GAM Run 08-40

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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 Saratoga Underground Water Conservation District for its groundwater management plan. The groundwater management plan for the Saratoga Underground Water Conservation District is due for approval by the executive administrator of the Texas Water Development Board before December 29, 2008.

This report discusses the method, assumptions, and results from model runs using the groundwater availability models for the northern part of the Trinity Aquifer. Table 1 summarizes the groundwater availability model data required by statute for the Saratoga Underground Water Conservation Districts groundwater management plan.

The Llano Uplift aquifers, which include the Marble Falls, Hickory, and Ellenburger-San Saba aquifers, also underlie the Saratoga Underground Water Conservation District. Groundwater availability models have not yet been completed for these minor aquifers. If the district would like information for the Llano Uplift aquifers, 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 northern part of the Trinity Aquifer and (1) extracted water budgets for each year of the 1980 through 1999 period and (2) averaged the 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 Trinity Aquifer located within the district.

PARAMETERS AND ASSUMPTIONS:

- We used version 1.01 of the groundwater availability model for the northern part of the Trinity Aquifer for this run. See Bené and others (2004) for assumptions and limitations of the model.

- The model includes seven layers, representing the Woodbine Aquifer (Layer 1), the Washita and Fredericksburg Series (Layer 2), the Paluxy Aquifer (Layer 3), the Glen Rose Formation (Layer 4), the Hensell Aquifer (Layer 5), the Pearsall/Cow Creek/Hammett/Sligo Formation (Layer 6), and the Hosston Aquifer (Layer 7).

- The mean absolute error (a measure of the difference between simulated and actual water levels during model calibration) for the four main aquifers in the model (Woodbine, Paluxy, Hensell, and Hosston) for the calibration and verification time periods (1980 to 2000) 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).

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

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 aquifers located within the district and averaged over the duration of the calibrated portion of the model run (1980 to 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.

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.

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

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Table 1: Summarized information needed for the Saratoga Underground Water 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	Woodbine Aquifer	0
	Washita and Fredericksburg Series	6,030
	Paluxy Aquifer	11,303
	Glen Rose Formation	23,485
	Hensell Aquifer	1,446
	Pearsall/Cow Creek/Hammett/Sligo Formation	0
	Hosston Aquifer	5,040
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Woodbine Aquifer	0
	Washita and Fredericksburg Series	0
	Paluxy Aquifer	0
	Glen Rose Formation	-2,059
	Hensell Aquifer	0
	Pearsall/Cow Creek/Hammett/Sligo Formation	0
	Hosston Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Woodbine Aquifer	0
	Washita and Fredericksburg Series	238
	Paluxy Aquifer	24
	Glen Rose Formation	265
	Hensell Aquifer	1,015
	Pearsall/Cow Creek/Hammett/Sligo Formation	2
	Hosston Aquifer	870
Estimated annual volume of flow out of the district within each aquifer in the district	Woodbine Aquifer	0
	Washita and Fredericksburg Series	0
	Paluxy Aquifer	-116
	Glen Rose Formation	-483
	Hensell Aquifer	-1,935
	Pearsall/Cow Creek/Hammett/Sligo Formation	-3
	Hosston Aquifer	-1,846
Estimated net annual volume of flow between each aquifer in the district	Woodbine Aquifer to Washita and Fredericksburg Series	0
	Washita and Fredericksburg Series to Paluxy Aquifer	-24
	Paluxy Aquifer to Glen Rose Formation	-144
	Glen Rose Formation to Hensell Aquifer	-877
	Hensell Aquifer to Pearsall/Cow Creek/Hammett/Sligo Formation	-973
	Pearsall/Cow Creek/Hammett/Sligo Formation to Hosston	-971