GAM Run 08-25

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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 model run is to provide information to the Glasscock Groundwater Conservation District for its groundwater management plan. The groundwater management plan for the Glasscock Groundwater Conservation District is due for approval by the executive administrator of the Texas Water Development Board before October 24, 2008.

This report discusses the methods, assumptions, and results from model runs using the groundwater availability models for the Edwards-Trinity (Plateau) Aquifer and the southern part of the Ogallala Aquifer. Table 1 summarizes the groundwater availability model data required by statute for the Glasscock Groundwater Conservation Districts groundwater management plan.

The Lipan and Dockum aquifers also underlie the Glasscock Groundwater Conservation District. The current version of the groundwater availability model for the Lipan Aquifer does not extend to Glasscock County and the groundwater availability model for the Dockum Aquifer is still under development. If the district would like information for the Lipan and Dockum aquifers, they may request it from the Groundwater Technical Assistance Section of the Texas Water Development Board.

METHODS:

We ran the groundwater availability models for the Edwards-Trinity (Plateau) Aquifer and the southern part of the Ogallala Aquifer, and (1) extracted water budgets for each year of the 1980 through 1999 period and (2) averaged the 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 Edwards, Trinity, and the Ogallala aquifers located within the district.

PARAMETERS AND ASSUMPTIONS:

- We used version 1.01 of the groundwater availability models for the Edwards-Trinity (Plateau) Aquifer and the southern portion of the Ogallala Aquifer.

- In the analysis, the pumpage distribution for each transient calibrated model is the same as described in Anaya and Jones (2004) for the Edwards-Trinity (Plateau) Aquifer model and in Blandford and others (2003) for the southern portion of the Ogallala Aquifer.

- See Anaya and Jones (2004) for assumptions and limitation of the model for the Edwards-Trinity (Plateau) Aquifer. The root mean square error (a measure of the difference between simulated and actual water levels during model calibration) of the Edwards-Trinity (Plateau) groundwater availability model for the period of 1990 to 2000 is 143 feet, or six percent of the range of measured water levels.

- See Blandford and others (2003) for assumptions and limitations of the model for the southern part of the Ogallala Aquifer. Root mean squared error for this model is 47 feet. This error will have more of an effect on model results where the aquifer is thin.

- The Edwards-Trinity (Plateau) Aquifer model includes two layers representing the Edwards Group and equivalent limestone hydrostratigraphic units (Layer 1) and the undifferentiated Trinity Group hydrostratigraphic units (Layer 2) in the district.

- The groundwater availability model for the southern part of the Ogallala Aquifer has only one single layer representing the Ogallala hydrostratigraphic unit in the district.

- We used Groundwater Vistas Version 5 (Environmental Simulations, Inc. 2007) as the interface to process model output results for the groundwater availability model for the Edwards-Trinity (Plateau) Aquifer and Processing Modflow for Windows (PMWIN) version 5.3 (Chiang and Kinzelbach, 2001) as the interface to process model output for the groundwater availability model for the southern part of the Ogallala Aquifer.

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 and averaged over the duration of the calibrated portion of the model run (1980 through 1999). 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).
- Flow into and out of district—This component describes lateral flow within the aquifer between the district and adjacent counties.
- Flow between aquifers—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.

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 groundwater availability model for the Edwards-Trinity (Plateau) Aquifer should be used with caution when interpreting predictive model simulation results for the area within and around Glasscock County. The simulated water budget results used for this report were reviewed and deemed reasonable for the model's historical calibration period. However, it should be noted that irrigation return flow is not represented in the model and the budget value for groundwater flowing into the county may be over estimated to compensate for irrigation return flows.

REFERENCES:

Anaya, R., and Jones, I., 2004, Groundwater availability model for the Edwards-Trinity (Plateau) and Cenozoic Pecos Alluvium aquifer systems, Texas: Texas Water Development Board, GAM Report, 208 p., http://www.twdb.state.tx.us/gam/eddt_p/eddt_p.htm, Blandford, T.N., Blazer, D.J., Calhoun, K.C., Dutton, A.R., Naing, T., Reedy, R.C., and Scanlon, B.R., 2003, Groundwater availability of the southern Ogallala aquifer in Texas and New Mexico—Numerical Simulations Through 2050: Final Report prepared for the Texas Water Development Board by Daniel B. Stephens & Associates, Inc., 158 p.

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

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

Table 1: Summarized information needed for the Glasscock Groundwater 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.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Edwards Group and equivalent limestone	12,712
	Undifferentiated Trinity Group	5,063
	Ogallala Aquifer	1,294
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Edwards Group and equivalent limestone	1,663
	Undifferentiated Trinity Group	0
	Ogallala Aquifer	631
Estimated annual volume of flow into the district within each aquifer in the district	Edwards Group and equivalent limestone	3,152
	Undifferentiated Trinity Group	47,716
	Ogallala Aquifer	1,535
Estimated annual volume of flow out of the district within each aquifer in the district	Edwards Group and equivalent limestone	4,733
	Undifferentiated Trinity Group	18,026
	Ogallala Aquifer	874
Estimated net annual volume of flow between each aquifer in the district	Edwards Group and equivalent limestone into undifferentiated Trinity Group	9,627
	Flow in or out of the Ogallala Aquifer	0*

*The models do not consider flow into or out of the Ogallala from other formations.

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