GAM Run 18-016: Starr County Groundwater Conservation District Groundwater Management Plan

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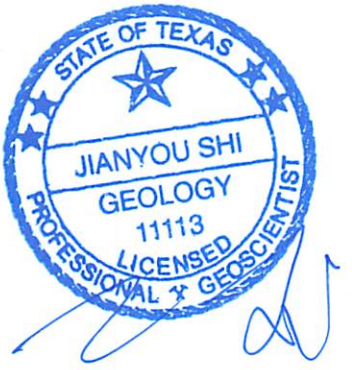
Groundwater Division
Groundwater Availability Modeling Department
512-463-5076
February 28, 2019



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EXECUTIVE SUMMARY:

Texas Water Code, Section 36.1071(h) (Texas Water Code, 2011), states that, in developing its groundwater management plan, a groundwater conservation district shall use groundwater availability modeling information provided by the Executive Administrator of the Texas Water Development Board (TWDB) in conjunction with any available site-specific information provided by the district for review and comment to the Executive Administrator.

The TWDB provides data and information to the Starr County 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 springs and any surface-water bodies, including lakes, streams, and rivers; 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 Starr County Groundwater Conservation District should be adopted by the district on or before April 26, 2019, and submitted to the Executive Administrator of the TWDB on or before May 26, 2019. The current management plan for the Starr County Groundwater Conservation District expires on July 25, 2019.

This report replaces the results of GAM Run 10-011 (Hassan, 2010). GAM Run 18-016 meets current standards set after GAM Run 10-011 was released. GAM Run 18-016 includes results from the groundwater availability model for the southern portion of the Gulf Coast Aquifer System (Chowdhury and Mace, 2007) and the groundwater availability model for the Yegua-Jackson Aquifer (Deeds and others, 2010). Tables 1 and 2 summarize the groundwater availability model data required by statute, and Figures 1 and 2 show the area of the models from which the values in the tables were extracted. If, after review of the figures, the Starr County 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(h), the groundwater availability model for the southern portion of the Gulf Coast Aquifer System and the groundwater availability model for the Yegua-Jackson Aquifer were used to estimate information for the Starr County Groundwater Conservation District management plan. Water budgets from the model for the southern portion of the Gulf Coast Aquifer System were extracted for the historical model period (1981 through 2000). Water budgets from the model for the Yegua-Jackson Aquifer were extracted for the historical model period (1980 through 1997). The water budgets were extracted from the models using ZONEBUDGET Version 3.01 (Harbaugh, 2009). The average annual water budget values for recharge, surface-water outflow, inflow to the district, and outflow from the district for the aquifers within the district are summarized in this report.

PARAMETERS AND ASSUMPTIONS:

Gulf Coast Aquifer System

- We used version 2.01 of the groundwater availability model for the southern portion of the Gulf Coast Aquifer System for this analysis. See Chowdhury and Mace (2007) for assumptions and limitations of the model.
- The model has four layers which represent four sub-units of the aquifer system: the Chicot Aquifer (Layer 1), the Evangeline Aquifer (layer 2), the Burkeville confining unit (layer 3), and the Jasper Aquifer (Layer 4).
- Water budgets for the district were determined for the Gulf Coast Aquifer System using all four layers based on official aquifer boundary.

- The model was run with MODFLOW-96 (Harbaugh and McDonald, 1996).
- The groundwater discharge to surface water was calculated from the MODFLOW-96 river boundary.

Yegua-Jackson Aquifer

- We used version 1.01 of the groundwater availability model for the Yegua-Jackson Aquifer for this analysis. See Deeds and others (2010) for assumptions and limitations of the model.
- The model has five layers which represent the aquifer shallow portion and the Catahoula Formation (Layer 1), the Upper Jackson (Layer 2), the Lower Jackson (Layer 3), the Upper Yegua (Layer 4), and the Lower Yegua (Layer 5).
- Water budgets for the district were determined using all five layers based on official aquifer boundary.
- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).
- The groundwater discharge to surface water was calculated from the combination of MODFLOW-2000 stream boundary, reservoir boundary, and drain boundary.

RESULTS:

A groundwater budget summarizes the amount of water entering and leaving the aquifers according to the groundwater availability model. The groundwater budget components listed below and reported in Tables 1 and 2 were extracted from the groundwater availability model results for the Gulf Coast Aquifer System and for the Yegua-Jackson Aquifer located within Starr County Groundwater Conservation District and averaged over the historical calibration periods.

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.
2. Surface-water outflow—the total water discharging from the aquifer (outflow) to surface-water features such as streams, reservoirs, and springs.
3. Flow into and out of district—the lateral flow within the aquifer between the district and adjacent counties.

4. 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.

Water budgets are estimates because of 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 GULF COAST AQUIFER SYSTEM FOR STARR COUNTY 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	Gulf Coast Aquifer System	4,119
Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, and rivers	Gulf Coast Aquifer System	167
Estimated annual volume of flow into the district within each aquifer in the district	Gulf Coast Aquifer System	1,241
Estimated annual volume of flow out of the district within each aquifer in the district	Gulf Coast Aquifer System	5,046
Estimated net annual volume of flow between each aquifer in the district	From Gulf Coast Aquifer System (Catahoula Formation) to Yegua-Jackson Aquifer	210*

*: Flow calculated from the groundwater availability model for the Yegua-Jackson Aquifer.

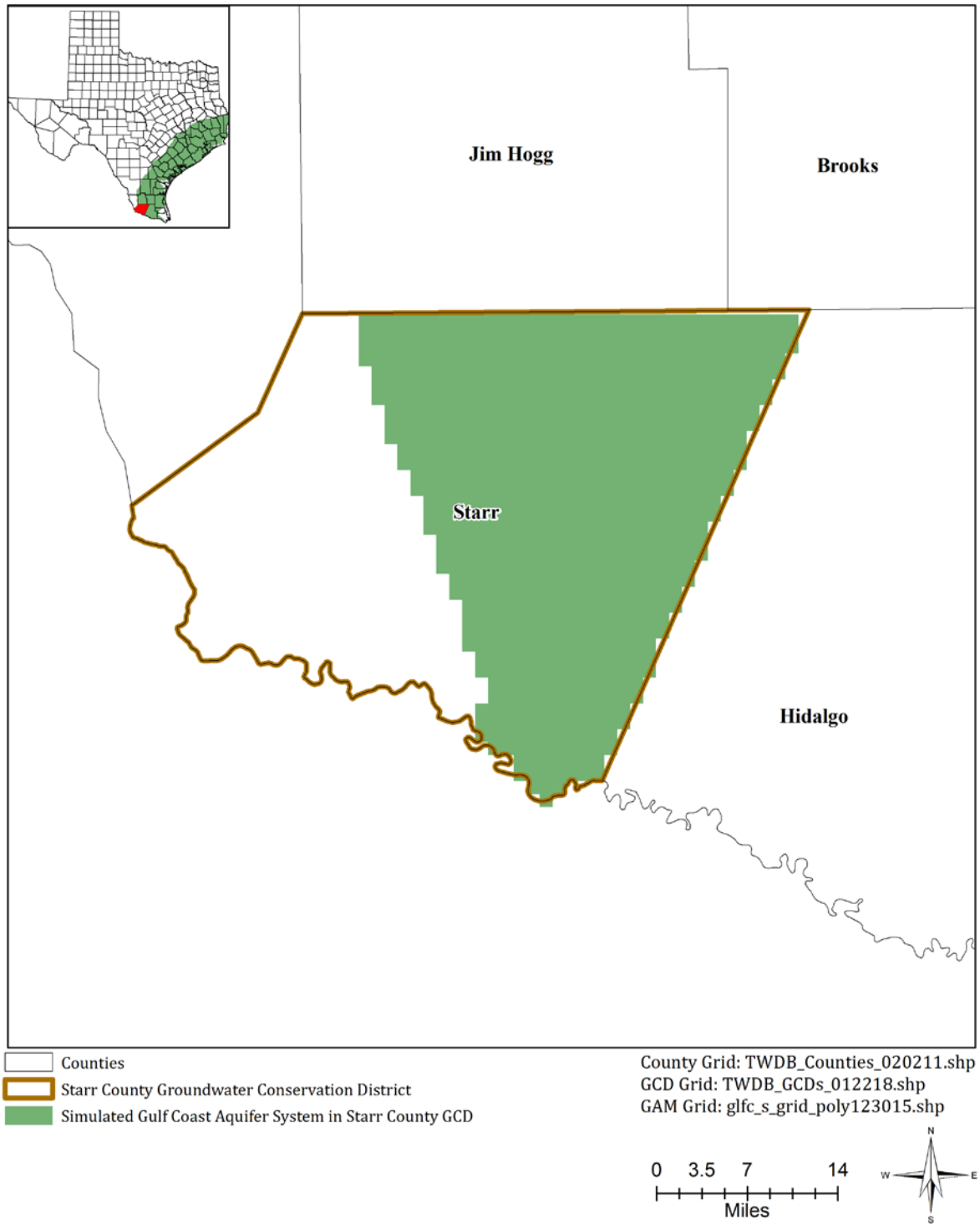

FIGURE 1. AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE GULF COAST AQUIFER SYSTEM FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED (THE GULF COAST AQUIFER SYSTEM EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 2. SUMMARIZED INFORMATION FOR THE YEGUA-JACKSON AQUIFER FOR STARR COUNTY 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	Yegua-Jackson Aquifer	0
Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, and rivers	Yegua-Jackson Aquifer	679
Estimated annual volume of flow into the district within each aquifer in the district	Yegua-Jackson Aquifer	1,150
Estimated annual volume of flow out of the district within each aquifer in the district	Yegua-Jackson Aquifer	248
Estimated net annual volume of flow between each aquifer in the district	From Yegua-Jackson downdip portion to Yegua-Jackson Aquifer	348
	From Gulf Coast Aquifer System (Catahoula Formation) to Yegua-Jackson Aquifer	210

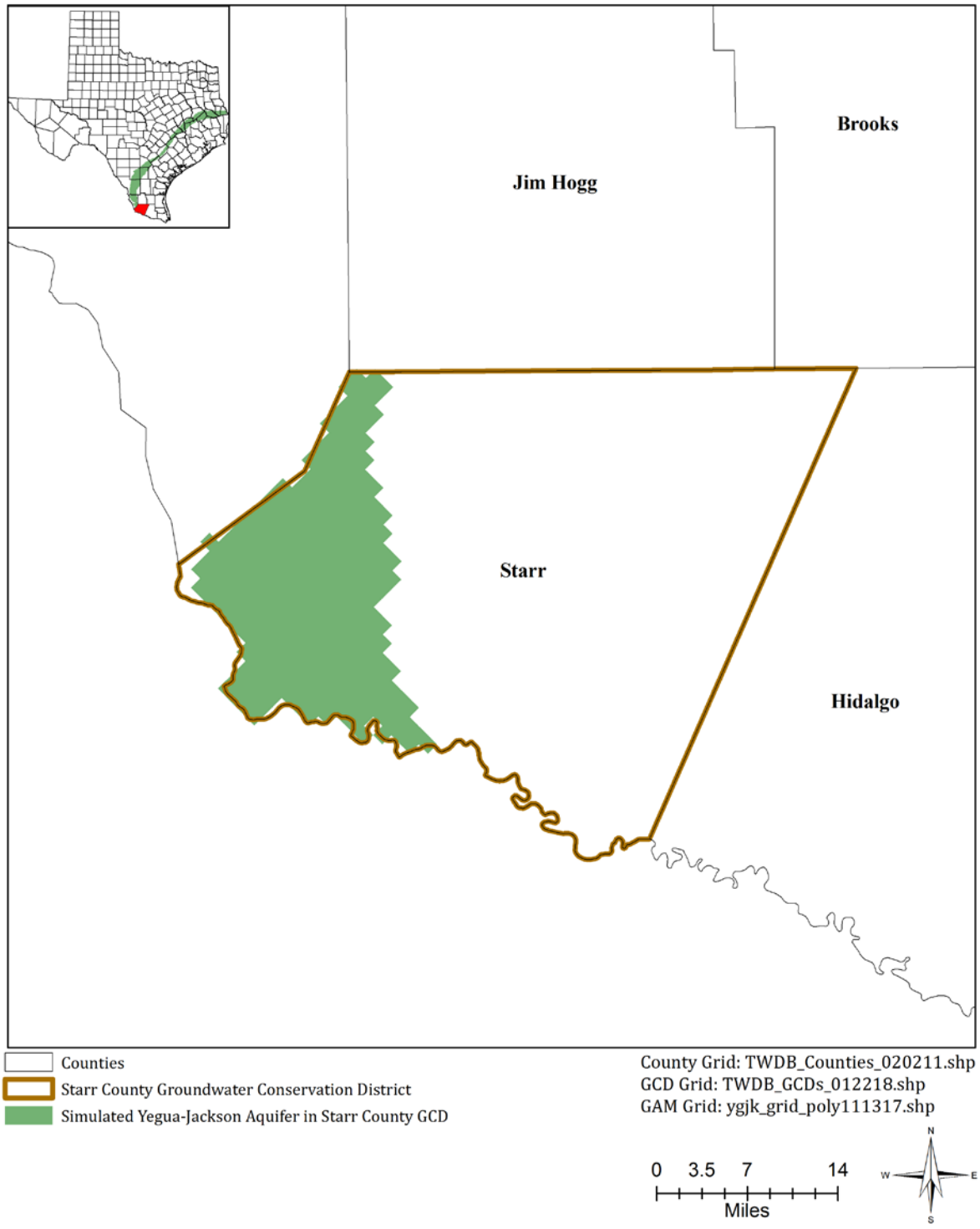

FIGURE 2. AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE YEGUA-JACKSON AQUIFER FROM WHICH THE INFORMATION IN TABLE 2 WAS EXTRACTED (THE YEGUA-JACKSON AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

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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Texas Water Code, 2011, https://statutes.capitol.texas.gov/docs/WA/pdf/WA.36.pdf