GAM Run 08-37

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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 groundwater management plans include:

(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 groundwater availability model run is to provide information to the Barton Springs/Edwards Aquifer Conservation District needed for its groundwater management plan. The groundwater management plan for the Barton Springs/Edwards Aquifer Conservation District is due for approval by the Executive Administrator of the Texas Water Development Board before December 29, 2008.

This report discusses the methods, assumptions, and results from model runs using the groundwater availability model for the Barton Springs segment of the Edwards (Balcones Fault Zone) Aquifer. Table 1 summarizes the groundwater availability model data required by statute for the Barton Springs/Edwards Aquifer Conservation Districts groundwater management plan.

Although the Trinity Aquifer also occurs in Hays and Travis counties, the groundwater availability model for the Hill Country portion of the Trinity Aquifer does not include the segment of the aquifer that underlies the Barton Springs/Edwards Aquifer Conservation District. If the district would like information for the Trinity Aquifer, they may request it from the Groundwater Technical Assistance Section of the Texas Water Development Board.

METHODS:

We ran the groundwater availability model for the Barton Springs segment of the Edwards (Balcones Fault Zone) Aquifer and extracted water budget values for recharge, surface water outflow, inflow to the district, and outflow from the district for the steady-state simulation period for the portions of the Edwards (Balcones Fault Zone) Aquifer located within the district.

PARAMETERS AND ASSUMPTIONS:

- We used version 1.01 of the groundwater availability model for the Barton Springs segment of the Edwards (Balcones Fault Zone) Aquifer.

- We used the steady-state model, which was based on recharge for a twenty year period (1979 through 1998), instead of the transient simulation, which encompassed 1989 to 1998, since the transient simulation represented a timeframe that was wetter than normal. The recharge used for the steady-state model appeared to cover a cycle that represents more average climatic conditions.

- The root mean squared error (a measure of the difference between simulated and measured discharge during model calibration) for Barton Springs is 12 cubic feet per second, which represents 11 percent of the discharge fluctuations measured at Barton Springs during that time (Scanlon and others, 2001).

- The Barton Springs segment of the Edwards (Balcones Fault Zone) Aquifer groundwater availability model is a one-layer model and assumes no interaction with the underlying Trinity Aquifer. The cells are 1,000 feet long parallel to the strike of the faults and 500 feet wide.

- We used Processing Modflow for Windows (PMWIN) version 5.3 (Chiang and Kinzelbach, 2001) as the interface to process model output.

RESULTS:

A groundwater budget summarizes the water entering and leaving the aquifer according to the groundwater availability model. Selected components were extracted from the groundwater budget for the calibrated steady-state portion of the model run. The components of the modified budgets shown in Table 1 include:

- Precipitation recharge—This is 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—This is the total water exiting the aquifer (outflow) to surface water features such as streams, reservoirs, and drains (springs).

- Lateral flow into and out of district—This component describes lateral flow within the aquifer between the district and adjacent counties.

- Net inter-aquifer flow—This describes the vertical flow, or leakage, 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. This model is a single-layer and does not include inter-aquifer flow.

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. The orientation of the model cells and the political boundaries of the district do not overlie perfectly, therefore even though the district is larger than the model boundaries, some flow into and out of the district is reported due to the method of data extraction from the model (Scanlon and others, 2001: see figure 2 for an overlay of the model boundaries and the district boundaries http://www.twdb.state.tx.us/gam/ebfz_b/ED-b_final.pdf).

REFERENCES:

Chiang, W. and Kinzelbach, W., 2001, Groundwater Modeling with PMWIN, 346 p.

Scanlon, B., Mace, R., Smith, B., Hovorka, S., Dutton, A., and Reedy, R., 2001, Groundwater Availability of the Barton Springs Segment of the Edwards Aquifer, Texas—Numerical Simulations through 2050: The University of Texas at Austin, Bureau of Economic Geology, final report prepared for the Lower Colorado River Authority, under contract no. UTA99-0.

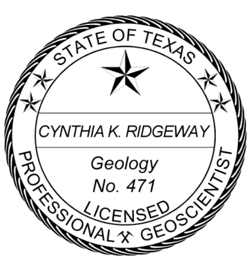
Table 1: Summarized information needed for the Barton Springs/Edwards Aquifer Conservation District's groundwater management plan. All values are reported in acre-feet per year. All numbers are rounded to the nearest 1 acre-foot. Negative values indicate water is leaving the aquifer system using the parameters or boundaries listed in the table.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Edwards and associated limestones	42,858[a]
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Edwards and associated limestones	-39,723
Estimated annual volume of flow into the district within each aquifer in the district	Edwards and associated limestones	3,191[b]
Estimated annual volume of flow out of the district within each aquifer in the district	Edwards and associated limestones	-2,651[b]
Estimated net annual volume of flow between each aquifer in the district	Edwards into Trinity	0[c]

[a] Recharge value includes concentrated infiltration of water from stream channels. Scanlon and others (2001) postulated that approximately 15 percent of recharge in the model was due to diffuse inter-stream recharge, or direct precipitation, which equates to approximately 6,429 acre-feet per year.

[b] The orientation of the model cells and the political boundaries of the district do not overlie perfectly, therefore even though the district is larger than the model boundaries, some flow into and out of the district is reported due to the method of data extraction from the model.

[c] The model does not consider flow into or out of the Edwards (Balcones Fault Zone) Aquifer from other formations.



Cynthia K. Ridgeway is Manager of the Groundwater Availability Modeling Section and is responsible for oversight of work performed by employees under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G., on June 20, 2008.