GAM Run 10-039 MAG

By Mr. Eric Aschenbach

Edited and finalized by Ian Jones to reflect statutory changes effective September 1, 2011

Texas Water Development Board
Groundwater Availability Modeling Section
(512) 463-6641
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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 availability groundwater for the Dockum Aquifer as a result of the desired future conditions adopted by Groundwater Management Area 3 is approximately 39,000 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 "base" scenario in Groundwater Availability Modeling Task 10-025, which Groundwater Management Area 3 used as the basis for developing their desired future condition.

REQUESTOR:

Mr. Paul Weatherby of Middle Pecos Groundwater Conservation District on behalf of Groundwater Management Area 3

DESCRIPTION OF REQUEST:

In a document dated August 31, 2010 and received September 7, 2010, Mr. Paul Weatherby provided the Texas Water Development Board (TWDB) with the desired future condition of the Dockum Aquifer adopted by Groundwater Management Area 3. The desired future condition for the Dockum Aquifer in Groundwater Management Area 3, as shown in Resolution # 08-09-2010-1 is as follows:

> *"The average total net decline in water levels within* [Groundwater Management Area] *3, taken as a whole, at the end of the fifty-year period in 2060, shall not exceed twenty seven (27) feet below water levels in the aquifer in the year 2010, and;*
>
> *The results of the revised Base Case of the Texas Water Development Board* [Groundwater Availability Modeling] *Task 10-025 as presented by Dr. Bill Hutchison on August 9, 2010, used to develop the* [desired future condition] *for the Dockum Aquifer in* [Groundwater Management Area] *3 are adopted in their entirety."*

In response to receiving the adopted desired future condition, the Texas Water Development Board has estimated the modeled available groundwater for the Dockum Aquifer in Groundwater Management Area 3.

METHODS:

The Texas Water Development Board previously completed several predictive groundwater availability model simulations of the Dockum Aquifer to assist Groundwater Management Area 3 in developing a desired future condition. The location of Groundwater Management Area 3, the Dockum Aquifer, and the model cells that represent the aquifer are shown in Figure 1. Since the above desired future condition is met in the "base" scenario of Groundwater Availability Modeling (GAM) Task 10-025 (Oliver, 2010), the estimated pumping for

Groundwater Management Area 3 presented here was taken directly from that 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 modified groundwater model for the Dockum Aquifer are described below:

- The results presented in this report are based on the "base" scenario in GAM Task 10-025 (Oliver, 2010). See GAM Task 10-025 for a full description of the methods, assumptions, and results for the model simulation.

- The modified groundwater model for the Dockum Aquifer described in Oliver and Hutchison (2010) was used for this analysis. This model is a modification to the previously developed groundwater availability model for the Dockum Aquifer described in Ewing and others (2008). The model was modified in order to more effectively simulate predictive conditions. See Oliver and Hutchison (2010) and Ewing and others (2008) for assumptions and limitations of the model.

- Layers 2 and 3 of the model represent the upper and lower portions of the Dockum Aquifer, respectively. Layer 1, which is active in version 1.01 of the model documented in Ewing and others (2008), was inactivated in the modified model as described in Oliver and Hutchison (2010).

- Cells were assigned to individual counties and groundwater conservation districts as shown in the September 14, 2009 version of the file that associates the model grid to political and natural boundaries for the Dockum Aquifer.

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 January 6, 2011, 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 statue made 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 Dockum Aquifer in Groundwater Management Area 3 consistent with the desired future conditions is approximately 39,000 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). Note that all areas of the Dockum Aquifer within Groundwater Management Area 3 are within the Region F Regional Water Planning Area.

The modeled available groundwater is also summarized by county, river basin, and groundwater conservation district as shown in tables 2, 3, and 4, respectively. The modeled available groundwater for the Dockum Aquifer in Middle Pecos Groundwater Conservation District within Groundwater Management Area 3 is approximately 14,000 acre-feet per year.

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:

Ewing, J.E., Jones, T.L., Yan, T., Vreugdenhil, A.M., Fryar, D.G., Pickens, J.F., Gordon, K., Nicot, J.P., Scanlon, B.R., Ashworth, J.B., Beach, J., 2008, Groundwater Availability Model for the Dockum Aquifer – Final Report: contract report to the Texas Water Development Board, 510 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.

Oliver, W., 2010, GAM Task 10-025: Texas Water Development Board, GAM Task 10-025 Model Run Report, 61 p.

Oliver, W., Hutchison, W.R., 2010, Modification and recalibration of the Groundwater Availability Model of the Dockum Aquifer: Texas Water Development Board, 114 p.

Table 1. Modeled available groundwater for the Dockum Aquifer in Groundwater Management Area 3. Results are in acre-feet per year and are divided by county, regional water planning area, and river basin.

County	Regional Water Planning Area	Basin	Year					
			2010	2020	2030	2040	2050	2060
Crane	F	Rio Grande	2,000	2,000	2,000	2,000	2,000	2,000
Loving	F	Rio Grande	1,000	1,000	1,000	1,000	1,000	1,000
Pecos	F	Rio Grande	13,962	13,962	13,962	13,962	13,962	13,962
Reeves	F	Rio Grande	5,000	5,000	5,000	5,000	5,000	5,000
Ward	F	Rio Grande	7,000	7,000	7,000	7,000	7,000	7,000
Winkler	F	Colorado	33	33	33	33	33	33
		Rio Grande	9,967	9,967	9,967	9,967	9,967	9,967
Total			**38,962**	**38,962**	**38,962**	**38,962**	**38,962**	**38,962**

Table 2. Modeled available groundwater for the Dockum Aquifer summarized by county in Groundwater Management Area 3 for each decade between 2010 and 2060. Results are in acre-feet per year.

County	Year					
	2010	2020	2030	2040	2050	2060
Crane	2,000	2,000	2,000	2,000	2,000	2,000
Loving	1,000	1,000	1,000	1,000	1,000	1,000
Pecos	13,962	13,962	13,962	13,962	13,962	13,962
Reeves	5,000	5,000	5,000	5,000	5,000	5,000
Ward	7,000	7,000	7,000	7,000	7,000	7,000
Winkler	10,000	10,000	10,000	10,000	10,000	10,000
Total	**38,962**	**38,962**	**38,962**	**38,962**	**38,962**	**38,962**

Table 3. Modeled available groundwater for the Dockum Aquifer summarized by river basin in Groundwater Management Area 3 for each decade between 2010 and 2060. Results are in acre-feet per year.

Basin	**Year**					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Colorado	33	33	33	33	33	33
Rio Grande	38,929	38,929	38,929	38,929	38,929	38,929
Total	**38,962**	**38,962**	**38,962**	**38,962**	**38,962**	**38,962**

Table 4. Modeled available groundwater for the Dockum Aquifer summarized by groundwater conservation district (GCD) in Groundwater Management Area 3 for each decade between 2010 and 2060. Results are in acre-feet per year.

Groundwater Conservation District	**Year**					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Middle Pecos GCD	13,962	13,962	13,962	13,962	13,962	13,962
No District	25,000	25,000	25,000	25,000	25,000	25,000
Total	**38,962**	**38,962**	**38,962**	**38,962**	**38,962**	**38,962**

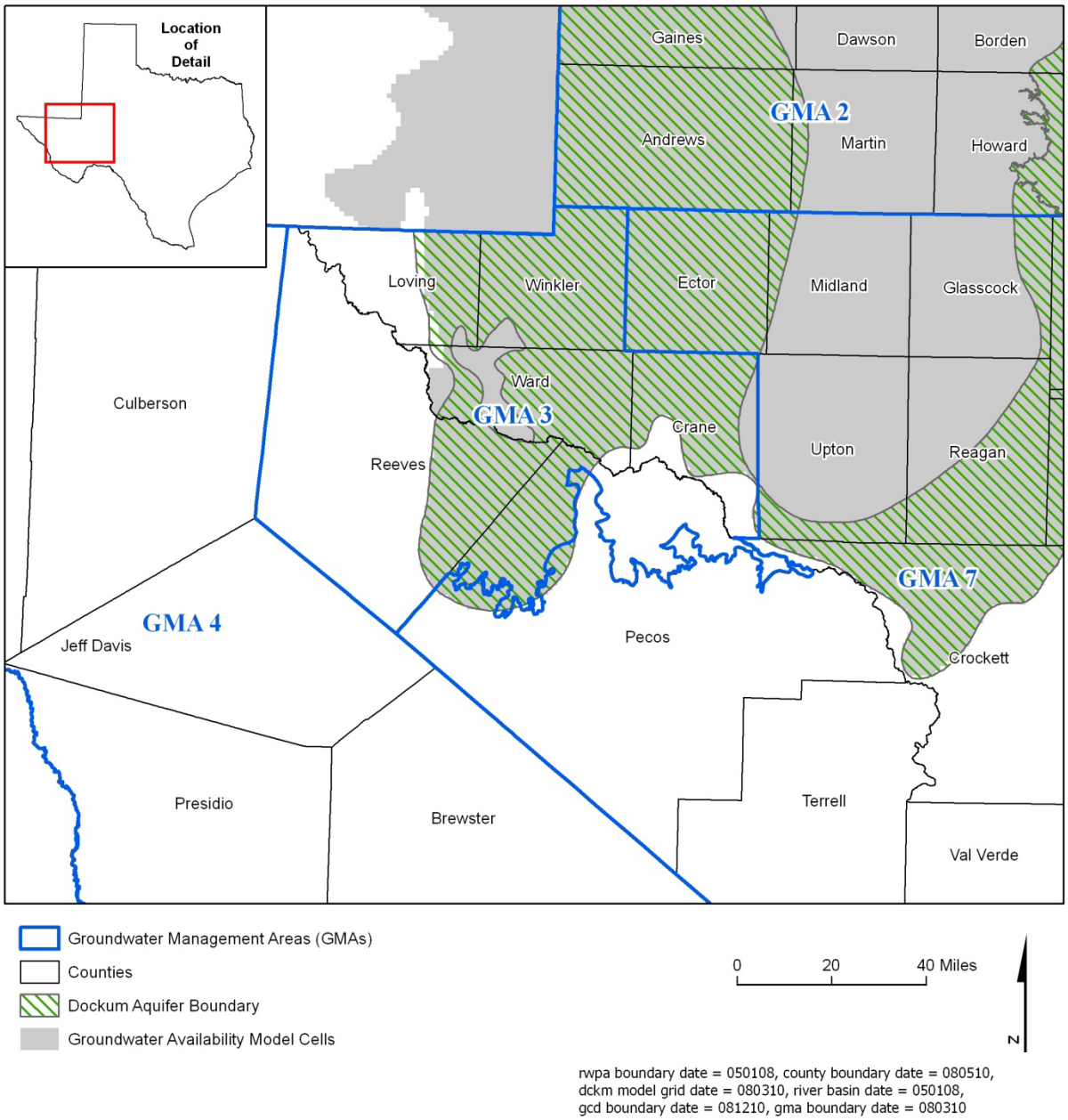

Figure 1. Map showing the areas covered by the groundwater model for the Dockum Aquifer.

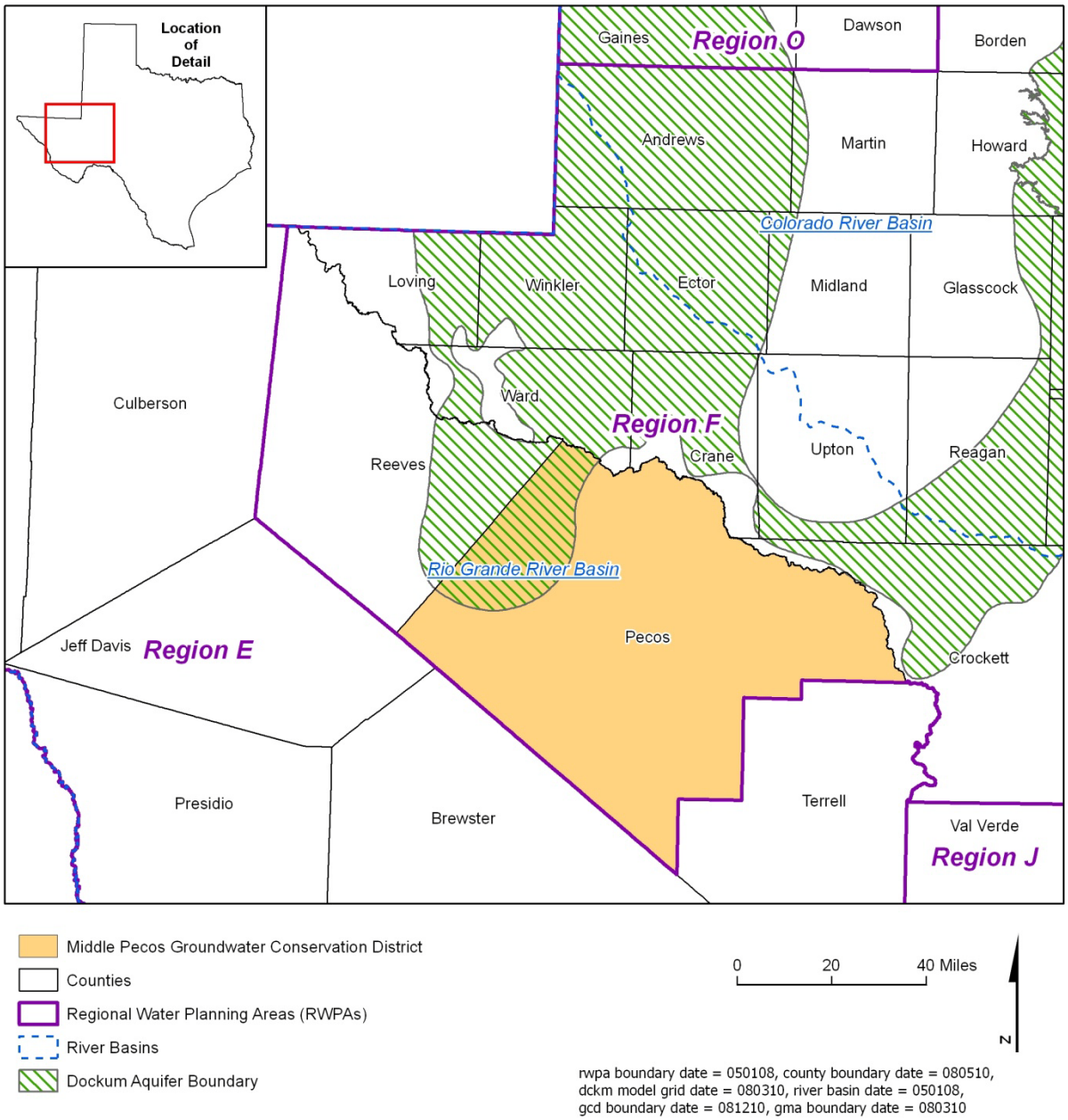

Figure 2. Map showing regional water planning areas (RWPAs), groundwater conservation districts (GCDs), counties, and river basins in Groundwater Management Area 3.