GAM Run 10-066

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Cynthia K. Ridgeway is the Manager of the Groundwater Availability Modeling Section and is responsible for oversight of work performed by Eric Aschenbach under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G. 471 on January 19, 2011.

EXECUTIVE SUMMARY:

Texas State Water Code, Section 36.1071, Subsection (h), states that, in developing its groundwater management plan, groundwater conservation districts shall use groundwater availability modeling information provided by the Executive Administrator of the Texas Water Development Board in conjunction with any available site-specific information provided by the district for review and comment to the Executive Administrator. Information derived from groundwater availability models that shall be included in the groundwater management plan includes:

(1) the annual amount of recharge from precipitation to the groundwater resources within the district, if any;
(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 purpose of this report is to provide information to Central Texas Groundwater Conservation District for its groundwater management plan. The groundwater management plan for Central Texas Groundwater Conservation District is due for approval by the Executive Administrator of the Texas Water Development Board before July 3, 2012.

This report discusses the methods, assumptions, and results from the model run using the groundwater availability model for the northern part of the Trinity 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 respective table were extracted. If after review of Figure 1, Central Texas Groundwater Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the Texas Water Development Board immediately.

The Ellenburger-San Saba Aquifer, Hickory Aquifer, and Marble Falls Aquifer also underlie the Central Texas Groundwater Conservation District. However, groundwater availability models for these minor aquifers have not been completed at this time. If the district would like information for these aquifers, they may request it from the Groundwater Technical Assistance Section of the Texas Water Development Board.

METHODS:

The groundwater availability model for the northern section of the Trinity Aquifer (1980 through 1999) was run for this analysis. Water budgets for each year of the transient model period were extracted 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 portion of the aquifer located within the district are summarized in this report.

PARAMETERS AND ASSUMPTIONS:

Trinity Aquifer

- Version 1.01 of the groundwater availability model for the northern section of the Trinity Aquifer was used for this analysis. See Bené and others (2004) for assumptions and limitations of the model.

- The northern section of the Trinity Aquifer model includes seven layers, which generally correspond to:

    1. the Woodbine Aquifer,
    2. the Washita and Fredericksburg Confining Unit,
    3. the Paluxy Aquifer,
    4. the Glen Rose Confining Unit,
    5. the Hensell Aquifer,
    6. the Pearsall/Cow Creek/Hammett/Sligo Confining Unit, and
    7. the Hosston Aquifer.

    Layer 1 is not present in the district. Out of the remaining layers listed above, an overall water budget for the district was determined for the Trinity Aquifer (Layer 2 through Layer 7, collectively).

- The mean absolute error (a measure of the difference between simulated and actual water levels during model calibration) for the four main aquifers/layers in the model (Woodbine, Paluxy, Hensell, and Hosston) for the calibration and verification time periods (1980 through 1999) ranged from approximately 37 to 75 feet. The root mean squared error was less than ten percent of the maximum change in water levels across the model (Bené and others, 2004).

- The evapotranspiration package of the groundwater availability model was used to represent evaporation, transpiration, springs, seeps, and discharge to streams not modeled by the streamflow-routing package as described in Bené and others (2004).

- As depicted by Bené and others (2004) and LBG-Guyton Associates (2003), groundwater in the Trinity Aquifer within the Central Texas Groundwater Conservation District is predominantly brackish (1,000 to 10,000 milligrams per liter total dissolved solids).

- Groundwater Vistas Version 5 (Environmental Simulations, Inc. 2007) was used as the interface to process model output.

RESULTS:

A groundwater budget summarizes the amount of water entering and leaving the aquifer according to the groundwater availability model. Selected components were extracted from the groundwater budget 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 Table 1. The components of the modified budget shown in Table 1 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 vertical flow between aquifers or confining units. 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. “Inflow” to an aquifer from an overlying or underlying aquifer will always equal the “Outflow” from the other aquifer.

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 Trinity Aquifer that is needed for Central Texas Groundwater Conservation District’s groundwater management plan. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot. These flows include brackish waters.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Trinity Aquifer	44,685
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Trinity Aquifer	7,692
Estimated annual volume of flow into the district within each aquifer in the district	Trinity Aquifer	1,318
Estimated annual volume of flow out of the district within each aquifer in the district	Trinity Aquifer	6,599
Estimated net annual volume of flow between each aquifer in the district	Not applicable	Not applicable

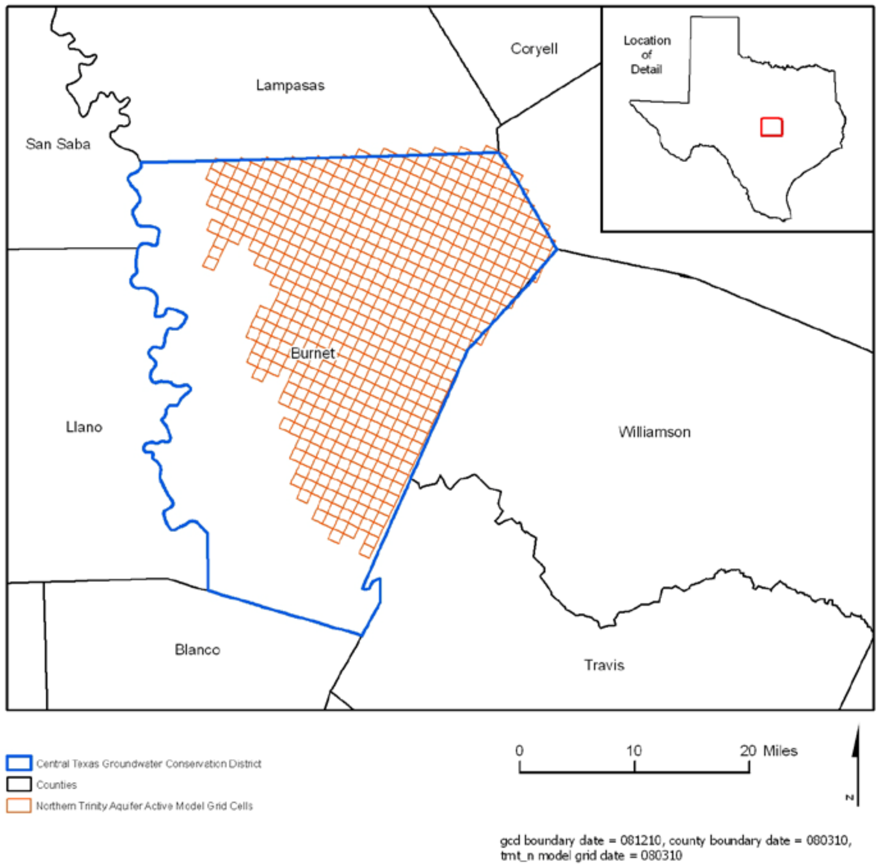

Figure 1: Area of the groundwater availability model for the northern section of the Trinity Aquifer from which the information in Table 1 was extracted (the aquifer extent within the district boundary).

REFERENCES:

Bené, J., Harden, B., O'Rourke, D., Donnelly, A., and Yelderman, J., 2004, Northern Trinity/Woodbine Groundwater Availability Model: contract report to the Texas Water Development Board by R.W. Harden and Associates, 391 p., http://www.twdb.state.tx.us/gam/trnt_n/trnt_n.htm.

Environmental Simulations, Inc., 2007, Guide to Using Groundwater Vistas Version 5, 381 p.

LBG-Guyton Associates, 2003, Brackish Groundwater Manual for Texas Regional Water Planning Groups: contract report to the Texas Water Development Board, 188 p., http://www.twdb.state.tx.us/RWPG/rpgm_rpts/2001483395.pdf.