GAM Run 12-023 Addendum: Jeff Davis County Underground Water Conservation District Management Plan

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February 11, 2013

Cynthia K. Ridgeway is the Manager of the Groundwater Availability Modeling Section and is responsible for oversight of work performed by Marius Jigmond under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G. 471 on February 11, 2013.

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EXECUTIVE SUMMARY:

The purpose of this report is to amend the groundwater availability model run 12-023 (GAM Run 12-023) (Jigmond, 2012) with results from the groundwater availability model of the Rustler Aquifer (Ewing and others, 2012). Since the release of GAM Run 12-023, the Texas Water Development Board (TWDB) adopted the groundwater availability model of the Rustler Aquifer which covers a small portion of Jeff Davis Underground Water Conservation District.

This report discusses the methods, assumptions, and results from the model run using the groundwater availability model of the Rustler Aquifer. Table 1 summarizes the groundwater availability model data required by the statute, and figure 1 shows the area of the model from which the values in the table were extracted. This model run is an addendum to GAM Run 12-023. If after review of the figures, the Jeff Davis County Underground Water Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the TWDB immediately.

METHODS:

The groundwater availability model of Rustler Aquifer (period: 1980 - 2008) was run for this analysis (Ewing and others, 2012; Niswonger and others, 2011). The water budget for each year of the transient model period (1980 – 2008) were extracted (Harbaugh, 1990), and the average annual water budget values for recharge, surface water outflow, inflow to the district, outflow from the district, net inter-aquifer flow (upper), and net inter-aquifer flow (lower) for the portions of the aquifers located within the district are summarized in this report.

PARAMETERS AND ASSUMPTIONS:

Rustler Aquifer

- Version 1.01 of the groundwater availability model of the Rustler Aquifer was used for this analysis. See Ewing and others (2012) for assumptions and limitations of the model.
- The model has two layers which represent the Dewey Lake Formation and Dockum Aquifer in layer one, and the Rustler Aquifer in layer two. Only results for layer two are presented in this report.

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 and verification portion of the model runs in the district, as shown in tables 1 through 4. The components of the modified budget 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 drains (springs).
- Flow into and out of district—the lateral flow within the aquifer between the district and adjacent counties.
- Flow between aquifers—the flow between aquifers or confining units within the district. This flow is controlled by the relative water levels in each aquifer or confining unit 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 table 1. 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 (see figure 1).

TABLE 1. SUMMARIZED INFORMATION FOR THE RUSTLER AQUIFER THAT IS NEEDED FOR JEFF DAVIS 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	Rustler Aquifer	0
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Rustler Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Rustler Aquifer	75
Estimated annual volume of flow out of the district within each aquifer in the district	Rustler Aquifer	542
Estimated net annual volume of flow between each aquifer in the district	From Overlying units into Rustler Aquifer	462[1]

[1] Includes 203 acre-feet of flow from the Davis Mountains simulated through injection wells (Ewing and others, 2012).

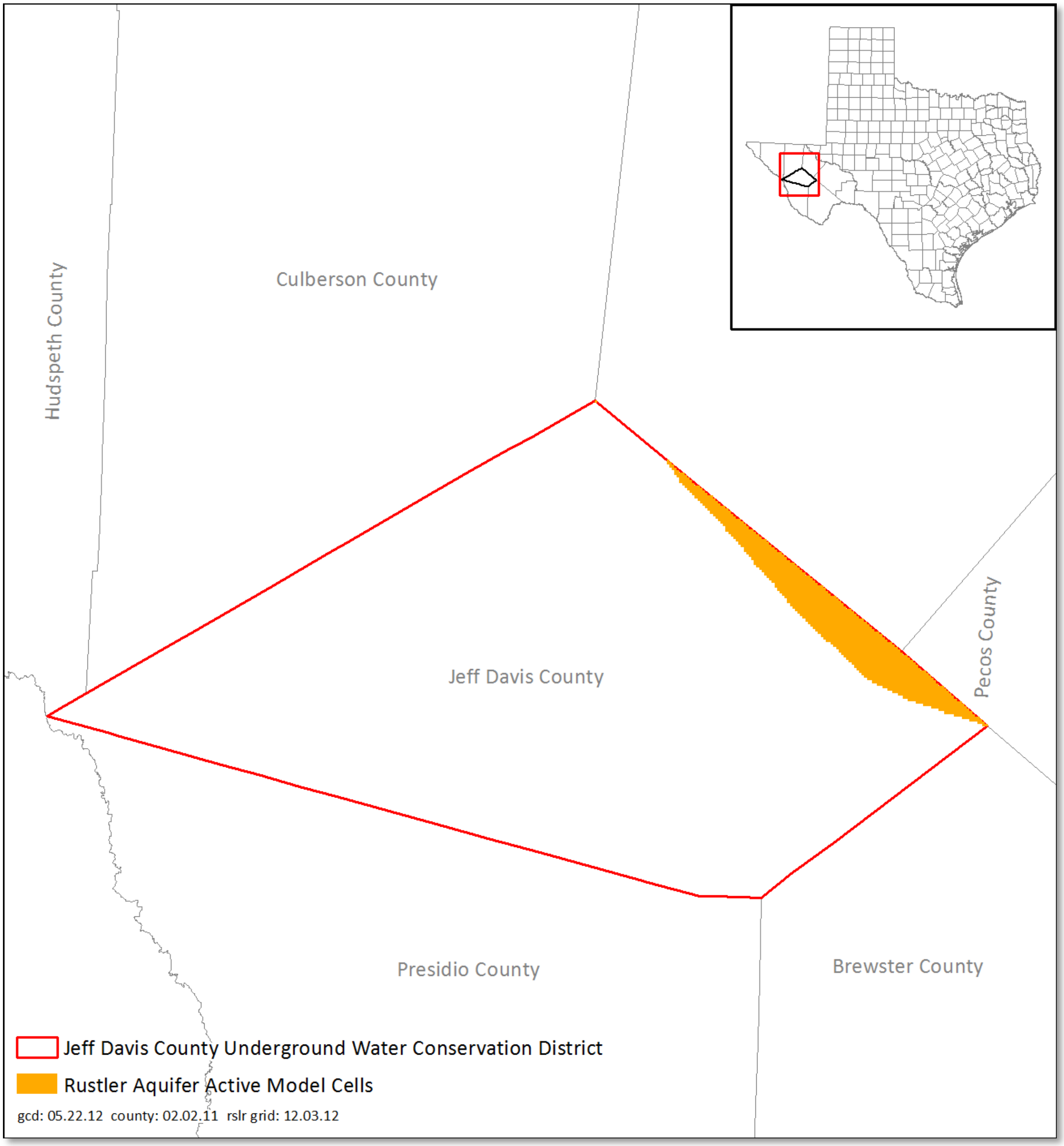

FIGURE 1. AREA OF THE GROUNDWATER AVAILABILITY MODEL OF THE RUSTLER AQUIFER FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED.

LIMITATIONS

The groundwater model(s) used in completing this analysis is the best available scientific tool that can be used to meet the stated objective(s). 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 streamflow are specific to a particular historic time period.

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 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.

REFERENCES:

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Niswonger, R.G., Panday, S., Ibaraki, M., 2011, MODFLOW-NWT, A Newton formulation for MODFLOW-2005: U.S. Geological Survey Techniques and Methods 6-A37, 44 p.