GAM Run 07-22

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EXECUTIVE SUMMARY:

The Santa Rita Underground Water Conservation District requested water budget values to be used in their groundwater management plan. We ran the Edwards-Trinity (Plateau) Aquifer groundwater availability model for the 1980 to 1999 period, extracted the water budgets for each year, averaged the yearly values, and generated tables to show the results.

REQUESTOR:

Ms. Cindy Weatherby of the Santa Rita Underground Water Conservation District

DESCRIPTION OF REQUEST:

Ms. Weatherby requested that we run the Edwards-Trinity (Plateau) Aquifer groundwater availability model to provide her with water budgets for her district's groundwater management plan. The run is a standard transient calibration-verification model run, which includes the years 1980 to 1999. The management plan requires estimated budgets for recharge from precipitation, surface-water inflow, surface-water outflow, inflow into the district, outflow from the district, net inter-aquifer flow (upper), and net inter-aquifer flow (lower).

METHODS:

To address the request, we ran the transient groundwater availability model for the Edwards-Trinity (Plateau) Aquifer and extracted water budgets for each year of the 1980 through 1999 period and averaged the budgets from the twenty-year period for recharge, surface water inflow, 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 and Trinity aquifers located within the district. We did not include the Dockum Aquifer in this analysis since it is not part of the model.

PARAMETERS AND ASSUMPTIONS:

- We used Version 1.0 of the groundwater availability model for the Edwards-Trinity (Plateau) Aquifer.

- In the analysis, the pumpage distribution is the same for the transient calibrated model as described in Anaya and Jones (2004).

- The root mean squared error (a measure of the difference between simulated and actual water levels during model calibration) in the entire 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 (Anaya and Jones, 2004).

- The Edwards-Trinity (Plateau) Aquifer model in Reagan County includes two layers representing the Edwards and associated limestones (Layer 1) and the undifferentiated Trinity units (Layer 2) in the district.

RESULTS:

A groundwater budget summarizes how the model estimates water entering and leaving the aquifer. The modified groundwater budget for the average values from the transient model (1980 to 1999) is shown in Table 1. The components of the modified budgets shown in Table 1 include:

- Surface water inflow and outflow—This is the total surface water entering the aquifer (inflow) through streams or reservoirs, or total surface water exiting the aquifer (outflow) to streams, reservoirs, drains (springs), or through evapotranspiration (return of moisture to the air through both evaporation from the soil and transpiration or loss of water vapor by plants).

- 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 and aquifer properties of each aquifer that define the amount of leakage that can occur. “Inflow” to an aquifer from an overlying or underlying aquifer will always equal the “Outflow” from the other aquifer.

- Precipitation recharge is the areally distributed recharge due to precipitation falling on the outcrop areas of the aquifers (where the aquifer is exposed at land surface) within the district. The information needed for the district’s management plan is summarized in Table 2.

It is important to note that sub-regional water budgets for individual counties, such as Reagan are not exact. This is due to the one-mile spacing of the model grid and because we assumed each model cell is assigned to a single county. The water budgets for an individual cell containing a county boundary are assigned to either one county or the other and therefore very minor variations in the county-wide budgets may be observed.

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.

Table 1: Selected flow terms for each aquifer layer, into and out of the Santa Rita Underground Water Conservation District, averaged for the years 1980 to 1999 from the groundwater availability model of the Edwards-Trinity (Plateau) Aquifer. Flows are in acre-feet per year. Note: a negative sign refers to flow out of the aquifer in the district. A positive sign refers to flow into the aquifer in the district. All numbers are rounded to the nearest 1 acre-foot. Flow into and out of the confining layers are negligible compared to the aquifers and are not included.

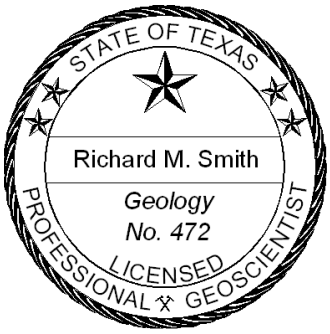
Aquifer	Surface water inflow	Surface water outflow	Lateral inflow into district	Lateral outflow from district	Net inter-aquifer flow (upper)	Net inter-aquifer flow (lower)
Edwards aquifer (Layer 1)	0	-814	5,910	-6,259	0	-16,995
Trinity aquifer* (Layer 2)	0	0	24,722	-35,823	16,995	0

*Note: The groundwater availability model for this layer in this area is particularly sensitive to assumptions on layer type (fixed transmissivity) and aquifer properties. Although the values appear realistic to us, they will likely change when the model is updated.

Table 2: Summarized information needed for the Santa Rita Underground Water Conservation District's management plan. All values reported in acre-feet per year. All numbers are rounded to the nearest 1 acre-foot. This analysis does not include estimates related to the Dockum Aquifer.

Management Plan requirement	Aquifer	Results
Estimated annual amount of recharge from precipitation to the district	All aquifers exposed at land surface in the district:	18,228
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Edwards (Plateau) Aquifer, Trinity (Plateau)*	-814
Estimated annual volume of flow into the district within each aquifer in the district	Edwards (Plateau) Aquifer	5,910
	Trinity (Plateau) Aquifer*	24,722
Estimated annual volume of flow out of the district within each aquifer in the district	Edwards (Plateau) Aquifer	-6,259
	Trinity (Plateau) Aquifer*	-35,823
Estimated annual volume of flow between each aquifer in the district	Edwards (Plateau) Aquifer to the Trinity (Plateau) Aquifer	-16,995
	Base of Trinity (Plateau) Aquifer*	0

*See note above



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