GAM Run 08-50

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July 16, 2008

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 Panola County Groundwater Conservation District for its groundwater management plan. The groundwater management plan for the Panola County Groundwater Conservation District is due for approval by the executive administrator of the Texas Water Development Board before November 6, 2010.

This report discusses the method, assumptions, and results from model runs using the groundwater availability models for the northern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers. Table 1 summarizes the groundwater availability model data required by statute for the Panola County Groundwater Conservation District's groundwater management plan.

METHODS:

We ran the groundwater availability model for the northern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers 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 Carrizo-Wilcox,

Queen City, and Sparta groundwater availability model located within the district. It is important to note that though the model contains layers for the Queen City and Sparta aquifers (Layers 1 and 3) and their associated confining units (Layers 2 and 4), these aquifers are not substantively present within the district. The reported water budget values for these layers, therefore, are very small or zero (see Table 1).

PARAMETERS AND ASSUMPTIONS:

- We used Version 2.01 of the groundwater availability model for the northern part of the Carrizo-Wilcox, Queen City and Sparta aquifers. See Fryar and others (2003) and Kelley and others (2004) for assumptions and limitations of the groundwater availability model for the northern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers.

- The groundwater availability model includes eight layers, representing:

    1. the Sparta Aquifer (Layer 1),
    2. the Weches Confining Unit (Layer 2),
    3. the Queen City Aquifer (Layer 3),
    4. the Reklaw Confining Unit (Layer 4),
    5. the Carrizo Aquifer (Layer 5),
    6. the Upper Wilcox Aquifer (Calvert Bluff Formation—Layer 6),
    7. the Middle Wilcox Aquifer (Simsboro Formation—Layer 7), and
    8. the Lower Wilcox Aquifer (Hooper Formation—Layer 8).

- As mentioned above, though layers 1 to 4 are present in the model, these aquifers and confining units are not substantively present in the district. The reported water budget values for these layers, therefore, are very small or zero.

- The mean absolute error (a measure of the difference between simulated and actual water levels during model calibration) in the entire model for the period of 1980 to 1999 ranges from 3.2 percent (Carrizo aquifer) to 7.8 percent (Sparta aquifer) of measured water levels (Kelley and others, 2004).

- We used 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 northern part of the Carrizo-Wilcox, Queen City and Sparta aquifers.

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) in the district, as shown in Table 1. 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.

Table 1: Summarized information needed for the Panola County 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	Sparta	0*
	Weches	0*
	Queen City	111*
	Reklaw	112*
	Carrizo	1,118
	Wilcox (upper)	6,324
	Wilcox (middle)	30,563
	Wilcox (lower)	0

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Sparta	0*
	Weches	0*
	Queen City	0*
	Reklaw	0*
	Carrizo	0
	Wilcox (upper)	1,701
	Wilcox (middle)	28,187
	Wilcox (lower)	0
Estimated annual volume of flow into the district within each aquifer in the district	Sparta	0*
	Weches	0*
	Queen City	3*
	Reklaw	5*
	Carrizo	200
	Wilcox (upper)	992
	Wilcox (middle)	4,275
	Wilcox (lower)	188
Estimated annual volume of flow out of the district within each aquifer in the district	Sparta	0*
	Weches	0*
	Queen City	0*
	Reklaw	0*
	Carrizo	0
	Wilcox (upper)	608
	Wilcox (middle)	2,390
	Wilcox (lower)	125
Estimated net annual volume of flow between each aquifer in the district	Sparta into Weches	0*
	Weches into Queen City	0*
	Queen City into Reklaw	6*
	Reklaw into Carrizo	16*
	Carrizo into Wilcox (upper)	174
	Wilcox (middle) into Wilcox (upper)	1,235
	Wilcox (lower) into Wilcox (middle)	358

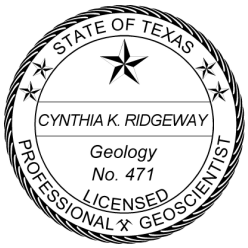
*Please note the Sparta and Queen City aquifers and the Weches and Reklaw confining units are not substantively present within the Panola County Groundwater Conservation District. The numbers reported for these groundwater availability model layers are, therefore, very small or zero.

REFERENCES:

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

Fryar, D., Senger, R., Deeds, N., Pickens, J., Jones, T., Whallon, A.J., Dean, K.E., 2003, Groundwater availability model for the northern Carrizo-Wilcox aquifer: Contract report to the Texas Water Development Board, 529 p.

Kelley, V.A., Deeds, N.E., Fryar, D.G., and Nicot, J.P., 2004, Groundwater availability models for the Queen City and Sparta aquifers: Contract report to the Texas Water Development Board, 867 p.



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 July 7, 2008.