

Section 3

Water Supply Analysis

[31 TAC §357.7(a)(3)]

The Llano Estacado Region is located in a semiarid climatic area of west Texas. Precipitation ranges from an average annual level of about 18 inches on the eastern border to only about 14 inches on the west at the New Mexico state line. Therefore, surface water supplies are very low. However, the region is underlain with aquifers in which large quantities of water have been captured and stored over very long periods of time. The ground and surface water resources of the region are identified and described below.

3.1 Groundwater

The major sources of water in the Llano Estacado Region are the Ogallala, Seymour, Edwards-Trinity (High Plains), and Dockum Aquifers. Each of these aquifers is identified and characterized briefly below. A more complete description of these aquifers is presented in Section 1, and is not repeated here.

3.1.1 Ogallala Aquifer

The Ogallala Aquifer is the major water-bearing formation in most of the 21 counties of the Llano Estacado Region. Most of the communities within the region obtain water from the Ogallala Aquifer as their primary source of drinking water; however, approximately 95 percent of the water obtained from the Ogallala is used for irrigation.

3.1.2 Seymour Aquifer

The Seymour Formation consists of isolated areas of alluvium found in parts of 23 north-central and High Plains counties, including parts of Briscoe, Motley, Dickens, and Crosby Counties of the Llano Estacado Region. The Seymour Aquifer supplies small quantities of water for municipal and irrigation use in these four counties.

3.1.3 Edwards-Trinity (High Plains) Aquifer

The Edwards-Trinity (High Plains) Aquifer includes Cretaceous Age water-bearing formations of the Fredericksburg and Trinity Groups. These formations underlie the Ogallala Formation in 11 counties in the southwestern corner of the Llano Estacado Region and extend

westward into New Mexico. The Edwards-Trinity (High Plains) Aquifer supplies water for municipal and irrigation use in Lynn County.

3.1.4 Dockum (Santa Rosa) Aquifer

The Dockum Group of Triassic Age underlies the Ogallala Formation of the High Plains area of Texas and New Mexico, the northern part of the Edwards Plateau, and the eastern part of the Cenozoic Pecos Alluvium. The Dockum Aquifer supplies small quantities of water for municipal and irrigation use in Briscoe, Deaf Smith, Garza, and Swisher Counties.

3.2 Surface Water

Although the Llano Estacado Region lies within the headwaters areas of the Canadian, Red, Brazos, and Colorado River Basins, the region has very little surface water; rainfall is less than 18 inches per year, and is not adequate to result in runoff to streams. Even though streamflow in the region is relatively low, four dams and reservoirs (Lake Meredith, Mackenzie, White River, and Alan Henry) have been built within and near the region to capture and store most of the surface water that is available from the streams on which they are located. The four reservoirs supply water for municipal and industrial uses to 15 of the 46 cities located in the region. These four reservoirs are described below. In segments of rivers where dams have not been built, surface water amounts to a trickle, with very little water leaving the region. Those entities that do not obtain water from the reservoirs mentioned above must rely upon groundwater to supply their water needs due to the lack of a reliable surface water source.

There are a limited number of surface water rights within the region; however, none of these rights are reliable during a drought according the WAM model. A total of 94 water rights, included rights for reservoirs, exist in the Llano Estacado Region, with a total authorized diversion of approximately 116,500 acft/yr. It is important to note that a small percentage of the water rights make up a large percentage of the authorized diversion volume. In the region, five water rights (5.3 percent) make up 100,910 acft/yr (86.6 percent) of the authorized diversion volume. The remaining 89 water rights primarily consists of small irrigation and municipal rights distributed throughout the region. Appendix F contains a list of all surface water rights in the region and their authorized diversion volumes.

3.2.1 Lake Meredith

Lake Meredith, operated by the CRMWA, is located in the Canadian River Basin to the north of the Llano Estacado Region, in Potter, Moore, and Hutchinson Counties. From Lake Meredith, a pipeline extends southward and delivers water for municipal and industrial purposes to Brownfield, Lamesa, Levelland, Lubbock, Plainview, O'Donnell, Slaton, and Tahoka of the Llano Estacado Region. The lake has a total storage capacity of 920,300 acft, a firm yield of approximately 69,750 acft of water per year, and a safe yield of 63,750 acft per year. Groundwater projects that obtain water from the Ogallala Aquifer in Roberts County have been added to increase the supply to present entities obtaining water from Lake Meredith. In addition, this water from the Ogallala Aquifer is firming up the reliability and improving the quality of current supplies from Lake Meredith.

3.2.2 Mackenzie Reservoir

Mackenzie Reservoir is located in the Red River Basin in Swisher and Briscoe Counties. Mackenzie Reservoir has a total storage capacity of 45,500 acft and can supply approximately 5,200 acft of water per year when the reservoir is at conservation pool elevation. Mackenzie Reservoir supplies water to Silverton, Tulia, Floydada, and Lockney. However, during recent dry years, Mackenzie Reservoir was unable to meet its contracted demands.

3.2.3 White River Reservoir

White River Reservoir is located in the Brazos River Basin in the southeast corner of Crosby County. It is owned and operated by the WRMWD, which supplies water to Ralls, Spur, Post, and Crosbyton. The reservoir has a surface area of 1,808 acres at conservation pool elevation, a drainage area of 173 square miles, total storage capacity of 31,846 acft, and can supply approximately 4,000 acft/yr when at conservation pool elevation. WRMWD has purchased groundwater rights and has drilled wells to supply its customers should the water levels in the reservoir drop below the level at which water can be removed.

3.2.4 Lake Alan Henry

Lake Alan Henry, owned by the City of Lubbock, Texas, is located on the Double Mountain Fork of the Brazos River in Garza and Kent Counties. TCEQ Permit 4146, with Priority Date of October 5, 1981, authorizes impoundment of 115,937 acft and the diversion of

up to 35,000 acft/yr of water for municipal purposes. Based upon the hydrologic record for the period 1940 through 2002, the firm yield of Lake Alan Henry was calculated at 22,500 acft/yr.¹ Lake Alan Henry was developed to serve as a future water supply for the City of Lubbock and at present is open for recreational purposes. In addition, the Lake Alan Henry Water Supply District, created in 2001, plans to contract with Lubbock to obtain water from Lake Alan Henry to supply municipal water to developing areas in southeastern Garza County of the Llano Estacado Region and western Kent County of the neighboring Brazos G Water Planning Region.

3.2.5 Surface Water Rights

Lake Alan Henry, owned by the City of Lubbock, Texas, is located on the Double Mountain Fork of the Brazos River in Garza and Kent Counties. TCEQ Permit 4146, with Priority Date of October 5, 1981, authorizes impoundment of 115,937 acft and the diversion of up to 35,000 acft/yr of water for municipal purposes. Based upon the hydrologic record for the period 1940 through 2002, the firm yield of Lake Alan Henry was calculated at 22,500 acft/yr.² Lake Alan Henry was developed to serve as a future water supply for the City of Lubbock and at present is open for recreational purposes. In addition, the Lake Alan Henry Water Supply District, created in 2001, plans to contract with Lubbock to obtain water from Lake Alan Henry to supply municipal water to developing areas in southeastern Garza County of the Llano Estacado Region and western Kent County of the neighboring Brazos G Water Planning Region.

3.3 Methodology to Calculate the Water Supplies Available to the Llano Estacado Region and Methodology for Calculating Water Supplies Available for Water User Groups

The water supplies available to the Llano Estacado Region during the “**drought of record**” were calculated from the following data sources:

- A. The LERWPG requested that TWDB run the Southern Ogallala Groundwater Availability Model (GAM) using the water demand projections for water user groups (WUGs) of LERWPG, as approved by the TWDB on September 17, 2003, for the planning period of 2010 through 2060. The TWDB performed the runs, as requested, and provided information showing the volume of groundwater present in each county-basin area of the Llano Estacado Region (Region O) for each of the projection dates 2004,

¹ “Draft Memorandum to File,” Gooch, Thomas C., P.E., and Andres A. Salazar, Ph.D., Freese and Nichols, March 19, 2003.

² “Draft Memorandum to File,” Gooch, Thomas C., P.E., and Andres A. Salazar, Ph.D., Freese and Nichols, March 19, 2003.

2010, 2020, 2030, 2040, 2050 and 2060. The quantity of water that could be pumped from each of the county-basin areas at each of the projection dates was calculated based upon the recharge and aquifer parameters of the Southern Ogallala GAM, and the water wells in place at the present time (the quantity of water available annually from the aquifer in the immediate future could be increased by adding more wells). However, well spacing is regulated by the Underground Water Conservation Districts of the area, and the addition of wells requires permits from the Districts. In a second request by the LERWPG, the TWDB made volumetric calculations 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 projected water demands, as approved by the TWDB on September 17, 2003, as the primary output. The results of the GAM and the mass balance calculations were used to obtain estimates of the quantities of water available from the Ogallala Aquifer for use in meeting projected water demand of the region (see Appendix E).

- B. Groundwater availability by aquifer for the Dockum, Edwards-Trinity (High Plains), and Seymour Aquifers was obtained from the TWDB. The groundwater availability by county was further subdivided into river basin parts of each county according to the TWDB estimates.
- C. Surface water availability for cities obtaining all or part of their water supply from surface water sources was estimated from water use data supplied by surface water suppliers and cities within the planning region that use surface water.
- D. Water availability from reclaimed water was obtained from TCEQ discharge permits.
- E. Range livestock water supply was allocated to local sources (stock tanks and windmills) and set at projected quantities of range livestock water demands.

The estimated quantity of water available from each source (Aquifer and Surface Source) to meet projected water demands in each county-basin area of the planning region is presented in Table 3-1 and Tables 4-1 through 4-21.

3.4 Projected Water Supplies Available to the Llano Estacado Region

Water demand projections for water user groups of each county and river basin area of the Llano Estacado Region were presented in Section 2, Table 2-21. The projected quantity of water available from each aquifer and other water source for use in each county and river basin area of each county of the Llano Estacado Region is presented below. The water supply information is explained briefly below for Bailey and Castro Counties and for the region. The explanations for Bailey and Castro Counties are illustrative as to how to read Table 3-1.

The total quantity of water used in Bailey County, which is located entirely in the Brazos River Basin, in 2000 was 179,414 acft (Table 3-1). The quantity estimated to be available for use

in 2010 is 103,288 acft, of which 101,923 acft are from the Ogallala Aquifer, 541 acft are from stock tanks and windmills, and 825 acft are reclaimed wastewater (Table 3-1). The projected quantity available in 2060 in Bailey County is 76,234 acft, which is only 42 percent as much as was available in 2000 (Table 3-1). The reason for the decline in quantity available between 2000 and 2060 is the decline in the quantity available from the Ogallala Aquifer (i.e., more water is being withdrawn from the aquifer than is being recharged to it).

The total quantity of water used in Castro County, which is located partially in the Red River Basin and partially in the Brazos River Basin, in 2000 was 517,384 acft (Table 3-1). The quantity estimated to be available for use in 2010 is 350,128 acft, of which 110,256 acft are from the Ogallala Aquifer in the Red River Basin and 235,507 acft are from the Ogallala Aquifer in the Brazos River Basin, 151 acft are from stock tanks and windmills in the Red River Basin and 184 acft are from stock tanks and windmills in the Brazos River Basin. In addition, in 2010 Castro County has available a projected quantity of 4,031 acft of reclaimed wastewater in the Brazos River Basin in 2010 (Table 3-1). The projected quantity available in 2060 in Castro County is 63,402 acft, which is only 12 percent as much as was available in 2000, with the reason for the decline in quantity available between 2000 and 2060 the same as for Bailey County (i.e., more water is being withdrawn from the Ogallala Aquifer than is being recharged to it) (Table 3-1).

The total quantity of water used in the Llano Estacado Region in 2000 was 4,695,422 acft, of which 96.5 percent was from the Ogallala Aquifer, 0.81 percent was from Lake Meredith of the CRMWA System, and 1.08 percent was from reclaimed wastewater (Table 3-1). The estimated total quantity of water available for use in the Region in 2060 is 1,509,023 acft, or only 32 percent as much as was available in 2000. As was explained above for Bailey and Castro Counties, more water is being withdrawn from the Ogallala Aquifer than is being recharged to it (Table 3-1 and Figure 3-1).

The Ogallala Aquifer supplied 96 percent of the water used in the Llano Estacado Region in 2000, and even though the quantity available annually from the Ogallala Aquifer is projected to decline from 4.530 million acft/yr in 2000 to 1.325 million acft/yr in 2060, it is still projected to provide about 88 percent of the region's total water supply in 2060 (Table 3-1 and Figure 3-1).

**Table 3-1
Water Supply Projections
Individual Counties with River Basin Summaries
Llano Estacado Region**

County	River Basin	Source	2000 (acft)	2010 (acft)	2020 (acft)	2030 (acft)	2040 (acft)	2050 (acft)	2060 (acft)
Counties									
Bailey	Brazos	Ogallala Aquifer	178,070	101,923	91,945	87,131	81,924	77,780	74,742
Bailey	Brazos	Stock Tanks and Windmills	519	541	563	587	612	639	667
Bailey	Brazos	Reclaimed	<u>825</u>	<u>825</u>	<u>825</u>	<u>825</u>	<u>825</u>	<u>825</u>	<u>825</u>
Bailey		Total	179,414	103,288	93,333	88,544	83,362	79,244	76,234
Briscoe	Red	Ogallala Aquifer	26,952	22,800	15,867	9,872	7,460	5,388	4,888
Briscoe	Red	Dockum Aquifer	100	100	100	100	100	100	100
Briscoe	Red	Seymour Aquifer	4,063	4,063	4,063	1,821	1,821	1,821	1,821
Briscoe	Red	Other Aquifers	115	109	96	94	95	91	91
Briscoe	Red	Stock Tanks and Windmills	284	292	301	310	320	330	341
Briscoe	Red	Lake Mackenzie	<u>85</u>	<u>85</u>	<u>85</u>	<u>85</u>	<u>85</u>	<u>85</u>	<u>85</u>
Briscoe		Total	31,599	27,449	20,512	12,282	9,882	7,816	7,326
Castro	Red	Ogallala Aquifer	163,591	110,256	72,609	45,405	25,992	23,784	20,890
Castro	Red	Stock Tanks and Windmills	149	151	176	178	181	185	188
Castro	Brazos	Ogallala Aquifer	349,432	235,507	211,116	147,124	59,674	44,832	38,066
Castro	Brazos	Stock Tanks and Windmills	181	184	214	218	220	223	227
Castro	Brazos	Reclaimed	<u>4,031</u>	<u>4,031</u>	<u>4,031</u>	<u>4,031</u>	<u>4,031</u>	<u>4,031</u>	<u>4,031</u>
Castro		Total	517,384	350,128	288,146	196,957	90,099	73,055	63,402
Cochran	Brazos	Ogallala Aquifer	77,961	44,285	43,420	36,681	33,797	12,126	12,157
Cochran	Brazos	Stock Tanks and Windmills	45	46	64	67	69	70	70
Cochran	Brazos	Reclaimed	267	267	267	267	267	267	267
Cochran	Colorado	Ogallala Aquifer	45,154	33,836	31,610	35,447	35,458	11,783	11,752
Cochran	Colorado	Stock Tanks and Windmills	87	88	123	123	124	125	128
Cochran	Colorado	Reclaimed	<u>27</u>	<u>27</u>	<u>27</u>	<u>27</u>	<u>27</u>	<u>27</u>	<u>27</u>
Cochran		Total	123,542	78,550	75,511	72,612	69,742	24,398	24,401
Crosby	Red	Ogallala Aquifer	1,391	1,307	1,256	1,204	1,158	1,101	1,078
Crosby	Red	Stock Tanks and Windmills	3	3	3	4	4	4	4
Crosby	Brazos	Ogallala Aquifer	112,337	96,710	92,844	89,147	85,593	83,138	79,835
Crosby	Brazos	Seymour Aquifer	483	483	483	474	474	474	474
Crosby	Brazos	Stock Tanks and Windmills	292	298	303	310	318	325	332
Crosby	Brazos	White River Reservoir	707	707	707	707	707	707	707
Crosby	Brazos	Reclaimed	<u>583</u>	<u>583</u>	<u>583</u>	<u>583</u>	<u>583</u>	<u>583</u>	<u>583</u>
Crosby		Total	115,796	100,091	96,179	92,430	88,836	86,332	83,013
Dawson	Brazos	Ogallala Aquifer	19	19	19	19	18	18	17
Dawson	Brazos	Stock Tanks and Windmills	1	1	2	1	2	2	2
Dawson	Colorado	Ogallala Aquifer	152,146	45,194	37,508	34,547	31,266	31,239	31,195
Dawson	Colorado	Ogallala (Roberts Co.)	892	892	892	892	892	892	892
Dawson	Colorado	Stock Tanks and Windmills	150	154	156	161	164	168	172
Dawson	Colorado	Lake Meredith (CRMWA)	<u>1,694</u>	<u>1,694</u>	<u>1,694</u>	<u>1,694</u>	<u>1,694</u>	<u>1,694</u>	<u>1,694</u>
Dawson		Total	154,903	47,954	40,271	37,314	34,036	34,013	33,972

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Table 3-1 Continued

County	River Basin	Source	2000 (acft)	2010 (acft)	2020 (acft)	2030 (acft)	2040 (acft)	2050 (acft)	2060 (acft)
Deaf Smith	Canadian	Ogallala Aquifer	171	112	74	1	1	1	1
Deaf Smith	Canadian	Stock Tanks and Windmills	220	281	317	326	336	344	353
Deaf Smith	Red	Ogallala Aquifer	388,182	204,702	170,696	128,078	88,180	86,199	81,704
Deaf Smith	Red	Dockum Aquifer	930	720	578	7,502	7,576	7,602	7,602
Deaf Smith	Red	Stock Tanks and Windmills	2,859	2,931	3,035	3,174	3,319	3,474	3,636
Deaf Smith	Red	Reclaimed	<u>2,810</u>	<u>2,810</u>	<u>2,810</u>	<u>2,810</u>	<u>2,810</u>	<u>2,810</u>	<u>2,810</u>
Deaf Smith		Total	395,172	211,556	177,511	141,891	102,222	100,430	96,106
Dickens	Red	Ogallala Aquifer	4,626	2,662	2,575	2,503	2,217	2,159	2,108
Dickens	Red	Seymour Aquifer	7,937	7,937	7,937	5,217	5,217	5,217	5,217
Dickens	Red	Stock Tanks and Windmills	230	233	239	246	251	258	264
Dickens	Brazos	Ogallala Aquifer	6,199	3,585	3,468	3,366	3,481	3,390	3,312
Dickens	Brazos	Seymour Aquifer	4,348	4,348	4,348	2,858	2,858	2,858	2,858
Dickens	Brazos	Stock Tanks and Windmills	391	401	408	417	427	437	449
Dickens	Brazos	White River Reservoir	<u>275</u>	<u>271</u>	<u>267</u>	<u>263</u>	<u>260</u>	<u>257</u>	<u>257</u>
Dickens		Total	24,005	19,437	19,243	14,869	14,711	14,576	14,464
Floyd	Red	Ogallala Aquifer	101,292	52,505	32,434	25,205	21,096	20,270	19,510
Floyd	Red	Stock Tanks and Windmills	253	259	266	271	279	288	296
Floyd	Brazos	Ogallala Aquifer	138,280	86,288	81,860	78,044	73,821	70,449	68,588
Floyd	Brazos	Stock Tanks and Windmills	199	205	210	218	223	229	236
Floyd	Brazos	Lake Mackenzie	362	362	362	362	362	362	362
Floyd	Brazos	Reclaimed	<u>449</u>	<u>449</u>	<u>449</u>	<u>449</u>	<u>449</u>	<u>449</u>	<u>449</u>
Floyd		Total	240,835	140,068	115,581	104,549	96,230	92,047	89,441
Gaines	Colorado	Ogallala Aquifer	424,778	335,917	275,995	241,173	213,273	188,235	165,735
Gaines	Colorado	Stock Tanks and Windmills	<u>296</u>	<u>304</u>	<u>312</u>	<u>320</u>	<u>329</u>	<u>338</u>	<u>348</u>
Gaines		Total	425,074	336,221	276,307	241,493	213,602	188,573	166,083
Garza	Brazos	Ogallala Aquifer	14,563	7,527	6,879	6,394	5,946	5,554	5,262
Garza	Brazos	Dockum Aquifer	136	136	136	136	136	136	136
Garza	Brazos	Stock Tanks and Windmills	355	363	423	432	442	453	465
Garza	Brazos	White River Reservoir	1,021	1,021	1,021	1,021	1,021	1,021	1,021
Garza	Brazos	Lake Alan Henry (WSD)	0	22	22	22	22	22	22
Garza	Brazos	Slaton CRMWA Supply	0	306	306	306	306	306	306
Garza	Colorado	Ogallala Aquifer	0	0	0	0	0	0	0
Garza	Colorado	Stock Tanks and Windmills	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Garza		Total	16,075	9,375	8,787	8,311	7,873	7,492	7,212
Hale	Red	Ogallala Aquifer	3,499	829	0	0	0	0	0
Hale	Red	Stock Tanks and Windmills	1	1	1	1	1	1	1
Hale	Brazos	Ogallala Aquifer	374,974	348,301	302,704	206,807	127,551	98,721	89,136
Hale	Brazos	Ogallala (Roberts Co.)	1,476	1,476	1,476	1,476	1,476	1,476	1,476
Hale	Brazos	Stock Tanks and Windmills	324	331	340	349	358	368	379
Hale	Brazos	Lake Meredith (CRMWA)	2,805	2,805	2,805	2,805	2,805	2,805	2,805
Hale	Brazos	Reclaimed	<u>5,477</u>	<u>5,477</u>	<u>5,477</u>	<u>5,477</u>	<u>5,477</u>	<u>5,477</u>	<u>5,477</u>
Hale		Total	388,556	359,221	312,803	216,915	137,668	108,848	99,274

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Table 3-1 Continued

County	River Basin	Source	2000 (acft)	2010 (acft)	2020 (acft)	2030 (acft)	2040 (acft)	2050 (acft)	2060 (acft)
Hockley	Brazos	Ogallala Aquifer	163,639	96,889	79,415	67,208	55,876	53,945	50,540
Hockley	Brazos	Ogallala (Roberts Co.)	1,116	1,116	1,116	1,116	1,116	1,116	1,116
Hockley	Brazos	Stock Tanks and Windmills	221	226	273	280	286	292	299
Hockley	Brazos	Lake Meredith (CRMWA)	2,120	2,120	2,120	2,120	2,120	2,120	2,120
Hockley	Brazos	Reclaimed	1,359	1,359	1,359	1,359	1,359	1,359	1,359
Hockley	Colorado	Ogallala Aquifer	20,274	12,761	10,678	8,807	8,186	7,686	7,689
Hockley	Colorado	Stock Tanks and Windmills	44	45	55	55	56	57	59
Hockley	Colorado	Reclaimed	<u>162</u>	<u>162</u>	<u>162</u>	<u>162</u>	<u>162</u>	<u>162</u>	<u>162</u>
Hockley		Total	188,935	114,679	95,178	81,107	69,160	66,737	63,343
Lamb	Brazos	Ogallala Aquifer	402,158	267,764	210,668	156,745	109,741	91,026	81,651
Lamb	Brazos	Stock Tanks and Windmills	472	491	510	531	552	575	599
Lamb	Brazos	Reclaimed	<u>7,199</u>	<u>7,199</u>	<u>7,199</u>	<u>7,199</u>	<u>7,199</u>	<u>7,199</u>	<u>7,199</u>
Lamb		Total	409,829	275,454	218,377	164,475	117,492	98,801	89,449
Lubbock	Brazos	Ogallala Aquifer	298,052	163,283	131,367	110,204	88,545	85,490	80,557
Lubbock	Brazos	Ogallala Aquifer (Bailey Co)	8,092	8,353	8,516	8,530	8,407	8,470	8,383
Lubbock	Brazos	Ogallala (Roberts Co.)	15,453	15,453	15,453	15,453	15,453	15,453	15,453
Lubbock	Brazos	Stock Tanks and Windmills	258	265	272	280	289	298	308
Lubbock	Brazos	Lake Meredith (CRMWA)	29,407	29,537	29,666	29,795	29,922	30,050	30,101
Lubbock	Brazos	Lake Alan Henry	0	0	0	0	22,478	22,478	22,478
Lubbock	Brazos	Reclaimed Lubbock-EI Pr.	5,776	5,221	4,440	5,191	6,106	7,222	8,582
Lubbock	Brazos	Reclaimed Lubbock-Irrig.	7,958	9,166	10,354	9,639	8,415	7,457	5,880
Lubbock	Brazos	Reclaimed Other Mun & Ind	<u>4,209</u>	<u>4,209</u>	<u>4,209</u>	<u>4,209</u>	<u>4,209</u>	<u>4,209</u>	<u>4,209</u>
Lubbock		Total	369,205	235,487	204,277	183,301	183,822	181,126	175,950
Lynn	Brazos	Ogallala Aquifer	120,425	120,425	120,425	120,425	120,425	120,425	120,425
Lynn	Brazos	Edwards-Trinity (H-P Aqu)	4,944	4,160	3,580	2,802	2,335	2,065	2,065
Lynn	Brazos	Ogallala (Roberts Co.)	184	184	184	184	184	184	184
Lynn	Brazos	Stock Tanks and Windmills	128	132	136	139	144	149	153
Lynn	Brazos	Lake Meredith (CRMWA)	350	350	350	350	350	350	350
Lynn	Brazos	Reclaimed (Lubbock-Irrig)	6,496	6,496	6,496	6,496	6,496	6,496	6,496
Lynn	Brazos	Reclaimed Other Mun & Ind	346	346	346	346	346	346	346
Lynn	Colorado	Ogallala Aquifer	1,141	491	473	462	467	422	381
Lynn	Colorado	Ogallala (Roberts Co.)	91	91	91	91	91	91	91
Lynn	Colorado	Stock Tanks and Windmills	11	11	11	12	12	13	14
Lynn	Colorado	Lake Meredith (CRMWA)	<u>173</u>	<u>173</u>	<u>173</u>	<u>173</u>	<u>173</u>	<u>173</u>	<u>173</u>
Lynn		Total	134,290	132,860	132,265	131,480	131,023	130,713	130,677
Motley	Red	Ogallala Aquifer	10,200	5,717	5,565	5,411	5,254	5,115	4,991
Motley	Red	Seymour Aquifer	18,817	18,817	18,817	13,507	13,507	13,507	13,507
Motley	Red	Other Aquifers	239	234	224	207	187	174	166
Motley	Red	Stock Tanks and Windmills	<u>625</u>	<u>636</u>	<u>647</u>	<u>659</u>	<u>671</u>	<u>684</u>	<u>698</u>
Motley		Total	29,881	25,404	25,253	19,784	19,619	19,480	19,362

Continued on next page

Table 3-1 Continued

County	River Basin	Source	2000 (acft)	2010 (acft)	2020 (acft)	2030 (acft)	2040 (acft)	2050 (acft)	2060 (acft)
Parmer	Red	Ogallala Aquifer	135,705	76,545	26,066	19,901	36,235	37,658	35,109
Parmer	Red	Stock Tanks and Windmills	273	286	298	309	324	341	356
Parmer	Red	Reclaimed	2,486	2,486	2,486	2,486	2,486	2,486	2,486
Parmer	Brazos	Ogallala Aquifer	289,384	182,317	60,373	31,879	15,545	14,122	16,671
Parmer	Brazos	Stock Tanks and Windmills	530	551	575	601	626	651	680
Parmer	Brazos	Reclaimed	<u>401</u>	<u>401</u>	<u>401</u>	<u>401</u>	<u>401</u>	<u>401</u>	<u>401</u>
Parmer		Total	428,779	262,586	90,199	55,577	55,617	55,659	55,703
Swisher	Red	Ogallala Aquifer	109,814	93,170	84,809	75,784	66,827	64,355	63,614
Swisher	Red	Dockum Aquifer	846	846	846	846	846	846	846
Swisher	Red	Stock Tanks and Windmills	421	435	475	493	512	531	551
Swisher	Red	Lake Mackenzie	417	417	417	417	417	417	417
Swisher	Brazos	Ogallala Aquifer	66,489	59,724	23,582	2,488	1,098	533	531
Swisher	Brazos	Stock Tanks and Windmills	<u>168</u>	<u>167</u>	<u>141</u>	<u>139</u>	<u>136</u>	<u>133</u>	<u>132</u>
Swisher	Brazos	Total	178,155	154,759	110,271	80,166	69,835	66,815	66,090
Terry	Brazos	Ogallala Aquifer	10,250	6,069	5,756	5,461	4,704	4,713	4,719
Terry	Brazos	Stock Tanks and Windmills	4	7	10	8	12	10	7
Terry	Colorado	Ogallala Aquifer	196,979	113,165	86,251	67,983	54,595	54,570	54,553
Terry	Colorado	Ogallala (Roberts Co.)	879	879	879	879	879	879	879
Terry	Colorado	Stock Tanks and Windmills	115	115	114	119	118	124	130
Terry	Colorado	Lake Meredith (CRMWA)	<u>1,670</u>	<u>1,670</u>	<u>1,670</u>	<u>1,670</u>	<u>1,670</u>	<u>1,670</u>	<u>1,670</u>
Terry		Total	209,897	121,904	94,681	76,121	61,979	61,966	61,958
Yoakum	Colorado	Ogallala Aquifer	133,881	103,958	99,734	95,204	91,342	88,062	85,269
Yoakum	Colorado	Stock Tanks and Windmills	<u>214</u>	<u>218</u>	<u>273</u>	<u>278</u>	<u>282</u>	<u>288</u>	<u>293</u>
Yoakum		Total	134,095	104,176	100,007	95,482	91,624	88,350	85,562
River Basins									
	Canadian	Ogallala Aquifer	171	112	74	1	1	1	1
	Canadian	Ogallala (Roberts Co.)	0	0	0	0	0	0	0
	Canadian	Dockum Aquifer	0	0	0	0	0	0	0
	Canadian	Seymour Aquifer	0	0	0	0	0	0	0
	Canadian	Other Aquifers	0	0	0	0	0	0	0
	Canadian	Stock Tanks and Windmills	220	281	317	326	336	344	353
	Canadian	Lake Mackenzie	0	0	0	0	0	0	0
	Canadian	White River Reservoir	0	0	0	0	0	0	0
	Canadian	Lake Meredith (CRMWA)	0	0	0	0	0	0	0
	Canadian	Reclaimed Lubbock-El Pr.	0	0	0	0	0	0	0
	Canadian	Reclaimed Lubbock-Irrig.	0	0	0	0	0	0	0
	Canadian	Reclaimed Other Mun & Ind	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
	Canadian	Total	390	393	391	327	337	345	354

Continued on next page

Table 3-1 Continued

County	River Basin	Source	2000 (acft)	2010 (acft)	2020 (acft)	2030 (acft)	2040 (acft)	2050 (acft)	2060 (acft)
Red		Ogallala Aquifer	945,251	570,492	411,878	313,364	254,419	246,029	233,892
		Ogallala (Roberts Co.)	0	0	0	0	0	0	0
		Dockum Aquifer	1,876	1,666	1,524	8,448	8,522	8,548	8,548
		Seymour Aquifer	30,817	30,817	30,817	20,545	20,545	20,545	20,545
		Other Aquifers	354	343	320	301	282	265	257
		Stock Tanks and Windmills	5,100	5,227	5,442	5,645	5,863	6,095	6,335
		Lake Mackenzie	502	502	502	502	502	502	502
		White River Reservoir	0	0	0	0	0	0	0
		Lake Meredith (CRMWA)	0	0	0	0	0	0	0
		Reclaimed Lubbock-El Pr.	0	0	0	0	0	0	0
		Reclaimed Lubbock-Irrig.	0	0	0	0	0	0	0
		Reclaimed Other Mun & Ind	<u>5,296</u>	<u>5,296</u>	<u>5,296</u>	<u>5,296</u>	<u>5,296</u>	<u>5,296</u>	<u>5,296</u>
		Total	989,196	614,343	455,779	354,101	295,429	287,281	275,375
Brazos		Ogallala Aquifer	2,610,326	1,828,970	1,474,356	1,157,654	876,144	774,733	734,591
		Ogallala (Roberts Co.)	18,229	18,229	18,229	18,229	18,229	18,229	18,229
		Dockum Aquifer	136	136	136	136	136	136	136
		Seymour Aquifer	4,831	4,831	4,831	3,332	3,332	3,332	3,332
		Edwards-Trinity (H-P Aqu)	4,944	4,160	3,580	2,802	2,335	2,065	2,065
		Stock Tanks and Windmills	4,088	4,210	4,446	4,577	4,716	4,854	5,003
		Lake Mackenzie	362	362	362	362	362	362	362
		White River Reservoir	2,003	1,999	1,995	1,991	1,988	1,985	1,985
		Lake Meredith (CRMWA)	34,682	35,118	35,247	35,376	35,503	35,631	35,682
		Lake Alan Henry	0	22	22	22	22,500	22,500	22,500
		Reclaimed Lubbock-El Pr.	5,776	5,221	4,440	5,191	6,106	7,222	8,582
		Reclaimed Lubbock-Irrig.	14,454	15,662	16,850	16,135	14,911	13,953	12,376
		Reclaimed Other Mun & Ind	<u>25,146</u>	<u>25,146</u>	<u>25,146</u>	<u>25,146</u>	<u>25,146</u>	<u>25,146</u>	<u>25,146</u>
	Total	2,724,977	1,944,065	1,589,640	1,270,952	1,011,408	910,147	869,989	
Colorado		Ogallala Aquifer	974,352	645,323	542,249	483,623	434,588	381,997	356,573
		Ogallala (Roberts Co.)	1,862	1,862	1,862	1,862	1,862	1,862	1,862
		Dockum Aquifer	0	0	0	0	0	0	0
		Seymour Aquifer	0	0	0	0	0	0	0
		Other Aquifers	0	0	0	0	0	0	0
		Stock Tanks and Windmills	918	936	1,045	1,068	1,086	1,113	1,144
		Lake Mackenzie	0	0	0	0	0	0	0
		White River Reservoir	0	0	0	0	0	0	0
		Lake Meredith (CRMWA)	3,537	3,537	3,537	3,537	3,537	3,537	3,537
		Reclaimed Lubbock-El Pr.	0	0	0	0	0	0	0
		Reclaimed Lubbock-Irrig.	0	0	0	0	0	0	0
		Reclaimed Other Mun & Ind	<u>189</u>	<u>189</u>	<u>189</u>	<u>189</u>	<u>189</u>	<u>189</u>	<u>189</u>
	Total	980,859	651,846	548,882	490,279	441,262	388,698	363,305	

Continued on next page

Table 3-1 Concluded

County	River Basin	Source	2000 (acft)	2010 (acft)	2020 (acft)	2030 (acft)	2040 (acft)	2050 (acft)	2060 (acft)
Llano Estacado Region — Totals									
Region		Ogallala Aquifer	4,530,100	3,044,897	2,428,556	1,954,641	1,565,152	1,402,760	1,325,057
Region		Ogallala (Roberts Co.)	20,091	20,091	20,091	20,091	20,091	20,091	20,091
Region		Dockum Aquifer	2,012	1,802	1,660	8,584	8,658	8,684	8,684
Region		Seymour Aquifer	35,648	35,648	35,648	23,877	23,877	23,877	23,877
Region		Other Aquifers	5,298	4,503	3,900	3,103	2,617	2,330	2,322
Region		Stock Tanks and Windmills	10,326	10,653	11,250	11,616	12,000	12,406	12,835
Region		Lake Mackenzie	864	864	864	864	864	864	864
Region		White River Reservoir	2,003	1,999	1,995	1,991	1,988	1,985	1,985
Region		Lake Meredith (CRMWA)	38,219	38,655	38,784	38,913	39,040	39,168	39,219
Region		Lake Alan Henry	0	22	22	22	22,500	22,500	22,500
Region		Reclaimed Lubbock-El Pr.	5,776	5,221	4,440	5,191	6,106	7,222	8,582
Region		Reclaimed Lubbock-Irrig.	14,454	15,662	16,850	16,135	14,911	13,953	12,376
Region		Reclaimed Other Mun & Ind	<u>30,631</u>	<u>30,631</u>	<u>30,631</u>	<u>30,631</u>	<u>30,631</u>	<u>30,631</u>	<u>30,631</u>
Region		Total	4,695,422	3,210,647	2,594,691	2,115,659	1,748,435	1,586,471	1,509,023
Llano Estacado Region — Percent of Total									
Region		Ogallala Aquifer	96.48%	94.84%	93.60%	92.39%	89.52%	88.42%	87.81%
Region		Ogallala (Roberts Co.)	0.43%	0.63%	0.77%	0.95%	1.15%	1.27%	1.33%
Region		Dockum Aquifer	0.04%	0.06%	0.06%	0.41%	0.50%	0.55%	0.58%
Region		Seymour Aquifer	0.76%	1.11%	1.37%	1.13%	1.37%	1.51%	1.58%
Region		Other Aquifers	0.11%	0.14%	0.15%	0.15%	0.15%	0.15%	0.15%
Region		Stock Tanks and Windmills	0.22%	0.33%	0.43%	0.55%	0.69%	0.78%	0.85%
Region		Lake Mackenzie	0.02%	0.03%	0.03%	0.04%	0.05%	0.05%	0.06%
Region		White River Reservoir	0.04%	0.06%	0.08%	0.09%	0.11%	0.13%	0.13%
Region		Lake Meredith (CRMWA)	0.81%	1.20%	1.49%	1.84%	2.23%	2.47%	2.60%
Region		Lake Alan Henry	0.00%	0.00%	0.00%	0.00%	1.29%	1.42%	1.49%
Region		Reclaimed Lubbock-El Pr.	0.12%	0.16%	0.17%	0.25%	0.35%	0.46%	0.57%
Region		Reclaimed Lubbock-Irrig.	0.31%	0.49%	0.65%	0.76%	0.85%	0.88%	0.82%
Region		Reclaimed Other Mun & Ind	<u>0.65%</u>	<u>0.95%</u>	<u>1.18%</u>	<u>1.45%</u>	<u>1.75%</u>	<u>1.93%</u>	<u>2.03%</u>
Region		Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

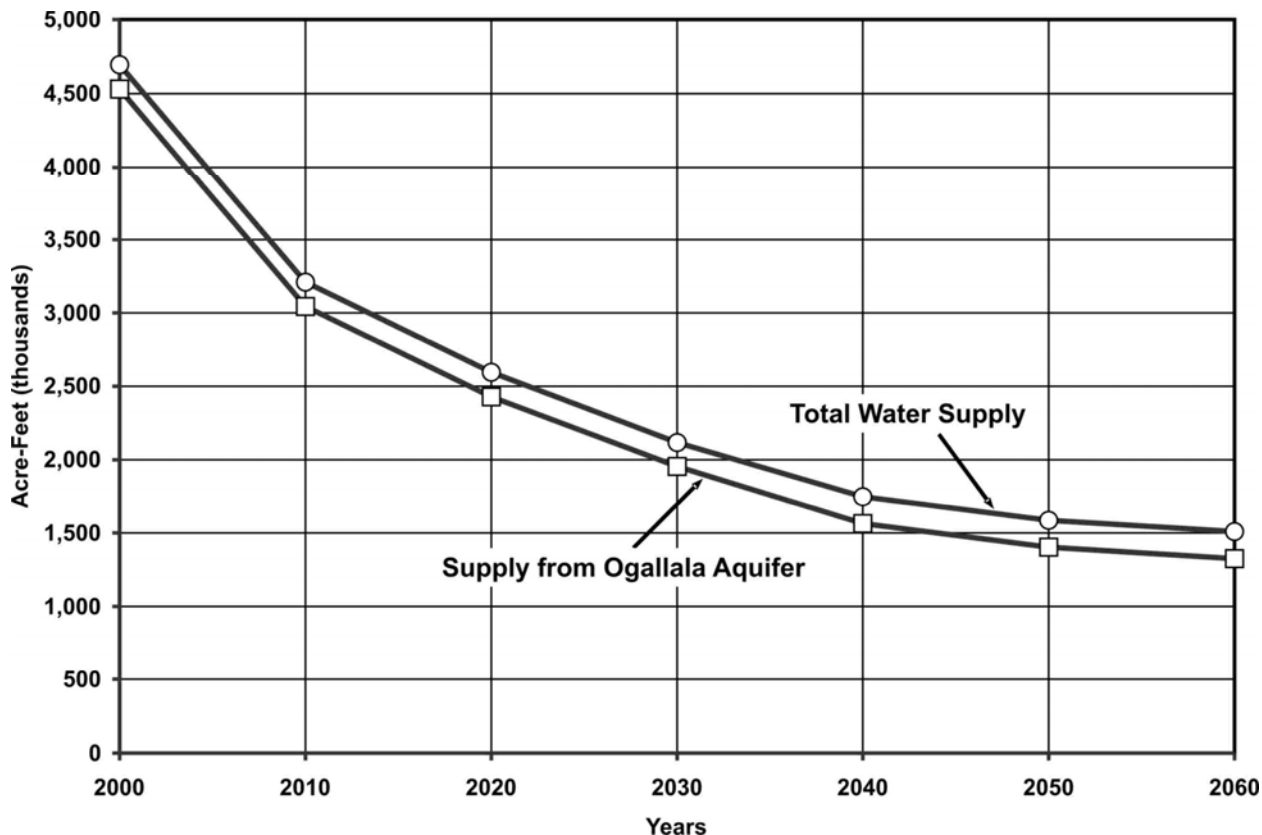


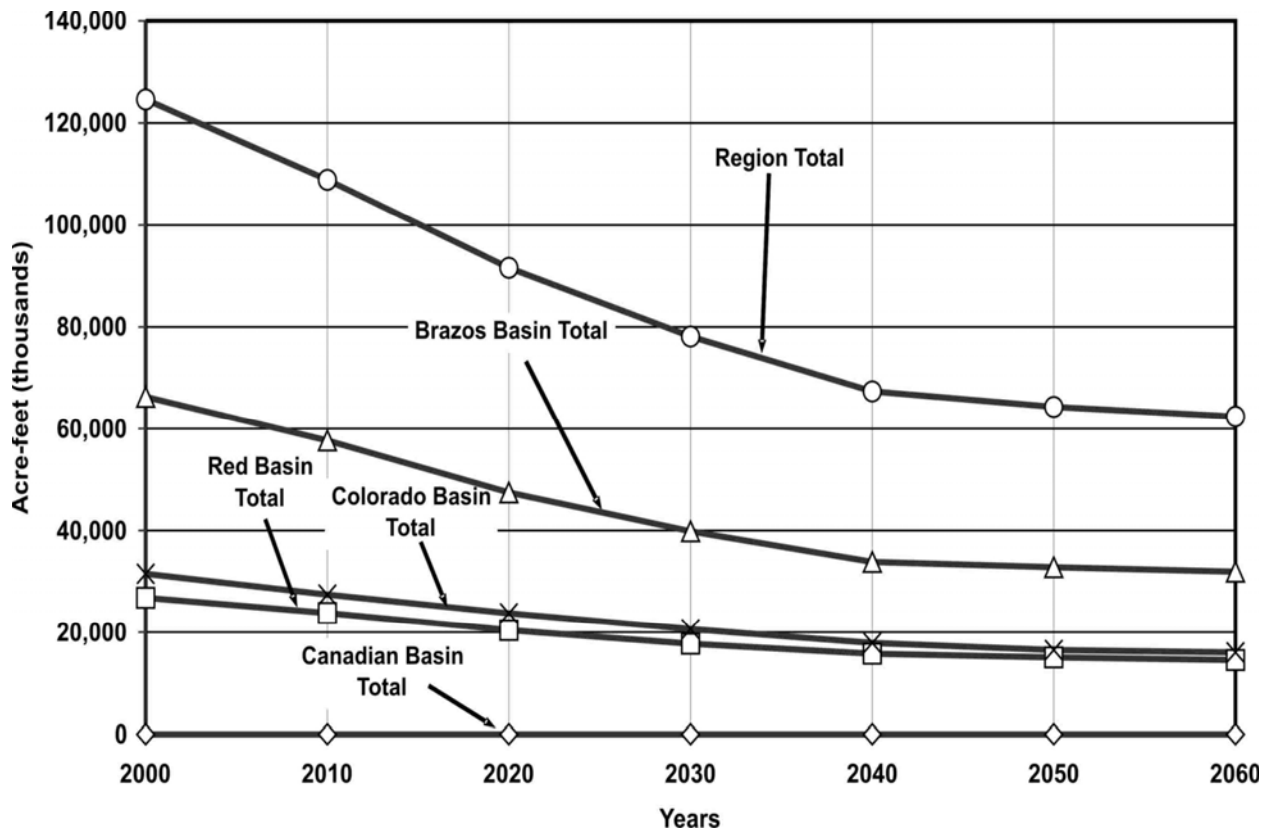
Figure 3-1. Projected Water Supply for the Llano Estacado Water Planning Region

The estimated quantity of water in storage in the Ogallala Aquifer in 2000 was 124,653,395 acft and is projected to decline to 62,418,860 acft in 2060(i.e., in 2060 it is projected that the quantity of water remaining in storage will be about 50.1 percent of the quantity estimated to have been in storage in 2000) (Table 3-2 and Figure 3-2).

It is reiterated that the quantity of water available from the Ogallala and the quantity remaining in storage at each of the projection dates was calculated using the TWDB GAM, and is based upon the capability of the aquifer to yield water to the wells presently in place. If the number of water wells is increased in future years, the Model Runs could result in larger quantities of water available per year in the early years of the projections, but due to the fact that pumpage is much greater than recharge, would be lower in later years. The calculated quantity that could be pumped for use by water user groups for each county-basin area for each projected year is less than the projected water demands for the same area (i.e., water supplies available annually are projected to be less than projected water demands) (Table 3-1).

**Table 3-2
Projected Quantity of Water in Storage
Individual Counties with River Basin Summaries
Llano Estacado Region**

County	2000 acft	2010 acft	2020 acft	2030 acft	2040 acft	2050 acft	2060 acft
Bailey	4,272,200	3,380,925	2,546,788	1,769,102	1,229,855	1,216,106	1,212,373
Briscoe	2,164,466	2,036,351	1,870,525	1,756,762	1,680,434	1,650,541	1,632,676
Castro	8,801,770	6,895,847	4,238,764	2,254,998	1,223,544	1,054,373	897,274
Cochran	2,578,704	1,834,111	1,308,992	813,743	347,354	81,708	37,705
Crosby	10,949,015	10,612,852	10,085,108	9,980,291	9,152,440	9,038,236	8,946,553
Dawson	7,266,792	7,202,322	7,202,322	7,202,322	7,202,322	7,202,322	7,202,322
Deaf Smith	7,851,767	6,647,546	5,230,982	4,163,213	3,383,867	3,152,925	3,000,017
Dickens	1,119,192	1,037,297	1,032,409	1,027,698	862,252	817,846	813,589
Floyd	13,012,008	11,832,107	11,397,458	10,489,267	9,764,296	9,587,136	9,409,491
Gaines	12,495,883	10,232,860	7,998,429	6,120,700	4,493,051	3,708,105	3,651,389
Garza	662,851	643,700	643,700	643,700	643,700	643,700	643,700
Hale	9,867,018	8,192,891	5,591,955	3,651,208	2,463,726	2,164,064	1,886,697
Hockley	5,480,511	4,993,208	4,432,736	3,965,426	3,615,247	3,591,108	3,533,107
Lamb	8,246,693	6,944,619	5,155,582	3,861,385	2,953,511	2,743,521	2,533,373
Lubbock	7,439,809	6,632,577	5,611,743	4,952,167	4,159,806	4,141,607	4,114,001
Lynn	3,786,579	3,645,979	3,655,103	3,655,103	3,655,103	3,655,103	3,655,103
Motley	355,295	282,644	231,003	180,893	132,340	85,257	39,482
Parmer	1,775,591	1,228,925	732,604	512,575	436,291	416,838	401,421
Swisher	7,568,857	6,816,315	5,837,065	5,156,220	4,622,929	4,392,133	4,184,417
Terry	4,576,781	4,161,424	3,801,304	3,563,138	3,428,883	3,520,915	3,619,055
Yoakum	<u>4,381,613</u>	<u>3,620,371</u>	<u>3,017,014</u>	<u>2,457,580</u>	<u>1,939,772</u>	<u>1,457,384</u>	<u>1,005,116</u>
Region	124,653,395	108,874,870	91,621,586	78,177,491	67,390,724	64,320,927	62,418,860
Basin Totals							
Canadian	2,599	1,798	894	684	684	684	684
Red	26,802,969	23,822,702	20,386,139	17,699,494	15,718,619	15,035,381	14,476,096
Brazos	66,322,545	57,639,248	47,478,393	39,860,073	33,829,805	32,839,469	31,939,798
Colorado	<u>31,525,282</u>	<u>27,411,121</u>	<u>23,756,159</u>	<u>20,617,240</u>	<u>17,841,616</u>	<u>16,445,393</u>	<u>16,002,283</u>
Total	124,653,395	108,874,870	91,621,586	78,177,491	67,390,724	64,320,927	62,418,860
Percent of Total in each Basin							
Canadian	0.0021%	0.0017%	0.0010%	0.0009%	0.0010%	0.0011%	0.0011%
Red	21.5020%	21.8808%	22.2504%	22.6401%	23.3246%	23.3756%	23.1919%
Brazos	53.2056%	52.9408%	51.8201%	50.9866%	50.1995%	51.0557%	51.1701%
Colorado	<u>25.2904%</u>	<u>25.1767%</u>	<u>25.9286%</u>	<u>26.3723%</u>	<u>26.4749%</u>	<u>25.5677%</u>	<u>25.6369%</u>
Total	100.0000%	100.0000%	100.0000%	100.0000%	100.0000%	100.0000%	100.0000%



**Figure 3-2. Projected Quantity of Water in Storage—Ogallala Aquifer
Llano Estacado Water Planning Region**

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