GAM Run 19-007: Presidio County Underground Water Conservation District Groundwater Management Plan

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March 15, 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 Presidio County Underground Water 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 Presidio County Underground Water Conservation District should be adopted by the district on or before October 17, 2019 and submitted to the Executive Administrator of the TWDB on or before November 16, 2019.

The current management plan for the Presidio County Underground Water Conservation District expires on January 15, 2020.

This report replaces GAM Run 12-026 (Wade, 2013) and meets current standards set after GAM Run 12-026 was released. GAM Run 19-007 includes results from the groundwater availability models for the following aquifers: West Texas Bolsons (Wild Horse Flat, Michigan Flat, Ryan Flat and Lobo Flat) and Igneous aquifers, West Texas Bolsons (Red Light Draw, Green River Valley, and Eagle Flat) Aquifer, and West Texas Bolsons (Presidio and Redford) Aquifer. Tables 1 and 2 summarize the groundwater availability model data required by statute, and Figures 1 and 2 show the areas of the models from which the values in the tables were extracted. If, after review of the figures, Presidio County Underground Water Conservation District determines that the district boundaries used in this 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 models for the West Texas Bolsons (Wild Horse Flat, Michigan Flat, Ryan Flat and Lobo Flat) and Igneous aquifers (Beach and others, 2004), West Texas Bolsons (Red Light Draw, Green River Valley, and Eagle Flat) Aquifer (Beach and others, 2008), and West Texas Bolsons (Presidio and Redford) Aquifer (Wade and Jigmond, 2013), were used to estimate information for the Presidio County Underground Water Conservation District groundwater management plan. Water budgets were extracted for the historical model periods using ZONEBUDGET Version 3.01 (Harbaugh, 2009). The historical model periods were for the years 1980 through 2000 for the West Texas Bolsons (Wild Horse Flat, Michigan Flat, Ryan Flat and Lobo Flat) and Igneous aquifers and for the West Texas Bolsons (Presidio and Redford) Aquifer. The groundwater availability model for the West Texas Bolsons (Red Light Draw, Green River Valley, and Eagle Flat) Aquifer is a steady-state model, therefore its historical period is that of predevelopment conditions. 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:

West Texas Bolsons (Wild Horse Flat, Michigan Flat, Ryan Flat and Lobo Flat) and Igneous Aquifers

- We used version 1.01 of the groundwater availability model for the West Texas Bolsons (Wild Horse Flat, Michigan Flat, Ryan Flat, and Lobo Flat) and Igneous Aquifers for this analysis. See Beach and others (2004) for assumptions and limitations of the model.
- The model has three layers which, in the area under the Presidio County Underground Water Conservation District, represent the West Texas Bolsons (Wild Horse Flat, Michigan Flat, Ryan Flat, and Lobo Flat) Aquifer (Layer 1), the Igneous Aquifer (Layer 2), and the underlying Cretaceous and Permian units (Layer 3).
- Water budgets for the district were determined for layers 1 and 2.
- The model was run with MODFLOW-96 (Harbaugh and McDonald, 1996).

West Texas Bolsons (Red Light Draw, Green River Valley, and Eagle Flat) Aquifer

- We used version 1.01 of the groundwater availability model for West Texas Bolsons (Red Light Draw, Green River Valley, and Eagle Flat) Aquifer for this analysis. See Beach and others (2008) for assumptions and limitations of the model.
- The model has three layers which, in the area under the Presidio County Underground Water Conservation District, represent the West Texas Bolsons (Red Light Draw, Green River Valley, and Eagle Flat) Aquifer (Layer 1), and Cretaceous, Paleozoic, Tertiary, Permian and other units in the model area (Layers 2 and 3).
- Water budgets for the district were determined for the West Texas Bolsons (Red Light Draw, Green River Valley, and Eagle Flat) Aquifer (Layer 1).
- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).

West Texas Bolsons (Presidio and Redford) Aquifer

- We used version 1.01 of the groundwater availability model for the West Texas Bolsons (Presidio and Redford) Aquifer for this analysis. See Wade and Jigmond (2013) for assumptions and limitations of the model.
- The model has three layers which, in the area under the Presidio County Underground Water Conservation District, represent the Rio Grande alluvium (Layer 1), the West Texas Bolsons (Presidio and Redford) Aquifer (Layer 2), and the underlying igneous and sedimentary rocks (Layer 3).
- Water budgets for the district were determined for the West Texas Bolsons (Presidio and Redford) Aquifer (Layer 2).
- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).

RESULTS:

A groundwater budget summarizes the amount of water entering and leaving the aquifers according to the groundwater availability model. The selected groundwater budget components listed below were extracted from the groundwater availability model results for the West Texas Bolsons (Wild Horse Flat, Michigan Flat, Ryan Flat and Lobo Flat) and Igneous aquifers, West Texas Bolsons (Red Light Draw, Green River Valley, and Eagle Flat) Aquifer, and West Texas Bolsons (Presidio and Redford) Aquifer within Presidio County Underground Water Conservation District and averaged over the historical calibration periods, as described under the *Methods* section above (see Table 1 and Table 2).

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.

The information needed for the district's management plan is summarized in Tables 1 and 2. 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 WEST TEXAS BOLSONS AQUIFER FOR PRESIDIO COUNTY UNDERGROUND WATER 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	West Texas Bolsons Aquifer	14,031
Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, and rivers	West Texas Bolsons Aquifer	9,117
Estimated annual volume of flow into the district within each aquifer in the district	West Texas Bolsons Aquifer	22,275
Estimated annual volume of flow out of the district within each aquifer in the district	West Texas Bolsons Aquifer	37,465
Estimated net annual volume of flow between each aquifer in the district	Net flow from West Texas Bolsons Aquifer into overlying Rio Grande alluvium	838
	Net flow from Igneous Aquifer and other underlying units into West Texas Bolsons Aquifer	12,965

*Due to changes to the model grid attributes for the West Texas Bolsons (Presidio and Redford) Aquifer Groundwater Availability Model since the previous management plan report (2013), the groundwater flow volumes have also changed.

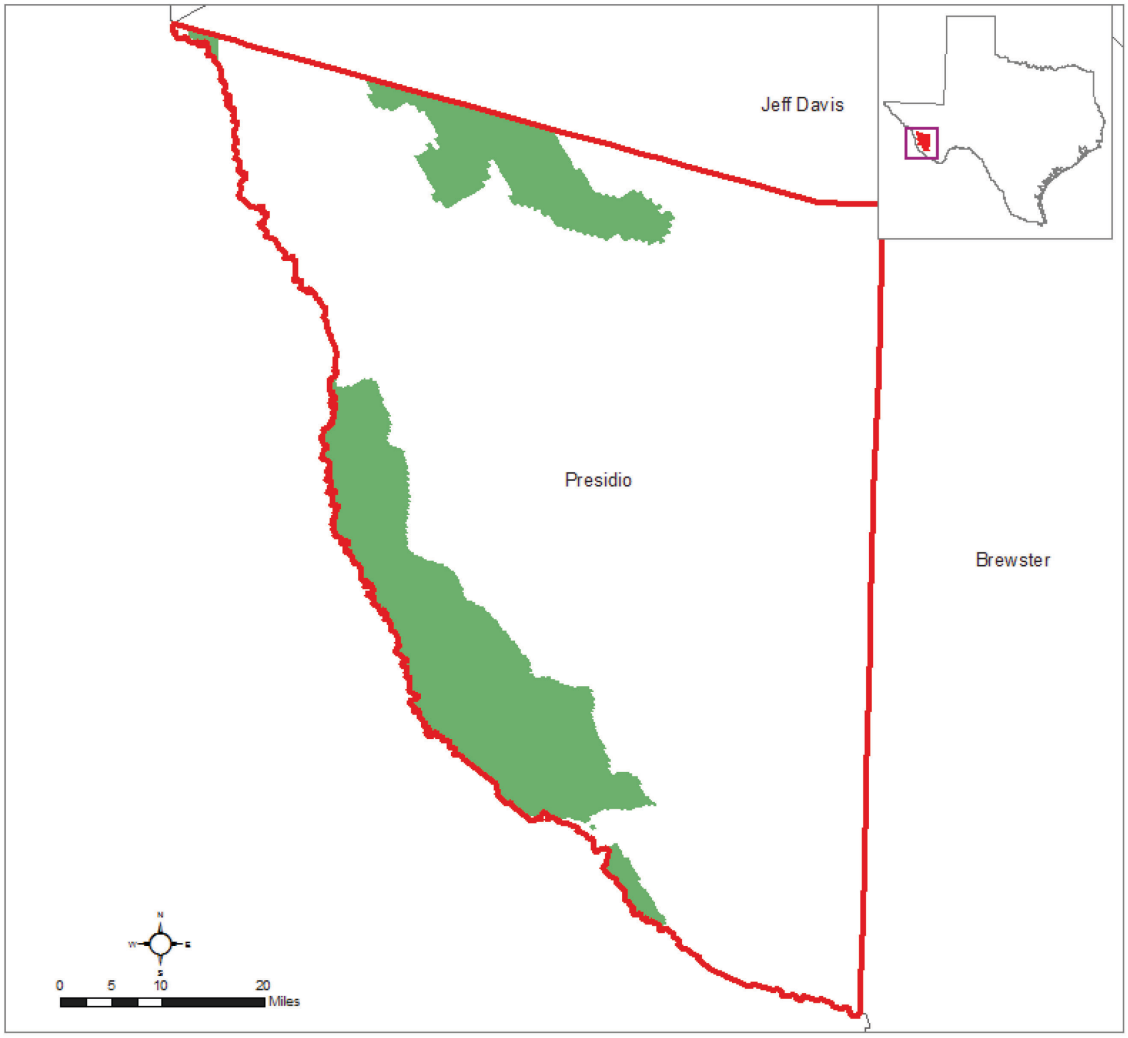


FIGURE 1. AREA OF THE GROUNDWATER AVAILABILITY MODELS FOR THE WEST TEXAS BOLSONS AQUIFER FOR WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED (THE WEST TEXAS BOLSONS AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 2. SUMMARIZED INFORMATION FOR THE IGNEOUS AQUIFER FOR PRESIDIO COUNTY UNDERGROUND WATER 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	Igneous Aquifer	9,409
Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, and rivers	Igneous Aquifer	3,252
Estimated annual volume of flow into the district within each aquifer in the district	Igneous Aquifer	4,429
Estimated annual volume of flow out of the district within each aquifer in the district	Igneous Aquifer	1,783
Estimated net annual volume of flow between each aquifer in the district	Net from Igneous Aquifer to overlying West Texas Bolsons Aquifer	1,611
	Net from Igneous Aquifer into underlying Cretaceous and Permian units	5,909

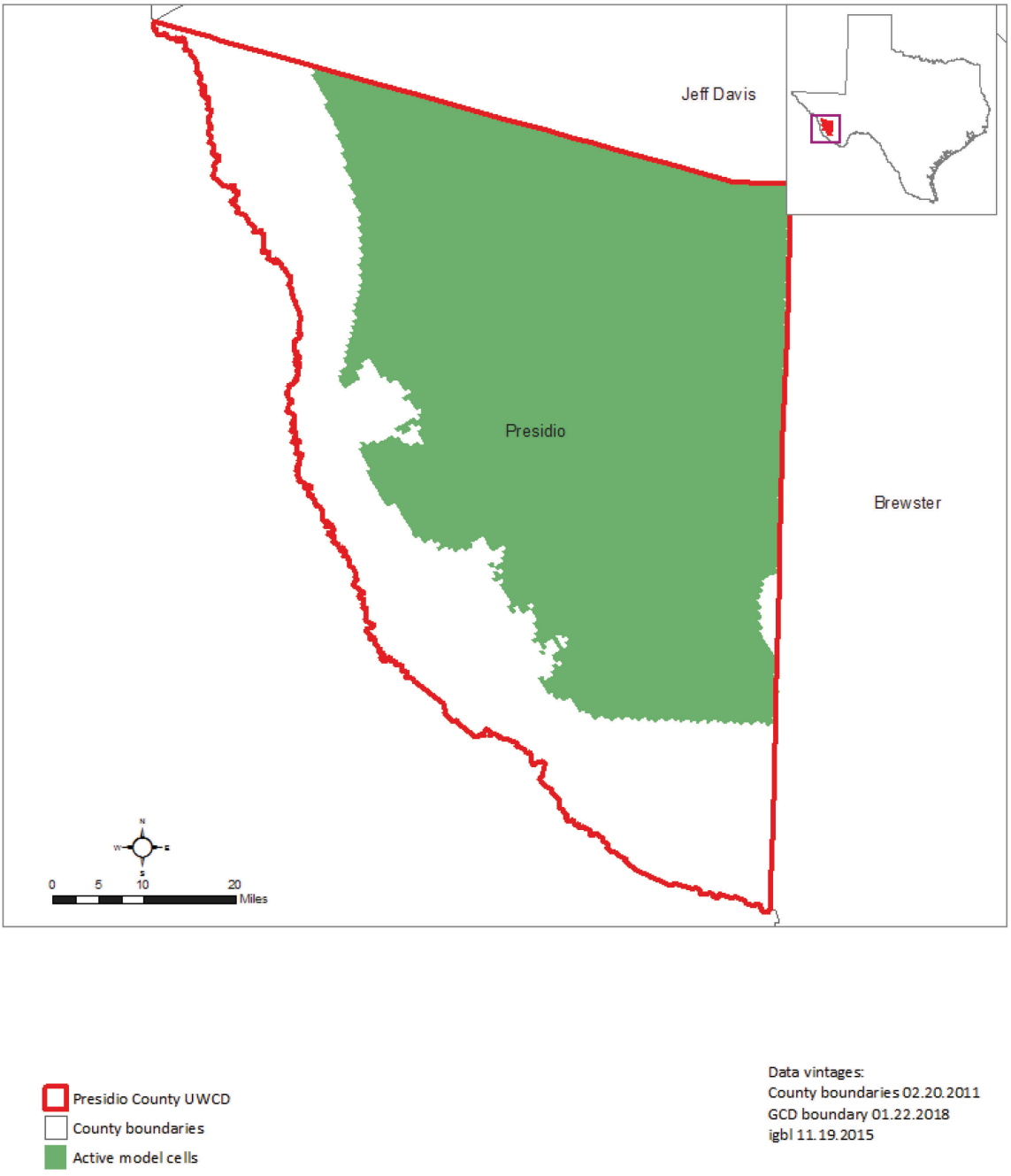


FIGURE 2. AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE IGNEOUS AQUIFER FOR WHICH THE INFORMATION IN TABLE 2 WAS EXTRACTED (THE IGNEOUS AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

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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