GAM RUN 18-010: MESQUITE GROUNDWATER CONSERVATION DISTRICT GROUNDWATER MANAGEMENT PLAN

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Groundwater Division
Groundwater Availability Modeling Department
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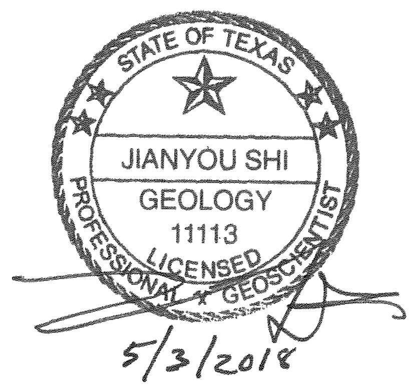
April 30, 2018



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EXECUTIVE SUMMARY:

Texas 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.

The TWDB provides data and information to the Mesquite Groundwater Conservation District in two parts. Part 1 is the Estimated Historical Water Use/State Water Plan dataset report, which will be provided to you separately by the TWDB Groundwater Technical Assistance Department. Please direct questions about the water data report to Mr. Stephen Allen at (512) 463-7317 or stephen.allen@twdb.texas.gov. Part 2 is the required groundwater availability modeling information and this information includes:

1. the annual amount of recharge from precipitation, if any, to the groundwater resources within the district;

2. for each aquifer within the district, the annual volume of water that discharges from the aquifer to any surface-water bodies, including lakes, streams, rivers, and springs; and

3. the annual volume of flow into and out of the district within each aquifer and between aquifers in the district.

The groundwater management plan for the Mesquite Groundwater Conservation District should be adopted by the district on or before December 25, 2018, and submitted to the Executive Administrator of the TWDB on or before January 24, 2019. The current management plan for the Mesquite Groundwater Conservation District expires on March 25, 2019.

The management plan information for the aquifers within Mesquite Groundwater Conservation District was extracted from two groundwater availability models:

1. the groundwater availability model for the High Plains Aquifer System (Deeds and Jigmond, 2015); and

2. the groundwater availability model for the Seymour and Blaine aquifers (Ewing and others, 2004).

This report replaces the results of GAM Run 13-017 (Kohlrenken, 2013). GAM Run 18-010 meets current standards set after the release of GAM Run 13-017. Tables 1 through 3 summarize the groundwater availability model data required by statute and Figures 1 through 3 show the area of the models from which the values in the tables were extracted. If after review of the figures, the Mesquite Groundwater Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the TWDB at your earliest convenience.

METHODS:

In accordance with the provisions of the Texas Water Code, Section 36.1071, Subsection (h), groundwater availability models for the High Plains Aquifer System (1980 through 2012) and the Seymour and Blaine aquifers (1980 through 1998) were run for this analysis. Water budgets for each year of the transient 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 cross-formation flow between aquifers, and net flow between aquifer and its brackish portion located within the district are summarized in this report.

PARAMETERS AND ASSUMPTIONS:

Ogallala Aquifer

- Version 1.01 of the groundwater availability model for the High Plains Aquifer System was used for this analysis. See Deeds and Jigmond (2015) for assumptions and limitations of the groundwater availability model.

- This groundwater availability model includes four layers, which generally represent the Ogallala Aquifer and the Pecos Valley Alluvium Aquifer (Layer 1), the Rita Blanca Aquifer, the Edwards-Trinity (Plateau) Aquifer, and the Edwards-Trinity (High Plains) Aquifer (Layer 2), the upper portion of the Dockum Aquifer (Layer 3), and the lower portion of the Dockum Aquifer (Layer 4). Layers 2 and 3 also contain the pass-through cells of the Dockum Aquifer.
- In the Mesquite Groundwater Conservation District, the Ogallala Aquifer is the only aquifer that was simulated by the groundwater availability model for the High Plains Aquifer System. Thus, the water budget for the Ogallala Aquifer within the district was determined from Model Layer 1.
- The model was run with MODFLOW-NWT (Niswonger and others, 2011).

Seymour and Blaine Aquifers

- Version 1.01 of the groundwater availability model for the Seymour and Blaine aquifers was used for this analysis. See Ewing and others (2004) for assumptions and limitations of the groundwater availability model.
- This groundwater availability model includes two layers which represent the Seymour Aquifer (Layer 1) and the Blaine Aquifer or its non-aquifer equivalent (Layer 2).
- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).
- An overall water budget for the district was determined from Layer 1 for the Seymour Aquifer and Layer 2 for the Blaine Aquifer.

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 portion of the model runs in the district. The components of the modified budget shown in tables 1 through 3 include:

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

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

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

- Flow between aquifers—the net vertical flow between the aquifer and adjacent aquifers or confining units. This flow is controlled by the relative water levels in each aquifer and aquifer properties of each aquifer or confining unit that define the amount of leakage that occurs.

The information needed for the district's management plan is summarized in Tables 1 through 3. It is important to note that sub-regional water budgets are not exact. This is due to the size of the model cells and the approach used to extract data from the model. To avoid double accounting, a model cell that straddles a political boundary, such as district or county boundaries, is assigned to one side of the boundary based on the location of the centroid of the model cell. For example, if a cell contains two counties, the cell is assigned to the county where the centroid of the cell is located (Figures 1 through 3).

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

Management Plan requirement	***Aquifer or confining unit***	***Results***
Estimated annual amount of recharge from precipitation to the district	Ogallala Aquifer	647
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Ogallala Aquifer	670
Estimated annual volume of flow into the district within each aquifer in the district	Ogallala Aquifer	434
Estimated annual volume of flow out of the district within each aquifer in the district	Ogallala Aquifer	420
Estimated net annual volume of flow between each aquifer in the district	Not Applicable	Not Applicable*

* The Ogallala Aquifer was the only hydrogeological unit simulated by the model within the Mesquite Groundwater Conservation District.

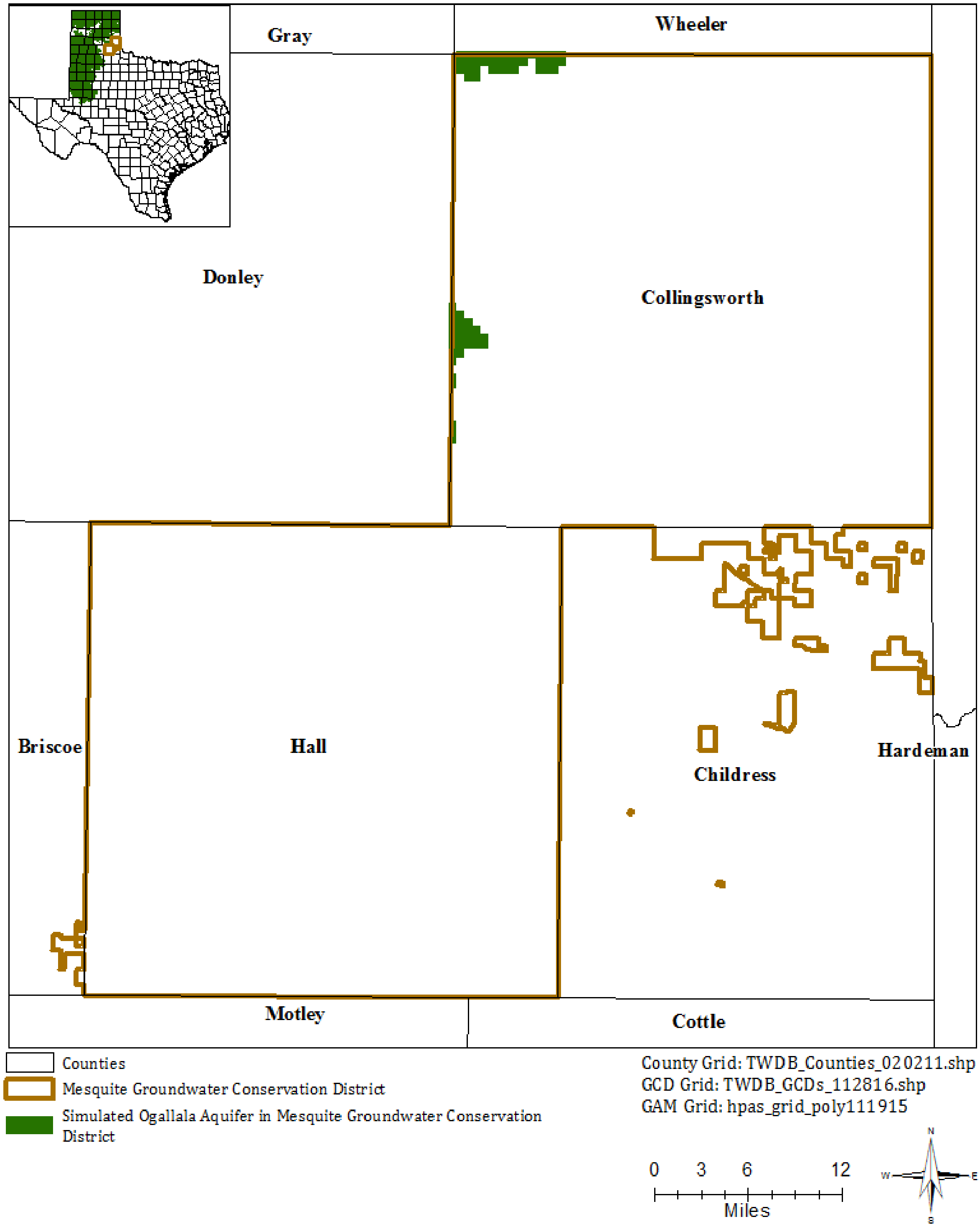

FIGURE 1: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE HIGH PLAINS AQUIFER SYSTEM FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED (THE OGALLALA AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

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

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Seymour Aquifer	43,601
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Seymour Aquifer	4,268
Estimated annual volume of flow into the district within each aquifer in the district	Seymour Aquifer	1,683
Estimated annual volume of flow out of the district within each aquifer in the district	Seymour Aquifer	1,024
Estimated net annual volume of flow between each aquifer in the district	From the Seymour Aquifer into the Blaine Aquifer	11,064
	From the non-aquifer Blaine equivalent geologic unit into the Seymour Aquifer	6,283

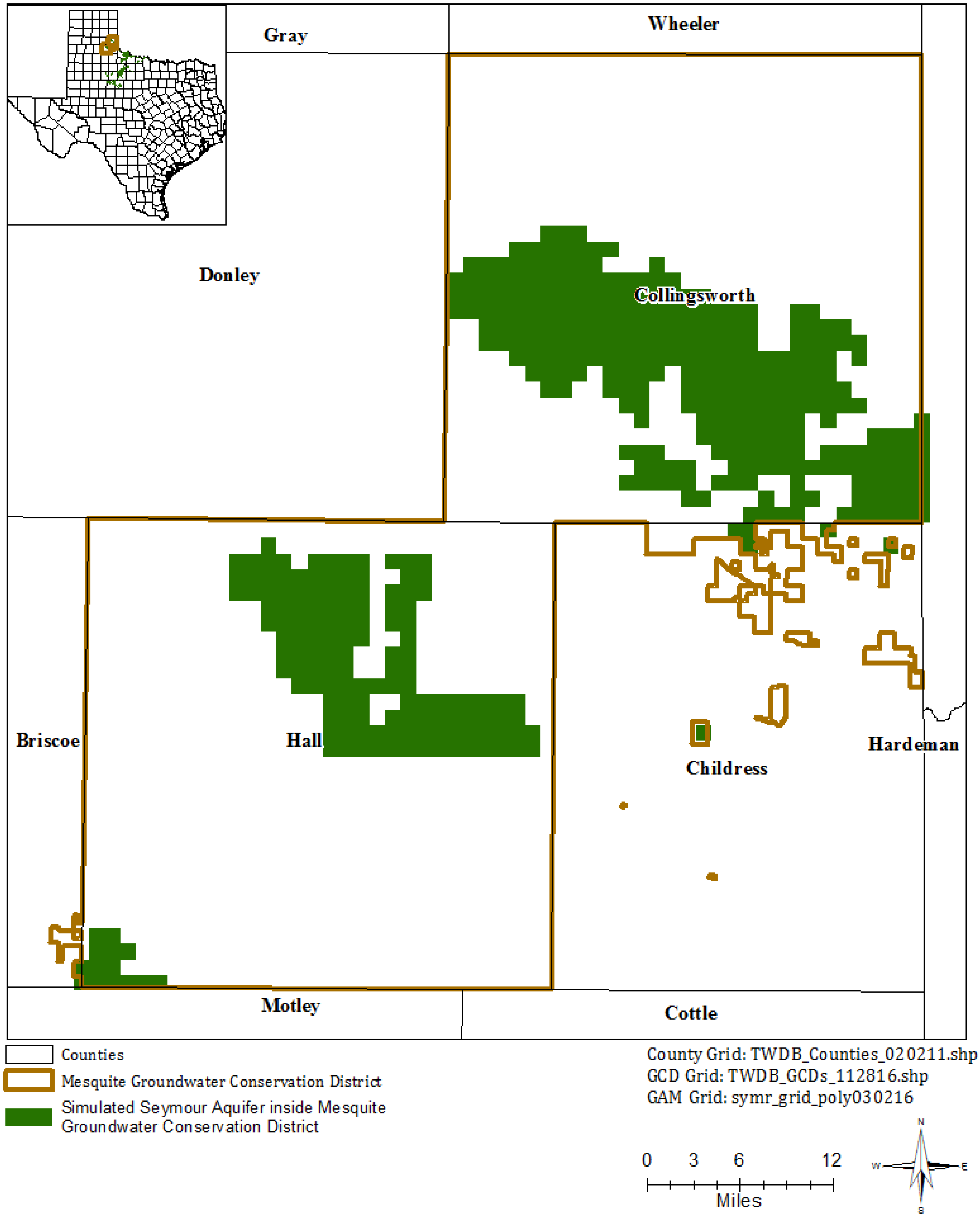

FIGURE 2: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE SEYMOUR AND BLAINE AQUIFERS FROM WHICH THE INFORMATION IN TABLE 2 WAS EXTRACTED (THE SEYMOUR AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

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

Management Plan requirement	***Aquifer***	***Results***
Estimated annual amount of recharge from precipitation to the district	Blaine Aquifer	23,236
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Blaine Aquifer	21,409
Estimated annual volume of flow into the district within each aquifer in the district	Blaine Aquifer	11,956
Estimated annual volume of flow out of the district within each aquifer in the district	Blaine Aquifer	16,316
Estimated net annual volume of flow between each aquifer in the district	From the Seymour Aquifer into the Blaine Aquifer	11,064
	From the non-aquifer Blaine equivalent geologic unit into the Blaine Aquifer	12,053

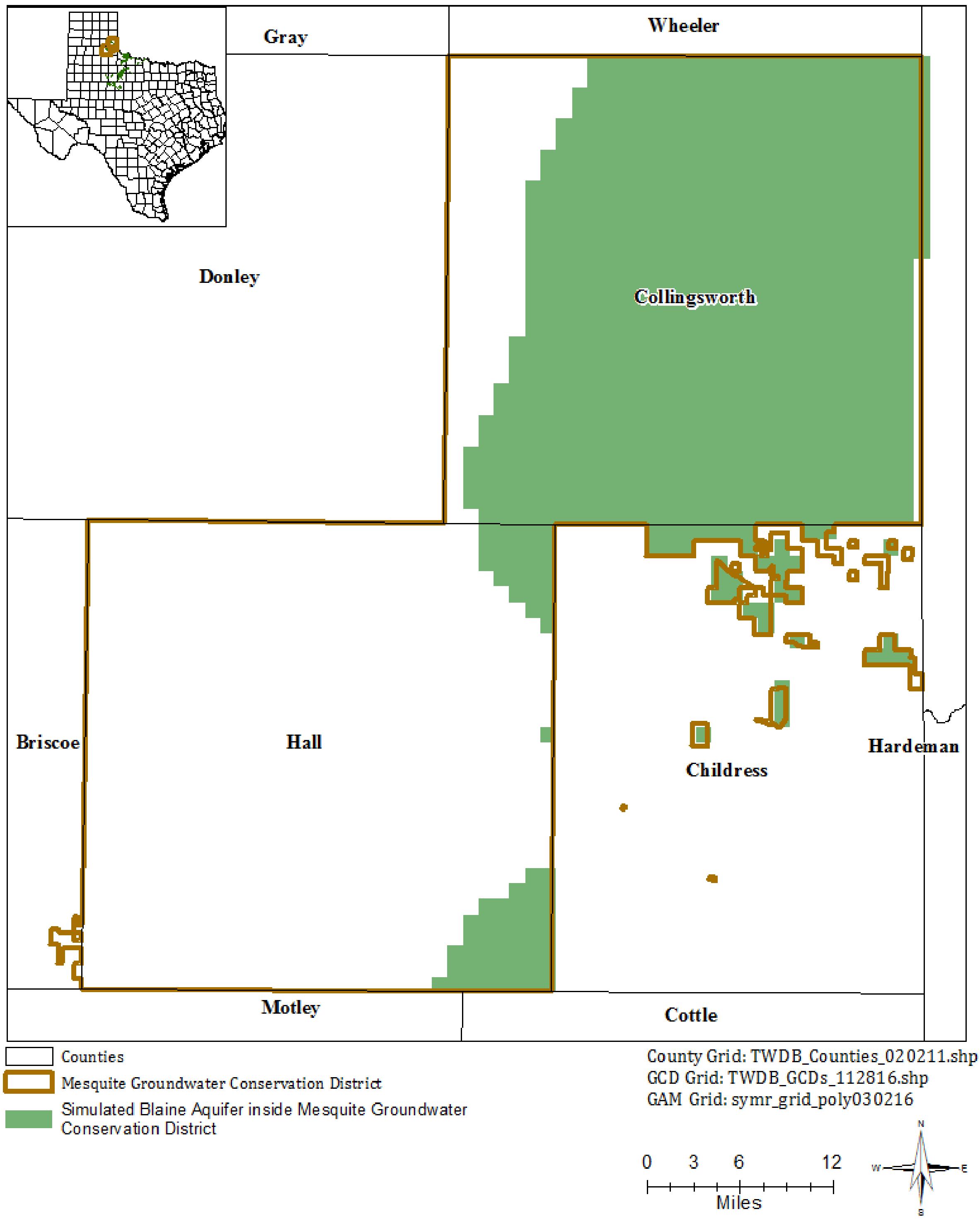

FIGURE 3: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE SEYMOUR AND BLAINE AQUIFERS FROM WHICH THE INFORMATION IN TABLE 3 WAS EXTRACTED (THE BLAINE AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

LIMITATIONS:

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

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

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

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

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

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