GAM run 05-06

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Texas Water Development Board
Groundwater Availability Modeling Section
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March 21, 2005

REQUESTOR:

Ms. Gina Harris, General Manager, Tri-County Groundwater Conservation District

DESCRIPTION OF REQUEST:

Ms. Harris requested that we extract the water budget for Hardeman and Foard counties from the Groundwater Availability Model (GAM) for the Seymour aquifer (Ewing and others, 2004) for the years 2005 through 2011.

METHODS:

To address the request, we ran the GAM with average recharge for 2005 through 2011 and extracted the water budget for Hardeman and Foard counties for the Blaine and Seymour aquifers.

PARAMETERS AND ASSUMPTIONS:

- See Ewing and others (2004) for assumptions and limitations of the GAM. Root mean squared error for this model is 9.7 to 27.5 ft for the Seymour aquifer and 45 ft for the Blaine.
- We used recharge values that represent average conditions from 2005 through 2011.
- The GAM uses pumpage based on the 2001 Region B Regional Water Planning Plan. We made no changes to the pumpage in the original model of Ewing and others (2004).

RESULTS:

A water budget is an assessment of all the inputs and outputs to a hydrologic system (Tables 1 through 4). These values reflect the basic inputs and outputs to the Seymour and Blaine aquifers in Hardeman and Foard counties so that gains are balanced with storage and losses from the system. Negative numbers represent water leaving the county, and positive numbers represent water entering the county. Note that the percent difference between water flowing into a county and water flowing out of a county is large for some years (for example, 2010 and 2011 for Hardeman County and 2007 and 2008 for Foard County). This difference appears to be due to a large amount of water moving into the layer from underneath. We were not able to discern why this was happening. However, it does not seem to affect the other parameters of the water budget and does not affect water levels (and therefore does not affect volumes). Given this, we believe the numbers are fine with the exception of the vertical flow for the years identified above.

REFERENCES:

Ewing, J. E., Jones, T. L., Pickens, J. F., Chastain-Howley, A., Dean, K. E., Spear, A. A., 2004, Groundwater availability model for the Seymour aquifer: Final Report prepared for the Texas Water Development Board by Intera Inc., 432 p.

Table 1. Water budgets for the Seymour aquifer in Hardeman County.

County	Year	Stor In	Stor Out	X-In	X-Out	LwExc In	LwExc Out	Wells	Spring	Rchrge	ET	StrLeakin	StrLeak out	Total_In	Total_Out	%Diff
Hardeman	2005	-3,138	204	336	-5,644	2,866	-9,888	-321	-167	22,400	-2,944	40	-3,407	25,847	-25,508	1.32
	2006	-3,052	183	339	-5,663	2,841	-9,888	-321	-172	22,400	-2,948	40	-3,430	25,803	-25,473	1.29
	2007	-3,071	167	341	-5,681	2,884	-9,881	-321	-176	22,460	-2,952	40	-3,612	25,893	-25,694	0.77
	2008	-2,909	152	343	-5,698	2,791	-9,875	-320	-181	22,400	-2,957	39	-3,475	25,726	-25,414	1.22
	2009	-2,845	141	345	-5,715	2,768	-9,858	-319	-185	22,400	-2,962	39	-3,496	25,693	-25,382	1.22
	2010	-2,772	216	346	-5,732	13,423	-9,873	-319	-190	22,475	-2,968	39	-3,675	36,499	-25,528	35.37
	2011	-2,712	206	347	-5,748	12,144	-9,885	-319	-194	22,495	-2,974	39	-3,695	35,231	-25,526	31.95

1. Stor In – Water going into storage
2. Stor Out – Water coming out of storage
3. X-In – Water moving horizontally in to the county
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5. LwExcIn – Water moving into the layer from beneath
6. LwExcOut – Water moving out of the layer vertically
7. Wells – pumpage from wells
8. Spring – spring flow
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10. ET – Evapotranspiration out of the county
11. StrLeak In – water entering the streams
12. StrLeak out – water leaving the streams
13. Total_In – total water into the county
14. Total_Out –total water out of the county
15. %Diff – percent difference between Total_In and Total_Out

Note: Values in the water budget are probably only accurate to two significant figures. We did not round these values so we could calculate the percent difference between water flowing in and water flowing out of the area of interest. A large percent difference in the water budget suggests that the model may not be converging to an accurate solution.

Table 2. Water budgets for the Seymour aquifer in Foard County.

County	Year	Stor In	Stor Out	X-In	X-Out	LwExc In	LwExc Out	Wells	Spring	Rchrge	ET	StrLeakin	StrLeak out	Total_In	TotalOut	%Diff
Foard	2005	-1,179	654	29	-781	1,813	-4,742	-4,416	0	13,296	-1,283	80	-3,401	15,872	-15,802	0.44
	2006	-1,156	713	32	-780	1,972	-4,675	-4,894	0	13,535	-1,286	80	-3,405	16,332	-16,197	0.83
	2007	-1,150	610	34	-780	2,543	-4,663	-4,616	0	13,448	-1,289	80	-3,600	16,715	-16,099	3.75
	2008	-1,355	609	36	-780	4,854	-4,595	-4,602	0	13,428	-1,293	80	-3,603	19,008	-16,228	15.78
	2009	-1,714	553	38	-781	2,718	-4,603	-4,849	0	13,500	-1,296	80	-3,418	16,889	-16,661	1.36
	2010	-1,054	389	39	-782	1,965	-4,614	-4,273	0	13,207	-1,299	80	-3,423	15,681	-15,445	1.52
	2011	-1,015	442	40	-783	1,828	-4,636	-4,511	0	13,360	-1,303	80	-3,428	15,751	-15,675	0.48

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Table 3. Water budgets for the Blaine aquifer in Hardeman County.

County	Year	Stor_In	Stor_Out	X-In	X-Out	Wells	Springs	Recharge	ET	Str_Leakin	Str_Leakout	Total_In	Total_Out	%Diff
Hardeman	2005	-7,152	5,269	5,541	-5,836	-4,772	0	10,950	-3,680	1,268	-4,908	28,464	-28,261	0.72
	2006	-6,972	5,104	5,536	-5,808	-4,757	0	10,950	-3,682	1,256	-4,937	28,286	-28,052	0.83
	2007	-6,812	5,020	5,531	-5,779	-4,743	0	10,890	-3,683	1,245	-4,965	28,123	-27,927	0.7
	2008	-6,718	4,785	5,526	-5,751	-4,728	0	10,950	-3,684	1,235	-4,992	27,929	-27,731	0.71
	2009	-6,569	4,643	5,521	-5,722	-4,714	0	10,935	-3,686	1,225	-5,018	27,750	-27,548	0.73
	2010	-6,401	4,548	5,515	-5,695	-4,699	0	10,875	-3,687	1,215	-5,044	27,586	-38,033	31.84
	2011	-6,276	4,414	5,509	-5,668	-4,685	0	10,855	-3,689	1,204	-5,069	27,427	-36,618	28.7

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Table 4. Water budgets for the Blaine aquifer in Foard County.

County	Year	Stor_In	Stor_Out	X-In	X-Out	Wells	Springs	Recharge	ET	Str_Leakin	Str_Leakout	Total_In	Total_Out	%Diff
Foard	2005	-2,373	7,598	3,082	-6,272	-18	-5	5,483	-3,279	249	-5,449	16,919	-17,509	-3.43
	2006	-2,298	7,481	3,073	-6,215	-18	-5	5,542	-3,265	249	-5,461	16,785	-17,371	-3.43
	2007	-2,234	7,367	3,063	-6,161	-18	-5	5,542	-3,255	248	-5,471	16,672	-17,249	-3.4
	2008	-2,185	7,288	3,055	-6,110	-18	-5	5,563	-3,235	248	-5,481	16,555	-17,135	-3.44
	2009	-2,137	7,167	3,047	-6,062	-18	-5	5,563	-3,191	248	-5,490	16,436	-17,001	-3.38
	2010	-2,090	7,056	3,041	-6,014	-18	-4	5,563	-3,164	248	-5,499	16,328	-16,884	-3.35
	2011	-2,046	6,956	3,035	-5,967	-18	-4	5,563	-3,143	248	-5,506	16,231	-16,777	-3.31

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