODFLOW Well

Package file to the TWDB containing pumping information for the groundwater conservation districts within Groundwater Management Area 12 (Groundwater Management Area 12, 2011). The pumping in this Well Package file, with minor modifications by the TWDB, results in drawdowns over 50 years that match each of the above desired future conditions within 5 feet or 5 percent. The modifications made by TWDB were to move and/or remove any pumping that was assigned to "conduit" cells included in the model to allow connection between the outcrop areas in Layer 1 and the downdip portions of each unit of the aquifer in layers 2 through 5 (Deeds and others, 2010).

PARAMETERS AND ASSUMPTIONS:

- We used version 1.01 of the groundwater availability model for the Yegua-Jackson Aquifer. See Deeds and others (2010) for assumptions and limitations of the groundwater availability model.
- The model includes five layers representing the Yegua-Jackson Aquifer and the overlying Catahoula unit.
- As reported in Deeds and others (2010), the mean absolute errors (a measure of the difference between simulated and measured water levels during model calibration) for the Jackson Group (combined upper and lower Jackson units), Upper Yegua, and Lower Yegua portions of the aquifer for the historical-calibration period of the model are 31.1, 23.9, and 24.5 feet, respectively. These represent 10.3, 5.7, and 6.3 percent of the hydraulic head drop across each model area, respectively.
- The recharge used for the model simulation represents average recharge as described in Deeds and others (2010).

Modeled Available Groundwater and Permitting

As defined in Chapter 36 of the Texas Water Code, "modeled available groundwater" is the estimated average amount of water that may be produced annually to achieve a desired future condition. 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 TWDB is 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 12 as a result of the above desired future conditions is approximately 27,000 acre-feet per year between 2010 and 2060. Table 1 contains the modeled available groundwater subdivided by county, regional water planning area, and river basin for use in the regional water planning process. Tables 2, 3, 4, and 5 show the modeled available groundwater for the Yegua-Jackson Aquifer summarized by county, regional water planning area, river basin, and groundwater conservation district, respectively, within Groundwater Management Area 14.

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. 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:

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.

Groundwater Management Area 12, 2011, Resolution to Adopt Desired Future Conditions for Groundwater Management, 36 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 12. 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*
Brazos	G	Brazos	7,071	7,071	7,071	7,071	7,071	7,071
Burleson	G	Brazos	12,923	12,923	12,923	12,923	12,923	12,923
Fayette	K	Colorado	5,065	5,065	5,065	5,065	5,065	5,065
		Guadalupe	650	650	650	650	650	650
		Lavaca	47	47	47	47	47	47
Leon	H	Trinity	4	4	4	4	4	4
Madison	H	Brazos	63	63	63	63	63	63
		Trinity	1,055	1,055	1,055	1,055	1,055	1,055
Total			**26,878**	**26,878**	**26,878**	**26,878**	**26,878**	**26,878**

TABLE 2: MODELED AVAILABLE GROUNDWATER FOR THE YEGUA-JACKSON AQUIFER BY COUNTY FOR EACH DECADE BETWEEN 2010 AND 2060. RESULTS ARE IN ACRE-FEET PER YEAR.

County	*Year*					
	2010	*2020*	*2030*	*2040*	*2050*	*2050*
Brazos	7,071	7,071	7,071	7,071	7,071	7,071
Burleson	12,923	12,923	12,923	12,923	12,923	12,923
Fayette	5,762	5,762	5,762	5,762	5,762	5,762
Leon	4	4	4	4	4	4
Madison	1,118	1,118	1,118	1,118	1,118	1,118
Total	**26,878**	**26,878**	**26,878**	**26,878**	**26,878**	**26,878**

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

Region	*Year*					
	2010	*2020*	*2030*	*2040*	*2050*	*2060*
G	19,994	19,994	19,994	19,994	19,994	19,994
H	1,122	1,122	1,122	1,122	1,122	1,122
K	5,762	5,762	5,762	5,762	5,762	5,762
Total	**26,878**	**26,878**	**26,878**	**26,878**	**26,878**	**26,878**

TABLE 4: MODELED AVAILABLE GROUNDWATER FOR THE YEGUA-JACKSON AQUIFER BY RIVER BASIN FOR EACH DECADE BETWEEN 2010 AND 2060. RESULTS ARE IN ACRE-FEET PER YEAR.

Basin	*Year*					
	2010	*2020*	*2030*	*2040*	*2050*	*2060*
Brazos	20,057	20,057	20,057	20,057	20,057	20,057
Colorado	5,065	5,065	5,065	5,065	5,065	5,065
Guadalupe	650	650	650	650	650	650
Lavaca	47	47	47	47	47	47
Trinity	1,059	1,059	1,059	1,059	1,059	1,059
Total	**26,878**	**26,878**	**26,878**	**26,878**	**26,878**	**26,878**

TABLE 5: MODELED AVAILABLE GROUNDWATER FOR THE YEGUA-JACKSON AQUIFER BY GROUNDWATER CONSERVATION DISTRICT (GCD) FOR EACH DECADE BETWEEN 2010 AND 2060. RESULTS ARE IN ACRE-FEET PER YEAR.

District	*Year*					
	2010	*2020*	*2030*	*2040*	*2050*	*2060*
Brazos Valley GCD	7,071	7,071	7,071	7,071	7,071	7,071
Fayette County GCD	5,762	5,762	5,762	5,762	5,762	5,762
Mid-East Texas GCD	1,122	1,122	1,122	1,122	1,122	1,122
Post Oak Savannah GCD	12,923	12,923	12,923	12,923	12,923	12,923
Total	**26,878**	**26,878**	**26,878**	**26,878**	**26,878**	**26,878**

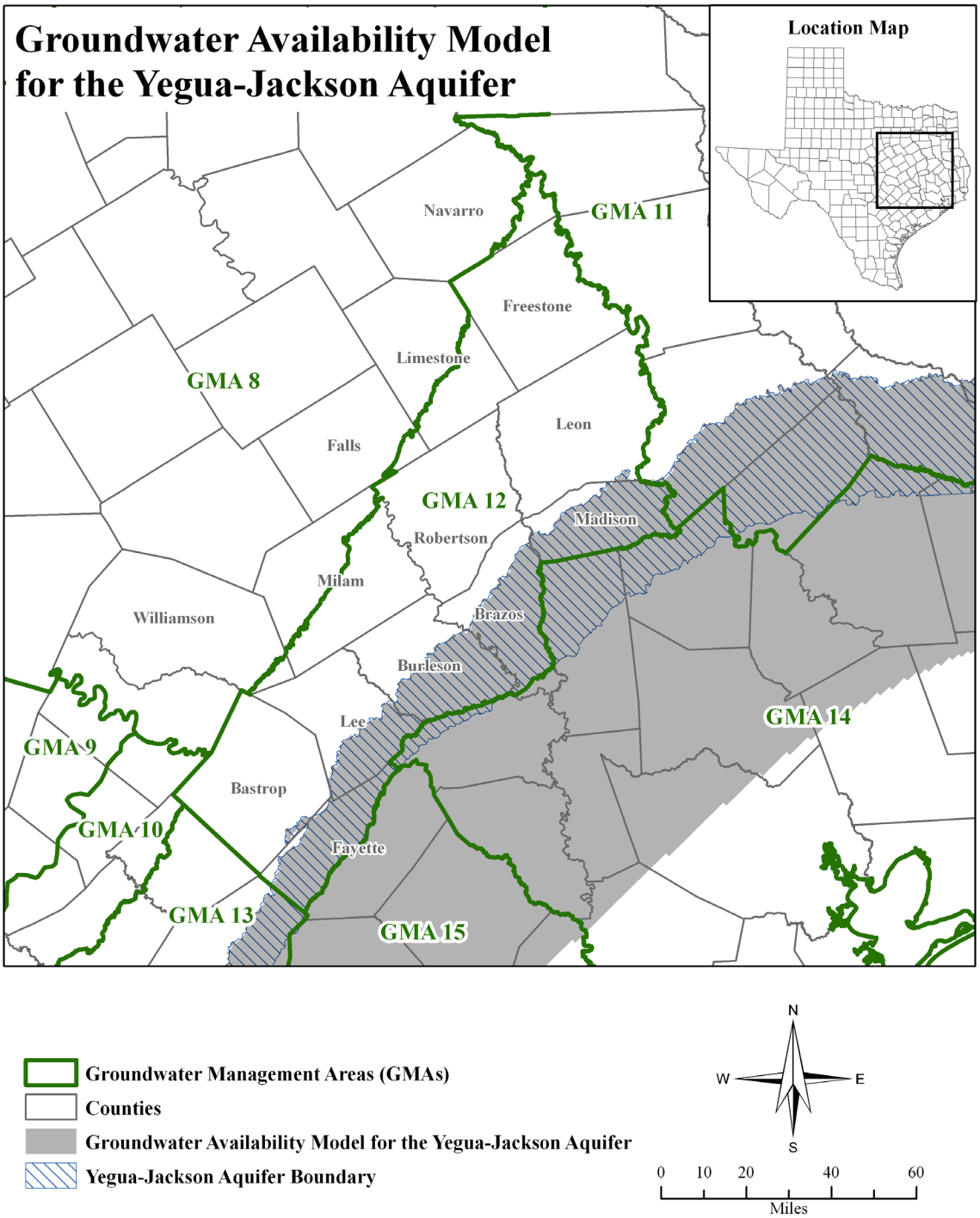

FIGURE 1: MAP SHOWING GROUNDWATER MANAGEMENT AREA 12 AND THE BOUNDARY OF THE YEGUA-JACKSON AQUIFER ACCORDING TO THE 2007 STATE WATER PLAN (TWDB, 2007).

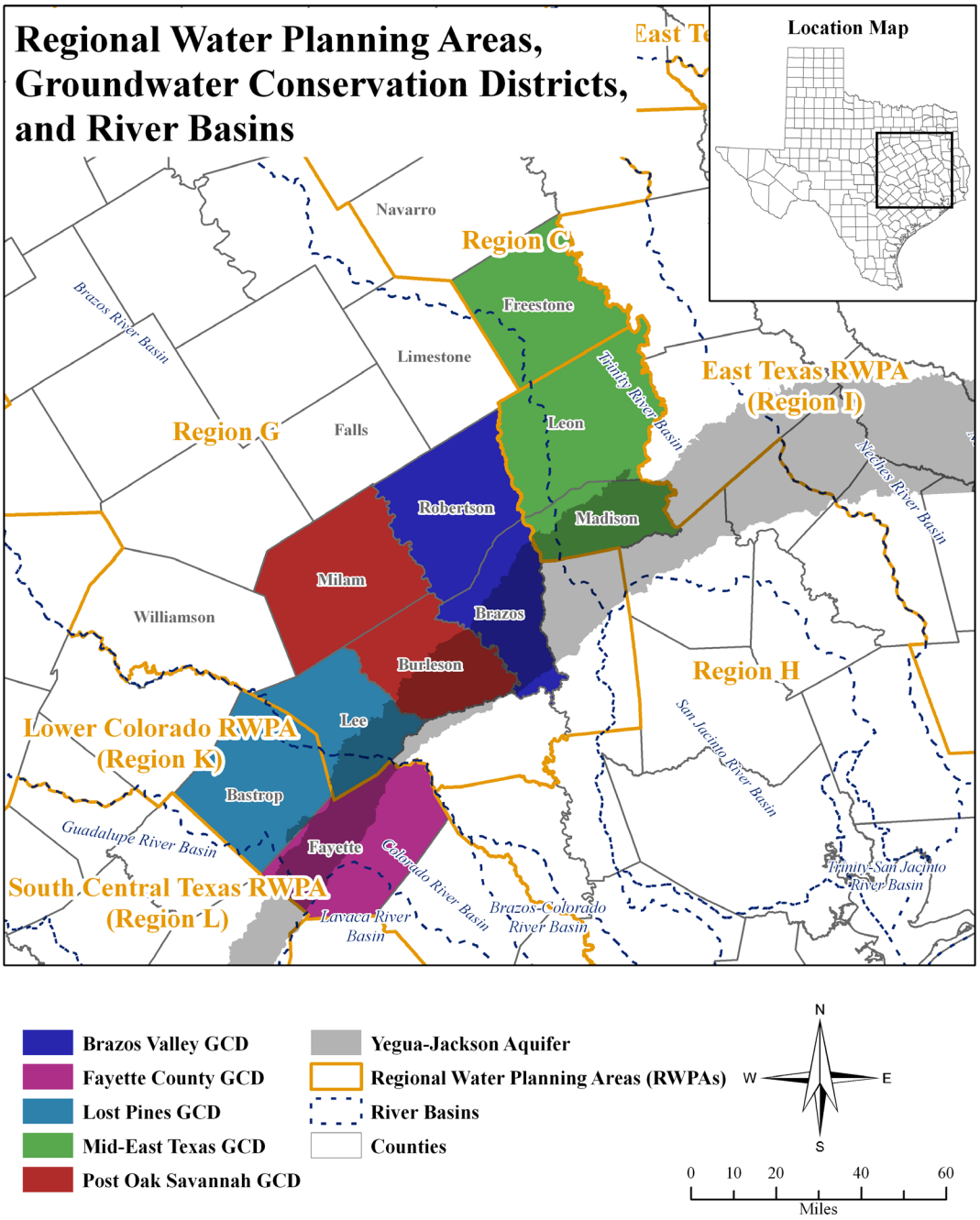

FIGURE 2: MAP SHOWING GROUNDWATER CONSERVATION DISTRICTS, REGIONAL WATER PLANNING AREAS, COUNTIES, AND RIVER BASINS IN AND NEIGHBORING GROUNDWATER MANAGEMENT AREA 12.