

# GAM run 04-07

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Texas Water Development Board  
Groundwater Availability Modeling Section  
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July 27, 2004

## **REQUESTOR:**

Mr. H. P. "Bo" Brown, Jr., Chairman, Llano Estacado Regional Water Planning Group (LERWPG)

## **DESCRIPTION OF REQUEST:**

The LERWPG requested that the Southern Ogallala Groundwater Availability Model (GAM) be run using the water demand projections for water user groups (WUGs) of LERWPG, as approved by the Texas Water Development Board on September 17, 2003 for the period of record through 2060. It was requested that volumetric calculations be made for the counties in the region using a mass balance approach with 1995 as the base starting point and continuing through 2060 with only average recharge from the model as the primary input and pumping numbers from the Regional Water Planning Group as the primary output.

In addition, based on the results of earlier model runs, questions were posed about the decrease of pumping in some counties when the projected volume of groundwater would appear to support the production of larger volumes.

## **METHODOLOGY:**

1. We used the 1995 volumetric calculations generated for Table 3-1 of the Llano Estacado Regional Water Plan submitted to the Texas Water Development Board in January 2001 as the base starting point. These numbers are in acre-feet.
2. Using the average recharge from the GAM and the water use numbers (1996-1999) generated by Dr. Stephen Amosson and others for the Southern Ogallala GAM (Blandford and others, 2003), we calculated the volumes for 1996-1999.
3. We calculated the volumes (county-basin) out to 2060 using the recharge from the model and the demand numbers from the RWPG (2000-2060) as the basic input and output to the equation.
4. In addition, we generated percentage change maps based on model results for each decade to illustrate the change in saturated thickness for the total area. This should provide some insight into areas within the region that could be adversely affected by future pumping.

## **PARAMETERS AND ASSUMPTIONS:**

The recharge in the model represented average climatic conditions for the entire model run of 2001 to 2060. No change in pumpage was considered for the counties not included on the new projected demands table. All other parameters and assumptions agree with those discussed in the GAM final report (Blandford and others, 2003).

## **RESULTS:**

The spreadsheet showing the results of the analysis is attached to this document. Twenty-one counties were analyzed for groundwater volumes for the period 2000 to 2060. Eleven of the twenty-one counties went dry (showed negative volumes) before the end of the period of projection. Parmer county goes dry in 2018, Lubbock county goes in 2019, Castro in 2020, Hale in 2021, Deaf Smith and Lamb in 2024, Hockley in 2025, Bailey in 2037, Gaines in 2047, Cochran in 2048 and Floyd in 2051. In contrast, Garza and Lynn counties were gaining water at the end of the projection period. The remaining counties were losing total groundwater volumes at varying rates for the 2000 to 2060 period.

The dry cell phenomena associated with the model contributes to several issues which affect the water budget in the predictive runs. First, as cells go dry in MODFLOW, pumping is no longer assigned to those cells in the model. As a consequence, where dry cells occur prior to the drought-of-record, increased pumping for drought conditions will not be applied. When pumping is reduced, horizontal flow and recharge will cause water level rises. Without using the re-wetting package in MODFLOW, the pumping cannot be turned back on no matter how much water appears to be available in the cell. This gives rise to the issue of apparently large volumes of water available in the future, but only small amounts of pumping taking place compared to the recommended pumpage numbers.

## **REFERENCES:**

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 by D. B. Stephens & Assoc, for the Texas Water Development Board

## Llano Estacado Region -- Water Demand Projections

County	WUG Name	Basin Name	1995	2000	2010	2020	2030	2040	2050	2060
Water Use				ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft
<b>BAILEY County</b>										
Municipal	COUNTY-OTHER	BRAZOS		331	342	358	364	371	370	363
Municipal	MULESHOE	BRAZOS		979	1,027	1,082	1,109	1,137	1,135	1,114
Municipal	Total			1,310	1,369	1,440	1,473	1,508	1,505	1,477
Manufacturing		BRAZOS		264	303	316	326	335	343	365
Steam-Electric		BRAZOS		0	0	0	0	0	0	0
Irrigation		BRAZOS		182,865	172,139	168,010	163,980	160,046	156,206	152,457
Mining		BRAZOS		0	0	0	0	0	0	0
Livestock		BRAZOS		1,723	2,824	3,856	3,962	4,074	4,192	4,318
	TOTAL			186,162	176,635	173,622	169,741	165,963	162,246	158,617
Recharge			25636.3	23716.2	24,599	24,599	24,599	24,599	24,599	24,599
Municipal			7745.3							
Livestock			2,074.70							
Pumpage Irr			102,866.40	186,162	176,635	173,622	169,741	165,963	162,246	158,617
Pumpother			10141.4							
Total Storage			6058316	5,538,289.9	3,975,063.3	2,471,279.6	1,002,295.6			
<b>BRISCOE County</b>										
Municipal	COUNTY-OTHER	RED		180	183	183	176	165	159	155
Municipal	SILVERTON	RED		126	128	128	123	115	111	108
Municipal	Total			306	311	311	299	280	270	263
Manufacturing		RED		0	0	0	0	0	0	0
Steam-Electric		RED		0	0	0	0	0	0	0
Irrigation		RED		26,329	29,002	27,950	26,936	25,958	25,016	24,108
Mining		RED		0	0	0	0	0	0	0
Livestock		RED		317	325	334	343	353	363	374
	TOTAL			26,952	29,638	28,595	27,578	26,591	25,649	24,745
Recharge			7538	7538	7,538	7538	7538	7538	7538	7538
Pumpage Irr			27,208.00	28,421.00						
Miuni			0	30.4						
Lvstk			243	161						
Pumpother			182.9	74.4						
Total Storage			1695000	1,624,665.00	1,415,752	1,200,489	995,512	800,541	615,192	439,054

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County	WUG Name	Basin Name	1995	2000	2010	2020	2030	2040	2050	2060
Water Use				ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft
<b>CASTRO County</b>										
Municipal	COUNTY-OTHER	BRAZOS		208	222	234	240	243	241	237
Municipal	COUNTY-OTHER	RED		247	263	278	285	288	286	281
Municipal	DIMMITT	BRAZOS		975	1,041	1,103	1,137	1,159	1,150	1,130
Municipal	HART	BRAZOS		223	238	251	258	262	260	256
Municipal	Total			1,653	1,764	1,866	1,920	1,952	1,937	1,904
Manufacturing		BRAZOS		1,637	1,923	2,082	2,213	2,337	2,445	2,617
Manufacturing		RED		95	112	121	128	136	142	152
Steam-Electric		BRAZOS		0	0	0	0	0	0	0
Steam-Electric		RED		0	0	0	0	0	0	0
Irrigation		BRAZOS		337,541	239,669	230,482	221,644	213,147	204,975	197,116
Irrigation		RED		166,251	118,046	113,520	109,168	104,982	100,957	97,087
Mining		BRAZOS		0	0	0	0	0	0	0
Mining		RED		0	0	0	0	0	0	0
Livestock		BRAZOS		2,631	3,599	4,417	4,623	4,842	5,074	5,321
Livestock		RED		3,215	4,398	5,399	5,650	5,918	6,202	6,503
	TOTAL	BRAZOS		343,215	246,692	238,569	230,115	221,990	214,145	206,677
Recharge			38501.9	38501.9	38501.9	38501.9				
Pumpage Irr			200976.4	337541.0						
Miuni			3035.5	2912.3						
Lvstk			3869.0	3978.0						
Pumpother			270.2	273.5						
	TOTAL	RED		169808.0	122,819	119,318	115,231	111,324	107,587	104,023
Recharge			22062.6	22062.6	22062.6	22062.6				
Pumpage Irr			200976.4	166251.0						
Miuni			0.0	0.0						
Lvstk			3556.9	3656.9						
Pumpother			207.4	205.7						
	TOTAL County			513023.0	369,511	357,887	345,346	333,314	321,732	310,700
<b>Total StorageCounty</b>			<b>9023308.0</b>	<b>6641101.2</b>	<b>2,905,833</b>	<b>-119,699</b>				

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County	WUG Name	Basin Name	1995	2000	2010	2020	2030	2040	2050	2060
Water Use				ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft
<b>COCHRAN County</b>										
Municipal	COUNTY-OTHER	BRAZOS		172	183	191	192	185	176	167
Municipal	COUNTY-OTHER	COLORADO		92	98	102	103	99	95	90
Municipal	MORTON	BRAZOS		499	535	560	565	547	521	496
Municipal	Total			763	816	853	860	831	792	753
Manufacturing		BRAZOS		0	0	0	0	0	0	0
Manufacturing		COLORADO		0	0	0	0	0	0	0
Steam-Electric		BRAZOS		0	0	0	0	0	0	0
Steam-Electric		COLORADO		0	0	0	0	0	0	0
Irrigation		BRAZOS		76,790	48,009	46,157	44,376	42,662	41,015	39,432
Irrigation		COLORADO		43,195	27,005	25,964	24,962	23,998	23,072	22,181
Mining		BRAZOS		16	14	10	8	6	4	2
Mining		COLORADO		1,704	1,448	1,022	852	639	426	256
Livestock		BRAZOS		544	697	861	900	941	984	1,030
Livestock		COLORADO		103	132	163	170	178	186	195
	TOTAL	BRAZOS		78,021	49,438	47,779	46,041	44,341	42,700	41,127
Recharge			12581.0	12581	12581	12581	12581	12581	125,810	
Pumpage Irr			70040.5	76,790						
Miuni			607.8	466						
Lvstk			248.0	242						
Pumpother			198.6	97.1						
	TOTAL	COLORADO		45,094	28,683	27,251	26,087	24,914	23,779	22,722
Recharge			11328.0	11328	11328	11328	11328	11328	113,280	
Pumpage Irr			70040.5	43,195						
Miuni			143.2	104.5						
Lvstk			450.1	440.1						
Pumpother			102.1	87.6						
	TOTAL County			123,115	78,121	75,030	72,128	69,255	66,479	63,849
<b>County Total Storage</b>			<b>3076092.0</b>	<b>2578704.4</b>	<b>1,834,111</b>	<b>1,308,992</b>	<b>813,743</b>	<b>347,354</b>		

## Llano Estacado Region -- Water Demand Projections

County	WUG Name	Basin Name	1995	2000	2010	2020	2030	2040	2050	2060
Water Use				ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft
<b>CROSBY County</b>										
Municipal	COUNTY-OTHER	BRAZOS		202	210	217	220	222	220	217
Municipal	COUNTY-OTHER	RED	1	1	1	1	1	1	1	1
Municipal	CROSBYTON	BRAZOS		351	369	386	394	402	400	394
Municipal	LORENZO	BRAZOS		260	275	288	296	302	301	296
Municipal	RALLS	BRAZOS		290	304	315	322	325	323	318
Municipal	Total			1,104	1,159	1,207	1,233	1,252	1,245	1,226
Manufacturing		BRAZOS		5	6	6	6	6	6	6
Manufacturing		RED		0	0	0	0	0	0	0
Steam-Electric		BRAZOS		0	0	0	0	0	0	0
Steam-Electric		RED		0	0	0	0	0	0	0
Irrigation		BRAZOS		109,892	99,305	95,304	91,464	87,778	84,244	80,851
Irrigation		RED		2,243	2,027	1,945	1,867	1,792	1,719	1,650
Mining		BRAZOS		119	71	34	20	8	0	0
Mining		RED		70	41	20	11	5	0	0
Livestock		BRAZOS		293	299	304	311	318	326	333
Livestock		RED		2	2	3	3	3	3	3
	TOTAL	BRAZOS		111,412	100,839	96,854	93,033	89,361	85,820	82,415
Recharge			41715	41715	41715	41715	41715	41715	41,715	41,715
Pumpage Irr			139,207.80							
Miuni			215.3							
Lvstk			214							
Pumpother			227.5	220.6						
	TOTAL	RED		2,316	2,071	1,969	1,882	1,801	1,723	1,654
Recharge										
Pumpage Irr			139,207.80							
Miuni										
Lvstk			9							
Pumpother			2.9	2.9						
	TOTAL			113,728	102,910	98,823	94,915	91,162	87,543	84,069
<b>Total County Storage</b>			<b>5893647</b>	<b>5,128,420</b>	<b>4,467,789</b>	<b>3,878,318</b>	<b>3,328,732</b>	<b>2,817,373</b>	<b>2,342,808</b>	<b>1,903,635</b>

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County	WUG Name	Basin Name	1995	2000	2010	2020	2030	2040	2050	2060
Water Use				ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft
<b>DAWSON County</b>										
Municipal	COUNTY-OTHER	BRAZOS		18	18	18	19	18	18	17
Municipal	COUNTY-OTHER	COLORADO		605	610	612	616	607	587	565
Municipal	LAMESA	COLORADO		2,486	2,540	2,573	2,602	2,603	2,529	2,433
Municipal	O'DONNELL	BRAZOS		17	17	17	17	17	17	16
Municipal	Total			3,126	3,185	3,220	3,254	3,245	3,151	3,031
Manufacturing		BRAZOS		0	0	0	0	0	0	0
Manufacturing		COLORADO		101	119	129	137	144	150	162
Steam-Electric		BRAZOS		0	0	0	0	0	0	0
Steam-Electric		COLORADO		0	0	0	0	0	0	0
Irrigation		BRAZOS		1,460	645	608	574	542	511	482
Irrigation		COLORADO		144,579	63,827	60,230	56,834	53,629	50,607	47,754
Mining		BRAZOS		0	0	0	0	0	0	0
Mining		COLORADO		2,728	1,624	779	455	195	0	0
Livestock		BRAZOS		1	1	1	1	1	1	1
Livestock		COLORADO		151	154	157	161	165	169	173
	TOTAL	BRAZOS		1,496	681	644	611	578	547	516
Recharge			2064	2064	2,064	2,064	2,064	2,064	2,064	2,064
Pumpage Irr			67,834.30							
Miuni										
Lvstk			2							
Pumpother			37.7							
	TOTAL	COLORADO		150,650	68,874	64,480	60,805	57,343	54,042	51,087
Recharge			60363	60363	60,363	60,363	60,363	60,363	60,363	60,363
Pumpage Irr			67,834.30							
Miuni			163.6							
Lvstk			118							
Pumpother			432.4							
	TOTAL			152,146	69,555	65,124	61,416	57,921	54,589	51,603
<b>Total County Storage</b>			<b>6962000</b>	<b>6,498,853</b>	<b>6,055,914</b>	<b>6,009,004</b>	<b>6,002,428</b>	<b>6,031,761</b>	<b>6,095,147</b>	<b>6,105,672</b>

## Llano Estacado Region -- Water Demand Projections

County	WUG Name	Basin Name	1995	2000	2010	2020	2030	2040	2050	2060
Water Use				ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft
<b>DEAF SMITH County</b>										
Municipal	COUNTY-OTHER	CANADIAN		0	1	1	1	1	1	1
Municipal	COUNTY-OTHER	RED		572	743	932	1,100	1,243	1,286	1,305
Municipal	HEREFORD	RED		3,564	3,634	3,694	3,751	3,788	3,801	3,813
Municipal	Total			4,136	4,378	4,627	4,852	5,032	5,088	5,119
Manufacturing		CANADIAN		0	0	0	0	0	0	0
Manufacturing		RED		1,234	1,454	1,594	1,710	1,821	1,917	2,055
Steam-Electric		CANADIAN		0	0	0	0	0	0	0
Steam-Electric		RED		0	0	0	0	0	0	0
Irrigation		CANADIAN		0	0	0	0	0	0	0
Irrigation		RED		372,827	246,983	239,160	231,583	224,246	217,142	210,263
Mining		CANADIAN		0	0	0	0	0	0	0
Mining		RED		0	0	0	0	0	0	0
Livestock		CANADIAN		102	130	152	160	168	176	185
Livestock		RED		10,054	12,796	15,048	15,780	16,557	17,381	18,253
	TOTAL	CANADIAN		102	131	153	161	169	177	186
Recharge			55	55	55	55	55	55	55	550
Pumpage Irr										
Miuni										
Lvstk			837							
Pumpother										
Total Storage										
	TOTAL	RED		388,251	265,610	260,428	253,924	247,655	241,527	235,689
Recharge			56984.9	56984.9	56984.9	56984.9	56984.9	56984.9	56984.9	569,849
Pumpage Irr			205,099.6							
Miuni			6155.9							
Lvstk			14,372.50							
Pumpother			562.4							
Total Storage										
	TOTAL			388,353	265,741	260,581	254,085	247,824	241,704	235,875
<b>Total County Storage</b>			<b>6397823</b>	<b>5,422,036</b>	<b>2,783,270</b>	<b>724,639</b>				



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County	WUG Name	Basin Name	1995	2000	2010	2020	2030	2040	2050	2060
Water Use				ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft
<b>DICKENS County</b>										
Municipal	COUNTY-OTHER	BRAZOS		234	224	212	194	169	158	147
Municipal	COUNTY-OTHER	RED		45	43	41	38	33	30	28
Municipal	SPUR	BRAZOS		275	271	267	263	260	257	257
Municipal	Total			554	538	520	495	462	445	432
Manufacturing		BRAZOS		0	0	0	0	0	0	0
Manufacturing		RED		0	0	0	0	0	0	0
Steam-Electric		BRAZOS		0	0	0	0	0	0	0
Steam-Electric		RED		0	0	0	0	0	0	0
Irrigation		BRAZOS		5,407	2,837	2,752	2,670	2,591	2,513	2,437
Irrigation		RED		4,079	2,140	2,076	2,015	1,955	1,896	1,839
Mining		BRAZOS		165	98	47	27	12	0	0
Mining		RED		0	0	0	0	0	0	0
Livestock		BRAZOS		390	399	408	417	427	437	448
Livestock		RED		230	235	240	245	251	258	264
	TOTAL	BRAZOS		6,471	3,829	3,686	3,571	3,459	3,365	3,289
Recharge			472.1	472.1	472.1	472.1	472.1	472.1	472.1	472.1
Pumpage Irr			3,547.90							
Miuni										
Lvstk			23							
Pumpother										
Total Storage										
	TOTAL	RED		4,354	2,418	2,357	2,298	2,239	2,184	2,131
Recharge			703.4	703.4	703.4	703.4	703.4	703.4	703.4	703.4
Pumpage Irr			3,547.90							
Miuni										
Lvstk			15							
Pumpother										
Total Storage										
	TOTAL			10,825	6,247	6,043	5,869	5,698	5,549	5,420
<b>Total County Storage</b>			<b>1168000</b>	<b>1,119,192</b>	<b>1,037,297</b>	<b>1,032,409</b>	<b>1,027,698</b>	<b>862,252</b>	<b>817,846</b>	<b>813,589</b>

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County	WUG Name	Basin Name	1995	2000	2010	2020	2030	2040	2050	2060
Water Use				ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft
<b>FLOYD County</b>										
Municipal	COUNTY-OTHER	BRAZOS		178	183	185	183	180	172	163
Municipal	COUNTY-OTHER	RED		103	106	107	106	104	100	95
Municipal	FLOYDADA	BRAZOS		663	680	696	693	685	657	623
Municipal	LOCKNEY	BRAZOS		237	242	244	240	234	224	212
Municipal	Total			1,181	1,211	1,232	1,222	1,203	1,153	1,093
Manufacturing		BRAZOS		0	0	0	0	0	0	0
Manufacturing		RED		0	0	0	0	0	0	0
Steam-Electric		BRAZOS		0	0	0	0	0	0	0
Steam-Electric		RED		0	0	0	0	0	0	0
Irrigation		BRAZOS		130,361	94,979	91,197	87,564	84,076	80,727	77,512
Irrigation		RED		106,659	77,710	74,615	71,643	68,789	66,050	63,419
Mining		BRAZOS		0	0	0	0	0	0	0
Mining		RED		0	0	0	0	0	0	0
Livestock		BRAZOS		1,029	1,236	1,396	1,462	1,532	1,605	1,683
Livestock		RED		342	411	465	487	510	535	561
	TOTAL	BRAZOS		132,468	97,320	93,718	90,142	86,707	83,385	80,193
Recharge			27769.6	27769.6	27769.6	27769.6	27769.6	27769.6	27769.6	27769.6
Pumpage Irr			190141.7							
Miuni			615.4							
Lvstk			406.0							
Pumpother			162.8							
Total Storage										
	TOTAL	RED		107,104	78,227	75,187	72,236	69,403	66,685	64,075
Recharge			14685.0	14685.0	14685.0	14685.0	14685.0	14685.0	14685.0	146,850
Pumpage Irr			190141.7							
Miuni										
Lvstk			863.9							
Pumpother			117.3							
Total Storage										
	TOTAL			239,572	175,547	168,905	162,378	156,110	150,070	144,268
<b>Total County Storage</b>			<b>7615602</b>	<b>6,481,844</b>	<b>4,862,808</b>	<b>3,568,415</b>	<b>2,339,810</b>	<b>1,175,050</b>	<b>71,717</b>	

## Llano Estacado Region -- Water Demand Projections

County	WUG Name	Basin Name	1995	2000	2010	2020	2030	2040	2050	2060
Water Use				ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft
<b>GAINES County</b>										
Municipal	COUNTY-OTHER	COLORADO		704	754	800	823	839	824	813
Municipal	SEAGRAVES	COLORADO		416	449	482	502	513	506	499
Municipal	SEMINOLE	COLORADO		2,019	2,214	2,401	2,525	2,605	2,579	2,544
Municipal	Total			3,139	3,417	3,683	3,850	3,957	3,909	3,856
Manufacturing		COLORADO		0	0	0	0	0	0	0
Steam-Electric		COLORADO		0	0	0	0	0	0	0
Irrigation		COLORADO		414,772	374,875	355,350	336,844	319,301	302,670	286,906
Mining		COLORADO		6,071	5,746	4,011	2,493	1,084	217	0
Livestock		COLORADO		796	913	995	1,045	1,099	1,156	1,216
Recharge			92586.0	92586.0	92586.0	92586.0	92586.0	92586.0	92586.0	92586.0
Pumpage Irr			285,229.60							
Miuni			2368.6							
Lvstk			1,073.70							
Pumpother			739.6							
	TOTAL			424,778	384,951	364,039	344,232	325,441	307,952	291,978
<b>Total County Storage</b>			<b>13583711</b>	<b>12,386,627</b>	<b>9,283,755</b>	<b>6,475,121</b>	<b>3,869,530</b>	<b>1,456,420</b>		
<b>GARZA County</b>										
Municipal	COUNTY-OTHER	BRAZOS		154	156	156	150	141	132	123
Municipal	COUNTY-OTHER	COLORADO		0	0	0	0	0	0	0
Municipal	POST	BRAZOS		623	631	642	616	579	549	512
Municipal	Total			777	787	798	766	720	681	635
Manufacturing		BRAZOS		2	2	2	2	2	2	2
Manufacturing		COLORADO		0	0	0	0	0	0	0
Steam-Electric		BRAZOS		0	0	0	0	0	0	0
Steam-Electric		COLORADO		0	0	0	0	0	0	0
Irrigation		BRAZOS		12,165	5,623	5,295	4,983	4,692	4,418	4,160
Irrigation		COLORADO		0	0	0	0	0	0	0
Mining		BRAZOS		1,264	752	361	211	90	0	0
Mining		COLORADO		0	0	0	0	0	0	0
Livestock		BRAZOS		355	363	423	432	442	453	465
Livestock		COLORADO		0	0	0	0	0	0	0
	TOTAL	BRAZOS		14,563	7,527	6,879	6,394	5,946	5,554	5,262
	TOTAL	COLORADO		0	0	0	0	0	0	0
Recharge			8778.1	8778.1	8778.1	8778.1	8778.1	8778.1	8778.1	8778.1
Pumpage Irr			10914.7							
Miuni										
Lvstk			51.0							
Pumpother			125.4							
	TOTAL			14,563	7,527	6,879	6,394	5,946	5,554	5,262
<b>Total County Storage</b>			<b>678000</b>	<b>662,851</b>	<b>643,700</b>	<b>659,775</b>	<b>681,433</b>	<b>707,738</b>	<b>738,215</b>	<b>772,062</b>

## Llano Estacado Region -- Water Demand Projections

County	WUG Name	Basin Name	1995	2000	2010	2020	2030	2040	2050	2060
Water Use				ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft
<b>HALE County</b>										
Municipal	ABERNATHY	BRAZOS		461	486	508	526	531	525	514
Municipal	COUNTY-OTHER	BRAZOS		1,109	1,144	1,187	1,207	1,203	1,184	1,161
Municipal	COUNTY-OTHER	RED		0	0	0	0	0	0	0
Municipal	HALE CENTER	BRAZOS		446	470	493	509	513	507	498
Municipal	PETERSBURG	BRAZOS		276	289	304	313	316	312	306
Municipal	PLAINVIEW	BRAZOS		4,078	4,288	4,490	4,605	4,635	4,577	4,488
Municipal	Total			6,370	6,677	6,982	7,160	7,198	7,105	6,967
Manufacturing		BRAZOS		2,605	2,993	3,188	3,339	3,482	3,604	3,840
Manufacturing		RED		0	0	0	0	0	0	0
Steam-Electric		BRAZOS		0	0	0	0	0	0	0
Steam-Electric		RED		0	0	0	0	0	0	0
Irrigation		BRAZOS		364,023	363,164	351,131	339,497	328,249	317,373	306,857
Irrigation		RED		3,677	3,668	3,547	3,429	3,316	3,206	3,100
Mining		BRAZOS		258	88	34	19	0	0	0
Mining		RED		0	0	0	0	0	0	0
Livestock		BRAZOS		1,525	2,148	2,688	2,795	2,910	3,031	3,160
Livestock		RED		15	21	27	28	29	30	31
	TOTAL	BRAZOS		374,781	375,070	364,023	352,810	341,839	331,113	320,824
Recharge			71563.7	71563.7	71563.7	71563.7	71563.7	71563.7	71563.7	71563.7
Pumpage Irr			333003.4							
Miuni			4108.2							
Lvstk			2051.9							
Pumpother			1203.0							
Total Storage										
	TOTAL	RED		3692.0	3,689	3,574	3,457	3,345	3,236	3,131
Recharge			0.0							
Pumpage Irr			333003.4							
Miuni										
Lvstk										
Pumpother			0.5							
Total Storage										
	TOTAL			378,473	378,759	367,597	356,267	345,184	334,349	323,955
<b>Total County Storage</b>			<b>8988379</b>	<b>6,846,193</b>	<b>3,059,890</b>	<b>49,328</b>				

## Llano Estacado Region -- Water Demand Projections

County	WUG Name	Basin Name	1995	2000	2010	2020	2030	2040	2050	2060
Water Use				ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft
<b>HOCKLEY County</b>										
Municipal	ANTON	BRAZOS		250	263	270	272	268	256	243
Municipal	<b>COUNTY-OTHER</b>	<b>BRAZOS</b>		<b>854</b>	<b>881</b>	<b>897</b>	<b>895</b>	<b>872</b>	<b>830</b>	<b>790</b>
Municipal	COUNTY-OTHER	COLORADO		40	41	42	42	41	39	37
Municipal	<b>LEVELLAND</b>	<b>BRAZOS</b>		<b>2,219</b>	<b>2,310</b>	<b>2,362</b>	<b>2,369</b>	<b>2,322</b>	<b>2,216</b>	<b>2,107</b>
Municipal	ROPESVILLE	BRAZOS		85	89	91	91	89	85	81
Municipal	<b>SMYER</b>	<b>BRAZOS</b>		<b>67</b>	<b>69</b>	<b>70</b>	<b>70</b>	<b>68</b>	<b>65</b>	<b>62</b>
Municipal	SUNDOWN	COLORADO		325	341	350	353	347	332	316
Municipal	Total			3,840	3,994	4,082	4,092	4,007	3,823	3,636
Manufacturing		BRAZOS		53	61	65	68	71	73	78
Manufacturing		COLORADO		0	0	0	0	0	0	0
Steam-Electric		BRAZOS		0	0	0	0	0	0	0
Steam-Electric		COLORADO		0	0	0	0	0	0	0
Irrigation		BRAZOS		157,496	107,099	102,910	98,887	95,018	91,304	87,734
Irrigation		COLORADO		17,500	11,900	11,435	10,988	10,558	10,145	9,749
Mining		BRAZOS		3,302	2,358	1,510	981	378	19	0
Mining		COLORADO		1,114	796	509	331	127	6	0
Livestock		BRAZOS		560	634	733	766	801	837	876
Livestock		COLORADO		48	55	63	66	69	73	76
	TOTAL	BRAZOS		164,886	113,764	108,908	104,399	99,887	95,685	91,971
Recharge			42683.0	42683.0	42683.0	42683.0	42683.0	42683.0	42683.0	42683.0
Pumpage Irr			156014.8							
Miuni			903.6							
Lvstk			456.9							
Pumpother			836.6							
Total Storage										
	TOTAL	COLORADO		19027.0	13,133	12,399	11,780	11,142	10,595	10,178
Recharge			3389.9	3389.9	3389.9	3389.9	3389.9	3389.9	3389.9	3389.9
Pumpage Irr			156014.8							
Miuni			374.6							
Lvstk			73.0							
Pumpother			29.7							
Total Storage										
	TOTAL			183,913	126,897	121,307	116,179	111,029	106,280	102,149
<b>Total County Storage</b>			<b>3539374</b>	<b>2,556,556</b>	<b>1,077,087</b>	<b>299,591</b>				

## Llano Estacado Region -- Water Demand Projections

County	WUG Name	Basin Name	1995	2000	2010	2020	2030	2040	2050	2060
Water Use				ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft
<b>LAMB County</b>										
Municipal	AMHERST	BRAZOS		163	168	176	182	185	183	181
Municipal	COUNTY-OTHER	BRAZOS		766	794	830	861	880	872	861
Municipal	EARTH	BRAZOS		248	257	268	277	283	280	276
Municipal	LITTLEFIELD	BRAZOS		1,480	1,530	1,602	1,660	1,694	1,676	1,655
Municipal	OLTON	BRAZOS		474	492	512	532	542	536	529
Municipal	SUDAN	BRAZOS		218	226	236	244	249	246	243
Municipal	Total			3,349	3,467	3,624	3,756	3,833	3,793	3,745
Manufacturing		BRAZOS		426	490	519	541	562	580	618
Steam-Electric		BRAZOS		17,990	17,827	17,663	20,651	24,292	28,731	34,142
Irrigation		BRAZOS		377,893	303,774	292,052	280,783	269,949	259,533	249,519
Mining		BRAZOS		88	52	25	15	6	0	0
Livestock		BRAZOS		2,412	3,661	4,817	4,949	5,090	5,239	5,397
	TOTAL			402,158	329,271	318,700	310,695	303,732	297,876	293,421
Recharge			76701.9	76701.9	76701.9	76701.9	76701.9	76701.9	76701.9	76701.9
Pumpage Irr			250205.2							
Miuni			5101.1							
Lvstk			3418.5							
Pumpother			629.3							
Total Storage				402,158	329,271	318,700	310,695	303,732	297,876	293,421
	<b>Total County Storage</b>		<b>7211222</b>	<b>6,230,587</b>	<b>3,376,905</b>	<b>909,354</b>				
<b>LUBBOCK County</b>										
Municipal	ABERNATHY	BRAZOS		153	171	182	188	186	190	186
Municipal	COUNTY-OTHER	BRAZOS		3,417	3,006	3,051	3,053	2,909	2,907	2,744
Municipal	IDALOU	BRAZOS		288	289	288	281	274	273	272
Municipal	LUBBOCK	BRAZOS		40,460	41,765	42,580	42,652	42,033	42,349	41,915
Municipal	NEW DEAL	BRAZOS		126	149	165	173	173	178	173
Municipal	RANSOM CANYON	BRAZOS		310	440	569	698	825	953	1,004
Municipal	SHALLOWATER	BRAZOS		311	344	367	377	371	379	371
Municipal	SLATON	BRAZOS		931	907	889	870	849	837	836
Municipal	WOLFFORTH	BRAZOS		412	1,468	1,758	1,822	1,884	1,962	2,006
Municipal	Total			46,408	48,539	49,849	50,114	49,504	50,028	49,507
Manufacturing		BRAZOS		1,566	1,881	2,103	2,291	2,472	2,625	2,836
Steam-Electric		BRAZOS		5,776	5,221	4,440	5,191	6,106	7,222	8,582
Irrigation		BRAZOS		242,978	174,779	164,967	155,706	146,964	138,715	130,929
Mining		BRAZOS		352	209	101	59	25	0	0
Livestock		BRAZOS		972	1,136	1,248	1,316	1,389	1,466	1,548
Recharge			51464.2	51464.2	51464.2	51464.2	51464.2	51464.2	51464.2	51464.2
Pumpage Irr			199,146.00							
Miuni			2839.1							
Lvstk			199,146.00							
Pumpother			3,500.90							
	TOTAL			298,052	231,765	222,708	214,677	206,460	200,056	193,402
	<b>Total County Storage</b>		<b>5120761</b>	<b>3,673,972</b>	<b>1,572,673</b>					

## Llano Estacado Region -- Water Demand Projections

County	WUG Name	Basin Name	1995	2000	2010	2020	2030	2040	2050	2060
Water Use				ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft
<b>LYNN County</b>										
Municipal	COUNTY-OTHER	BRAZOS		290	299	301	292	282	267	249
Municipal	COUNTY-OTHER	COLORADO		6	7	7	6	6	6	6
Municipal	O'DONNELL	BRAZOS		139	144	146	142	138	130	121
Municipal	TAHOKA	BRAZOS		473	492	504	490	478	453	421
Municipal	WILSON	BRAZOS		65	67	68	65	63	60	55
Municipal	Total			973	1,009	1,026	995	967	916	852
Manufacturing		BRAZOS		0	0	0	0	0	0	0
Manufacturing		COLORADO		0	0	0	0	0	0	0
Steam-Electric		BRAZOS		0	0	0	0	0	0	0
Steam-Electric		COLORADO		0	0	0	0	0	0	0
Irrigation		BRAZOS		119,289	48,861	46,233	43,746	41,392	39,165	37,059
Irrigation		COLORADO		1,083	444	420	397	376	356	336
Mining		BRAZOS		66	39	19	11	5	0	0
Mining		COLORADO		15	9	4	2	1	0	0
Livestock		BRAZOS		129	132	136	140	144	149	153
Livestock		COLORADO		11	11	11	12	12	12	13
	TOTAL	BRAZOS		120,451	50,034	47,407	44,886	42,502	40,224	38,058
Recharge			65282.1	65282.1	65282.1	65282.1	65282.1	65282.1	65282.1	65282.1
Pumpage Irr			52036.2							
Miuni			281.2							
Lvstk			142.0							
Pumpother			364.5							
Total Storage										
	TOTAL	COLORADO		1,115	471	442	417	395	374	355
Recharge			4052.8	4052.8	4052.8	4052.8	4052.8	4052.8	4052.8	4052.8
Pumpage Irr			52036.2							
Miuni										
Lvstk			11							
Pumpother			10.7							
Total Storage										
	TOTAL			121,566	50,505	47,849	45,303	42,897	40,598	38,413
Total County Storage			3909248	3,786,579	3,655,103	3,858,010	4,086,871	4,086,871	4,363,894	4,663,280

## Llano Estacado Region -- Water Demand Projections

County	WUG Name	Basin Name	1995	2000	2010	2020	2030	2040	2050	2060
Water Use				ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft
<b>MOTLEY County</b>										
Municipal	COUNTY-OTHER	RED		148	143	136	123	108	98	93
Municipal	MATADOR	RED		239	234	224	207	187	174	166
Municipal	Total			387	377	360	330	295	272	259
Manufacturing		RED		5	6	6	6	6	6	6
Steam-Electric		RED		0	0	0	0	0	0	0
Irrigation		RED		9,168	4,689	4,548	4,413	4,281	4,153	4,028
Mining		RED		15	9	4	3	1	0	0
Livestock		RED		625	636	647	659	671	684	698
Recharge			469.3	469.3	469.3	469.3	469.3	469.3	469.3	469.3
Pumpage Irr			429.9							
Miuni										
Lvstk										
Total Storage										
	TOTAL			10,200	5,717	5,565	5,411	5,254	5,115	4,991
Total County Storage			366000	355,295	282,644	231,003	180,893	132,340	85,257	39,482



## Llano Estacado Region -- Water Demand Projections

County	WUG Name	Basin Name	1995	2000	2010	2020	2030	2040	2050	2060
Water Use				ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft
<b>PARMER County</b>										
Municipal	BOVINA	BRAZOS		309	321	334	335	330	317	300
Municipal	COUNTY-OTHER	BRAZOS		287	297	305	304	298	286	270
Municipal	COUNTY-OTHER	RED		106	110	113	112	110	106	100
Municipal	FARWELL	BRAZOS		370	388	405	410	408	393	371
Municipal	FRIONA	RED		803	835	872	879	870	838	791
Municipal	Total			1,875	1,951	2,029	2,040	2,016	1,940	1,832
Manufacturing		BRAZOS		0	0	0	0	0	0	0
Manufacturing		RED		2,070	2,427	2,617	2,772	2,921	3,051	3,261
Steam-Electric		BRAZOS		0	0	0	0	0	0	0
Steam-Electric		RED		0	0	0	0	0	0	0
Irrigation		BRAZOS		294,969	243,430	240,846	238,289	235,759	233,256	230,779
Irrigation		RED		120,480	99,429	98,373	97,329	96,296	95,273	94,262
Mining		BRAZOS		0	0	0	0	0	0	0
Mining		RED		0	0	0	0	0	0	0
Livestock		BRAZOS		3,372	4,579	5,581	5,845	6,126	6,425	6,741
Livestock		RED		2,323	3,154	3,844	4,027	4,221	4,426	4,644
	TOTAL	BRAZOS		299,307	249,015	247,471	245,183	242,921	240,677	238,461
Recharge			37366.1	37366.1	37366.1	37366.1	37366.1	37366.1	37366.1	37366.1
Pumpage Irr			271614.3							
Miuni			738.7							
Lvstk										
Pumpother			371.0							
Total Storage										
	TOTAL	RED		125,782	105,955	105,819	105,119	104,418	103,694	103,058
Recharge			14413.9	14413.9	14413.9	14413.9	14413.9	14413.9	14413.9	14413.9
Pumpage Irr			271614.3							
Miuni			851.8							
Lvstk										
Pumpother			123.9							
Total Storage										
	TOTAL			425,089	354,970	353,290	350,302	347,339	344,371	341,519
<b>Total County Storage</b>			<b>7843473</b>	<b>5,749,089</b>	<b>2,401,654</b>					

## Llano Estacado Region -- Water Demand Projections

County	WUG Name	Basin Name	1995	2000	2010	2020	2030	2040	2050	2060
Water Use				ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft
<b>SWISHER County</b>										
Municipal	COUNTY-OTHER	BRAZOS		41	41	42	41	41	40	38
Municipal	COUNTY-OTHER	RED		207	211	211	211	207	202	193
Municipal	HAPPY	RED		107	109	110	111	110	108	103
Municipal	KRESS	BRAZOS		21	22	22	22	22	21	20
Municipal	KRESS	RED		80	82	82	83	81	79	76
Municipal	TULIA	RED		1,020	1,050	1,065	1,072	1,064	1,038	993
Municipal	Total			1,476	1,515	1,532	1,540	1,525	1,488	1,423
Manufacturing		BRAZOS		0	0	0	0	0	0	0
Manufacturing		RED		0	0	0	0	0	0	0
Steam-Electric		BRAZOS		0	0	0	0	0	0	0
Steam-Electric		RED		0	0	0	0	0	0	0
Irrigation		BRAZOS		73,834	66,689	63,892	65,929	65,552	65,178	64,805
Irrigation		RED		97,872	88,400	84,693	87,393	86,894	86,397	85,904
Mining		BRAZOS		0	0	0	0	0	0	0
Mining		RED		0	0	0	0	0	0	0
Livestock		BRAZOS		212	255	286	302	318	335	353
Livestock		RED		2,909	3,502	3,930	4,140	4,363	4,600	4,852
	TOTAL	BRAZOS		74,108	67,007	64,242	66,294	65,933	65,574	65,216
Recharge			8272.2	8272.2	8272.2	8272.2	8272.2	8272.2	8272.2	8272.2
Pumpage Irr			157949.7							
Miuni			58.4							
Lvstk										
Pumpother										
Total Storage										
	TOTAL	RED		102,195	93,354	90,091	93,010	92,719	92,424	92,121
Recharge			26848.4	26848.4	26848.4	26848.4	26848.4	26848.4	26848.4	26848.4
Pumpage Irr			157949.7							
Miuni			616.4							
Lvstk										
Pumpother										
Total Storage										
	TOTAL			176,303	160,361	154,333	159,304	158,652	157,998	157,337
Total County Storage			4481000	3,598,840	2,274,698	1,055,449				

## Llano Estacado Region -- Water Demand Projections

County	WUG Name	Basin Name	1995	2000	2010	2020	2030	2040	2050	2060
Water Use				ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft
<b>TERRY County</b>										
Municipal	BROWNFIELD	COLORADO		2,593	2,747	2,905	3,047	3,181	3,185	3,167
Municipal	COUNTY-OTHER	BRAZOS		13	14	14	15	16	15	15
Municipal	COUNTY-OTHER	COLORADO		362	376	393	407	419	418	415
Municipal	MEADOW	COLORADO		70	73	75	78	80	79	79
Municipal	Total			3,038	3,210	3,387	3,547	3,696	3,697	3,676
Manufacturing		BRAZOS		0	0	0	0	0	0	0
Manufacturing		COLORADO		1	1	1	1	1	1	1
Steam-Electric		BRAZOS		0	0	0	0	0	0	0
Steam-Electric		COLORADO		0	0	0	0	0	0	0
Irrigation		BRAZOS		10,157	6,350	6,025	5,716	5,423	5,145	4,881
Irrigation		COLORADO		192,984	120,659	114,472	108,603	103,036	97,753	92,741
Mining		BRAZOS		0	0	0	0	0	0	0
Mining		COLORADO		930	554	266	155	66	0	0
Livestock		BRAZOS		3	5	7	7	8	8	8
Livestock		COLORADO		116	196	276	279	281	285	288
	TOTAL	BRAZOS		10,173	6,369	6,046	5,738	5,447	5,168	4,904
Recharge			4082.4	4082.4	4082.4	4082.4	4082.4	4082.4	4082.4	4082.4
Pumpage Irr			145,810.10							
Miuni										
Lvstk										
Pumpother										
Total Storage										
	TOTAL	COLORADO		197,056	124,606	118,388	112,570	107,064	101,721	96,691
Recharge			67021.8	67021.8	67021.8	67021.8	67021.8	67021.8	67021.8	67021.8
Pumpage Irr			145,810.10							
Miuni			632.4							
Lvstk										
Pumpother										
Total Storage										
	TOTAL			207,229	130,975	124,434	118,308	112,511	106,889	101,595
<b>Total County Storage</b>			<b>4339000</b>	<b>3,327,986</b>	<b>2,386,135</b>	<b>1,823,403</b>	<b>1,323,798</b>	<b>883,643</b>	<b>500,497</b>	<b>171,766</b>



## Llano Estacado Region -- Water Demand Projections

County	WUG Name	Basin Name	1995	2000	2010	2020	2030	2040	2050	2060
Water Use				ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft
	<b>BASIN</b>									
	CANADIAN Basin	Municipal		0	1	1	1	1	1	1
	CANADIAN Basin	Manufacturing		0	0	0	0	0	0	0
	CANADIAN Basin	Steam-Electric		0	0	0	0	0	0	0
	CANADIAN Basin	Irrigation		0	0	0	0	0	0	0
	CANADIAN Basin	Mining		0	0	0	0	0	0	0
	CANADIAN Basin	Livestock		102	130	152	160	168	176	185
	CANADIAN Basin	TOTAL		102	131	153	161	169	177	186
	RED Basin	Municipal		7,548	7,875	8,177	8,378	8,474	8,417	8,301
	RED Basin	Manufacturing		3,404	3,999	4,338	4,616	4,884	5,116	5,474
	RED Basin	Steam-Electric		0	0	0	0	0	0	0
	RED Basin	Irrigation		909,585	672,094	650,427	635,776	618,509	601,809	585,660
	RED Basin	Mining		85	50	24	14	6	0	0
	RED Basin	Livestock		20,032	25,480	29,937	31,362	32,876	34,482	36,183
	RED Basin	TOTAL								
	BRAZOS Basin	Municipal		68,499	71,548	73,708	74,315	73,668	73,641	72,420
	BRAZOS Basin	Manufacturing		6,558	7,659	8,281	8,786	9,267	9,678	10,362
	BRAZOS Basin	Steam-Electric		23,766	23,048	22,103	25,842	30,398	35,953	42,724
	BRAZOS Basin	Irrigation		2,497,120	1,977,352	1,907,861	1,845,808	1,783,840	1,724,278	1,667,010
	BRAZOS Basin	Mining		5,630	3,681	2,141	1,351	530	23	2
	BRAZOS Basin	Livestock		16,151	21,968	27,162	28,228	29,363	30,562	31,835
	BRAZOS Basin	TOTAL		2,617,724	2,105,256	2,041,256	1,984,330	1,927,066	1,874,135	1,824,353
	COLORADO Basin	Municipal		11,315	11,995	12,621	13,058	13,371	13,145	12,864
	COLORADO Basin	Manufacturing		102	120	130	138	145	151	163
	COLORADO Basin	Steam-Electric		1,852	2,597	3,718	4,346	5,113	6,047	7,186
	COLORADO Basin	Irrigation		941,172	695,692	660,211	626,548	594,610	564,308	535,557
	COLORADO Basin	Mining		15,721	12,593	8,115	4,994	2,316	705	256
	COLORADO Basin	Livestock		1,439	1,679	1,938	2,011	2,086	2,169	2,254
	COLORADO Basin	TOTAL		971,601	724,676	686,733	651,095	617,641	586,525	558,280
	REGION O	Municipal		87,362	91,419	94,507	95,752	95,514	95,204	93,586
	REGION O	Manufacturing		10,064	11,778	12,749	13,540	14,296	14,945	15,999
	REGION O	Steam-Electric		25,618	25,645	25,821	30,188	35,511	42,000	49,910
	REGION O	Irrigation		4,347,877	3,345,138	3,218,499	3,108,132	2,996,959	2,890,395	2,788,227
	REGION O	Mining		21,436	16,324	10,280	6,359	2,852	728	258
	REGION O	Livestock		37,724	49,257	59,189	61,761	64,493	67,389	70,457
	REGION O	TOTAL		4,530,081	3,539,561	3,421,045	3,315,732	3,209,625	3,110,661	3,018,437