Regional Water Plan
Panhandle Water Planning Area

PPC99134

Regional Water Plan – Panhandle Water Planning Area
VOLUME II
APPENDICES

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VOLUME II

APPENDIX A

Population and Municipal Water Demand Projections

Population	1990	2000	2010	2020	2030	2040	2050
CLAUDE	1,199	1,253	1,335	1,410	1,476	1,478	1,480
County-Other, Red River Area	822	775	701	612	502	416	355
TOTAL	2,021	2,028	2,036	2,022	1,978	1,894	1,835

Municipal Water Use (ac-ft)	1990	2000	2010	2020	2030	2040	2050
CLAUDE	250	265	266	267	274	268	267
County-Other, Red River Area	103	92	78	61	50	40	33
TOTAL	353	357	344	328	324	308	300

Water Use Per Capita (gpcd)	1990	2000	2010	2020	2030	2040	2050
CLAUDE	186	189	178	169	166	162	161
County-Other, Red River Area	112	106	99	89	89	86	83
TOTAL	156	157	151	145	146	145	146

Population	1990	2000	2010	2020	2030	2040	2050
PANHANDLE	2,353	2,469	3,750	4,104	4,281	4,401	4,523
WHITE DEER	1,125	1,231	1,341	1,391	1,445	1,477	1,510
GROOM	613	655	658	648	600	545	501
SKELLYTOWN	664	666	667	650	572	564	556
County-Other, Canadian River Area	619	619	617	582	648	632	588
County-Other, Red River Area	1,202	1,164	1,159	1,094	1,125	1,148	1,117
TOTAL	6,576	6,804	8,192	8,469	8,671	8,767	8,795

Municipal Water Use (ac-ft)	1990	2000	2010	2020	2030	2040	2050
PANHANDLE	539	589	844	879	902	913	933
WHITE DEER	149	266	275	271	275	276	281
GROOM	147	180	173	163	149	132	121
SKELLYTOWN	84	88	83	76	64	61	59
County-Other, Canadian River Area	78	114	107	95	100	93	90
County-Other, Red River Area	364	350	341	324	328	331	334
TOTAL	1,361	1,587	1,823	1,808	1,818	1,806	1,818

Water Use Per Capita (gpcd)	1990	2000	2010	2020	2030	2040	2050
PANHANDLE	204	213	201	191	188	185	184
WHITE DEER	118	193	183	174	170	167	166
GROOM	214	245	235	225	222	216	216
SKELLYTOWN	113	118	111	104	100	97	95
County-Other, Canadian River Area	112	164	155	146	138	131	137
County-Other, Red River Area	270	268	263	264	260	257	267
TOTAL	185	208	198	190	187	184	185

ac-ft = Acre- Feet
gpcd = Gallons Per Capita per Day

CHILDRESS COUNTY

Population	1990	2000	2010	2020	2030	2040	2050
CHILDRESS	5,055	6,000	6,500	6,750	7,000	7,250	7,500
County-Other, Red River Area	898	1,818	1,720	1,724	1,716	1,737	1,774
TOTAL	5,953	7,818	8,220	8,474	8,716	8,987	9,274

Municipal Water Use (ac-ft)	1990	2000	2010	2020	2030	2040	2050
CHILDRESS	1,015	1,170	1,194	1,179	1,192	1,210	1,243
County-Other, Red River Area	176	382	341	326	317	313	318
TOTAL	1,191	1,551	1,536	1,506	1,509	1,523	1,562

Water Use Per Capita (gpcd)	1990	2000	2010	2020	2030	2040	2050
CHILDRESS	179	174	164	156	152	149	148
County-Other, Red River Area	175	187	177	169	165	161	160
TOTAL	179	176	166	158	154	151	150

COLLINGSWORTH COUNTY

Population	1990	2000	2010	2020	2030	2040	2050
WELLINGTON	2,456	2,482	2,508	2,577	2,588	2,583	2,569
County-Other, Red River Area	1,117	1,062	1,119	1,149	1,155	1,152	1,146
TOTAL	3,573	3,544	3,627	3,726	3,743	3,735	3,715

Municipal Water Use (ac-ft)	1990	2000	2010	2020	2030	2040	2050
WELLINGTON	512	614	593	580	571	561	553
County-Other, Red River Area	227	227	227	223	219	213	211
TOTAL	739	841	820	803	790	774	764

Water Use Per Capita (gpcd)	1990	2000	2010	2020	2030	2040	2050
WELLINGTON	186	221	211	201	197	194	192
County-Other, Red River Area	181	191	181	173	169	165	164
TOTAL	185	212	202	192	188	185	184

ac-ft = Acre- Feet
gpcd = Gallons Per Capita per Day

DALLAM COUNTY

Population	1990	2000	2010	2020	2030	2040	2050
DALHART (DALLAM COUNTY)	4,001	4,543	4,766	4,891	4,828	4,695	4,566
County-Other, Canadian River Area	1,460	1,477	1,634	1,727	1,764	1,816	1,824
TOTAL	5,461	6,020	6,400	6,618	6,592	6,511	6,390

Municipal Water Use (ac-ft)	1990	2000	2010	2020	2030	2040	2050
DALHART (DALLAM COUNTY)	978	1,145	1,142	1,118	1,087	1,037	1,002
County-Other, Canadian River Area	156	179	183	178	176	175	174
TOTAL	1,134	1,324	1,325	1,296	1,263	1,212	1,176

Water Use Per Capita (gpcd)	1990	2000	2010	2020	2030	2040	2050
DALHART (DALLAM COUNTY)	218	225	214	204	201	197	196
County-Other, Canadian River Area	95	108	100	92	89	86	85
TOTAL	185	195	183	173	169	165	163

DONLEY COUNTY

Population	1990	2000	2010	2020	2030	2040	2050
CLARENDON	2,067	2,032	1,959	1,904	1,785	1,662	1,520
County-Other, Red River Area	1,629	1,592	1,536	1,492	1,400	1,302	1,192
TOTAL	3,696	3,624	3,495	3,396	3,185	2,964	2,712

Municipal Water Use (ac-ft)	1990	2000	2010	2020	2030	2040	2050
CLARENDON	522	503	465	433	396	365	332
County-Other, Red River Area	179	187	170	152	135	125	114
TOTAL	701	690	635	585	531	490	446

Water Use Per Capita (gpcd)	1990	2000	2010	2020	2030	2040	2050
CLARENDON	225	221	212	203	198	196	195
County-Other, Red River Area	98	105	99	91	86	86	85
TOTAL	169	170	162	154	149	148	147

ac-ft = Acre- Feet

gpcd = Gallons Per Capita per Day

GRAY COUNTY

Population	1990	2000	2010	2020	2030	2040	2050
MCLEAN	849	891	931	970	868	850	832
PAMPA	19,959	20,778	21,723	22,698	20,395	19,992	19,597
LEFORS	656	638	603	559	517	500	488
County-Other, Canadian River Area	1,286	1,333	1,391	1,416	1,239	1,197	1,165
County-Other, Red River Area	1,217	1,304	1,423	1,503	1,288	1,244	1,209
TOTAL	23,967	24,944	26,071	27,146	24,307	23,783	23,291

Municipal Water Use (ac-ft)	1990	2000	2010	2020	2030	2040	2050
MCLEAN	240	266	266	265	232	226	220
PAMPA	3,933	4,003	3,966	3,941	3,404	3,314	3,227
LEFORS	92	120	107	95	85	80	78
County-Other, Canadian River Area	209	264	261	253	213	203	197
County-Other, Red River Area	342	264	273	273	225	216	208
TOTAL	4,816	4,917	4,873	4,827	4,159	4,039	3,930

Water Use Per Capita (gpcd)	1990	2000	2010	2020	2030	2040	2050
MCLEAN	252	267	255	244	239	237	236
PAMPA	176	172	163	155	149	148	147
LEFORS	125	168	158	152	147	143	143
County-Other, Canadian River Area	145	177	167	159	153	151	151
County-Other, Red River Area	251	181	171	162	156	155	154
TOTAL	179	176	167	159	153	152	151

HALL COUNTY

Population	1990	2000	2010	2020	2030	2040	2050
MEMPHIS	2,465	2,338	2,306	2,264	2,190	2,117	2,057
TURKEY	507	569	578	588	597	615	632
County-Other, Red River Area	933	809	782	747	695	634	581
TOTAL	3,905	3,716	3,666	3,599	3,482	3,366	3,270

Municipal Water Use (ac-ft)	1990	2000	2010	2020	2030	2040	2050
MEMPHIS	510	469	439	408	383	365	353
TURKEY	121	118	114	111	110	110	113
County-Other, Red River Area	212	203	187	170	154	143	131
TOTAL	843	790	740	689	647	618	597

Water Use Per Capita (gpcd)	1990	2000	2010	2020	2030	2040	2050
MEMPHIS	185	179	170	161	156	154	153
TURKEY	213	185	176	169	164	160	160
County-Other, Red River Area	203	224	213	203	198	201	201
TOTAL	193	190	180	171	166	164	163

ac-ft = Acre- Feet
gpcd = Gallons Per Capita per Day

HANSFORD COUNTY

Population	1990	2000	2010	2020	2030	2040	2050
GRUVER	1,172	1,216	1,280	1,297	1,278	1,247	1,202
SPEARMAN	3,197	3,318	3,506	3,555	3,498	3,422	3,348
County-Other, Canadian River Area	1,479	1,535	1,604	1,624	1,605	1,556	1,448
TOTAL	5,848	6,069	6,390	6,476	6,381	6,225	5,998

Municipal Water Use (ac-ft)	1990	2000	2010	2020	2030	2040	2050
GRUVER	343	377	381	372	361	346	334
SPEARMAN	844	844	852	832	803	770	754
County-Other, Canadian River Area	226	222	219	207	200	185	172
TOTAL	1,413	1,443	1,452	1,411	1,364	1,301	1,260

Water Use Per Capita (gpcd)	1990	2000	2010	2020	2030	2040	2050
GRUVER	261	277	266	256	252	248	248
SPEARMAN	236	227	217	209	205	201	201
County-Other, Canadian River Area	136	129	122	114	111	106	106
TOTAL	216	212	203	194	191	187	188

HARTLEY COUNTY

Population	1990	2000	2010	2020	2030	2040	2050
CHANNING	277	368	419	426	432	439	446
DALHART (HARTLEY COUNTY)	2,245	2,998	3,412	3,468	3,514	3,584	3,655
County-Other, Canadian River Area	1,112	1,867	2,123	2,146	2,168	2,198	2,221
TOTAL	3,634	5,233	5,954	6,040	6,114	6,221	6,322

Municipal Water Use (ac-ft)	1990	2000	2010	2020	2030	2040	2050
CHANNING	48	83	90	87	87	87	87
DALHART (HARTLEY COUNTY)	549	755	818	793	791	791	803
County-Other, Canadian River Area	159	343	368	351	349	345	346
TOTAL	756	1,181	1,276	1,231	1,227	1,223	1,236

Water Use Per Capita (gpcd)	1990	2000	2010	2020	2030	2040	2050
CHANNING	155	201	192	182	180	177	174
DALHART (HARTLEY COUNTY)	218	225	214	204	201	197	196
County-Other, Canadian River Area	128	164	155	146	144	140	139
TOTAL	186	202	192	182	180	176	175

ac-ft = Acre- Feet
gpcd = Gallons Per Capita per Day

HEMPHILL COUNTY

Population	1990	2000	2010	2020	2030	2040	2050
CANADIAN	2,417	2,604	2,757	2,789	2,725	2,665	2,606
County-Other, Canadian River Area	733	720	766	780	766	753	723
County-Other, Red River Area	570	560	596	606	595	585	562
TOTAL	3,720	3,884	4,119	4,175	4,086	4,003	3,891

Municipal Water Use (ac-ft)	1990	2000	2010	2020	2030	2040	2050
CANADIAN	572	683	692	669	641	615	601
County-Other, Canadian River Area	87	91	90	86	81	76	73
County-Other, Red River Area	70	71	70	67	63	59	57
TOTAL	729	845	852	822	785	750	731

Water Use Per Capita (gpcd)	1990	2000	2010	2020	2030	2040	2050
CANADIAN	211	234	224	214	210	206	206
County-Other, Canadian River Area	106	113	105	98	94	90	90
County-Other, Red River Area	110	113	105	99	95	90	91
TOTAL	175	194	185	176	172	167	168

HUTCHINSON COUNTY

Population	1990	2000	2010	2020	2030	2040	2050
BORGER	15,675	15,903	16,367	16,519	16,169	15,697	15,161
FRITCH	2,325	2,523	2,588	2,595	2,529	2,444	2,362
STINNETT	2,166	2,303	2,371	2,396	2,347	2,281	2,217
County-Other, Canadian River Area	5,523	5,372	5,536	5,602	5,493	5,341	5,143
TOTAL	25,689	26,101	26,862	27,112	26,538	25,763	24,883

Municipal Water Use (ac-ft)	1990	2000	2010	2020	2030	2040	2050
BORGER	1,717	2,387	2,310	2,202	2,083	1,934	1,868
FRITCH	498	514	499	477	453	424	410
STINNETT	427	433	425	411	392	368	358
County-Other, Canadian River Area	856	1,108	1,085	1,041	997	946	913
TOTAL	3,498	4,442	4,319	4,131	3,925	3,672	3,549

Water Use Per Capita (gpcd)	1990	2000	2010	2020	2030	2040	2050
BORGER	98	134	126	119	115	110	110
FRITCH	191	182	172	164	160	155	155
STINNETT	176	168	160	153	149	144	144
County-Other, Canadian River Area	138	184	175	166	162	158	158
TOTAL	122	152	144	136	132	127	127

ac-ft = Acre- Feet
gpcd = Gallons Per Capita per Day

LIPSCOMB COUNTY

Population	1990	2000	2010	2020	2030	2040	2050
BOOKER	1,231	1,255	1,310	1,323	1,319	1,298	1,255
LIPSCOMB	190	208	217	219	218	215	208
County-Other, Canadian River Area	1,722	1,794	1,871	1,890	1,885	1,854	1,794
TOTAL	3,143	3,257	3,398	3,432	3,422	3,367	3,257

Municipal Water Use (ac-ft)	1990	2000	2010	2020	2030	2040	2050
BOOKER	342	392	392	379	372	361	347
LIPSCOMB	42	46	46	44	43	42	40
County-Other, Canadian River Area	385	400	396	381	372	357	346
TOTAL	769	838	834	804	787	760	733

Water Use Per Capita (gpcd)	1990	2000	2010	2020	2030	2040	2050
BOOKER	248	279	267	256	252	248	247
LIPSCOMB	197	198	189	179	175	173	170
County-Other, Canadian River Area	200	199	189	180	176	172	172
TOTAL	218	230	219	209	205	202	201

MOORE COUNTY

Population	1990	2000	2010	2020	2030	2040	2050
DUMAS	12,871	14,620	16,451	18,312	19,942	21,443	23,057
SUNRAY	1,729	1,902	2,271	2,678	3,022	3,267	3,532
CACTUS	1,529	2,500	2,871	3,279	3,921	4,717	5,673
County-Other, Canadian River Area	1,736	1,879	1,969	2,017	1,996	1,991	2,053
TOTAL	17,865	20,901	23,562	26,286	28,881	31,418	34,315

Municipal Water Use (ac-ft)	1990	2000	2010	2020	2030	2040	2050
DUMAS	2,615	2,833	3,022	3,200	3,418	3,603	3,848
SUNRAY	465	492	560	630	701	750	807
CACTUS	292	445	476	511	592	703	838
County-Other, Canadian River Area	438	453	452	441	427	419	430
TOTAL	3,810	4,223	4,510	4,782	5,139	5,475	5,923

Water Use Per Capita (gpcd)	1990	2000	2010	2020	2030	2040	2050
DUMAS	181	173	164	156	153	150	149
SUNRAY	240	231	220	210	207	205	204
CACTUS	170	159	148	139	135	133	132
County-Other, Canadian River Area	225	215	205	195	191	188	187
TOTAL	190	181	172	163	160	156	155

ac-ft = Acre- Feet
gpcd = Gallons Per Capita per Day

OCHILTREE COUNTY

Population	1990	2000	2010	2020	2030	2040	2050
BOOKER (Ochiltree County)	5	24	25	25	24	24	24
PERRYTON	7,607	8,071	8,566	8,863	8,824	8,708	8,594
County-Other, Canadian River Area	1,516	1,552	1,644	1,696	1,686	1,659	1,544
TOTAL	9,128	9,647	10,235	10,584	10,534	10,391	10,162

Municipal Water Use (ac-ft)	1990	2000	2010	2020	2030	2040	2050
BOOKER (Ochiltree County)	1	8	7	7	7	7	7
PERRYTON	2,418	2,468	2,504	2,482	2,432	2,370	2,320
County-Other, Canadian River Area	192	228	227	221	212	201	187
TOTAL	2,611	2,704	2,738	2,710	2,651	2,578	2,514

Water Use Per Capita (gpcd)	1990	2000	2010	2020	2030	2040	2050
BOOKER (Ochiltree County)	179	298	250	250	260	260	260
PERRYTON	284	273	261	250	246	243	241
County-Other, Canadian River Area	113	131	123	116	112	108	108
TOTAL	255	250	239	229	225	221	221

OLDHAM COUNTY

Population	1990	2000	2010	2020	2030	2040	2050
VEGA	840	931	1,000	1,034	1,055	1,016	978
County-Other, Canadian River Area	1,226	1,247	1,311	1,304	1,258	1,195	1,110
County-Other, Red River Area	212	215	227	225	218	207	192
TOTAL	2,278	2,393	2,538	2,563	2,531	2,418	2,280

Municipal Water Use (ac-ft)	1990	2000	2010	2020	2030	2040	2050
VEGA	257	265	273	269	270	255	245
County-Other, Canadian River Area	2,440	2,466	2,463	2,452	2,441	2,427	2,417
County-Other, Red River Area	56	30	29	27	26	23	22
TOTAL	2,753	2,761	2,765	2,748	2,737	2,705	2,684

Water Use Per Capita (gpcd)	1990	2000	2010	2020	2030	2040	2050
VEGA	273	254	244	232	228	224	224
County-Other, Canadian River Area	1,777	1,765	1,677	1,679	1,732	1,813	1,944
County-Other, Red River Area	236	125	114	107	106	99	102
TOTAL	1,079	1,030	973	957	965	999	1,051

ac-ft = Acre- Feet
gpcd = Gallons Per Capita per Day

POTTER COUNTY

Population	1990	2000	2010	2020	2030	2040	2050
AMARILLO (Potter County)	91,502	98,526	105,245	114,253	121,228	128,644	136,514
County-Other, Canadian River Area	5,359	13,050	13,703	14,615	15,798	17,058	17,074
County-Other, Red River Area	1,013	2,467	2,590	2,763	2,985	3,225	3,229
TOTAL	97,874	114,042	121,538	131,631	140,012	148,927	156,817

Municipal Water Use (ac-ft)	1990	2000	2010	2020	2030	2040	2050
AMARILLO (Potter County)	23,982	24,611	24,993	25,852	27,023	28,243	29,818
County-Other, Canadian River Area	740	1,678	1,655	1,648	1,706	1,780	1,766
County-Other, Red River Area	123	319	316	316	325	339	337
TOTAL	24,845	26,608	26,964	27,815	29,054	30,362	31,921

Water Use Per Capita (gpcd)	1990	2000	2010	2020	2030	2040	2050
AMARILLO (Potter County)	234	223	212	202	199	196	195
County-Other, Canadian River Area	123	115	108	101	96	93	92
County-Other, Red River Area	108	116	109	102	97	94	93
TOTAL	227	216	205	196	192	189	189

RANDALL COUNTY

Population	1990	2000	2010	2020	2030	2040	2050
AMARILLO (Randall County)	66,113	79,118	92,341	105,281	117,927	133,079	150,178
CANYON	11,365	13,577	14,891	16,119	17,222	18,883	20,704
HAPPY	588	567	552	527	503	500	503
LAKE TANGLEWOOD	637	1,085	1,177	1,254	1,311	1,344	1,351
County-Other, Canadian River Area	1,295	2,821	3,539	4,279	5,032	5,836	6,849
County-Other, Red River Area	9,675	21,650	27,704	33,928	40,272	47,028	55,573
TOTAL	89,673	118,818	140,205	161,389	182,267	206,671	235,159

Municipal Water Use (ac-ft)	1990	2000	2010	2020	2030	2040	2050
AMARILLO (Randall County)	17,328	19,763	21,928	23,822	26,287	29,217	32,803
CANYON	2,397	2,723	2,835	2,907	3,048	3,279	3,572
HAPPY	120	97	88	80	74	71	71
LAKE TANGLEWOOD	79	292	301	305	303	294	282
County-Other, Canadian River Area	162	326	372	417	480	543	629
County-Other, Red River Area	1,235	2,551	2,963	3,354	3,884	4,427	5,158
TOTAL	21,321	25,752	28,488	30,884	34,076	37,831	42,514

Water Use Per Capita (gpcd)	1990	2000	2010	2020	2030	2040	2050
AMARILLO (Randall County)	234	223	212	202	199	196	195
CANYON	188	179	170	161	158	155	154
HAPPY	182	153	142	136	131	127	126
LAKE TANGLEWOOD	111	240	228	217	206	195	186
County-Other, Canadian River Area	112	103	94	87	85	83	82
County-Other, Red River Area	114	105	95	88	86	84	83
TOTAL	212	199	187	176	173	169	167

ac-ft = Acre- Feet
gpcd = Gallons Per Capita per Day

ROBERTS COUNTY

Population	1990	2000	2010	2020	2030	2040	2050
MIAMI	675	710	748	737	703	663	625
County-Other, Canadian River Area	334	330	346	335	315	284	212
County-Other, Red River Area	16	16	17	16	15	14	10
TOTAL	1,025	1,056	1,111	1,088	1,033	961	847

Municipal Water Use (ac-ft)	1990	2000	2010	2020	2030	2040	2050
MIAMI	191	208	209	197	184	172	162
County-Other, Canadian River Area	42	38	38	34	30	26	19
County-Other, Red River Area	2	2	2	2	1	1	1
TOTAL	235	248	249	233	215	199	182

Water Use Per Capita (gpcd)	1990	2000	2010	2020	2030	2040	2050
MIAMI	253	262	249	239	234	232	231
County-Other, Canadian River Area	112	103	98	91	85	82	80
County-Other, Red River Area	112	112	105	112	60	64	89
TOTAL	205	210	200	191	186	185	192

SHERMAN COUNTY

Population	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
STRATFORD	1,781	1,904	2,027	2,104	2,036	1,962	1,891
County-Other, Canadian River Area	1,077	1,296	1,265	1,192	1,107	1,027	926
TOTAL	2,858	3,200	3,292	3,296	3,143	2,989	2,817

Municipal Water Use (ac-ft)	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
STRATFORD	460	565	574	570	543	514	496
County-Other, Canadian River Area	154	180	165	145	127	117	105
TOTAL	614	745	739	715	670	631	601

Water Use Per Capita (gpcd)	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
STRATFORD	231	265	253	242	238	234	234
County-Other, Canadian River Area	128	124	116	108	102	102	101
TOTAL	192	215	207	200	197	195	197

ac-ft = Acre- Feet
gpcd = Gallons Per Capita per Day

WHEELER COUNTY

Population	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
SHAMROCK	2,286	2,312	2,338	2,356	2,389	2,399	2,409
WHEELER	1,393	1,447	1,462	1,472	1,492	1,497	1,502
County-Other, Red River Area	2,200	2,160	2,159	2,146	2,140	2,136	2,132
TOTAL	5,879	5,919	5,959	5,974	6,021	6,032	6,043

Municipal Water Use (ac-ft)	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
SHAMROCK	329	370	354	338	332	322	321
WHEELER	292	300	288	275	272	268	268
County-Other, Canadian River Area	280	296	279	261	251	241	238
TOTAL	901	966	921	874	855	831	827

Water Use Per Capita (gpcd)	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
SHAMROCK	128	143	135	128	124	120	119
WHEELER	187	185	176	167	163	160	159
County-Other, Canadian River Area	114	122	115	109	105	101	100
TOTAL	137	146	138	131	127	123	122

ac-ft = Acre- Feet
gpcd = Gallons Per Capita per Day

APPENDIX B

Streams With Ecologically Unique Resources and Threatened and Endangered Species

STREAMS WITH ECOLOGICALLY UNIQUE RESOURCES

Senate Bill 1 requires that the State Water Plan identify river and stream segments of unique ecological value. The identification of such resources may be done regionally by the RWPG. If not, the state plan must do so. Among criteria for identifying a stream segment as one with unique ecological value are its biological and hydrologic functions. In addition, segments with riparian conservation areas, or that have high water quality, exceptional aquatic life, or high aesthetic quality may be identified as having unique ecological value. Finally, stream or river segments where water development projects would have significant detrimental effects on state or federally listed threatened or endangered species may be considered ecologically unique (TPWD, 1999c).

Using these criteria, the TPWD has developed a draft list of Texas streams and river satisfying at least one of the criteria defined in the Senate Bill 1 for ecologically unique river and stream segments. Those in PWPA are identified in Table B-1

THREATENED AND ENDANGERED SPECIES

The presence or potential occurrence of threatened or endangered species is an important consideration in planning and implementing any water resource project or water management strategy. Both the state and federal governments have identified species that need protection. Species listed by the U. S. Fish and Wildlife Service (USFWS) are afforded the most legal protection, but the Texas Parks and Wildlife Department (TPWD) also has regulations governing state-listed species. Table B-2 contains the state or federally protected species which have the potential to occur within the PWPA. This does not include species without official protection such as those proposed for listing or species that are considered rare or otherwise of special concern.

Table B-1 Stream Segments in PWPA with Ecologically Unique Resources

Stream Segment	Location	Regional Conservation Area	Endangered/Threatened Resource	Aquatic Life
Canadian River, Segment 0101	Oklahoma State line to Sanford Dam	Gene Howe Wildlife Management Area	Interior Least Tern, Arkansas River Shiner	
Canadian River, Segment 0103	immediately upstream of the confluence of Camp Creek to the New Mexico State line	Sanford Recreation Area	Unique, exemplary, and extensive natural community; Arkansas River Shiner	
Coldwater Creek, unclassified	Dallam County	Rita Blanca National Grassland		
Graham Creek, unclassified	confluence with Sweetwater Creek east of Mobeetie to SH 152		Unique habitat-wetlands	
Lelia Lake Creek, Unclassified	confluence with the Salt Fork of the Red River to SH 152			Ecoregion Stream, Dissolved Oxygen, Benthic macroinvertebrates
McClellan Creek, unclassified	confluence with the North Fork of the Red River to its headwaters in Gray County			Ecoregion Stream, Dissolved Oxygen, Benthic macroinvertebrates, fish
Prairie Dog Town Fork Red River, Segment 0229	Armstrong/Briscoe County line to Lake Tanglewood	Palo Duro Canyon State Park (National Natural Landmark)	Interior Least Tern	Exceptional aesthetic value
Prairie Dog Town Fork Red River, Segment 0207	Childress/Hardeman County line to the Hall/Briscoe County line		Interior Least Tern	
Rita Blanca Creek, unclassified	From the headwaters of Lake Rita Blanca to US 87	Rita Blanca Conservation Area		
Saddlers Creek, unclassified	confluence with the Salt Fork of the Red River to its headwaters two miles southeast of Evans		Unique, exemplary, and extensive natural community	Ecoregion Stream, Dissolved oxygen
Sweetwater Creek, unclassified	Oklahoma State line to its headwaters in northwest Wheeler County		Unique habitat-wetlands	Ecoregion Stream, Dissolved oxygen
Tierra Blanca Creek, unclassified	Randall County	Buffalo Lake National Wildlife Refuge		
West Fork of Rita Blanca Creek, unclassified	confluence with Rita Blanca Creek to the New Mexico state line	Rita Blanca National Grassland		
Wolf Creek, Segment 0104	Oklahoma State line to a point 1.2 miles upstream of FM 3045			Ecoregion Stream, Dissolved Oxygen, Benthic macroinvertebrates, fish

Source: TPWD, 1999c

Table B-2. Threatened and Endangered Species Potentially Occurring in the PWPA

Species	Federal Status*	State Status*	Armstrong	Carson	Childress	Collingsworth	Dallam	Donley	Gray	Hall	Hansford	Hartley	Hemphill	Hutchinson	Lipscomb	Moore	Ochiltree	Oldham	Potter	Randall	Roberts	Sherman	Wheeler
			County of Potential Occurrence																				
Birds																							
American Peregrine Falcon *(Falco peregrinus anatum)*		E	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Arctic Peregrine Falcon *(Falco peregrinus tundrius)*		T	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Bald Eagle *(Haliaeetus leucocephalus)*	LT-PDL	T	⊙	⊙	•	•	•	⊙	⊙	•	⊙	⊙	⊙	⊙	•	⊙	•	•	⊙	⊙	•	•	•
Interior Least Tern *(Sterna antillarum athalassos)*	LE	E	•	⊙	⊙	⊙	•	⊙	⊙	⊙	•	•	⊙	⊙	•	•	•	⊙	⊙	⊙	⊙	•	⊙
Whooping Crane *(Grus americana)*	LE	E	⊙	⊙	⊙	⊙	•	⊙	⊙	⊙	•	•	•	•	•	•	•	•	⊙	⊙	•	•	⊙
Fishes																							
Arkansas River Shiner *(Notropis girardi)*	LT												○	○				○	○		○		
Mammals																							
Black-footed Ferret *(Mustela nigripes)*	LE	E	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Palo Duro Mouse *(Peromyscus truei comanche)*		T	•																	•			
Texas Kangaroo Rat *(Dipodomys elator)*		T			•																		
Reptiles																							
Texas Horned Lizard (*Phrynosoma cornutum*)		T	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

Sources: Texas Parks and Wildlife Annotated Lists of Rare Species;
U.S. Fish and Wildlife List of species by county for Texas (http://ifw2es.fws.gov/endangeredspecies/lists/ListSpecies.cfm)

* Key

LE,LT Federally Listed Endangered/Threatened

E/SA,T/SA Federally Endangered/Threatened by Similarity of Appearance

DL,PDL Federally Delisted/Proposed Delisted

E,T State Endangered/Threatened

Occurs on State List for County	•
Occurs on Federal List for County	○
Occurs on both State and Federal Lists for County	⊙

APPENDIX C

Summary of Available Regional Data Sources

Groundwater Districts

- water level measurements
- groundwater quality data

Texas Agricultural Experiment Station-Blackland Research Center (TAES-BRC)

- "Almanac Tool" database developed by Muchugu and Corbett (1999):
  - Panhandle Counties, Monthly Rainfall (Graph);
  - Panhandle Counties, Total Cropland, 1997 (Graph);
  - Panhandle Counties, Total Irrigated Land, 1997 (Graph);
  - Region A: Total Yearly Planted Crop Acres by Crop Residue Management and County, 1989-1997;
  - Number of Acres Irrigated by Size, (1 acre to > 2,000 acres), Region A; USDOC, 1982, 1987, 1992, and 1997;
  - Total Cropland, Region A, 1978-1997, USDOC;
  - Harvested Cropland, Region A, 1978-1997, USDOC;
  - Irrigated Cropland, Region A, 1978-1997, USDOC;
  - Cattle and Calves Inventory – Region A, USDOC, 1978-97;
  - Sheep Inventory – Region A, USDOC, 1978-97;
  - Historical Hog Data, NASS-USDA, 1974-86; USDOC 1978-97;
  - Region A: Census of Agriculture – 1997, 1992, 1987, 1982, 1978 (Farm Value Date);
  - Region A: Census of Agriculture – 97, 92, 87, 82, 78 (Corn Data) USDOC;
  - Region A: Census of Agriculture – 97, 92, 87, 82, 78 (Peanut Date) USDOC;
  - Region A: Census of Agriculture – 97, 92, 87, 82, 78 (Soybean Data) USDOC;
  - Region A: Census of Agriculture – 97, 92, 87, 82, 78 (Wheat Data) USDOC;
  - Region A: Census of Agriculture – 97, 92, 87, 82, 78 (Cotton Data) USDOC;
  - Region A: Census of Agriculture – 97, 92, 87, 82, 78 (Sorghum Data) USDOC;
  - Region A: Winter Wheat Yearly Data Under Irrigation Practice, 1978-98, Including Harvested Acres, Yield per Acre and Production (Bushels), NASS-USDA;
  - Region A: Sorghum Yearly Data Under Irrigation Practice, 1972-88, Including Harvested Acres, Yield Per Acre and Production (Bushels) NASS-USDA;
  - Region A: Cotton Yearly Data Under Irrigation Practice, 1972-97, Including Harvested Acres, Yield Per Acre and Production (Bushels) NASS-USDA; and
  - Region A: Peanuts Yearly Data Under Irrigation Practice, 1972-98, Including Harvested Acres, Yield Per Acre and Production (Bushels) NASS-USDA.

Other agriculture related data which is available includes: (A) county acreages of tillage practice by crop and year for 1989-1997. Types of tillage systems catalogued included: no-till, ridge till, mulch till, reduced till (0-15% residue and 15-30% residue), fallow, single or double cropping, etc. This data was from the Conservation Technology Information Center, National Crop Residue Management Survey; and (B) USDOC values from Census of Agriculture for county crop acreage, inches of water applied, and acre-feet of water for all the following crops: cotton, grain sorghum, corn, rice, wheat, other grain, forage crops, peanuts, soybeans, other oil crops, citrus, pecans, vineyard, other orchard, alfalfa, hay-pasture, sugarbeets, irish potatoes, vegetables (shallow), vegetables (deep), sugarcane, and all other crops.

Texas Natural Resource Conservation Commission (TNRCC)

- Water Quality:
  - Clean Rivers Program water quality database,
  - Texas State Water Quality Inventory, and
  - Clean Water Action Section 303(d) List.
- Water Quantity/Water Rights:
  - stream flow data,
  - water use reports, and
  - water rights permits.

Texas Water Development Board

- Water Resource Planning Division data for Region A, Panhandle Water Planning Area:
  - Total Water Use Estimate -- 1990-2050.
  - Total Withdrawals (Surface and Groundwater), Livestock and Irrigation Water Use, 1980-1997, County Basis.
  - Total Water Use, 1980-97: Municipal, Manufacturing, Steam Electric, Mining, Irrigation, and Livestock.
  - History of Groundwater Pumpage, 1980-97, by User Category, Aquifer and County.

United States Geological Survey

- USGS National Water Use Survey, 1995 :
  - Total Water Withdrawals by County, 1995 (Graph),
  - TWDB and USGS Water Use Surveys 1985, 1990 and 1995,
  - PWPA Water Use for Irrigation and Livestock, 1995 and Total Acres Irrigated,
  - Total Acres Irrigated, 1995 (Graph),
  - Total Irrigation Water Use, 1995 (Graph),
  - Total Livestock Water Use, 1995 (Graph);
- stream gage data, including measurements of water quality and quantity;
- water supply papers and reports; and
- groundwater data and reports.

Table 1: Population by City and Rural County

WUGNAME	COUNTYNAME	BASINNAME	WUGNUM	RWPG	SEQ#	CITY#	COUNTY#	BASIN#	pop1996	pop2000	pop2010	pop2020	pop2030	pop2040	pop2050
CLAUDE	ARMSTRONG	RED	10173000	A	173	114	006	02	1,276	1,253	1,335	1,410	1,476	1,478	1,480
COUNTY-OTHER	ARMSTRONG	RED	10996006	A	996	757	006	02	916	775	701	612	502	416	355
GROOM	CARSON	RED	10365000	A	365	875	033	02	630	655	658	648	600	545	501
PANHANDLE	CARSON	RED	10675000	A	675	453	033	02	2,274	2,469	3,750	4,104	4,281	4,401	4,523
SKELLYTOWN	CARSON	CANADIAN	10834000	A	834	960	033	01	680	666	667	650	572	564	556
WHITE DEER	CARSON	CANADIAN	10962000	A	962	647	033	01	1,141	1,169	1,273	1,321	1,372	1,403	1,434
WHITE DEER	CARSON	RED	10962000	A	962	647	033	02	61	62	68	70	73	74	76
COUNTY-OTHER	CARSON	CANADIAN	10996033	A	996	757	033	01	614	619	617	582	648	632	588
COUNTY-OTHER	CARSON	RED	10996033	A	996	757	033	02	1,192	1,164	1,159	1,094	1,125	1,148	1,117
CHILDRESS	CHILDRESS	RED	10164000	A	164	109	038	02	5,204	6,000	6,500	6,750	7,000	7,250	7,500
COUNTY-OTHER	CHILDRESS	RED	10996038	A	996	757	038	02	2,258	1,818	1,720	1,724	1,716	1,737	1,774
WELLINGTON	COLLINGSWORTH	RED	10947000	A	947	637	044	02	2,525	2,482	2,508	2,577	2,588	2,583	2,569
COUNTY-OTHER	COLLINGSWORTH	RED	10996044	A	996	757	044	02	1,132	1,062	1,119	1,149	1,155	1,152	1,146
DALHART	DALLAM	CANADIAN	10226000	A	226	150	056	01	4,290	4,543	4,766	4,891	4,828	4,695	4,566
COUNTY-OTHER	DALLAM	CANADIAN	10996056	A	996	757	056	01	1,475	1,477	1,634	1,727	1,764	1,816	1,824
CLARENDON	DONLEY	RED	10170000	A	170	112	065	02	2,171	2,032	1,959	1,904	1,785	1,662	1,520
COUNTY-OTHER	DONLEY	RED	10996065	A	996	757	065	02	1,734	1,592	1,536	1,492	1,400	1,302	1,192
LEFORS	GRAY	RED	10515000	A	515	898	090	02	707	638	603	559	517	500	488
MCLEAN	GRAY	RED	10578000	A	578	380	090	02	839	891	931	970	868	850	832
PAMPA	GRAY	CANADIAN	10674000	A	674	452	090	01	19,776	20,778	21,723	22,698	20,395	19,992	19,597
COUNTY-OTHER	GRAY	RED	10996090	A	996	757	090	02	1,700	1,304	1,423	1,503	1,288	1,244	1,209
COUNTY-OTHER	GRAY	CANADIAN	10996090	A	996	757	090	01	1,797	1,333	1,391	1,416	1,239	1,197	1,165
MEMPHIS	HALL	RED	10585000	A	585	394	096	02	2,454	2,338	2,306	2,264	2,190	2,117	2,057
TURKEY	HALL	RED	10915000	A	915	979	096	02	548	569	578	588	597	615	632
COUNTY-OTHER	HALL	RED	10996096	A	996	757	096	02	970	809	782	747	695	634	581
GRUVER	HANSFORD	CANADIAN	10368000	A	368	256	098	01	1,089	1,216	1,280	1,297	1,278	1,247	1,202
SPEARMAN	HANSFORD	CANADIAN	10849000	A	849	573	098	01	2,990	3,318	3,506	3,555	3,498	3,422	3,348
COUNTY-OTHER	HANSFORD	CANADIAN	10996098	A	996	757	098	01	1,399	1,535	1,604	1,624	1,605	1,556	1,448
CHANNING	HARTLEY	CANADIAN	10159000	A	159	106	103	01	274	368	419	426	432	439	446
DALHART	HARTLEY	CANADIAN	10226000	A	226	150	103	01	2,267	2,998	3,412	3,468	3,514	3,584	3,655
COUNTY-OTHER	HARTLEY	CANADIAN	10996103	A	996	757	103	01	2,354	1,867	2,123	2,146	2,168	2,198	2,221
CANADIAN	HEMPHILL	CANADIAN	10142000	A	142	93	106	01	2,376	2,604	2,757	2,789	2,725	2,665	2,606
COUNTY-OTHER	HEMPHILL	RED	10996106	A	996	757	106	02	625	560	596	606	595	585	562
COUNTY-OTHER	HEMPHILL	CANADIAN	10996106	A	996	757	106	01	804	720	766	780	766	753	723
BORGER	HUTCHINSON	CANADIAN	10100000	A	100	67	117	01	15,640	15,903	16,367	16,519	16,169	15,697	15,161
FRITCH	HUTCHINSON	CANADIAN	10320000	A	320	222	117	01	2,447	2,523	2,588	2,595	2,529	2,444	2,362
STINNETT	HUTCHINSON	CANADIAN	10861000	A	861	582	117	01	2,292	2,303	2,371	2,396	2,347	2,281	2,217
COUNTY-OTHER	HUTCHINSON	CANADIAN	10996117	A	996	757	117	01	5,528	5,372	5,536	5,602	5,493	5,341	5,143
BOOKER	LIPSCOMB	CANADIAN	10099000	A	99	66	148	01	1,224	1,255	1,310	1,323	1,319	1,298	1,255
LIPSCOMB	LIPSCOMB	CANADIAN	10526000	A	526	359	148	01	200	208	217	219	218	215	208
COUNTY-OTHER	LIPSCOMB	CANADIAN	10996148	A	996	757	148	01	1,786	1,794	1,871	1,890	1,885	1,854	1,794
CACTUS	MOORE	CANADIAN	10134000	A	134	762	171	01	1,910	2,500	2,871	3,279	3,921	4,717	5,673
DUMAS	MOORE	CANADIAN	10255000	A	255	170	171	01	13,961	14,620	16,451	18,312	19,942	21,443	23,057
SUNRAY	MOORE	CANADIAN	10872000	A	872	588	171	01	1,873	1,902	2,271	2,678	3,022	3,267	3,532
COUNTY-OTHER	MOORE	CANADIAN	10996171	A	996	757	171	01	1,981	1,879	1,969	2,017	1,996	1,991	2,053
BOOKER	OCHILTREE	CANADIAN	10099000	A	99	66	179	01	5	24	25	25	24	24	24
PERRYTON	OCHILTREE	CANADIAN	10689000	A	689	461	179	01	7,784	8,071	8,566	8,863	8,824	8,708	8,594
COUNTY-OTHER	OCHILTREE	CANADIAN	10996179	A	996	757	179	01	1,509	1,552	1,644	1,696	1,686	1,659	1,544
VEGA	OLDHAM	CANADIAN	10928000	A	928	622	180	01	229	231	248	257	262	252	243
VEGA	OLDHAM	RED	10928000	A	928	622	180	02	691	700	752	777	793	764	735
COUNTY-OTHER	OLDHAM	RED	10996180	A	996	757	180	02	214	215	227	225	218	207	192
COUNTY-OTHER	OLDHAM	CANADIAN	10996180	A	996	757	180	01	1,238	1,247	1,311	1,304	1,258	1,195	1,110
AMARILLO	POTTER	CANADIAN	10020000	A	20	14	188	01	56,253	56,416	60,263	65,421	69,415	73,662	78,168
AMARILLO	POTTER	RED	10020000	A	20	14	188	02	41,988	42,110	44,982	48,832	51,813	54,982	58,346
COUNTY-OTHER	POTTER	RED	10996188	A	996	757	188	02	1,673	2,467	2,590	2,763	2,985	3,225	3,229

Table 1: Population by City and Rural County

WUGNAME	COUNTYNAME	BASINNAME	WUGNUM	RWPG	SEQ#	CITY#	COUNTY#	BASIN#	pop1996	pop2000	pop2010	pop2020	pop2030	pop2040	pop2050
COUNTY-OTHER	POTTER	CANADIAN	10996188	A	996	757	188	01	8,851	13,050	13,703	14,615	15,798	17,058	17,074
AMARILLO	RANDALL	RED	10020000	A	20	14	191	02	73,650	79,118	92,341	105,281	117,927	133,079	150,178
CANYON	RANDALL	RED	10145000	A	145	96	191	02	12,571	13,577	14,891	16,119	17,222	18,883	20,704
HAPPY	RANDALL	RED	10378000	A	378	877	191	02	641	567	552	527	503	500	503
LAKE TANGLEWOOD	RANDALL	RED	10500000	A	500	895	191	02	766	1,085	1,177	1,254	1,311	1,344	1,351
COUNTY-OTHER	RANDALL	CANADIAN	10996191	A	`	757	191	01	1,508	2,821	3,539	4,279	5,032	5,836	6,849
COUNTY-OTHER	RANDALL	RED	10996191	A	996	757	191	02	11,264	21,650	27,704	33,928	40,272	47,028	55,573
MIAMI	ROBERTS	CANADIAN	10594000	A	594	403	197	01	531	710	748	737	703	663	625
COUNTY-OTHER	ROBERTS	RED	10996197	A	996	757	197	02	16	16	17	16	15	14	10
COUNTY-OTHER	ROBERTS	CANADIAN	10996197	A	996	757	197	01	328	330	346	335	315	284	212
STRATFORD	SHERMAN	CANADIAN	10864000	A	864	584	211	01	1,910	1,904	2,027	2,104	2,036	1,962	1,891
COUNTY-OTHER	SHERMAN	CANADIAN	10996211	A	996	757	211	01	1,158	1,296	1,265	1,192	1,107	1,027	926
SHAMROCK	WHEELER	RED	10822000	A	822	554	242	02	2,104	2,312	2,338	2,356	2,389	2,399	2,409
WHEELER	WHEELER	RED	10961000	A	961	646	242	02	1,380	1,447	1,462	1,472	1,492	1,497	1,502
COUNTY-OTHER	WHEELER	RED	10996242	A	996	757	242	02	2,100	2,160	2,159	2,146	2,140	2,136	2,132

Table 2: Water Demand by City and Category

WUGNAME	COUNTYNAME	BASINNAME	DATACAT	WUGNUM	RWPG	SEQ#	CITY#	COUNTY#	BASIN#	h1996	d2000
CLAUDE	ARMSTRONG	RED	MUN	10173000	A	173	114	6	2	357	265
COUNTY-OTHER	ARMSTRONG	RED	MUN	10996006	A	996	757	6	2	113	92
MANUFACTURING	ARMSTRONG	RED	MFG	11001006	A	1001	1001	6	2	0	0
STEAM ELECTRIC POWER	ARMSTRONG	RED	PWR	11002006	A	1002	1002	6	2	0	0
MINING	ARMSTRONG	RED	MIN	11003006	A	1003	1003	6	2	19	25
IRRIGATION	ARMSTRONG	RED	IRR	11004006	A	1004	1004	6	2	9,654	6,753
LIVESTOCK	ARMSTRONG	RED	STK	11005006	A	1005	1005	6	2	616	590
GROOM	CARSON	RED	MUN	10365000	A	365	875	33	2	155	180
PANHANDLE	CARSON	RED	MUN	10675000	A	675	453	33	2	574	589
SKELLYTOWN	CARSON	CANADIAN	MUN	10834000	A	834	960	33	1	48	88
WHITE DEER	CARSON	CANADIAN	MUN	10962000	A	962	647	33	1	246	253
WHITE DEER	CARSON	RED	MUN	10962000	A	962	647	33	2	13	13
COUNTY-OTHER	CARSON	CANADIAN	MUN	10996033	A	996	757	33	1	135	114
COUNTY-OTHER	CARSON	RED	MUN	10996033	A	996	757	33	2	263	350
MANUFACTURING	CARSON	CANADIAN	MFG	11001033	A	1001	1001	33	1	0	0
MANUFACTURING	CARSON	RED	MFG	11001033	A	1001	1001	33	2	536	825
STEAM ELECTRIC POWER	CARSON	CANADIAN	PWR	11002033	A	1002	1002	33	1	0	0
STEAM ELECTRIC POWER	CARSON	RED	PWR	11002033	A	1002	1002	33	2	0	0
MINING	CARSON	CANADIAN	MIN	11003033	A	1003	1003	33	1	1,146	1,456
MINING	CARSON	RED	MIN	11003033	A	1003	1003	33	2	639	727
IRRIGATION	CARSON	CANADIAN	IRR	11004033	A	1004	1004	33	1	16,000	29,766
IRRIGATION	CARSON	RED	IRR	11004033	A	1004	1004	33	2	60,190	63,254
LIVESTOCK	CARSON	CANADIAN	STK	11005033	A	1005	1005	33	1	941	479
LIVESTOCK	CARSON	RED	STK	11005033	A	1005	1005	33	2	1,213	605
CHILDRESS	CHILDRESS	RED	MUN	10164000	A	164	109	38	2	1,070	1,170
COUNTY-OTHER	CHILDRESS	RED	MUN	10996038	A	996	757	38	2	665	382
MANUFACTURING	CHILDRESS	RED	MFG	11001038	A	1001	1001	38	2	0	0
STEAM ELECTRIC POWER	CHILDRESS	RED	PWR	11002038	A	1002	1002	38	2	0	0
MINING	CHILDRESS	RED	MIN	11003038	A	1003	1003	38	2	20	25
IRRIGATION	CHILDRESS	RED	IRR	11004038	A	1004	1004	38	2	4,703	3,819
LIVESTOCK	CHILDRESS	RED	STK	11005038	A	1005	1005	38	2	420	295
WELLINGTON	COLLINGSWORTH	RED	MUN	10947000	A	947	637	44	2	463	614
COUNTY-OTHER	COLLINGSWORTH	RED	MUN	10996044	A	996	757	44	2	241	227
MANUFACTURING	COLLINGSWORTH	RED	MFG	11001044	A	1001	1001	44	2	0	0
STEAM ELECTRIC POWER	COLLINGSWORTH	RED	PWR	11002044	A	1002	1002	44	2	0	0

Table 2: Water Demand by City and Category

d2010	d2020	d2030	d2040	d2050
266	267	274	268	267
78	61	50	40	33
0	0	0	0	0
0	0	0	0	0
24	25	26	26	26
6,753	6,753	6,753	6,753	6,753
647	701	755	814	880
173	163	149	132	121
844	879	902	913	933
83	76	64	61	59
261	257	261	262	267
14	14	14	14	14
107	95	100	93	90
341	324	328	331	334
0	0	0	0	0
987	1,168	1,368	1,586	1,820
0	0	0	0	0
0	0	0	0	0
982	765	665	608	580
716	726	739	757	778
29,766	29,766	29,766	29,766	29,766
63,254	63,254	63,254	63,254	63,254
504	536	565	597	632
650	690	728	769	814
1,194	1,179	1,192	1,210	1,243
341	326	317	313	318
0	0	0	0	0
0	0	0	0	0
24	25	26	27	28
3,819	3,819	3,819	3,819	3,819
313	373	385	397	411
593	580	571	561	553
227	223	219	213	211
0	0	0	0	0
0	0	0	0	0

Table 2: Water Demand by City and Category

WUGNAME	COUNTYNAME	BASINNAME	DATACAT	WUGNUM	RWPG	SEQ#	CITY#	COUNTY#	BASIN#	h1996	d2000
MINING	COLLINGSWORTH	RED	MIN	11003044	A	1003	1003	44	2	0	0
IRRIGATION	COLLINGSWORTH	RED	IRR	11004044	A	1004	1004	44	2	32,707	17,811
LIVESTOCK	COLLINGSWORTH	RED	STK	11005044	A	1005	1005	44	2	886	608
DALHART	DALLAM	CANADIAN	MUN	10226000	A	226	150	56	1	1,291	1,145
COUNTY-OTHER	DALLAM	CANADIAN	MUN	10996056	A	996	757	56	1	703	179
MANUFACTURING	DALLAM	CANADIAN	MFG	11001056	A	1001	1001	56	1	0	235
STEAM ELECTRIC POWER	DALLAM	CANADIAN	PWR	11002056	A	1002	1002	56	1	0	0
MINING	DALLAM	CANADIAN	MIN	11003056	A	1003	1003	56	1	0	0
IRRIGATION	DALLAM	CANADIAN	IRR	11004056	A	1004	1004	56	1	393,795	386,403
LIVESTOCK	DALLAM	CANADIAN	STK	11005056	A	1005	1005	56	1	3,786	6,973
CLARENDON	DONLEY	RED	MUN	10170000	A	170	112	65	2	392	503
COUNTY-OTHER	DONLEY	RED	MUN	10996065	A	996	757	65	2	217	187
MANUFACTURING	DONLEY	RED	MFG	11001065	A	1001	1001	65	2	0	0
STEAM ELECTRIC POWER	DONLEY	RED	PWR	11002065	A	1002	1002	65	2	0	0
MINING	DONLEY	RED	MIN	11003065	A	1003	1003	65	2	22	24
IRRIGATION	DONLEY	RED	IRR	11004065	A	1004	1004	65	2	9,338	17,031
LIVESTOCK	DONLEY	RED	STK	11005065	A	1005	1005	65	2	1,711	1,171
LEFORS	GRAY	RED	MUN	10515000	A	515	898	90	2	132	120
MCLEAN	GRAY	RED	MUN	10578000	A	578	380	90	2	205	266
PAMPA	GRAY	CANADIAN	MUN	10674000	A	674	452	90	1	4,076	4,003
COUNTY-OTHER	GRAY	CANADIAN	MUN	10996090	A	996	757	90	1	390	264
COUNTY-OTHER	GRAY	RED	MUN	10996090	A	996	757	90	2	369	264
MANUFACTURING	GRAY	CANADIAN	MFG	11001090	A	1001	1001	90	1	3,874	3,947
MANUFACTURING	GRAY	RED	MFG	11001090	A	1001	1001	90	2	0	0
STEAM ELECTRIC POWER	GRAY	CANADIAN	PWR	11002090	A	1002	1002	90	1	0	0
STEAM ELECTRIC POWER	GRAY	RED	PWR	11002090	A	1002	1002	90	2	0	0
MINING	GRAY	CANADIAN	MIN	11003090	A	1003	1003	90	1	105	67
MINING	GRAY	RED	MIN	11003090	A	1003	1003	90	2	1,261	1,457
IRRIGATION	GRAY	CANADIAN	IRR	11004090	A	1004	1004	90	1	4,287	4,899
IRRIGATION	GRAY	RED	IRR	11004090	A	1004	1004	90	2	13,576	17,371
LIVESTOCK	GRAY	CANADIAN	STK	11005090	A	1005	1005	90	1	421	268
LIVESTOCK	GRAY	RED	STK	11005090	A	1005	1005	90	2	2,673	1,705
MEMPHIS	HALL	RED	MUN	10585000	A	585	394	96	2	469	469
TURKEY	HALL	RED	MUN	10915000	A	915	979	96	2	68	118
COUNTY-OTHER	HALL	RED	MUN	10996096	A	996	757	96	2	223	203

Table 2: Water Demand by City and Category

d2010	d2020	d2030	d2040	d2050
0	0	0	0	0
17,811	17,811	17,811	17,811	17,811
637	710	735	764	795
1,142	1,118	1,087	1,037	1,002
183	178	176	175	174
235	235	235	235	235
0	0	0	0	0
0	0	0	0	0
386,403	386,403	386,403	386,403	386,403
10,737	12,234	13,799	15,590	17,644
465	433	396	365	332
170	152	135	125	114
0	0	0	0	0
0	0	0	0	0
25	26	27	30	33
17,031	17,031	17,031	17,031	17,031
1,251	1,331	1,392	1,459	1,531
107	95	85	80	78
266	265	232	226	220
3,966	3,941	3,404	3,314	3,227
261	253	213	203	197
273	273	225	216	208
4,225	4,332	4,407	4,692	4,967
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
62	60	60	59	59
1,050	936	860	889	970
4,899	4,899	4,899	4,899	4,899
17,371	17,371	17,371	17,371	17,371
351	398	434	474	518
2,234	2,535	2,760	3,010	3,290
439	408	383	365	353
114	111	110	110	113
187	170	154	143	131

Table 2: Water Demand by City and Category

WUGNAME	COUNTYNAME	BASINNAME	DATACAT	WUGNUM	RWPG	SEQ#	CITY#	COUNTY#	BASIN#	h1996	d2000
MANUFACTURING	HALL	RED	MFG	11001096	A	1001	1001	96	2	0	0
STEAM ELECTRIC POWER	HALL	RED	PWR	11002096	A	1002	1002	96	2	0	0
MINING	HALL	RED	MIN	11003096	A	1003	1003	96	2	22	29
IRRIGATION	HALL	RED	IRR	11004096	A	1004	1004	96	2	11,764	8,077
LIVESTOCK	HALL	RED	STK	11005096	A	1005	1005	96	2	348	289
GRUVER	HANSFORD	CANADIAN	MUN	10368000	A	368	256	98	1	308	377
SPEARMAN	HANSFORD	CANADIAN	MUN	10849000	A	849	573	98	1	648	844
COUNTY-OTHER	HANSFORD	CANADIAN	MUN	10996098	A	996	757	98	1	208	222
MANUFACTURING	HANSFORD	CANADIAN	MFG	11001098	A	1001	1001	98	1	44	46
STEAM ELECTRIC POWER	HANSFORD	CANADIAN	PWR	11002098	A	1002	1002	98	1	0	0
MINING	HANSFORD	CANADIAN	MIN	11003098	A	1003	1003	98	1	982	1,331
IRRIGATION	HANSFORD	CANADIAN	IRR	11004098	A	1004	1004	98	1	211,978	121,492
LIVESTOCK	HANSFORD	CANADIAN	STK	11005098	A	1005	1005	98	1	5,443	5,192
CHANNING	HARTLEY	CANADIAN	MUN	10159000	A	159	106	103	1	58	83
DALHART	HARTLEY	CANADIAN	MUN	10226000	A	226	150	103	1	682	755
COUNTY-OTHER	HARTLEY	CANADIAN	MUN	10996103	A	996	757	103	1	362	343
MANUFACTURING	HARTLEY	CANADIAN	MFG	11001103	A	1001	1001	103	1	0	0
STEAM ELECTRIC POWER	HARTLEY	CANADIAN	PWR	11002103	A	1002	1002	103	1	0	0
MINING	HARTLEY	CANADIAN	MIN	11003103	A	1003	1003	103	1	0	0
IRRIGATION	HARTLEY	CANADIAN	IRR	11004103	A	1004	1004	103	1	224,642	202,232
LIVESTOCK	HARTLEY	CANADIAN	STK	11005103	A	1005	1005	103	1	6,020	4,066
CANADIAN	HEMPHILL	CANADIAN	MUN	10142000	A	142	93	106	1	481	683
COUNTY-OTHER	HEMPHILL	CANADIAN	MUN	10996106	A	996	757	106	1	98	91
COUNTY-OTHER	HEMPHILL	RED	MUN	10996106	A	996	757	106	2	76	71
MANUFACTURING	HEMPHILL	CANADIAN	MFG	11001106	A	1001	1001	106	1	0	0
MANUFACTURING	HEMPHILL	RED	MFG	11001106	A	1001	1001	106	2	0	4
STEAM ELECTRIC POWER	HEMPHILL	CANADIAN	PWR	11002106	A	1002	1002	106	1	0	0
STEAM ELECTRIC POWER	HEMPHILL	RED	PWR	11002106	A	1002	1002	106	2	0	0
MINING	HEMPHILL	CANADIAN	MIN	11003106	A	1003	1003	106	1	0	0
MINING	HEMPHILL	RED	MIN	11003106	A	1003	1003	106	2	0	0
IRRIGATION	HEMPHILL	CANADIAN	IRR	11004106	A	1004	1004	106	1	853	953
IRRIGATION	HEMPHILL	RED	IRR	11004106	A	1004	1004	106	2	962	3,424
LIVESTOCK	HEMPHILL	CANADIAN	STK	11005106	A	1005	1005	106	1	1,430	858
LIVESTOCK	HEMPHILL	RED	STK	11005106	A	1005	1005	106	2	990	594
BORGER	HUTCHINSON	CANADIAN	MUN	10100000	A	100	67	117	1	3,114	2,387

Table 2: Water Demand by City and Category

d2010	d2020	d2030	d2040	d2050
0	0	0	0	0
0	0	0	0	0
30	31	32	33	34
8,077	8,077	8,077	8,077	8,077
301	310	320	330	343
381	372	361	346	334
852	832	803	770	754
219	207	200	185	172
50	51	51	55	58
0	0	0	0	0
1,215	1,190	1,084	1,083	1,087
121,492	121,492	121,492	121,492	121,492
8,993	10,165	11,320	12,629	14,115
90	87	87	87	87
818	793	791	791	803
368	351	349	345	346
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
202,232	202,232	202,232	202,232	202,232
4,471	4,912	5,223	5,555	5,912
692	669	641	615	601
90	86	81	76	73
70	67	63	59	57
0	0	0	0	0
5	6	7	8	9
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
953	953	953	953	953
3,424	3,424	3,424	3,424	3,424
933	1,017	1,113	1,184	1,288
646	704	770	820	847
2,310	2,202	2,083	1,934	1,868

Table 2: Water Demand by City and Category

WUGNAME	COUNTYNAME	BASINNAME	DATACAT	WUGNUM	RWPG	SEQ#	CITY#	COUNTY#	BASIN#	h1996	d2000
FRITCH	HUTCHINSON	CANADIAN	MUN	10320000	A	320	222	117	1	479	514
STINNETT	HUTCHINSON	CANADIAN	MUN	10861000	A	861	582	117	1	439	433
COUNTY-OTHER	HUTCHINSON	CANADIAN	MUN	10996117	A	996	757	117	1	899	1,108
MANUFACTURING	HUTCHINSON	CANADIAN	MFG	11001117	A	1001	1001	117	1	14,371	19,871
STEAM ELECTRIC POWER	HUTCHINSON	CANADIAN	PWR	11002117	A	1002	1002	117	1	0	0
MINING	HUTCHINSON	CANADIAN	MIN	11003117	A	1003	1003	117	1	407	551
IRRIGATION	HUTCHINSON	CANADIAN	IRR	11004117	A	1004	1004	117	1	50,023	41,758
LIVESTOCK	HUTCHINSON	CANADIAN	STK	11005117	A	1005	1005	117	1	541	590
BOOKER	LIPSCOMB	CANADIAN	MUN	10099000	A	99	66	148	1	366	392
LIPSCOMB	LIPSCOMB	CANADIAN	MUN	10526000	A	526	359	148	1	38	46
COUNTY-OTHER	LIPSCOMB	CANADIAN	MUN	10996148	A	996	757	148	1	339	400
MANUFACTURING	LIPSCOMB	CANADIAN	MFG	11001148	A	1001	1001	148	1	91	156
STEAM ELECTRIC POWER	LIPSCOMB	CANADIAN	PWR	11002148	A	1002	1002	148	1	0	0
MINING	LIPSCOMB	CANADIAN	MIN	11003148	A	1003	1003	148	1	6	8
IRRIGATION	LIPSCOMB	CANADIAN	IRR	11004148	A	1004	1004	148	1	14,767	35,122
LIVESTOCK	LIPSCOMB	CANADIAN	STK	11005148	A	1005	1005	148	1	1,719	1,127
CACTUS	MOORE	CANADIAN	MUN	10134000	A	134	762	171	1	230	445
DUMAS	MOORE	CANADIAN	MUN	10255000	A	255	170	171	1	2,750	2,833
SUNRAY	MOORE	CANADIAN	MUN	10872000	A	872	588	171	1	460	492
COUNTY-OTHER	MOORE	CANADIAN	MUN	10996171	A	996	757	171	1	875	453
MANUFACTURING	MOORE	CANADIAN	MFG	11001171	A	1001	1001	171	1	6,702	7,238
STEAM ELECTRIC POWER	MOORE	CANADIAN	PWR	11002171	A	1002	1002	171	1	441	200
MINING	MOORE	CANADIAN	MIN	11003171	A	1003	1003	171	1	2,208	810
IRRIGATION	MOORE	CANADIAN	IRR	11004171	A	1004	1004	171	1	358,509	200,579
LIVESTOCK	MOORE	CANADIAN	STK	11005171	A	1005	1005	171	1	5,748	3,510
BOOKER	OCHILTREE	CANADIAN	MUN	10099000	A	99	66	179	1	2	8
PERRYTON	OCHILTREE	CANADIAN	MUN	10689000	A	689	461	179	1	1,820	2,468
COUNTY-OTHER	OCHILTREE	CANADIAN	MUN	10996179	A	996	757	179	1	190	228
MANUFACTURING	OCHILTREE	CANADIAN	MFG	11001179	A	1001	1001	179	1	1	0
STEAM ELECTRIC POWER	OCHILTREE	CANADIAN	PWR	11002179	A	1002	1002	179	1	0	0
MINING	OCHILTREE	CANADIAN	MIN	11003179	A	1003	1003	179	1	201	228
IRRIGATION	OCHILTREE	CANADIAN	IRR	11004179	A	1004	1004	179	1	85,237	47,300
LIVESTOCK	OCHILTREE	CANADIAN	STK	11005179	A	1005	1005	179	1	2,426	6,747
VEGA	OLDHAM	CANADIAN	MUN	10928000	A	928	622	180	1	52	66
VEGA	OLDHAM	RED	MUN	10928000	A	928	622	180	2	158	199

Table 2: Water Demand by City and Category

d2010	d2020	d2030	d2040	d2050
499	477	453	424	410
425	411	392	368	358
1,085	1,041	997	946	913
21,975	23,374	24,545	26,895	29,203
0	0	0	0	0
510	373	210	132	95
41,758	41,758	41,758	41,758	41,758
657	722	781	845	915
392	379	372	361	347
46	44	43	42	40
396	381	372	357	346
166	172	176	188	200
0	0	0	0	0
8	8	8	9	18
35,122	35,122	35,122	35,122	35,122
2,281	2,645	3,007	3,424	3,906
476	511	592	703	838
3,022	3,200	3,418	3,603	3,848
560	630	701	750	807
452	441	427	419	430
7,712	8,035	8,269	8,863	9,429
200	200	200	200	200
579	333	213	156	159
200,579	200,579	200,579	200,579	200,579
7,158	8,105	9,059	10,146	11,386
7	7	7	7	7
2,504	2,482	2,432	2,370	2,320
227	221	212	201	187
0	0	0	0	0
0	0	0	0	0
202	186	170	151	155
47,300	47,300	47,300	47,300	47,300
7,253	8,255	9,308	10,514	11,897
68	67	67	63	61
205	202	203	192	184

Table 2: Water Demand by City and Category

WUGNAME	COUNTYNAME	BASINNAME	DATACAT	WUGNUM	RWPG	SEQ#	CITY#	COUNTY#	BASIN#	h1996	d2000
COUNTY-OTHER	OLDHAM	CANADIAN	MUN	10996180	A	996	757	180	1	497	2,466
COUNTY-OTHER	OLDHAM	RED	MUN	10996180	A	996	757	180	2	86	30
MANUFACTURING	OLDHAM	CANADIAN	MFG	11001180	A	1001	1001	180	1	0	0
MANUFACTURING	OLDHAM	RED	MFG	11001180	A	1001	1001	180	2	0	0
STEAM ELECTRIC POWER	OLDHAM	CANADIAN	PWR	11002180	A	1002	1002	180	1	0	0
STEAM ELECTRIC POWER	OLDHAM	RED	PWR	11002180	A	1002	1002	180	2	0	0
MINING	OLDHAM	CANADIAN	MIN	11003180	A	1003	1003	180	1	218	231
MINING	OLDHAM	RED	MIN	11003180	A	1003	1003	180	2	263	271
IRRIGATION	OLDHAM	CANADIAN	IRR	11004180	A	1004	1004	180	1	1,524	8,216
IRRIGATION	OLDHAM	RED	IRR	11004180	A	1004	1004	180	2	6,094	18,281
LIVESTOCK	OLDHAM	CANADIAN	STK	11005180	A	1005	1005	180	1	2,061	1,623
LIVESTOCK	OLDHAM	RED	STK	11005180	A	1005	1005	180	2	120	94
AMARILLO	POTTER	CANADIAN	MUN	10020000	A	20	14	188	1	14,509	14,092
AMARILLO	POTTER	RED	MUN	10020000	A	20	14	188	2	10,830	10,519
COUNTY-OTHER	POTTER	CANADIAN	MUN	10996188	A	996	757	188	1	1,137	1,678
COUNTY-OTHER	POTTER	RED	MUN	10996188	A	996	757	188	2	215	319
MANUFACTURING	POTTER	CANADIAN	MFG	11001188	A	1001	1001	188	1	1,055	1,124
MANUFACTURING	POTTER	RED	MFG	11001188	A	1001	1001	188	2	3,979	3,490
STEAM ELECTRIC POWER	POTTER	CANADIAN	PWR	11002188	A	1002	1002	188	1	4,582	18,300
STEAM ELECTRIC POWER	POTTER	RED	PWR	11002188	A	1002	1002	188	2	0	0
MINING	POTTER	CANADIAN	MIN	11003188	A	1003	1003	188	1	284	276
MINING	POTTER	RED	MIN	11003188	A	1003	1003	188	2	673	154
IRRIGATION	POTTER	CANADIAN	IRR	11004188	A	1004	1004	188	1	13,864	12,214
IRRIGATION	POTTER	RED	IRR	11004188	A	1004	1004	188	2	9,751	12,089
LIVESTOCK	POTTER	CANADIAN	STK	11005188	A	1005	1005	188	1	630	441
LIVESTOCK	POTTER	RED	STK	11005188	A	1005	1005	188	2	48	34
AMARILLO	RANDALL	RED	MUN	10020000	A	20	14	191	2	18,996	19,763
CANYON	RANDALL	RED	MUN	10145000	A	145	96	191	2	2,405	2,723
HAPPY	RANDALL	RED	MUN	10378000	A	378	877	191	2	84	97
LAKE TANGLEWOOD	RANDALL	RED	MUN	10500000	A	500	895	191	2	163	292
COUNTY-OTHER	RANDALL	CANADIAN	MUN	10996191	A	996	757	191	1	198	326
COUNTY-OTHER	RANDALL	RED	MUN	10996191	A	996	757	191	2	1,478	2,551
MANUFACTURING	RANDALL	CANADIAN	MFG	11001191	A	1001	1001	191	1	0	0
MANUFACTURING	RANDALL	RED	MFG	11001191	A	1001	1001	191	2	509	557
STEAM ELECTRIC POWER	RANDALL	CANADIAN	PWR	11002191	A	1002	1002	191	1	0	0

Table 2: Water Demand by City and Category

d2010	d2020	d2030	d2040	d2050
2,463	2,452	2,441	2,427	2,417
29	27	26	23	22
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
238	245	252	260	268
279	287	296	305	314
8,216	8,216	8,216	8,216	8,216
18,281	18,281	18,281	18,281	18,281
1,785	1,955	2,100	2,259	2,433
103	113	122	131	141
14,311	14,803	15,473	16,172	17,074
10,682	11,049	11,550	12,071	12,744
1,655	1,648	1,706	1,780	1,766
316	316	325	339	337
1,226	1,300	1,377	1,468	1,566
3,812	4,065	4,266	4,663	5,040
22,432	25,387	26,804	28,408	30,011
0	0	0	0	0
222	223	224	225	231
159	164	169	174	179
12,214	12,214	12,214	12,214	12,214
12,089	12,089	12,089	12,089	12,089
482	524	569	618	673
37	40	43	47	51
21,928	23,822	26,287	29,217	32,803
2,835	2,907	3,048	3,279	3,572
88	80	74	71	71
301	305	303	294	282
372	417	480	543	629
2,963	3,354	3,884	4,427	5,158
0	0	0	0	0
517	472	475	478	482
0	0	0	0	0

Table 2: Water Demand by City and Category

WUGNAME	COUNTYNAME	BASINNAME	DATACAT	WUGNUM	RWPG	SEQ#	CITY#	COUNTY#	BASIN#	h1996	d2000
STEAM ELECTRIC POWER	RANDALL	RED	PWR	11002191	A	1002	1002	191	2	0	0
MINING	RANDALL	CANADIAN	MIN	11003191	A	1003	1003	191	1	1	1
MINING	RANDALL	RED	MIN	11003191	A	1003	1003	191	2	20	7
IRRIGATION	RANDALL	CANADIAN	IRR	11004191	A	1004	1004	191	1	842	569
IRRIGATION	RANDALL	RED	IRR	11004191	A	1004	1004	191	2	45,909	56,922
LIVESTOCK	RANDALL	CANADIAN	STK	11005191	A	1005	1005	191	1	39	31
LIVESTOCK	RANDALL	RED	STK	11005191	A	1005	1005	191	2	3,789	3,036
MIAMI	ROBERTS	CANADIAN	MUN	10594000	A	594	403	197	1	126	208
COUNTY-OTHER	ROBERTS	CANADIAN	MUN	10996197	A	996	757	197	1	41	38
COUNTY-OTHER	ROBERTS	RED	MUN	10996197	A	996	757	197	2	2	2
MANUFACTURING	ROBERTS	CANADIAN	MFG	11001197	A	1001	1001	197	1	0	0
MANUFACTURING	ROBERTS	RED	MFG	11001197	A	1001	1001	197	2	0	0
STEAM ELECTRIC POWER	ROBERTS	CANADIAN	PWR	11002197	A	1002	1002	197	1	0	0
STEAM ELECTRIC POWER	ROBERTS	RED	PWR	11002197	A	1002	1002	197	2	0	0
MINING	ROBERTS	CANADIAN	MIN	11003197	A	1003	1003	197	1	2	2
MINING	ROBERTS	RED	MIN	11003197	A	1003	1003	197	2	9	9
IRRIGATION	ROBERTS	CANADIAN	IRR	11004197	A	1004	1004	197	1	6,210	0
IRRIGATION	ROBERTS	RED	IRR	11004197	A	1004	1004	197	2	847	5,755
LIVESTOCK	ROBERTS	CANADIAN	STK	11005197	A	1005	1005	197	1	343	509
LIVESTOCK	ROBERTS	RED	STK	11005197	A	1005	1005	197	2	11	16
STRATFORD	SHERMAN	CANADIAN	MUN	10864000	A	864	584	211	1	504	565
COUNTY-OTHER	SHERMAN	CANADIAN	MUN	10996211	A	996	757	211	1	163	180
MANUFACTURING	SHERMAN	CANADIAN	MFG	11001211	A	1001	1001	211	1	0	0
STEAM ELECTRIC POWER	SHERMAN	CANADIAN	PWR	11002211	A	1002	1002	211	1	0	0
MINING	SHERMAN	CANADIAN	MIN	11003211	A	1003	1003	211	1	23	26
IRRIGATION	SHERMAN	CANADIAN	IRR	11004211	A	1004	1004	211	1	259,210	195,197
LIVESTOCK	SHERMAN	CANADIAN	STK	11005211	A	1005	1005	211	1	3,399	3,813
SHAMROCK	WHEELER	RED	MUN	10822000	A	822	554	242	2	315	370
WHEELER	WHEELER	RED	MUN	10961000	A	961	646	242	2	287	300
COUNTY-OTHER	WHEELER	RED	MUN	10996242	A	996	757	242	2	263	296
MANUFACTURING	WHEELER	RED	MFG	11001242	A	1001	1001	242	2	0	0
STEAM ELECTRIC POWER	WHEELER	RED	PWR	11002242	A	1002	1002	242	2	0	0
MINING	WHEELER	RED	MIN	11003242	A	1003	1003	242	2	113	102
IRRIGATION	WHEELER	RED	IRR	11004242	A	1004	1004	242	2	2,956	5,698
LIVESTOCK	WHEELER	RED	STK	11005242	A	1005	1005	242	2	2,596	1,529

Table 2: Water Demand by City and Category

d2010	d2020	d2030	d2040	d2050
0	0	0	0	0
1	1	2	2	2
5	4	3	3	5
569	569	569	569	569
56,922	56,922	56,922	56,922	56,922
34	38	40	43	46
3,353	3,714	3,979	4,265	4,575
209	197	184	172	162
38	34	30	26	19
2	2	1	1	1
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
1	1	1	1	1
10	8	7	7	7
0	0	0	0	0
5,755	5,755	5,755	5,755	5,755
556	599	648	700	758
18	19	20	22	24
574	570	543	514	496
165	145	127	117	105
0	0	0	0	0
0	0	0	0	0
26	27	28	29	31
195,197	195,197	195,197	195,197	195,197
5,576	6,279	6,945	7,695	8,543
354	338	332	322	321
288	275	272	268	268
279	261	251	241	238
0	0	0	0	0
0	0	0	0	0
43	23	11	5	2
5,698	5,698	5,698	5,698	5,698
1,632	1,788	1,868	1,954	2,046

		Projected Water Demand (ac-ft)					
County Name	**Agricultural/Livestock Category**	**2000** ac-ft/yr	**2010** ac-ft/yr	**2020** ac-ft/yr	**2030** ac-ft/yr	**2040** ac-ft/yr	**2050** ac-ft/yr
Armstrong	Irrigation	6,753	6,753	6,753	6,753	6,753	6,753
Armstrong	Beef Cows	134	134	134	134	134	134
Armstrong	Cattle - Dairy	0	0	0	0	0	0
Armstrong	Cattle - Summer Beef Stockers	247	273	301	333	368	406
Armstrong	Cattle - Winter Beef Stockers	89	98	109	120	132	146
Armstrong	Cattle on Feedlots	112	124	137	145	154	164
Armstrong	Horses	4	5	5	6	6	7
Armstrong	Poultry	0	0	0	0		0
Armstrong	Swine	3	12	14	17	19	22
Carson	Irrigation	93,020	93,020	93,020	93,020	93,020	93,020
Carson	Beef Cows	470	470	470	470	470	470
Carson	Cattle - Dairy	0	0	0	0	0	0
Carson	Cattle - Summer Beef Stockers	91	100	110	122	135	149
Carson	Cattle - Winter Beef Stockers	268	296	327	361	399	441
Carson	Cattle on Feedlots	246	272	300	319	338	359
Carson	Horses	3	3	3	4	4	4
Carson	Poultry	0	0	0	0		0
Carson	Swine	7	12	14	17	19	22
Childress	Irrigation	3,819	3,819	3,819	3,819	3,819	3,819
Childress	Beef Cows	224	224	224	224	224	224
Childress	Cattle - Dairy	0	0	0	0	0	0
Childress	Cattle - Summer Beef Stockers	0	0	0	0	0	0
Childress	Cattle - Winter Beef Stockers	66	72	80	88	98	108
Childress	Cattle on Feedlots	0	0	0	0	0	0
Childress	Horses	4	4	5	5	6	6
Childress	Poultry	0	0	50	50	50	50
Childress	Swine	1	12	14	17	19	22
Collingsworth	Irrigation	17,811	17,811	17,811	17,811	17,811	17,811
Collingsworth	Beef Cows	426	426	426	426	426	426
Collingsworth	Cattle - Dairy	0	0	0	0	0	0
Collingsworth	Cattle - Summer Beef Stockers	63	70	77	85	94	104
Collingsworth	Cattle - Winter Beef Stockers	107	118	131	144	160	176
Collingsworth	Cattle on Feedlots	0	0	0	0	0	0
Collingsworth	Horses	10	11	12	13	14	16
Collingsworth	Poultry	0	0	50	50	50	50
Collingsworth	Swine	2	12	14	17	19	22
Dallam	Irrigation	386,403	386,403	386,403	386,403	386,403	386,403
Dallam	Beef Cows	269	269	269	269	269	269
Dallam	Cattle - Dairy	95	164	205	235	271	311
Dallam	Cattle - Summer Beef Stockers	142	157	173	192	212	234
Dallam	Cattle - Winter Beef Stockers	448	495	547	604	667	737
Dallam	Cattle on Feedlots	2,596	2,868	3,168	3,363	3,570	3,790
Dallam	Horses	6	7	8	8	9	10
Dallam	Poultry	0	0	0	0		0
Dallam	Swine	3,416	6,777	7,865	9,127	10,592	12,292
Donley	Irrigation	17,031	17,031	17,031	17,031	17,031	17,031
Donley	Beef Cows	493	493	493	493	493	493
Donley	Cattle - Dairy	0	0	0	0	0	0

		Projected Water Demand (ac-ft)					
County Name	**Agricultural/Livestock Category**	**2000** ac-ft/yr	**2010** ac-ft/yr	**2020** ac-ft/yr	**2030** ac-ft/yr	**2040** ac-ft/yr	**2050** ac-ft/yr
Donley	Cattle - Summer Beef Stockers	136	150	166	183	202	223
Donley	Cattle - Winter Beef Stockers	20	22	24	27	29	32
Donley	Cattle on Feedlots	509	562	621	659	700	743
Donley	Horses	10	11	13	14	15	17
Donley	Poultry	0	0	0	0		0
Donley	Swine	3	12	14	17	19	22
Gray	Irrigation	22,270	22,270	22,270	22,270	22,270	22,270
Gray	Beef Cows	224	224	224	224	224	224
Gray	Cattle - Dairy	236	688	860	989	1,137	1,308
Gray	Cattle - Summer Beef Stockers	136	150	166	183	202	223
Gray	Cattle - Winter Beef Stockers	171	189	208	230	254	281
Gray	Cattle on Feedlots	1,188	1,312	1,449	1,539	1,634	1,734
Gray	Horses	9	10	11	12	14	15
Gray	Poultry	0	0	0	0		0
Gray	Swine	10	12	14	17	19	22
Hall	Irrigation	8,077	8,077	8,077	8,077	8,077	8,077
Hall	Beef Cows	224	224	224	224	224	224
Hall	Cattle - Dairy	0	0	0	0	0	0
Hall	Cattle - Summer Beef Stockers	38	42	46	51	57	63
Hall	Cattle - Winter Beef Stockers	19	21	23	25	28	31
Hall	Cattle on Feedlots	0	0	0	0	0	0
Hall	Horses	2	2	2	2	3	3
Hall	Poultry	0	0	0	0		0
Hall	Swine	7	12	14	17	19	22
Hansford	Irrigation	121,492	121,492	121,492	121,492	121,492	121,492
Hansford	Beef Cows	67	67	67	67	67	67
Hansford	Cattle - Dairy	0	0	0	0	0	0
Hansford	Cattle - Summer Beef Stockers	181	200	221	245	270	298
Hansford	Cattle - Winter Beef Stockers	609	673	743	821	907	1,002
Hansford	Cattle on Feedlots	3,411	3,768	4,162	4,418	4,690	4,979
Hansford	Horses	8	9	9	10	11	13
Hansford	Poultry	0	0	0	0		0
Hansford	Swine	915	4,276	4,962	5,758	6,682	7,755
Hartley	Irrigation	202,232	202,232	202,232	202,232	202,232	202,232
Hartley	Beef Cows	269	269	269	269	269	269
Hartley	Cattle - Dairy	0	0	0	0	0	0
Hartley	Cattle - Summer Beef Stockers	287	317	350	387	427	472
Hartley	Cattle - Winter Beef Stockers	157	174	192	212	234	259
Hartley	Cattle on Feedlots	3,343	3,693	4,079	4,330	4,597	4,880
Hartley	Horses	6	6	7	8	9	10
Hartley	Poultry	0	0	0	0		0
Hartley	Swine	3	12	14	17	19	22
Hemphill	Irrigation	4,377	4,377	4,377	4,377	4,377	4,377
Hemphill	Beef Cows	224	224	224	224	224	224
Hemphill	Cattle - Dairy	0	0	0	0	0	0
Hemphill	Cattle - Summer Beef Stockers	303	335	370	409	451	499
Hemphill	Cattle - Winter Beef Stockers	37	41	46	50	56	61
Hemphill	Cattle on Feedlots	865	956	1,056	1,121	1,190	1,263

		Projected Water Demand (ac-ft)					
County Name	**Agricultural/Livestock Category**	**2000** ac-ft/yr	**2010** ac-ft/yr	**2020** ac-ft/yr	**2030** ac-ft/yr	**2040** ac-ft/yr	**2050** ac-ft/yr
Hemphill	Horses	9	10	11	12	14	15
Hemphill	Poultry	0	0	0	50	50	50
Hemphill	Swine	12	12	14	17	19	22
Hutchinson	Irrigation	41,758	41,758	41,758	41,758	41,758	41,758
Hutchinson	Beef Cows	45	45	45	45	45	45
Hutchinson	Cattle - Dairy	0	0	0	0	0	0
Hutchinson	Cattle - Summer Beef Stockers	192	212	234	259	286	316
Hutchinson	Cattle - Winter Beef Stockers	99	109	120	133	147	162
Hutchinson	Cattle on Feedlots	246	272	300	319	338	359
Hutchinson	Horses	6	7	8	9	10	11
Hutchinson	Poultry	0	0	0	0		0
Hutchinson	Swine	2	12	14	17	19	22
Lipscomb	Irrigation	35,122	35,122	35,122	35,122	35,122	35,122
Lipscomb	Beef Cows	202	202	202	202	202	202
Lipscomb	Cattle - Dairy	0	0	0	0	0	0
Lipscomb	Cattle - Summer Beef Stockers	154	170	188	208	230	254
Lipscomb	Cattle - Winter Beef Stockers	149	164	182	201	222	245
Lipscomb	Cattle on Feedlots	14	15	17	18	19	20
Lipscomb	Horses	4	5	5	6	6	7
Lipscomb	Poultry	0	0	50	50	50	50
Lipscomb	Swine	605	1,725	2,002	2,323	2,696	3,129
Moore	Irrigation	200,579	200,579	200,579	200,579	200,579	200,579
Moore	Beef Cows	202	202	202	202	202	202
Moore	Cattle - Dairy	0	0	0	0	0	0
Moore	Cattle - Summer Beef Stockers	82	90	100	110	122	135
Moore	Cattle - Winter Beef Stockers	253	280	309	341	377	417
Moore	Cattle on Feedlots	2,411	2,664	2,942	3,124	3,316	3,520
Moore	Horses	4	4	5	5	6	6
Moore	Poultry	0	0	0	0		0
Moore	Swine	558	3,918	4,547	5,277	6,124	7,107
Ochiltree	Irrigation	47,300	47,300	47,300	47,300	47,300	47,300
Ochiltree	Beef Cows	179	179	179	179	179	179
Ochiltree	Cattle - Dairy	0	0	0	0	0	0
Ochiltree	Cattle - Summer Beef Stockers	47	52	57	63	70	77
Ochiltree	Cattle - Winter Beef Stockers	297	328	362	400	442	488
Ochiltree	Cattle on Feedlots	1,816	2,006	2,216	2,352	2,497	2,651
Ochiltree	Horses	5	6	7	7	8	9
Ochiltree	Poultry	0	0	0	0		0
Ochiltree	Swine	4,402	4,682	5,434	6,306	7,318	8,492
Oldham	Irrigation	26,497	26,497	26,497	26,497	26,497	26,497
Oldham	Beef Cows	179	179	179	179	179	179
Oldham	Cattle - Dairy	0	0	0	0	0	0
Oldham	Cattle - Summer Beef Stockers	482	533	589	650	718	793
Oldham	Cattle - Winter Beef Stockers	215	238	263	290	321	354
Oldham	Cattle on Feedlots	832	919	1,015	1,077	1,143	1,214
Oldham	Horses	7	7	8	9	10	11
Oldham	Poultry	0	0	0	0		0
Oldham	Swine	2	12	14	17	19	22

		Projected Water Demand (ac-ft)					
County Name	**Agricultural/Livestock Category**	**2000** ac-ft/yr	**2010** ac-ft/yr	**2020** ac-ft/yr	**2030** ac-ft/yr	**2040** ac-ft/yr	**2050** ac-ft/yr
Potter	Irrigation	24,303	24,303	24,303	24,303	24,303	24,303
Potter	Beef Cows	90	90	90	90	90	90
Potter	Cattle - Dairy	0	0	0	0	0	0
Potter	Cattle - Summer Beef Stockers	270	298	329	364	402	444
Potter	Cattle - Winter Beef Stockers	57	63	70	77	85	94
Potter	Cattle on Feedlots	44	49	54	57	61	64
Potter	Horses	6	7	7	8	9	10
Potter	Poultry	0	0	0	0		0
Potter	Swine	8	12	14	17	19	22
Randall	Irrigation	57,491	57,491	57,491	57,491	57,491	57,491
Randall	Beef Cows	157	157	157	157	157	157
Randall	Cattle - Dairy	47	181	226	260	299	343
Randall	Cattle - Summer Beef Stockers	181	200	221	244	269	298
Randall	Cattle - Winter Beef Stockers	259	287	317	350	386	427
Randall	Cattle on Feedlots	2,291	2,531	2,795	2,968	3,150	3,344
Randall	Horses	18	20	22	25	27	30
Randall	Poultry	0	0	0	0		0
Randall	Swine	113	12	14	17	19	22
Roberts	Irrigation	5,755	5,755	5,755	5,755	5,755	5,755
Roberts	Beef Cows	157	157	157	157	157	157
Roberts	Cattle - Dairy	0	0	0	0	0	0
Roberts	Cattle - Summer Beef Stockers	321	354	391	432	478	528
Roberts	Cattle - Winter Beef Stockers	42	46	51	56	62	69
Roberts	Cattle on Feedlots	0	0	0	0	0	0
Roberts	Horses	4	4	5	5	6	6
Roberts	Poultry	0	0	0	0		0
Roberts	Swine	1	12	14	17	19	22
Sherman	Irrigation	195,197	195,197	195,197	195,197	195,197	195,197
Sherman	Beef Cows	67	67	67	67	67	67
Sherman	Cattle - Dairy	0	0	0	0	0	0
Sherman	Cattle - Summer Beef Stockers	98	108	120	132	146	161
Sherman	Cattle - Winter Beef Stockers	330	365	403	445	492	543
Sherman	Cattle on Feedlots	2,503	2,765	3,054	3,242	3,442	3,654
Sherman	Horses	3	4	4	4	5	5
Sherman	Poultry	0	0	0	0		0
Sherman	Swine	811	2,267	2,631	3,053	3,543	4,112
Wheeler	Irrigation	5,698	5,698	5,698	5,698	5,698	5,698
Wheeler	Beef Cows	627	627	627	627	627	627
Wheeler	Cattle - Dairy	0	0	0	0	0	0
Wheeler	Cattle - Summer Beef Stockers	136	150	166	183	202	223
Wheeler	Cattle - Winter Beef Stockers	40	45	49	54	60	66
Wheeler	Cattle on Feedlots	713	787	870	923	980	1,040
Wheeler	Horses	10	11	12	13	14	16
Wheeler	Poultry	0	0	50	50	50	50
Wheeler	Swine	3	12	14	17	19	22
	Total	**1,569,777**	**1,586,578**	**1,594,397**	**1,601,771**	**1,610,041**	**1,619,398**

Table 3: Water Demand by Major Water Provider of Municipal and Manufacturing Water

Major Water Provider Name	Name of Recipient of Water	Recipient's City Name	Recipient's County Name	Recipient's Basin Name	Recipient's Data Category	Major Water Provider Number (TWDB Alpha Number)	Recipient of Water from the Major Provider. User Number (TWDB Alpha Number)	Recipient's Water User Group Identifier	Recipient's Regional Water Planning Group Letter	Recipient's Sequence Number	Recipient's City Number	Recipient's County Number	Recipient's Basin Number	1996 Demand Value	Projected 2000 Demand Value	Projected 2010 Demand Value	Projected 2020 Demand Value	Projected 2030 Demand Value	Projected 2040 Demand Value	Projected 2050 Demand Value	COMMENT
Amarillo	Amarillo	Amarillo	Potter	CANADIAN	MUN	17600	17600	010020000	A	20	14	188	1	9521	14092	14311	14803	15473	16172	17074	Projected Demands on MWP were calculated using the recipient's projected demand multiplied by the historic % contribution by the MWP to the recipient's total water use. Historic data from "munhist.xls." This represents INTERNAL DEMAND for the City of Amarillo
Amarillo	Amarillo	Amarillo	Potter	RED	MUN	17600	17600	010020000	A	20	14	188	2	7107	10519	10682	11049	11550	12071	12744	Projected Demands on MWP were calculated using the recipient's projected demand multiplied by the historic % contribution by the MWP to the recipient's total water use. Historic data from "munhist.xls." This represents INTERNAL DEMAND for the City of Amarillo
Amarillo	ASARCO, INC.	Manufacturing	Potter	CANADIAN	MFG	17600	36100	011001188	A	1001	1001	188	1	799	706	737	737	767	767	767	Projected Demands on MWP were calculated using the recipient's projected demand multiplied by the historic % contribution by the MWP to the recipient's total water use. All info from recipient's survey questionnaire
Amarillo	IBP, Inc.	Manufacturing	Potter	RED	MFG	17600	422225	011001188	A	1001	1001	188	2	4068	4149	4356	4573	4801	5040	5292	Projected Demands on MWP were calculated using the recipient's projected demand multiplied by the historic % contribution by the MWP to the recipient's total water use. Used 5% increase every 10 years through period.
Amarillo	Amarillo	Amarillo	Randall	RED	MUN	17600	17600	010020000	A	20	14	191	2	13353	19763	21928	23822	26287	29217	32803	Projected Demands on MWP were calculated using the recipient's projected demand multiplied by the historic % contribution by the MWP to the recipient's total water use. Historic data from "munhist.xls." This represents INTERNAL DEMAND for the City of Amarillo
Amarillo	City of Canyon	Canyon	Randall	RED	MUN	17600	133000	010145000	A	145	96	191	2	807	2323	2435	2800	2800	2800	2800	based on Table 5, contract amount for 5 MGD, maximum provided - average = 2.5 MGD (2800 ac-ft/yr)
Amarillo	TPWD	Palo Duro Canyon SP	Randall	RED	MUN	17600	854196	010996191	A	996	757	191	2	31	31	31	31	31	31	31	Projected Demands on MWP were calculated using the recipient's demand from 1996, multiplied by the historic % contribution by the MWP to the recipient's total water use. Historic data from "munhist.xls"
Amarillo	Owens-Corning	Manufacturing	Randall	Red	MFG	17600	632546	011001191	A	1001	1001	191	2		300	300	300	300	300	300	estimated Owens Corning demand.
CRMWA	City of Lamesa	Lamesa	Dawson	COLORADO	MUN	10	483600	150507000	O	507	343	58	14	1591	1677	2194	2194	2194	2194	2194	Projected Demands on MWP were provided by CRMWA and represent the lesser of the recipients total water demand or CRMWA's max system capacity. Historic data from "munhist.xls"
CRMWA	City of Odonnell	Odonnell	Dawson	COLORADO	MUN	10	622000	150645000	O	645	439	58	14	20	20	22	22	21	21	21	Projected Demands on MWP were provided by CRMWA and represent the lesser of the recipients total water demand or CRMWA's max system capacity. Historic data from "munhist.xls"
CRMWA	City of Pampa	Pampa	Gray	CANADIAN	MUN	10	642200	010674000	A	674	452	90	1	2675	3499	3966	3941	3404	3314	3227	Projected Demands on MWP were provided by CRMWA and represent the lesser of the recipients total water demand or CRMWA's max system capacity. Historic data from "munhist.xls"
CRMWA	City of Plainview	Plainview	Hale	BRAZOS	MUN	10	684600	150703000	O	703	471	95	12	2657	2735	4296	4296	4267	4074	3939	Projected Demands on MWP were provided by CRMWA and represent the lesser of the recipients total water demand or CRMWA's max system capacity. Historic data from "munhist.xls"
CRMWA	City of Levelland	Levelland	Hockley	BRAZOS	MUN	10	492400	150518000	O	518	354	110	12	1578	1867	2302	2302	2302	2176	2099	Projected Demands on MWP were provided by CRMWA and represent the lesser of the recipients total water demand or CRMWA's max system capacity. Historic data from "munhist.xls"
CRMWA	AGRIUM	Manufacturing	HUTCHINSON	CANADIAN	MFG	10	130755	011001117	A	1001	1001	117	1	0	2000	2000	2000	2000	2000	2000	Projected Demands on MWP were provided by CRMWA. Historical informatior not available.
CRMWA	City of Borger	Borger	HUTCHINSON	CANADIAN	MUN	10	88000	010100000	A	100	67	117	1	2695	700	700	700	700	700	700	Projected Demands on MWP were provided by CRMWA Historic data from "munhist.xls"
CRMWA	City of Lubbock WTP	Lubbock	Lubbock	BRAZOS	MUN	10	518000	150546000	O	546	370	152	12	29600	33771	39556	40206	41123	41123	41123	Projected Demands on MWP were provided by CRMWA and represent the lesser of the recipients total water demand or CRMWA's max system capacity. Historic data from "munhist.xls"
CRMWA	City of Slaton	Slaton	Lubbock	BRAZOS	MUN	10	801800	150835000	O	835	563	152	12	683	827	891	864	946	969	997	Projected Demands on MWP were provided by CRMWA and represent the lesser of the recipients total water demand or CRMWA's max system capacity. Historic data from "munhist.xls"
CRMWA	City of Odonnell	Odonnell	Lynn	COLORADO	MUN	10	622000	150645000	O	645	439	153	14	146	148	157	157	157	152	151	Projected Demands on MWP were provided by CRMWA and represent the lesser of the recipients total water demand or CRMWA's max system capacity. Historic data from "munhist.xls"
CRMWA	City of Tahoka	Tahoka	Lynn	BRAZOS	MUN	10	842000	150879000	O	879	594	153	12	325	374	480	480	480	480	480	Projected Demands on MWP were provided by CRMWA and represent the lesser of the recipients total water demand or CRMWA's max system capacity. Historic data from "munhist.xls"
CRMWA	Amarillo	Amarillo	Potter	CANADIAN	MUN	10	17600	010020000	A	20	14	188	1	9521	12219	11895	11635	11440	11197	10954	Calculated from Table 5, Amarillo sheet, for use from CRMWA. The distribution between county and basin assumes all other users use CRMWA water.
CRMWA	Amarillo	Amarillo	Potter	RED	MUN	10	17600	010020000	A	20	14	188	2	7107	13058	12670	12388	12178	11948	11719	Calculated from Table 5, Amarillo sheet, for use from CRMWA. The distribution between county and basin assumes all other users use CRMWA water.
CRMWA	Southwestern Public Service	Harrington Station	Potter	CANADIAN	PWR	10	816300	011002188	A	1002	1002	188	1	3507	740	905	1023	1080	1144	1208	Projected Demands on MWP were calculated using the recipient's projected demand from SPS report for Task 2, multiplied by the historic % contribution of purchased surface water to the recipient's total water use. Historic data from survey results and report provided by SPS.
CRMWA	Amarillo	Amarillo	Randall	RED	MUN	10	17600	010020000	A	20	14	191	2	13353	17687	18398	18942	19346	19820	20291	Calculated from Table 5, Amarillo sheet, for use from CRMWA. The distribution between county and basin assumes all other users use CRMWA water.
CRMWA	City of Brownfield	Brownfield	Terry	COLORADO	MUN	10	99200	150117000	O	117	79	223	14	1173	1311	1712	1719	1719	1719	1719	Projected Demands on MWP were provided by CRMWA and represent the lesser of the recipients total water demand or CRMWA's max system capacity. Historic data from "munhist.xls"
Greenbelt M&IWA	City of Childress	Childress	Childress	RED	MUN	20	149000	010164000	A	164	109	38	2	1365	1370	1394	1379	1392	1410	1443	Projected Demands on MWP were calculated using the recipient's projected demand multiplied by the historic % contribution by the MWP to the recipient's total water use. Historic data from "munhist.xls". Includes estimate of municipa sales from Childress (200 afy new demand)
Greenbelt M&IWA	Red River Authority	County-Other	Childress	RED	MUN	20	721174	10996038	A	996	757	38	2	45	45	45	45	45	45	45	Projected Demands on MWP were calculated using the recipient's demand from MWP from 1996. Historic data from "munhist.xls"
Greenbelt M&IWA	Red River Authority	County-Other	Childress	RED	MUN	20	721175	10996038	A	996	757	38	2	11	11	11	11	11	11	11	Projected Demands on MWP were calculated using the recipient's demand from MWP from 1996. Historic data from "munhist.xls"
Greenbelt M&IWA	Red River Authority	County-Other	Childress	RED	MUN	20	721160	10996038	A	996	757	38	2	39	39	39	39	39	39	39	Projected Demands on MWP were calculated using the recipient's demand from MWP from 1996. Historic data from "munhist.xls"
Greenbelt M&IWA	Red River Authority	County-Other	Childress	RED	MUN	20	721173	10996038	A	996	757	38	2	42	42	42	42	42	42	42	Projected Demands on MWP were calculated using the recipient's demand from MWP from 1996. Historic data from "munhist.xls"
Greenbelt M&IWA	Red River Authority	County-Other	Childress	RED	MUN	20	721176	10996038	A	996	757	38	2	9	9	9	9	9	9	9	Projected Demands on MWP were calculated using the recipient's demand from MWP from 1996. Historic data from "munhist.xls"
Greenbelt M&IWA	Red River Authority	County-Other	Childress	RED	MUN	20	721172	10996038	A	996	757	38	2	98	98	98	98	98	98	98	Projected Demands on MWP were calculated using the recipient's demand from MWP from 1996. Historic data from "munhist.xls"
Greenbelt M&IWA	Red River Authority	County-Other	Collingsworth	RED	MUN	20	721185	10996044	A	996	757	44	2	7	7	7	7	7	7	7	Projected Demands on MWP were calculated using the recipient's demand from MWP from 1996. Historic data from "munhist.xls"
Greenbelt M&IWA	Red River Authority	County-Other	Donley	RED	MUN	20	721177	10996065	A	996	757	65	2	27	27	27	27	27	27	27	Projected Demands on MWP were calculated using the recipient's demand from MWP from 1996. Historic data from "munhist.xls"

Table 3: Water Demand by Major Water Provider of Municipal and Manufacturing Water

Major Water Provider Name	Name of Recipient of Water	Recipient's City Name	Recipient's County Name	Recipient's Basin Name	Recipient's Data Category	Major Water Provider Number (TWDB Alpha Number)	Recipient of Water from the Major Provider. User Number (TWDB Alpha Number)	Recipient's Water User Group Identifier	Recipient's Regional Water Planning Group Letter	Recipient's Sequence Number	Recipient's City Number	Recipient's County Number	Recipient's Basin Number	1996 Demand Value	Projected 2000 Demand Value	Projected 2010 Demand Value	Projected 2020 Demand Value	Projected 2030 Demand Value	Projected 2040 Demand Value	Projected 2050 Demand Value	COMMENT
Greenbelt M&IWA	City of Clarendon	Clarendon	DONLEY	RED	MUN	20	156200	010170000	A	170	112	65	2	397	503	465	433	396	365	332	Projected Demands on MWP were calculated using the recipient's projected demand multiplied by the historic % contribution by the MWP to the recipient's total water use. Historic data from "munhist.xls"
Greenbelt M&IWA	City of Hedley	Hedley	DONLEY	RED	MUN	20	378800	010996065	A	996	757	65	2	91	91	91	91	91	91	91	Projected Demands on MWP were calculated using the recipient's demand from 1996, multiplied by the historic % contribution by the MWP to the recipient's total water use. Historic data from "munhist.xls"
Greenbelt M&IWA	City of Crowell	Crowell	Foard	RED	MUN	20	195400	020217000	B	217	144	78	2	247	313	294	275	257	243	230	Projected Demands on MWP were calculated using the recipient's projected demand multiplied by the historic % contribution by the MWP to the recipient's total water use. Historic data from "munhist.xls"
Greenbelt M&IWA	Red River Authority	County-Other	Foard	RED	MUN	20	721178	20996078	B	996	757	78	2	68	68	68	68	68	68	68	Projected Demands on MWP were calculated using the recipient's demand from MWP from 1996. Historic data from "munhist.xls"
Greenbelt M&IWA	City of Memphis	Memphis	Hall	RED	MUN	20	555800	010585000	A	585	394	96	2	69	71	67	62	58	56	54	Projected Demands on MWP were calculated using the recipient's projected demand multiplied by the historic % contribution by the MWP to the recipient's total water use. Historic data from "munhist.xls"
Greenbelt M&IWA	Red River Authority	County-Other	Hall	RED	MUN	20	721186	10996096	A	996	757	96	2	9	9	9	9	9	9	9	Projected Demands on MWP were calculated using the recipient's demand from MWP from 1996. Historic data from "munhist.xls"
Greenbelt M&IWA	Red River Authority	County-Other	Hall	RED	MUN	20	721183	10996096	A	996	757	96	2	49	49	49	49	49	49	49	Projected Demands on MWP were calculated using the recipient's demand from MWP from 1996. Historic data from "munhist.xls"
Greenbelt M&IWA	Red River Authority	County-Other	Hall	RED	MUN	20	721188	10996096	A	996	757	96	2	9	9	9	9	9	9	9	Projected Demands on MWP were calculated using the recipient's demand from MWP from 1996. Historic data from "munhist.xls"
Greenbelt M&IWA	Red River Authority	County-Other	Hall	RED	MUN	20	721154	10996096	A	996	757	96	2	39	39	39	39	39	39	39	Projected Demands on MWP were calculated using the recipient's demand from MWP from 1996. Historic data from "munhist.xls"
Greenbelt M&IWA	City of Chillicothe	Chillicothe	Hardeman	RED	MUN	20	149800	020165000	B	165	110	99	2	36	61	58	56	56	55	55	Projected Demands on MWP were calculated using the recipient's projected demand multiplied by the historic % contribution by the MWP to the recipient's total water use. Historic data from "munhist.xls"
Greenbelt M&IWA	City of Quanah	Quanah	Hardeman	RED	MUN	20	708800	020727000	B	727	488	99	2	752	614	572	532	514	502	492	Projected Demands on MWP were calculated using the recipient's projected demand multiplied by the historic % contribution by the MWP to the recipient's total water use. Historic data from "munhist.xls"
Greenbelt M&IWA	Red River Authority	Georgia-Pacific	Hardeman	RED	MFG	20	72050	021001099	B	1001	1001	99	2	327	347	374	398	424	452	480	Projected Demands on MWP were calculated using the recipient's demand from 1996, multiplied by the historic % contribution by the MWP to the recipient's total water use - assumed 100%. Historic and projected data from coordination with Region B
Greenbelt M&IWA	Red River Authority	County-Other	Hardeman	RED	MUN	20	721189	20996099	B	996	757	99	2	73	73	73	73	73	73	73	Projected Demands on MWP were calculated using the recipient's demand from MWP from 1996. Historic data from "munhist.xls"
Greenbelt M&IWA	Red River Authority	County-Other	Hardeman	RED	MUN	20	721191	20996099	B	996	757	99	2	7	7	7	7	7	7	7	Projected Demands on MWP were calculated using the recipient's demand from MWP from 1996. Historic data from "munhist.xls"
Greenbelt M&IWA	Red River Authority	County-Other	Hardeman	RED	MUN	20	721198	20996099	B	996	757	99	2	10	10	10	10	10	10	10	Projected Demands on MWP were calculated using the recipient's demand from MWP from 1996. Historic data from "munhist.xls"
Greenbelt M&IWA	Red River Authority	County-Other	Hardeman	RED	MUN	20	721190	20996099	B	996	757	99	2	58	58	58	58	58	58	58	Projected Demands on MWP were calculated using the recipient's demand from MWP from 1996. Historic data from "munhist.xls"
Greenbelt M&IWA	Red River Authority	County-Other	Hardeman	RED	MUN	20	721193	20996099	B	996	757	99	2	11	11	11	11	11	11	11	Projected Demands on MWP were calculated using the recipient's demand from MWP from 1996. Historic data from "munhist.xls"
Greenbelt M&IWA	Red River Authority	County-Other	Hardeman	RED	MUN	20	721192	20996099	B	996	757	99	2	7	7	7	7	7	7	7	Projected Demands on MWP were calculated using the recipient's demand from MWP from 1996. Historic data from "munhist.xls"
Greenbelt M&IWA	Red River Authority	County-Other	Wilbarger	RED	MUN	20	721168	20996244	B	996	757	244	2	3	3	3	3	3	3	3	Projected Demands on MWP were calculated using the recipient's demand from MWP from 1996. Historic data from "munhist.xls"

Table 4: Current Water Supply Sources

Name of Specific Source	Type of Water Supply	Regional Water Planning Group Where Supply Source is Located	County Number For County Where Supply Source is Located	County Name	Basin Number For Basin Where Supply Source is Located	Basin Name	Identifier for Specific Source	Value for Year 2000 of Total Supply from this Source (ac-ft/yr)	Value for Year 2010 of Total Supply from this Source (ac-ft/yr)	Value for Year 2020 of Total Supply from this Source (ac-ft/yr)	Value for Year 2030 of Total Supply from this Source (ac-ft/yr)	Value for Year 2040 of Total Supply from this Source (ac-ft/yr)	Value for Year 2050 of Total Supply from this Source (ac-ft/yr)	Comment	Comment_(H)	TS Comments
DOCKUM	[illegible]	A	[illegible]	ARMSTRONG	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
local supply - stock ponds	[illegible]	A	[illegible]	ARMSTRONG	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
OGALLALA	[illegible]	A	[illegible]	ARMSTRONG	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
OTHER U-DIF (Whitehorse)	[illegible]	A	[illegible]	ARMSTRONG	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
AMARILLO SYSTEM	[illegible]	A	[illegible]	CARSON	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
AMARILLO SYSTEM	[illegible]	A	[illegible]	CARSON	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DOCKUM	[illegible]	A	[illegible]	CARSON	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
DOCKUM	[illegible]	A	[illegible]	CARSON	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
local supply - stock ponds	[illegible]	A	[illegible]	CARSON	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
local supply - stock ponds	[illegible]	A	[illegible]	CARSON	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
OGALLALA	[illegible]	A	[illegible]	CARSON	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
OGALLALA	[illegible]	A	[illegible]	CARSON	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	[illegible]	A	[illegible]	CARSON	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	A	[illegible]	CARSON	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BAYLOR	[illegible]	A	[illegible]	CHILDRESS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BLAINE	[illegible]	A	[illegible]	CHILDRESS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
local supply	[illegible]	A	[illegible]	CHILDRESS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
local supply - stock ponds	[illegible]	A	[illegible]	CHILDRESS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
OTHER U-DIF (Whitehorse)	[illegible]	A	[illegible]	CHILDRESS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	[illegible]	A	[illegible]	CHILDRESS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SEYMOUR	[illegible]	A	[illegible]	CHILDRESS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
BLAINE	[illegible]	A	[illegible]	COLLINGSWORTH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	[illegible]	A	[illegible]	COLLINGSWORTH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
local supply - stock ponds	[illegible]	A	[illegible]	COLLINGSWORTH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
OTHER U-DIF (Whitehorse)	[illegible]	A	[illegible]	COLLINGSWORTH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
SEYMOUR	[illegible]	A	[illegible]	COLLINGSWORTH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
DOCKUM	[illegible]	A	[illegible]	DALLAM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
local supply - stock ponds	[illegible]	A	[illegible]	DALLAM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
OGALLALA	[illegible]	A	[illegible]	DALLAM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	[illegible]	A	[illegible]	DALLAM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RITA BLANCA AQUIFER	[illegible]	A	[illegible]	DALLAM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
AMARILLO SYSTEM	[illegible]	A	[illegible]	DEAF SMITH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Greenbelt Reservoir	[illegible]	A	[illegible]	DONLEY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
local supply - stock ponds	[illegible]	A	[illegible]	DONLEY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
OGALLALA	[illegible]	A	[illegible]	DONLEY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
OTHER U-DIF (Whitehorse)	[illegible]	A	[illegible]	DONLEY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
SEYMOUR	[illegible]	A	[illegible]	DONLEY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
local supply - stock ponds	[illegible]	A	[illegible]	GRAY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
local supply - stock ponds	[illegible]	A	[illegible]	GRAY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
OGALLALA	[illegible]	A	[illegible]	GRAY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
OGALLALA	[illegible]	A	[illegible]	GRAY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
OTHER U-DIF (Whitehorse)	[illegible]	A	[illegible]	GRAY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	[illegible]	A	[illegible]	GRAY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	A	[illegible]	GRAY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BLAINE	[illegible]	A	[illegible]	HALL	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
local supply - stock ponds	[illegible]	A	[illegible]	HALL	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
OTHER U-DIF (Whitehorse)	[illegible]	A	[illegible]	HALL	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	[illegible]	A	[illegible]	HALL	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SEYMOUR	[illegible]	A	[illegible]	HALL	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	[illegible]	A	[illegible]	HANSFORD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
local supply - stock ponds	[illegible]	A	[illegible]	HANSFORD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
OGALLALA	[illegible]	A	[illegible]	HANSFORD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
PALO DURO	[illegible]	A	[illegible]	HANSFORD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	A	[illegible]	HANSFORD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DOCKUM	[illegible]	A	[illegible]	HARTLEY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
local supply - stock ponds	[illegible]	A	[illegible]	HARTLEY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
OGALLALA	[illegible]	A	[illegible]	HARTLEY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	[illegible]	A	[illegible]	HARTLEY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RITA BLANCA AQUIFER	[illegible]	A	[illegible]	HARTLEY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	[illegible]	A	[illegible]	HEMPHILL	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
local supply - stock ponds	[illegible]	A	[illegible]	HEMPHILL	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
OGALLALA	[illegible]	A	[illegible]	HEMPHILL	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
OGALLALA	[illegible]	A	[illegible]	HEMPHILL	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	[illegible]	A	[illegible]	HEMPHILL	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	A	[illegible]	HEMPHILL	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
AMARILLO SYSTEM	[illegible]	A	[illegible]	HUTCHINSON	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CRMWA SYSTEM	[illegible]	A	[illegible]	HUTCHINSON	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
local supply - stock ponds	00	A	117	HUTCHINSON	01	Canadian	01997	994	994	994	994	994	994			Supply added per TWDB comments. Information from Table 5 (TWDB print version)
OGALLALA	01	A	117	HUTCHINSON	01	Canadian	11721	77,000	79,000	79,000	79,000	79,000	81,000		BEG Model availability, values revised (12/11) per Dutton November supply corrections and to meet projected demands	Vol 1, Draft Regional Water Plan, p. 3-4, paragraph 1 states that groundwater availability is considered to be 50% of current total storage, allocated over 50-year planning period. Appendix K, Draft Regional Water Plan, Table 11, p. 74 lists Ogallala volume in storage. i.e. Armstrong County Ogallala storage = 4.01 MM ac-ft in Year 2000. 50% availability = 2.00 MM ac-ft. Per year availability over 50-year planning period: 2.005 MM ac-ft/50 years = 40,100 ac-ft/year.
REUSE: BaZoCou 01-02-117	00	A	117	HUTCHINSON	01	Canadian	36011	1,376	1,332	1,270	1,198	1,112	1,073	2REUSE	Data from Ixxxx-14.txt on CD	
IRRIGATION LOCAL SUPPLY1 - 148 - 1	00	A	148	LIPSCOMB	01	Canadian	148996	75	75	75	75	75	75		Data from Irls.xls on CD	
local supply - stock ponds	00	A	148	LIPSCOMB	01	Canadian	01997	1,547	1,547	1,547	1,547	1,547	1,547			Supply added per TWDB comments. Information from Table 5 (TWDB print version)
OGALLALA	01	A	148	LIPSCOMB	01	Canadian	14821	172,700	172,700	172,700	172,700	172,700	172,700		BEG Model availability	Vol 1, Draft Regional Water Plan, p. 3-4, paragraph 1 states that groundwater availability is considered to be 50% of current total storage, allocated over 50-year planning period. Appendix K, Draft Regional Water Plan, Table 11, p. 74 lists Ogallala volume in storage. i.e. Armstrong County Ogallala storage = 4.01 MM ac-ft in Year 2000. 50% availability = 2.00 MM ac-ft. Per year availability over 50-year planning period: 2.005 MM ac-ft/50 years = 40,100 ac-ft/year.
REUSE: BaZoCou 01-01-148	00	A	148	LIPSCOMB	01	Canadian	36002	34	34	33	32	31	30	1REUSE	Data from Ixxxx-14.txt on CD	
DOCKUM	01	A	171	MOORE	01	Canadian	17126	3	3	3	3	3	3		No data in Ixxx-12.txt; from Bradley 1997, 50% of storage over 50 yrs + recharge	
local supply	00	A	171	MOORE	01	Canadian	01999	1,658	1,658	1,658	1,658	1,658	1,658		mining usage	Supply added per TWDB comments. Information from Table 5 (TWDB print version)
local supply - stock ponds	00	A	171	MOORE	01	Canadian	01997	1,600	1,600	1,600	1,600	1,600	1,600			Supply added per TWDB comments. Information from Table 5 (TWDB print version)
OGALLALA	01	A	171	MOORE	01	Canadian	17121	214,150	218,559	199,791	0	0	0		BEG Model availability, using maximum use distribution, values changed per Dutton supply revisions	G-L: Value format changed to show "0" instead of "-" Vol 1, Draft Regional Water Plan, p. 3-4, paragraph 1 states that groundwater availability is considered to be 50% of current total storage, allocated over 50-year planning period. Appendix K, Draft Regional Water Plan, Table 11, p. 74 lists Ogallala volume in storage. i.e. Moore County Ogallala storage = 12.37 MM ac-ft in Year 2000. 50% availability = 6.185 MM ac-ft. Max. demands met by decade until supply shortage, then remaining supply allocated equally over next decade. No remaining supply shown for subsequent decades.
local supply - stock ponds	00	A	179	OCHILTREE	01	Canadian	01997	2,183	2,183	2,183	2,183	2,183	2,183			Supply added per TWDB comments. Information from Table 5 (TWDB print version)
OGALLALA	01	A	179	OCHILTREE	01	Canadian	17921	187,400	187,400	187,400	187,400	187,400	187,400		BEG Model availability	Vol 1, Draft Regional Water Plan, p. 3-4, paragraph 1 states that groundwater availability is considered to be 50% of current total storage, allocated over 50-year planning period. Appendix K, Draft Regional Water Plan, Table 11, p. 74 lists Ogallala volume in storage. i.e. Armstrong County Ogallala storage = 4.01 MM ac-ft in Year 2000. 50% availability = 2.00 MM ac-ft. Per year availability over 50-year planning period: 2.005 MM ac-ft/50 years = 40,100 ac-ft/year.
DOCKUM	01	A	180	OLDHAM	01	Canadian	18026	7,402	7,402	7,402	7,402	7,402	7,402		Data Ixxx-12.txt; 96% of aquifer in co/basin; was 9600; from Bradley 1997, 50% of storage over 50 yrs + recharge	Values do not appear to have included annual recharge (See Appendix L, p. L-2 of Draft Regional Water Plan). Correct County availability should be 7,710 afy (7,402 afy in Canadian basin) G-L corrected to 7,402 from 4,714
DOCKUM	01	A	180	OLDHAM	02	Red	18026	308	308	308	308	308	308		Data Ixxx-12.txt; 4% of aquifer in co/basin; was 400; from Bradley 1997, 50% of storage over 50 yrs + recharge	Values do not appear to have included annual recharge (See Appendix L, p. L-2 of Draft Regional Water Plan). Correct County availability should be 7,710 afy (308 afy in Red basin) G-L corrected to 308 from 196
local supply - stock ponds	00	A	180	OLDHAM	01	Canadian	01997	1,855	1,855	1,855	1,855	1,855	1,855			Supply added per TWDB comments. Information from Table 5 (TWDB print version)
local supply - stock ponds	00	A	180	OLDHAM	02	Red	02997	108	108	108	108	108	108			Supply added per TWDB comments. Information from Table 5 (TWDB print version)
OGALLALA	01	A	180	OLDHAM	01	Canadian	18021	10,088	10,087	10,075	10,128	9,404	0		BEG 2000 data; using maximum use distribution for entire county	
OGALLALA	01	A	180	OLDHAM	02	Red	18021	18,746	18,759	18,762	18,771	17,183	0		BEG 2000 data; using maximum use distribution for entire county	
AMARILLO SYSTEM	02	A	188	POTTER	01	Canadian	18821	3487	4443	5553	6857	6344	0		BEG Model availability (18% in Red, 82% in Canadian, allocated by aquifer area in basins). 42,964 afy of CRMWA System supply allocated to Amarillo System.	L: Value format changed to show "0" instead of "-" Vol 1, Draft Regional Water Plan, p. 3-4, paragraph 1 states that groundwater availability is considered to be 50% of current total storage, allocated over 50-year planning period. Appendix K, Draft Regional Water Plan, Table 11, p. 74 lists Ogallala volume in storage. i.e. Moore County Ogallala storage = 12.37 MM ac-ft in Year 2000. 50% availability = 6.185 MM ac-ft. Max. demands met by decade until supply shortage, then remaining supply allocated equally over next decade. No remaining supply shown for subsequent decades.
AMARILLO SYSTEM	02	A	188	POTTER	02	Red	18821	764	977	1217	1505	1392	0		BEG Model availability (18% in Red, 82% in Canadian, allocated by aquifer area in basins). 42,964 afy of CRMWA System supply allocated to Amarillo System.	K-L: Value format changed to show "0" instead of "-" Vol 1, Draft Regional Water Plan, p. 3-4, paragraph 1 states that groundwater availability is considered to be 50% of current total storage, allocated over 50-year planning period. Appendix K, Draft Regional Water Plan, Table 11, p. 74 lists Ogallala volume in storage. i.e. Moore County Ogallala storage = 12.37 MM ac-ft in Year 2000. 50% availability = 6.185 MM ac-ft. Max. demands met by decade until supply shortage, then remaining supply allocated equally over next decade. No remaining supply shown for subsequent decades.
DOCKUM	01	A	188	POTTER	01	Canadian	18826	1,848	1,848	1,848	1,848	1,848	1,848		No data in Ixxx-12.txt; from Bradley 1997, 50% of storage over 50 yrs + recharge	
DOCKUM	01	A	188	POTTER	02	Red	18826	252	252	252	252	252	252		No data in Ixxx-12.txt; from Bradley 1997, 50% of storage over 50 yrs + recharge	I: Value corrected to 252 from 25.
IRRIGATION LOCAL SUPPLY1 - 188 - 2	00	A	188	POTTER	01	Canadian	188996	340	340	340	340	340	340		Data from Irls.xls on CD	
IRRIGATION LOCAL SUPPLY2 - 188 - 1	00	A	188	POTTER	02	Red	188996	1,363	1,363	1,363	1,363	1,363	1,363		Data from Irls.xls on CD	
local supply - stock ponds	00	A	188	POTTER	01	Canadian	01997	736	736	736	736	736	736			Supply added per TWDB comments. Information from Table 5 (TWDB print version)
local supply - stock ponds	00	A	188	POTTER	02	Red	02997	56	56	56	56	56	56			Supply added per TWDB comments. Information from Table 5 (TWDB print version)
OGALLALA	01	A	188	POTTER	01	Canadian	18821	15,433	19,123	21,728	22,812	3,264	0		BEG Model availability, using maximum use distribution, after accounting for Amarillo system, value revised (11/25) per Dutton Ogallala supply correction.	L: Value format changed to show "0" instead of "-" Vol 1, Draft Regional Water Plan, p. 3-4, paragraph 1 states that groundwater availability is considered to be 50% of current total storage, allocated over 50-year planning period. Appendix K, Draft Regional Water Plan, Table 11, p. 74 lists Ogallala volume in storage. i.e. Moore County Ogallala storage = 12.37 MM ac-ft in Year 2000. 50% availability = 6.185 MM ac-ft. Max. demands met by decade until supply shortage, then remaining supply allocated equally over next decade. No remaining supply shown for subsequent decades.
OGALLALA	01	A	188	POTTER	02	Red	18821	8,943	8,742	8,505	2,904	0	0		BEG Model availability, using maximum use distribution, after accounting for Amarillo system, value revised (11/25) per Dutton Ogallala supply correction.	K-L: Value format changed to show "0" instead of "-" Vol 1, Draft Regional Water Plan, p. 3-4, paragraph 1 states that groundwater availability is considered to be 50% of current total storage, allocated over 50-year planning period. Appendix K, Draft Regional Water Plan, Table 11, p. 74 lists Ogallala volume in storage. i.e. Moore County Ogallala storage = 12.37 MM ac-ft in Year 2000. 50% availability = 6.185 MM ac-ft. Max. demands met by decade until supply shortage, then remaining supply allocated equally over next decade. No remaining supply shown for subsequent decades.
REUSE: BaZoCou 01-02-188	00	A	188	POTTER	01	Canadian	36014	7,046	7,155	7,401	7,736	8,086	8,537	2REUSE	Data from Ixxxx-14.txt on CD	Supply values corrected 10-16-00
REUSE: BaZoCou 02-01-188	00	A	188	POTTER	02	Red	36030	5259	5341	5524	5775	6035	6372	1REUSE	Data from Ixxxx-14.txt on CD	Supply values corrected 10-16-00
AMARILLO SYSTEM	02	A	191	RANDALL	02	Red	19121	410	524	653	807	747	0	Maximum use scenario, includes CRMWA contract (42,964) plus Carson, Potter, Randall and Deaf Smith well fields.	42,964 afy of CRMWA System supply allocated to Amarillo System.	3.9% (basin allocation) of Amarillo System supply for Roberts County/Ogallala
DOCKUM	01	A	191	RANDALL	01	Canadian	19126	0	0	0	0	0	0		No data in Ixxx-12.txt; from Bradley 1997, 50% of storage over 50 yrs + recharge	G-L: Value format changed to show "0" instead of "-"
DOCKUM	01	A	191	RANDALL	02	Red	19126	230	230	230	230	230	230		No data in Ixxx-12.txt; from Bradley 1997, 50% of storage over 50 yrs + recharge	
IRRIGATION LOCAL SUPPLY2 - 191 - 1	00	A	191	RANDALL	02	Red	191996	671	671	671	671	671	671		Data from Irls.xls on CD	
local supply - stock ponds	00	A	191	RANDALL	01	Canadian	01997	10	10	10	10	10	10			Supply added per TWDB comments. Information from Table 5 (TWDB print version)
local supply - stock ponds	00	A	191	RANDALL	02	Red	02997	972	972	972	972	972	972			Supply added per TWDB comments. Information from Table 5 (TWDB print version)
OGALLALA	01	A	191	RANDALL	01	Canadian	19121	902	947	993	927	4	4		BEG 2000 data; using maximum use distribution	
OGALLALA	01	A	191	RANDALL	02	Red	19121	57,486	57,370	56,601	56,344	9,041	0		BEG 2000 data; using maximum use distribution, after accounting for Amarillo system	
OTHER U-DIF (Santa Rosa)	01	A	191	RANDALL	02	Red	19122	57	40	40	37	35	35		Partial Happy demands	
REUSE: BaZoCou 01-02-191	00	A	191	RANDALL	01	Canadian	36015	16	20	23	26	30	35	2REUSE	Data from Ixxxx-14.txt on CD	
REUSE: BaZoCou 02-01-191	00	A	191	RANDALL	02	Red	36031	9,881	10,963	11,911	13,144	14,609	16,402	1REUSE	Data from Ixxxx-14.txt on CD	Values adjusted by 1 afy for rounding error.
CRMWA SYSTEM	02	A	197	ROBERTS	01	Canadian	19721	24,011	24,011	24,011	24,011	24,011	24,011		76,000 afy firm yield from Lake Meredith plus 40,000 afy from Roberts County well field project. 42,964 afy Amarillo System allocation from CRMWA System. 96.1% (basin allocation) of Amarillo System supply for Roberts County/Ogallala	
AMARILLO SYSTEM	02	A	197	ROBERTS	01	Canadian	19721	10,967	10,967	10,967	10,967	10,967	10,967		76,000 afy firm yield from Lake Meredith plus 40,000 afy from Roberts County well field project. 42,964 afy Amarillo System allocation from CRMWA System. 96.1% (basin allocation) of Amarillo System supply for Roberts County/Ogallala	
CRMWA SYSTEM	02	A	197	ROBERTS	02	Red	19721	974	974	974	974	974	974		76,000 afy firm yield from Lake Meredith plus 40,000 afy from Roberts County well field project. 42,964 afy Amarillo System allocation from CRMWA System. 3.9% (basin allocation) of Amarillo System supply for Roberts County/Ogallala	
AMARILLO SYSTEM	02	A	197	ROBERTS	02	Red	19721	446	446	446	446	446	446		76,000 afy firm yield from Lake Meredith plus 40,000 afy from Roberts County well field project. 42,964 afy Amarillo System allocation from CRMWA System. 3.9% (basin allocation) of Amarillo System supply for Roberts County/Ogallala	
local supply - stock ponds	00	A	197	ROBERTS	01	Canadian	01997	529	529	529	529	529	529			Supply added per TWDB comments. Information from Table 5 (TWDB print version)
local supply - stock ponds	00	A	197	ROBERTS	02	Red	02997	16	18	19	20	22	24			Supply added per TWDB comments. Information from Table 5 (TWDB print version)
OGALLALA	01	A	197	ROBERTS	01	Canadian	19721	203,540	203,540	203,540	203,540	203,540	203,540		BEG Model availability (minus CRMWA 40,000 afy, minus Amarillo System afy, then 96.1% in Canadian, 3.9% in Red), values corrected per Dutton Ogallala supply revisions (11/25)	Vol 1, Draft Regional Water Plan, p. 3-4, paragraph 1 states that groundwater availability is considered to be 50% of current total storage, allocated over 50-year planning period. Appendix K, Draft Regional Water Plan, Table 11, p. 74 lists Ogallala volume in storage. i.e. Armstrong County Ogallala storage = 4.01 MM ac-ft in Year 2000. 50% availability = 2.00 MM ac-ft. Per year availability over 50-year planning period: 2.005 MM ac-ft/50 years = 40,100 ac-ft/year. Allocated 3.9% of available Ogallala supply (302,40 afy) to Roberts / Red (11,794)
OGALLALA	01	A	197	ROBERTS	02	Red	19721	8,260	8,260	8,260	8,260	8,260	8,260		BEG Model availability (minus CRMWA 40,000 afy, minus Amarillo System afy, then 96.1% in Canadian, 3.9% in Red), values corrected per Dutton Ogallala supply revisions (11/25)	G-L: Value format changed to show "0" instead of "-" Vol 1, Draft Regional Water Plan, p. 3-4, paragraph 1 states that groundwater availability is considered to be 50% of current total storage, allocated over 50-year planning period. Appendix K, Draft Regional Water Plan, Table 11, p. 74 lists Ogallala volume in storage. i.e. Armstrong County Ogallala storage = 4.01 MM ac-ft in Year 2000. 50% availability = 2.00 MM ac-ft. Per year availability over 50-year planning period: 2.005 MM ac-ft/50 years = 40,100 ac-ft/year. No supply shown in Table 4 for Roberts/Canadian/Ogallala. Table 5 has ~ 5,800 afy supply. Red Basin has 294,000 afy excess. Consider transferring extra supply to Canadian to meet Table 5 levels. Allocated 3.9% of available Ogallala supply (302,40 afy) to Roberts / Red (11,794)
REUSE: BaZoCou 01-02-197	00	A	197	ROBERTS	01	Canadian	36016	25	25	23	22	20	18	2REUSE	Data from Ixxxx-14.txt on CD	
DOCKUM	01	A	211	SHERMAN	01	Canadian	21126	0	0	0	0	0	0		No data in Ixxx-12.txt; from Bradley 1997, 50% of storage over 50 yrs + recharge	G-L: Value format changed to show "0" instead of "-"
IRRIGATION LOCAL SUPPLY1 - 211 - 1	00	A	211	SHERMAN	01	Canadian	211996	418	418	418	418	418	418		Data from Irls.xls on CD	
local supply - stock ponds	00	A	211	SHERMAN	01	Canadian	01997	846	846	846	846	846	846			Supply added per TWDB comments. Information from Table 5 (TWDB print version)
OGALLALA	01	A	211	SHERMAN	01	Canadian	21121	208,300	208,300	208,300	208,300	208,300	208,300		BEG Model availability, values revised (11/25) per Dutton November supply corrections	L: Value format changed to show "0" instead of "-" Vol 1, Draft Regional Water Plan, p. 3-4, paragraph 1 states that groundwater availability is considered to be 50% of current total storage, allocated over 50-year planning period. Appendix K, Draft Regional Water Plan, Table 11, p. 74 lists Ogallala volume in storage. i.e. Moore County Ogallala storage = 12.37 MM ac-ft in Year 2000. 50% availability = 6.185 MM ac-ft. Max. demands met by decade until supply shortage, then remaining supply allocated equally over next decade. No remaining supply shown for subsequent decades.
BLAINE	01	A	242	WHEELER	02	Red	24206	14,241	14,241	14,241	14,241	14,241	14,241		F&N availability estimate 4-3-00	Basin corrected to 02 (Red) based on Draft Regional Water Plan Figure 1-1 PWPA Map Basin boundaries and to correlate with Table 5 comments per TWDB
local supply - stock ponds	00	A	242	WHEELER	02	Red	02997	2,236	2,236	2,236	2,236	2,236	2,236			Supply added per TWDB comments. Information from Table 5 (TWDB print version)
OGALLALA	01	A	242	WHEELER	02	Red	24221	98,000	98,000	98,000	98,000	98,000	98,000		BEG Model availability, values revised (11/25) per Dutton November supply corrections	G-L: Value format changed to show "0" instead of "-" Vol 1, Draft Regional Water Plan, p. 3-4, paragraph 1 states that groundwater availability is considered to be 50% of current total storage, allocated over 50-year planning period. Appendix K, Draft Regional Water Plan, Table 11, p. 74 lists Ogallala volume in storage. i.e. Armstrong County Ogallala storage = 4.01 MM ac-ft in Year 2000. 50% availability = 2.00 MM ac-ft. Per year availability over 50-year planning period: 2.005 MM ac-ft/50 years = 40,100 ac-ft/year.
OTHER U-DIF (Whitehorse)	01	A	242	WHEELER	02	Red	24222	335	335	335	335	335	335		max. historical pumpage	adjusted to 125% of historical maximum to match Table 5 values.
REUSE: BaZoCou 02-01-242	00	A	242	WHEELER	02	Red	36034	17	16	15	15	15	14	1REUSE	Data from Ixxxx-14.txt on CD	
SEYMOUR	01	A	242	WHEELER	02	Red	24204	3,975	3,975	3,975	3,975	3,975	3,975		F&N availability estimate 4/3/00	Basin corrected to 02 (Red) based on Draft Regional Water Plan Figure 1-1 PWPA Map Basin boundaries and to correlate with Table 5 comments per TWDB

Table 5: Current Water Supplies Available to the PWPG by City and Category

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T							
WUGNAME	WUGNUM	WUG RWPG	SEQ#	WUG CITY#	WUG COUNTY#	WUG BASIN#	Type of Water Supply Source	MWP#	SUPPLY RWPG	SUPPLY COUNTY#	SUPPLY BASIN#	SPECIFIC SOURCE IDENTIFIER	SPECIFIC SOURCE NAME	YEAR 2000 SUPPLY	YEAR 2010 SUPPLY	YEAR 2020 SUPPLY	YEAR 2030 SUPPLY	YEAR 2040 SUPPLY	YEAR 2050 SUPPLY	Comments	Status of Supply Values	TS comments from TWDB review	MAJOR WATER PROVIDER NAME	DATA CAT	COUNTY NAME	BASIN NAME
CLAUDE	010173000	A	0173	0114	006	02	01		A	006	02	00621	OGALLALA	265	266	267	124	0	0	From PGWCD3-Cities.xls. Allocated to meet demands until supply exhausted.	Updated 3/16/00	S-T: Value format changed to show "0" instead of "-"		MUN	ARMSTRONG	RED
COUNTY-OTHER	010996006	A	0996	0757	006	02	01		A	006	02	00621	OGALLALA	139	139	139	139	139	139	HISTORICAL MAXIMUM USE	Updated 5/4/00			MUN	ARMSTRONG	RED
COUNTY-OTHER	010996006	A	0996	0757	006	02	01		A	006	02	00622	OTHER U-DIF (Whitehorse)	2	1	1	1	1	1	Ratioed among CATs w/ hist pumpage. Claude had no pumpage in HistMunA.xls	Updated 2/14/00			MUN	ARMSTRONG	RED
IRRIGATION	011004006	A	1004	1004	006	02	01		A	006	02	00626	DOCKUM	16	16	15	15	15	15	No historical pumpage (gw_pumpage.xls); All supply allocated to IRR and STK by Table 2 demand ratio.	Updated 2/11/00			IRR	ARMSTRONG	RED
IRRIGATION	011004006	A	1004	1004	006	02	01		A	006	02	00621	OGALLALA	16,951	16,951	16,951	16,951	16,951	16,951	HISTORICAL MAXIMUM USE	Updated 4/21/00			IRR	ARMSTRONG	RED
IRRIGATION	011004006	A	1004	1004	006	02	01		A	006	02	00622	OTHER U-DIF (Whitehorse)	0	0	0	0	0	0	HISTORICAL MAXIMUM USE	Updated 4/1/00	O-T: Value format changed to show "0" instead of "-"		IRR	ARMSTRONG	RED
LIVESTOCK	011005006	A	1005	1005	006	02	01		A	006	02	00626	DOCKUM	1	1	2	2	2	2	No historical pumpage (gw_pumpage.xls); All supply allocated to IRR and STK by Table 2 demand ratio.	Updated 2/11/00			STK	ARMSTRONG	RED
LIVESTOCK	011005006	A	1005	1005	006	02	00		A	006	02	02997	local supply - stock ponds	232	232	232	232	232	232	HISTORICAL MAXIMUM USE		Table 4 updated to include stock pond supply information B-G, K:Info added. M: ID corrected to 02997		STK	ARMSTRONG	RED
LIVESTOCK	011005006	A	1005	1005	006	02	01		A	006	02	00621	OGALLALA	926	926	926	926	926	926	HISTORICAL MAXIMUM USE	Updated 4/1/00			STK	ARMSTRONG	RED
MINING	011003006	A	1003	1003	006	02	01		A	006	02	00621	OGALLALA	26	26	26	26	26	26	125% OF HISTORICAL MAXIMUM USE	Updated 4/1/00			MIN	ARMSTRONG	RED
COUNTY-OTHER	010996033	A	0996	0757	033	01	01		A	033	01	03321	OGALLALA	114	107	95	100	93	90	used demands	Updated 3/20/00			MUN	CARSON	CANADIAN
COUNTY-OTHER	010996033	A	0996	0757	033	02	01		A	033	02	03321	OGALLALA	350	341	324	328	331	334	Maximum use scenario - from storage	Updated 3/29/00	S-T: Value format changed to show "0" instead of "-". Table 5 submittal to TWDB shows 2030=328, 2040=331, 2050=334		MUN	CARSON	RED
GROOM	010365000	A	0365	0875	033	02	01		A	033	02	03321	OGALLALA	180	173	163	149	81	0	From PGWCD3-Cities.xls. Allocated to meet demands until supply exhausted.	Updated 3/29/00	T: Value format changed to show "0" instead of "-"		MUN	CARSON	RED
IRRIGATION	011004033	A	1004	1004	033	02	01		A	033	02	03326	DOCKUM	0	0	0	0	0	0	HISTORICAL MAXIMUM USE	Updated 4/1/00	O-T: Value format changed to show "0" instead of "-"		IRR	CARSON	RED
IRRIGATION	011004033	A	1004	1004	033	01	01		A	033	01	03321	OGALLALA	46,832	46,832	46,832	46,832	46,832	46,832	HISTORICAL MAXIMUM USE	Updated 4/21/00			IRR	CARSON	CANADIAN
IRRIGATION	011004033	A	1004	1004	033	02	01		A	033	02	03321	OGALLALA	63,244	63,244	63,244	63,244	63,244	63,244	Maximum use scenario - from storage	Updated 5/5/00	S-T: Value format changed to show "0" instead of "-"		IRR	CARSON	RED
IRRIGATION	011004033	A	1004	1004	033	01	00		A	033	01	36005	REUSE: BaZoCou 01-02-033	4	4	3	3	3	3	All reuse assumed to IRR unless otherwise specified.	Get w/ TLS re: reuse allocations			IRR	CARSON	CANADIAN
IRRIGATION	011004033	A	1004	1004	033	02	00		A	033	02	36019	REUSE: BaZoCou 02-01-033	10	10	10	10	10	10	All reuse assumed to IRR unless otherwise specified.	Get w/ TLS re: reuse allocations	Source identifier corrected from 36005 to 36019		IRR	CARSON	RED
LIVESTOCK	011005033	A	1005	1005	033	02	01		A	033	02	03326	DOCKUM	0	0	0	0	0	0	HISTORICAL MAXIMUM USE	Updated 4/1/00	O-T: Value format changed to show "0" instead of "-"		STK	CARSON	RED
LIVESTOCK	011005033	A	1005	1005	033	01	00		A	033	01	01997	local supply - stock ponds	188	188	188	188	188	188	HISTORICAL MAXIMUM USE		Table 4 updated to include stock pond supply information B-G, K:Info added. M: ID added.		STK	CARSON	CANADIAN
LIVESTOCK	011005033	A	1005	1005	033	02	00		A	033	02	02997	local supply - stock ponds	243	243	243	243	243	243	HISTORICAL MAXIMUM USE		Table 4 updated to include stock pond supply information B-G, K:Info added. M: ID corrected, was 02999.		STK	CARSON	RED
LIVESTOCK	011005033	A	1005	1005	033	01	01		A	033	01	03321	OGALLALA	753	753	753	753	753	753	HISTORICAL MAXIMUM USE	Updated 4/1/00			STK	CARSON	CANADIAN
LIVESTOCK	011005033	A	1005	1005	033	02	01		A	033	02	03321	OGALLALA	362	407	447	485	526	571	Maximum use scenario - from storage	Updated 3/29/00	S-T: Value format changed to show "0" instead of "-"		STK	CARSON	RED
MANUFACTURING	011001033	A	1001	1001	033	02	01		A	033	02	03321	OGALLALA	825	987	1,168	1,368	1,586	1,820	Maximum use scenario - from storage	Updated 3/29/00	S-T: Value format changed to show "0" instead of "-"		MFG	CARSON	RED
MINING	011003033	A	1003	1003	033	01	01		A	033	01	03321	OGALLALA	1,456	1,165	1,165	1,165	1,165	1,165	HISTORICAL MAXIMUM USE, increased for 2000 to 125%	Updated 4/1/00			MIN	CARSON	CANADIAN
MINING	011003033	A	1003	1003	033	02	01		A	033	02	03321	OGALLALA	727	716	726	739	757	778	Maximum use scenario - from storage	Updated 3/29/00	S-T: Value format changed to show "0" instead of "-"		MIN	CARSON	RED
PANHANDLE	010675000	A	0675	0453	033	02	01		A	033	02	03321	OGALLALA	589	844	879	902	175	0	From PGWCD3-Cities.xls. Allocated to meet demands until supply exhausted.	Updated 3/29/00	T: Value format changed to show "0" instead of "-"		MUN	CARSON	RED
SKELLYTOWN	010834000	A	0834	0960	033	01	01		A	033	01	03321	OGALLALA	88	83	32	0	0	0	From PGWCD3-Cities.xls. Allocated to meet demands until supply exhausted.	Updated 3/20/00	R-T: Value format changed to show "0" instead of "-"		MUN	CARSON	CANADIAN
WHITE DEER	010962000	A	0962	0647	033	01	01		A	033	01	03321	OGALLALA	253	261	257	261	217	0	From PGWCD3-Cities.xls. Allocated to meet demands until supply exhausted.	Updated 3/20/00	T: Value format changed to show "0" instead of "-"		MUN	CARSON	CANADIAN
WHITE DEER	010962000	A	0962	0647	033	02	01		A	033	02	03321	OGALLALA	13	14	14	14	11	0	From PGWCD3-Cities.xls. Allocated to meet demands until supply exhausted.		J: RWPG A listed for supply. O-T: Values in this table are different than TWDB submittal B-M: Info added.		MUN	CARSON	RED
CHILDRESS	10164000	A	0164	0109	038	02	00		A	065	02	02090	Baylor	0	0	0	0	0	0	Baylor lake, 397 af/y water rights are to City of Childress. No infrastructure. No firm yield study available.	36,570			MUN	CHILDRESS	RED
CHILDRESS	010164000	A	0164	0109	038	02	00		A	065	02	02050	Greenbelt Reservoir	1,170	1,194	1,179	1,192	1,210	1,243	Greenbelt Supply = Demand from Table 2	Updated 3/20/00		Greenbelt	MUN	CHILDRESS	RED
CHILDRESS	010164000	A	0164	0109	038	02	01		A	038	02	03804	SEYMOUR	0	0	0	0	0	0	Recent historical use = 0	Updated 2/14/00	H: Corrected to 01 for ground water source.		MUN	CHILDRESS	RED
COUNTY-OTHER	010996038	A	0996	0757	038	02	00		A	065	02	02050	Greenbelt Reservoir	400	400	400	400	400	400	Sales from Childress and Red River Authority	Updated 4/1/00	B-G: Info added. J: RWPG A listed for supply. K-L: Info from SFK sheet M: Leading zero added	Greenbelt	MUN	CHILDRESS	RED
COUNTY-OTHER	010996038	A	0996	0757	038	02	01		A	038	02	03804	SEYMOUR	150	150	150	150	150	150	HISTORICAL USE	Updated 2/14/00			MUN	CHILDRESS	RED
IRRIGATION	011004038	A	1004	1004	038	02	01		A	038	02	03806	BLAINE	5,182	5,164	5,104	5,092	5,080	5,066	Blaine supply to IRR and STK	Updated 2/11/00			IRR	CHILDRESS	RED
IRRIGATION	011004038	A	1004	1004	038	02	01		A	038	02	03822	OTHER U-DIF (Whitehorse)	62	62	62	62	62	62	IRR is only CAT w/ hist pumpage (gw_pumpage.xls)				IRR	CHILDRESS	RED
IRRIGATION	011004038	A	1004	1004	038	02	00		A	038	02	36037	REUSE: BaZoCou 02-02-038	120	120	117	117	118	120	All reuse assumed to IRR unless otherwise specified.	Get w/ TLS re: reuse allocations	M: Had no value. Was 999 in TWDB submittal. Corrected per TWDB comment.		IRR	CHILDRESS	RED
IRRIGATION	011004038	A	1004	1004	038	02	01		A	038	02	03804	SEYMOUR	52	52	52	52	52	52	HISTORICAL MAX	Updated 4/1/00			IRR	CHILDRESS	RED
LIVESTOCK	011005038	A	1005	1005	038	02	01		A	038	02	03806	BLAINE	0	0	0	0	0	0	no historical usage	Update 8/25/00	B-H: Info added. J: RWPG A listed for supply. K: County #38 added.		STK	CHILDRESS	RED
LIVESTOCK	011005038	A	1005	1005	038	02	00		A	038	02	02997	local supply - stock ponds	560	560	560	560	560	560	HISTORICAL MAXIMUM USE		Table 4 updated to include stock pond supply information B-G, K:Info added. M: ID added.		STK	CHILDRESS	RED
LIVESTOCK	011005038	A	1005	1005	038	02	01		A	038	02	03804	SEYMOUR	49	49	49	49	49	49	HISTORICAL USE	Updated 2/14/00			STK	CHILDRESS	RED
MINING	11003038	A	1003	1003	038	02	01		A	038	02	02999	LOCAL SUPPLY	21	21	21	21	21	21	HISTORICAL MAX USE		This row inserted to match SFK sheet. Now matches TWDB version.		MIN	CHILDRESS	RED
MINING	011003038	A	1003	1003	038	02	01		A	038	02	03804	SEYMOUR	20	20	20	21	22	22	No historical pumpage (historical gw_pumpage.xls); Demand shown in Table 2	Updated 2/14/00			MIN	CHILDRESS	RED
COUNTY-OTHER	010996044	A	0996	0757	044	02	01		A	044	02	04406	BLAINE	63	63	63	63	63	63	HISTORICAL MAXIMUM USE	Updated 4/1/00			MUN	COLLINGSWORTH	RED
COUNTY-OTHER	010996044	A	0996	0757	044	02	01		A	044	02	04422	OTHER U-DIF (Whitehorse)	6	6	6	6	6	6	Historical MUN pumpage (gw_pumpage.xls) Ratioed among CATs w/ hist pumpage. HistMunA.xls shows no Wellington pumpage from this aquifer	Updated 10-18-00. Matches Table 4 Supply.			MUN	COLLINGSWORTH	RED
COUNTY-OTHER	010996044	A	0996	0757	044	02	01		A	044	02	04404	SEYMOUR	182	182	182	182	182	182	HISTORICAL MAXIMUM USE	Updated 2/14/00			MUN	COLLINGSWORTH	RED
IRRIGATION	011004044	A	1004	1004	044	02	01		A	044	02	04406	BLAINE	6,566	6,556	6,532	6,525	6,517	6,507	Ratioed among CATs w/ hist pumpage.	Updated 2/11/00			IRR	COLLINGSWORTH	RED
IRRIGATION	011004044	A	1004	1004	044	02	00		A	044	02	44996	IRRIGATION LOCAL SUPPLY2 - 44 - 2	40	40	39	39	39	39	All irrigation supply to IRR and STK unless otherwise specified. Ratioed by Table 4 demand	Updated 2/14/00			IRR	COLLINGSWORTH	RED
IRRIGATION	011004044	A	1004	1004	044	02	01		A	044	02	04404	SEYMOUR	19,730	19,753	19,769	19,779	19,790	19,799	REMAINDER OF AVAILABLE SUPPLY	Updated 2/14/00			IRR	COLLINGSWORTH	RED
LIVESTOCK	011005044	A	1005	1005	044	02	01		A	044	02	04406	BLAINE	36	36	36	36	36	36	HISTORICAL MAXIMUM USE	Updated 2/11/00			STK	COLLINGSWORTH	RED
LIVESTOCK	011005044	A	1005	1005	044	02	00		A	044	02	44996	IRRIGATION LOCAL SUPPLY2 - 44 - 2	1	1	2	2	2	2	All irrigation supply to IRR and STK unless otherwise specified. Ratioed by Table 4 demand.	Updated 2/14/00			STK	COLLINGSWORTH	RED
LIVESTOCK	011005044	A	1005	1005	044	02	00		A	044	02	02997	local supply - stock ponds	797	797	797	797	797	797	HISTORICAL MAXIMUM USE		Table 4 updated to include stock pond supply information B-G, K:Info added. M: ID added.		STK	COLLINGSWORTH	RED
LIVESTOCK	011005044	A	1005	1005	044	02	01		A	044	02	04422	OTHER U-DIF (Whitehorse)	24	24	24	24	24	24	HISTORICAL USE	Updated 10-18-00. Matches Table 4 Supply.			STK	COLLINGSWORTH	RED
LIVESTOCK	011005044	A	1005	1005	044	02	01		A	044	02	04404	SEYMOUR	26	26	26	26	26	26	HISTORICAL MAXIMUM USE	Updated 2/14/00			STK	COLLINGSWORTH	RED
WELLINGTON	010947000	A	0947	0637	044	02	01		A	044	02	04404	SEYMOUR	657	634	618	608	597	588	Ratioed among CATs w/ hist pumpage. HistMunA.xls shows historical pumpage from this aquifer for Wellington	Updated 2/14/00			MUN	COLLINGSWORTH	RED
COUNTY-OTHER	010996056	A	0996	0757	056	01	01		A	056	01	05621	OGALLALA	177	181	176	174	0	0	Maximum use scenario - from storage, revised per Dutton Ogallala supply correction	Update 11/24/00	O-T: Value format changed to show "0" instead of "-"		MUN	DALLAM	CANADIAN
COUNTY-OTHER	010996056	A	0996	0757	056	01	01		A	103	01	10321	OGALLALA	0	0	0	0	173	172	Supply provided by the city of Dalhart	Update 11/24/00	O-T: Value format changed to show "0" instead of "-"		MUN	DALLAM	CANADIAN
COUNTY-OTHER	010996056	A	0996	0757	056	01	01		A	056	01	05623	RITA BLANCA AQUIFER	2	2	2	2	2	2		Updated 2/14/00			MUN	DALLAM	CANADIAN

Table 5: Current Water Supplies Available to the PWPG by City and Category

DALHART	010226000	A	0226	0150	056	01	01		A	056	01	05621	OGALLALA	1,145	1,142	1,118	1,087	0	0	Maximum use scenario - from storage, revised per Dutton Ogallala supply correction	Update 11/24/00	O-T: Value format changed to show "0" instead of "-"		MUN	DALLAM	CANADIAN
DALHART	010226000	A	0226	0150	056	01	01		A	103	01	10321	OGALLALA	0	0	0	0	1,037	1,002	Additional supply from Hartley when Dallam Ogallala supply exhausted.	Update 11/24/00	O-T: Value format changed to show "0" instead of "-"		MUN	DALLAM	CANADIAN
IRRIGATION	011004056	A	1004	1004	056	01	01		A	056	01	05626	DOCKUM	200	200	200	400	0	0	All supply allocated to IRR. Future usage moved up to 2020 when Ogallala supply exhausted.	Updated 2/11/00			IRR	DALLAM	CANADIAN
IRRIGATION	011004056	A	1004	1004	056	01	01		A	056	01	05621	OGALLALA	380,620	380,670	380,701	106,554	0	0	Maximum use scenario - from storage, revised per Dutton Ogallala supply correction	Update 11/24/00	R-T: Value format changed to show "0" instead of "-"		IRR	DALLAM	CANADIAN
IRRIGATION	011004056	A	1004	1004	056	01	00		A	056	01	36006	REUSE: BaZoCou 01-02-056	431	430	421	409	391	379	All reuse assumed to IRR unless otherwise specified.	Get w/ TLS re: reuse allocations			IRR	DALLAM	CANADIAN
IRRIGATION	011004056	A	1004	1004	056	01	01		A	056	01	05623	RITA BLANCA AQUIFER	5,152	5,103	5,081	5,064	5,041	5,061		Updated 2/14/00			IRR	DALLAM	CANADIAN
LIVESTOCK	011005056	A	1005	1005	056	01	01		A	056	01	05626	DOCKUM	0	0	0	0	0	0	No historical pumpage (gw_pumpage.xls); All supply allocated to IRR and STK by Table 2 demand ratio.	Updated 2/11/00	O-T: Value format changed to show "0" instead of "-"		STK	DALLAM	CANADIAN
LIVESTOCK	011005056	A	1005	1005	056	01	00		A	056	01	01997	local supply - stock ponds	757	757	757	757	757	757	HISTORICAL MAXIMUM USE		Table 4 updated to include stock pond supply information B-G, K:Info added. M: ID added.		STK	DALLAM	CANADIAN
LIVESTOCK	011005056	A	1005	1005	056	01	01		A	056	01	05621	OGALLALA	6,125	9,889	11,386	12,951	0	0	Maximum use scenario - from storage, revised per Dutton Ogallala supply correction	Update 11/24/00			STK	DALLAM	CANADIAN
LIVESTOCK	011005056	A	1005	1005	056	01	01		A	056	01	05623	RITA BLANCA AQUIFER	91	91	91	91	91	91		Updated 2/14/00			STK	DALLAM	CANADIAN
MANUFACTURING	011001056	A	1001	1001	056	01	01		A	056	01	05621	OGALLALA	232	232	232	232	0	0	Maximum use scenario - from storage, revised per Dutton Ogallala supply correction	Update 11/24/00	R-T: Value format changed to show "0" instead of "-"		MFG	DALLAM	CANADIAN
MANUFACTURING	011001056	A	1001	1001	056	01	01		A	056	01	05623	RITA BLANCA AQUIFER	3	3	3	3	3	3	seeTLS	Updated 4/1/00			MFG	DALLAM	CANADIAN
CLARENDON	010170000	A	0170	0112	065	02	00		A	065	02	02050	Greenbelt Reservoir	503	465	433	396	365	332	Greenbelt Supply = Demand from Table 2	Updated 3/20/00	M: Leading zero added	Greenbelt	MUN	DONLEY	RED
COUNTY-OTHER	010996065	A	0996	0757	065	02	00		A	065	02	02050	Greenbelt Reservoir	91	91	91	91	91	91	City of Henley	Updated 3/20/00	L: 2 added per SFK sheet. M: Leading zero added	Greenbelt	MUN	DONLEY	RED
COUNTY-OTHER	010996065	A	0996	0757	065	02	01		A	065	02	06521	OGALLALA	143	143	143	143	143	143	HISTORICAL MAX	Updated 4/1/00			MUN	DONLEY	RED
IRRIGATION	011004065	A	1004	1004	065	02	01		A	065	02	06521	OGALLALA	17,516	17,516	17,516	17,516	17,516	17,516	HISTORICAL MAX	Updated 4/1/00			IRR	DONLEY	RED
IRRIGATION	011004065	A	1004	1004	065	02	01		A	065	02	06522	OTHER U-DIF (Whitehorse)	0	0	0	0	0	0	HISTORICAL MAX	Updated 4/1/00	O-T: Value format changed to show "0" instead of "-"		IRR	DONLEY	RED
LIVESTOCK	011005065	A	1005	1005	065	02	00		A	065	02	02997	local supply - stock ponds	1,540	1,540	1,540	1,540	1,540	1,540		Updated 3/20/00	Table 4 updated to include stock pond supply information M: ID corrected, was 65999.		STK	DONLEY	RED
LIVESTOCK	011005065	A	1005	1005	065	02	01		A	065	02	06521	OGALLALA	100	100	100	100	100	100	HISTORICAL MAX	Updated 4/1/00			STK	DONLEY	RED
LIVESTOCK	011005065	A	1005	1005	065	02	01		A	065	02	06522	OTHER U-DIF (Whitehorse)	71	71	71	71	71	71	HISTORICAL MAX	Updated 4/1/00			STK	DONLEY	RED
MINING	011003065	A	1003	1003	065	02	01		A	065	02	06521	OGALLALA	28	28	28	28	31	34	125% HISTORICAL MAX, increased slightly to meet demands starting in 2040	Updated 4/1/00			MIN	DONLEY	RED
COUNTY-OTHER	010996090	A	0996	0757	090	01	01		A	090	01	09021	OGALLALA	632	602	575	481	444	419	Ratioed among CATs w/ hist pumpage. (Pampa supply subtracted from total supply before ratioing.)	Updated 3/20/00	K: Added County # 90.		MUN	GRAY	CANADIAN
COUNTY-OTHER	010996090	A	0996	0757	090	02	01		A	090	02	09021	OGALLALA	521	521	521	521	521	521	HISTORICAL MAX	Updated 4/1/00			MUN	GRAY	RED
IRRIGATION	011004090	A	1004	1004	090	01	01		A	090	01	09021	OGALLALA	6,976	6,976	6,976	6,976	6,976	6,976	HISTORICAL MAX	Updated 4/1/00	K: Added County # 90.		IRR	GRAY	CANADIAN
IRRIGATION	011004090	A	1004	1004	090	02	01		A	090	02	09021	OGALLALA	24,731	24,731	24,731	24,731	24,731	24,731	HISTORICAL MAX	Updated 4/1/00			IRR	GRAY	RED
IRRIGATION	011004090	A	1004	1004	090	01	00		A	090	01	36008	REUSE: BaZoCou 01-02-090	1,683	1,672	1,654	1,423	1,383	1,346	All reuse assumed to IRR unless otherwise specified.	Get w/ TLS re: reuse allocations			IRR	GRAY	CANADIAN
IRRIGATION	011004090	A	1004	1004	090	02	00		A	090	02	36025	REUSE: BaZoCou 02-01-090	233	230	225	192	185	179	All reuse assumed to IRR unless otherwise specified.	Get w/ TLS re: reuse allocations	M: Source ID added for Gray/Red		IRR	GRAY	RED
LEFORS	010515000	A	0515	0898	090	02	01		A	090	02	09021	OGALLALA	120	88	0	0	0	0	From PGWCD3-Cities.xls. Allocated to meet demands until supply exhausted.	Updated 3/20/00	Q-T: Value format changed to show "0" instead of "-"		MUN	GRAY	RED
LIVESTOCK	011005090	A	1005	1005	090	01	00		A	090	01	01997	local supply - stock ponds	396	396	396	396	396	396	HISTORICAL MAXIMUM USE		Table 4 updated to include stock pond supply information B-G, K:Info added. M: ID added.		STK	GRAY	CANADIAN
LIVESTOCK	011005090	A	1005	1005	090	02	00		A	090	02	02997	local supply - stock ponds	2,515	2,515	2,515	2,515	2,515	2,515	HISTORICAL MAXIMUM USE		Table 4 updated to include stock pond supply information B-G, K:Info added. M: ID added.		STK	GRAY	RED
LIVESTOCK	011005090	A	1005	1005	090	01	01		A	090	01	09021	OGALLALA	44	44	44	44	78	122	HISTORICAL MAX, increased to meet demands	Updated 4/1/00	K: Added County # 90.		STK	GRAY	CANADIAN
LIVESTOCK	011005090	A	1005	1005	090	02	01		A	090	02	09021	OGALLALA	239	239	239	299	495	775	HISTORICAL MAX, increased to meet demands	Updated 4/1/00			STK	GRAY	RED
MANUFACTURING	011001090	A	1001	1001	090	01	01		A	090	01	09021	OGALLALA	3,947	4,225	4,332	4,407	4,692	4,910	used demands, increased historical use to meet demands to 125% max use	Updated 4/1/00	K: Added County # 90.		MFG	GRAY	CANADIAN
MCLEAN	010578000	A	0578	0380	090	02	01		A	090	02	09021	OGALLALA	266	266	19	0	0	0	From PGWCD3-Cities.xls. Allocated to meet demands until supply exhausted.	Updated 3/20/00	R-T: Value format changed to show "0" instead of "-"		MUN	GRAY	RED
MINING	011003090	A	1003	1003	090	01	01		A	090	01	09021	OGALLALA	135	135	135	135	135	135	HISTORICAL MAX	Updated 4/1/00	K: Added County # 90.		MIN	GRAY	CANADIAN
MINING	011003090	A	1003	1003	090	02	01		A	090	02	09021	OGALLALA	1,655	1,324	1,324	1,324	1,324	1,324	125% HISTORICAL MAX for year 2000	Updated 4/1/00			MIN	GRAY	RED
PAMPA	010674000	A	0674	0452	090	01	02	10	A	117	01	010A0	CRMWA SYSTEM	2,292	2,598	2,582	2,230	2,171	2,114	From CRMWA Information system max capacity by City (CRMA information for Table3.xls)	36,573	M: Added 010A0 for CRMWA System per TWDB comment.	CRMWA	MUN	GRAY	CANADIAN
PAMPA	010674000	A	0674	0452	090	01	02	10	A	191	01	19721	CRMWA SYSTEM	1,159	1,314	1,306	1,128	1,098	1,069	From CRMWA Information system max capacity by City (CRMA information for Table3.xls)			CRMWA	MUN	GRAY	CANADIAN
PAMPA	010674000	A	0674	0452	090	01	02	10	A	191	02	19721	CRMWA SYSTEM	47	53	53	46	45	43	From CRMWA Information system max capacity by City (CRMA information for Table3.xls)			CRMWA	MUN	GRAY	CANADIAN
PAMPA	010674000	A	0674	0452	090	01	01		A	090	01	09021	OGALLALA	736	736	736	736	736	736	Based on City survey (citysurveryresponse.xls).	Updated 3/20/00	K: Added County # 90.		MUN	GRAY	CANADIAN
COUNTY-OTHER	010996096	A	0996	0757	096	02	00		A	065	02	02050	Greenbelt Reservoir	120	120	120	120	120	120	sales from Red River Authority	Updated 4/1/00	M: Leading zero added K: Value corrected to 65 from 96 L: Basin corrected to 2 (Red)	Greenbelt	MUN	HALL	RED
COUNTY-OTHER	010996096	A	0996	0757	096	02	01		A	096	02	09604	SEYMOUR	271	250	228	206	192	176	Ratioed among CATs w/ hist pumpage. (gw_pumpage.xls)	Updated 2/14/00			MUN	HALL	RED
IRRIGATION	011004096	A	1004	1004	096	02	01		A	096	02	09606	BLAINE	0	0	0	0	0	0	HISTORICAL MAX	Updated 4/1/00	O-T: Value format changed to show "0" instead of "-"		IRR	HALL	RED
IRRIGATION	011004096	A	1004	1004	096	02	00		A	096	02	36043	REUSE: BaZoCou 02-02-096	7	7	6	6	6	5	All reuse assumed to IRR unless otherwise specified.	Get w/ TLS re: reuse allocations	M: Added Source ID, was 999		IRR	HALL	RED
IRRIGATION	011004096	A	1004	1004	096	02	01		A	096	02	09604	SEYMOUR	10,797	10,807	10,820	10,829	10,830	10,825	Ratioed among CATs w/ hist pumpage. (gw_pumpage.xls)	Updated 2/14/00			IRR	HALL	RED
LIVESTOCK	011005096	A	1005	1005	096	02	01		A	096	02	09606	BLAINE	0	0	0	0	0	0	HISTORICAL MAX	Updated 4/1/00	O-T: Value format changed to show "0" instead of "-"		STK	HALL	RED
LIVESTOCK	011005096	A	1005	1005	096	02	00		A	096	02	02997	local supply - stock ponds	375	375	375	375	375	375			Table 4 updated to include stock pond supply information M: ID corrected, was 02999.		STK	HALL	RED
LIVESTOCK	011005096	A	1005	1005	096	02	01		A	096	02	09622	OTHER U-DIF (Whitehorse)	18	18	18	18	18	18	HISTORICAL usage	Updated 10-18-00. Matches Table 4 Supply.			STK	HALL	RED
LIVESTOCK	011005096	A	1005	1005	096	02	01		A	096	02	09604	SEYMOUR	21	21	21	21	21	21	HISTORICAL MAX	Updated 4/1/00			STK	HALL	RED
MEMPHIS	010585000	A	0585	0394	096	02	00		A	065	02	02050	Greenbelt Reservoir	71	67	62	58	56	54	Greenbelt Supply = Demand from Table 2	Updated 4/25/00		Greenbelt	MUN	HALL	RED
MEMPHIS	010585000	A	0585	0394	096	02	01		A	065	02	06521	OGALLALA	405	405	405	405	405	405	1996 historical use from Ogallala per TWDB info. No Ogallala supply shown in Hall. Supply available from Seymour aquifer.	Updated 4/25/00			MUN	HALL	RED
MINING	011003096	A	1003	1003	096	02	01		A	096	02	09622	OTHER U-DIF (Whitehorse)	28	28	28	28	28	28	125% historical max uage	Updated 10-18-00. Matches Table 4 Supply.			MIN	HALL	RED
TURKEY	010915000	A	0915	0979	096	02	01		A	096	02	09604	SEYMOUR	128	128	128	128	128	128	HISTORICAL MAX	Updated 4/1/00			MUN	HALL	RED
COUNTY-OTHER	010996098	A	0996	0757	098	01	01		A	098	01	09821	OGALLALA	265	265	265	265	265	265	HISTORICAL MAXIMUM USE	Updated 2/11/00			MUN	HANSFORD	CANADIAN
COUNTY-OTHER	010996098	A	0996	0757	098	01	00		A	098	01	01020	PALO DURO	0	0	0	0	0	0	Waiting for info from PDRA	Updated 2/14/00	H: Corrected to 00 for surface water M: Source ID with leading zero added. O-T: Value format changed to show "0" instead of "-"		MUN	HANSFORD	CANADIAN
GRUVER	010368000	A	0368	0256	098	01	01		A	098	01	09821	OGALLALA	377	86	0	0	0	0	From City survery response (citysurveyresponse.xls). 50% of water rights developed in 2000	Updated7/21/00			MUN	HANSFORD	CANADIAN
GRUVER	010368000	A	0368	0256	098	01	00		A	098	01	01020	PALO DURO	0	0	0	0	0	0	Waiting for info from PDRA	Updated 2/14/00	H: Corrected to 00 for surface water M: Source ID with leading zero added. O-T: Value format changed to show "0" instead of "-"		MUN	HANSFORD	CANADIAN
IRRIGATION	011004098	A	1004	1004	098	01	00		A	098	01	98996	IRRIGATION LOCAL SUPPLY1 - 98 - 1	154	150	149	147	146	144	All irrigation supply to IRR and STK unless otherwise specified..	Updated 2/14/00			IRR	HANSFORD	CANADIAN
IRRIGATION	011004098	A	1004	1004	098	01	01		A	098	01	09821	OGALLALA	236,075	234,233	233,148	231,994	230,674	229,190	Remaining supply after other users supplies allocated.	Updated 11/25/00			IRR	HANSFORD	CANADIAN
IRRIGATION	011004098	A	1004	1004	098	01	00		A	098	01	01020	PALO DURO	0	0	0	0	0	0	Waiting for info from PDRA	Updated 2/14/00	H: Corrected to 00 for surface water M: Source ID with leading zero added. O-T: Value format changed to show "0" instead of "-"		IRR	HANSFORD	CANADIAN
IRRIGATION	011004098	A	1004	1004	098	01	00		A	098	01	36001	REUSE: BaZoCou 01-01-098	259	260	252	243	232	223	All reuse assumed to IRR unless otherwise specified.	Get w/ TLS re: reuse allocations			IRR	HANSFORD	CANADIAN
LIVESTOCK	011005098	A	1005	1005	098	01	00		A	098	01	98996	IRRIGATION LOCAL SUPPLY1 - 98 - 1	7	11	12	14	15	17	All irrigation supply to IRR and STK unless otherwise specified..	Updated 2/14/00			STK	HANSFORD	CANADIAN
LIVESTOCK	011005098	A	1005	1005	098	01	00		A	098	01	01997	local supply - stock ponds	4,061	4,061	4,061	4,061	4,061	4,061	HISTORICAL MAXIMUM USE		Table 4 updated to include stock pond supply information B-G, K:Info added. M: ID added.		STK	HANSFORD	CANADIAN
LIVESTOCK	011005098	A	1005	1005	098	01	01		A	098	01	09821	OGALLALA	2,707	4,921	6,092	7,246	8,553	10,037	125% HISTORICAL MAX, increased to meet demands	Updated 5/4/00			STK	HANSFORD	CANADIAN
LIVESTOCK	011005098	A	1005	1005	098	01	00		A	098	01	01020	PALO DURO	0	0	0	0	0	0	Waiting for info from PDRA	Updated 2/14/00	H: Corrected to 00 for surface water M: Source ID with leading zero added. O-T: Value format changed to show "0" instead of "-"		STK	HANSFORD	CANADIAN
MANUFACTURING	011001098	A	1001	1001	098	01	01		A	098	01	09821	OGALLALA	53	53	53	53	66	66	increased to 125% HISTORICAL MAX	Updated 4/1/00			MFG	HANSFORD	CANADIAN

Table 5: Current Water Supplies Available to the PWPG by City and Category

MANUFACTURING	011001098	A	1001	1001	098	01	00		A	098	01	01020	PALO DURO	0	0	0	0	0	0	Waiting for info from PDRA	Updated 2/14/00	H: Corrected to 00 for surface water M: Source ID with leading zero added. O-T: Value format changed to show "0" instead of "-"		MFG	HANSFORD	CANADIAN
MINING	011003098	A	1003	1003	098	01	01		A	098	01	09821	OGALLALA	1,331	1,250	1,250	1,250	1,250	1,250	HISTORICAL MAX	Updated 4/1/00			MIN	HANSFORD	CANADIAN
MINING	011003098	A	1003	1003	098	01	00		A	098	01	01020	PALO DURO	0	0	0	0	0	0	Waiting for info from PDRA	Updated 2/14/00	H: Corrected to 00 for surface water M: Source ID with leading zero added. O-T: Value format changed to show "0" instead of "-"		MIN	HANSFORD	CANADIAN
SPEARMAN	010849000	A	0849	0573	098	01	01		A	098	01	09821	OGALLALA	892	892	892	892	892	892	HISTORICAL MAX	Updated 4/1/00			MUN	HANSFORD	CANADIAN
SPEARMAN	010849000	A	0849	0573	098	01	00		A	098	01	01020	PALO DURO	0	0	0	0	0	0	Waiting for info from PDRA	Updated 2/14/00	H: Corrected to 00 for surface water M: Source ID with leading zero added. O-T: Value format changed to show "0" instead of "-"		MUN	HANSFORD	CANADIAN
STEAM ELECTRIC POWER	011002098	A	1002	1002	098	01	00		A	098	01	01020	PALO DURO	0	0	0	0	0	0	Waiting for info from PDRA	Updated 2/14/00	H: Corrected to 00 for surface water M: Source ID with leading zero added. O-T: Value format changed to show "0" instead of "-"		PWR	HANSFORD	CANADIAN
CHANNING	010159000	A	0159	0106	103	01	01		A	103	01	10321	OGALLALA	96	104	100	100	100	100	Ratioed among CATs w/ hist pumpage. Dallam supply subtracted from total supply before rationing.)	Updated 3/20/00			MUN	HARTLEY	CANADIAN
COUNTY-OTHER	010996103	A	0996	0757	103	01	01		A	103	01	10321	OGALLALA	362	368	362	362	362	362	HISTORICAL MAX, increased slightly in 2010 to meet demands	Updated 4/1/00			MUN	HARTLEY	CANADIAN
DALHART	010226000	A	0226	0150	103	01	01		A	103	01	10321	OGALLALA	755	818	793	791	791	803	Allocated to meet projected demands	Updated 3/20/00			MUN	HARTLEY	CANADIAN
IRRIGATION	011004103	A	1004	1004	103	01	01		A	103	01	10326	DOCKUM	382	382	381	380	380	379	Supply ratioed b/tw IRR and STK (only two historical uses in gw_pumpage.xls)	Updated 3/20/00			IRR	HARTLEY	CANADIAN
IRRIGATION	011004103	A	1004	1004	103	01	01		A	103	01	10321	OGALLALA	377,956	377,474	377,069	376,761	375,219	374,887	remainder of available supply	Update 11-25-00	BEG supply revised 11/25. Values corrected accordingly.		IRR	HARTLEY	CANADIAN
IRRIGATION	011004103	A	1004	1004	103	01	00		A	103	01	36009	REUSE: BaZoCou 01-02-103	240	258	250	248	247	249	All reuse assumed to IRR unless otherwise specified.	Get w/ TLS re: reuse allocations			IRR	HARTLEY	CANADIAN
LIVESTOCK	011005103	A	1005	1005	103	01	01		A	103	01	10326	DOCKUM	8	8	9	10	10	11	Supply ratioed b/tw IRR and STK (only two historical uses in gw_pumpage.xls)	Updated 3/20/00			STK	HARTLEY	CANADIAN
LIVESTOCK	011005103	A	1005	1005	103	01	00		A	103	01	01997	local supply - stock ponds	3,027	3,027	3,027	3,027	3,027	3,027	HISTORICAL MAXIMUM USE		Table 4 updated to include stock pond supply information B-G, K:Info added. M: ID added.		STK	HARTLEY	CANADIAN
LIVESTOCK	011005103	A	1005	1005	103	01	01		A	103	01	10321	OGALLALA	1,031	1,436	1,876	2,186	2,518	2,874	used demands	Updated 4/1/00			STK	HARTLEY	CANADIAN
CANADIAN	010142000	A	0142	0093	106	01	01		A	106	01	10621	OGALLALA	683	692	470	0	0	0	Based on City Survey Response for water rights area and Dutton values for aquifer availability. Assumes purchase of 1280 acres is completed.	Updated 3/20/00	R-T: Value format changed to show "0" instead of "-"		MUN	HEMPHILL	CANADIAN
COUNTY-OTHER	010996106	A	0996	0757	106	01	01		A	106	01	10621	OGALLALA	174	174	174	174	174	174	HISTORICAL MAXIMUM USE	Updated 4/1/00			MUN	HEMPHILL	CANADIAN
COUNTY-OTHER	010996106	A	0996	0757	106	02	01		A	106	02	10621	OGALLALA	106	106	106	106	106	106	HISTORICAL MAXIMUM USE	Updated 4/1/00	G: Corrected to 2 for Red Basin		MUN	HEMPHILL	RED
IRRIGATION	011004106	A	1004	1004	106	01	01		A	106	01	10621	OGALLALA	946	946	946	946	946	946	HISTORICAL MAXIMUM USE	Updated 4/1/00			IRR	HEMPHILL	CANADIAN
IRRIGATION	011004106	A	1004	1004	106	02	01		A	106	02	10621	OGALLALA	3,424	3,424	3,424	3,424	3,424	3,424	Demands,	Updated 4/1/00	G: Corrected to 2 for Red Basin		IRR	HEMPHILL	RED
IRRIGATION	011004106	A	1004	1004	106	01	00		A	106	01	36010	REUSE: BaZoCou 01-02-106	125	126	121	116	110	107	All reuse assumed to IRR unless otherwise specified.	Get w/ TLS re: reuse allocations			IRR	HEMPHILL	CANADIAN
IRRIGATION	011004106	A	1004	1004	106	02	00		A	106	02	36027	REUSE: BaZoCou 02-01-106	13	13	12	11	10	10	All reuse assumed to IRR unless otherwise specified.	Get w/ TLS re: reuse allocations	M: Source ID added		IRR	HEMPHILL	RED
LIVESTOCK	011005106	A	1005	1005	106	01	00		A	106	01	01997	local supply - stock ponds	858	858	858	858	858	858	HISTORICAL MAXIMUM USE		Table 4 updated to include stock pond supply information B-G, K:Info added. M: ID added.		STK	HEMPHILL	CANADIAN
LIVESTOCK	011005106	A	1005	1005	106	02	00		A	106	02	02997	local supply - stock ponds	594	594	594	594	594	594	HISTORICAL MAXIMUM USE		Table 4 updated to include stock pond supply information B-G, K:Info added. M: ID added.		STK	HEMPHILL	RED
LIVESTOCK	011005106	A	1005	1005	106	01	01		A	106	01	10621	OGALLALA	572	572	572	572	572	572	HISTORICAL MAXIMUM USE	Updated 4/1/00			STK	HEMPHILL	CANADIAN
LIVESTOCK	011005106	A	1005	1005	106	02	00		A	106	02	10621	OGALLALA	396	396	396	396	396	396	Historical use		Row inserted to match SFK sheet.		STK	HEMPHILL	RED
BORGER	010100000	A	0100	0067	117	01	02	10	A	117	01	010A0	CRMWA SYSTEM	459	459	459	459	459	459	demands from Table 3	36,573	M: Added 010A0 for CRMWA System per TWDB comment.	CRMWA	MUN	HUTCHINSON	CANADIAN
BORGER	010100000	A	0100	0067	117	01	02	10	A	191	01	19721	CRMWA SYSTEM	232	232	232	232	232	232	demands from Table 3	36,573	M: Added 010A0 for CRMWA System per TWDB comment.	CRMWA	MUN	HUTCHINSON	CANADIAN
BORGER	010100000	A	0100	0067	117	01	02	10	A	191	02	19721	CRMWA SYSTEM	9	9	9	9	9	9	demands from Table 3	36,573	M: Added 010A0 for CRMWA System per TWDB comment.	CRMWA	MUN	HUTCHINSON	CANADIAN
BORGER	010100000	A	0100	0067	117	01	01		A	117	01	11721	OGALLALA	1,690	1,610	1,510	1,390	1,240	1,190	assume ground water supply developed to meet demands (total rights for 2475 af/y)	Updated 5/5/00			MUN	HUTCHINSON	CANADIAN
COUNTY-OTHER	010996117	A	0996	0757	117	01	01		A	117	01	11721	OGALLALA	1,120	1,120	1,120	1,120	1,120	1,120	HISTORICAL MAX USE	Updated 5/5/00			MUN	HUTCHINSON	CANADIAN
FRITCH	010320000	A	0320	0222	117	01	01		A	117	01	11721	OGALLALA	515	515	515	515	515	515	HISTORICAL MAX USE	Updated 5/5/00			MUN	HUTCHINSON	CANADIAN
IRRIGATION	011004117	A	1004	1004	117	01	01		A	117	01	11721	OGALLALA	41,758	41,758	41,758	41,758	41,758	41,758	Projected demands	Updated 11/25/00			IRR	HUTCHINSON	CANADIAN
LIVESTOCK	011005117	A	1005	1005	117	01	00		A	117	01	01997	local supply - stock ponds	994	994	994	994	994	994	HISTORICAL MAX USE	Updated 5/5/00	Table 4 updated to include stock pond supply information. M: ID added.		STK	HUTCHINSON	CANADIAN
LIVESTOCK	011005117	A	1005	1005	117	01	01		A	117	01	11721	OGALLALA	110	110	110	110	110	110	HISTORICAL MAX USE	Updated 5/5/00			STK	HUTCHINSON	CANADIAN
MANUFACTURING	011001117	A	1001	1001	117	01	02	10	A	117	01	010A0	CRMWA SYSTEM	1,310	1,310	1,310	1,310	1,310	1,310	Supply to Agrium via Borger		Row inserted to match SFK sheet.	CRMWA	MFG	HUTCHINSON	CANADIAN
MANUFACTURING	011001117	A	1001	1001	117	01	02	10	A	191	01	19721	CRMWA SYSTEM	663	663	663	663	663	663	Supply to Agrium via Borger		Row inserted to match SFK sheet.	CRMWA	MFG	HUTCHINSON	CANADIAN
MANUFACTURING	011001117	A	1001	1001	117	01	02	10	A	191	02	19721	CRMWA SYSTEM	27	27	27	27	27	27	Supply to Agrium via Borger		Row inserted to match SFK sheet.	CRMWA	MFG	HUTCHINSON	CANADIAN
MANUFACTURING	011001117	A	1001	1001	117	01	01		A	117	01	11721	OGALLALA	17,871	20,437	21,374	22,545	24,900	27,546	Projected demands	Updated 11/25/00			MFG	HUTCHINSON	CANADIAN
MINING	011003117	A	1003	1003	117	01	01		A	117	01	11721	OGALLALA	690	690	690	690	690	690	HISTORICAL MAX USE	Updated 5/5/00			MIN	HUTCHINSON	CANADIAN
STINNETT	010861000	A	0861	0582	117	01	01		A	117	01	11721	OGALLALA	485	485	485	485	485	485	HISTORICAL MAX	Updated 5/5/00			MUN	HUTCHINSON	CANADIAN
TCW Supply, Inc.	010996117	A	0996	0757	117	01	01		A	117	01	11721	OGALLALA	1,350	1,350	1,350	1,350	1,350	1,350	Based on maximum usage shown in 8/31/99 TNRCC fax to J. Atkinson. Water obtained from Phillips Petroleum Co., Engineered Carbons Co., and City of Borger. Source for each is assumed to be Ogallala.	Updated 2/11/00	B, D, E: Values added per TWDB comments Was 10100000, 100, blank		MUN	HUTCHINSON	CANADIAN
BOOKER	010099000	A	0099	0066	148	01	01		A	148	01	14821	OGALLALA	447	447	447	447	447	447	HISTORICAL MAX	Updated 4/1/00			MUN	LIPSCOMB	CANADIAN
COUNTY-OTHER	010996148	A	0996	0757	148	01	01		A	148	01	14821	OGALLALA	441	431	425	421	409	397	HISTORICAL MAX - excess to meet other WUG demands	Updated 12/1/00			MUN	LIPSCOMB	CANADIAN
IRRIGATION	011004148	A	1004	1004	148	01	00		A	148	01	148996	IRRIGATION LOCAL SUPPLY1 - 148 - 1	73	70	70	69	68	67	All irrigation supply to IRR and STK unless otherwise specified..	Updated 2/14/00			IRR	LIPSCOMB	CANADIAN
IRRIGATION	011004148	A	1004	1004	148	01	01		A	148	01	14821	OGALLALA	35,025	35,025	35,025	35,025	35,025	35,025	INCREASED ABOVE 125% HISTORICAL MAX to meet demands	Updated 4/17/00			IRR	LIPSCOMB	CANADIAN
IRRIGATION	011004148	A	1004	1004	148	01	00		A	148	01	36002	REUSE: BaZoCou 01-01-148	34	34	33	32	31	30	All reuse assumed to IRR unless otherwise specified.	Get w/ TLS re: reuse allocations			IRR	LIPSCOMB	CANADIAN
LIPSCOMB	010526000	A	0526	0359	148	01	01		A	148	01	14821	OGALLALA	46	46	46	46	46	46	HISTORICAL MAX	Updated 4/1/00			MUN	LIPSCOMB	CANADIAN
LIVESTOCK	011005148	A	1005	1005	148	01	00		A	148	01	148996	IRRIGATION LOCAL SUPPLY1 - 148 - 1	2	5	5	6	7	8	All irrigation supply to IRR and STK unless otherwise specified..	Updated 2/14/00			STK	LIPSCOMB	CANADIAN
LIVESTOCK	011005148	A	1005	1005	148	01	00		A	148	01	01997	local supply - stock ponds	1,547	1,547	1,547	1,547	1,547	1,547	HISTORICAL MAX USE	Updated 4/1/00	Table 4 updated to include stock pond supply information. M: ID added.		STK	LIPSCOMB	CANADIAN
LIVESTOCK	011005148	A	1005	1005	148	01	01		A	148	01	14821	OGALLALA	172	729	1,093	1,454	1,870	2,351	125% HISTORICAL MAX, increased to meet demands	Updated 5/4/00			STK	LIPSCOMB	CANADIAN
MANUFACTURING	011001148	A	1001	1001	148	01	01		A	148	01	14821	OGALLALA	156	166	172	176	188	200	Increased to meet projected demands	Updated 12/01/00			MFG	LIPSCOMB	CANADIAN
MINING	011003148	A	1003	1003	148	01	01		A	148	01	14821	OGALLALA	9	9	9	9	9	9	125% HISTORICAL MAX	Updated 4/1/00			MIN	LIPSCOMB	CANADIAN
CACTUS	010134000	A	0134	0762	171	01	01		A	171	01	17121	OGALLALA	445	476	511	0	0	0	Maximum use scenario - from storage, revised per Dutton Ogallala supply correction	Updated 11/25/00	S-T: Value format changed to show "0" instead of "-"		MUN	MOORE	CANADIAN
COUNTY-OTHER	010996171	A	0996	0757	171	01	01		A	171	01	17121	OGALLALA	453	452	441	0	0	0	Maximum use scenario - from storage, revised per Dutton Ogallala supply correction	Updated 11/25/00	S-T: Value format changed to show "0" instead of "-"		MUN	MOORE	CANADIAN
DUMAS	010255000	A	0255	0170	171	01	01		A	171	01	17121	OGALLALA	2,833	3,022	3,200	0	0	0	Maximum use scenario - from storage, revised per Dutton Ogallala supply correction	Updated 11/25/00	S-T: Value format changed to show "0" instead of "-"		MUN	MOORE	CANADIAN
IRRIGATION	011004171	A	1004	1004	171	01	01		A	171	01	17126	DOCKUM	3	3	3	3	3	3	AVAILABLE STORAGE				IRR	MOORE	CANADIAN
IRRIGATION	011004171	A	1004	1004	171	01	01		A	171	01	17121	OGALLALA	200,579	200,579	179,181	0	0	0	Maximum use scenario - from storage, revised per Dutton Ogallala supply correction	Updated 11/25/00	S-T: Value format changed to show "0" instead of "-"		IRR	MOORE	CANADIAN
LIVESTOCK	011005171	A	1005	1005	171	01	00		A	171	01	01997	local supply - stock ponds	1,600	1,600	1,600	1,600	1,600	1,600			Table 4 updated to include stock pond supply information. M: ID added.		STK	MOORE	CANADIAN
LIVESTOCK	011005171	A	1005	1005	171	01	01		A	171	01	17121	OGALLALA	1,910	5,558	7,293	0	0	0	Maximum use scenario - from storage, revised per Dutton Ogallala supply correction	Updated 11/25/00	S-T: Value format changed to show "0" instead of "-"		STK	MOORE	CANADIAN
MANUFACTURING	011001171	A	1001	1001	171	01	01		A	171	01	17121	OGALLALA	7,238	7,712	8,035	0	0	0	Maximum use scenario - from storage, revised per Dutton Ogallala supply correction	Updated 11/25/00	S-T: Value format changed to show "0" instead of "-"		MFG	MOORE	CANADIAN
MINING	011003171	A	1003	1003	171	01	00		A	171	01	01999	Local Supply	1,658	1,658	1,658	1,658	1,658	1,658			M: Valued added per SFK sheet		MIN	MOORE	CANADIAN
MINING	011003171	A	1003	1003	171	01	01		A	171	01	17121	OGALLALA	0	0	300	0	0	0	Maximum use scenario - from storage, revised per Dutton Ogallala supply correction	Updated 11/25/00	O-T: Value format changed to show "0" instead of "-"		MIN	MOORE	CANADIAN
STEAM ELECTRIC POWER	011002171	A	1002	1002	171	01	01		A	171	01	17121	OGALLALA	200	200	200	0	0	0	Maximum use scenario - from storage, revised per Dutton Ogallala supply correction	Updated 11/25/00	S-T: Value format changed to show "0" instead of "-"		PWR	MOORE	CANADIAN
SUNRAY	010872000	A	0872	0588	171	01	01		A	171	01	17121	OGALLALA	492	560	630	0	0	0	Maximum use scenario - from storage, revised per Dutton Ogallala supply correction	Updated 11/25/00	S-T: Value format changed to show "0" instead of "-"		MUN	MOORE	CANADIAN
BOOKER	010099000	A	0099	0066	179	01	01		A	179	01	17921	OGALLALA	7	7	7	7	7	7	historical max	Updated 5/03/00			MUN	OCHILTREE	CANADIAN
COUNTY-OTHER	010996179	A	0996	0757	179	01	01		A	179	01	17921	OGALLALA	255	319	319	319	319	319	historical max	Updated 5/03/00			MUN	OCHILTREE	CANADIAN
IRRIGATION	011004179	A	1004	1004	179	01	01		A	179	01	17921	OGALLALA	56,388	56,388	56,388	56,388	56,388	56,388	Used TAES 1997 historical use	Updated 3/20/00			IRR	OCHILTREE	CANADIAN

Table 5: Current Water Supplies Available to the PWPG by City and Category

LIVESTOCK	011005179	A	1005	1005	179	01	00		A	179	01	01997	local supply - stock ponds	2,183	2,183	2,183	2,183	2,183	2,183	HISTORICAL MAX USE	Updated 4/1/00	Table 4 updated to include stock pond supply information M: Source ID corrected, was 17921.		STK	OCHILTREE	CANADIAN
LIVESTOCK	011005179	A	1005	1005	179	01	01		A	179	01	17921	OGALLALA	6,747	6,747	6,747	7,200	8,400	9,714	TAES 2000 USE, increased to meet demands	Updated 4/1/00			STK	OCHILTREE	CANADIAN
MINING	011003179	A	1003	1003	179	01	01		A	179	01	17921	OGALLALA	234	234	234	234	234	234	HISTORICAL MAX	Updated 4/1/00			MIN	OCHILTREE	CANADIAN
PERRYTON	010689000	A	0689	0461	179	01	01		A	179	01	17921	OGALLALA	2,468	986	0	0	0	0	Based on City survey for developed water rights only	Updated 5/5/00	Q-T: Value format changed to show "0" instead of "-"		MUN	OCHILTREE	CANADIAN
COUNTY-OTHER	010996180	A	0996	0757	180	01	01		A	180	01	18026	DOCKUM	144	144	144	144	144	144	125% HISTORICAL MAX	Updated 4/1/00			MUN	OLDHAM	CANADIAN
COUNTY-OTHER	010996180	A	0996	0757	180	01	01		A	180	01	18021	OGALLALA	2,322	2,319	2,308	2,297	2,283	0	Maximum use scenario - from storage	Updated 4/1/00	T: Value format changed to show "0" instead of "-"		MUN	OLDHAM	CANADIAN
COUNTY-OTHER	010996180	A	0996	0757	180	02	01		A	180	02	18021	OGALLALA	30	29	27	26	23	0	Maximum use scenario - from storage	Updated 3/20/00	T: Value format changed to show "0" instead of "-"		MUN	OLDHAM	RED
IRRIGATION	011004180	A	1004	1004	180	01	01		A	180	01	18026	DOCKUM	516	516	516	516	516	516	125% HISTORICAL MAX	Updated 4/1/00			IRR	OLDHAM	CANADIAN
IRRIGATION	011004180	A	1004	1004	180	02	01		A	180	02	18026	DOCKUM	33	33	33	33	33	33	125% HISTORICAL MAX	Updated 4/1/00			IRR	OLDHAM	RED
IRRIGATION	011004180	A	1004	1004	180	01	01		A	180	01	18021	OGALLALA	7,700	7,700	7,700	7,700	6,854	0	Maximum use scenario - from storage	Updated 3/30/00	T: Value format changed to show "0" instead of "-"		IRR	OLDHAM	CANADIAN
IRRIGATION	011004180	A	1004	1004	180	02	01		A	180	02	18021	OGALLALA	18,249	18,249	18,249	18,249	16,666	0	Maximum use scenario - from storage	Updated 3/30/00	T: Value format changed to show "0" instead of "-"		IRR	OLDHAM	RED
LIVESTOCK	011005180	A	1005	1005	180	01	01		A	180	01	18026	DOCKUM	145	145	145	181	200	578	increased from historical max to meet demands	Updated 5/4/00			STK	OLDHAM	CANADIAN
LIVESTOCK	011005180	A	1005	1005	180	02	01		A	180	02	18026	DOCKUM	12	14	18	22	27	34	increased from historical max to meet demands	Updated 2/14/00			STK	OLDHAM	RED
LIVESTOCK	011005180	A	1005	1005	180	01	00		A	180	01	01997	local supply - stock ponds	1,855	1,855	1,855	1,855	1,855	1,855	HISTORICAL MAX USE	Updated 4/1/00	Table 4 updated to include stock pond supply information. M: ID added.		STK	OLDHAM	CANADIAN
LIVESTOCK	011005180	A	1005	1005	180	02	00		A	180	02	02997	local supply - stock ponds	108	108	108	108	108	108			Table 4 updated to include stock pond supply information J: RWPG A listed for supply. B-G, K: Info added. M: ID added.		STK	OLDHAM	RED
LIVESTOCK	011005180	A	1005	1005	180	01	01		A	180	01	18021	OGALLALA	0	0	0	64	204	0	Maximum use scenario - from storage	Updated 5/4/00	O-T: Value format changed to show "0" instead of "-"		STK	OLDHAM	CANADIAN
LIVESTOCK	011005180	A	1005	1005	180	02	01		A	180	02	18021	OGALLALA	0	0	0	0	0	0	Maximum use scenario - from storage	Updated 3/20/00	O-T: Value format changed to show "0" instead of "-"		STK	OLDHAM	RED
MINING	011003180	A	1003	1003	180	01	01		A	180	01	18026	DOCKUM	283	283	283	283	283	283	HISTORICAL MAX	Updated 5/5/00			MIN	OLDHAM	CANADIAN
MINING	011003180	A	1003	1003	180	02	01		A	180	02	18026	DOCKUM	3	3	3	3	3	3	Ratioed among CATs w/ hist pumpage.	Updated 2/14/00			MIN	OLDHAM	RED
MINING	011003180	A	1003	1003	180	01	01		A	180	01	18021	OGALLALA	0	0	0	0	0	0	Maximum use scenario - from storage	Updated 4/1/00	O-T: Value format changed to show "0" instead of "-"		MIN	OLDHAM	CANADIAN
MINING	011003180	A	1003	1003	180	02	01		A	180	02	18021	OGALLALA	268	276	284	293	302	0	Maximum use scenario - from storage	Updated 3/20/00	T: Value format changed to show "0" instead of "-"		MIN	OLDHAM	RED
VEGA	010928000	A	0928	0622	180	01	01		A	180	01	18021	OGALLALA	66	68	67	67	63	0	Maximum use scenario - from storage	Updated 3/20/00	T: Value format changed to show "0" instead of "-"		MUN	OLDHAM	CANADIAN
VEGA	010928000	A	0928	0622	180	02	01		A	180	02	18021	OGALLALA	199	205	202	203	192	0	Maximum use scenario - from storage	Updated 4/1/00	T: Value format changed to show "0" instead of "-"		MUN	OLDHAM	RED
AMARILLO	010020000	A	0020	0014	188	01	02	17600	A	117	01	010A0	AMARILLO SYSTEM	8,425	8,141	7,973	7,842	7,575	6,761	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Lake Meredith via CRMWA system set to ~48.55%	Updated 12/01/00		AMARILLO	MUN	POTTER	CANADIAN
AMARILLO	010020000	A	0020	0014	188	01	02	17600	A	191	01	19721	AMARILLO SYSTEM	2,929	2,830	2,771	2,726	2,633	2,350	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Roberts County/Canadian/Ogallala via CRMWA system set to ~24.56%	Updated 12/01/00		AMARILLO	MUN	POTTER	CANADIAN
AMARILLO	010020000	A	0020	0014	188	01	02	17600	A	191	02	19721	AMARILLO SYSTEM	119	115	112	111	107	95	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Roberts County/Red/Ogallala via CRMWA system set to ~1.00%	Updated 12/01/00		AMARILLO	MUN	POTTER	CANADIAN
AMARILLO	010020000	A	0020	0014	188	01	02	17600	A	033	01	03321	AMARILLO SYSTEM	649	799	978	1,188	1,062	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Carson County/Canadian/Ogallala via CRMWA system set to ~6.42%	Updated 12/01/00		AMARILLO	MUN	POTTER	CANADIAN
AMARILLO	010020000	A	0020	0014	188	01	02	17600	A	033	02	03321	AMARILLO SYSTEM	703	866	1,060	1,287	1,150	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Carson County/Red/Ogallala via CRMWA system set to ~16.95%	Updated 12/01/00		AMARILLO	MUN	POTTER	CANADIAN
AMARILLO	010020000	A	0020	0014	188	01	02	17600	A	059	02	05921	AMARILLO SYSTEM	22	27	33	40	36	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Deaf Smith County/Red/Ogallala via CRMWA system set to ~0.22%	Updated 12/01/00		AMARILLO	MUN	POTTER	CANADIAN
AMARILLO	010020000	A	0020	0014	188	01	02	17600	A	188	01	18821	AMARILLO SYSTEM	931	1,146	1,403	1,704	1,523	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Potter County/Canadian/Ogallala via CRMWA system set to ~9.21%	Updated 12/01/00		AMARILLO	MUN	POTTER	CANADIAN
AMARILLO	010020000	A	0020	0014	188	01	02	17600	A	188	02	18821	AMARILLO SYSTEM	204	252	308	374	334	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Potter County/Red/Ogallala via CRMWA system set to ~2.02%	Updated 12/01/00		AMARILLO	MUN	POTTER	CANADIAN
AMARILLO	010020000	A	0020	0014	188	01	02	17600	A	191	02	19121	AMARILLO SYSTEM	110	135	165	201	180	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Randall County/Red/Ogallala via CRMWA system set to ~1.09%	Updated 12/01/00		AMARILLO	MUN	POTTER	CANADIAN
AMARILLO	010020000	A	0020	0014	188	02	02	17600	A	117	01	010A0	AMARILLO SYSTEM	6,289	6,077	5,951	5,853	5,654	5,047	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Lake Meredith via CRMWA system set to ~48.55%	Updated 12/01/00		AMARILLO	MUN	POTTER	RED
AMARILLO	010020000	A	0020	0014	188	02	02	17600	A	191	01	19721	AMARILLO SYSTEM	2,186	2,111	2,068	2,035	1,965	1,754	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Roberts County/Canadian/Ogallala via CRMWA system set to ~24.56%	Updated 12/01/00		AMARILLO	MUN	POTTER	RED
AMARILLO	010020000	A	0020	0014	188	02	02	17600	A	191	02	19721	AMARILLO SYSTEM	89	86	84	83	80	71	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Roberts County/Red/Ogallala via CRMWA system set to ~1.00%	Updated 12/01/00		AMARILLO	MUN	POTTER	RED
AMARILLO	010020000	A	0020	0014	188	02	02	17600	A	033	01	03321	AMARILLO SYSTEM	485	597	730	887	793	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Carson County/Canadian/Ogallala via CRMWA system set to ~6.42%	Updated 12/01/00		AMARILLO	MUN	POTTER	RED
AMARILLO	010020000	A	0020	0014	188	02	02	17600	A	033	02	03321	AMARILLO SYSTEM	525	646	791	961	859	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Carson County/Red/Ogallala via CRMWA system set to ~16.95%	Updated 12/01/00		AMARILLO	MUN	POTTER	RED
AMARILLO	010020000	A	0020	0014	188	02	02	17600	A	059	02	05921	AMARILLO SYSTEM	16	20	25	30	27	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Deaf Smith County/Red/Ogallala via CRMWA system set to ~0.22%	Updated 12/01/00		AMARILLO	MUN	POTTER	RED
AMARILLO	010020000	A	0020	0014	188	02	02	17600	A	188	01	18821	AMARILLO SYSTEM	695	856	1,047	1,272	1,137	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Potter County/Canadian/Ogallala via CRMWA system set to ~9.21%	Updated 12/01/00		AMARILLO	MUN	POTTER	RED
AMARILLO	010020000	A	0020	0014	188	02	02	17600	A	188	02	18821	AMARILLO SYSTEM	152	188	230	279	249	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Potter County/Red/Ogallala via CRMWA system set to ~2.02%	Updated 12/01/00		AMARILLO	MUN	POTTER	RED
AMARILLO	010020000	A	0020	0014	188	02	02	17600	A	191	02	19121	AMARILLO SYSTEM	82	101	123	150	134	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Randall County/Red/Ogallala via CRMWA system set to ~1.09%	Updated 12/01/00		AMARILLO	MUN	POTTER	RED
AMARILLO	010020000	A	0020	0014	188	01	01		A	188	01	18821	OGALLALA	0	0	0	0	0	0	Maximum use scenario - from storage, revised per Dutton Ogallala supply correction	revised 11/25/00	J: RWPG A listed for supply. T: Value format changed to show "0" instead of "-" K: Supply county added.		MUN	POTTER	CANADIAN
AMARILLO	010020000	A	0020	0014	188	02	01		A	188	02	18821	OGALLALA	0	0	0	0	0	0	calculated separately	updated 3/30/00	Q-T: Value format changed to show "0" instead of "-" K: Supply county added.		MUN	POTTER	RED
COUNTY-OTHER	010996188	A	0996	0757	188	01	01		A	188	01	18826	DOCKUM	506	506	506	506	506	506	Ratioed among CATs w/ hist pumpage.	Updated 2/14/00	J: RWPG A listed for supply.		MUN	POTTER	CANADIAN
COUNTY-OTHER	010996188	A	0996	0757	188	02	01		A	188	02	18826	DOCKUM	69	69	69	69	69	69	125% HISTORICAL MAX	Updated 4/1/00	K: Supply County added		MUN	POTTER	RED
COUNTY-OTHER	010996188	A	0996	0757	188	01	01		A	188	01	18821	OGALLALA	1,172	1,149	1,142	1,200	180	0	Maximum use scenario - from storage, revised per Dutton Ogallala supply correction	revised 11/25/00	J: RWPG A listed for supply. T: Value format changed to show "0" instead of "-" K: Supply county added.		MUN	POTTER	CANADIAN
COUNTY-OTHER	010996188	A	0996	0757	188	02	01		A	188	02	18821	OGALLALA	250	247	247	256	0	0	Maximum use scenario - from storage, revised per Dutton Ogallala supply correction	revised 11/25/00	Q-T: Value format changed to show "0" instead of "-" K: Supply County added		MUN	POTTER	RED
IRRIGATION	011004188	A	1004	1004	188	01	01		A	188	01	18826	DOCKUM	0	0	0	0	0	0	125% HISTORICAL MAX	Updated 4/1/00	J: RWPG A listed for supply. K: Supply County added O-T: Value format changed to show "0" instead of "-"		IRR	POTTER	CANADIAN
IRRIGATION	011004188	A	1004	1004	188	02	01		A	188	02	18826	DOCKUM	0	0	0	0	0	0	125% HISTORICAL MAX	Updated 4/1/00	K: Supply County added O-T: Value format changed to show "0" instead of "-"		IRR	POTTER	RED
IRRIGATION	011004188	A	1004	1004	188	01	00		A	188	01	188996	IRRIGATION LOCAL SUPPLY1 - 188 - 2	328	327	326	325	324	322	All irrigation supply to IRR and STK unless otherwise specified..	Updated 2/14/00	J: RWPG A listed for supply.		IRR	POTTER	CANADIAN

Table 5: Current Water Supplies Available to the PWPG by City and Category

IRRIGATION	011004188	A	1004	1004	188	02	00		A	188	02	188996	IRRIGATION LOCAL SUPPLY2 - 188 - 1	1,359	1,359	1,359	1,358	1,358	1,357	All irrigation supply to IRR and STK unless otherwise specified..		K: Supply County added		IRR	POTTER	RED
IRRIGATION	011004188	A	1004	1004	188	01	01		A	188	01	18821	OGALLALA	8,951	8,680	8,344	7,911	1,053	0	Maximum use scenario - from storage, revised per Dutton Ogallala supply correction	revised 11/25/00	J: RWPG A listed for supply. T: Value format changed to show "0" instead of "-" K: Supply county added.		IRR	POTTER	CANADIAN
IRRIGATION	011004188	A	1004	1004	188	02	01		A	188	02	18821	OGALLALA	8,539	8,336	8,085	2,374	0	0	Maximum use scenario - from storage, revised per Dutton Ogallala supply correction	revised 11/25/00	Q-T: Value format changed to show "0" instead of "-" K: Supply county added.		IRR	POTTER	RED
IRRIGATION	011004188	A	1004	1004	188	01	00		A	188	02	36030	REUSE: BaZoCou 02-01-188	0	0	0	323	671	1,120	Allocation from reuse source with remaining supply	Added 12/5/00			IRR	POTTER	CANADIAN
IRRIGATION	011004188	A	1004	1004	188	02	00		A	188	02	36030	REUSE: BaZoCou 02-01-188	0	0	0	244	506	845	Allocation from reuse source with remaining supply	Added 12/5/00			IRR	POTTER	RED
IRRIGATION	011004188	A	1004	1004	188	01	00		A	191	02	36031	REUSE: BaZoCou 02-01-191	2,935	3,207	3,544	3,655	2,434	1,254	Remaining reuse supply in Potter and Randall county after PWR allocation	Updated 11/29/00			IRR	POTTER	CANADIAN
IRRIGATION	011004188	A	1004	1004	188	02	00		A	191	02	36031	REUSE: BaZoCou 02-01-191	2,191	2,394	2,645	2,728	4,148	5,527	Remaining reuse supply in Potter and Randall county after PWR allocation	Updated 11/29/00			IRR	POTTER	RED
LIVESTOCK	011005188	A	1005	1005	188	01	01		A	188	01	18826	DOCKUM	13	13	13	13	13	13	HISTORICAL MAX	Updated 4/1/00	J: RWPG A listed for supply. K: Supply County added		STK	POTTER	CANADIAN
LIVESTOCK	011005188	A	1005	1005	188	02	01		A	188	02	18826	DOCKUM	13	13	13	13	13	13	HISTORICAL MAX	Updated 4/1/00	K: Supply County added		STK	POTTER	RED
LIVESTOCK	011005188	A	1005	1005	188	01	00		A	188	01	188996	IRRIGATION LOCAL SUPPLY1 - 188 - 2	12	13	14	15	16	18	All irrigation supply to IRR and STK unless otherwise specified..	Updated 2/14/00	J: RWPG A listed for supply. K: Supply County added		STK	POTTER	CANADIAN
LIVESTOCK	011005188	A	1005	1005	188	02	00		A	188	02	188996	IRRIGATION LOCAL SUPPLY2 - 188 - 1	4	4	4	5	5	6	All irrigation supply to IRR and STK unless otherwise specified..		K: Supply County added		STK	POTTER	RED
LIVESTOCK	011005188	A	1005	1005	188	01	00		A	188	01	01997	local supply - stock ponds	736	736	736	736	736	736	HISTORICAL MAXIMUM USE		Table 4 updated to include stock pond supply information B-G, K:Info added. M: ID added.		STK	POTTER	CANADIAN
LIVESTOCK	011005188	A	1005	1005	188	02	00		A	188	02	02997	local supply - stock ponds	56	56	56	56	56	56	HISTORICAL MAXIMUM USE		Table 4 updated to include stock pond supply information B-G, K:Info added. M: ID added.		STK	POTTER	RED
LIVESTOCK	011005188	A	1005	1005	188	01	01		A	188	01	18821	OGALLALA	0	0	0	0	0	0	Maximum use scenario - from storage, revised per Dutton Ogallala supply correction	revised 11/25/00	J: RWPG A listed for supply. O-T: Value format changed to show "0" instead of "-" K: Supply county added.		STK	POTTER	CANADIAN
LIVESTOCK	011005188	A	1005	1005	188	02	01		A	188	02	18821	OGALLALA	0	0	0	0	0	0	used demands until supply exhausted	updated 3/30/00	O-T: Value format changed to show "0" instead of "-" K: Supply county added.		STK	POTTER	RED
MANUFACTURING	011001188	A	1001	1001	188	01	02	17600	A	117	01	010A0	AMARILLO SYSTEM	423	419	397	388	398	580	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Lake Meredith via CRMWA system set to ~48.55%. Table 3 demands.	Updated 12/01/00		AMARILLO	MFG	POTTER	CANADIAN
MANUFACTURING	011001188	A	1001	1001	188	01	02	17600	A	191	01	19721	AMARILLO SYSTEM	147	146	138	135	138	201	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Roberts County/Canadian/Ogallala via CRMWA system set to ~24.56%. Table 3 demands.	Updated 12/01/00		AMARILLO	MFG	POTTER	CANADIAN
MANUFACTURING	011001188	A	1001	1001	188	01	02	17600	A	191	02	19721	AMARILLO SYSTEM	6	6	6	5	6	8	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Roberts County/Red/Ogallala via CRMWA system set to ~1.00%. Table 3 demands.	Updated 12/01/00		AMARILLO	MFG	POTTER	CANADIAN
MANUFACTURING	011001188	A	1001	1001	188	01	02	17600	A	033	01	03321	AMARILLO SYSTEM	32	41	49	59	56	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Carson County/Canadian/Ogallala via CRMWA system set to ~6.42%. Table 3 demands.	Updated 12/01/00		AMARILLO	MFG	POTTER	CANADIAN
MANUFACTURING	011001188	A	1001	1001	188	01	02	17600	A	033	02	03321	AMARILLO SYSTEM	35	45	53	64	60	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Carson County/Red/Ogallala via CRMWA system set to ~16.95%. Table 3 demands.	Updated 12/01/00		AMARILLO	MFG	POTTER	CANADIAN
MANUFACTURING	011001188	A	1001	1001	188	01	02	17600	A	059	02	05921	AMARILLO SYSTEM	1	1	2	2	2	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Deaf Smith County/Red/Ogallala via CRMWA system set to ~0.22%. Table 3 demands.	Updated 12/01/00		AMARILLO	MFG	POTTER	CANADIAN
MANUFACTURING	011001188	A	1001	1001	188	01	02	17600	A	188	01	18821	AMARILLO SYSTEM	47	59	69	85	80	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Potter County/Canadian/Ogallala via CRMWA system set to ~9.21%. Table 3 demands.	Updated 12/01/00		AMARILLO	MFG	POTTER	CANADIAN
MANUFACTURING	011001188	A	1001	1001	188	01	02	17600	A	188	02	18821	AMARILLO SYSTEM	10	13	15	19	18	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Potter County/Red/Ogallala via CRMWA system set to ~2.02%. Table 3 demands.	Updated 12/01/00		AMARILLO	MFG	POTTER	CANADIAN
MANUFACTURING	011001188	A	1001	1001	188	01	02	17600	A	191	02	19121	AMARILLO SYSTEM	5	7	8	10	9	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Randall County/Red/Ogallala via CRMWA system set to ~1.09%. Table 3 demands.	Updated 12/01/00		AMARILLO	MFG	POTTER	CANADIAN
MANUFACTURING	011001188	A	1001	1001	188	02	02	17600	A	117	01	010A0	AMARILLO SYSTEM	3,012	2,866	2,714	2,555	2,615	3,808	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Lake Meredith via CRMWA system set to ~48.55%. Contract with IBP.	Updated 12/01/00		AMARILLO	MFG	POTTER	RED
MANUFACTURING	011001188	A	1001	1001	188	02	02	17600	A	191	01	19721	AMARILLO SYSTEM	1,047	997	944	888	909	1,324	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Roberts County/Canadian/Ogallala via CRMWA system set to ~24.56%. Contract with IBP.	Updated 12/01/00		AMARILLO	MFG	POTTER	RED
MANUFACTURING	011001188	A	1001	1001	188	02	02	17600	A	191	02	19721	AMARILLO SYSTEM	42	40	38	36	37	54	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Roberts County/Red/Ogallala via CRMWA system set to ~1.00%. Contract with IBP.	Updated 12/01/00		AMARILLO	MFG	POTTER	RED
MANUFACTURING	011001188	A	1001	1001	188	02	02	17600	A	033	01	03321	AMARILLO SYSTEM	232	282	333	387	367	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Carson County/Canadian/Ogallala via CRMWA system set to ~6.42%. Contract with IBP.	Updated 12/01/00		AMARILLO	MFG	POTTER	RED
MANUFACTURING	011001188	A	1001	1001	188	02	02	17600	A	033	02	03321	AMARILLO SYSTEM	252	305	361	419	397	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Carson County/Red/Ogallala via CRMWA system set to ~16.95%. Contract with IBP.	Updated 12/01/00		AMARILLO	MFG	POTTER	RED
MANUFACTURING	011001188	A	1001	1001	188	02	02	17600	A	059	02	05921	AMARILLO SYSTEM	8	9	11	13	12	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Deaf Smith County/Red/Ogallala via CRMWA system set to ~0.22%. Contract with IBP.	Updated 12/01/00		AMARILLO	MFG	POTTER	RED
MANUFACTURING	011001188	A	1001	1001	188	02	02	17600	A	188	01	18821	AMARILLO SYSTEM	333	404	477	555	526	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Potter County/Canadian/Ogallala via CRMWA system set to ~9.21%. Contract with IBP.	Updated 12/01/00		AMARILLO	MFG	POTTER	RED
MANUFACTURING	011001188	A	1001	1001	188	02	02	17600	A	188	02	18821	AMARILLO SYSTEM	73	89	105	122	115	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Potter County/Red/Ogallala via CRMWA system set to ~2.02%. Contract with IBP.	Updated 12/01/00		AMARILLO	MFG	POTTER	RED
MANUFACTURING	011001188	A	1001	1001	188	02	02	17600	A	191	02	19121	AMARILLO SYSTEM	39	48	56	65	62	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Randall County/Red/Ogallala via CRMWA system set to ~1.09%. Contract with IBP.	Updated 12/01/00		AMARILLO	MFG	POTTER	RED
MANUFACTURING	011001188	A	1001	1001	188	01	01		A	188	01	18821	OGALLALA	418	489	563	610	99	0	Maximum use scenario - from storage, revised per Dutton Ogallala supply correction	revised 11/25/00	J: RWPG A listed for supply. O-T: Value format changed to show "0" instead of "-" K: Supply county added.		MFG	POTTER	CANADIAN
MANUFACTURING	011001188	A	1001	1001	188	02	01		A	188	02	18821	OGALLALA	0	0	0	0	0	0	used demands until supply exhausted	updated 3/30/00	Q-T: Value format changed to show "0" instead of "-" K: Supply county added.		MFG	POTTER	RED
MINING	011003188	A	1003	1003	188	01	01		A	188	01	18821	OGALLALA	276	222	223	224	32	0	Maximum use scenario - from storage, revised per Dutton Ogallala supply correction	revised 11/25/00	J: RWPG A listed for supply. T: Value format changed to show "0" instead of "-" K: Supply county added.		MIN	POTTER	CANADIAN
MINING	011003188	A	1003	1003	188	02	01		A	188	02	18821	OGALLALA	154	159	164	169	0	0	Maximum use scenario - from storage, revised per Dutton Ogallala supply correction	revised 11/25/00	Q-T: Value format changed to show "0" instead of "-" K: Supply county added.		MIN	POTTER	RED

Table 5: Current Water Supplies Available to the PWPG by City and Category

STEAM ELECTRIC POWER	011002188	A	1002	1002	188	01	02	10	A	117	01	010A0	CRMWA SYSTEM	485	593	670	708	750	791	Table 3 demands - SPS	Updated 2/14/00	Corrected supply source to CRMWA from Amarillo System	CRMWA	PWR	POTTER	CANADIAN
STEAM ELECTRIC POWER	011002188	A	1002	1002	188	01	02	10	A	191	01	19721	CRMWA SYSTEM	245	300	339	358	379	400	Table 3 demands - SPS	Updated 2/14/00	Corrected supply source to CRMWA from Amarillo System	CRMWA	PWR	POTTER	CANADIAN
STEAM ELECTRIC POWER	011002188	A	1002	1002	188	01	02	10	A	191	02	19721	CRMWA SYSTEM	10	12	14	15	15	16	Table 3 demands - SPS	Updated 2/14/00	Corrected supply source to CRMWA from Amarillo System	CRMWA	PWR	POTTER	CANADIAN
STEAM ELECTRIC POWER	011002188	A	1002	1002	188	01	01		A	188	01	18821	OGALLALA	4,616	8,583	11,420	12,779	2,026	0	Maximum use scenario - from storage, revised per Dutton Ogallala supply correction	revised 11/25/00	J: RWPG A listed for supply. T: Value format changed to show "0" instead of "-" K: Supply County added		PWR	POTTER	CANADIAN
STEAM ELECTRIC POWER	011002188	A	1002	1002	188	02	01		A	188	02	18821	OGALLALA	0	0	0	0	0	0	used demands until supply exhausted	updated 3/30/00	O-T: Value format changed to show "0" instead of "-" K: Supply county added.		PWR	POTTER	RED
STEAM ELECTRIC POWER	011002188	A	1002	1002	188	01	00		A	188	01	36014	REUSE: BaZoCou 01-02-188	7,046	7,155	7,401	7,736	8,086	8,537	Represents SPS reuse,allocating Potter reuse first, followed by Randall reuse supply.	Updated 11/29/00			PWR	POTTER	CANADIAN
STEAM ELECTRIC POWER	011002188	A	1002	1002	188	01	00		A	188	02	36030	REUSE: BaZoCou 02-01-188	5,259	5,341	5,524	5,208	4,858	4,407	Represents SPS reuse,allocating Potter reuse first, followed by Randall reuse supply.	Updated 11/29/00			PWR	POTTER	CANADIAN
STEAM ELECTRIC POWER	011002188	A	1002	1002	188	02	00		A	188	02	36030	REUSE: BaZoCou 02-01-188	0	0	0	0	0	0	ALL DEMANDS IN CANADIAN BASIN	Updated 11/29/00			PWR	POTTER	RED
STEAM ELECTRIC PC	011002188	A	1002	1002	188	02	00		A	191	02	36031	REUSE: BaZoCou 02-01-191	639	448	19	0	0	0	All demands are in Potter county. Reuse allocated only to Potter County, Canadian basin	Updated 11/29/00			PWR	POTTER	CANADIAN
AMARILLO	010020000	A	0020	0014	191	02	02	17600	A	117	01	010A0	AMARILLO SYSTEM	11,814	12,473	12,830	13,323	13,685	12,989	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Lake Meredith via CRMWA system set to ~48.55%	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
AMARILLO	010020000	A	0020	0014	191	02	02	17600	A	191	01	19721	AMARILLO SYSTEM	4,107	4,336	4,460	4,632	4,757	4,516	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Roberts County/Canadian/Ogallala via CRMWA system set to ~24.56%	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
AMARILLO	010020000	A	0020	0014	191	02	02	17600	A	191	02	19721	AMARILLO SYSTEM	167	176	181	188	193	183	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Roberts County/Red/Ogallala via CRMWA system set to ~1.00%	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
AMARILLO	010020000	A	0020	0014	191	02	02	17600	A	033	01	03321	AMARILLO SYSTEM	911	1,225	1,574	2,018	1,919	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Carson County/Canadian/Ogallala via CRMWA system set to ~6.42%	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
AMARILLO	010020000	A	0020	0014	191	02	02	17600	A	033	02	03321	AMARILLO SYSTEM	986	1,327	1,705	2,187	2,079	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Carson County/Red/Ogallala via CRMWA system set to ~16.95%	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
AMARILLO	010020000	A	0020	0014	191	02	02	17600	A	059	02	05921	AMARILLO SYSTEM	31	41	53	68	64	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Deaf Smith County/Red/Ogallala via CRMWA system set to ~0.22%	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
AMARILLO	010020000	A	0020	0014	191	02	02	17600	A	188	01	18821	AMARILLO SYSTEM	1,306	1,757	2,258	2,895	2,752	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Potter County/Canadian/Ogallala via CRMWA system set to ~9.21%	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
AMARILLO	010020000	A	0020	0014	191	02	02	17600	A	188	02	18821	AMARILLO SYSTEM	287	386	495	635	604	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Potter County/Red/Ogallala via CRMWA system set to ~2.02%	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
AMARILLO	010020000	A	0020	0014	191	02	02	17600	A	191	02	19121	AMARILLO SYSTEM	154	207	266	341	324	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Randall County/Red/Ogallala via CRMWA system set to ~1.09%	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
CANYON	010145000	A	0145	0096	191	02	02	17600	A	117	01	010A0	AMARILLO SYSTEM	1,388	1,384	1,508	1,419	1,453	2,116	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Lake Meredith via CRMWA system set to ~48.55%. 5 mgd (5,628 afy) contract limitation. Assume average day = 2.5 mgd. Increased supply to meet demands as Ogallala use becomes limited. B&V 1996 report.	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
CANYON	010145000	A	0145	0096	191	02	02	17600	A	191	01	19721	AMARILLO SYSTEM	483	482	524	493	505	735	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Roberts County/Canadian/Ogallala via CRMWA system set to ~24.56%. 5 mgd (5,628 afy) contract limitation. Assume average day = 2.5 mgd. Increased supply to meet demands as Ogallala use becomes limited. B&V 1996 report.	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
CANYON	010145000	A	0145	0096	191	02	02	17600	A	191	02	19721	AMARILLO SYSTEM	20	20	21	20	20	30	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Roberts County/Red/Ogallala via CRMWA system set to ~1.00%. 5 mgd (5,628 afy) contract limitation. Assume average day = 2.5 mgd. Increased supply to meet demands as Ogallala use becomes limited. B&V 1996 report.	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
CANYON	010145000	A	0145	0096	191	02	02	17600	A	033	01	03321	AMARILLO SYSTEM	107	136	212	277	115	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Carson County/Canadian/Ogallala via CRMWA system set to ~6.42%. 5 mgd (5,628 afy) contract limitation. Assume average day = 2.5 mgd. Increased supply to meet demands as Ogallala use becomes limited. B&V 1996 report.	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
CANYON	010145000	A	0145	0096	191	02	02	17600	A	033	02	03321	AMARILLO SYSTEM	116	147	230	300	125	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Carson County/Red/Ogallala via CRMWA system set to ~16.95%. 5 mgd (5,628 afy) contract limitation. Assume average day = 2.5 mgd. Increased supply to meet demands as Ogallala use becomes limited. B&V 1996 report.	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
CANYON	010145000	A	0145	0096	191	02	02	17600	O	059	02	05921	AMARILLO SYSTEM	4	5	7	9	4	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Deaf Smith County/Red/Ogallala via CRMWA system set to ~0.22%. 5 mgd (5,628 afy) contract limitation. Assume average day = 2.5 mgd. Increased supply to meet demands as Ogallala use becomes limited. B&V 1996 report.	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
CANYON	010145000	A	0145	0096	191	02	02	17600	A	188	01	18821	AMARILLO SYSTEM	153	195	304	397	166	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Potter County/Canadian/Ogallala via CRMWA system set to ~9.21%. 5 mgd (5,628 afy) contract limitation. Assume average day = 2.5 mgd. Increased supply to meet demands as Ogallala use becomes limited. B&V 1996 report.	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
CANYON	010145000	A	0145	0096	191	02	02	17600	A	188	02	18821	AMARILLO SYSTEM	34	43	66	87	37	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Potter County/Red/Ogallala via CRMWA system set to ~2.02%. 5 mgd (5,628 afy) contract limitation. Assume average day = 2.5 mgd. Increased supply to meet demands as Ogallala use becomes limited. B&V 1996 report.	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
CANYON	010145000	A	0145	0096	191	02	02	17600	A	191	02	19121	AMARILLO SYSTEM	18	23	35	46	20	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Randall County/Red/Ogallala via CRMWA system set to ~1.09%. 5 mgd (5,628 afy) contract limitation. Assume average day = 2.5 mgd. Increased supply to meet demands as Ogallala use becomes limited. B&V 1996 report.	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
CANYON	010145000	A	0145	0096	191	02	01		A	191	02	19121	OGALLALA	400	400	0	0	0	0	used demands until supply exhausted	Updated 3/30/00	O-T: Value format changed to show "0" instead of "-" K: Supply county added.		MUN	RANDALL	RED
COUNTY-OTHER	11004188	A	1004	1001	188	01	02	17600	A	117	01	010A0	AMARILLO SYSTEM	19	18	17	16	16	23	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Lake Meredith via CRMWA system set to ~48.55%. Represents TPWD Palo Duro Canyon SP, contract limitation.	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
COUNTY-OTHER	11004188	A	1004	1001	188	01	02	17600	A	191	01	19721	AMARILLO SYSTEM	6	6	6	5	6	8	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Roberts County/Canadian/Ogallala via CRMWA system set to ~24.56%. Represents TPWD Palo Duro Canyon SP, contract limitation.	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
COUNTY-OTHER	11004188	A	1004	1001	188	01	02	17600	A	191	02	19721	AMARILLO SYSTEM	0	0	0	0	0	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Roberts County/Red/Ogallala via CRMWA system set to ~1.00%. Represents TPWD Palo Duro Canyon SP, contract limitation.	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED

Table 5: Current Water Supplies Available to the PWPG by City and Category

COUNTY-OTHER	11004188	A	1004	1001	188	01	02	17600	A	033	01	03321	AMARILLO SYSTEM	2	2	2	2	2	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Carson County/Canadian/Ogallala via CRMWA system set to ~6.42%. Represents TPWD Palo Duro Canyon SP, contract limitation.	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
COUNTY-OTHER	11004188	A	1004	1001	188	01	02	17600	A	033	02	03321	AMARILLO SYSTEM	2	2	2	3	2	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Carson County/Red/Ogallala via CRMWA system set to ~16.95%. Represents TPWD Palo Duro Canyon SP, contract limitation.	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
COUNTY-OTHER	11004188	A	1004	1001	188	01	02	17600	A	059	02	05921	AMARILLO SYSTEM	0	0	0	0	0	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Deaf Smith County/Red/Ogallala via CRMWA system set to ~0.22%. Represents TPWD Palo Duro Canyon SP, contract limitation.	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
COUNTY-OTHER	11004188	A	1004	1001	188	01	02	17600	A	188	01	18821	AMARILLO SYSTEM	2	2	3	4	3	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Potter County/Canadian/Ogallala via CRMWA system set to ~9.21%. Represents TPWD Palo Duro Canyon SP, contract limitation.	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
COUNTY-OTHER	11004188	A	1004	1001	188	01	02	17600	A	188	02	18821	AMARILLO SYSTEM	0	1	1	1	1	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Potter County/Red/Ogallala via CRMWA system set to ~2.02%. Represents TPWD Palo Duro Canyon SP, contract limitation.	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
COUNTY-OTHER	11004188	A	1004	1001	188	01	02	17600	A	191	02	19121	AMARILLO SYSTEM	0	0	0	0	0	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Randall County/Red/Ogallala via CRMWA system set to ~1.09%. Represents TPWD Palo Duro Canyon SP, contract limitation.	Updated 12/01/00		AMARILLO	MUN	RANDALL	RED
COUNTY-OTHER	010996191	A	0996	0757	191	02	01		A	191	02	19126	DOCKUM	9	11	12	14	16	18	Supply divided among categories with historical use	Updated 2/14/00	K: Supply County added		MUN	RANDALL	RED
COUNTY-OTHER	010996191	A	0996	0757	191	01	01		A	191	01	19121	OGALLALA	326	372	417	480	0	0	used demands until supply exhausted. Note: there is no Canadian basin in Randall County	Updated 3/30/00	G: Basin # corrected to 1. S-T: Value format changed to show "0" instead of "-" K: Supply county added.		MUN	RANDALL	CANADIAN
COUNTY-OTHER	010996191	A	0996	0757	191	02	01		A	191	02	19121	OGALLALA	2,511	2,921	3,311	3,839	710	0	used demands until supply exhausted	Updated 3/30/00	T: Value format changed to show "0" instead of "-" K: Supply county added.		MUN	RANDALL	RED
HAPPY	010378000	A	0378	0877	191	02	01		A	191	02	19122	OTHER U-DIF (Santa Rosa)	57	40	40	37	35	35	used approx. 1/2 demands - remaining from Swisher Co.	Updated 8/7/00	K: Supply County added		MUN	RANDALL	RED
IRRIGATION	011004191	A	1004	1004	191	02	01		A	191	02	19126	DOCKUM	0	0	0	0	0	0	no historical use last 4 years	Updated 2/14/00	O-T: Value format changed to show "0" instead of "-"		IRR	RANDALL	RED
IRRIGATION	011004191	A	1004	1004	191	02	00		A	191	02	191996	IRRIGATION LOCAL SUPPLY2 - 191 - 1	637	634	630	627	624	621	All irrigation supply to IRR and STK unless otherwise specified..	Updated 2/14/00	K: Supply County added		IRR	RANDALL	RED
IRRIGATION	011004191	A	1004	1004	191	01	01		A	191	01	19121	OGALLALA	553	549	546	415	0	0	used demands until supply exhausted	Updated 3/30/00	G: Basin # corrected to 1. S-T: Value format changed to show "0" instead of "-" K: Supply county added.		IRR	RANDALL	CANADIAN
IRRIGATION	011004191	A	1004	1004	191	02	01		A	191	02	19121	OGALLALA	52,169	51,374	50,589	49,534	7,819	0	used demands until supply exhausted	Updated 3/30/00	T: Value format changed to show "0" instead of "-" K: Supply county added.		IRR	RANDALL	RED
IRRIGATION	011004191	A	1004	1004	191	01	00		A	191	01	36015	REUSE: BaZoCou 01-02-191	16	20	23	26	30	35	Remaining reuse supply in Potter and Randall county after PWR allocation	Updated 11/29/00			IRR	RANDALL	CANADIAN
IRRIGATION	011004191	A	1004	1004	191	02	00		A	191	02	36031	REUSE: BaZoCou 02-01-191	4,116	4,914	5,703	6,761	8,027	9,621	Remaining reuse supply in Potter and Randall county after PWR allocation	Updated 11/29/00			IRR	RANDALL	RED
LAKE TANGLEWOOD	010500000	A	0500	0895	191	02	01		A	191	02	19121	OGALLALA	292	289	0	0	0	0	used demands until supply exhausted	Updated 3/30/00	Q-T: Value format changed to show "0" instead of "-" K: Supply county added.		MUN	RANDALL	RED
LIVESTOCK	011005191	A	1005	1005	191	02	01		A	191	02	19126	DOCKUM	180	180	180	180	180	180	used demands until supply exhausted	Updated 3/30/00	K: Supply County added		STK	RANDALL	Red
LIVESTOCK	011005191	A	1005	1005	191	02	00		A	191	02	191996	IRRIGATION LOCAL SUPPLY2 - 191 - 1	34	37	41	44	46	50	All irrigation supply to IRR and STK unless otherwise specified..	Updated 2/14/00	K: Supply County added		STK	RANDALL	RED
LIVESTOCK	011005191	A	1005	1005	191	01	00		A	191	01	01997	local supply - stock ponds	10	10	10	10	10	10	HISTORICAL MAX USE		G: Basin # corrected to 1. J: RWPG A listed for supply. Not identified by TWDB. Needs to be added to Table 4 B-H, K: Info added.		STK	RANDALL	CANADIAN
LIVESTOCK	011005191	A	1005	1005	191	02	00		A	191	02	02997	local supply - stock ponds	972	972	972	972	972	972	HISTORICAL MAX USE	Updated 4/1/00	Table 4 updated to include stock pond supply information K: Supply County added M: ID corrected, was 19126.		STK	RANDALL	RED
LIVESTOCK	011005191	A	1005	1005	191	01	01		A	191	01	19121	OGALLALA	21	24	28	30	2	2			G: Basin # corrected to 1. K: Supply County added		STK	RANDALL	CANADIAN
LIVESTOCK	011005191	A	1005	1005	191	02	01		A	191	02	19121	OGALLALA	1,850	2,164	2,521	2,783	497	0	used demands until supply exhausted	Updated 3/30/00	T: Value format changed to show "0" instead of "-" K: Supply county added.		STK	RANDALL	RED
MANUFACTURING	011001191	A	1001	1001	191	02	02	17600	A	117	01	010A0	AMARILLO SYSTEM	179	171	162	152	156	227	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Lake Meredith via CRMWA system set to ~48.55%. Estimated supply for Owens-Corning.	Updated 12/01/00		AMARILLO	MFG	RANDALL	RED
MANUFACTURING	011001191	A	1001	1001	191	02	02	17600	A	191	01	19721	AMARILLO SYSTEM	62	59	56	53	54	79	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Roberts County/Canadian/Ogallala via CRMWA system set to ~24.56%. Estimated supply for Owens-Corning.	Updated 12/01/00		AMARILLO	MFG	RANDALL	RED
MANUFACTURING	011001191	A	1001	1001	191	02	02	17600	A	191	02	19721	AMARILLO SYSTEM	3	2	2	2	2	3	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Roberts County/Red/Ogallala via CRMWA system set to ~1.00%. Estimated supply for Owens-Corning.	Updated 12/01/00		AMARILLO	MFG	RANDALL	RED
MANUFACTURING	011001191	A	1001	1001	191	02	02	17600	A	033	01	03321	AMARILLO SYSTEM	14	17	20	23	22	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Carson County/Canadian/Ogallala via CRMWA system set to ~6.42%. Estimated supply for Owens-Corning.	Updated 12/01/00		AMARILLO	MFG	RANDALL	RED
MANUFACTURING	011001191	A	1001	1001	191	02	02	17600	A	033	02	03321	AMARILLO SYSTEM	15	18	21	25	24	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Carson County/Red/Ogallala via CRMWA system set to ~16.95%. Estimated supply for Owens-Corning.	Updated 12/01/00		AMARILLO	MFG	RANDALL	RED
MANUFACTURING	011001191	A	1001	1001	191	02	02	17600	A	059	02	05921	AMARILLO SYSTEM	1	1	1	1	1	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Deaf Smith County/Red/Ogallala via CRMWA system set to ~0.22%. Estimated supply for Owens-Corning.	Updated 12/01/00		AMARILLO	MFG	RANDALL	RED
MANUFACTURING	011001191	A	1001	1001	191	02	02	17600	A	188	01	18821	AMARILLO SYSTEM	20	24	28	33	31	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Potter County/Canadian/Ogallala via CRMWA system set to ~9.21%. Estimated supply for Owens-Corning.	Updated 12/01/00		AMARILLO	MFG	RANDALL	RED
MANUFACTURING	011001191	A	1001	1001	191	02	02	17600	A	188	02	18821	AMARILLO SYSTEM	4	5	6	7	7	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Potter County/Red/Ogallala via CRMWA system set to ~2.02%. Estimated supply for Owens-Corning.	Updated 12/01/00		AMARILLO	MFG	RANDALL	RED
MANUFACTURING	011001191	A	1001	1001	191	02	02	17600	A	191	02	19121	AMARILLO SYSTEM	2	3	4	4	4	0	Supply from Amarillo System arbitrarily segregated by original source per TWDB request. % from Randall County/Red/Ogallala via CRMWA system set to ~1.09%. Estimated supply for Owens-Corning.	Updated 12/01/00		AMARILLO	MFG	RANDALL	RED
MANUFACTURING	011001191	A	1001	1001	191	02	01		A	191	02	19121	OGALLALA	257	217	172	175	29	0	used demands until supply exhausted	Updated 3/30/00	T: Value format changed to show "0" instead of "-" K: Supply county added.		MFG	RANDALL	RED
MINING	011003191	A	1003	1003	191	01	01		A	191	01	19121	OGALLALA	2	2	2	2	2	2			B-G: Info added. J: RWPG A listed for supply. K: Supply county added.		MIN	RANDALL	CANADIAN
MINING	011003191	A	1003	1003	191	02	01		A	191	02	19121	OGALLALA	7	5	4	3	0	0	used demands until supply exhausted	Updated 3/30/00	T: Value format changed to show "0" instead of "-" K: Supply county added.		MIN	RANDALL	RED
COUNTY-OTHER	010996197	A	0996	0757	197	01	01		A	197	01	19721	OGALLALA	38	38	34	30	26	19	used demands, historical pumpage 42 ac/ft	Updated 2/11/00			MUN	ROBERTS	CANADIAN
COUNTY-OTHER	010996197	A	0996	0757	197	02	01		A	197	02	19721	OGALLALA	2	2	2	1	1	1	used demands, historical pumpage 2 ac/ft	Updated 2/11/00	G: Corrected to 2 for Red Basin		MUN	ROBERTS	RED
IRRIGATION	011004197	A	1004	1004	197	01	01		A	197	01	19721	OGALLALA	6,210	6,210	6,210	6,210	6,210	6,210	1996 historical pumpage = 6210 ac/ft	Updated 4/1/00			IRR	ROBERTS	CANADIAN
IRRIGATION	011004197	A	1004	1004	197	02	01		A	197	02	19721	OGALLALA	5,755	5,755	5,755	5,755	5,755	5,755	used demands (appears demands are all attributed to red basin, yet use is greater in canadian basin	Get w/ TLS re: reuse allocations	G: Corrected to 2 for Red Basin		IRR	ROBERTS	RED
IRRIGATION	011004197	A	1004	1004	197	01	00		A	197	01	36016	REUSE: BaZoCou 01-02-197	25	25	23	22	20	18	All reuse assumed to IRR unless otherwise specified.	Get w/ TLS re: reuse allocations			IRR	ROBERTS	CANADIAN

Table 5: Current Water Supplies Available to the PWPG by City and Category

LIVESTOCK	011005197	A	1005	1005	197	01	00		A	197	01	01997	local supply - stock ponds	529	529	529	529	529	529	historical use =90% of demands, max use = 529	Updated 2/11/00	Table 4 updated to include stock pond supply information. M: ID added.		STK	ROBERTS	CANADIAN
LIVESTOCK	011005197	A	1005	1005	197	02	00		A	197	02	02997	local supply - stock ponds	16	18	19	20	22	24	used demands	Updated 2/11/00	Not identified by TWDB. Needs to be added to Table 4 G: Corrected to 2 for Red Basin M: ID added.		STK	ROBERTS	RED
LIVESTOCK	011005197	A	1005	1005	197	01	01		A	197	01	19721	OGALLALA	0	27	70	119	171	229	remainder of demands	Updated 2/11/00			STK	ROBERTS	CANADIAN
MIAMI	010594000	A	0594	0403	197	01	01		A	197	01	19721	OGALLALA	208	209	203	203	203	203	HISTORICAL MAXIMUM USE,increased slightly in 2000/2010 to meet demands	Updated 3/20/00			MUN	ROBERTS	CANADIAN
MINING	011003197	A	1003	1003	197	01	01		A	197	01	19721	OGALLALA	2	1	1	1	1	1	used demands	Updated 2/11/00			MIN	ROBERTS	CANADIAN
MINING	011003197	A	1003	1003	197	02	01		A	197	02	19721	OGALLALA	11	11	11	11	11	11			J: RWPG A listed for supply. Identifying info added.		MIN	ROBERTS	RED
COUNTY-OTHER	010996211	A	0996	0757	211	01	01		A	211	01	21121	OGALLALA	180	165	145	127	117	105	used demands, values updated per Dutton Ogallala corrections	Updated 11/25/00	T: Value format changed to show "0" instead of "-"		MUN	SHERMAN	CANADIAN
IRRIGATION	011004211	A	1004	1004	211	01	00		A	211	01	211996	IRRIGATION LOCAL SUPPLY1 - 211 - 1	410	406	405	404	402	400	All irrigation supply to IRR and STK unless otherwise specified..	Updated 2/14/00			IRR	SHERMAN	CANADIAN
IRRIGATION	011004211	A	1004	1004	211	01	01		A	211	01	21121	OGALLALA	194,787	194,791	194,792	194,793	194,795	194,797	used demands, values updated per Dutton Ogallala corrections	Updated 11/25/00	T: Value format changed to show "0" instead of "-"		IRR	SHERMAN	CANADIAN
LIVESTOCK	011005211	A	1005	1005	211	01	00		A	211	01	211996	IRRIGATION LOCAL SUPPLY1 - 211 - 1	8	12	13	14	16	18	All irrigation supply to IRR and STK unless otherwise specified..	Updated 2/14/00			STK	SHERMAN	CANADIAN
LIVESTOCK	011005211	A	1005	1005	211	01	00		A	211	01	01997	local supply - stock ponds	846	846	846	846	846	846	HISTORICAL MAX USE	Updated 4/1/00	Table 4 updated to include stock pond supply information M: Source ID corrected, was 21121.		STK	SHERMAN	CANADIAN
LIVESTOCK	011005211	A	1005	1005	211	01	01		A	211	01	21121	OGALLALA	2,959	4,718	5,420	6,085	6,833	7,679	used demands, values updated per Dutton Ogallala corrections	Updated 11/25/00	T: Value format changed to show "0" instead of "-"		STK	SHERMAN	CANADIAN
MINING	011003211	A	1003	1003	211	01	01		A	211	01	21121	OGALLALA	26	26	27	28	29	31	used demands, values updated per Dutton Ogallala corrections	Updated 11/25/00	T: Value format changed to show "0" instead of "-"		MIN	SHERMAN	CANADIAN
STRATFORD	010864000	A	0864	0584	211	01	01		A	211	01	21121	OGALLALA	565	574	570	543	514	496	used demands, values updated per Dutton Ogallala corrections	Updated 11/25/00	T: Value format changed to show "0" instead of "-"		MUN	SHERMAN	CANADIAN
HAPPY	150378000	O	0378	0877	219	02	01		O	219	02	21922	OTHER U-DIF (Santa Rosa)	40	48	40	37	36	36	used approx. 1/2 demands - remaining from Randall Co. (record added for reference. Supply and portion of source are in Region O).	Updated 8/7/00	J: RWPG A listed for supply.		MUN	SWISHER	RED
COUNTY-OTHER	010996242	A	0996	0757	242	02	01		A	242	02	24206	BLAINE	14	14	14	14	14	14	HISTORICAL MAXIMUM USE	Updated 4/1/00	M: Source ID changed from 09606 to 24206		MUN	WHEELER	RED
COUNTY-OTHER	010996242	A	0996	0757	242	02	01		A	242	02	24221	OGALLALA	541	541	541	541	541	541	HISTORICAL MAXIMUM USE	Updated 4/1/00			MUN	WHEELER	RED
COUNTY-OTHER	010996242	A	0996	0757	242	02	01		A	242	02	24222	OTHER U-DIF (Whitehorse)	11	10	9	9	8	8	Ratioed among CATs w/ hist pumpage.				MUN	WHEELER	RED
COUNTY-OTHER	010996242	A	0996	0757	242	02	01		A	242	02	24204	SEYMOUR	21	21	21	21	21	21	HISTORICAL MAXIMUM USE	Updated 4/1/00			MUN	WHEELER	RED
IRRIGATION	011004242	A	1004	1004	242	02	01		A	242	02	24206	BLAINE	15	15	15	15	15	16	125% OF HISTORICAL MAXIMUM USE	Updated 4/1/00	M: Source ID changed from 09606 to 24206		IRR	WHEELER	RED
IRRIGATION	011004242	A	1004	1004	242	02	01		A	242	02	24221	OGALLALA	5,336	5,336	5,336	5,336	5,336	5,336	increased to MEET DEMANDS	Updated 4/1/00			IRR	WHEELER	RED
IRRIGATION	011004242	A	1004	1004	242	02	01		A	242	02	24222	OTHER U-DIF (Whitehorse)	295	295	295	295	295	295	125% OF HISTORICAL MAXIMUM USE	Updated 4/1/00			IRR	WHEELER	RED
IRRIGATION	011004242	A	1004	1004	242	02	00		A	242	02	36034	REUSE: BaZoCou 02-01-242	17	16	15	15	15	14	All reuse assumed to IRR unless otherwise specified.	Get w/ TLS re: reuse allocations			IRR	WHEELER	RED
IRRIGATION	011004242	A	1004	1004	242	02	01		A	242	02	24204	SEYMOUR	38	38	38	38	38	38	125% OF HISTORICAL MAXIMUM USE	Updated 4/1/00			IRR	WHEELER	RED
LIVESTOCK	011005242	A	1005	1005	242	02	01		A	242	02	24206	BLAINE	19	19	19	19	19	19	HISTORICAL MAXIMUM USE	Updated 4/1/00	M: Source ID changed from 09606 to 24206		STK	WHEELER	RED
LIVESTOCK	011005242	A	1005	1005	242	02	00		A	242	02	02997	local supply - stock ponds	2,236	2,236	2,236	2,236	2,236	2,236	HISTORICAL MAXIMUM USE		Table 4 updated to include stock pond supply information B-G, K:Info added. M: ID added.		STK	WHEELER	RED
LIVESTOCK	011005242	A	1005	1005	242	02	01		A	242	02	24221	OGALLALA	240	240	240	240	240	240	HISTORICAL MAXIMUM USE	Updated 4/1/00			STK	WHEELER	RED
LIVESTOCK	011005242	A	1005	1005	242	02	01		A	242	02	24222	OTHER U-DIF (Whitehorse)	29	29	29	29	29	29	HISTORICAL MAXIMUM USE	Updated 4/1/00			STK	WHEELER	RED
LIVESTOCK	011005242	A	1005	1005	242	02	01		A	242	02	24204	SEYMOUR	29	29	29	29	29	29	HISTORICAL MAXIMUM USE	Updated 4/1/00			STK	WHEELER	RED
MINING	011003242	A	1003	1003	242	02	01		A	242	02	24221	OGALLALA	157	157	157	157	157	157	HISTORICAL MAXIMUM USE	Updated 4/1/00			MIN	WHEELER	RED
MINING	011003242	A	1003	1003	242	02	01		A	242	02	24222	OTHER U-DIF (Whitehorse)	0	0	0	0	0	0	HISTORICAL MAX	Updated 4/1/00	O-T: Value format changed to show "0" instead of "-"		MIN	WHEELER	RED
MINING	011003242	A	1003	1003	242	02	01		A	242	02	24204	SEYMOUR	0	0	0	0	0	0	HISTORICAL MAX	Updated 4/1/00	O-T: Value format changed to show "0" instead of "-"		MIN	WHEELER	RED
SHAMROCK	010822000	A	0822	0554	242	02	01		A	242	02	24221	OGALLALA	370	354	338	332	70	0	From PGWCD3-Cities.xls. Allocated to meet demands until supply exhausted.	Updated 3/20/00	T: Value format changed to show "0" instead of "-"		MUN	WHEELER	RED
WHEELER	010961000	A	0961	0646	242	02	01		A	242	02	24221	OGALLALA	300	266	0	0	0	0	From PGWCD3-Cities.xls. Allocated to meet demands until supply exhausted.	Updated 3/20/00	Q-T: Value format changed to show "0" instead of "-"		MUN	WHEELER	RED

Table 6: Current Water Supplies Available by Major Water Provider

Major Water Provider Name	Major Water Provider Number	Type of Water Supply Source	MWP Number (Seller)	Location of Supply Source (RWPG Letter)	Location of Groundwater Supply Source (County Number)	Location of Supply Source (Basin Number)	Specific Source Indentifier	Specific Source Name	Available Supply for the Year 2000 (Ac-Ft)	Available Supply for the Year 2010 (Ac-Ft)	Available Supply for the Year 2020 (Ac-Ft)	Available Supply for the Year 2030 (Ac-Ft)	Available Supply for the Year 2040 (Ac-Ft)	Available Supply for the Year 2050 (Ac-Ft)	Comments
Amarillo	17600	02		A	117	01	010A0	Amarillo System	31,549	31,549	31,552	31,548	31,552	31,551	
Amarillo	17600	02		A	033	01	03321	Amarillo System	2,432	3,099	3,898	4,841	4,336	0	
Amarillo	17600	02		A	033	02	03321	Amarillo System	2,634	3,356	4,223	5,246	4,696	0	
Amarillo	17600	02		A	188	01	18821	Amarillo System	3,487	4,443	5,589	6,945	6,218	0	
Amarillo	17600	02		A	188	02	18821	Amarillo System	764	977	1,226	1,524	1,365	0	
Amarillo	17600	02		A	059	02	05921	Amarillo System	83	104	132	163	146	0	
Amarillo	17600	02		A	191	02	19121	Amarillo System	410	524	657	817	733	0	
Amarillo	17600	02		A	191	01	19721	Amarillo System	10,967	10,967	10,967	10,967	10,967	10,967	
Amarillo	17600	02		B	191	02	19721	Amarillo System	446	445	444	445	445	444	
CRMWA	10	02		A	117	01	010A0	CRMWA System	33,036	33,036	33,036	33,036	33,036	33,036	
CRMWA	10	02		A	191	01	19121	CRMWA System	24,011	24,011	24,011	24,011	24,011	24,011	
CRMWA	10	02		A	191	02	19121	CRMWA System	974	974	974	974	974	974	
Greenbelt M&IWA	20	00		B		02	02050	Greenbelt Reservoir	7,699	7,548	7,396	7,245	7,093	6,942	

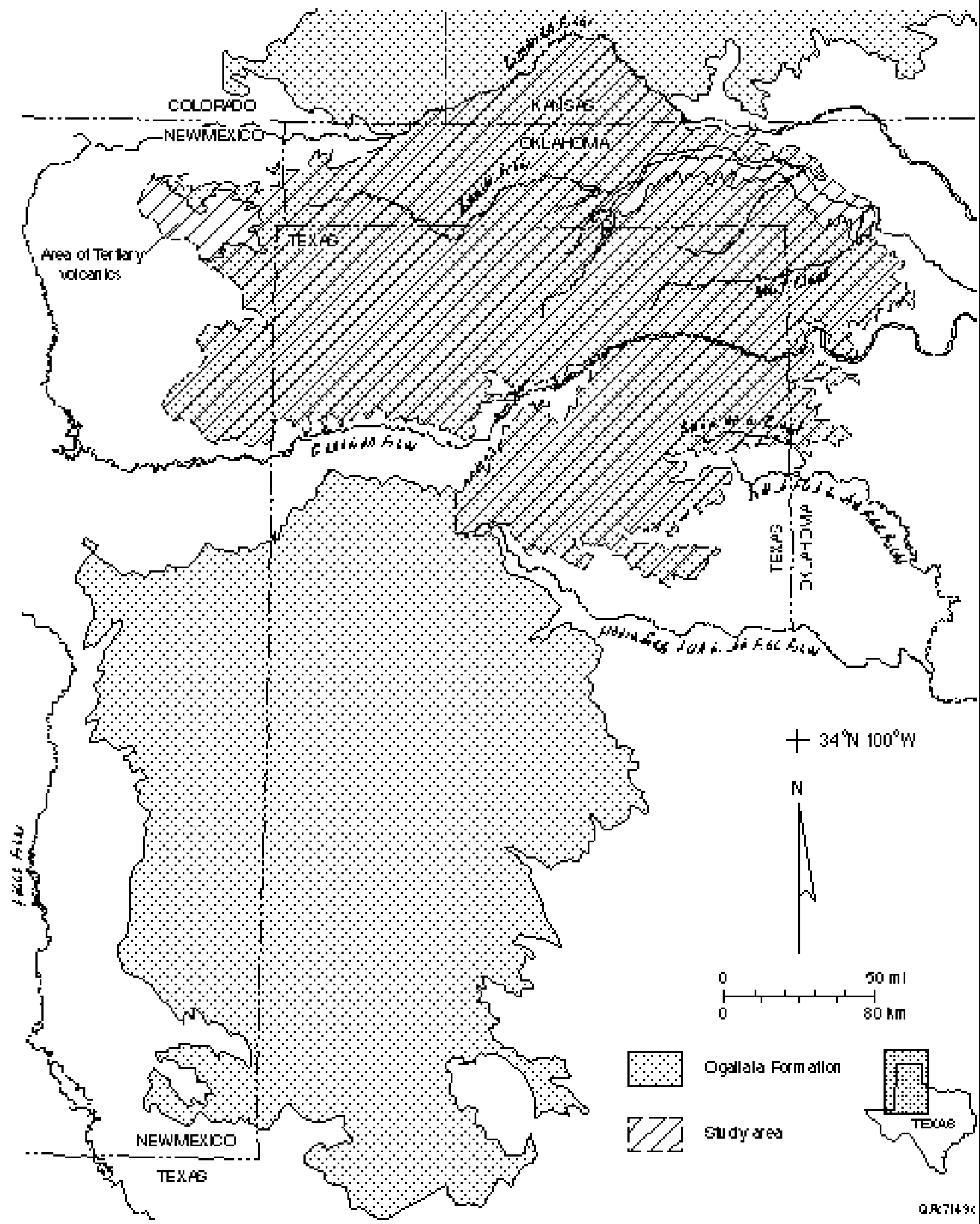

Figure 1. Location of the study area in the northern Texas Panhandle and parts of northwestern New Mexico, western Oklahoma, and southwestern Kansas. The study area was extended beyond Texas to provide natural hydrologic boundaries for a numerical model away from the area of interest. Modified from U.S. Geological Survey (1998).

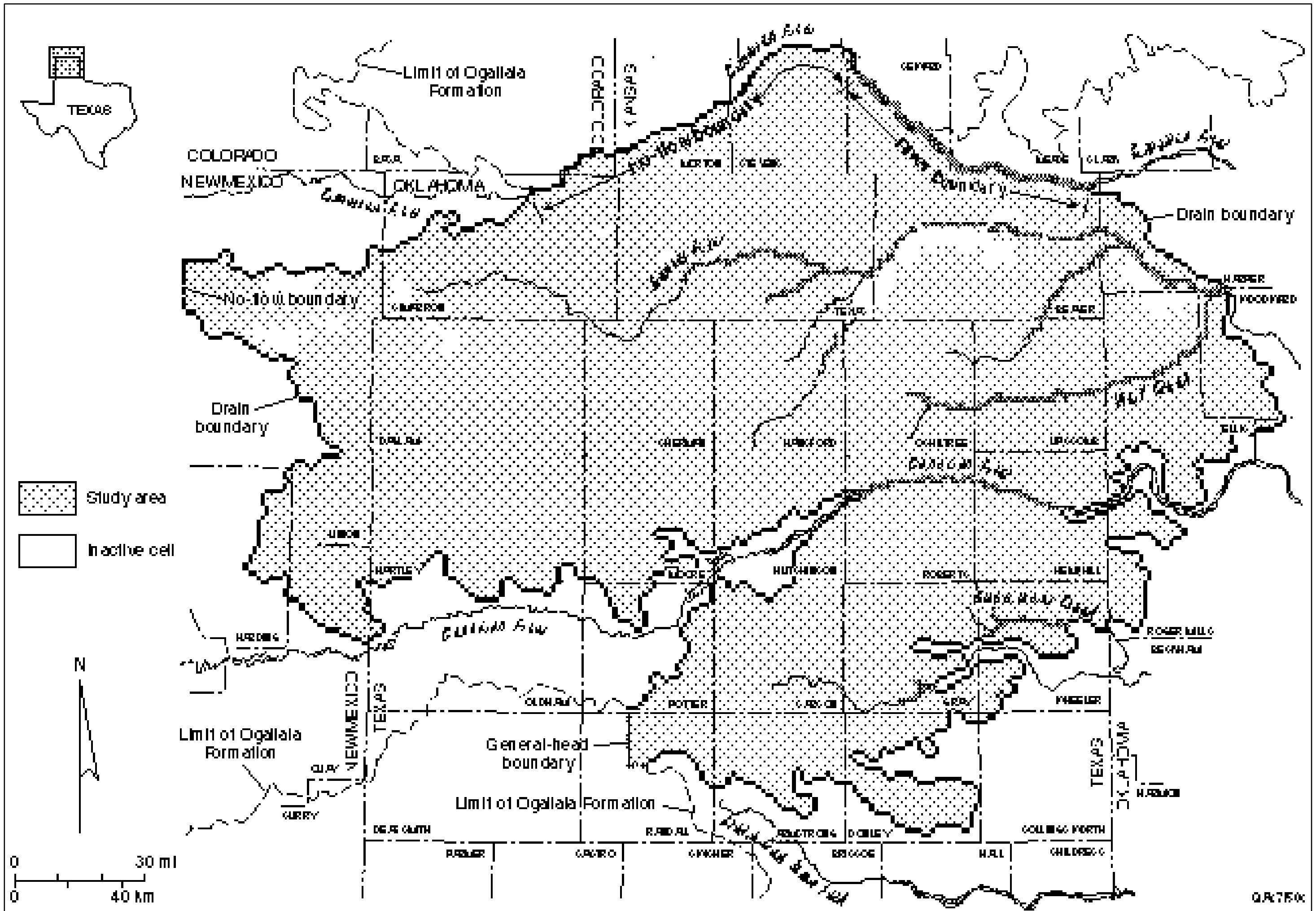

Figure 2. Map of modeled area and selection of boundary conditions.

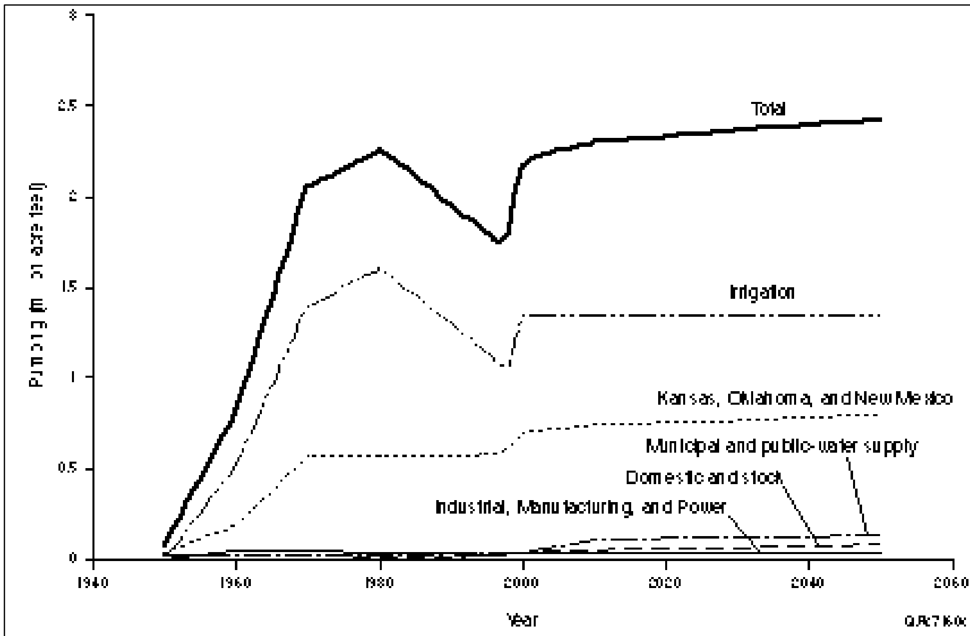

Figure 3. Change in total annual rate of groundwater withdrawal for irrigation, municipal, and other uses in Texas. Withdrawal rates for other states from Luckey and Becker (1999) as described in the text.

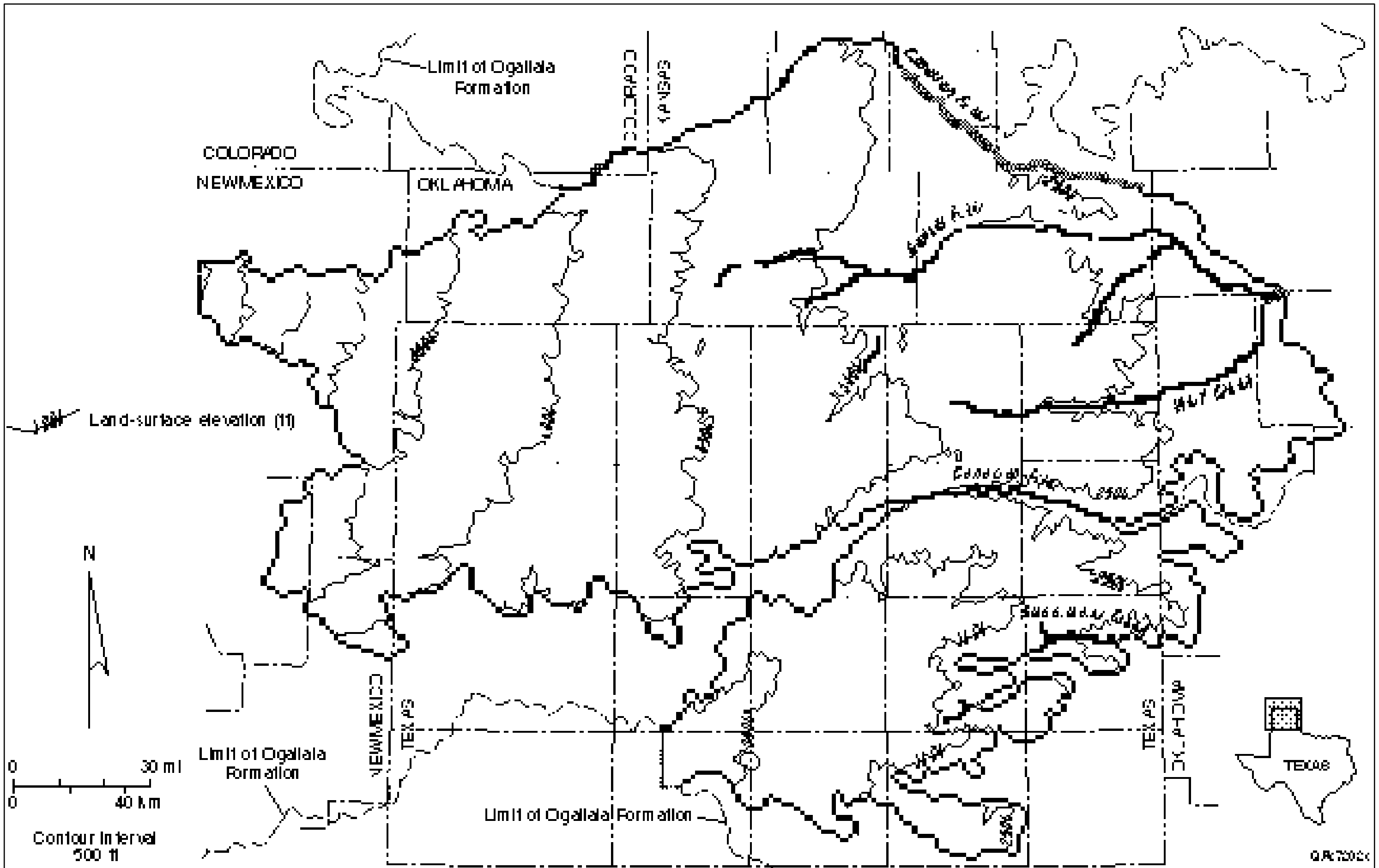

Figure 4. Ground-surface elevation across the study area.

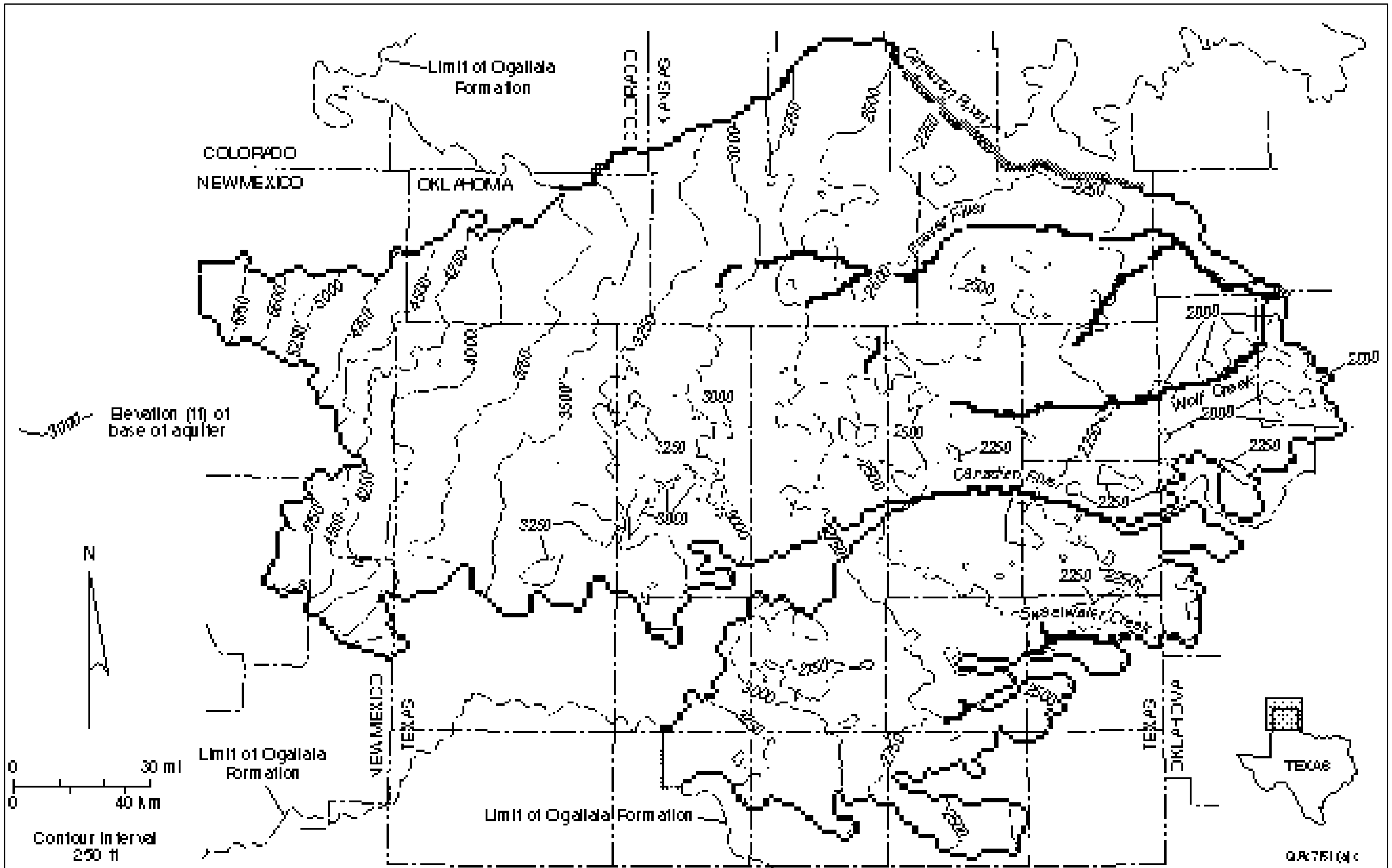

Figure 5. Structural elevation of the base of the Ogallala Formation as used in the numerical model. Sources of data and contouring method described in text.

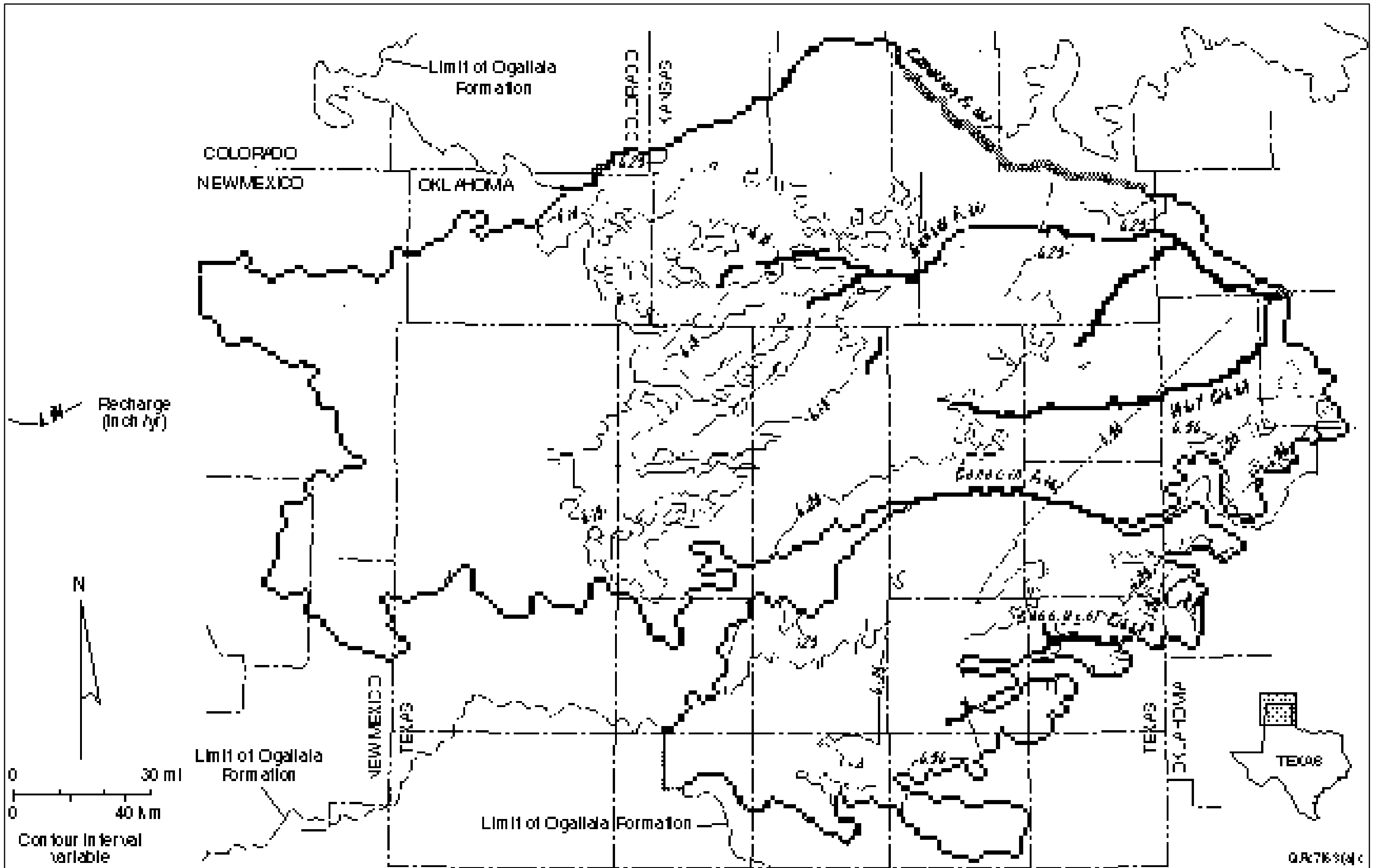

Figure 6. Recharge used in the numerical model assigned on the basis of precipitation and soil texture. See table 3 for description of soil groups.

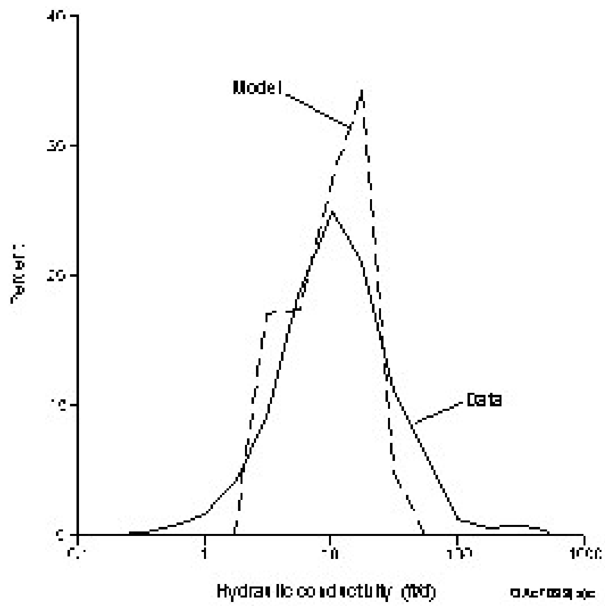

Figure 7. Comparison of measured and calibrated values of hydraulic conductivity used in the Texas part of the model.

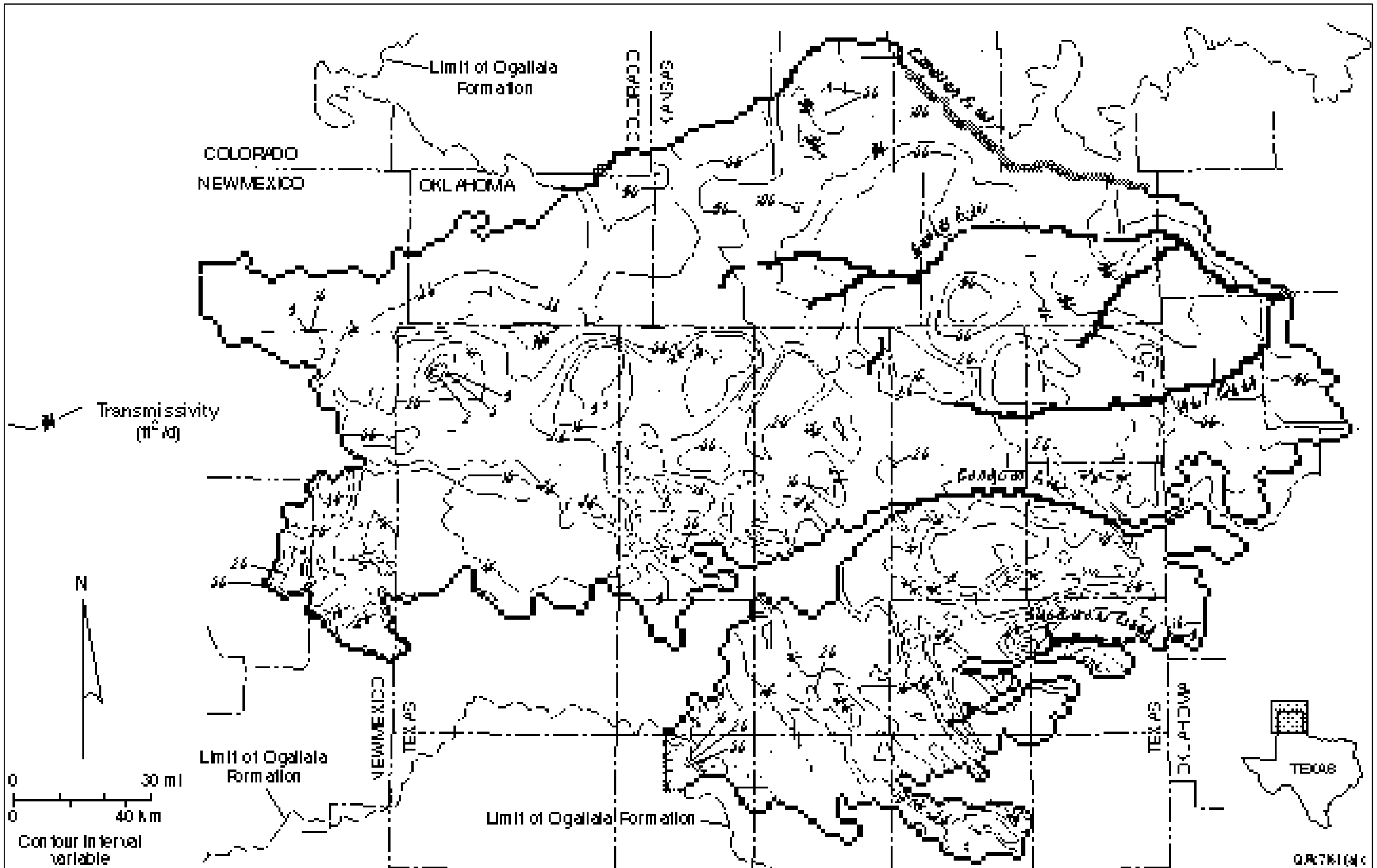

Figure 8. Hydraulic conductivity of the Ogallala aquifer used for historical and predictive simulations. Data, mapping, and calibration procedure described in text.

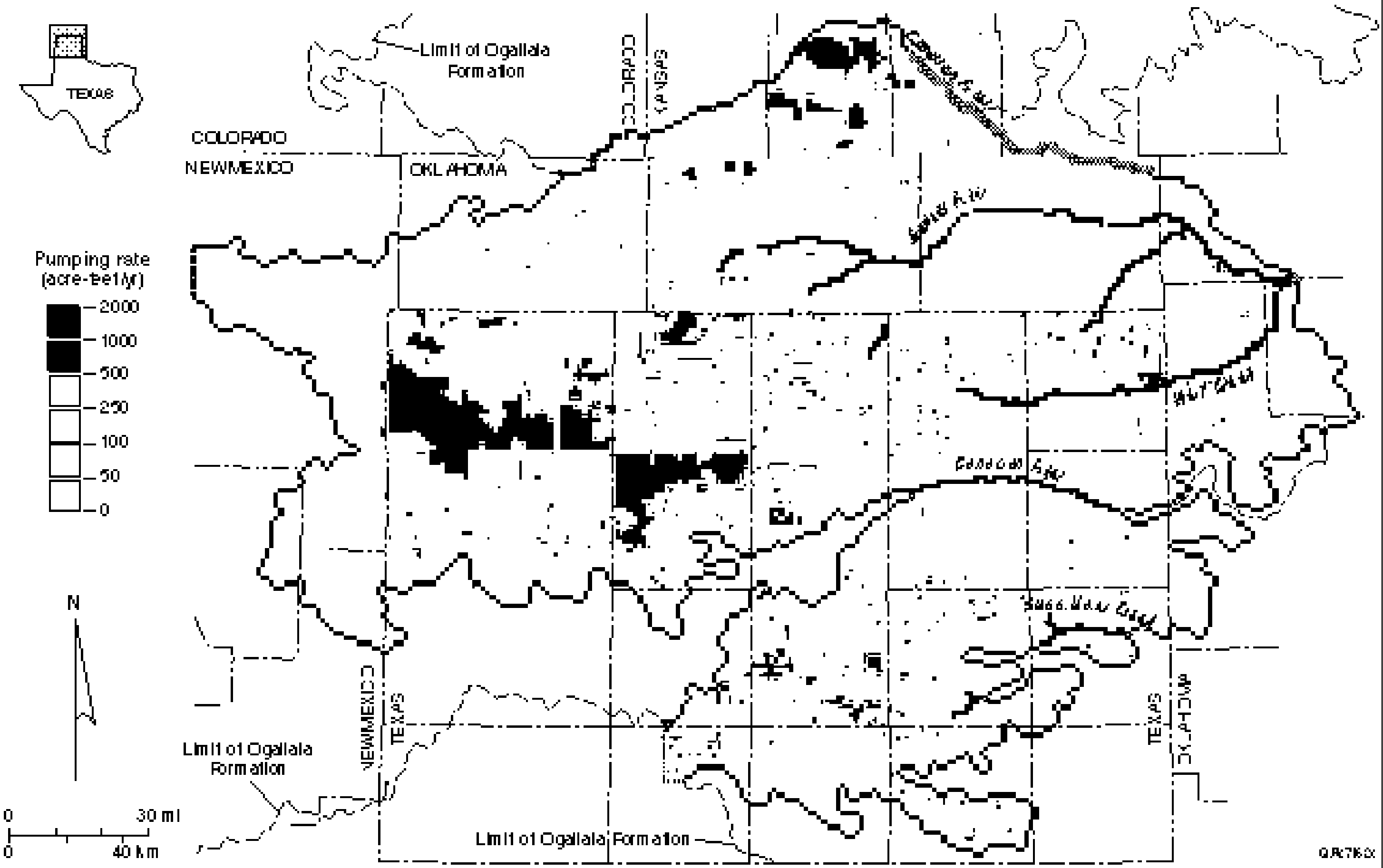

Figure 9. Pumping rates assigned to cells in the model. During 1950 to 1998, irrigation made up 57 to 96 percent of the total ground-water demand in various counties. Irrigation distribution was based on digital (GIS) results of a 1994 survey provided by TNRIS.

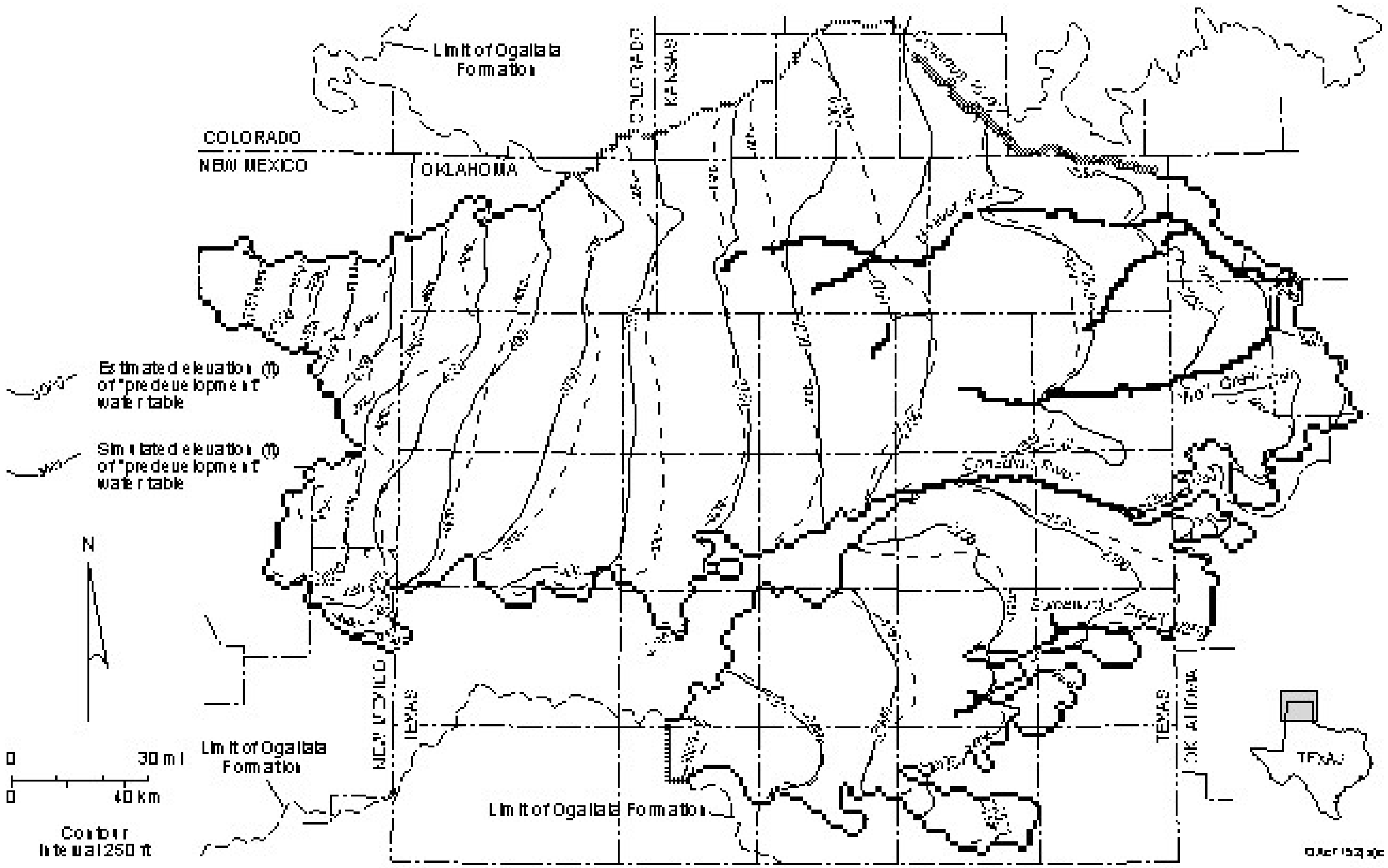

Figure 10. Comparison of estimated and simulated elevations of "predevelopment" water table.

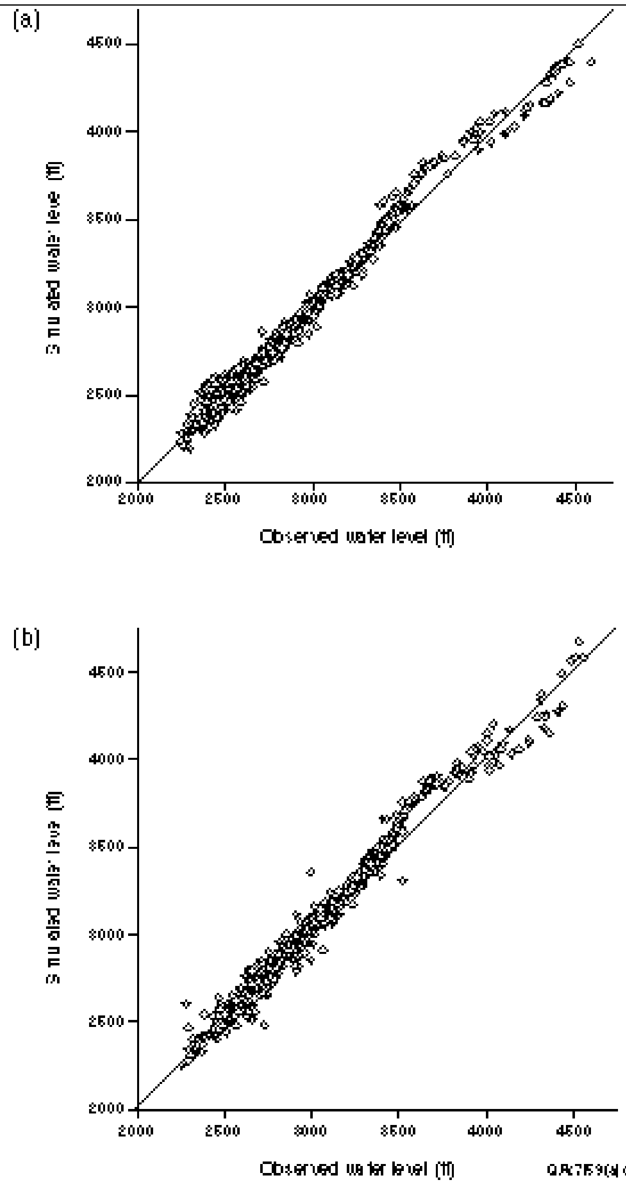

Figure 11. Calibration results for (a) "predevelopment," or 1950, water table and (b) 1998 water table. The calibration (mean-square) error for the "predevelopment" water table was 64 feet and for the 1998 water table was 74 feet.

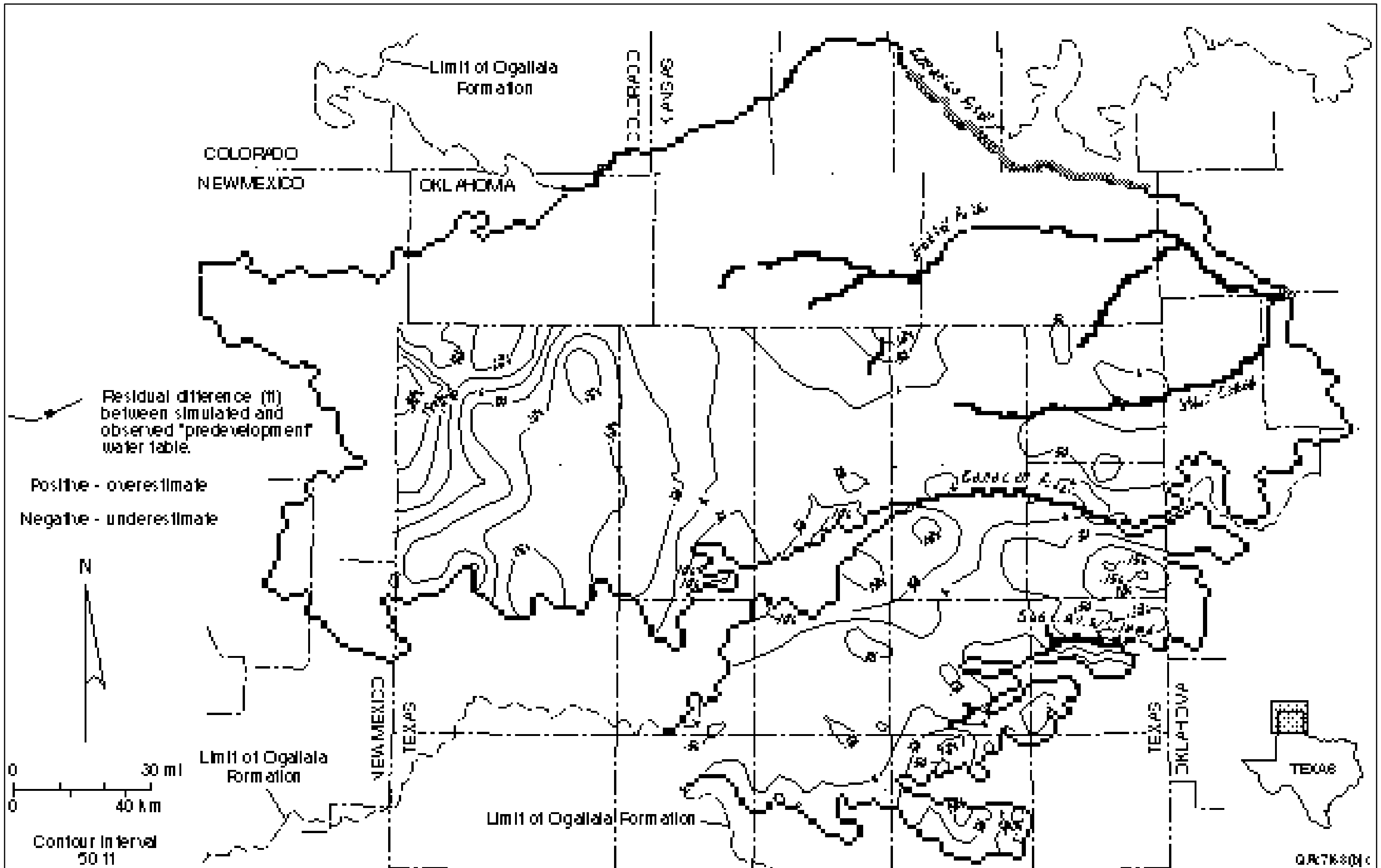

Figure 12. Residual between estimated and simulated elevations of "predevelopment" water table.

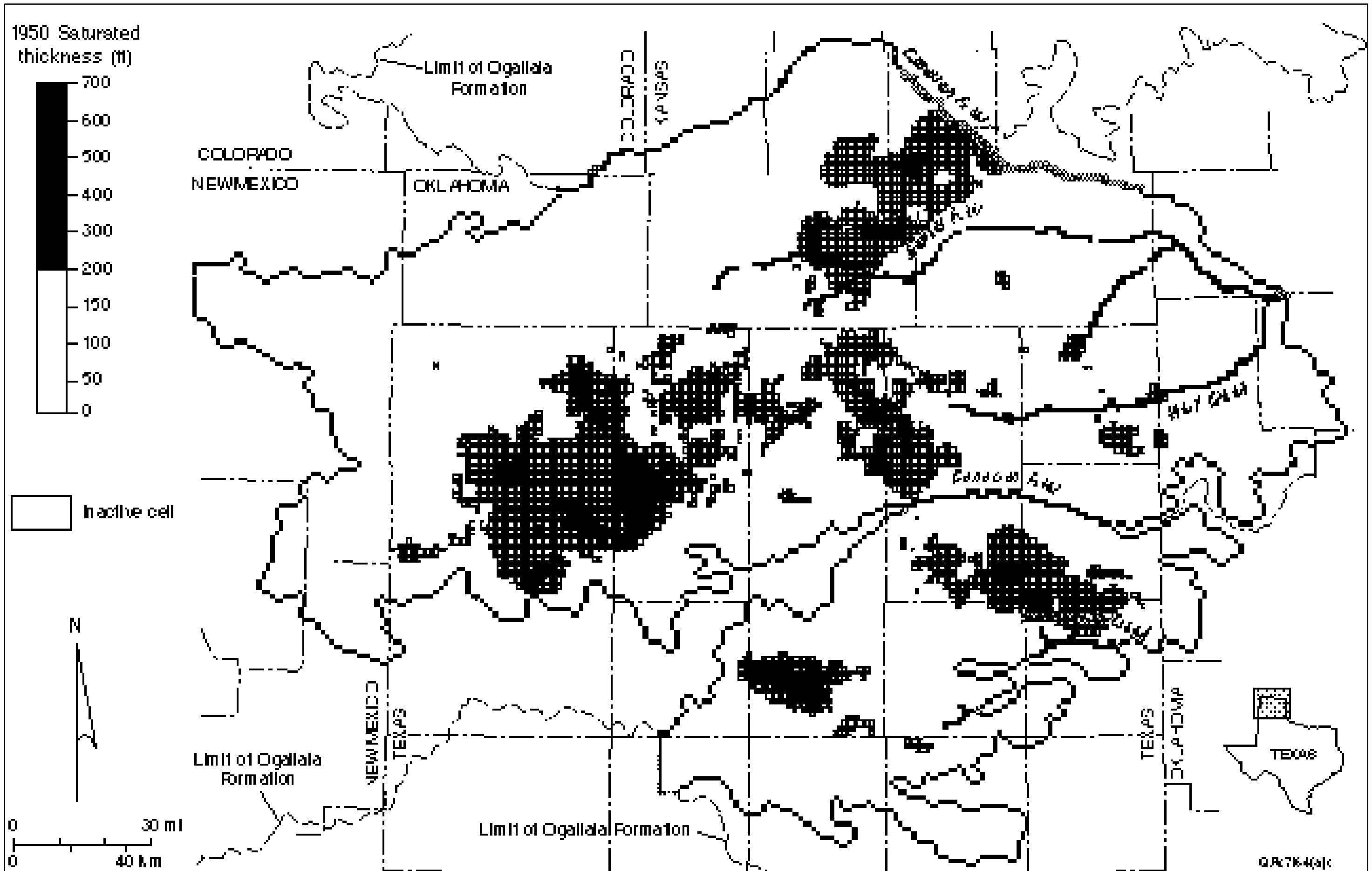

Figure 13. Simulated saturated thickness of the Ogallala aquifer under "predevelopment," or 1950, water-table conditions.

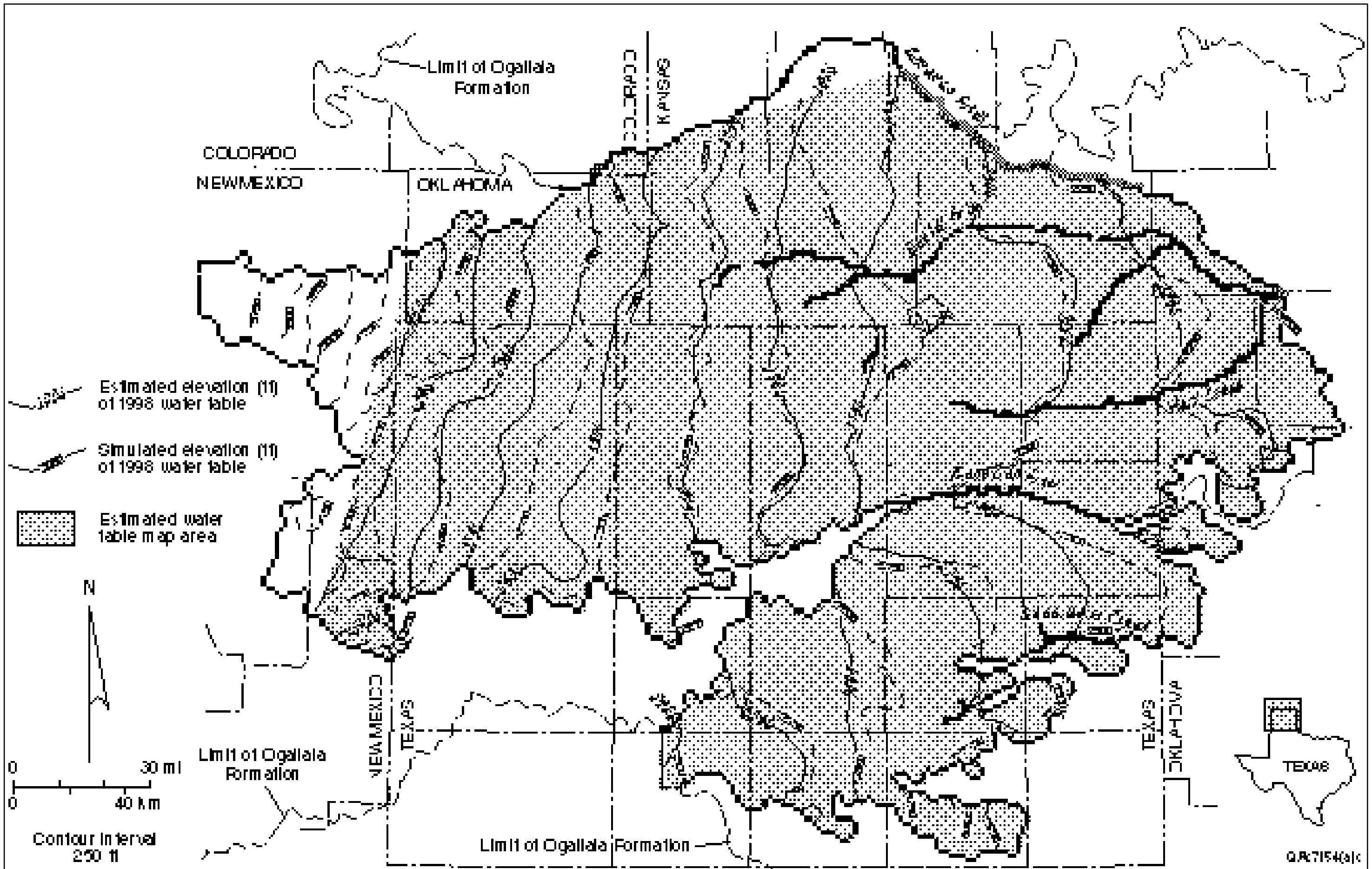

Figure 14. Comparison of estimated and simulated elevations of 1998 water table.

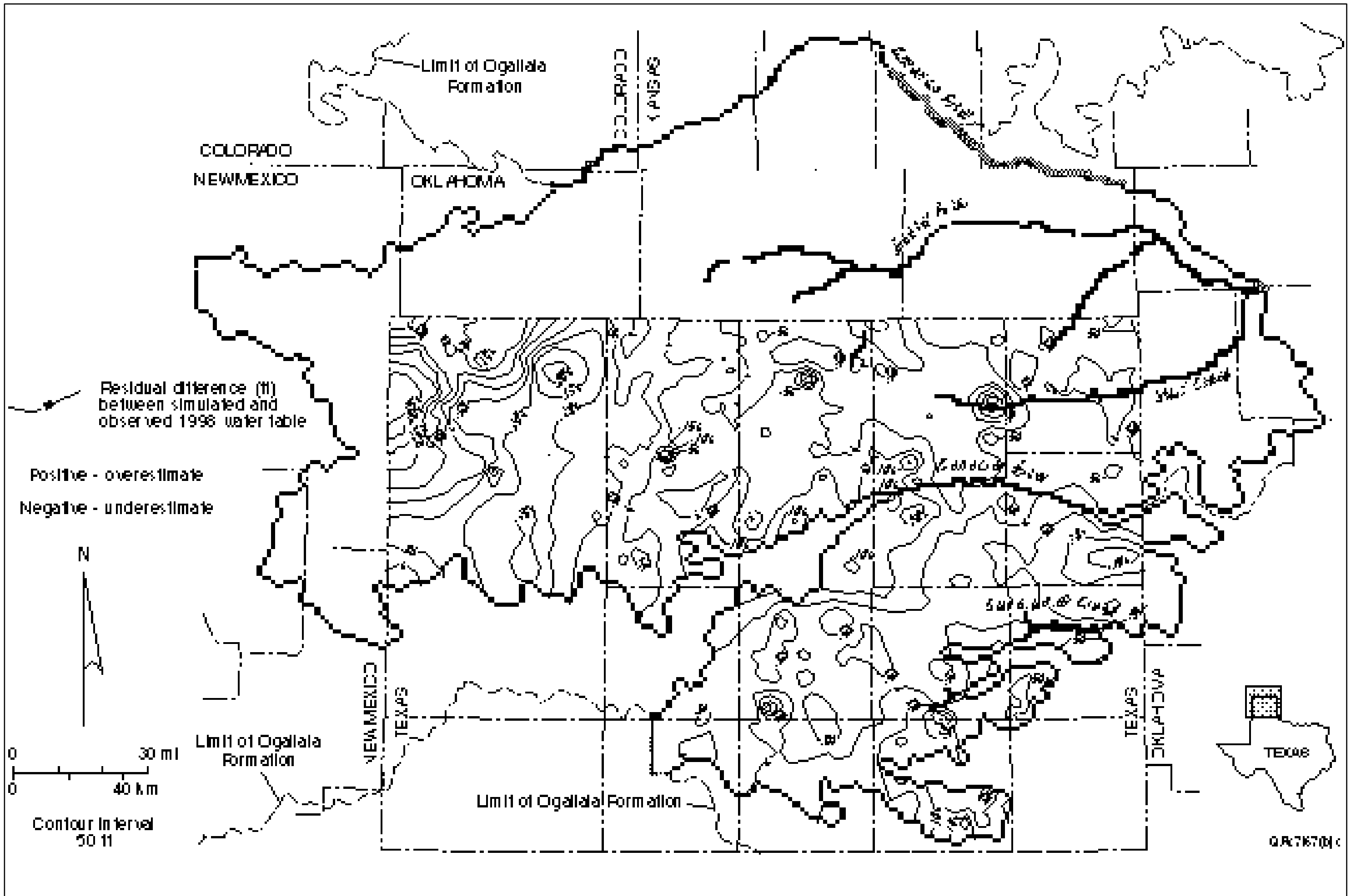

Figure 15. Residual between estimated and simulated elevations of 1998 water table.

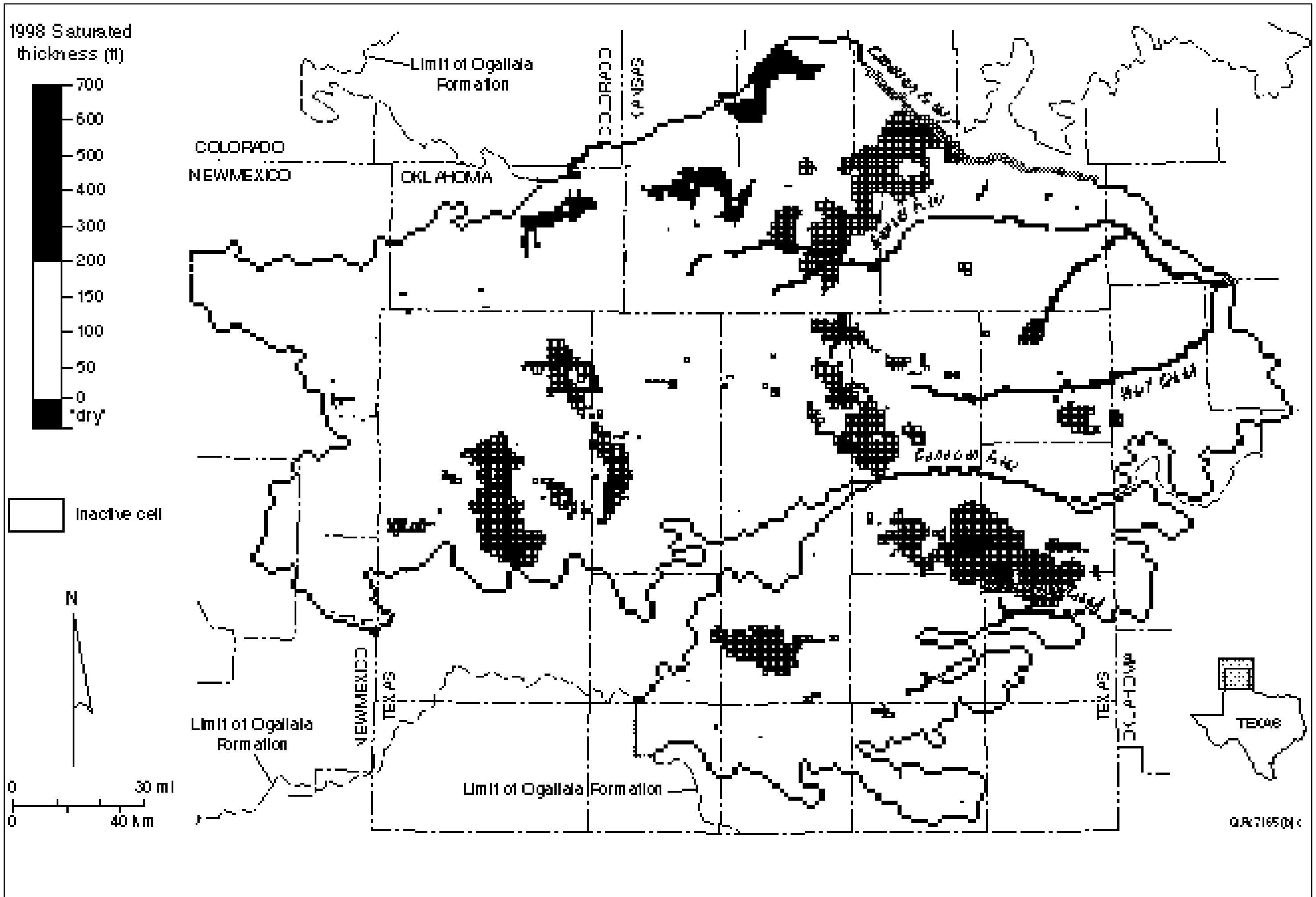

Figure 16. Simulated saturated thickness of the Ogallala aquifer under 1998 water-table conditions.

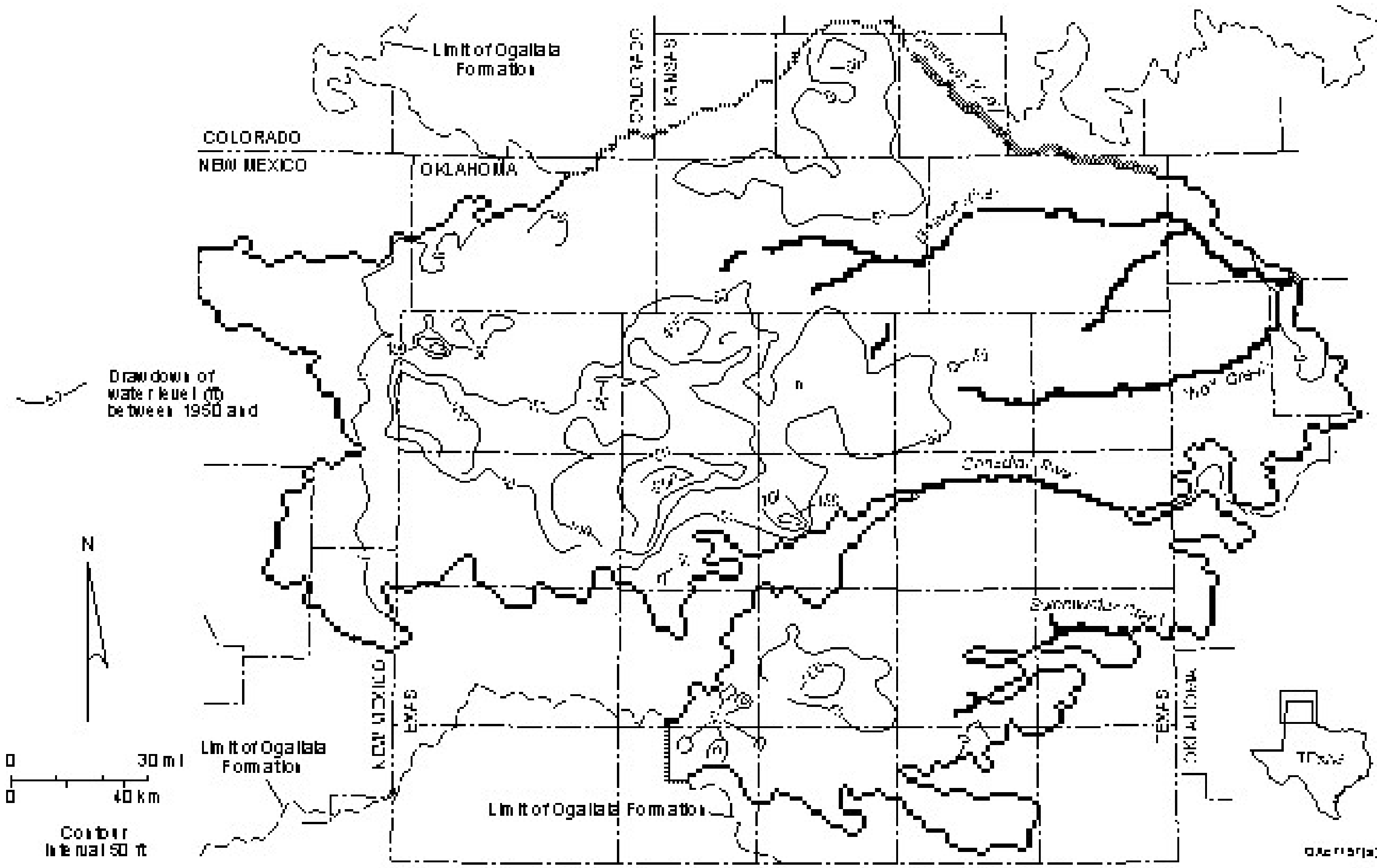

Figure 17. Drawdown in water levels in the Ogallala aquifer simulated for the period from 1950 to 1998.

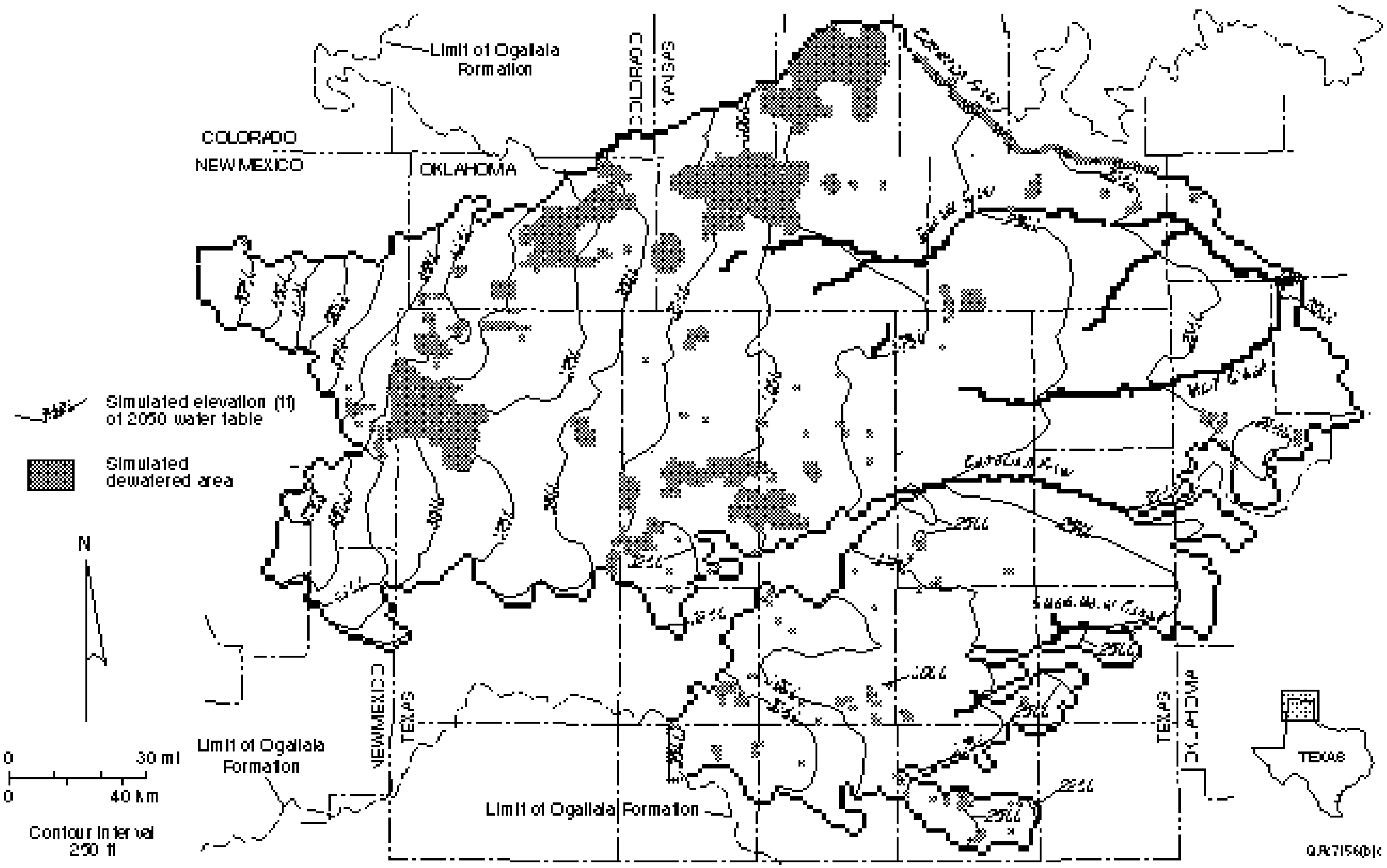

Figure 18. Water-table elevation predicted for the Ogallala aquifer in 2050, given the groundwater withdrawal rates and other assumptions used in the model.

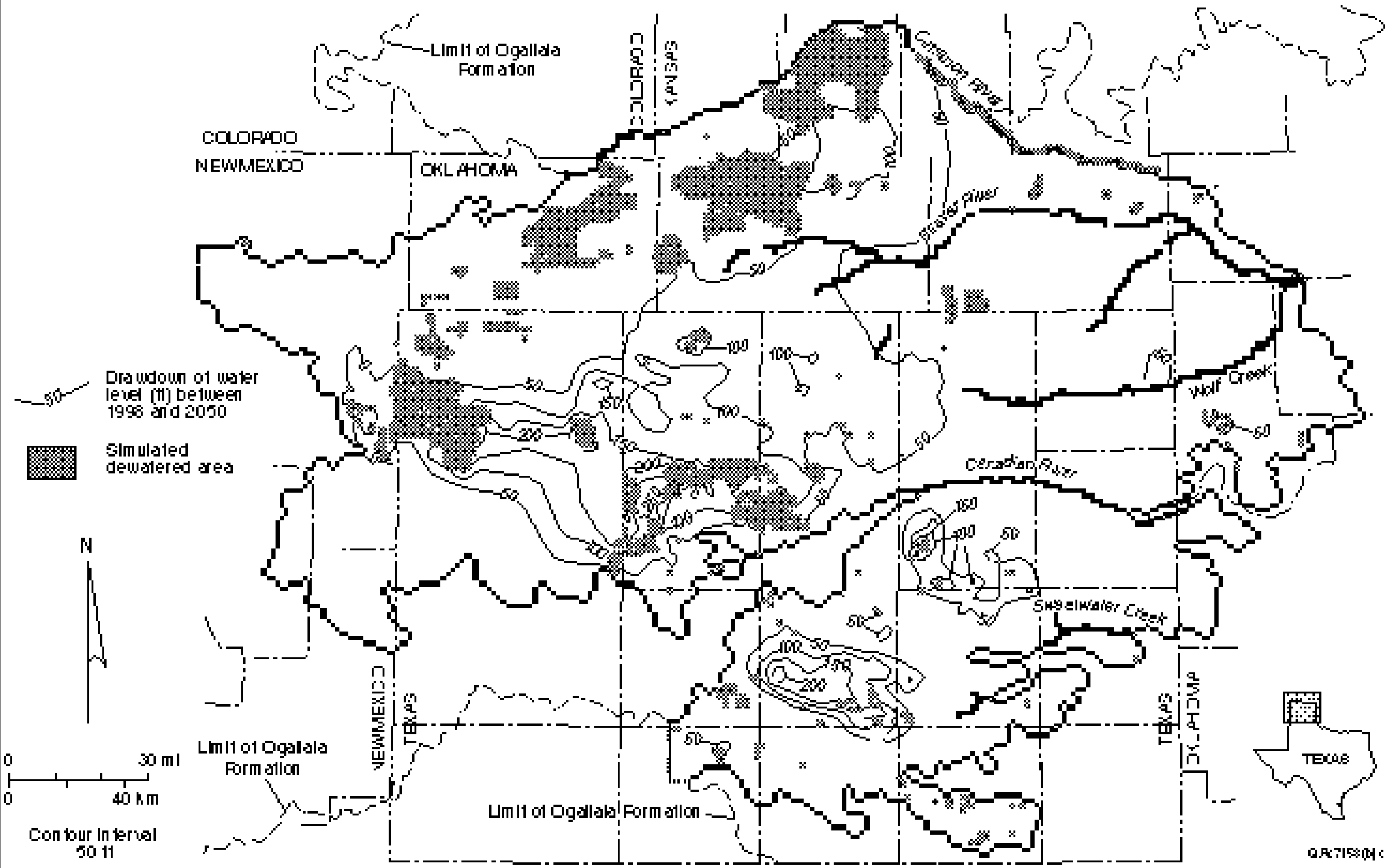

Figure 19. Drawdown in water levels in the Ogallala aquifer simulated for the period from 1998 to 2050.

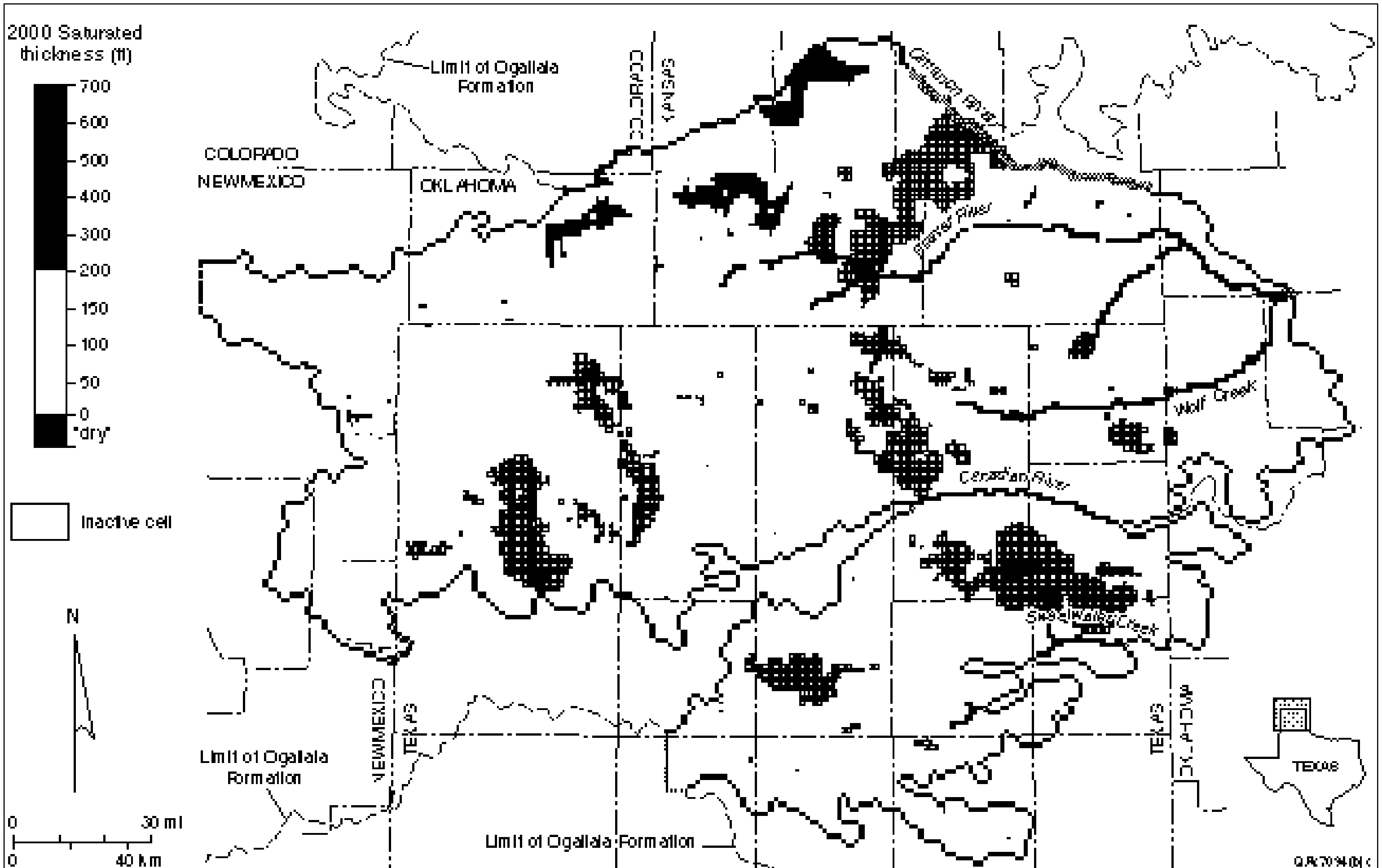

Figure 20. Saturated thickness of the Ogallala aquifer predicted for 2000.

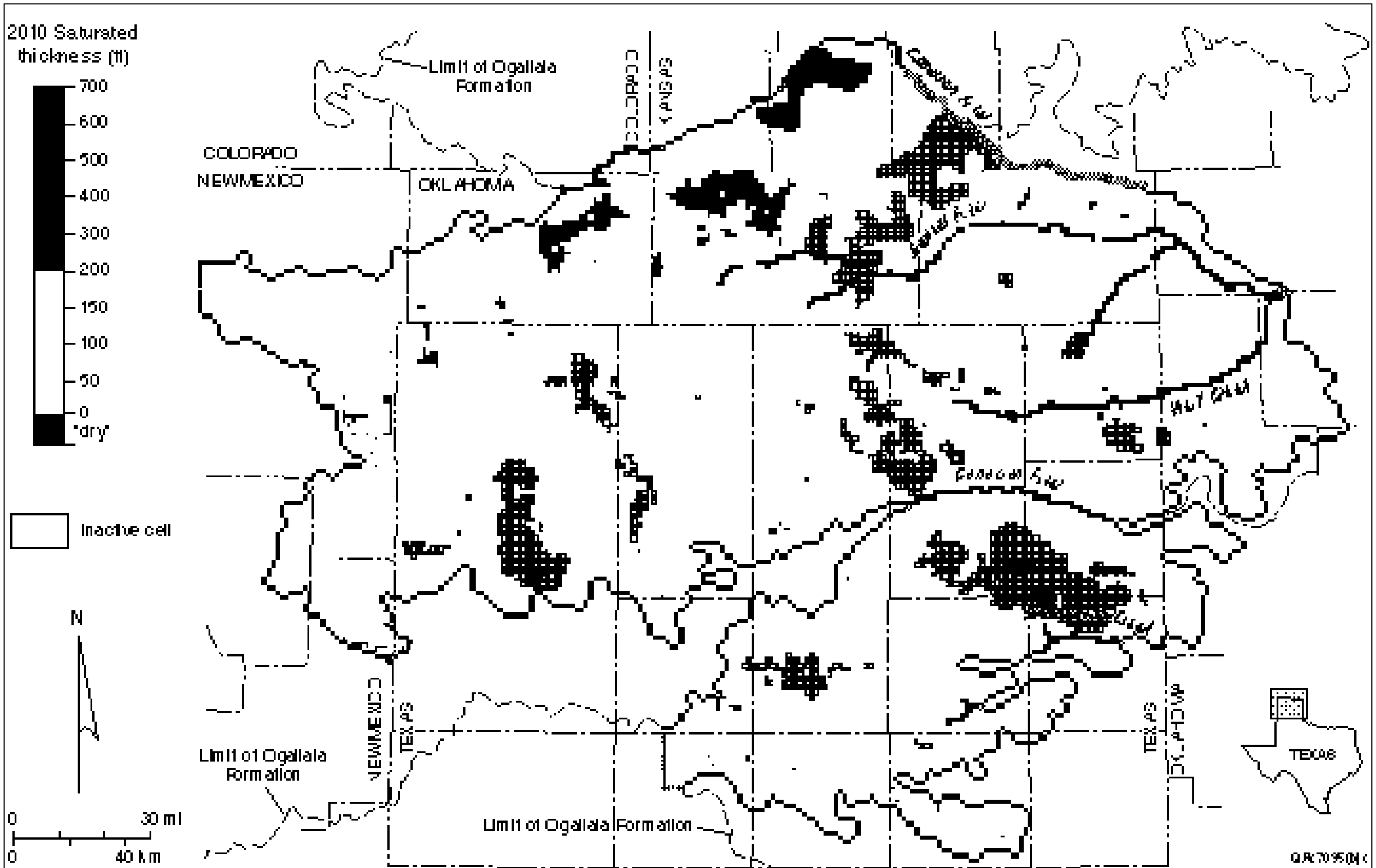

Figure 21. Saturated thickness of the Ogallala aquifer predicted for 2010.

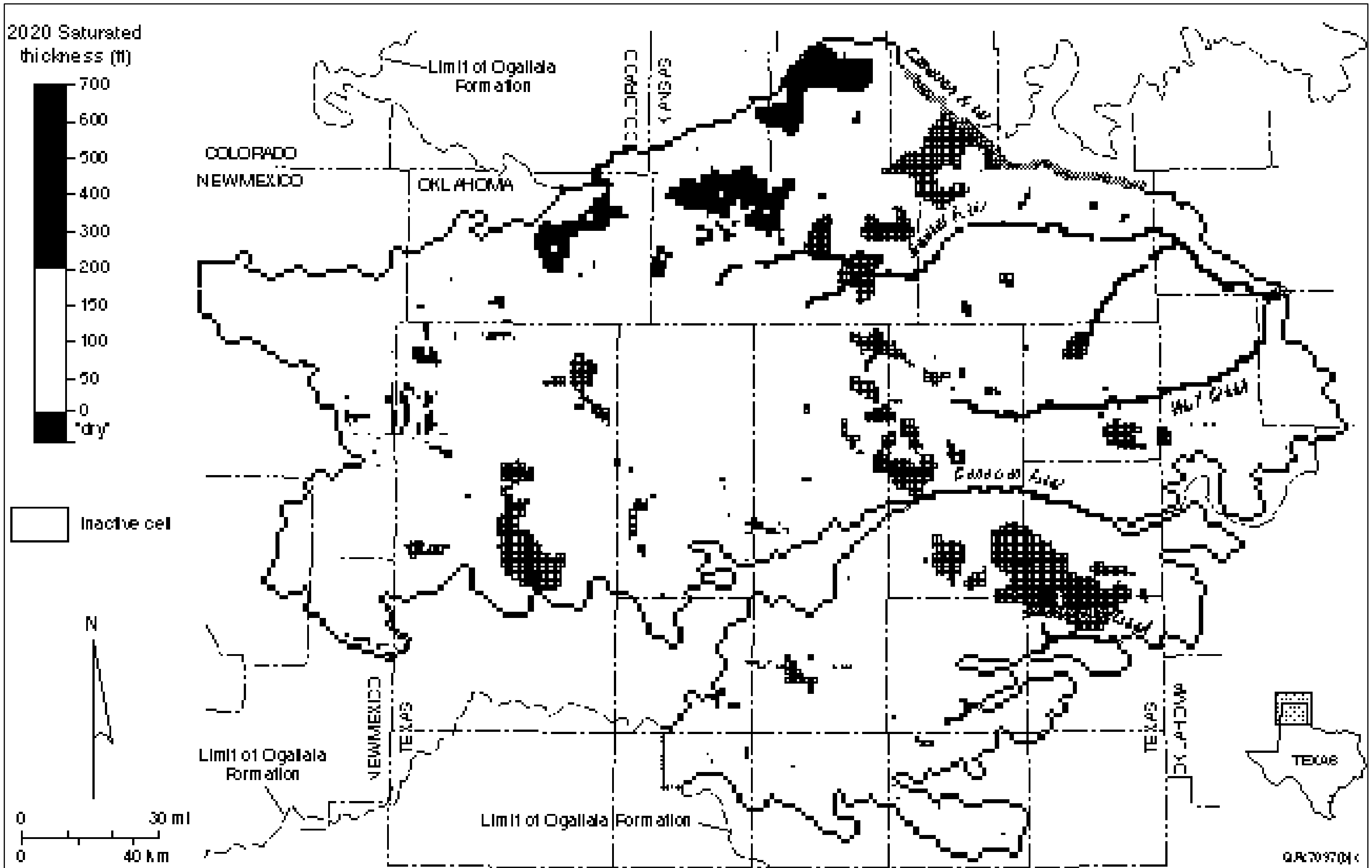

Figure 22. Saturated thickness of the Ogallala aquifer predicted for 2020.

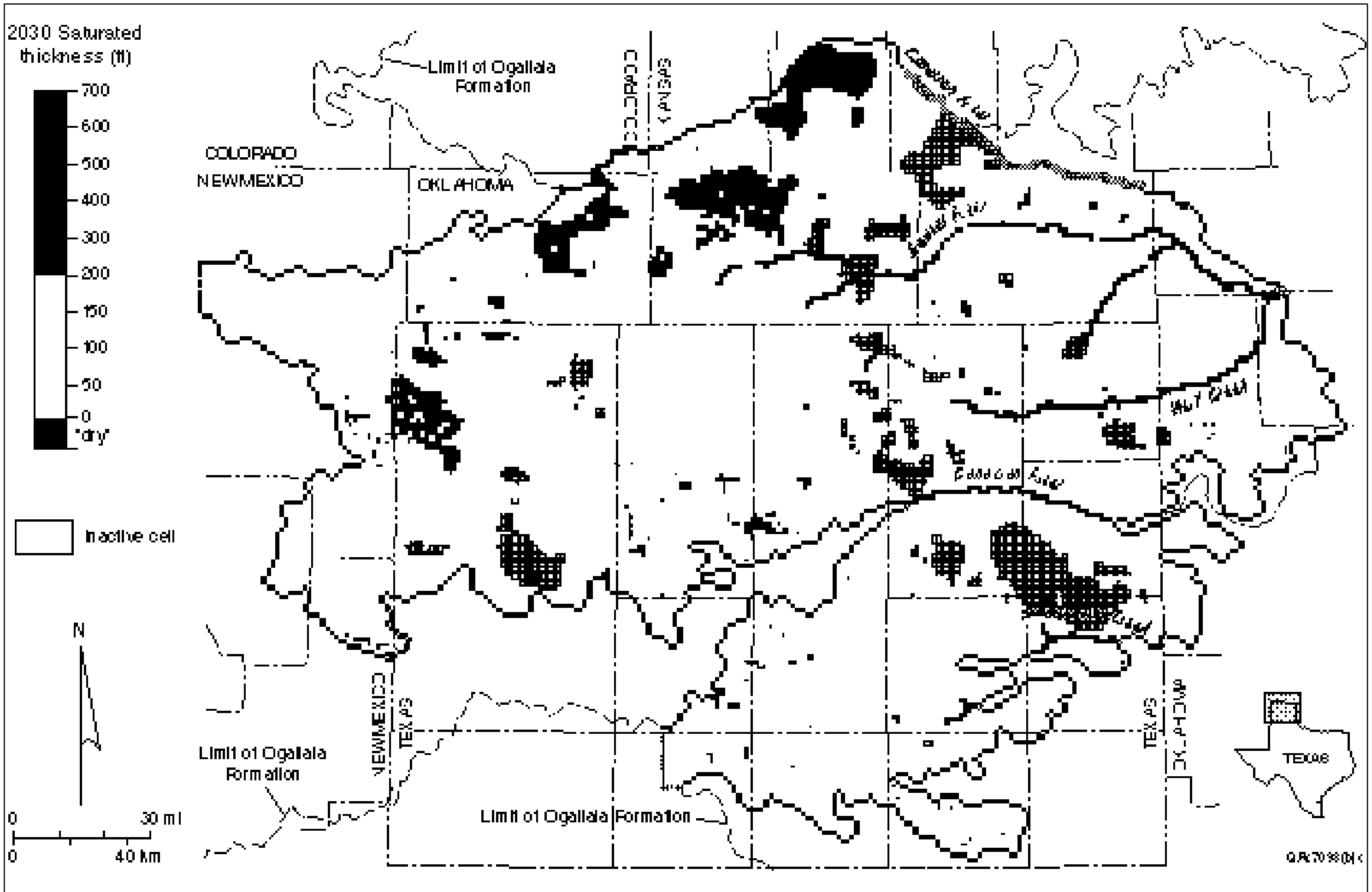

Figure 23. Saturated thickness of the Ogallala aquifer predicted for 2030.

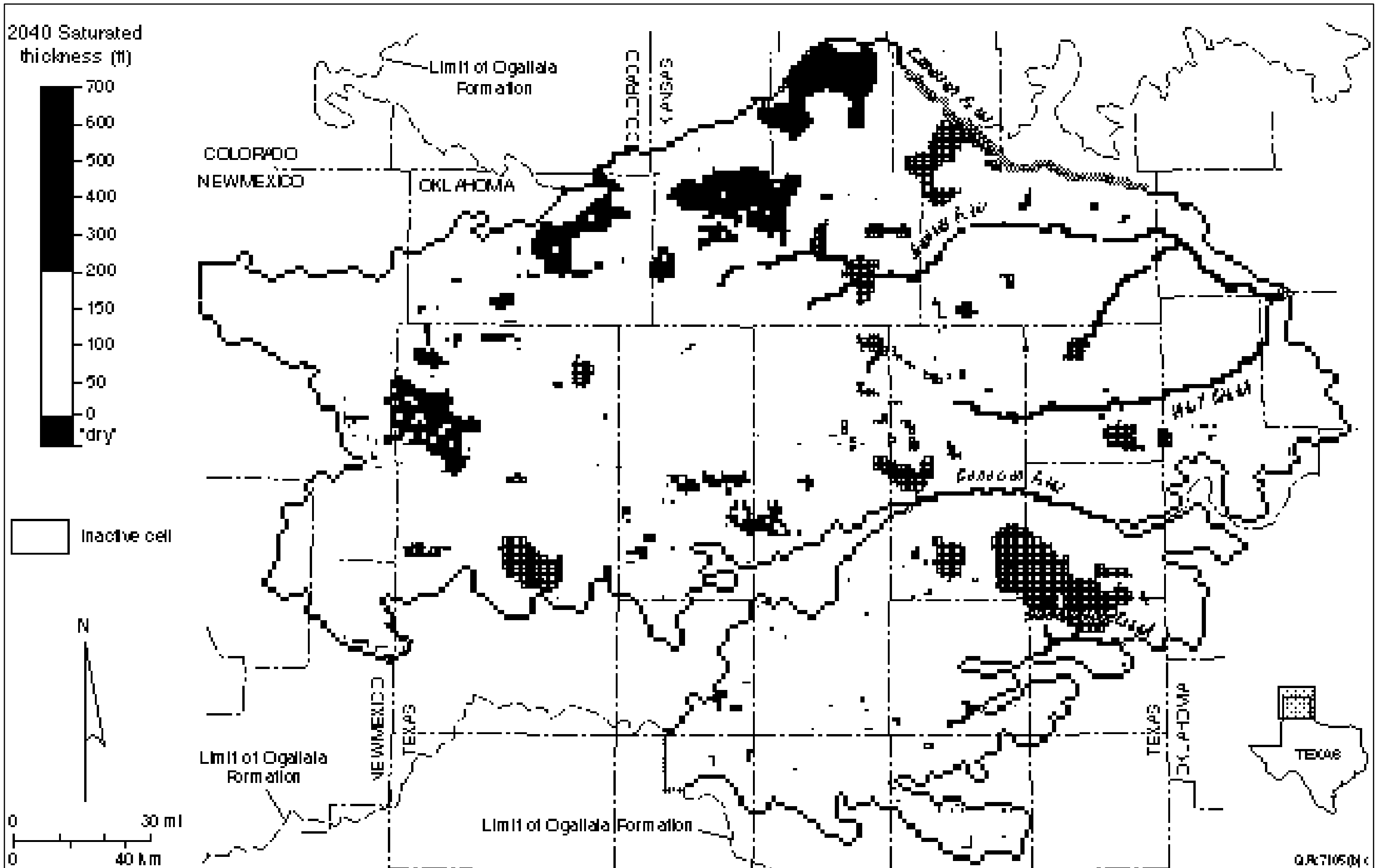

Figure 24. Saturated thickness of the Ogallala aquifer predicted for 2040.

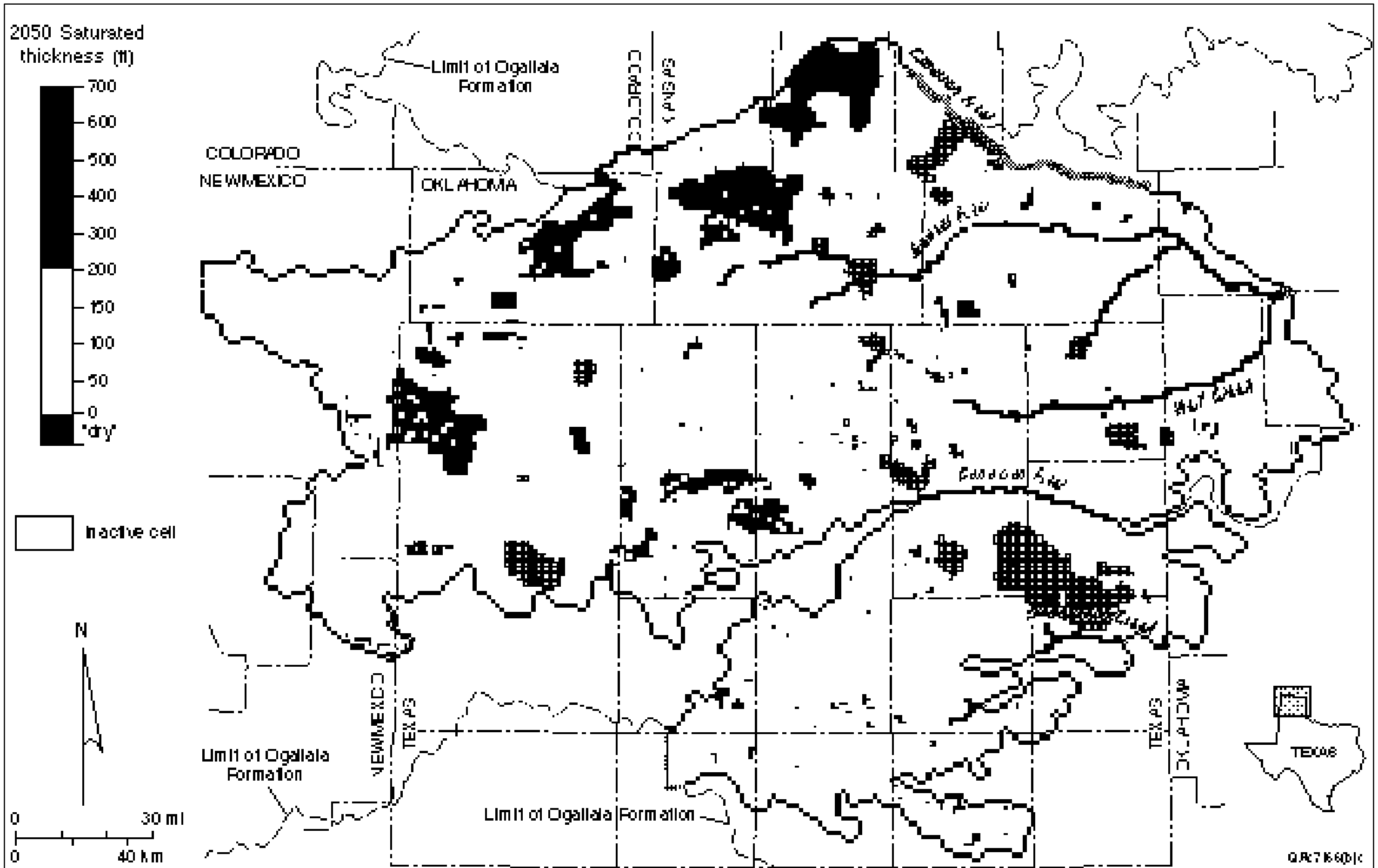

Figure 25. Saturated thickness of the Ogallala aquifer predicted for 2050.

Table 1. Tally of water in storage in the Ogallala aquifer in the PWPA estimated using the water-budget method. Numbers determined from calculations in geographic information system (GIS). From Dutton and Reedy (2000).

County	Area[1] (1,000 acres)	Average specific yield[2] (%)	Volume in storage[3] (million acre-feet) Predevelopment	1998	Depletion (%)	Average saturated thickness[4] (feet) Predevelopment	1998	Decline (feet)
Armstrong	369	14.1	4.48	3.95	11.2	78	72	6
Carson	605	17	19.17	14.85	22.6	184	146	38
Dallam	951	17.1	26.15	20.26	22.5	158	126	32
Donley	360	16.2	7.21	7.25	-0.6	99	94	5
Gray	570	18	14.85	14.12	4.9	141	133	8
Hansford	576	17.4	28.42	21.17	25.5	282	209	73
Hartley	910	17.9	35.19	28.10	20.1	211	169	42
Hemphill	584	17.2	16.99	16.60	2.3	171	169	2
Hutchinson	456	16.8	15.41	12.09	21.5	197	156	41
Lipscomb	576	14.9	20.02	16.94	15.4	228	195	33
Moore	534	14.7	18.87	13.36	29.2	232	169	63
Ochiltree	580	15.5	22.61	17.60	22.2	247	195	52
Oldham	383	13.7	3.26	2.84	12.9	20	21	-1
Potter	251	14.9	3.11	2.75	11.6	76	75	1
Randall	543	15	6.39	4.88	23.6	86	64	22
Roberts	573	17.7	27.97	26.92	3.8	278	267	11
Sherman	597	17.5	28.73	19.17	33.3	276	186	90
Wheeler	363	17.2	8.28	7.09	14.4	130	106	24
Total*/Average	9,781*	16.3	307.11*	249.94*	16.4	172	142	30

Footnotes:
[1]Aquifer area was determined in GIS from assigning model grid cells within counties.
[2]Specific yield is an average of all cells in a county; the average cannot be used to consistently convert between volume and saturated thickness.
[3]Volume is weighted value determined in GIS by multiplying saturated thickness by specific yield for each cell, multiplying by the 1-square-mile area of each cell, and summing for all cells in each county. Different numbers will be obtained by multiplying average saturated thickness by average specific yield for each county.
[4]Saturated thickness was determined directly in GIS as the difference in elevations of the water table and the base of aquifer.

Table 2. Stratigraphic nomenclature of Permian and younger strata, including the Ogallala Formation, in the study area. Modified from Gustavson and Simpkins (1989).

AGE	GEOLOGIC UNIT	
Quaternary	Blackwater Draw Formation	Tahoka Formation Double Lakes Formation Tule Formation
Tertiary	Blanco Formation	Cita Canyon lake beds
	Ogallala Formation	
Cretaceous	Edwards Group	
Triassic	Dockum Group	
Permian	Ochoan Series Guadalupian Series Leonardian Series	

Table 3. Weighting factors for recharge rates. Recharge rates were assigned in the model on the basis of long-term average precipitation and locally adjusted on the basis of weighting factors derived from soil textures. Soil data compiled from USDA-NRCS.

Soil group	Soil textures	Area in model (square miles)	Soil permeability (inches per hour)	Weighting factor
1	Loam–Silt loam	6,933	1.0	1.0
2	Loamy sand–Sandy loam	8,280	14.6	1.0
3	Sandy loam–Clayey loam–Silty clay loam	2,255	4.4	1.0
4	Silty clay loam–Silty clay	5,311	0.1	0.67
5	Silt loam–Clayey loam	517	0.5	0.67
6	Clay loam–Clay	341	0.3	0.67
7	Sandy loam–Loam–Clay loam	124	4.4	0.67
8	Sand	957	29.7	2.77

Table 4. River conductance values assigned in the “River” module of MODFLOW. Conductance varies with the tortuosity and length of the river segment in each cell of the model.

	River conductance (square feet per day)		
River	Maximum	Minimum	Average
Cimarron River	8,057	258	5,446
Beaver River	5,351	7	604
Wolf Creek	5,351	33	3,176
Canadian River	3,726	43	2,665
Sweetwater Creek	1,121	41	551

Table 5. Rates of groundwater withdrawal (thousand acre-feet) applied in the model. Note negative signs for well discharge removed for convenience of presentation.

	1950–1959	1950–1969	1970–1979	1980–1989	1990–1999	2000	2001–2010	2011–2021	2021–2030	2031–2040	2041–2050
Irrigation											
Armstrong	79	152	117	81	43	5	46	46	46	46	46
Carson	295	803	1,043	979	744	93	927	927	927	927	927
Dallam	449	1,114	1,860	2,910	3,095	369	3,692	3,692	3,692	3,692	3,692
Donley	23	77	116	158	154	17	170	170	170	170	170
Gray	35	125	151	101	123	22	222	222	222	222	222
Hansford	231	1,202	1,924	1,423	1,217	121	1,215	1,215	1,215	1,215	1,215
Hartley	152	873	1,977	2,278	1,703	186	1,862	1,862	1,862	1,862	1,862
Hemphill	1	5	6	2	18	4	44	44	44	44	44
Hutchinson	174	490	707	622	324	42	417	417	417	417	417
Lipscomb	14	42	124	170	222	35	351	351	351	351	351
Moore	402	1,447	2,237	2,140	1,665	183	1,831	1,831	1,831	1,831	1,831
Ochiltree	91	524	993	843	440	47	473	473	473	473	473
Oldham	0	0	0	0	0	0	0	0	0	0	0
Potter	31	60	62	37	60	15	149	149	149	149	149
Randall	110	184	142	97	76	12	116	116	116	116	116
Roberts	17	57	73	50	46	6	58	58	58	58	58
Sherman	395	2,095	3,419	2,829	1,881	195	1,952	1,952	1,952	1,952	1,952
Wheeler	9	22	35	24	22	3	34	34	34	34	34
Municipal and Public Water Supply											
Armstrong	0	1	1	2	2	0	2	2	2	2	2
Carson	6	10	17	22	84	23	233	246	261	279	300
Dallam	23	7	9	10	9	1	11	11	11	10	10
Donley	4	4	4	4	2	0	0	0	0	0	0
Gray	31	39	19	24	34	3	29	29	26	24	23
Hansford	6	12	13	14	12	1	14	14	14	13	13
Hartley	1	1	2	3	4	1	12	13	12	12	12
Hemphill	2	3	10	12	7	1	8	8	8	8	7
Hutchinson	23	29	28	33	30	3	25	24	23	22	21
Lipscomb	3	4	6	8	8	1	8	8	8	8	7
Moore	15	21	34	54	58	4	44	47	50	53	57
Ochiltree	10	13	13	20	21	3	27	27	27	26	25
Oldham	0	0	0	0	0	0	0	0	0	0	0
Potter	0	0	1	4	6	1	10	10	10	11	11
Randall	55	81	43	75	76	3	28	31	33	37	41
Roberts	1	1	2	2	2	0	467	657	757	802	802
Sherman	3	3	6	7	7	1	7	7	7	6	6
Wheeler	12	11	11	11	8	1	8	8	8	7	7
Industrial and Manufacturing											
Armstrong	0	0	0	0	0	0	0	0	0	0	0
Carson	68	103	88	63	26	6	65	71	76	83	92
Dallam	0	0	2	0	0	0	2	2	2	2	2
Donley	18	50	52	32	37	4	40	42	43	45	48
Gray	3	7	11	0	0	0	0	1	1	1	1
Hansford	0	0	0	0	0	0	0	0	0	0	0
Hartley	0	0	5	0	0	0	0	0	0	0	0
Hemphill	0	0	0	1	0	0	0	0	0	0	0
Hutchinson	113	199	144	160	149	15	155	167	177	190	207
Lipscomb	0	0	0	0	0	0	2	2	2	2	2
Moore	65	147	126	57	43	7	75	79	82	86	92
Ochiltree	0	0	0	0	0	0	0	0	0	0	0
Oldham	0	0	0	0	0	0	0	0	0	0	0
Potter	8	16	18	5	0	0	0	0	0	0	0
Randall	0	0	0	0	0	0	1	1	1	1	1
Roberts	0	0	0	0	0	0	0	0	0	0	0
Sherman	0	0	0	0	0	0	0	0	0	0	0
Wheeler	1	2	2	0	0	0	0	0	0	0	0
Power Generation											
Potter	0	1	2	14	12	1	11	11	11	11	11

Table 5 (cont.)

	1950–1959	1950–1969	1970–1979	1980–1989	1990–1999	2000	2001–2010	2011–2021	2021–2030	2031–2040	2041–2050
Domestic and Stock											
Armstrong	1	1	2	4	5	0	5	5	6	6	7
Carson	2	2	2	9	13	1	11	12	13	13	14
Dallam	2	3	4	16	31	7	89	114	129	146	165
Donley	1	2	1	0	1	1	6	7	7	7	8
Gray	2	3	4	4	5	2	22	26	29	32	35
Hansford	1	4	6	26	26	5	73	96	108	120	134
Hartley	1	1	4	17	20	3	30	33	36	38	41
Hemphill	1	2	3	3	9	1	15	16	18	19	21
Hutchinson	1	2	2	1	1	0	5	5	6	6	7
Lipscomb	0	0	1	1	3	1	18	25	28	32	37
Moore	2	3	6	26	38	4	55	77	86	97	108
Ochiltree	2	3	4	10	12	7	70	78	88	100	113
Oldham	0	0	0	0	0	0	1	1	1	1	1
Potter	2	3	3	1	1	0	3	3	3	3	4
Randall	0	1	1	4	6	1	6	6	7	8	8
Roberts	0	1	1	1	1	1	6	6	6	7	8
Sherman	1	2	4	22	29	4	48	60	66	74	82
Wheeler	1	2	1	2	3	1	10	11	12	12	13

Table 6. Summary of groundwater discharge (cubic feet per second) to major rivers included in the model. Note that discharge from the aquifer to rivers is represented here as a positive value.

	Steady state	1960	1970	1980	1990	2000	2010	2020	2030	2040	2050
Cimarron River	52	50	45	38	31	25	19	13	8	5	1
Beaver River	94	93	91	87	83	78	73	68	63	59	54
Wolf Creek	59	58	56	52	47	40	33	27	22	18	14
Canadian River	66	66	65	65	64	63	62	61	59	57	55
Sweetwater Creek	13	13	13	13	13	13	13	13	13	13	12

Table 7. Average simulated saturated thickness (feet) in the modeled part of the Ogallala aquifer.

County	1950	1998	2000	2010	2020	2030	2040	2050
Armstrong	93	86	85	84	83	82	80	79
Carson	217	176	174	159	145	130	116	102
Dallam	215	163	158	137	118	104	92	81
Donley	76	69	69	67	65	63	62	61
Gray	155	146	145	141	136	131	127	122
Hansford	279	222	219	206	192	178	164	150
Hartley	275	234	232	220	209	198	186	176
Hemphill	208	207	207	206	205	204	203	202
Hutchinson	146	108	106	97	87	79	71	65
Lipscomb	199	193	193	189	186	183	180	177
Moore	249	157	153	130	107	84	65	49
Ochiltree	238	210	209	203	197	190	184	177
Oldham*	80	80	80	80	79	79	79	78
Potter	93	82	80	76	73	71	69	67
Randall*	121	94	94	90	88	86	84	81
Roberts	258	254	254	246	235	227	222	218
Sherman	303	208	204	186	167	147	128	109
Wheeler	177	175	175	174	173	172	171	170

*Includes only that part of county in model area (fig. 2).

Table 8. Comparison of estimated and simulated volumes of water in storage for 1950 and 1998.

County	County Area (mi^2)	County area in model (mi^2)	Aquifer area in model (mi^2)	1950 Estimated volume (maf)	1950 Simulated volume (maf)	1950 Difference (%)	1998 Estimated volume (maf)	1998 Simulated volume (maf)	1998 Difference (%)
Armstrong	915	927	513	4.48	4.60	-0.4	3.95	4.20	-2.0
Carson	922	930	915	19.17	21.70	5.0	14.85	17.66	4.8
Dallam	1,505	1,509	1,494	26.15	36.28	-5.0	20.26	27.04	10.4
Donley	936	930	539	7.21	4.42	3.9	7.25	4.01	11.4
Gray	929	939	893	14.85	28.06	-5.4	14.12	22.29	-3.9
Hansford	921	900	897	28.42	28.82	-5.8	21.17	24.41	-13.2
Hartley	1,463	1,470	1,411	35.19	45.33	10.3	28.10	38.39	13.3
Hemphill	912	923	910	16.99	20.47	-10.4	16.60	20.40	-12.6
Hutchinson	895	900	665	15.41	11.02	-14.1	12.09	8.04	-20.5
Lipscomb	933	927	927	20.02	17.80	-3.9	16.94	17.33	-19.8
Moore	909	930	852	18.87	20.84	-8.4	13.36	13.01	4.7
Ochiltree	919	900	897	22.61	21.47	-8.5	17.60	18.85	-24.4
Oldham	1,508	1,486	80	3.26	0.44	na	2.84	0.44	na
Potter	922	954	374	3.11	3.33	-19.0	2.75	2.92	-17.1
Randall	922	907	195	6.39	2.37	na	4.88	1.82	na
Roberts	924	904	899	27.97	25.62	-9.9	26.92	25.21	-12.5
Sherman	923	913	913	28.73	30.88	0.2	19.17	21.18	3.2
Wheeler	916	900	520	8.28	9.92	7.6	7.09	9.81	-5.9
Total	18,274	18,249	13,894	307.11	333.37	-4.0	249.94	277.00	-5.3**

maf Million acre feet
na Not applicable calculation
* Includes only that part of county in model area (fig. 2)
** Average of differences

Table 9. Percentage of county having saturated thickness of 50 feet or less in the modeled part of the Ogallala aquifer.

County	1950	1998	2000	2010	2020	2030	2040	2050
Armstrong	19.1	21.2	21.2	21.4	22.0	22.4	23.4	23.8
Carson	2.3	3.0	3.0	3.5	4.3	6.3	9.8	14.6
Dallam	4.3	9.8	10.8	20.7	32.4	37.3	42.6	49.2
Donley	53.8	63.6	63.8	65.1	66.8	66.6	67.2	67.2
Gray	10.8	11.9	11.9	12.2	12.8	13.7	14.2	15.3
Hansford	0.1	0.6	0.7	1.1	1.8	2.8	5.1	7.1
Hartley	4.3	4.6	4.6	4.8	5.7	6.4	6.7	9.4
Hemphill	3.0	3.0	3.0	3.0	3.2	3.2	3.2	3.5
Hutchinson	15.3	23.9	24.1	29.3	33.5	38.0	43.9	47.4
Lipscomb	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.6
Moore	11.4	13.6	14.2	16.8	24.1	36.9	50.8	60.8
Ochiltree	1.3	1.9	1.9	2.3	2.9	3.2	4.0	5.0
Oldham*	47.5	47.5	47.5	47.5	47.5	47.5	47.5	47.5
Potter	35.0	39.8	41.2	44.4	45.7	46.8	47.9	48.4
Randall*	7.7	12.8	13.8	17.9	19.5	19.5	23.1	24.6
Roberts	0.3	0.3	0.3	0.3	0.7	1.4	1.8	1.8
Sherman	0.0	0.0	0.0	0.0	0.5	1.3	5.4	12.4
Wheeler	21.0	21.2	21.2	21.3	21.5	21.9	22.5	22.7

*Includes only that part of county in model area (fig. 2).

Table 10. Percentage of aquifer in modeled part of county having less than 50 percent of 1998 saturated thickness.

County	2000	2010	2020	2030	2040	2050
Armstrong	0.0	0.0	0.0	0.2	0.2	0.8
Carson	0.0	0.0	1.2	6.7	15.8	31.7
Dallam	0.2	10.2	24.2	33.5	44.4	51.7
Donley	0.0	0.6	3.2	4.8	5.9	7.1
Gray	0.0	0.1	0.4	0.8	1.9	2.8
Hansford	0.0	0.0	0.4	2.1	6.7	15.6
Hartley	0.0	0.0	1.4	3.4	11.3	19.7
Hemphill	0.0	0.0	0.0	0.0	0.0	0.0
Hutchinson	0.2	3.3	9.5	17.1	23.2	30.7
Lipscomb	0.0	0.0	0.0	0.0	0.0	0.0
Moore	0.0	1.4	13.7	37.6	55.3	68.3
Ochiltree	0.0	0.1	0.2	0.3	0.3	0.7
Oldham*	0.0	0.0	0.0	0.0	0.0	0.0
Potter	0.8	4.3	5.6	6.4	6.4	7.2
Randall*	0.0	1.5	2.6	3.1	4.6	5.6
Roberts	0.0	0.0	1.4	2.2	2.8	3.2
Sherman	0.0	0.0	0.5	4.9	20.6	43.4
Wheeler	0.0	0.2	0.2	0.2	0.2	0.2

*Includes only that part of county in model area (fig. 2).

Table 11. Volume of water in storage (million acre feet) projected for 2000 to 2050 in the Ogallala aquifer using TAES irrigation estimates. Projections should not be relied upon for anything other than their intended use in identifying areas with surpluses and deficits between supply and demand for groundwater in the PWPA, as discussed in the text.

County	2000	2010	2020	2030	2040	2050	1998 volume remaining in 2050 (%)
Armstrong	4.19	4.13	4.07	4.01	3.95	3.89	93
Carson	17.40	15.99	14.56	13.12	11.71	10.31	58
Dallam	26.33	22.65	19.25	16.76	14.69	12.81	47
Donley	3.98	3.87	3.76	3.68	3.60	3.55	89
Gray	22.03	20.70	19.31	17.91	16.51	15.11	68
Hansford	24.17	22.93	21.71	20.49	19.29	18.13	74
Hartley	38.02	36.08	34.15	32.23	30.35	28.52	74
Hemphill	20.38	20.29	20.18	20.07	19.96	19.85	97
Hutchinson	7.90	7.19	6.50	5.86	5.30	4.80	60
Lipscomb	17.27	16.96	16.66	16.37	16.09	15.83	91
Moore	12.65	10.73	8.79	6.90	5.23	3.94	30
Ochiltree	18.74	18.18	17.61	17.02	16.42	15.80	84
Oldham*	0.44	0.44	0.43	0.43	0.43	0.43	98
Potter	2.86	2.71	2.61	2.53	2.46	2.39	82
Randall*	1.80	1.74	1.69	1.65	1.61	1.56	86
Roberts	25.18	24.43	23.39	22.62	22.14	21.70	86
Sherman	20.83	18.94	16.96	14.97	13.00	11.06	52
Wheeler	9.80	9.75	9.70	9.65	9.60	9.55	97
Total	273.99	257.70	241.33	226.27	212.32	199.21	72

*Includes only that part of county in model area (fig. 2)

Table 12. Volume of water in storage (million acre feet) projected for 2000 to 2050 in the Ogallala aquifer using TWDB irrigation estimates and the specified-transmissivity model (Dutton and others, 2000). Projections should not be relied upon for anything other than their intended use in identifying areas with surpluses and deficits between supply and demand for groundwater in the PWPA, as discussed in the text. Volume projections on the basis of TWDB irrigation estimates may provide a "worst-case" scenario as TWDB rates generally are greater than TAES rates (see table 11) and the specified-transmissivity model predicts greater drawdown than the calculated-transmissivity model.

County	2000	2010	2020	2030	2040	2050	2000 volume remaining in 2050
Armstrong	4.01	3.92	3.82	3.72	3.60	3.47	86.5
Carson	13.87	12.42	10.95	9.49	8.08	6.71	48.4
Dallam	17.44	13.72	10.41	7.90	6.01	4.57	26.2
Donley	6.39	6.23	6.06	5.90	5.75	5.60	87.6
Gray	14.59	14.13	13.61	13.04	12.44	11.81	80.9
Hansford	23.71	22.32	20.90	19.48	18.03	16.58	69.9
Hartley	23.97	21.89	19.89	18.22	16.72	15.38	64.2
Hemphill	18.67	18.58	18.48	18.36	18.23	18.09	96.9
Hutchinson	14.43	13.65	12.84	12.01	11.14	10.23	70.9
Lipscomb	20.23	19.88	19.54	19.20	18.87	18.53	91.6
Moore	12.37	10.53	8.71	7.05	5.50	4.10	33.2
Ochiltree	21.78	21.21	20.64	20.05	19.46	18.85	86.5
Oldham*	0.73	0.71	0.69	0.67	0.64	0.62	84.6
Potter	3.15	2.82	2.58	2.35	2.15	1.96	62.1
Randall*	1.84	1.78	1.72	1.66	1.60	1.53	83.1
Roberts	30.24	29.47	28.41	27.27	26.11	25.03	82.7
Sherman	18.17	16.17	14.14	12.14	10.20	8.32	45.8
Wheeler	7.50	7.44	7.38	7.32	7.27	7.21	96.2
Total	253.10	236.86	220.78	205.83	191.79	178.59	70.6

*Includes only that part of county in model area (fig. 2)

Final Topical Report

Saturated Thickness in the Ogallala Aquifer in the Panhandle Water Planning Area—Simulation of 2000 through 2050 Withdrawal Projections

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EXECUTIVE SUMMARY

The Ogallala aquifer is one of Texas' major aquifer systems. This study focused on the part of the Ogallala aquifer that underlies 18 of the 21 counties of the Panhandle Water Planning Area (PWPA). In the past 50 years, water-level drawdown in parts of the unconfined aquifer has been as much as 190 feet, or about 4 feet per year. Pumping rates for the next 50 years to 2050 have been projected to be greater than previous rates, and additional drawdown is possible.

A numerical, or computer, model of the occurrence and movement of groundwater in the Ogallala aquifer was developed to predict future water-level changes. Model development was part of a state-wide process of developing water-resource management plans under Senate Bill 1, 75th Texas Legislative Session. This model improved on previous models by (1) covering the Ogallala aquifer within most of each county in the PWPA with detailed resolution, (2) using as much as possible spatially controlled geologic and hydrologic data, and (3) placing of the model edges to minimize their effects on the area of interest in Texas. The model is intended to be used as a tool to assess surpluses and deficits in aquifer resources and to evaluate water management strategies that might address resource deficits.

The model was calibrated under two sets of conditions: "predevelopment" without appreciable rates of pumping, and "current" conditions, representing 1950 and 1998, respectively. The model (root mean square) error for the predevelopment calibration was about 64 feet and includes uncertainties due to the inherent model simplifications and approximations of recharge, transmissivity, base-flow discharge to rivers and springs, and model geometry. The model error for the 1998 calibration was about 74 feet. The somewhat larger model error for 1998 includes uncertainties associated with the predevelopment calibration and approximation of specific yield, historical pumping rates, and return flow. These model errors represent less than 5 percent of the change in hydraulic head across the Texas part of the model. In much of the Texas part of the model, the residual difference in hydraulic head is less than ±50 feet.

Using groundwater demands projected by the Panhandle Water Planning Group (PWPG) and the Texas Water Development Board (TWDB), the model predicts that by 2050 major areas of the aquifer will have less than 50 feet of remaining saturated thickness and that parts of the aquifer in Dallam, Sherman, Hartley, Moore, Potter, and Carson Counties may be dry. Details of this prediction may not be realized because of the following:

- a goal of the PWPG in the area is that at least half the 1998 saturated thickness of the aquifer will remain by 2050;
- pumping rates were not decreased as water levels fell in this version of the model;
- the model is not well calibrated for the extreme event of aquifer dewatering, so predicting saturated thickness where the water table is near the base of the aquifer may have an error greater than 74 feet.

The model can be used, however, to identify areas where there may be surpluses and deficits in groundwater resources, to evaluate water-management alternatives, and to estimate what rates of groundwater pumping in various parts of the PWPA would ensure the goal of groundwater conservation districts is met. The model also may be used as an aquifer management tool to evaluate or compare proposed scenarios of groundwater development.

INTRODUCTION

Purpose and Objectives

The Ogallala aquifer, which makes up the main part of the High Plains aquifer along with adjacent and hydraulically interconnected older and younger formations, is the main source of agricultural and public-water supply in much of the Texas Panhandle (fig. 1). Prediction of the amount of remaining groundwater in the Ogallala aquifer over the course of the next 50 years is an important part of managing the aquifer’s resource and of developing regional plans to meet future water needs. This report focuses on groundwater in the Ogallala aquifer in the Panhandle Water Planning Area (PWPA) (figs. 1, 2). Under Senate Bill 1, 75th Texas Legislative Session, the

Panhandle Water Planning Group (PWPG) is charged with developing a regional water plan for the PWPA. The regional plan will be used by the Texas Water Development Board (TWDB) in developing a state-wide water-resource management plan.

Preliminary estimates of water remaining in storage in the Ogallala aquifer in the PWPA during 2000 to 2050 were made using a water-budget method, in which original water in place was estimated using data in a geographic information system (GIS) and water inflow and outflow were added and subtracted in a spreadsheet (Dutton and Reedy, 2000). That preliminary analysis predicted that saturated thickness in the Ogallala aquifer in Dallam, Moore, Oldham, Potter, and Randall Counties will decline to less than 50 feet by 2050. A numerical model of the occurrence and movement of groundwater in the Ogallala aquifer was developed to

- predict with more accuracy and precision the remaining Ogallala groundwater within each county of the PWPA, given specific groundwater demands, and
- assess surpluses and deficits in Ogallala aquifer resources to meet demands.

Goals for developing this model were to provide a water-management tool that would cover the PWPA area, set model boundaries having minimal impact on results in the area of interest, and use measured hydrologic properties and other data to constrain model parameters and ensure results are representative of aquifer conditions.

A preliminary version of the numerical model was reported in August 2000 (Dutton and others, 2000). That version of the model assumed a constant transmissivity, recharge that varied with soil type, and no return flow. The model predicted that by 2050, appreciable parts of Dallam, Sherman, Hartley, Moore, Potter, and Carson Counties would have run out of groundwater in the Ogallala aquifer or have less than 50 feet of saturated section. Dutton and others (2000) stated that the accuracy of this prediction was limited because pumping rates were not decreased as water level fell and the model was not well calibrated for dewatering conditions since transmissivity was held constant. It was also pointed out that groundwater conservation districts in the area have the goal of limiting drawdown so that at least half the 1998 column of water in the aquifer will remain by 2050.

Between May and October 2000 additional work focused on revising the model to improve accuracy of the prediction of 2050 water levels. The changes included (a) specifying hydraulic conductivity and varying transmissivity with water level, (b) varying recharge with precipitation rate as well as soil type, and (c) including estimates of return flow. This report documents the final revised model. This report documents model construction and calibration and use of the model to predict saturated thickness from 2000 to 2050, given consensus-based estimates of future demand for groundwater.

CONCEPTUAL HYDROGEOLOGIC MODEL

Few regional aquifers have been as extensively studied as the Ogallala aquifer. Computer, or numerical, models of groundwater flow have been important tools for managing the groundwater resource and evaluating future changes in water level and saturated thickness. At least 15 numerical groundwater flow models have been developed for different parts of the Ogallala aquifer in Texas (Mace and Dutton, 1998). Numerical models integrate much of the known information on an aquifer, allow consideration of how the water-level response to pumping is influenced by aquifer properties, and help identify what information and conceptual understanding needs additional development. Each of the previous Ogallala models has had a specific purpose and carried associated strengths and weaknesses.

On the basis of this previous work, a conceptual model was developed for the occurrence and movement of water in the Ogallala aquifer in the study area. This conceptual model was used as a starting point for constructing the numerical model.

Water Resources and Water Demand

More water is pumped from the Ogallala aquifer than any other aquifer in Texas. The volume of water in the aquifer in the PWPA as of 1950 was estimated by the water-budget method as approximately 307 million acre-feet of water (table 1). Estimates of average saturated thickness of groundwater originally in place in the Ogallala aquifer range from 20 feet in Oldham County to 282 feet in Hansford County. Saturated thickness is less than 50 feet in parts of several counties, for example, in much of Oldham County and in southwestern Randall County (Knowles and others, 1984, v. 3, p. 433).

The rate of groundwater withdrawal for irrigation markedly increased after 1950 (Texas Water Development Board, 1996; fig. 3). Historically, withdrawal for irrigation has made up from 57 to 96 percent of the total groundwater demand (Dutton and Reedy, 2000). Average total annual withdrawal was greatest during the 1980s. During the 1990s the total rate of withdrawal appears to have decreased to about 1.24 million acre-feet per year. Future demand, on the basis of consensus-based projections and assuming water availability (Freese and Nichols, Inc., 2000), is expected to continue to increase but after 2000 at lower rates than in the past (fig. 3). This assumes no future growth in demand for irrigation.

Hydrostratigraphy

The Ogallala Formation in the study area consists of Tertiary-age alluvial fan, fluvial, lacustrine, and eolian deposits derived from erosion of the Rocky Mountains (Seni, 1980; Gustavson and Winkler, 1988). The Ogallala Formation in the study area unconformably overlies Permian, Triassic, and other Mesozoic formations (Gutentag and others, 1984) and in turn may be covered by Quaternary fluvial, lacustrine, and eolian deposits (table 2). Ogallala sediments filled paleovalleys eroded into the pre-Ogallala surface (Seni, 1980; Gustavson and Winkler, 1988). Deposition of the Ogallala Formation in some areas was contemporaneous with dissolution of underlying Permian salt beds, resulting in additional ground-surface subsidence and increased accumulation of Ogallala sediment (Gustavson and Finley, 1985). At the northwestern limit of the study area in northeastern New Mexico, the Ogallala Formation is also interbedded and locally covered with Tertiary-age volcanic deposits (fig. 1).

This depositional framework of the Ogallala aquifer has resulted in lateral and vertical heterogeneity. Aquifer heterogeneity is the spatial variability in properties that control the occurrence and movement of groundwater, such as hydraulic conductivity and specific yield, and is largely related to geologic features. Areas of the aquifer with a greater amount of sand and gravel have greater hydraulic conductivity. The lower part of the formation tends to have more coarse-grained sediment and greater hydraulic conductivity than the upper part. Within any section, sediment bedding may slightly impede the vertical circulation of groundwater.

Gutentag and others (1984) advocated referring to the groundwater system in the study area as the High Plains aquifer, for two main reasons. First, groundwater can move between the Ogallala Formation and adjacent Permian, Mesozoic, and Quaternary formations, so the term Ogallala aquifer is inadequate to refer to the whole aquifer system. Second, it also may be noted that not all of the Ogallala Formation is saturated. The term “High Plains aquifer” addresses these issues and avoids using a formational name also as an aquifer name. Because the focus of this study is on groundwater in the Ogallala Formation, however, the term “Ogallala aquifer” is used in this report, following local usage.

The Ogallala aquifer is an unconfined aquifer; that is, volume of water in storage changes by the filling and draining of pore or void space in the material that makes up the aquifer. The regional water table marks the top of the saturated zone within the Ogallala aquifer.

The Ogallala Formation and overlying Blackwater Draw Formation underlie the High Plains. Retreat of the edge of the High Plains surface has left a steep escarpment in most areas, which is held up in part by an erosion-resistant caprock, a calicified soil layer that separates the Ogallala from the Blackwater Draw Formations (Gustavson and Simpkins, 1989; Gustavson, 1996). The other main physiographic feature in the study area is the Canadian River Breaks, consisting of the dissected erosional drainage bordering the Canadian River.

Flow Paths

The conceptual model of flow paths in the Ogallala aquifer includes the following understandings, hypotheses, and assumptions:

- Under historical conditions, groundwater moved generally eastward in directions parallel to the slope of ground surface. South of the Prairie Dog Town Fork of the Red River (figs. 1, 2), flow is generally directed to the southeast (Knowles and others, 1984). In the area between the Canadian River and Prairie Dog Town Fork, flow is generally toward the northeast but follows an arcuate path curving toward either river valley. North of the Canadian River, flow is generally to the east.
- The drawdown of water levels in well fields such as the Amarillo well field in Carson County locally changes the direction of regional flow paths.
- The volume of flow within the Ogallala aquifer is large relative to the volume of cross-formational flow at the base of the aquifer. The Ogallala aquifer is thought to be the source of groundwater in the Triassic-age Dockum Group (Santa Rosa) that underlies the Ogallala Formation beneath much of the High Plains (Dutton, 1995). Over geologic time, downward movement of water out of the Ogallala around the perimeter of the High Plains drives dissolution of Permian salt beds (Simpkins and Fogg, 1982; Dutton, 1990); however, the rate of downward flow is low (Simpkins and Fogg, 1982; Senger and Fogg, 1987; Dutton and Simpkins, 1989; Dutton, 1995). There is evidence of upward movement of water from underlying formations where chlorinity of groundwater is more than 50 milligrams per liter in northern Carson and Gray Counties (Mehta and others, in press).
- Water levels in the aquifer in the northern part of the Texas Panhandle declined an average of about 5.5 feet per year during 1960–80 (Knowles and others, 1984), although there also was comparable water-level recovery in parts of the aquifer south of the Canadian River.

- Flow rates in the Ogallala aquifer between the Canadian River and Prairie Dog Town Fork are estimated to be roughly 80 to 100 feet per year (Mullican and others, 1997). Carbon-14 activity of six Ogallala groundwater samples in Texas ranges from 20.8 to 61 percent of Modern carbon, suggesting an average age of less than several thousand years (Dutton, 1995). Local presence of naturally occurring tritium indicates that in places some Ogallala groundwater is less than 50 years old (Nativ, 1988; Dutton, 1995).

Recharge and Discharge

The conceptual model of recharge and discharge is based on the following information and assumptions:

- The study-area climate is dry continental with moderate precipitation, low humidity, and high evaporation. Precipitation decreases from east to west across the Texas Panhandle from more than 22 inches per year to less than 16 inches per year, whereas potential evapotranspiration increases (Larkin and Bomar, 1983).
- Groundwater in the Ogallala aquifer is recharged from downward percolation of water from the surface of the High Plains.
- The distribution of recharge is poorly known; estimates range from 0.01 to 6 inches per year (Mullican and others, 1997).
- In much of the study area, runoff of surface water is not well integrated in streams, and much of the runoff collects in playa basins. Playas can focus recharge to the aquifer (Mullican and others, 1997).
- Estimates of regional recharge rates are averages of the higher rates beneath playas and lower rates beneath interplaya settings (Mullican and others, 1997).
- Regional and local recharge rates may vary with the characteristics of the soils that underlie playa and interplaya areas.

- Return flow is the recharge to the aquifer owing to deep percolation of excess irrigation water. An unknown proportion of irrigation water passes below root depth and out of the reach of evapotranspiration. Luckey and Becker (1999) assumed that return flow decreased from 24 percent during the 1940s and 1950s to less than 4 percent by the 1980s. Efficiency of irrigation application has continued to increase during the past decades.
- The time of travel between ground surface and the water table is unknown
- River bottomlands can be groundwater-discharge areas. Notable springs and seeps in river valleys and along the High Plains Escarpment discharged at rates of 1 to 2 cubic feet per second (cfs) (Brune, 1975).
- Since water levels have fallen during the past several decades, the amount of spring flow has decreased; some historical springs have ceased to flow.
- Groundwater discharge continues to provide varying amounts of base flow to the Cimarron, Beaver, and Canadian Rivers and to Wolf and Sweetwater Creeks (fig. 1). The Cimarron River does not have perennial flow across the western side of the High Plains (fig. 1; Luckey and Becker, 1999).

MODEL DESIGN AND APPROACH

Models are simplifications of groundwater flow and give only an approximate representation of actual aquifer conditions. The accuracy and applicability of model results depend on the selection of data and the assumptions made in building the model. A given model result may be obtained from various nonunique combinations of input data. Model design and calibration, therefore, attempt to constrain possible results.

Five general categories of information and decision making are involved in model construction: (1) model architecture, (2) aquifer geometry, (3) boundary conditions, (4) aquifer parameters, and (5) aquifer stresses such as pumping. ArcInfo/ArcView, a geographic information system (GIS), was used to collect, organize, and map model data and assign values to the model grid.

Model Architecture

Model architecture refers to the code, size of blocks, and the number of layers used in the model. The choice of code is important to ensure that important processes in the aquifer are represented accurately.

The governing equation for regional flow of groundwater derives from a water-balance equation:

$$\text{inflow} - \text{outflow} = -\text{div } q - R^{*} = S_s \, \partial h/\partial t, \qquad (1)$$

where div q represents any difference between the rates of specific discharge of water (q, volumetric flow of fluid per unit time per unit volume) flowing into and out of a unit volume of an aquifer, R^{*} represents the volumetric flux of various sources and sinks of water such as recharge (source) and extraction wells (sinks) per unit volume of an aquifer, S_s is specific storage, and $\partial h/\partial t$ expresses the rate of change of hydraulic head (h). Hydraulic head is an expression of potential energy per unit weight of water. In this report the datum for hydraulic head is mean sea level. Any imbalance in the left-hand side of equation 1 results in a change of hydraulic head (h). The sources and sink of water as summed up in the R^{*}-term are expressed in the model as boundary conditions and aquifer stresses, as described in following sections.

Specific storage is a proportionality factor between the divergence or difference of water inflow and outflow rates and the rate of change of hydraulic head. It measures the volume of water released as a result of expansion of water and compression of the porous media per unit volume and unit decline in hydraulic head. For an unconfined aquifer such as the Ogallala aquifer, storage changes mainly by filling or draining of pore space.

Flow rates (q) are generally not directly measured in aquifers. Equation 1 is typically solved by factoring in the expression of Darcy's law describing the flow of groundwater:

$$q = -K \text{ grad } h, \tag{2}$$

where K is hydraulic conductivity, which expresses the ease with which water moves through a unit volume of the aquifer, and grad h is the gradient of hydraulic head in horizontal and vertical directions. The negative sign indicates that groundwater movement is in the direction of decreasing hydraulic head.

Combining equations 1 and 2 yields the general form of the governing equation for groundwater flow:

$$-\text{div}(-K \text{ grad } h) - R^* = S_s\, \partial h/\partial t \tag{3a}$$

$$\frac{\partial}{\partial x}\left(K_x \frac{\partial h}{\partial x}\right) + \frac{\partial}{\partial y}\left(K_y \frac{\partial h}{\partial y}\right) + \frac{\partial}{\partial z}\left(K_z \frac{\partial h}{\partial z}\right) - R^* = S_s \frac{\partial h}{\partial t} \tag{3b}$$

where x, y, and z are Cartesian coordinates of the system and K_x, K_y, and K_z are the directional components of hydraulic conductivity. This model of the Ogallala aquifer assumes only horizontal flow and ignores the third term on the left-hand side of equation 3b. Multiplying both sides of equation (3b) by saturated thickness (b) expresses the governing equation in terms of transmissivity (T) and storativity (S). Transmissivity, which is the ease with which water moves through a unit width of a column of an aquifer, is equal to the saturated thickness times hydraulic conductivity:

$$K \times b = T \tag{4a}$$

Similarly, storativity, which is equal to the volume of water released from a vertical column of the aquifer per unit surface area of the aquifer and unit decline in hydraulic head, is equal to the saturated thickness of the aquifer times specific storage:

$$S_s \times b = S \tag{4b}$$

Solving equation 3b for the distribution of hydraulic head in time and space also requires specified values of initial and lateral boundary conditions. A numerical model represents an approximate solution to the flow equation, given a particular set of boundary conditions. Constructing a numerical model involves specifying all of the parameters in equations 1 to 4 and in the initial and boundary conditions. This study used MODFLOW (Harbaugh and McDonald, 1996) to solve the flow equation according to the finite-difference method (Anderson and Woessner, 1992). MODFLOW is a tested and widely used groundwater modeling program. Processing MODFLOW (version 4.00.5000; Chiang and others, 1998) was used as the modeling interface to help load and package data into the formats needed for running simulations in MODFLOW and for looking at simulation results.

MODFLOW simulates some sources and sinks of water using variations on a head-dependent flux equation (Harbaugh and McDonald, 1996). Movement into and out of the aquifer at model cells, for example, those representing rivers and springs, depends on (a) the relative difference in elevation between simulated hydraulic head and the hydraulic head prescribed for the boundary condition, and (b) a conductance term that is a combination of hydraulic conductivity at the boundary and the dimensions of the boundary feature (Harbaugh and McDonald, 1996). MODFLOW modules such as “river” and “drain” allow for prescribed changes in flux as water level changes. A MODFLOW module known as a “general head boundary (GHB),” in which flux is always a linear function of the head difference, also was used.

The model grid for the finite-difference model was defined by 256 columns and 188 rows. Rows were aligned west-to-east, and columns were aligned north-to-south. Cells or blocks of the model were square and 1 mile long on each side (1-square-mile area). The model grid was projected in ArcView using the Albers equal-area projection. The Ogallala aquifer was simulated as one layer; no vertical heterogeneity within the Ogallala aquifer was modeled. There were 24,207 active cells representing the aquifer in the model.

Aquifer Geometry

Geometry of the model consists of the physical dimensions of the aquifer: the perimeter of the modeled part of the aquifer and the topography of the top and bottom (figs. 4, 5) of the modeled layer. To move lateral boundary conditions away from the area of interest in Texas, lateral boundaries to the west and east were set at the limit of the Ogallala Formation in New Mexico and Oklahoma. The boundary to the north was set at the Cimarron River in Oklahoma and Kansas. The boundary to the south crosses between the Canadian River and the Prairie Dog Town Fork of the Red River (figs. 1, 2). Only those parts of Oldham and Randall Counties that lie within this area were included in the model.

Aquifer geometry is probably the best characterized of all the input data. Ground-surface topography (fig. 4) was defined by a 1:250,000-scale digital elevation model (DEM) downloaded from a U.S. Geological Survey Internet site (ftp://edcftp.cr.usgs.gov/pub/data/DEM). Structure of the bottom of the aquifer is defined by numerous wells. The elevation of the water-table surface was based on measured water levels. Nonetheless, the water table and base of the aquifer are not perfectly known, and data input to the model still required some simplification and approximation.

The base of the Ogallala aquifer was contoured using mapping tools in ArcView. This involved creating triangulated irregular networks (TINs), gridding the TIN surfaces, and assigning values to the model grid. The resulting contoured map is a reasonable representation of regional trends but might not accurately depict local features, especially where data are sparse. Where well data on the base of the aquifer in Texas were sparse, contoured maps presented in Knowles and others (1984, v. 2 and 3) for each county were digitized and used as breaklines in the GIS triangulation process. Possible error is greatest where data on the base of Ogallala aquifer are sparse, for example, in Hartley and Dallam Counties. Locally the elevation of the base was lowered to ensure model cells representing the predevelopment water level did not dewater. This adjustment was mainly in eastern Union County, New Mexico, and western Dallam County.

Reported measurements of depth to water in wells in Texas were downloaded from the TWDB Internet site (http://www.twdb.state.tx.us/Newwell/well_info.html). Information on water levels and hydrogeologic properties of the Ogallala aquifer outside of Texas included digital data used in a numerical model by Luckey and Becker (1999) and hydrogeologic data for Quay and Union Counties, New Mexico (Berkstresser and Mourant, 1966; Cooper and Davis, 1967). The map of the "predevelopment" water table is based on the earliest reported measurements within all areas. For example, in one area the first reported water-level data may be for 1940, in another for 1960, and in another for 1970. This composite surface was assumed to represent the "predevelopment" water table as of 1950. The map of the "predevelopment" water table was contoured by hand; earliest data were given precedence and the initial water level was assumed to be higher than later measurements. Uncertainty in depicting the 1950 "predevelopment" surface is assumed to be at least commensurate with other simplifications in the model. The water table for 1998 is based on water-level measurements taken in 1997 and 1998.

Data control for both the water-table elevation and base of the Ogallala aquifer (fig. 5) were generally good except as follows:

- Water-level data were sparse in parts of several counties (including but not limited to Lipscomb, Ochiltree, Oldham, Potter, and Randall Counties). Control points and break lines were added in GIS to adjust the mapped water-table surface and calculated saturated thicknesses to resemble those shown in Knowles and others (1984).
- The base of the aquifer in the Ogallala Formation is not consistently mapped throughout Dallam, Moore, and Randall Counties (Knowles and others, 1984, v. 2 and 3). For part of these counties the mapped base includes formations underlying the Ogallala aquifer. This overestimates the volume of water in storage in the Ogallala in these counties. In areas where well control was sparse, maps of the base of the Ogallala presented in Knowles and others (1984) were used to constrain the structure drawn in GIS.

Boundary Conditions

Numerical models solve the general equation of groundwater flow (equation 3b) with spatial boundary conditions and initial conditions (a boundary condition in time). Initial conditions used in the model assumed that recharge and discharge for the Ogallala aquifer were near equilibrium (pseudo-steady state) prior to 1950, after which rates of pumping increased throughout the region.

Spatial boundary conditions involve specifying inflow and outflow fluxes (R*, equations 1 and 3) across the top, bottom, and perimeter of the modeled aquifer. Boundaries may be approximations of (1) physical conditions, such as the limit or pinch-out of the Ogallala aquifer, or (2) hydraulic conditions, such as groundwater divides and streamlines. Boundaries may also be set at artificial positions, determined by neither physical nor hydrological features. Of the three types, physical and hydraulic boundaries are preferable because they more accurately represent actual boundaries in the natural system. Artificial boundaries are generally used to limit the upstream or downstream extent of a model to the area of interest and are most appropriate for steady-state models. They are appropriate in transient models if the variation of water levels at the boundary is minimal over time and the area of interest is a sufficient distance away from the boundary. Several previous models of the Ogallala aquifer included significant artificial boundaries (Mace and Dutton, 1998).

This model of the Ogallala aquifer uses a combination of physical, hydrological, and artificial boundaries, minimizing the extent of the last:

- The limited amount of water that flows across the base of the Ogallala aquifer (a physical boundary) was assumed to be negligible in comparison with the overall water budget. The lower boundary of the aquifer, therefore, was defined as a no-flow boundary.
- The top of the model was assigned a constant rate of recharge (a hydraulic boundary) for each stress period.

- Recharge rates (fig. 6) were set as a function of precipitation and soil types (table 3). Data on long-term average (1950 to 1990) precipitation were compiled from the National Weather Service Internet site. These data were contoured and interpolated for the cells in the model area. Initially recharge was assumed to vary linearly from 0.1 to 0.5 inches per year where precipitation ranged from 16.5 to 22.5 inches per year, respectively. During calibration the straight-line relationship between recharge and precipitation was changed. The final version of the model has (1) a greater percentage of precipitation becoming recharge on the wetter, eastern side of the study area than to the west, and (2) minimum recharge set at 19 inches per year of precipitation. Further research on the relation of recharge to precipitation is needed.
- Recharge was also varied with soil type. GIS polygons of soil types were downloaded from http://www.ftw.nrcs.usda.gov/stat_data:html, the U.S. Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) Internet database. The numerous soil types were joined into eight groups (table 3). Groups 1 to 3 mainly have loamy surface and subsurface soils, whereas Groups 4 to 7 have loamy surface but clayey subsurface soils (Gustavson, 1996). Groups 1 and 2 roughly correspond to the extent of the Ogallala Formation outcrop, especially south of the Canadian River. Group 8 is made up of windblown sands (Eifler and Barnes, 1969) that are younger deposits than the Blackwater Draw Formation (table 2). Recharge estimated from precipitation was not changed (weighting factor of 1.0) for “Ogallala” soils. Recharge was decreased for “Blackwater Draw” soils and increased for sandy Group 8 soils (table 3).
- Groundwater recharge as calibrated in the revised model was less than 1 percent of precipitation across about 72 percent of the model area. The other 99 percent is assumed to have returned to the atmosphere by evapotranspiration or run off as surface water. Groundwater recharge was set at less than 2 percent of precipitation across 92 percent of the model area but was between 5 to 6 percent of precipitation in 3 percent of the area.

The higher recharge rates were on sandy soils on the eastern, wetter side of the High Plains.

- Return flow was not included in the earlier version of the model (Dutton and others, 2000) since pumpage, return flow, and specific-yield calibration are interrelated and the latter two are poorly known. Irrigation loss probably was large during the 1940s and 1950s (Luckey and Becker, 1999) but may have gone to increasing moisture content of the unsaturated zone. During the past few decades irrigation losses have decreased. Luckey and Becker (1999) assumed return flow is most likely to be less than 5 percent of irrigation in the future.
- Return flow was assigned in the revised model and varied with irrigation rate, loss rate or inefficiency, soil type, depth to water, and velocity or rate of downward movement of water from the root zone to the water table. Loss rate was initially taken from Luckey and Becker (1999) and set equal to 24 percent for the 1950s and decreased to 2 percent since the 1990s. To evaluate the sensitivity of model results to return flow, simulations also were made with twice these loss rates. The same soil-weighting factors were applied to return flow as to recharge from precipitation (table 3); less return flow was predicted from irrigation on Blackwater Draw soils than on Ogallala soils. Depth to water was approximated using preliminary model results without return flow. Depth to water increases through time at most model cells, increasing the travel time for water to move from the root zone to the water table. Accordingly, return flow may recharge the water table later than the year in which irrigation was applied, and the delay or lag may increase through time as depth to water increases. Finally, velocity of water through the unsaturated zone was assumed to lie between 5 and 40 feet per year. Several simulations were made to evaluate the sensitivity of model results to assumed velocities.
- The perimeter was defined by physical and hydraulic boundaries. Most of the perimeter of the Ogallala aquifer coincides with the limit of the Ogallala Formation where groundwater is discharged in small springs and seeps, or as evapotranspiration where the

water table is close to ground surface. This part of the boundary was simulated using the "drain" package of MODFLOW (fig. 2). Luckey and Becker (1999) used 10,000 square feet per day for drain conductance for grid-cell areas of 36×10^6 square feet. This model proportionally decreased drain conductance to 7,744 square feet per day for its 27.8×10^6 square foot (1-square-mile) grid-cell area. Drain elevation was set to 75 percent of saturated thickness, about 35 to 40 feet above the base of the aquifer.

- Part of the northern boundary of the model follows the Cimarron River and included a no-flow boundary and a river boundary (fig. 2). Along about the half of its course across the study area, the Cimarron River has little or no perennial flow and is assumed to coincide with a groundwater flow line (Luckey and Becker, 1999). This reach, therefore, was treated as a no-flow boundary for all stress periods (fig. 2). On the northeast side of the model, the Cimarron River in Kansas and Oklahoma was treated as a river boundary.
- MODFLOW's "river" module was also used to represent the interaction of surface and groundwater along segments of the Cimarron, Beaver, and Canadian Rivers and Wolf and Sweetwater Creeks (fig. 2). The "river" module includes three parameters: river stage, river-bottom elevation, and riverbed hydraulic conductance (table 4). Initial values of river stage were set to 20 feet beneath the "predevelopment" water table to ensure river segments were simulated as gaining streams for the predevelopment model. This adjustment was needed because ground-surface elevation in each 1-square-mile cell is averaged and does not represent surface elevation at the river. River-bottom elevation was set 20 feet beneath the river stage. Riverbed conductance was initially set as a function of how much the river channel meanders in the model cell, then adjusted as part of model calibration to match reported regional rates of groundwater contribution to base flow (table 4).
- MODFLOW's "general-head boundary" module was used to close the southwest side of the model between the Canadian River and Prairie Dog Town Fork of the Red River (fig.

2). Boundary head was set to the predevelopment surface, and conductance was set equal to the average hydraulic conductivity times cell width and divided by saturated thickness.

Aquifer Parameters

This model of the unconfined aquifer used a combination of measured and interpolated values for aquifer parameters. Data for transmissivity, hydraulic conductivity, and specific yield are typically sparse for model calibration. Parameter values for large areas of the models are estimated or extrapolated. Hydraulic conductivity was assumed to be locally isotropic, that is, the same in x and y directions within each cell. It was also assumed that the Ogallala aquifer is made up of consolidated materials and that no compaction occurs with change in volume of water in storage.

An earlier version of the model (Dutton and others, 2000) was calibrated with a specified transmissivity; that is, transmissivity did not vary with water level. That model predicted parts of the aquifer could dewater, an extreme condition outside of the model calibration. Additional effort, therefore, focused on revising and recalibrating the model with specified hydraulic conductivity. In the revised model, transmissivity varies with water level and decreases as saturated thickness decreases.

To estimate hydraulic properties for the study area in Texas and expand upon previous studies, we (1) compiled available information on aquifer properties or tests from published reports and well records, (2) used specific-capacity information to estimate transmissivity and hydraulic conductivity, (3) used statistics to summarize results, and (4) used geological maps to "condition," or map, values of hydraulic conductivity. A major improvement to hydraulic properties over previous studies is the inclusion of specific-capacity information, which can significantly increase the number of measurement points for an aquifer.

We compiled tests from Mullican and others (1997) and from the groundwater database at the Texas Water Development Board (Texas Water Development Board, 1999). Mullican and others (1997) had information on 70 aquifer tests, which included high-quality specific-capacity tests. We were able to cull data from an additional 1,271 specific-capacity tests in the TWDB groundwater database. To estimate transmissivity and hydraulic conductivity from specific capacity, we used an analytical technique developed by Theis (1963). Hydraulic conductivity was determined by dividing transmissivity by the saturated thickness exposed to the wellbore (1,130 wells included information that allowed us to calculate saturated thickness).

Based on results from the data compilation and specific-capacity analysis, we found that hydraulic conductivity for all the tests in the Ogallala aquifer appears to be lognormally distributed (fig. 7) with a geometric mean of about 14.8 feet per day and a standard deviation that spans from 5 to 44 feet per day. A lognormal distribution means that the logarithms of the values are normally distributed, and a geometric mean is the antilogarithm of the mean of the logarithms of the values.

Semivariograms (see Clark, 1979; McCuen and Snyder, 1986) show that hydraulic conductivity in the Ogallala aquifer is spatially correlated. Spatial correlation infers that points that are closer together are more similar to each other than points that are further apart. Fitting a spherical theoretical semivariogram to the experimental semivariogram resulted in a nugget of 0.12 $[\log(\text{ft/day})]^2$, a sill of 0.22 $[\log(\text{ft/day})]^2$, and a range of 140,000 feet. The range suggests that hydraulic conductivity is spatially correlated within 140,000 feet (26 miles) in the Ogallala aquifer.

Hydraulic conductivity was assigned to the Texas part of the model on the basis of depositional systems of the Ogallala Formation (Seni, 1980). Measured values of hydraulic conductivity were posted and overlain on the depositional-systems maps. Contours and trend lines from the depositional-systems maps were then used as a guide to contour the hydraulic-conductivity data (fig. 8). Figure 7 compares the statistical distribution of the measured and final calibrated distribution of hydraulic conductivity for the Texas part of the model. Hydraulic-conductivity values for Texas and adjacent parts of the model were pooled using kriging. The kriging parameters were based on a semivariogram for the Texas data and the 1-square-mile cell size. Only minor changes to hydraulic conductivity were made during model calibration. Changes were made in southern Hartley and northern Oldham Counties, Texas, and in eastern Union County, New Mexico, where there were no available hydraulic-conductivity data.

Maps of specific yield were taken from Knowles and others (1984) and merged with cell values used by Luckey and Becker (1999) for the non-Texas part of the model. Grid center values of specific yield were interpolated using ArcView. Only minor adjustments were made, for example, in eastern Union County, New Mexico, since calibration results could not be appreciably improved by adjusting specific yield within reasonable limits.

Pumping

Accurate estimates of water withdrawal by pumping can be crucial to highly accurate modeling of water-level drawdown (Konikow, 1986). Pumping rates affect the calibration of the model and prediction of future water levels. Because there are few direct measures of historical pumping rates, pumping is generally estimated indirectly and may be a major source of calibration error in this and other numerical models. Errors in reconstructing pumping can be attributed to both uncertainty in total amount of pumping in a county and the allocation to specific cells in a county (Mullican and others, 1997).

For 1950 to 1998, approximately 54 million acre-feet of groundwater were simulated as being pumped from the Ogallala aquifer (table 5). This historical withdrawal was reconstructed from several sources. Pumping for municipal, industrial, irrigation, livestock, mining, and power uses during 1958, 1964, 1969, and 1974 was taken from worksheets compiled for the Knowles and others (1984) study. Pumping for 1980 to 1996 was tallied from a groundwater-summary database compiled by the TWDB (Dutton and Reedy, 2000). Decadal estimates of irrigation withdrawal for 1950 to 1997 also were made by the Texas Agricultural Experiment Station (TAES) on the basis of rainfall and irrigation efficiencies (Dutton and Reedy, 2000). Both TWDB and TAES irrigation estimates were run. The TWDB estimates serve as a “worst-case” estimate giving more predicted drawdown.

For 1999 to 2050, approximately 82 million acre-feet of groundwater was simulated as being pumped from the Ogallala aquifer (table 5). Projected groundwater withdrawal for 2000 to 2050 (table 5) was derived from the consensus-based estimates of water demand compiled by Freese and Nichols, Inc. (2000). That projection of total water use by county is irrespective of source of water (for example, surface water or groundwater, and Ogallala aquifer versus other groundwater-bearing formations). Revisions to derive a table of projected withdrawals from the Ogallala aquifer included subtracting out surface-water sources and groundwater supplied from sources other than the Ogallala aquifer, and water produced in one county but supplied to meet demand in another (Dutton and Reedy, 2000).

Projections of irrigation withdrawal from the Ogallala aquifer have been developed by TAES for this project (Freese and Nichols, Inc., 2000) and by the TWDB as part of its statewide planning. The TAES estimates are about 15 percent less than the TWDB values in 2000 but only 2 percent different by 2050 (Freese and Nichols, Inc., 2000). As irrigation withdrawal is projected to make up approximately 85 percent of total withdrawal, these differences have the potential to impact model results, as stated in the opening paragraph in this section. Both sets of numbers were run to compare the resulting predictions of saturated thicknesses and volumes of groundwater remaining in the aquifer in 2050. The TWDB irrigation projections may be considered more conservative in that their higher withdrawal rates may overestimate water-level decline through 2050.

Average annual withdrawal for irrigation was greatest during the 1980s at approximately 1.5 million acre-feet per year (fig. 3). During the 1990s the total rate of irrigation withdrawal appears to have decreased to about 1.2 million acre-feet per year. Irrigation water in 1997 made up on average 86 percent of groundwater production from the Ogallala aquifer but ranged from 59 percent for Randall County to 98 percent in Dallam, Hartley, and Sherman Counties. Irrigation withdrawal is projected to average about 84 to 92 percent of total water production from the Ogallala aquifer over the next 50 years. Irrigation rates for Texas as applied in the model ranged about 0.17 to 0.52 acre-foot per year per acre during 1960 to 1998 and were about 0.44 acre-foot per year per acre for 2000 to 2050. For 1998 to 2050, about 99.5 percent of simulated irrigation rates were less than 1.5 acre-feet per year per acre.

Irrigation withdrawal in the Texas part of the study area was distributed using ArcView on the basis of results of a 1994 survey obtained in GIS format from the Texas Natural Resources Information System (TNRIS). That database identified polygons with irrigated acreage and specified the percentage of the polygon area under irrigation in 1994. We assumed that the same pattern of irrigated acreage applied for the entire modeling period (1950 to 2050). Total county withdrawal of groundwater for irrigation for a given year was proportionately distributed across the model grid to those cells with irrigated acreage.

Withdrawal of groundwater for municipal use was distributed to model cells using a database from the Texas Natural Resource Conservation Commission (TNRCC) Water Utilities Division, which identified the number, location, and drilling date of public water-supply wells in each county. Total municipal water pumping for each county was allocated equally among these public water-supply wells. Groundwater pumping for industrial and stock uses was distributed using data from the TWDB on locations of industrial and stock wells and their drilling date. Groundwater use related to power generation in Potter County was allocated to two cells representing wells used by the Southwest Public Service Company (Gale Henslee, 2000, personal communication).

Total withdrawal assigned to each model cell for each stress period was summed from a database using a Visual Basic program and loaded into the Processing MODFLOW utility. Figure 9 shows the distribution of simulated pumping for 1998. The same footprint of pumping cells was used to simulate pumping for 1998 to 2050; the proportion of withdrawal rates between cells was maintained. Historical and future water use in the study area outside of Texas, undifferentiated by water-use category (fig. 3), was taken from digital files by Luckey and Becker (1999).

Some model cells are predicted to go dry between 2000 and 2050, given these pumping rates, as will be discussed. As the cells go dry, the model cells are made inactive and pumping from those cells stops. The pumping allocated to those cells was not reallocated to remaining active cells. Thus the final amount of pumping in the predictive model runs was less than the consensus-based demand used as model input.

Model Calibration Approach

Once the model was constructed, the model was calibrated in two stages: steady state and transient. Model calibration was evaluated by

- comparing contours of the simulated and “observed” water tables for “predevelopment” and 1998 periods,
- mapping the residual of differences between simulated and “observed” water levels for individual well locations, and
- calculating the root mean square error of simulated versus observed hydraulic head (Anderson and Woessner, 1992).

First, the calibration of the predevelopment model was based on reproducing the estimated “predevelopment,” or 1950, distribution of water levels as follows:

- During this first calibration stage, hydraulic conductivity, recharge rate, and parameter values for drains and rivers were inspected to see whether any changes were needed to improve the goodness-of-fit, or reduce model calibration error, calculated between simulated and observed values of hydraulic head. Only slight changes were made to hydraulic conductivity and recharge as previously discussed. The relation between recharge and precipitation rates was changed from one to three straight-line segments; the three segments may approximate a more complex relation between these two rates. Additional recharge was added to Donley County.
- Drain parameters were adjusted so that simulated discharge around the perimeter of the model would be consistent with historical observations of spring discharge (Brune, 1975).
- River conductances were iteratively adjusted so simulated groundwater discharge would match reported values of base flow (Luckey and others, 1986; Luckey and Becker, 1999).

- The predevelopment model was run as a transient model over a 6,000-year simulation time. Head changes after 6,000 years were found to be less than 0.01 foot. The 6,000-year time was broken up into 60 stress periods with 400 to 600 equal time steps for model convergence.

Second, the model was calibrated against water-level changes between 1950 and 1998. Model input at this stage included (1) simulated steady-state hydraulic-head values, (2) parameter values from the steady-state calibration (hydraulic conductivity, and drain and river packages), (3) estimated pumping rates, and (4) recharge rate modified to include return flow. This period is referred to as a “transient” period in that hydraulic head is changing in response to pumping rates that also are changing: As pumping rates were interpolated to a yearly basis, each stress period was 1 year. A stress period is a time interval in a model when all inflow and outflow are constant. Transient calibration included the following steps:

- After checking model calibration for 1998, model parameters for the predevelopment simulation were readjusted as needed, for example, aquifer-base elevation along the Texas–New Mexico border.
- No changes to storage were made during model calibration. Coefficient of storage in an unconfined aquifer, or specific yield, typically ranges between 0.05 and 0.3, which leaves little room for parameter adjustment to improve model calibration. Uncertainty in prescribing the distribution of pumping rates probably has a much bigger effect on model calibration than error in specific yield, and it would be inappropriate to try to correct for the pumping-rate error by pushing specific yield to unreasonable values.

CALIBRATION

Steady-State Calibration

Steady-state calibration involved adjusting hydraulic properties, recharge rate, and parameter values for drains and rivers to reduce model calibration error. It is considered steady state because pumping was left out of this version of the model to represent “predevelopment” conditions. It was assumed that before pumping came to make up a significant amount of aquifer discharge, recharge was balanced over the long term (tens to hundreds of years) by discharge to springs and seeps in river valleys and along the escarpment.

There is a direct relation between recharge rate and hydraulic conductivity for the model. If recharge rate were set higher in all or part of the model, hydraulic conductivity would have to be increased to compensate and keep calibration error unchanged. It would take a higher hydraulic conductivity to move the greater volume of water recharging the aquifer and keep simulated water level the same. This pattern was documented in sensitivity analyses by Luckey and Becker (1999, p. 52).

Figure 10 compares the estimated and simulated elevations of the “predevelopment” water table. The picture of the “predevelopment” water table is imperfect because

- data were composited from a wide range of years to include the first recorded measurements in different areas of the model;
- some amount of groundwater was already being withdrawn in each area of the model when the earliest water levels were being reported; and
- some areas have sparse data on water levels, and elevation of the water table is extrapolated partly on the basis of the shape of ground-surface topography.

The major features of the estimated and simulated water table (fig. 10) reproduce those depicted by Knowles and others (1984) and Luckey and others (1986) for the water-table surfaces of the area; each study used a common pool of data. The major features are

- water-level contours generally strike north in the area north of the Canadian River, and northwest in the area between the Canadian River and Prairie Dog Town Fork of the Red River (fig. 10);
- contours bend upstream across the broad valleys of the Canadian and Beaver Rivers, indicating the tendency of groundwater to discharge to springs and seeps along the river bottomlands;

- contours bend upstream along the part of the Cimarron River simulated as a river segment at the northeastern side of the model and are perpendicular to the model boundary along the part farther upstream that was modeled as a no-flow boundary (fig. 2);
- simulated groundwater discharge contributes about 66 cubic feet per second of base flow to the Canadian River (table 6), consistent with historical trends (John Williams, personal communication, 2000) and previous model results (Luckey and Becker, 1999);
- contours bend slightly to the west in the vicinity of the model perimeter, reflecting the influence of the "drain" package used to simulate discharge to springs and seeps.
- groundwater discharge at springs and seeps around the model perimeter amounts to an average of 0.06 cubic foot per second per cell, with 98 percent of "drain" cells having discharge of less than 1 cubic foot per second and maximum simulated discharge of 2.1 cubic feet per second. As previously mentioned, notable springs discharge at rates of 1 to 2 cubic feet per second (Brune, 1975).

Contours of the simulated water table reasonably match the estimated, or "observed," predevelopment water table (fig. 10) across most of the study area. Areas of poor fit include the Canadian River and Beaver River valleys, where uncertainty in the boundary values assigned to riverbed conductance and stage height affect model results, and in New Mexico and along the Texas–New Mexico border data are sparse for mapping the aquifer base and water table in New Mexico, so it is possible that the estimated water table in that area includes appreciable error itself.

Figure 11a compares water levels measured for specific wells to the simulated water levels calculated for corresponding cells. The root mean square error of simulated versus observed hydraulic head (Anderson and Woessner, 1992) is about 64 feet, and there is no evident bias. This error is less than 4 percent of the head drop across the Texas part of the model (1,750 to 2,525 feet), whereas a typical calibration goal is 10 percent for a numerical model.

Figure 12 maps the calculated residual, or difference, between the reported and simulated water levels shown in figure 11a. Considerable effort was made to reduce the residual in northern

Union County, New Mexico, and to reduce its effect on results in western Dallam and Hartley Counties. Additional geologic research on the hydrogeology of the Ogallala aquifer in Union County, New Mexico, and along the Texas–New Mexico border would help improve model results in the northwestern Texas Panhandle.

Saturated thickness of groundwater in the Ogallala aquifer in the study area was as much as 700 feet in southwestern Kansas and the Oklahoma Panhandle, but it was generally less than 300 feet in Texas under predevelopment conditions (table 7, fig. 13). Given that the top of the saturated section is fairly smooth, much of the variation in saturated thickness is due to relief on the base of the Ogallala (fig. 5). In Carson County, the thick accumulation of Ogallala sediments reflects continued Tertiary-age deposition contemporaneous with ground-surface subsidence above salt-dissolution zones (Gustavson and Finley, 1985). A zone of low saturated thickness striking northwest across north-central Carson County reflects the "ridge" on the base of the Ogallala described by Mullican and others (1997). The thinnest saturated sections of the Ogallala were in eastern New Mexico and around the perimeter or limit of the aquifer.

Transient Calibration

Many of the regional features of the predevelopment water table remain for the 1998 water table (fig. 14), including the following:

- Contours on the 1998 water table strike north in the area north of the Canadian River and arc from northwest to south-southeast in the area between the Canadian River and Prairie Dog Town Fork.
- Contours still bend upstream across the broad valleys of the Canadian and Beaver Rivers, as seen in the "predevelopment" water-table surface.
- Contours bend upgradient in the vicinity of the model perimeter, reflecting continued influence of the "drain" package used to simulate discharge to springs and seeps, although about 7 percent of the springs have ceased to flow in the simulation.

There is generally good correspondence between estimated and simulated contours of water level for 1998 (fig. 14). It is hard to discern an overall change in calibration by comparing water-level contours (figs. 10 versus 14) or even calculated residuals (figs. 12 versus 15), perhaps partly because calibrations for both 1950 and 1998 are fairly good. Figure 11b shows that the mean square error of calibration for 1998 is 74 feet. This is larger than the calibration error for the "predevelopment" water table because of additional uncertainties associated with return flow, pumping rates, and specific yield. The mean square errors of calibration of the earlier model (Dutton and others, 2000) were 37 and 54 feet for predevelopment and transient models, respectively. The earlier model's calibration was somewhat forced in that transmissivity had been adjusted to improve model fit. This revised model includes little parameter adjustment and is a more "natural" model. Model error remains less than 5 percent of the head change across the Texas part of the model.

Groundwater discharge to base flow is simulated as decreasing by 15 to 52 percent to the Cimarron and Beaver Rivers and Wolf Creek but not by much to the Canadian River (table 6). Model results suggest simulated base flow to the Canadian River was largely unchanged between 1950 and 1998.

Saturated thickness decreased in the simulation from 1950 to 1998 (table 7; figs. 13, 16) because withdrawal was much greater than recharge rate. The greatest decrease in saturated thickness and greatest simulated drawdown of water levels between 1950 and 1998 in the model area in Texas were in Moore and Sherman Counties (table 7, fig. 17). The model also simulated a more than 100-foot decrease in water level in Amarillo's Carson County well field (fig. 17).

Volume of water in storage was determined for model cells by multiplying saturated thickness times cell area (1 square mile) and specific yield, and summed for all cells in a county. Averaged across all counties, the difference is 3 to 5 percent, but for individual counties the calibration residual translates into a difference in volume of 0 to 24 percent (table 8). The accuracy of the volume estimate for 1950 and 1998 depends on the same factors as did the accuracy of the water-table elevation (composite and sparse data, drawdown effects), plus accuracy of estimated and model-calibrated values of specific yield.

The magnitude and effect of return flow remain poorly known. The difference between maximum rate of return flow and no return flow accounts for less than 20 feet of drawdown between 1950 and 1998, and not much more than 20 feet by 2050. Other model uncertainties associated with hydraulic properties and pumping rate account for at least this much error. Comparison of observed and simulated hydrographs, therefore, does not suffice to back out the most likely rate of return flow. Return flow may be important to future water budgets in areas that had high irrigation rates and low irrigation efficiency.

MODEL PREDICTIONS

A main purpose of model calibration was to qualify a model for use in predicting the remaining groundwater within each county of the PWPA from 2000 to 2050, given specific groundwater demands. As previously stated, however, uncertainty in projected pumping rates may be the most important factor in determining the accuracy of water-level forecasts (Konikow, 1986). Calibration error related to allocating pumping to too many or too few cells of a model is compounded if the projection of total future pumping does not prove accurate. It is important, therefore, to plan for future audits to see how well model results predicted water levels, and to revise predictions on the basis of revised estimates of future pumping rates.

Average saturated thickness in 2050 is predicted to be more than 100 feet in 10 counties in the model area and more than 200 feet in Hemphill and Roberts Counties (table 7). Given the prescribed rate of pumping for the period from 2000 to 2050 and the other assumptions of the calibrated model, however, water levels are expected to decline during 2000 to 2050 in all counties (figs. 18, 19). Major changes predicted by the model include the following:

- Although average saturated thickness in most counties in the PWPA is simulated to be above 50 feet (table 7), there are areas within each county in which saturated thickness falls to less than 50 feet (table 9, figs. 20 to 25).
- Drawdown from 1998 to 2050 is predicted to be more than 150 feet in some areas (fig. 19), given the forecast amount of pumping.
- By 2020, parts of the model area in Oklahoma and Dallam and Potter Counties, Texas, are predicted to begin to go dry (fig. 22). This finding is consistent with similar model results obtained by Luckey and Becker (1999, p. 53–55).
- By 2050, parts of Dallam, Sherman, Hartley, Moore, Potter, Carson, and Donley Counties are simulated as being dry or having less than 50 feet of saturated section (fig. 25). The results for Donley County may be inaccurate since the predevelopment model underestimated water in storage in the Ogallala aquifer in that county (fig. 13, table 8). Parts of Oldham and Randall Counties, of course, have long had saturated thickness of less than 50 feet. Table 10 tallies the percentage of counties in which saturated thickness is less than half of the 1998 saturated thickness. More than 60 percent of Oldham County had less than 50 feet of saturated thickness in 1998 (table 9). Even so, simulated drawdown will leave at least half of that water through 2050 (zero values in table 10), given forecast pumping rates.

The dewatered areas were determined by MODFLOW where simulated water level reached the aquifer base. Model prediction of dewatered areas might not be accurate for several reasons. Pumping rates were prescribed by consensus of what future demand will be (fig. 3), rather than what the aquifer might sustain, and pumping rates were not decreased as water levels fell in this version of the model. As saturated thickness decreases, it may not be cost effective for irrigators to operate large-capacity wells or multiple small-capacity wells. Also, groundwater conservation districts in the area have the goal of limiting drawdown so that at least half the 1998 column of water in the aquifer will remain by 2050.

The model is better calibrated for simulating dewatering conditions than the earlier model (Dutton and others, 2000). Transmissivity decreases as saturated thickness decreases. On the other hand, the hydraulic conductivity tends to be greater in the basal section of the Ogallala than in the upper section, so the effect of decreasing saturated thickness on transmissivity might be partly compensated for by an increase in average hydraulic conductivity.

The withdrawal of groundwater predicted for 2000 to 2050, which is much greater than the recharge rate, results in a further decrease in volume of water in storage in the Ogallala aquifer (table 11). Volume in storage was calculated from simulated saturated thickness, model-cell area, and calibrated specific yield. Volume of water in the aquifer is projected to decrease from approximately 250 to 277 million acre feet in 1998 (table 8) to about 199 million acre feet by 2050 (table 11). Dallam and Moore Counties are forecast to have on average less than half their 1998 volume of water by 2050, given the TAES irrigation projections and the other consensus-based demands. Sherman County is projected to have on average 52 percent of its 1998 water volume. Total volume of water, however, does not by itself completely describe the availability of groundwater in 2050. Some areas within each county are predicted to have less than half the 1998 saturated thickness (table 10), and there may be a marked deficit in groundwater resources in parts of several counties (for example, Dallam and Moore) by 2050 (fig. 25), given the forecast pumping rates and other model assumptions. Also, as only parts of Oldham and Randall Counties were included in the model, table 11 does not fully characterize whether there is a county-wide surplus or deficit in water availability.

As previously stated, irrigation projections by TWDB are somewhat higher than those of the TAES used in this study. Using the TWDB irrigation projections may give a so-called “worst-case” scenario in which less groundwater would remain by 2050, owing to the greater withdrawal rates. In addition, the earlier model (Dutton and others, 2000) may overestimate future drawdown relative to the results of the revised model. According to the earlier model (Dutton and others, 2000), volume of remaining groundwater is projected to decrease to less than 180 million acre feet by 2050 using the TWDB irrigation values (table 12). In addition to Dallam, Moore, and

Sherman Counties, Carson County is forecast to have less than half of its 1998 groundwater volume remaining by 2050. The results of the earlier model may be taken as a "worst-case" projection with higher pumping rates and greater simulated drawdown.

DISCUSSION

The most appropriate use of these model predictions is to

- identify areas where apparent supply of groundwater is adequate to meet forecast demand through 2050,
- identify areas in each county where supply of groundwater might not meet projected demand, and
- point out areas where saturated thickness is predicted to be less than 50 feet (the model calibration error), where there may be a need for water-supply alternatives, drought contingency plans, and water-management strategies that might address resource deficits.

The predicted drawdown and decrease in saturated thickness shown in figures 18 to 24 assume no decrease in pumping rate as water levels fall, contrary to regulations of the groundwater conservation districts, except where model cells are simulated to go dry. A water-management goal of the groundwater conservation districts is to limit future drawdown so that at least half of the 1998 saturated section will remain in 2050. The regional model of the Ogallala remains not well calibrated for the extreme event of aquifer dewatering. The model was calibrated for average hydrologic properties, which may differ from properties at the base of the aquifer.

There are various uncertainties associated with predicting exactly where the aquifer might go dry if projected pumping rates are sustained. Accordingly, model predictions can be used to identify areas where there may be surpluses and deficits in water resources, but they should not be used to predict to the nearest square mile where the Ogallala aquifer might go dry.

A variety of water-management plans might be evaluated by using the groundwater flow model. Additional research is needed to reevaluate projected demand for groundwater, assess surpluses and deficits in groundwater resources, and identify water-management alternatives, including various spatial reallocations of water withdrawal. The model also can be used to further research recharge rates and to identify areas where additional data collection would help improve model accuracy.

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Seymour Aquifer
Freese and Nichols Estimated Ground Water Availability Calculation Methodology

A	B	C	D	E	F	G
County	Aquifer Outcrop Area in County (acres)	Avg. Annual Precip. in County/Year (ft)	Estimated Recharge Rate (%)	Effective Recharge (ac-ft/yr)	1994-1997 Pumpage (ac-ft/yr)	Estimated Availability (ac-ft/yr)
Childress	52,352	1.767	5%	4,625	215	4,625
Collingsworth	176,901	1.842	5%	16,293	20,595	20,595
Donley	130	1.833	5%	12	0	12
Hall	93,934	1.742	5%	8,182	11,612	11,612
Wheeler	41,472	1.917	5%	3,975	73	3,975
TOTAL	**364,789**			**33,087**	**32,495**	**40,819**

Reference Sources by Column

B: TWDB 1999. Data used is geospatial analysis of TWDB GIS data.

C: NCDC Station data 1999(www.worldclimate.com)

D: Duffin 1992.

E: Effective Recharge = Aquifer Outcrop Area in County (acres) * Avg. Ann. Precip. In County/Year * Est. Recharge Rate (%)

F: TWDB 1999

G: No significant decreases in aquifer levels have occurred in the Seymour aquifer (TWDB, 1997). The annual availability is therefore estimated to be the greater of either effective recharge or historical pumpage rates.

Blaine Aquifer Freese and Nichols Estimated Ground Water Availability Calculation Methodology

A	B	C	D	E	F	G
County	Aquifer Outcrop Area in County (acres)	Avg. Annual Precip. in County/Year (ft)	Estimated Recharge Rate (%)	Effective Recharge (ac-ft/yr)	1994-1997 Pumpage (ac-ft/yr)	Estimated Availability (ac-ft/yr)
Childress	329,089	1.767	5%	29,075	5,416	29,075
Collingsworth	525,546	1.842	5%	48,403	6,874	48,403
Hall	35,166	1.742	5%	3,063	0	3063
Wheeler	148,576	1.917	5%	14,241	40	14,241
TOTAL	**1,038,377**			**94,782**	**12,330**	**94,782**

Reference Sources by Column

B: TWDB 1999. Data used is geospatial analysis of TWDB GIS data.

C: NCDC Station data 1999(www.worldclimate.com)

D: Duffin 1992.

E: Effective Recharge = Aquifer Outcrop Area in County (acres) * Avg. Ann. Precip. In County/Year * Est. Recharge Rate (%)

F: TWDB 1999

G: No significant decreases in aquifer levels have occurred in the Blaine aquifer, and declines that have occurred are due to heavy irrigation use and are quickly recharged after seasonal rainfall (TWDB, 1997). The annual availability is therefore estimated to be the greater of either effective recharge or historical pumpage rates.

Dockum Aquifer
Freese and Nichols Estimated Ground Water Availability Calculation Methodology

A	B	C	D	E	F	G	H	I	J	K
County	Estimated Available Storage (acre-feet) <5,000 mg/l TDS	Estimated Annual Recharge* (ac-ft)	Percent Recoverable (%)	Planning Period (years)	Year 2000 Avail. (ac-ft)	Year 2010 Avail. (ac-ft)	Year 2020 Avail. (ac-ft)	Year 2030 Avail. (ac-ft)	Year 2040 Avail. (ac-ft)	Year 2050 Avail. (ac-ft)
Armstrong	1,700	—	50%	50	17	17	17	17	17	17
Carson	1,200	—	50%	50	12	12	12	12	12	12
Dallam	20,000	—	50%	50	200	200	200	200	200	200
Hartley	39,000	—	50%	50	390	390	390	390	390	390
Moore	300	—	50%	50	3	3	3	3	3	3
Oldham	491,000	2,800	50%	50	7,710	7,710	7,710	7,710	7,710	7,710
Potter	180,000	300	50%	50	2,100	2,100	2,100	2,100	2,100	2,100
Randall	23,000	—	50%	50	230	230	230	230	230	230
TOTAL	**756,200**	**3,100**	**50%**	**50**	**10,662**	**10,662**	**10,662**	**10,662**	**10,662**	**10,662**

Reference Sources by Column

B-C: Bradley 1997 (The Ground-Water Resources of the Dockum Aquifer, Texas.)

D: PWPG determined allowable aquifer reduction over entire planning period.

E: Length of planning period, Year 2000-2050

F-K: Year 20XX Avail. (ac-ft) = [Est. Avail. Storage * 50% (recoverable amount over 50 year planning period) / 50 years] + Est. Ann. Recharge

Example: Potter County (180,000 ac-ft * 50% / 50 years) + 300 ac-ft/yr = 2,100 ac-ft/yr groundwater availability

Rita Blanca Aquifer Freese and Nichols Estimated Ground Water Availability Calculation Methodology

A	B	C	D	E	F	G	H
County	Average Pumpage 1994-1997 (ac-ft/yr)	Estimated Annual Availability (ac-ft/yr)					
		2000	2010	2020	2030	2040	2050
Dallam	5,250	5,250	5,250	5,250	5,250	5,250	5,250
Hartley	-	0	0	0	0	0	0
TOTAL	**5,250**	**5,250**	**5,250**	**5,250**	**5,250**	**5,250**	**5,250**

Reference Sources by Column

B: TWDB 1999

C-H: The only data identified to estimate groundwater availability for the Rita Blanca aquifer was historical pumpage (TWDB 1999). No data for saturated thickness, water well levels, recoverable storage or other water availability parameters were identified. Therefore, estimated annual availability was considered to be equal to the average pumpage in TWDB, 1999.

Whitehorse Aquifer Freese and Nichols Estimated Ground Water Availability Calculation Methodology

A	B		C	D	E	F	G	H
County	Average Pumpage 1994-1997 (ac-ft/yr)	Historical Maximum Pumpage (ac-ft/yr)	Estimated Annual Availability (ac-ft/yr)					
			2000	2010	2020	2030	2040	2050
Armstrong	120	144	120	120	120	120	120	120
Childress	62	82	62	62	62	62	62	62
Collingsworth	30	32	30	30	30	30	30	30
Donley	43	71	71	71	71	71	71	71
Hall	40	46	46	46	46	46	46	46
Wheeler	271	335	335	335	335	335	335	335
TOTAL	**566**	**710**	**664**	**664**	**664**	**664**	**664**	**664**

Reference Sources by Column

B: TWDB 1999

C-H: The only data identified to estimate groundwater availability for the Whitehorse aquifer was historical pumpage (TWDB 1999). No data for saturated thickness, water well levels, recoverable storage or other water availability parameters were identified. Therefore, estimated annual availability was considered to be equal to the average pumpage in TWDB, 1999.

DEVELOPED USING TAES IRRIGATION VALUE, AS REQUESTED BY PANHANDLE RWPG

TABLE 1. RELATIONSHIP OF WATER NEEDS AND IMPACTS TO PROJECTIONS WITHOUT CONSTRAINTS, PANHANDLE REGION, 2000 - 2050

WATER

Decade	Projected Demand	Projected Water Shortage	Percent Shortage
	(acre-feet)		
2000	1,718,402	49	0.0%
2010	1,744,732	1,631	0.1%
2020	1,759,864	342,320	19.5%
2030	1,773,591	628,813	35.5%
2040	1,791,838	797,995	44.5%
2050	1,812,949	985,410	54.4%

EMPLOYMENT

Decade	Baseline Employment	Employment With Water Shortage	Percent Loss
	(FTE jobs)		
2000	167,968	167,866	0.1%
2010	185,393	184,199	0.6%
2020	197,040	181,216	8.0%
2030	212,852	169,795	20.2%
2040	226,382	149,976	33.8%
2050	240,578	108,149	55.0%

POPULATION

Decade	Baseline Population	Population With Water Shortage	Percent Loss
2000	379,018	378,810	0.1%
2010	416,870	414,458	0.6%
2020	453,496	421,940	7.0%
2030	481,637	396,691	17.6%
2040	515,393	361,775	29.8%
2050	552,072	285,978	48.2%

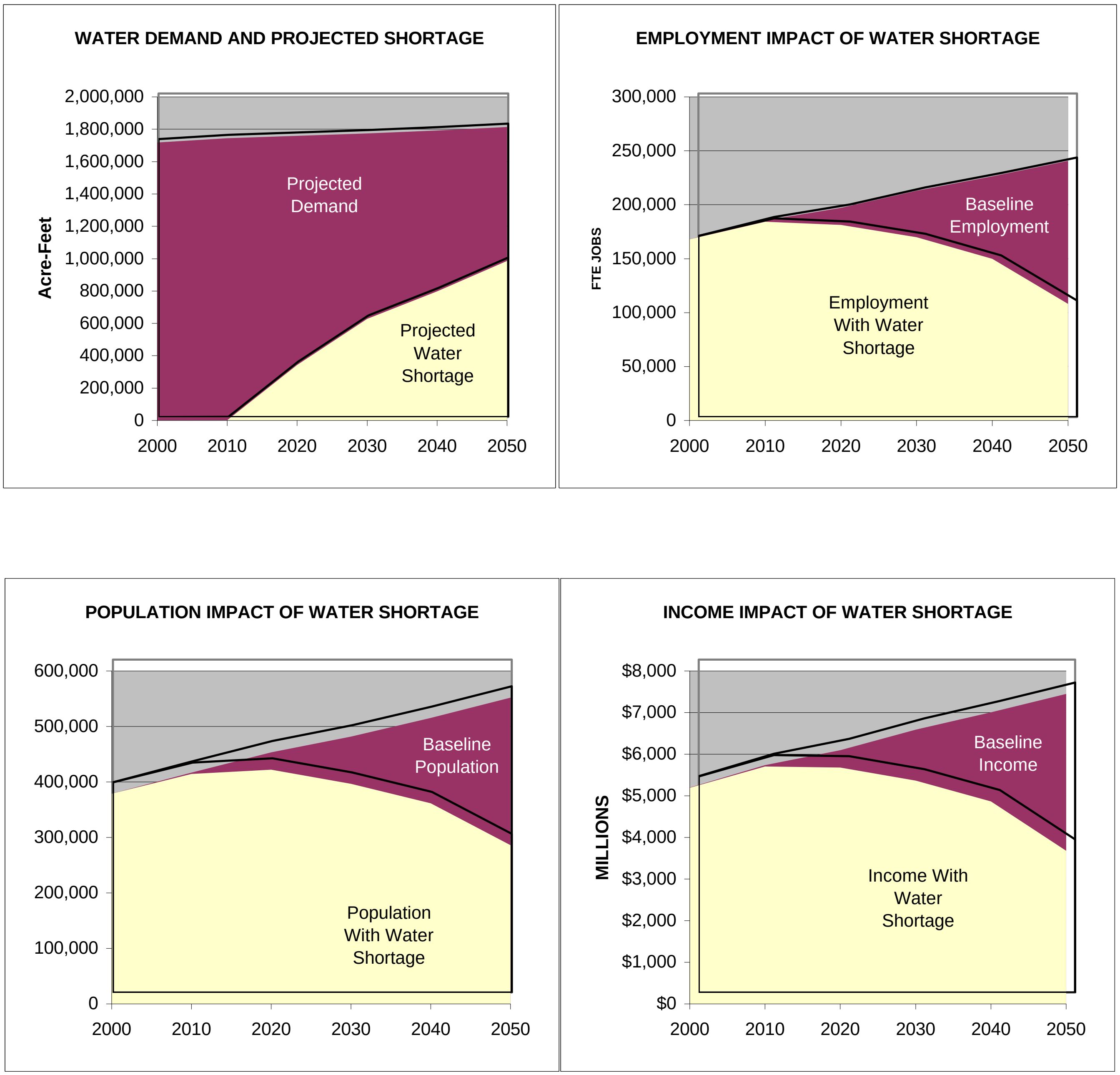
INCOME

Decade	Baseline Income	Income With Water Shortage	Percent Loss
	(millions, 1999 $)		
2000	5,199	5,195	0.1%
2010	5,738	5,707	0.5%
2020	6,098	5,678	6.9%
2030	6,588	5,363	18.6%
2040	7,007	4,868	30.5%
2050	7,446	3,677	50.6%

Impacts based on water needs identified in Table 7 delivered to TWDB as of 9/11/2001

DEVELOPED USING TAES IRRIGATION VALUE, AS REQUESTED BY PANHANDLE RWPG

FIGURE 1. SUMMARY OF SOCIO-ECONOMIC IMPACTS OF NOT MEETING WATER NEEDS, PANHANDLE REGION, 2000 - 2050



Impacts based on water needs identified in Table 7 delivered to TWDB as of 9/11/2001

DEVELOPED USING TAES IRRIGATION VALUE, AS REQUESTED BY PANHANDLE RWPG

TABLE 2. SUMMARY OF IMPACTS BY DECADE AND CATEGORY
PANHANDLE REGION, 2000 - 2050

Category	Decade	Value of Need (Acre-Feet)	Impact of Need on Employment	Impact of Need on Gross Business Output in 1999 US Dollars (Millions)	Impact of Need on Population	Impact of Need on School Enrollment	Impact of Need on Income in 1999 US Dollars (Millions)	Number of WUGs with Needs
Municipal	2000	-1	1	0.1	2	1	0.0	1
Manufacturing	2000	-46	101	16.5	206	69	3.4	2
Steam Elec.	2000	0	0	0.0	0	0	0.0	0
Mining	2000	-2	0	0.0	0	0	0.0	1
Irrigation	2000	0	0	0.0	0	0	0.0	0
Livestock	2000	0	0	0.0	0	0	0.0	0
TOTAL		-49	102	16.6	208	70	3.4	
Municipal	2010	-1,571	1,070	94.5	2,150	548	26.3	4
Manufacturing	2010	-57	125	20.4	262	71	4.2	2
Steam Elec.	2010	0	0	0.0	0	0	0.0	0
Mining	2010	-3	0	0.1	0	0	0.0	1
Irrigation	2010	0	0	0.0	0	0	0.0	0
Livestock	2010	0	0	0.0	0	0	0.0	0
TOTAL		-1,631	1,195	114.9	2,412	619	30.6	
Municipal	2020	-6,312	4,902	416.8	9,581	2,499	122.0	16
Manufacturing	2020	-1,496	3,905	638.9	7,874	1,992	131.8	4
Steam Elec.	2020	-31	16	3.2	31	8	0.8	1
Mining	2020	-4	0	0.1	0	0	0.0	1
Irrigation	2020	-324,676	2,132	226.6	4,285	1,087	41.0	2
Livestock	2020	-9,801	4,868	766.7	9,785	2,483	124.7	2
TOTAL		-342,320	15,824	2,052.2	31,556	8,069	420.3	
Municipal	2030	-12,225	10,602	875.3	21,375	5,646	265.7	19
Manufacturing	2030	-8,570	18,336	2,999.9	35,051	9,028	618.7	4
Steam Elec.	2030	-200	106	20.5	213	58	5.3	1
Mining	2030	-129	18	2.8	37	13	0.6	2
Irrigation	2030	-587,277	3,855	409.8	7,789	1,974	74.2	4
Livestock	2030	-20,412	10,139	1,596.6	20,481	5,172	259.8	3
TOTAL		-628,813	43,057	5,904.9	84,946	21,891	1,224.3	
Municipal	2040	-29,425	34,757	2,674.4	71,341	17,889	885.8	36
Manufacturing	2040	-9,512	20,284	3,318.4	38,774	10,010	684.4	6
Steam Elec.	2040	-3,982	2,107	409.1	4,287	1,077	105.2	2
Mining	2040	-281	39	6.0	91	21	1.4	6
Irrigation	2040	-725,694	4,764	506.4	9,777	2,452	91.7	9
Livestock	2040	-29,101	14,455	2,276.3	29,348	7,373	370.4	5
TOTAL		-797,995	76,407	9,190.6	153,618	38,822	2,138.8	
Municipal	2050	-55,038	74,398	5,579.0	149,000	37,981	1,907.0	36
Manufacturing	2050	-12,451	25,046	4,097.6	50,100	12,780	845.1	8
Steam Elec.	2050	-16,059	8,498	1,649.5	17,252	4,334	424.0	2
Mining	2050	-772	108	16.6	230	67	3.8	7
Irrigation	2050	-863,421	5,668	602.5	11,528	2,905	109.1	9
Livestock	2050	-37,668	18,711	2,946.5	37,984	9,544	479.4	5
TOTAL		-985,410	132,429	14,891.7	266,094	67,611	3,768.5	

Impacts based on water needs identified in Table 7 delivered to TWDB as of 9/11/2001

DEVELOPED USING TAES IRRIGATION VALUE, AS REQUESTED BY PANHANDLE RWPG

Table 9.00 - Social and Economic Impacts of Not Meeting Needs by Region, 2000

RWPG Letter, Water User Group Identifier, Name	Value of Need (Acre-Feet)	Impact of Need on Employment	Impact of Need on Gross Business Output in 1999 US Dollars (Millions)	Impact of Need on Population	Impact of Need on School Enrollment	Impact of Need on Income in 1999 US Dollars (Millions)
A 11003096 MINING	-2	0	0.0	0	0	0.0
A 11001106 MANUFACTURING	-4	6	1.0	12	4	0.2
A 11001148 MANUFACTURING	-42	95	15.5	194	65	3.2
A 10099000 BOOKER	-1	1	0.1	2	1	0.0
Grand Total	-49	102	16.6	208	70	3.4

Impacts based on water needs identified in Table 7 delivered to TWDB as of 9/11/2001

DEVELOPED USING TAES IRRIGATION VALUE, AS REQUESTED BY PANHANDLE RWPG

Table 9.10 - Social and Economic Impacts of Not Meeting Needs by Region, 2010

RWPG Letter, Water User Group Identifier, Name	Value of Need (Acre-Feet)	Impact of Need on Employment	Impact of Need on Gross Business Output in 1999 US Dollars (Millions)	Impact of Need on Population	Impact of Need on School Enrollment	Impact of Need on Income in 1999 US Dollars (Millions)
A 10515000 LEFORS	-19	18	1.4	44	14	0.5
A 11003096 MINING	-3	0	0.1	0	0	0.0
A 11001106 MANUFACTURING	-5	7	1.2	17	5	0.2
A 11001148 MANUFACTURING	-52	117	19.2	245	66	4.0
A 10689000 PERRYTON	-1,518	1,019	90.4	2,028	510	25.1
A 10500000 LAKE TANGLEWOOD	-12	11	0.9	27	8	0.3
A 10961000 WHEELER	-22	21	1.7	51	16	0.5
Grand Total	-1,631	1,195	114.9	2,412	619	30.6

Impacts based on water needs identified in Table 7 delivered to TWDB as of 9/11/2001

DEVELOPED USING TAES IRRIGATION VALUE, AS REQUESTED BY PANHANDLE RWPG

Table 9.20 - Social and Economic Impacts of Not Meeting Needs by Region, 2020

RWPG Letter, Water User Group Identifier, Name	Value of Need (Acre-Feet)	Impact of Need on Employment	Impact of Need on Gross Business Output in 1999 US Dollars (Millions)	Impact of Need on Population	Impact of Need on School Enrollment	Impact of Need on Income in 1999 US Dollars (Millions)
A 10834000 SKELLYTOWN	-44	42	3.4	81	21	1.0
A 10226000 DALHART	-863	579	51.4	1,112	295	14.3
A 10996056 COUNTY-OTHER	-136	93	8.2	179	47	2.3
A 11001056 MANUFACTURING	-179	1,257	205.7	2,539	641	42.4
A 11004056 IRRIGATION	-293,412	1,926	204.7	3,891	982	37.1
A 11005056 LIVESTOCK	-8,787	4,365	687.3	8,817	2,226	111.8
A 10515000 LEFORS	-95	90	7.2	173	46	2.3
A 10578000 MCLEAN	-246	232	18.8	445	118	5.8
A 11003096 MINING	-4	0	0.1	0	0	0.0
A 10368000 GRUVER	-203	192	15.5	369	98	4.8
A 10226000 DALHART	-612	411	36.5	789	210	10.1
A 10142000 CANADIAN	-199	188	15.2	361	96	4.7
A 11001106 MANUFACTURING	-6	9	1.5	17	5	0.3
A 11001148 MANUFACTURING	-58	131	21.4	252	67	4.4
A 10134000 CACTUS	-80	75	6.1	144	38	1.9
A 10255000 DUMAS	-499	533	41.9	1,023	272	13.5
A 10872000 SUNRAY	-98	93	7.5	179	47	2.3
A 10996171 COUNTY-OTHER	-69	47	4.1	90	24	1.2
A 11001171 MANUFACTURING	-1,253	2,508	410.3	5,066	1,279	84.6
A 11002171 STEAM ELECTRIC POWER	-31	16	3.2	31	8	0.8
A 11004171 IRRIGATION	-31,264	205	21.8	394	105	3.9
A 11005171 LIVESTOCK	-1,014	504	79.3	968	257	12.9
A 10689000 PERRYTON	-2,482	1,667	147.9	3,367	850	41.0
A 10145000 CANYON	-107	114	9.0	219	58	2.9
A 10500000 LAKE TANGLEWOOD	-305	288	23.3	553	147	7.2
A 10961000 WHEELER	-275	259	21.0	497	132	6.5
Grand Total	-342,320	15,824	2,052.2	31,556	8,069	420.3

Impacts based on water needs identified in Table 7 delivered to TWDB as of 9/11/2001

DEVELOPED USING TAES IRRIGATION VALUE, AS REQUESTED BY PANHANDLE RWPG

Table 9.30 - Social and Economic Impacts of Not Meeting Needs by Region, 2030

RWPG Letter, Water User Group Identifier, Name			Value of Need (Acre-Feet)	Impact of Need on Employment	Impact of Need on Gross Business Output in 1999 US Dollars (Millions)	Impact of Need on Population	Impact of Need on School Enrollment	Impact of Need on Income in 1999 US Dollars (Millions)
A	**10173000**	**CLAUDE**	-150	142	11.4	285	78	3.6
A	**10834000**	**SKELLYTOWN**	-64	60	4.9	125	41	1.5
A	**10226000**	**DALHART**	-1,087	730	64.8	1,467	402	18.0
A	**10996056**	**COUNTY-OTHER**	-174	119	10.5	239	65	2.9
A	**11001056**	**MANUFACTURING**	-232	1,629	266.6	3,291	831	55.0
A	**11004056**	**IRRIGATION**	-380,930	2,501	265.8	5,052	1,276	48.1
A	**11005056**	**LIVESTOCK**	-12,951	6,433	1,013.0	12,995	3,281	164.8
A	**10515000**	**LEFORS**	-85	80	6.5	166	55	2.0
A	**10578000**	**MCLEAN**	-232	219	17.7	440	120	5.5
A	**11003096**	**MINING**	-5	1	0.1	2	1	0.0
A	**10368000**	**GRUVER**	-361	341	27.5	685	188	8.6
A	**10226000**	**DALHART**	-791	531	47.1	1,067	292	13.1
A	**10142000**	**CANADIAN**	-641	605	48.9	1,216	333	15.2
A	**11001106**	**MANUFACTURING**	-7	10	1.7	21	7	0.3
A	**11001148**	**MANUFACTURING**	-62	140	22.9	281	77	4.7
A	**10134000**	**CACTUS**	-592	558	45.2	1,122	307	14.1
A	**10255000**	**DUMAS**	-3,418	3,654	287.1	7,381	1,864	92.7
A	**10872000**	**SUNRAY**	-701	661	53.5	1,329	364	16.7
A	**10996171**	**COUNTY-OTHER**	-427	292	25.8	587	161	7.2
A	**11001171**	**MANUFACTURING**	-8,269	16,557	2,708.7	31,458	8,113	558.6
A	**11002171**	**STEAM ELECTRIC POWER**	-200	106	20.5	213	58	5.3
A	**11004171**	**IRRIGATION**	-200,576	1,317	140.0	2,660	672	25.3
A	**11005171**	**LIVESTOCK**	-7,459	3,705	583.5	7,484	1,890	94.9
A	**10689000**	**PERRYTON**	-2,432	1,633	144.9	3,299	833	40.2
A	**10996188**	**COUNTY-OTHER**	-188	129	11.4	259	71	3.2
A	**11003188**	**MINING**	-124	17	2.7	35	12	0.6
A	**11004188**	**IRRIGATION**	-5,704	37	4.0	77	26	0.7
A	**10145000**	**CANYON**	-248	265	20.8	533	146	6.7
A	**10500000**	**LAKE TANGLEWOOD**	-303	286	23.1	575	157	7.2
A	**10996191**	**COUNTY-OTHER**	-59	40	3.6	83	28	1.0
A	**11004191**	**IRRIGATION**	-67	0	0.0	0	0	0.0
A	**11005191**	**LIVESTOCK**	-2	1	0.2	2	1	0.0

Impacts based on water needs identified in Table 7 delivered to TWDB as of 9/11/2001

DEVELOPED USING TAES IRRIGATION VALUE, AS REQUESTED BY PANHANDLE RWPG

Table 9.30 - Social and Economic Impacts of Not Meeting Needs by Region, 2030

RWPG Letter, Water User Group Identifier, Name	Value of Need (Acre-Feet)	Impact of Need on Employment	Impact of Need on Gross Business Output in 1999 US Dollars (Millions)	Impact of Need on Population	Impact of Need on School Enrollment	Impact of Need on Income in 1999 US Dollars (Millions)
A 10961000 WHEELER	-272	257	20.7	517	141	6.5
Grand Total	-628,813	43,057	5,904.9	84,946	21,891	1,224.3

Impacts based on water needs identified in Table 7 delivered to TWDB as of 9/11/2001

DEVELOPED USING TAES IRRIGATION VALUE, AS REQUESTED BY PANHANDLE RWPG

Table 9.40 - Social and Economic Impacts of Not Meeting Needs by Region, 2040

RWPG Letter, Water User Group Identifier, Name			Value of Need (Acre-Feet)	Impact of Need on Employment	Impact of Need on Gross Business Output in 1999 US Dollars (Millions)	Impact of Need on Population	Impact of Need on School Enrollment	Impact of Need on Income in 1999 US Dollars (Millions)
A	**10173000**	**CLAUDE**	-268	253	20.4	536	134	6.4
A	**10365000**	**GROOM**	-51	48	3.9	113	26	1.2
A	**10675000**	**PANHANDLE**	-738	696	56.3	1,476	369	17.5
A	**10834000**	**SKELLYTOWN**	-61	58	4.7	136	32	1.4
A	**10962000**	**WHITE DEER**	-48	45	3.7	106	25	1.1
A	**10226000**	**DALHART**	-1,037	696	61.8	1,476	369	17.1
A	**10996056**	**COUNTY-OTHER**	-173	118	10.4	250	63	2.9
A	**11001056**	**MANUFACTURING**	-232	1,629	266.6	3,307	831	55.0
A	**11004056**	**IRRIGATION**	-380,971	2,501	265.8	5,077	1,276	48.1
A	**11005056**	**LIVESTOCK**	-14,742	7,323	1,153.1	14,866	3,735	187.6
A	**10515000**	**LEFORS**	-80	75	6.1	176	41	1.9
A	**10578000**	**MCLEAN**	-226	213	17.2	452	113	5.4
A	**11003096**	**MINING**	-6	1	0.1	2	1	0.0
A	**10368000**	**GRUVER**	-346	326	26.4	691	173	8.2
A	**10226000**	**DALHART**	-791	531	47.1	1,126	281	13.1
A	**10142000**	**CANADIAN**	-615	580	46.9	1,230	307	14.6
A	**11001106**	**MANUFACTURING**	-8	12	1.9	28	7	0.4
A	**11001148**	**MANUFACTURING**	-74	167	27.3	354	89	5.6
A	**10134000**	**CACTUS**	-703	663	53.6	1,406	351	16.7
A	**10255000**	**DUMAS**	-3,603	3,852	302.6	7,820	1,965	97.7
A	**10872000**	**SUNRAY**	-750	708	57.2	1,501	375	17.8
A	**10996171**	**COUNTY-OTHER**	-419	287	25.3	608	152	7.1
A	**11001171**	**MANUFACTURING**	-8,863	17,746	2,903.3	33,540	8,696	598.8
A	**11002171**	**STEAM ELECTRIC POWER**	-200	106	20.5	225	56	5.3
A	**11004171**	**IRRIGATION**	-200,576	1,317	140.0	2,674	672	25.3
A	**11005171**	**LIVESTOCK**	-8,546	4,245	668.5	8,617	2,165	108.8
A	**10689000**	**PERRYTON**	-2,370	1,592	141.2	3,232	812	39.2
A	**10928000**	**VEGA**	-21	20	1.6	47	11	0.5
A	**10996180**	**COUNTY-OTHER**	-194	133	11.7	282	71	3.3
A	**11003180**	**MINING**	-25	4	0.5	9	2	0.1
A	**11004180**	**IRRIGATION**	-2,188	14	1.5	33	8	0.3
A	**10020000**	**AMARILLO**	-5,142	9,320	666.8	18,919	4,753	241.3

Impacts based on water needs identified in Table 7 delivered to TWDB as of 9/11/2001

DEVELOPED USING TAES IRRIGATION VALUE, AS REQUESTED BY PANHANDLE RWPG

Table 9.40 - Social and Economic Impacts of Not Meeting Needs by Region, 2040

RWPG Letter, Water User Group Identifier, Name			Value of Need (Acre-Feet)	Impact of Need on Employment	Impact of Need on Gross Business Output in 1999 US Dollars (Millions)	Impact of Need on Population	Impact of Need on School Enrollment	Impact of Need on Income in 1999 US Dollars (Millions)
A	**10996188**	**COUNTY-OTHER**	-606	415	36.6	880	220	10.2
A	**11001188**	**MANUFACTURING**	-185	394	64.5	835	209	13.3
A	**11002188**	**STEAM ELECTRIC POWER**	-3,782	2,001	388.5	4,062	1,021	99.9
A	**11003188**	**MINING**	-233	33	5.0	75	17	1.2
A	**11004188**	**IRRIGATION**	-9,382	62	6.5	146	34	1.2
A	**10020000**	**AMARILLO**	-5,319	9,642	689.8	19,573	4,917	249.6
A	**10145000**	**CANYON**	-479	512	40.2	1,085	271	13.0
A	**10378000**	**HAPPY**	-59	56	4.5	132	31	1.4
A	**10500000**	**LAKE TANGLEWOOD**	-294	277	22.4	587	147	7.0
A	**10996191**	**COUNTY-OTHER**	-4,214	2,883	254.3	5,888	1,478	71.0
A	**11001191**	**MANUFACTURING**	-149	335	54.8	710	178	11.3
A	**11003191**	**MINING**	-3	0	0.1	0	0	0.0
A	**11004191**	**IRRIGATION**	-40,991	269	28.6	573	143	5.2
A	**11005191**	**LIVESTOCK**	-2,601	1,292	203.4	2,625	659	33.1
A	**10864000**	**STRATFORD**	-242	228	18.4	483	121	5.7
A	**10996211**	**COUNTY-OTHER**	-55	38	3.3	89	21	0.9
A	**11003211**	**MINING**	-14	2	0.3	5	1	0.1
A	**11004211**	**IRRIGATION**	-91,586	601	63.9	1,274	319	11.6
A	**11005211**	**LIVESTOCK**	-3,213	1,596	251.3	3,240	814	40.9
A	**10822000**	**SHAMROCK**	-252	238	19.2	505	126	6.0
A	**10961000**	**WHEELER**	-268	253	20.4	536	134	6.4
Grand Total			-797,995	76,407	9,190.6	153,618	38,822	2,138.8

Impacts based on water needs identified in Table 7 delivered to TWDB as of 9/11/2001

DEVELOPED USING TAES IRRIGATION VALUE, AS REQUESTED BY PANHANDLE RWPG

Table 9.50 - Social and Economic Impacts of Not Meeting Needs by Region, 2050

RWPG Letter, Water User Group Identifier, Name			Value of Need (Acre-Feet)	Impact of Need on Employment	Impact of Need on Gross Business Output in 1999 US Dollars (Millions)	Impact of Need on Population	Impact of Need on School Enrollment	Impact of Need on Income in 1999 US Dollars (Millions)
A	**10173000**	**CLAUDE**	-267	252	20.4	514	129	6.3
A	**10365000**	**GROOM**	-121	114	9.2	233	58	2.9
A	**10675000**	**PANHANDLE**	-933	880	71.2	1,795	449	22.2
A	**10834000**	**SKELLYTOWN**	-59	56	4.5	119	34	1.4
A	**10962000**	**WHITE DEER**	-281	265	21.4	542	137	6.7
A	**10226000**	**DALHART**	-1,002	673	59.7	1,373	343	16.6
A	**10996056**	**COUNTY-OTHER**	-172	118	10.4	241	60	2.9
A	**11001056**	**MANUFACTURING**	-232	1,629	266.6	3,307	831	55.0
A	**11004056**	**IRRIGATION**	-381,008	2,501	265.9	5,077	1,276	48.1
A	**11005056**	**LIVESTOCK**	-16,796	8,343	1,313.8	16,936	4,255	213.8
A	**10515000**	**LEFORS**	-78	74	5.9	158	45	1.9
A	**10578000**	**MCLEAN**	-220	208	16.8	424	106	5.2
A	**11001090**	**MANUFACTURING**	-57	49	8.0	104	30	1.7
A	**11003096**	**MINING**	-7	1	0.1	2	1	0.0
A	**10368000**	**GRUVER**	-334	315	25.5	643	161	7.9
A	**10226000**	**DALHART**	-803	539	47.8	1,100	275	13.3
A	**10142000**	**CANADIAN**	-601	567	45.8	1,157	289	14.3
A	**11001106**	**MANUFACTURING**	-9	13	2.2	28	8	0.4
A	**11001117**	**MANUFACTURING**	-1,657	2,171	355.1	4,407	1,107	73.2
A	**11001148**	**MANUFACTURING**	-86	194	31.7	396	99	6.5
A	**11003148**	**MINING**	-9	1	0.2	2	1	0.0
A	**10134000**	**CACTUS**	-838	563	49.9	1,149	287	13.8
A	**10255000**	**DUMAS**	-3,848	4,114	323.2	8,351	2,098	104.3
A	**10872000**	**SUNRAY**	-807	761	61.6	1,552	388	19.2
A	**10996171**	**COUNTY-OTHER**	-430	294	26.0	600	150	7.2
A	**11001171**	**MANUFACTURING**	-9,429	18,879	3,088.7	37,569	9,628	637.0
A	**11002171**	**STEAM ELECTRIC POWER**	-200	106	20.5	216	54	5.3
A	**11004171**	**IRRIGATION**	-200,576	1,317	140.0	2,674	672	25.3
A	**11005171**	**LIVESTOCK**	-9,786	4,861	765.5	9,868	2,479	124.5
A	**10689000**	**PERRYTON**	-2,320	1,558	138.2	3,163	795	38.3
A	**10928000**	**VEGA**	-245	231	18.7	479	124	5.8
A	**10996180**	**COUNTY-OTHER**	-2,295	1,570	138.5	3,189	802	38.7

Impacts based on water needs identified in Table 7 delivered to TWDB as of 9/11/2001

DEVELOPED USING TAES IRRIGATION VALUE, AS REQUESTED BY PANHANDLE RWPG

Table 9.50 - Social and Economic Impacts of Not Meeting Needs by Region, 2050

RWPG Letter, Water User Group Identifier, Name			Value of Need (Acre-Feet)	Impact of Need on Employment	Impact of Need on Gross Business Output in 1999 US Dollars (Millions)	Impact of Need on Population	Impact of Need on School Enrollment	Impact of Need on Income in 1999 US Dollars (Millions)
A	**11003180**	**MINING**	-311	44	6.7	94	27	1.5
A	**11004180**	**IRRIGATION**	-25,948	170	18.1	354	92	3.3
A	**10020000**	**AMARILLO**	-14,191	25,723	1,840.3	51,189	13,119	666.0
A	**10996188**	**COUNTY-OTHER**	-1,528	1,045	92.2	2,131	533	25.8
A	**11001188**	**MANUFACTURING**	-799	1,702	278.5	3,455	868	57.4
A	**11002188**	**STEAM ELECTRIC POWER**	-15,859	8,392	1,629.0	17,036	4,280	418.8
A	**11003188**	**MINING**	-410	58	8.8	121	35	2.0
A	**11004188**	**IRRIGATION**	-13,877	91	9.7	194	55	1.8
A	**10020000**	**AMARILLO**	-15,612	28,298	2,024.5	56,313	14,432	732.7
A	**10145000**	**CANYON**	-772	825	64.8	1,683	421	20.9
A	**10378000**	**HAPPY**	-71	67	5.4	143	41	1.7
A	**10500000**	**LAKE TANGLEWOOD**	-282	266	21.5	543	136	6.7
A	**10996191**	**COUNTY-OTHER**	-5,738	3,926	346.3	7,974	2,002	96.7
A	**11001191**	**MANUFACTURING**	-182	409	66.9	834	209	13.8
A	**11003191**	**MINING**	-5	1	0.1	2	1	0.0
A	**11004191**	**IRRIGATION**	-47,214	310	32.9	633	158	6.0
A	**11005191**	**LIVESTOCK**	-3,407	1,692	266.5	3,436	864	43.4
A	**10864000**	**STRATFORD**	-496	468	37.8	955	239	11.8
A	**10996211**	**COUNTY-OTHER**	-105	72	6.3	153	44	1.8
A	**11003211**	**MINING**	-31	4	0.7	9	2	0.2
A	**11004211**	**IRRIGATION**	-194,797	1,279	135.9	2,596	652	24.6
A	**11005211**	**LIVESTOCK**	-7,679	3,815	600.7	7,744	1,946	97.7
A	**10822000**	**SHAMROCK**	-321	303	24.5	618	155	7.6
A	**10961000**	**WHEELER**	-268	253	20.4	516	129	6.4
Grand Total			-985,410	132,429	14,891.7	266,094	67,611	3,768.5

Impacts based on water needs identified in Table 7 delivered to TWDB as of 9/11/2001

DEVELOPED USING TAES IRRIGATION VALUE, AS REQUESTED BY PANHANDLE RWPG

Table 10.00 - Social and Economic Impacts of Not Meeting Needs by Basin, 2000

Water User Group Name	Water User Group Identifier	Regional Water Planning Group	Basin	Value of Need (Acre-Feet)	Impact of Need on Employment	Impact of Need on Gross Business Output in 1999 US Dollars (Millions)	Impact of Need on Population	Impact of Need on School Enrollment	Impact of Need on Income in 1999 US Dollars (Millions)
MINING	11003096	A	2	-2	0	0.0	0	0	0.0
MANUFACTURING	11001106	A	1	-4	6	1.0	12	4	0.2
MANUFACTURING	11001148	A	1	-42	95	15.5	194	65	3.2
BOOKER	10099000	A	1	-1	1	0.1	2	1	0.0

Impacts based on water needs identified in Table 7 delivered to TWDB as of 9/11/2001

DEVELOPED USING TAES IRRIGATION VALUE, AS REQUESTED BY PANHANDLE RWPG

Table 10.10 - Social and Economic Impacts of Not Meeting Needs by Basin, 2010

Water User Group Name	Water User Group Identifier	Regional Water Planning Group	Basin	Value of Need (Acre-Feet)	Impact of Need on Employment	Impact of Need on Gross Business Output in 1999 US Dollars (Millions)	Impact of Need on Population	Impact of Need on School Enrollment	Impact of Need on Income in 1999 US Dollars (Millions)
LEFORS	10515000	A	2	-19	18	1.4	44	14	0.5
MINING	11003096	A	2	-3	0	0.1	0	0	0.0
MANUFACTURING	11001106	A	1	-5	7	1.2	17	5	0.2
MANUFACTURING	11001148	A	1	-52	117	19.2	245	66	4.0
PERRYTON	10689000	A	1	-1,518	1,019	90.4	2,028	510	25.1
LAKE TANGLEWOOD	10500000	A	2	-12	11	0.9	27	8	0.3
WHEELER	10961000	A	2	-22	21	1.7	51	16	0.5

Impacts based on water needs identified in Table 7 delivered to TWDB as of 9/11/2001

DEVELOPED USING TAES IRRIGATION VALUE, AS REQUESTED BY PANHANDLE RWPG

Table 10.20 - Social and Economic Impacts of Not Meeting Needs by Basin, 2020

Water User Group Name	Water User Group Identifier	Regional Water Planning Group	Basin	Value of Need (Acre-Feet)	Impact of Need on Employment	Impact of Need on Gross Business Output in 1999 US Dollars (Millions)	Impact of Need on Population	Impact of Need on School Enrollment	Impact of Need on Income in 1999 US Dollars (Millions)
SKELLYTOWN	10834000	A	1	-44	42	3.4	81	21	1.0
DALHART	10226000	A	1	-863	579	51.4	1,112	295	14.3
COUNTY-OTHER	10996056	A	1	-136	93	8.2	179	47	2.3
MANUFACTURING	11001056	A	1	-179	1,257	205.7	2,539	641	42.4
IRRIGATION	11004056	A	1	-293,412	1,926	204.7	3,891	982	37.1
LIVESTOCK	11005056	A	1	-8,787	4,365	687.3	8,817	2,226	111.8
LEFORS	10515000	A	2	-95	90	7.2	173	46	2.3
MCLEAN	10578000	A	2	-246	232	18.8	445	118	5.8
MINING	11003096	A	2	-4	0	0.1	0	0	0.0
GRUVER	10368000	A	1	-203	192	15.5	369	98	4.8
DALHART	10226000	A	1	-612	411	36.5	789	210	10.1
CANADIAN	10142000	A	1	-199	188	15.2	361	96	4.7
MANUFACTURING	11001106	A	1	-6	9	1.5	17	5	0.3
MANUFACTURING	11001148	A	1	-58	131	21.4	252	67	4.4
CACTUS	10134000	A	1	-80	75	6.1	144	38	1.9
DUMAS	10255000	A	1	-499	533	41.9	1,023	272	13.5
SUNRAY	10872000	A	1	-98	93	7.5	179	47	2.3
COUNTY-OTHER	10996171	A	1	-69	47	4.1	90	24	1.2
MANUFACTURING	11001171	A	1	-1,253	2,508	410.3	5,066	1,279	84.6
STEAM ELECTRIC POWER	11002171	A	1	-31	16	3.2	31	8	0.8
IRRIGATION	11004171	A	1	-31,264	205	21.8	394	105	3.9
LIVESTOCK	11005171	A	1	-1,014	504	79.3	968	257	12.9
PERRYTON	10689000	A	1	-2,482	1,667	147.9	3,367	850	41.0
CANYON	10145000	A	2	-107	114	9.0	219	58	2.9
LAKE TANGLEWOOD	10500000	A	2	-305	288	23.3	553	147	7.2
WHEELER	10961000	A	2	-275	259	21.0	497	132	6.5

Impacts based on water needs identified in Table 7 delivered to TWDB as of 9/11/2001

DEVELOPED USING TAES IRRIGATION VALUE, AS REQUESTED BY PANHANDLE RWPG

Table 10.30 - Social and Economic Impacts of Not Meeting Needs by Basin, 2030

Water User Group Name	Water User Group Identifier	Regional Water Planning Group	Basin	Value of Need (Acre-Feet)	Impact of Need on Employment	Impact of Need on Gross Business Output in 1999 US Dollars (Millions)	Impact of Need on Population	Impact of Need on School Enrollment	Impact of Need on Income in 1999 US Dollars (Millions)
CLAUDE	10173000	A	2	-150	142	11.4	285	78	3.6
SKELLYTOWN	10834000	A	1	-64	60	4.9	125	41	1.5
DALHART	10226000	A	1	-1,087	730	64.8	1,467	402	18.0
COUNTY-OTHER	10996056	A	1	-174	119	10.5	239	65	2.9
MANUFACTURING	11001056	A	1	-232	1,629	266.6	3,291	831	55.0
IRRIGATION	11004056	A	1	-380,930	2,501	265.8	5,052	1,276	48.1
LIVESTOCK	11005056	A	1	-12,951	6,433	1,013.0	12,995	3,281	164.8
LEFORS	10515000	A	2	-85	80	6.5	166	55	2.0
MCLEAN	10578000	A	2	-232	219	17.7	440	120	5.5
MINING	11003096	A	2	-5	1	0.1	2	1	0.0
GRUVER	10368000	A	1	-361	341	27.5	685	188	8.6
DALHART	10226000	A	1	-791	531	47.1	1,067	292	13.1
CANADIAN	10142000	A	1	-641	605	48.9	1,216	333	15.2
MANUFACTURING	11001106	A	1	-7	10	1.7	21	7	0.3
MANUFACTURING	11001148	A	1	-62	140	22.9	281	77	4.7
CACTUS	10134000	A	1	-592	558	45.2	1,122	307	14.1
DUMAS	10255000	A	1	-3,418	3,654	287.1	7,381	1,864	92.7
SUNRAY	10872000	A	1	-701	661	53.5	1,329	364	16.7
COUNTY-OTHER	10996171	A	1	-427	292	25.8	587	161	7.2
MANUFACTURING	11001171	A	1	-8,269	16,557	2,708.7	31,458	8,113	558.6
STEAM ELECTRIC POWER	11002171	A	1	-200	106	20.5	213	58	5.3
IRRIGATION	11004171	A	1	-200,576	1,317	140.0	2,660	672	25.3
LIVESTOCK	11005171	A	1	-7,459	3,705	583.5	7,484	1,890	94.9
PERRYTON	10689000	A	1	-2,432	1,633	144.9	3,299	833	40.2
COUNTY-OTHER	10996188	A	2	-188	129	11.4	259	71	3.2
MINING	11003188	A	2	-124	17	2.7	35	12	0.6
IRRIGATION	11004188	A	2	-5,704	37	4.0	77	26	0.7
CANYON	10145000	A	2	-248	265	20.8	533	146	6.7
LAKE TANGLEWOOD	10500000	A	2	-303	286	23.1	575	157	7.2
COUNTY-OTHER	10996191	A	1	-59	40	3.6	83	28	1.0
IRRIGATION	11004191	A	1	-67	0	0.0	0	0	0.0
LIVESTOCK	11005191	A	1	-2	1	0.2	2	1	0.0

Impacts based on water needs identified in Table 7 delivered to TWDB as of 9/11/2001

DEVELOPED USING TAES IRRIGATION VALUE, AS REQUESTED BY PANHANDLE RWPG

Table 10.30 - Social and Economic Impacts of Not Meeting Needs by Basin, 2030

Water User Group Name	Water User Group Identifier	Regional Water Planning Group	Basin	Value of Need (Acre-Feet)	Impact of Need on Employment	Impact of Need on Gross Business Output in 1999 US Dollars (Millions)	Impact of Need on Population	Impact of Need on School Enrollment	Impact of Need on Income in 1999 US Dollars (Millions)
WHEELER	10961000	A	2	-272	257	20.7	517	141	6.5

Impacts based on water needs identified in Table 7 delivered to TWDB as of 9/11/2001

DEVELOPED USING TAES IRRIGATION VALUE, AS REQUESTED BY PANHANDLE RWPG

Table 10.40 - Social and Economic Impacts of Not Meeting Needs by Basin, 2040

Water User Group Name	Water User Group Identifier	Regional Water Planning Group	Basin	Value of Need (Acre-Feet)	Impact of Need on Employment	Impact of Need on Gross Business Output in 1999 US Dollars (Millions)	Impact of Need on Population	Impact of Need on School Enrollment	Impact of Need on Income in 1999 US Dollars (Millions)
CLAUDE	10173000	A	2	-268	253	20.4	536	134	6.4
GROOM	10365000	A	2	-51	48	3.9	113	26	1.2
PANHANDLE	10675000	A	2	-738	696	56.3	1,476	369	17.5
SKELLYTOWN	10834000	A	1	-61	58	4.7	136	32	1.4
WHITE DEER	10962000	A	1	-45	42	3.4	99	23	1.1
WHITE DEER	10962000	A	2	-3	3	0.2	7	2	0.1
DALHART	10226000	A	1	-1,037	696	61.8	1,476	369	17.1
COUNTY-OTHER	10996056	A	1	-173	118	10.4	250	63	2.9
MANUFACTURING	11001056	A	1	-232	1,629	266.6	3,307	831	55.0
IRRIGATION	11004056	A	1	-380,971	2,501	265.8	5,077	1,276	48.1
LIVESTOCK	11005056	A	1	-14,742	7,323	1,153.1	14,866	3,735	187.6
LEFORS	10515000	A	2	-80	75	6.1	176	41	1.9
MCLEAN	10578000	A	2	-226	213	17.2	452	113	5.4
MINING	11003096	A	2	-6	1	0.1	2	1	0.0
GRUVER	10368000	A	1	-346	326	26.4	691	173	8.2
DALHART	10226000	A	1	-791	531	47.1	1,126	281	13.1
CANADIAN	10142000	A	1	-615	580	46.9	1,230	307	14.6
MANUFACTURING	11001106	A	1	-8	12	1.9	28	7	0.4
MANUFACTURING	11001148	A	1	-74	167	27.3	354	89	5.6
CACTUS	10134000	A	1	-703	663	53.6	1,406	351	16.7
DUMAS	10255000	A	1	-3,603	3,852	302.6	7,820	1,965	97.7
SUNRAY	10872000	A	1	-750	708	57.2	1,501	375	17.8
COUNTY-OTHER	10996171	A	1	-419	287	25.3	608	152	7.1
MANUFACTURING	11001171	A	1	-8,863	17,746	2,903.3	33,540	8,696	598.8
STEAM ELECTRIC POWER	11002171	A	1	-200	106	20.5	225	56	5.3
IRRIGATION	11004171	A	1	-200,576	1,317	140.0	2,674	672	25.3
LIVESTOCK	11005171	A	1	-8,546	4,245	668.5	8,617	2,165	108.8
PERRYTON	10689000	A	1	-2,370	1,592	141.2	3,232	812	39.2
VEGA	10928000	A	1	-5	5	0.4	12	3	0.1
VEGA	10928000	A	2	-16	15	1.2	35	8	0.4
COUNTY-OTHER	10996180	A	1	-193	132	11.6	280	70	3.2
COUNTY-OTHER	10996180	A	2	-2	1	0.1	2	1	0.0

Impacts based on water needs identified in Table 7 delivered to TWDB as of 9/11/2001

DEVELOPED USING TAES IRRIGATION VALUE, AS REQUESTED BY PANHANDLE RWPG

Table 10.40 - Social and Economic Impacts of Not Meeting Needs by Basin, 2040

Water User Group Name	Water User Group Identifier	Regional Water Planning Group	Basin	Value of Need (Acre-Feet)	Impact of Need on Employment	Impact of Need on Gross Business Output in 1999 US Dollars (Millions)	Impact of Need on Population	Impact of Need on School Enrollment	Impact of Need on Income in 1999 US Dollars (Millions)
MINING	11003180	A	2	-25	4	0.5	9	2	0.1
IRRIGATION	11004180	A	1	-649	4	0.5	9	2	0.1
IRRIGATION	11004180	A	2	-1,539	10	1.1	24	6	0.2
AMARILLO	10020000	A	1	-2,944	5,337	381.8	10,834	2,722	138.2
AMARILLO	10020000	A	2	-2,198	3,983	285.0	8,085	2,031	103.1
COUNTY-OTHER	10996188	A	1	-336	230	20.3	488	122	5.7
COUNTY-OTHER	10996188	A	2	-270	185	16.3	392	98	4.6
MANUFACTURING	11001188	A	1	-185	394	64.5	835	209	13.3
STEAM ELECTRIC POWER	11002188	A	1	-3,782	2,001	388.5	4,062	1,021	99.9
MINING	11003188	A	1	-59	8	1.3	19	4	0.3
MINING	11003188	A	2	-174	24	3.7	56	13	0.9
IRRIGATION	11004188	A	1	-1,967	13	1.4	31	7	0.2
IRRIGATION	11004188	A	2	-7,415	49	5.2	115	27	0.9
AMARILLO	10020000	A	2	-5,319	9,642	689.8	19,573	4,917	249.6
CANYON	10145000	A	2	-479	512	40.2	1,085	271	13.0
HAPPY	10378000	A	2	-59	56	4.5	132	31	1.4
LAKE TANGLEWOOD	10500000	A	2	-294	277	22.4	587	147	7.0
COUNTY-OTHER	10996191	A	1	-543	372	32.8	789	197	9.2
COUNTY-OTHER	10996191	A	2	-3,671	2,512	221.6	5,099	1,281	61.9
MANUFACTURING	11001191	A	2	-149	335	54.8	710	178	11.3
MINING	11003191	A	2	-3	0	0.1	0	0	0.0
IRRIGATION	11004191	A	1	-539	4	0.4	9	2	0.1
IRRIGATION	11004191	A	2	-40,452	266	28.2	564	141	5.1
LIVESTOCK	11005191	A	1	-31	15	2.4	35	8	0.4
LIVESTOCK	11005191	A	2	-2,570	1,276	201.0	2,590	651	32.7
STRATFORD	10864000	A	1	-242	228	18.4	483	121	5.7
COUNTY-OTHER	10996211	A	1	-55	38	3.3	89	21	0.9
MINING	11003211	A	1	-14	2	0.3	5	1	0.1
IRRIGATION	11004211	A	1	-91,586	601	63.9	1,274	319	11.6
LIVESTOCK	11005211	A	1	-3,213	1,596	251.3	3,240	814	40.9
SHAMROCK	10822000	A	2	-252	238	19.2	505	126	6.0
WHEELER	10961000	A	2	-268	253	20.4	536	134	6.4

Impacts based on water needs identified in Table 7 delivered to TWDB as of 9/11/2001

DEVELOPED USING TAES IRRIGATION VALUE, AS REQUESTED BY PANHANDLE RWPG

Table 10.50 - Social and Economic Impacts of Not Meeting Needs by Basin, 2050

Water User Group Name	Water User Group Identifier	Regional Water Planning Group	Basin	Value of Need (Acre-Feet)	Impact of Need on Employment	Impact of Need on Gross Business Output in 1999 US Dollars (Millions)	Impact of Need on Population	Impact of Need on School Enrollment	Impact of Need on Income in 1999 US Dollars (Millions)
CLAUDE	10173000	A	2	-267	252	20.4	514	129	6.3
GROOM	10365000	A	2	-121	114	9.2	233	58	2.9
PANHANDLE	10675000	A	2	-933	880	71.2	1,795	449	22.2
SKELLYTOWN	10834000	A	1	-59	56	4.5	119	34	1.4
WHITE DEER	10962000	A	1	-267	252	20.4	514	129	6.3
WHITE DEER	10962000	A	2	-14	13	1.1	28	8	0.3
DALHART	10226000	A	1	-1,002	673	59.7	1,373	343	16.6
COUNTY-OTHER	10996056	A	1	-172	118	10.4	241	60	2.9
MANUFACTURING	11001056	A	1	-232	1,629	266.6	3,307	831	55.0
IRRIGATION	11004056	A	1	-381,008	2,501	265.9	5,077	1,276	48.1
LIVESTOCK	11005056	A	1	-16,796	8,343	1,313.8	16,936	4,255	213.8
LEFORS	10515000	A	2	-78	74	5.9	158	45	1.9
MCLEAN	10578000	A	2	-220	208	16.8	424	106	5.2
MANUFACTURING	11001090	A	1	-57	49	8.0	104	30	1.7
MINING	11003096	A	2	-7	1	0.1	2	1	0.0
GRUVER	10368000	A	1	-334	315	25.5	643	161	7.9
DALHART	10226000	A	1	-803	539	47.8	1,100	275	13.3
CANADIAN	10142000	A	1	-601	567	45.8	1,157	289	14.3
MANUFACTURING	11001106	A	1	-9	13	2.2	28	8	0.4
MANUFACTURING	11001117	A	1	-1,657	2,171	355.1	4,407	1,107	73.2
MANUFACTURING	11001148	A	1	-86	194	31.7	396	99	6.5
MINING	11003148	A	1	-9	1	0.2	2	1	0.0
CACTUS	10134000	A	1	-838	563	49.9	1,149	287	13.8
DUMAS	10255000	A	1	-3,848	4,114	323.2	8,351	2,098	104.3
SUNRAY	10872000	A	1	-807	761	61.6	1,552	388	19.2
COUNTY-OTHER	10996171	A	1	-430	294	26.0	600	150	7.2
MANUFACTURING	11001171	A	1	-9,429	18,879	3,088.7	37,569	9,628	637.0
STEAM ELECTRIC POWER	11002171	A	1	-200	106	20.5	216	54	5.3
IRRIGATION	11004171	A	1	-200,576	1,317	140.0	2,674	672	25.3
LIVESTOCK	11005171	A	1	-9,786	4,861	765.5	9,868	2,479	124.5
PERRYTON	10689000	A	1	-2,320	1,558	138.2	3,163	795	38.3
VEGA	10928000	A	1	-61	58	4.7	124	35	1.4

Impacts based on water needs identified in Table 7 delivered to TWDB as of 9/11/2001

DEVELOPED USING TAES IRRIGATION VALUE, AS REQUESTED BY PANHANDLE RWPG

Table 10.50 - Social and Economic Impacts of Not Meeting Needs by Basin, 2050

Water User Group Name	Water User Group Identifier	Regional Water Planning Group	Basin	Value of Need (Acre-Feet)	Impact of Need on Employment	Impact of Need on Gross Business Output in 1999 US Dollars (Millions)	Impact of Need on Population	Impact of Need on School Enrollment	Impact of Need on Income in 1999 US Dollars (Millions)
VEGA	10928000	A	2	-184	174	14.0	355	89	4.4
COUNTY-OTHER	10996180	A	1	-2,273	1,555	137.2	3,157	793	38.3
COUNTY-OTHER	10996180	A	2	-22	15	1.3	32	9	0.4
MINING	11003180	A	2	-311	44	6.7	94	27	1.5
IRRIGATION	11004180	A	1	-7,700	51	5.4	109	31	1.0
IRRIGATION	11004180	A	2	-18,249	120	12.7	245	61	2.3
AMARILLO	10020000	A	1	-8,126	14,729	1,053.8	29,311	7,512	381.4
AMARILLO	10020000	A	2	-6,065	10,994	786.5	21,878	5,607	284.6
COUNTY-OTHER	10996188	A	1	-1,260	862	76.0	1,758	440	21.2
COUNTY-OTHER	10996188	A	2	-268	183	16.2	373	93	4.5
MANUFACTURING	11001188	A	1	-799	1,702	278.5	3,455	868	57.4
STEAM ELECTRIC POWER	11002188	A	1	-15,859	8,392	1,629.0	17,036	4,280	418.8
MINING	11003188	A	1	-231	32	5.0	68	20	1.1
MINING	11003188	A	2	-179	25	3.9	53	15	0.9
IRRIGATION	11004188	A	1	-6,884	45	4.8	96	27	0.9
IRRIGATION	11004188	A	2	-6,993	46	4.9	98	28	0.9
AMARILLO	10020000	A	2	-15,612	28,298	2,024.5	56,313	14,432	732.7
CANYON	10145000	A	2	-772	825	64.8	1,683	421	20.9
HAPPY	10378000	A	2	-71	67	5.4	143	41	1.7
LAKE TANGLEWOOD	10500000	A	2	-282	266	21.5	543	136	6.7
COUNTY-OTHER	10996191	A	1	-629	430	38.0	877	219	10.6
COUNTY-OTHER	10996191	A	2	-5,109	3,496	308.4	7,097	1,783	86.1
MANUFACTURING	11001191	A	2	-182	409	66.9	834	209	13.8
MINING	11003191	A	2	-5	1	0.1	2	1	0.0
IRRIGATION	11004191	A	1	-534	4	0.4	9	2	0.1
IRRIGATION	11004191	A	2	-46,680	306	32.6	624	156	5.9
LIVESTOCK	11005191	A	1	-34	17	2.7	36	10	0.4
LIVESTOCK	11005191	A	2	-3,373	1,675	263.8	3,400	854	42.9
STRATFORD	10864000	A	1	-496	468	37.8	955	239	11.8
COUNTY-OTHER	10996211	A	1	-105	72	6.3	153	44	1.8
MINING	11003211	A	1	-31	4	0.7	9	2	0.2
IRRIGATION	11004211	A	1	-194,797	1,279	135.9	2,596	652	24.6

Impacts based on water needs identified in Table 7 delivered to TWDB as of 9/11/2001

DEVELOPED USING TAES IRRIGATION VALUE, AS REQUESTED BY PANHANDLE RWPG

Table 10.50 - Social and Economic Impacts of Not Meeting Needs by Basin, 2050

Water User Group Name	Water User Group Identifier	Regional Water Planning Group	Basin	Value of Need (Acre-Feet)	Impact of Need on Employment	Impact of Need on Gross Business Output in 1999 US Dollars (Millions)	Impact of Need on Population	Impact of Need on School Enrollment	Impact of Need on Income in 1999 US Dollars (Millions)
LIVESTOCK	11005211	A	1	-7,679	3,815	600.7	7,744	1,946	97.7
SHAMROCK	10822000	A	2	-321	303	24.5	618	155	7.6
WHEELER	10961000	A	2	-268	253	20.4	516	129	6.4

Impacts based on water needs identified in Table 7 delivered to TWDB as of 9/11/2001

IMPLAN REPORT OF INDUSTRY FINAL DEMAND AGGREGATED TO 7 SECTORS

REGION A

Industry	Households	Federal Gov't	State & Local Gov't	Capital	Inventory	Domestic Exports	Foreign Exports	Final Demand (Sum)
	Millions of Dollars							
Livestock	14.332	0.248	1.907	0.374	0.287	1,460.74	10.248	1488.138
Irrigation	2.937	0.022	0.281	0.034	0.388	156.192	130.617	290.471
Mining	21.953	0.915	2.836	1.64	1.689	1,641.90	19.899	1690.836
Manufacturing	1,044.55	43.584	127.451	65.306	79.722	644.871	464.89	2470.371
Steam Electric	117.492	0.017	27.783	0.026	0.009	142.843	0.783	288.953
Municipal Commercial	1,525.29	37.228	353.267	56.702	19.527	1.415	70.748	2064.181
Municipal Household	146.3	1,141.6	0.0	0.0	255.6	0.0	286.9	1830.4

NOTE: The sum of these final demands are not total final demand for the region. These numbers include only selected sectors from a larger (528 sector) regional model that reported significant water use in the base year. Total final demand for the region would include all remaining, lower water use sectors.

IMPLAN REPORT OF MULTIPLIERS

Panhandle Water Planning Region (Region A)

Employment

Industry	Direct Effects	Indirect Effects	Induced Effects	Total	Type I Multiplier	Type II Multiplier
	Jobs Per Million Dollars of Output					
Livestock	3.8	8.1	4.2	16.1	3.133	4.251
Irrigation	9.5	9.9	4.8	24.1	2.043	2.545
Municipal Commercial	22.1	4.0	9.6	35.7	1.179	1.615
Mining	5.2	2.6	4.4	12.1	1.495	2.343
Manufacturing	3.2	8.3	6.1	17.7	3.556	5.439
Steam Electric	2.3	2.0	4.5	8.9	1.862	3.817
Municipal Household	9.5	1.9	2.7	14.1	1.200	1.484

Output

(Gross Business Receipts/Sales)

Industry	Direct Effects	Indirect Effects	Induced Effects	Total	Type I Multiplier	Type II Multiplier
Livestock	1	0.979	0.339	2.318	1.979	2.318
Irrigation	1	0.961	0.381	2.342	1.961	2.342
Municipal Commercial	1	0.384	0.772	2.156	1.384	2.156
Mining	1	0.344	0.351	1.694	1.344	1.694
Manufacturing	1	1.154	0.490	2.644	2.154	2.644
Steam Electric	1	0.209	0.363	1.572	1.209	1.572
Municipal Household	1	0.145	0.172	1.317	1.145	1.317

Labor Income

Industry	Direct Effects*	Indirect Effects*	Induced Effects*	Total*	Type I Multiplier	Type II Multiplier
Livestock	0.059	0.216	0.102	0.377	4.670	6.404
Irrigation	0.062	0.247	0.115	0.424	4.951	6.790
Municipal Commercial	0.514	0.113	0.233	0.859	1.219	1.672
Mining	0.203	0.082	0.106	0.390	1.404	1.925
Manufacturing	0.140	0.258	0.148	0.545	2.849	3.907
Steam Electric	0.231	0.064	0.109	0.404	1.278	1.753
Municipal Household	0.198	0.048	0.059	0.304	1.242	1.539

*** Income Portion of Gross Outputs**

SOCIO-ECONOMIC IMPACTS OF NOT MEETING WATER NEEDS

PANHANDLE REGIONAL WATER PLANNING GROUP (REGION A)

SECTION 1 SUMMARY OF RESULTS

Section 357.7(4) of the rules for implementing Senate Bill 1 require that the social and economic impact of not meeting regional water supply needs be evaluated by the Regional Water Planning Groups (RWPG). The Texas Water Development Board (TWDB) is required to provide technical assistance, upon request, to complete the evaluations. The Board has offered its staff to conduct the required analysis of the impacts of the identified needs for each region, using a common methodological approach for all regions.

The Panhandle Regional Water Planning Group submitted a request to TWDB for assistance, and then requested this alternative analysis, with the estimated direct impact of irrigation originally developed by TWDB staff replaced by an estimate developed by the Texas Agricultural Extension Service. Board staff has completed the analysis of the social and economic impacts of not meeting water needs as identified in Exhibit B, Table 7. TWDB evaluated each negative value, showing an unmet water need for an individual water user group (WUG), using data that connected water use with the economy and the population of the region.

The detailed results of the analysis are found in Tables 9 and 10, included in Section 3 of this report. Each water user group with a need is evaluated in terms of direct and indirect economic and social impact on the region resulting from the shortage. Economic variables chosen by TWDB for this analysis include gross economic output (sales and business gross income), employment (number of jobs) and personal income (wages, salaries and proprietors net receipts). The effects of shortages on population and school enrollments are the social variables of the analysis. Declining populations indicate a deprecation of social services in most, but not every case, while declining school enrollment indicates loss of younger cohorts of the population and possibilities of strains on the tax bases, when combined with economic losses. RWPGs are allowed to expand this analysis at their discretion.

The purpose of this element of Senate Bill 1 planning is to give the regions an estimate of the potential costs of not acting to meet anticipated needs in each water user group, or conversely, the potential benefit to be gained from devising a strategy to meet a particular need. Collectively, the summation of all the impacts gives the region a view of the ultimate magnitude of the impacts caused by not meeting all of the entire list of needs. These summations should be considered a worst-case scenario for the region, since the likelihood of not meeting the entire list of needs is very small.

IMPACTS OF UNMET WATER NEEDS FOR THE REGION

The Panhandle Regional Water Planning Group identified individual water user groups which showed an unmet need during drought-of-record supply conditions for each decade from 2000 to 2050.

The region projected that total water demands would increase from 1.72 million acre-feet in 2000 to 1.77 million acre-feet in 2030, and continuing to increase to 1.81 million acre-feet in 2050.

Under extreme supply limitations and with no management strategies in place, water shortages would amount to 49 acre-feet in 2000, rising to 629 thousand acre-feet in 2030 and to 985 thousand acre-feet by 2050.

The water needs of the region amount to about 20% of the forecasted demand by 2020, rising to 45% of demand in 2040 and 54% in 2050. This means that by 2050 the region would be able to supply only 46% of the projected needs unless supply development or other water management strategies are implemented.

(See Figure 1 and Table 1)

Economic Growth Limitations

The difference between expected future growth, unrestricted by water shortage, and expected growth restricted by unmet water needs provides the measure of impact.

Employment–
Left entirely unmet, the level of shortage in 2010 results in 1,200 fewer jobs than would be expected in unrestricted development (without water needs) by 2010. The gap between unrestricted and restricted job growth grows to 43 thousand by 2030,and to 132 thousand jobs that the restricted economy could not create by 2050.

Population–
The forecasted population growth of the region would be economically restricted by curtailed potential job creation. This in turn causes both an outmigration of some current population and an expected curtailment of future population growth. Compared to the baseline growth in population, the region could expect 2,400 fewer people in 2010, growing to 85 thousand fewer in 2030 and 266 thousand fewer in 2050. The expected 2050 population under the severe shortage conditions would be 48% lower than projected in the region's most likely growth forecast.

Income–
The potential loss of economic development in the region amounts to about 0.5% less income to people in 2010, with the gap growing to 20% less than expected in 2030. By 2050 the region would have 51% less income than is currently projected assuming no water restrictions.

Water User Groups with Shortages

The economic and social impact of an unmet water need varies greatly depending on the type of Water User Group for which the shortage is anticipated. On a per acre-foot basis, the largest impacts will generally result from shortages in manufacturing and municipal uses, while shortages for irrigation will typically result in the smallest impact. Table 2 (in Section 2 of this report) presents the impacts of unmet water needs summarized for each of the six types of Water User Group.

Water shortages in the Panhandle region are relatively small until the year 2020, when irrigation water needs begin to be unmet. While irrigation represents the largest category of need, relatively smaller water shortages for municipal, manufacturing, steam electric, and livestock result in more significant social and economic impacts.

In 2010, municipalities have unmet needs of 1,571 acre-feet, 96% of the total unmet needs. The economic impacts of this shortage (1,070 jobs, $95 million in output, and $26 million of income) represent approximately 80-90% of the total impacts. By 2050, unmet municipal needs total 55 thousand acre-feet (only 6% of the total) resulting in 74 thousand jobs not created, and reductions of $5.6 billion in potential output and $1.9 billion in potential income.

The impact of not meeting manufacturing needs is significant from 2020 through 2050. In 2020, manufacturing has unmet needs of 1.5 thousand acre-feet, 0.4% of the total unmet needs. The economic impacts of this shortage include loss of 4 thousand jobs (25% of the total employment impact) and $639 million in output (31% of the total output impact). In 2050, unmet manufacturing needs are over 12 thousand acre-feet (1% of the total) resulting in 25 thousand jobs not created and reduction of $4.1 billion in output (27.5% of the total output impact).

Significant shortages are also expected in the generation of steam electric power in 2050, when unmet steam electric needs total 16 thousand acre-feet (1.6% of the total) resulting in 8.5 thousand jobs not created, and reductions of $1.6 billion in potential output and $424 million in potential income.

Water needs for livestock begin to be unmet in 2020, when the shortage totals nearly 10 thousand acre-feet (about 3% of needs). The result is a loss of nearly 5 thousand jobs and $125 million in income (about 30% of the total impact). By 2050, the shortage of 38 thousand acre-feet represents 4% of total needs, and results in 19 thousand jobs lost and $480 million in reduced income (13% of the income impact).

Unmet irrigation needs represent the largest category of need, but, due to the relatively small value of economic output added per acre-foot, the impacts of not meeting irrigation needs are considerably less. In 2020, irrigation has unmet needs of 325 thousand acre-feet, 95% of the total. The economic impacts of the shortage (2,132 direct and indirect jobs, $227 million in output, and $41 million in income) represent less than 15% of the total economic impact. By 2050, even though the unmet irrigation needs are 88% of total needs, they account for less than 5 percent of the total economic and social impact.

INTERPRETATION OF THE RESULTS

Users are cautioned not to assume that the entire list of needs with impacts is a prediction of future water disasters. These data simply give regional planners one source of information by which to develop efficient and effective means to meet the needs and avoid calamities.

Some clarification is needed to understand the impact numbers. The following points must be kept in mind when using the data:

a) The impacts are expressed in terms of regional impact. Thus, individual water user group shortages are shown as they influence the entire region's economy and not just the limits of the direct impact. The total impact of municipal shortage for a particular city, for example, includes the direct impact within the city limits and the impact indirectly through the region. The indirect linkages were derived from regional economic models. There are no models for individual water user groups.

b) While the entirety of an estimated impact applies to the region as a whole, a significant portion will generally be felt in the local area where the shortage occurs. An impact that is of a small magnitude relative to impacts of other shortages on other areas may be extremely severe if its magnitude is large relative to the size of the local economy. Thus, while the absolute magnitude of agricultural shortages may appear to be small, the true severity of the impact may be much more significant to the surrounding rural area.

c) Water supplies are calculated on drought-of-record levels. Shortages that show up for the 2000 decade and beyond are considered to be mostly the result of severe dry conditions; this contributes to the apparent abnormally large size of some impacts. This approach to supply analysis results in a worst-case scenario. Historically, most water user groups have at least partially met their needs through management of the remaining supplies, either by conservation, limitations on lower-valued uses such as lawn watering, or finding alternative sources of water. The results in this report assume no applied management strategies. The entirety of the needs is not met in any fashion.

d) The analysis begins by calculating water use coefficients–defined as production (dollars of sales to final customers, or final demand) resulting from use of an acre-foot of water. This measure is considered an average, not marginal measure of water use. Thus, the analysis does not attempt to measure the market forces that would tend to drive the price of water higher or reserve limited water for the highest-valued uses, as it becomes scarce. The average value approach was used because the analysis is intended to show the present value in today's regional economies of differing amounts of water use. With this information analysts can answer the question, "How much water does it take to support the current level and structure of economic activity and population?" The baseline projections for the future of regional economies assume a continuation of this known relationship of volumes of water use to economic output, under current structures of use. The models do not attempt to estimate the market allocation of the resource among competing activities because this change in structure is considered a possible management strategy–relying on market forces to work in a water-marketing system. Marginal cost analysis would be necessary for evaluating such an approach.

e) The Municipal water use category includes commercial establishments. The impacts from even small shortages in many such establishments are considerably higher on a per-acre-foot basis than in any other category. Thus, relatively small Municipal shortages can have a very large amount of economic impact, since the analysis assumes a direct relationship between curtailed water use and lost economic production. Since this analysis is intended to provide impacts without assuming any strategies, the normal response of conservation programs is not assumed. The impact data appear to overstate the Municipal category, but the results are consistently measured, since no response to the shortage is assumed that would mitigate loss of critical water used in commercial and residential settings.

f) The sizes of the projected impacts do not represent reductions from the current levels of economic activity or population. That is, the data are a comparison between a baseline forecast, assuming no water shortages, and a restricted forecast, based on the assumption of future water shortages. In some cases, with severe water shortages the regional economy could actually decline, dropping employment below current levels. For most regions, however, the measurement of impact represents an opportunity cost, or lost potential development that would be foregone in the absence of water management strategies.

OVERVIEW OF THE METHODOLOGY

Estimation of the socioeconomic impact of unmet water needs begins with estimation of the direct impact of the absence of water on the individual or business making productive use of the water. The direct economic impact of unmet water needs is defined as the dollar value of final demand (production for sale to final consumers) that could not be produced because of the absence of water. This direct impact per acre-foot was estimated by region for each type of water user – residential, commercial, manufacturing, irrigation, livestock, mining, and steam-electric.

The term *Water Use Coefficients* is used in this study to refer to the direct impact on the different water user groups of the loss of one acre-foot of water. Estimates were based on the average value of output added per acre-foot of water used by those firms/individuals that are reliant on water (i.e., where lack of water would result in inability to operate or at least cause significant curtailment of operations).

The total regional impact of water shortage does not end with the direct impact. Indirect impacts (often referred to as third-party impacts) refer to the reduction of output by firms/individuals which result from change in operations by those who are directly impacted by lack of water. Those who are directly impacted, producing less due to lack of water, will make fewer purchases of inputs, thus resulting in losses to the firms/individuals who produce and sell those products. These firms, facing less demand for their products, then reduce their purchases from their own suppliers. Indirect impacts can thus be said to continue to ripple throughout the economy.

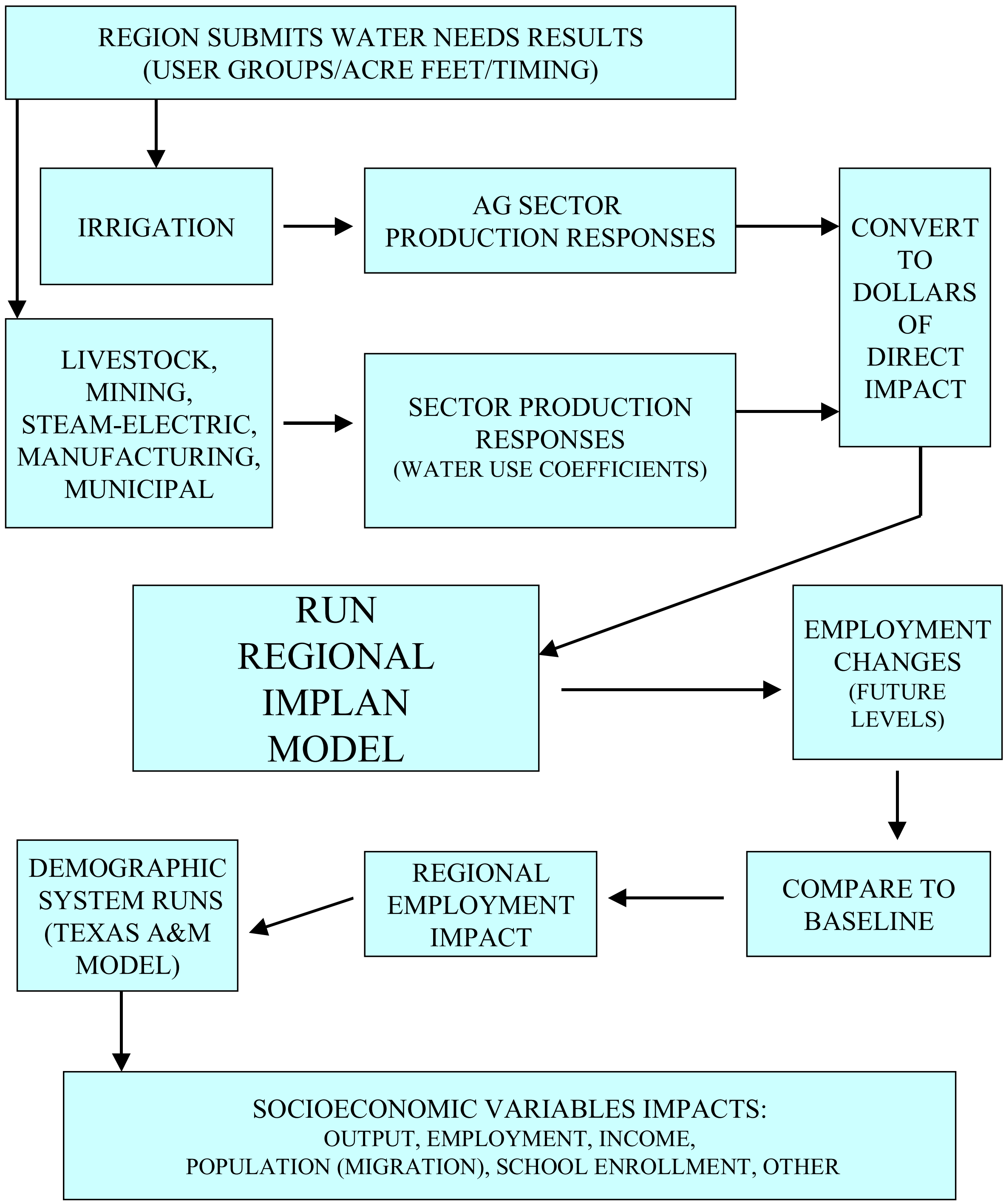
The most common method of estimating the extent of indirect impact is the *Input-Output Model*. This type of model uses actual data from local economies to show the buying and selling linkages among the different economic sectors. For this study, input-output models were assembled for each of the 16 regions from county-level input-output models developed by the Minnesota Implan Group. Data from these models are available in Attachment B.

The total extent of economic loss, direct plus indirect impact relative to the estimated direct impact, is derived from the input-output model in the form of a *multiplier*. Multipliers have been derived to estimate the total impact on three important economic variables – Total business output, personal income, and employment.

In addition to the economic impacts related to water shortages, demographic changes would also be expected to take place. While availability of jobs is not the sole reason for living in a given place, the absence of jobs created would be expected to cause many current residents to leave a region in search of other opportunities or cause reduction of anticipated migration into the region by current nonresidents. Thus, the estimated employment impact was used to estimate change in two important social variables – regional population and school enrollment.

The relationship between employment change and change in population and school enrollment was estimated using the model developed for the Texas Population Estimates and Projections Program, specifically modified for the purposes of this study by the Department of Rural Sociology at Texas A&M University.

FLOW OF THE ANALYSIS SYSTEM



Detailed Data Availability

The data in Section 3, Tables 9.00 through 9.50 show the impacts on the socioeconomic variables for each water user group by decade, 2000 (Table 9.00) through 2050 (Table 9.50). Tables 10.00 through 10.50 correspond to the same decades as for Table(s) 9, but provides additional detail on the impact in each river basin where a shortage for a particular water user group occurs in two or more basins. Users can consult the tables to determine any remaining unmet needs after the management strategies to meet the needs are determined by the RWPG. Each unmet, or partially met, need can be added together to determine the remaining economic development costs of not meeting the needs.

Under the Rules the RWPG can determine any social impact or other economic variables of impact at its discretion. The analysis submitted by TWDB represents the assistance provided upon request. The underlying data and calculation techniques are available to each region.

The Attachments to this report will provide the RWPG with details of the data used in its region and the worksheets used in the calculations. Staff of TWDB is available to answer technical questions about the data.

SECTION 2 SUMMARY DATA

Table 2 provides details of the summary of regional water needs before management strategies are in place, including the needs impacts listed by category of use.

The Table should be used only for measuring the extreme limit of lost potential economic development for the region as a whole, caused by complete lack of development of water supplies in the region for those water user groups in need of supply.

The data are not a prediction or forecast of water shortages, but show the cumulative effect of simultaneous unmet needs for those with potential shortages.

Water use categories include Municipal (residential and commercial), Manufacturing (industry), Steam Electric Power (consumptive use), Mining (including oil and gas), Irrigation (on-farm water use) and Livestock. The level of impact is largely determined by which category has an unmet shortage. Under the analysis system, small amounts of water shortage in the Municipal category can cause relatively large economic impacts, since water use is measured against value of production. Thus, unmet needs in the Municipal category often overshadow those in other categories. Often, however, relatively small adjustments to the supply allocations can be strategically made to meet less water intensive needs, producing large positive impacts. These decisions are part of the RWPGs responsibilities. The data provided by the Summary tables can point to the sources of most of the potential economic and social impacts.

SECTION 3 EXHIBIT B, TABLES 9 AND 10

Tables 9.00 through 9.50 show the impacts on the socioeconomic variables for each water user group by decade, 2000 (Table 9.00) through 2050 (Table 9.50). Tables 10.00 through 10.50 correspond to the same decades as for Table(s) 9, but provides additional detail on the impact in each river basin where a shortage for a particular water user group occurs in two or more basins.

Note: In these tables, for all entities other than cities, the last three digits of the Water User Group identifier represent the county code. The following list shows county codes and corresponding county names for this region.

CODE	COUNTY NAME
6	ARMSTRONG
33	CARSON
38	CHILDRESS
44	COLLINGSWORTH
56	DALLAM
65	DONLEY
90	GRAY
96	HALL
98	HANSFORD
103	HARTLEY
106	HEMPHILL
117	HUTCHINSON
148	LIPSCOMB
171	MOORE
179	OCHILTREE
180	OLDHAM
188	POTTER
191	RANDALL
197	ROBERTS
211	SHERMAN
242	WHEELER

ATTACHMENT A

WATER USE COEFFICIENTS

PANHANDLE WATER PLANNING REGION
(REGION A)

Water Use Coefficients, as used in this study, represent the average dollar value of output sold to final demand per acre-foot of water used in the production of this output.

For 4 of the 6 types of Water User Group, a single Water Use Coefficient has been estimated for all users in the region:

Water User Group	Water Use Coefficient ($ per acre-foot)
Steam Electric	65,348
Mining	12,698
Irrigation	298
Livestock	33,748

The Municipal water user group provides water for both commercial and residential users, each of which were estimated to have a different water use coefficient. The distribution of water use between the two types of users was assumed to vary depending on whether the water user group had a city or a "county other" classification. For cities, the assumed distribution is dependent on population.

User Type	Water Use Coefficient ($ per acre-foot)
Residential	34,946
Commercial	122,096

Population	% Sales to Residential	% Sales to Commercial
< 5000	86.07%	13.93%
5,000-10,000	93.76%	6.24%
10,000-25,000	82.52%	17.48%
25,000-50,000	77.92%	22.08%
50,000-250,000	71.11%	28.89%
> 250,000	61.49%	38.51%
"County Other"	93.40%	6.60%

Water use coefficients for manufacturing were estimated separately for individual counties, based on the distribution of water use among different manufacturing industries in the county and the average productivity of water in different types of manufacturing industries.

County	Water Use Coefficient ($ per acre-foot)
CARSON	434,608
GRAY	53,174
HANSFORD	48,260
HEMPHILL	91,475
HUTCHINSON	81,078
LIPSCOMB	138,963
MOORE	123,907
OCHILTREE	138,963
POTTER	131,846
RANDALL	138,963

ATTACHMENT B

REGIONAL ECONOMIC MODEL DATA, MULTIPLIERS AND BASE YEAR VARIABLES

PANHANDLE WATER PLANNING REGION
(REGION A)

The impact analysis was conducted using a regional interindustry (input/output) model for the region. These models were developed by TWDB using IMPLAN Professional™ Version 2.0 software, a proprietary product of MIG, Inc. of Stillwater, MN. The county economic data was provided in a dataset containing details for 586 economic sectors in Texas for 1995. TWDB collapsed these sectors into models of seven sectors, representing the major water use categories used in water development planning. The data are unique to the region.

For this region, the summary data in IMPLAN for the 1995 base year for major economic variables were as follows:

POPULATION	342,917	
EMPLOYMENT	203,755	
HOUSEHOLDS	142,107	
TOTAL PERSONAL INCOME	$7.049 Billion	In 1999 dollars– $7.705 Billion

The tables on the following pages include 1) the base year Final Demands for the seven water use sectors and 2) the multipliers used to estimate the indirect impacts from economic changes due to water shortages by sector.

The Final Demand data were used to calculate the Water Use Coefficients by matching each sector's dollar totals to volumes of water use in the corresponding category for the calendar year–base year 1995. The result is an average of production associated with an acre-foot of water use. This measure produces an average value of water in terms that can be used to apply the IMPLAN multipliers. Regional indirect economic changes can then be estimated.

The multipliers are ratios that, when applied to the direct changes (estimated by the Water Use Coefficients in Attachment A), result in a total impact on the entire region. The impact totals represent the sum of successive changes among all economic sectors caused by the initial change in the affected sector. Multipliers are listed for Employment, Output (Gross Sales or Receipts), and Income (earned income from business and labor activity, not including transfer payments).

ATTACHMENT C LETTER OF REQUEST FOR TECHNICAL ASSISTANCE

Table 7: Comparison of Demands to Current Water Supplier by City and Category

WUGNAME	COUNTYNAME	BASINNAME	WUGNUM	RWPG	SEQ#	CITY#	COUNTY#	BASIN#	2000	2010	2020	2030	2040	2050	Comments
CLAUDE	ARMSTRONG	RED	010173000	A	0173	0114	006	02	0	0	0	-150	-268	-267	
COUNTY-OTHER	ARMSTRONG	RED	010996006	A	0996	0757	006	02	49	62	79	90	100	107	
IRRIGATION	ARMSTRONG	RED	011004006	A	1004	1004	006	02	10,214	10,214	10,213	10,213	10,213	10,213	
LIVESTOCK	ARMSTRONG	RED	011005006	A	1005	1005	006	02	569	512	459	405	346	280	
MANUFACTURING	ARMSTRONG	RED	011001006	A	1001	1001	006	02	0	0	0	0	0	0	
MINING	ARMSTRONG	RED	011003006	A	1003	1003	006	02	1	2	1	0	0	0	
STEAM ELECTRIC POWER	ARMSTRONG	RED	011002006	A	1002	1002	006	02	0	0	0	0	0	0	
COUNTY-OTHER	CARSON	CANADIAN	010996033	A	0996	0757	033	01	0	0	0	0	0	0	
COUNTY-OTHER	CARSON	RED	010996033	A	0996	0757	033	02	0	0	0	0	0	0	
GROOM	CARSON	RED	010365000	A	0365	0875	033	02	0	0	0	0	-51	-121	
IRRIGATION	CARSON	CANADIAN	011004033	A	1004	1004	033	01	17,070	17,070	17,069	17,069	17,069	17,069	
IRRIGATION	CARSON	RED	011004033	A	1004	1004	033	02	0	0	0	0	0	0	
LIVESTOCK	CARSON	CANADIAN	011005033	A	1005	1005	033	01	462	437	405	376	344	309	
LIVESTOCK	CARSON	RED	011005033	A	1005	1005	033	02	0	0	0	0	0	0	
MANUFACTURING	CARSON	CANADIAN	011001033	A	1001	1001	033	01	0	0	0	0	0	0	
MANUFACTURING	CARSON	RED	011001033	A	1001	1001	033	02	0	0	0	0	0	0	
MINING	CARSON	CANADIAN	011003033	A	1003	1003	033	01	0	183	400	500	557	585	
MINING	CARSON	RED	011003033	A	1003	1003	033	02	0	0	0	0	0	0	
PANHANDLE	CARSON	RED	010675000	A	0675	0453	033	02	0	0	0	0	-738	-933	
SKELLYTOWN	CARSON	CANADIAN	010834000	A	0834	0960	033	01	0	0	-44	-64	-61	-59	
STEAM ELECTRIC POWER	CARSON	CANADIAN	011002033	A	1002	1002	033	01	0	0	0	0	0	0	
STEAM ELECTRIC POWER	CARSON	RED	011002033	A	1002	1002	033	02	0	0	0	0	0	0	
WHITE DEER	CARSON	CANADIAN	010962000	A	0962	0647	033	01	0	0	0	0	-45	-267	
WHITE DEER	CARSON	RED	010962000	A	0962	0647	033	02	0	0	0	0	-3	-14	
CHILDRESS	CHILDRESS	RED	010164000	A	0164	0109	038	02	0	0	0	0	0	0	
COUNTY-OTHER	CHILDRESS	RED	010996038	A	0996	0757	038	02	168	209	224	233	237	232	
IRRIGATION	CHILDRESS	RED	011004038	A	1004	1004	038	02	1,597	1,579	1,516	1,504	1,493	1,481	
LIVESTOCK	CHILDRESS	RED	011005038	A	1005	1005	038	02	314	296	236	224	212	198	
MANUFACTURING	CHILDRESS	RED	011001038	A	1001	1001	038	02	0	0	0	0	0	0	
MINING	CHILDRESS	RED	011003038	A	1003	1003	038	02	16	17	16	16	16	15	
STEAM ELECTRIC POWER	CHILDRESS	RED	011002038	A	1002	1002	038	02	0	0	0	0	0	0	
COUNTY-OTHER	COLLINGSWORTH	RED	010996044	A	0996	0757	044	02	24	24	28	32	38	40	
IRRIGATION	COLLINGSWORTH	RED	011004044	A	1004	1004	044	02	8,525	8,538	8,529	8,532	8,535	8,534	
LIVESTOCK	COLLINGSWORTH	RED	011005044	A	1005	1005	044	02	276	247	175	150	121	90	
MANUFACTURING	COLLINGSWORTH	RED	011001044	A	1001	1001	044	02	0	0	0	0	0	0	
MINING	COLLINGSWORTH	RED	011003044	A	1003	1003	044	02	0	0	0	0	0	0	
STEAM ELECTRIC POWER	COLLINGSWORTH	RED	011002044	A	1002	1002	044	02	0	0	0	0	0	0	
WELLINGTON	COLLINGSWORTH	RED	010947000	A	0947	0637	044	02	43	41	38	37	36	35	
COUNTY-OTHER	DALLAM	CANADIAN	010996056	A	0996	0757	056	01	0	0	0	0	0	0	
DALHART	DALLAM	CANADIAN	010226000	A	0226	0150	056	01	0	0	0	0	0	0	
IRRIGATION	DALLAM	CANADIAN	011004056	A	1004	1004	056	01	0	0	0	-273,976	-380,971	-380,963	
LIVESTOCK	DALLAM	CANADIAN	011005056	A	1005	1005	056	01	0	0	0	0	-14,742	-16,796	
MANUFACTURING	DALLAM	CANADIAN	011001056	A	1001	1001	056	01	0	0	0	0	-232	-232	
MINING	DALLAM	CANADIAN	011003056	A	1003	1003	056	01	0	0	0	0	0	0	
STEAM ELECTRIC POWER	DALLAM	CANADIAN	011002056	A	1002	1002	056	01	0	0	0	0	0	0	
CLARENDON	DONLEY	RED	010170000	A	0170	0112	065	02	0	0	0	0	0	0	
COUNTY-OTHER	DONLEY	RED	010996065	A	0996	0757	065	02	47	64	82	99	109	120	
IRRIGATION	DONLEY	RED	011004065	A	1004	1004	065	02	485	485	485	485	485	485	
LIVESTOCK	DONLEY	RED	011005065	A	1005	1005	065	02	540	460	380	319	252	180	
MANUFACTURING	DONLEY	RED	011001065	A	1001	1001	065	02	0	0	0	0	0	0	

Table 7: Comparison of Demands to Current Water Supplier by City and Category

WUGNAME	COUNTYNAME	BASINNAME	WUGNUM	RWPG	SEQ#	CITY#	COUNTY#	BASIN#	2000	2010	2020	2030	2040	2050	Comments
MINING	DONLEY	RED	011003065	A	1003	1003	065	02	4	3	2	1	1	1	
STEAM ELECTRIC POWER	DONLEY	RED	011002065	A	1002	1002	065	02	0	0	0	0	0	0	
COUNTY-OTHER	GRAY	CANADIAN	010996090	A	0996	0757	090	01	368	341	322	268	241	222	
COUNTY-OTHER	GRAY	RED	010996090	A	0996	0757	090	02	257	248	248	296	305	313	
IRRIGATION	GRAY	CANADIAN	011004090	A	1004	1004	090	01	3,760	3,749	3,731	3,500	3,460	3,423	
IRRIGATION	GRAY	RED	011004090	A	1004	1004	090	02	7,593	7,590	7,585	7,552	7,545	7,539	
LEFORS	GRAY	RED	010515000	A	0515	0898	090	02	0	-19	-95	-85	-80	-78	
LIVESTOCK	GRAY	CANADIAN	011005090	A	1005	1005	090	01	172	89	42	6	0	0	
LIVESTOCK	GRAY	RED	011005090	A	1005	1005	090	02	1,049	520	219	54	0	0	
MANUFACTURING	GRAY	CANADIAN	011001090	A	1001	1001	090	01	0	0	0	0	0	-57	
MANUFACTURING	GRAY	RED	011001090	A	1001	1001	090	02	0	0	0	0	0	0	
MCLEAN	GRAY	RED	010578000	A	0578	0380	090	02	0	0	-246	-232	-226	-220	
MINING	GRAY	CANADIAN	011003090	A	1003	1003	090	01	68	73	75	75	76	76	
MINING	GRAY	RED	011003090	A	1003	1003	090	02	198	274	388	464	435	354	
PAMPA	GRAY	CANADIAN	010674000	A	0674	0452	090	01	231	735	736	736	736	735	
STEAM ELECTRIC POWER	GRAY	CANADIAN	011002090	A	1002	1002	090	01	0	0	0	0	0	0	
STEAM ELECTRIC POWER	GRAY	RED	011002090	A	1002	1002	090	02	0	0	0	0	0	0	
COUNTY-OTHER	HALL	RED	010996096	A	0996	0757	096	02	188	183	178	172	169	165	
IRRIGATION	HALL	RED	011004096	A	1004	1004	096	02	2,727	2,737	2,749	2,758	2,759	2,753	
LIVESTOCK	HALL	RED	011005096	A	1005	1005	096	02	125	113	104	94	84	71	
MANUFACTURING	HALL	RED	011001096	A	1001	1001	096	02	0	0	0	0	0	0	
MEMPHIS	HALL	RED	010585000	A	0585	0394	096	02	7	33	59	80	96	106	
MINING	HALL	RED	011003096	A	1003	1003	096	02	-1	-2	-3	-4	-5	-6	
STEAM ELECTRIC POWER	HALL	RED	011002096	A	1002	1002	096	02	0	0	0	0	0	0	
TURKEY	HALL	RED	010915000	A	0915	0979	096	02	10	14	17	18	18	15	
COUNTY-OTHER	HANSFORD	CANADIAN	010996098	A	0996	0757	098	01	43	46	58	65	80	93	
GRUVER	HANSFORD	CANADIAN	010368000	A	0368	0256	098	01	0	-295	-372	-361	-346	-334	
IRRIGATION	HANSFORD	CANADIAN	011004098	A	1004	1004	098	01	114,996	113,151	112,057	110,892	109,560	108,065	
LIVESTOCK	HANSFORD	CANADIAN	011005098	A	1005	1005	098	01	1,583	0	0	1	0	0	
MANUFACTURING	HANSFORD	CANADIAN	011001098	A	1001	1001	098	01	7	3	2	2	11	8	
MINING	HANSFORD	CANADIAN	011003098	A	1003	1003	098	01	0	35	60	166	167	163	
SPEARMAN	HANSFORD	CANADIAN	010849000	A	0849	0573	098	01	48	40	60	89	122	138	
STEAM ELECTRIC POWER	HANSFORD	CANADIAN	011002098	A	1002	1002	098	01	0	0	0	0	0	0	
CHANNING	HARTLEY	CANADIAN	010159000	A	0159	0106	103	01	13	14	13	13	13	13	
COUNTY-OTHER	HARTLEY	CANADIAN	010996103	A	0996	0757	103	01	19	0	11	13	17	16	
DALHART	HARTLEY	CANADIAN	010226000	A	0226	0150	103	01	0	0	0	0	0	0	
IRRIGATION	HARTLEY	CANADIAN	011004103	A	1004	1004	103	01	176,346	175,882	175,468	175,157	173,614	173,283	
LIVESTOCK	HARTLEY	CANADIAN	011005103	A	1005	1005	103	01	0	0	0	0	0	0	
MANUFACTURING	HARTLEY	CANADIAN	011001103	A	1001	1001	103	01	0	0	0	0	0	0	
MINING	HARTLEY	CANADIAN	011003103	A	1003	1003	103	01	0	0	0	0	0	0	
STEAM ELECTRIC POWER	HARTLEY	CANADIAN	011002103	A	1002	1002	103	01	0	0	0	0	0	0	
CANADIAN	HEMPHILL	CANADIAN	010142000	A	0142	0093	106	01	0	0	-199	-641	-615	-601	
COUNTY-OTHER	HEMPHILL	CANADIAN	010996106	A	0996	0757	106	01	83	84	88	93	98	101	
COUNTY-OTHER	HEMPHILL	RED	010996106	A	0996	0757	106	02	35	36	39	43	47	49	
IRRIGATION	HEMPHILL	CANADIAN	011004106	A	1004	1004	106	01	118	119	114	109	103	100	
IRRIGATION	HEMPHILL	RED	011004106	A	1004	1004	106	02	13	13	12	11	10	10	
LIVESTOCK	HEMPHILL	CANADIAN	011005106	A	1005	1005	106	01	572	497	413	317	246	142	
LIVESTOCK	HEMPHILL	RED	011005106	A	1005	1005	106	02	396	344	286	220	170	143	
MANUFACTURING	HEMPHILL	CANADIAN	011001106	A	1001	1001	106	01	0	0	0	0	0	0	
MANUFACTURING	HEMPHILL	RED	011001106	A	1001	1001	106	02	-4	-5	-6	-7	-8	-9	

Table 7: Comparison of Demands to Current Water Supplier by City and Category

WUGNAME	COUNTYNAME	BASINNAME	WUGNUM	RWPG	SEQ#	CITY#	COUNTY#	BASIN#	2000	2010	2020	2030	2040	2050	Comments
MINING	HEMPHILL	CANADIAN	011003106	A	1003	1003	106	01	0	0	0	0	0	0	
MINING	HEMPHILL	RED	011003106	A	1003	1003	106	02	0	0	0	0	0	0	
STEAM ELECTRIC POWER	HEMPHILL	CANADIAN	011002106	A	1002	1002	106	01	0	0	0	0	0	0	
STEAM ELECTRIC POWER	HEMPHILL	RED	011002106	A	1002	1002	106	02	0	0	0	0	0	0	
BORGER	HUTCHINSON	CANADIAN	010100000	A	0100	0067	117	01	3	0	8	7	6	22	
COUNTY-OTHER	HUTCHINSON	CANADIAN	010996117	A	0996	0757	117	01	12	35	79	123	174	207	
FRITCH	HUTCHINSON	CANADIAN	010320000	A	0320	0222	117	01	1	16	38	62	91	105	
IRRIGATION	HUTCHINSON	CANADIAN	011004117	A	1004	1004	117	01	0	0	0	0	0	0	
LIVESTOCK	HUTCHINSON	CANADIAN	011005117	A	1005	1005	117	01	514	447	382	323	259	189	
MANUFACTURING	HUTCHINSON	CANADIAN	011001117	A	1001	1001	117	01	0	462	0	0	5	343	
MINING	HUTCHINSON	CANADIAN	011003117	A	1003	1003	117	01	139	180	317	480	558	595	
STEAM ELECTRIC POWER	HUTCHINSON	CANADIAN	011002117	A	1002	1002	117	01	0	0	0	0	0	0	
STINNETT	HUTCHINSON	CANADIAN	010861000	A	0861	0582	117	01	52	60	74	93	117	127	
TCW Supply, Inc.	HUTCHINSON	CANADIAN						01	0	0	0	0	0	0	
BOOKER	LIPSCOMB	CANADIAN	010099000	A	0099	0066	148	01	55	55	68	75	86	100	
COUNTY-OTHER	LIPSCOMB	CANADIAN	010996148	A	0996	0757	148	01	41	35	44	49	52	51	
IRRIGATION	LIPSCOMB	CANADIAN	011004148	A	1004	1004	148	01	10	7	6	4	2	0	
LIPSCOMB	LIPSCOMB	CANADIAN	010526000	A	0526	0359	148	01	0	0	2	3	4	6	
LIVESTOCK	LIPSCOMB	CANADIAN	011005148	A	1005	1005	148	01	594	0	0	0	0	0	
MANUFACTURING	LIPSCOMB	CANADIAN	011001148	A	1001	1001	148	01	0	0	0	0	0	0	
MINING	LIPSCOMB	CANADIAN	011003148	A	1003	1003	148	01	1	1	1	1	0	-9	
STEAM ELECTRIC POWER	LIPSCOMB	CANADIAN	011002148	A	1002	1002	148	01	0	0	0	0	0	0	
CACTUS	MOORE	CANADIAN	010134000	A	0134	0762	171	01	0	0	0	-592	-703	-838	
COUNTY-OTHER	MOORE	CANADIAN	010996171	A	0996	0757	171	01	0	0	0	-427	-419	-430	
DUMAS	MOORE	CANADIAN	010255000	A	0255	0170	171	01	0	0	0	-3,418	-3,603	-3,848	
IRRIGATION	MOORE	CANADIAN	011004171	A	1004	1004	171	01	3	3	-21,395	-200,576	-200,576	-200,576	
LIVESTOCK	MOORE	CANADIAN	011005171	A	1005	1005	171	01	0	0	788	-7,459	-8,546	-9,786	
MANUFACTURING	MOORE	CANADIAN	011001171	A	1001	1001	171	01	0	0	0	-8,269	-8,863	-9,429	
MINING	MOORE	CANADIAN	011003171	A	1003	1003	171	01	848	1,079	1,625	1,445	1,502	1,499	
STEAM ELECTRIC POWER	MOORE	CANADIAN	011002171	A	1002	1002	171	01	0	0	0	-200	-200	-200	
SUNRAY	MOORE	CANADIAN	010872000	A	0872	0588	171	01	0	0	0	-701	-750	-807	
BOOKER	OCHILTREE	CANADIAN	010099000	A	0099	0066	179	01	-1	0	0	0	0	0	
COUNTY-OTHER	OCHILTREE	CANADIAN	010996179	A	0996	0757	179	01	27	92	98	107	118	132	
IRRIGATION	OCHILTREE	CANADIAN	011004179	A	1004	1004	179	01	9,088	9,088	9,088	9,088	9,088	9,088	
LIVESTOCK	OCHILTREE	CANADIAN	011005179	A	1005	1005	179	01	2,183	1,677	675	75	69	0	
MANUFACTURING	OCHILTREE	CANADIAN	011001179	A	1001	1001	179	00	0	0	0	0	0	0	
MINING	OCHILTREE	CANADIAN	011003179	A	1003	1003	179	01	6	32	48	64	83	79	
PERRYTON	OCHILTREE	CANADIAN	010689000	A	0689	0461	179	01	0	-1,518	-2,482	-2,432	-2,370	-2,320	
STEAM ELECTRIC POWER	OCHILTREE	CANADIAN	011002179	A	1002	1002	179	01	0	0	0	0	0	0	
COUNTY-OTHER	OLDHAM	CANADIAN	010996180	A	0996	0757	180	01	0	0	0	0	0	-2,273	
COUNTY-OTHER	OLDHAM	RED	010996180	A	0996	0757	180	02	0	0	0	0	0	-22	
IRRIGATION	OLDHAM	CANADIAN	011004180	A	1004	1004	180	01	0	0	0	0	-846	-7,700	
IRRIGATION	OLDHAM	RED	011004180	A	1004	1004	180	02	1	1	1	1	-1,582	-18,248	
LIVESTOCK	OLDHAM	CANADIAN	011005180	A	1005	1005	180	01	377	215	45	0	0	0	
LIVESTOCK	OLDHAM	RED	011005180	A	1005	1005	180	02	26	19	13	8	4	1	
MANUFACTURING	OLDHAM	CANADIAN	011001180	A	1001	1001	180	01	0	0	0	0	0	0	
MANUFACTURING	OLDHAM	RED	011001180	A	1001	1001	180	02	0	0	0	0	0	0	
MINING	OLDHAM	CANADIAN	011003180	A	1003	1003	180	01	52	45	38	31	23	15	
MINING	OLDHAM	RED	011003180	A	1003	1003	180	02	0	0	0	0	0	-311	
STEAM ELECTRIC POWER	OLDHAM	CANADIAN	011002180	A	1002	1002	180	01	0	0	0	0	0	0	

Table 7: Comparison of Demands to Current Water Supplier by City and Category

WUGNAME	COUNTYNAME	BASINNAME	WUGNUM	RWPG	SEQ#	CITY#	COUNTY#	BASIN#	2000	2010	2020	2030	2040	2050	Comments
STEAM ELECTRIC POWER	OLDHAM	RED	011002180	A	1002	1002	180	02	0	0	0	0	0	0	
VEGA	OLDHAM	CANADIAN	010928000	A	0928	0622	180	01	0	0	0	0	0	-61	
VEGA	OLDHAM	RED	010928000	A	0928	0622	180	02	0	0	0	0	0	-184	
AMARILLO	POTTER	CANADIAN	010020000	A	0020	0014	188	01	0	0	0	0	-1,572	-7,868	
AMARILLO	POTTER	RED	010020000	A	0020	0014	188	02	0	0	0	0	-1,173	-5,872	
COUNTY-OTHER	POTTER	CANADIAN	010996188	A	0996	0757	188	01	0	0	0	0	-1,094	-1,260	
COUNTY-OTHER	POTTER	RED	010996188	A	0996	0757	188	02	0	0	0	0	-270	-268	
IRRIGATION	POTTER	CANADIAN	011004188	A	1004	1004	188	01	0	0	0	0	-7,732	-9,518	
IRRIGATION	POTTER	RED	011004188	A	1004	1004	188	02	0	0	0	-5,385	-6,077	-4,360	
LIVESTOCK	POTTER	CANADIAN	011005188	A	1005	1005	188	01	320	280	239	195	147	94	
LIVESTOCK	POTTER	RED	011005188	A	1005	1005	188	02	39	36	33	31	27	24	
MANUFACTURING	POTTER	CANADIAN	011001188	A	1001	1001	188	01	0	0	0	0	-602	-777	
MANUFACTURING	POTTER	RED	011001188	A	1001	1001	188	02	1,548	1,228	974	774	377	146	
MINING	POTTER	CANADIAN	011003188	A	1003	1003	188	01	0	0	0	0	-193	-231	
MINING	POTTER	RED	011003188	A	1003	1003	188	02	0	0	0	0	-174	-179	
STEAM ELECTRIC POWER	POTTER	CANADIAN	011002188	A	1002	1002	188	01	0	0	0	0	-12,294	-15,860	
STEAM ELECTRIC POWER	POTTER	RED	011002188	A	1002	1002	188	02	0	0	0	0	0	0	
AMARILLO	RANDALL	RED	010020000	A	0020	0014	191	02	0	0	0	0	-2,840	-15,115	
CANYON	RANDALL	RED	010145000	A	0145	0096	191	02	0	0	0	0	-834	-691	
COUNTY-OTHER	RANDALL	CANADIAN	010996191	A	0996	0757	191	01	0	0	0	0	-543	-629	
COUNTY-OTHER	RANDALL	RED	010996191	A	0996	0757	191	02	0	0	0	0	-3,671	-5,109	
HAPPY	RANDALL	RED	010378000	A	0378	0877	191	02	0	0	0	0	0	0	Swisher County supply meets additional demand shown in Table 2 not covered by supply in Table 5. (9/22/00)
IRRIGATION	RANDALL	CANADIAN	011004191	A	1004	1004	191	01	0	0	0	-128	-539	-534	
IRRIGATION	RANDALL	RED	011004191	A	1004	1004	191	02	0	0	0	0	-40,452	-46,680	
LAKE TANGLEWOOD	RANDALL	RED	010500000	A	0500	0895	191	02	0	-12	-305	-303	-294	-282	
LIVESTOCK	RANDALL	CANADIAN	011005191	A	1005	1005	191	01	0	0	0	0	-31	-34	
LIVESTOCK	RANDALL	RED	011005191	A	1005	1005	191	02	0	0	0	0	-2,570	-3,373	
MANUFACTURING	RANDALL	CANADIAN	011001191	A	1001	1001	191	01	0	0	0	0	0	0	
MANUFACTURING	RANDALL	RED	011001191	A	1001	1001	191	02	0	0	0	0	-148	-173	
MINING	RANDALL	CANADIAN	011003191	A	1003	1003	191	01	1	1	1	0	0	0	
MINING	RANDALL	RED	011003191	A	1003	1003	191	02	0	0	0	0	-3	-5	
STEAM ELECTRIC POWER	RANDALL	CANADIAN	011002191	A	1002	1002	191	01	0	0	0	0	0	0	
STEAM ELECTRIC POWER	RANDALL	RED	011002191	A	1002	1002	191	02	0	0	0	0	0	0	
COUNTY-OTHER	ROBERTS	CANADIAN	010996197	A	0996	0757	197	01	0	0	0	0	0	0	
COUNTY-OTHER	ROBERTS	RED	010996197	A	0996	0757	197	02	0	0	0	0	0	0	
IRRIGATION	ROBERTS	CANADIAN	011004197	A	1004	1004	197	01	6,235	6,235	6,233	6,232	6,230	6,228	
IRRIGATION	ROBERTS	RED	011004197	A	1004	1004	197	02	0	0	0	0	0	0	
LIVESTOCK	ROBERTS	CANADIAN	011005197	A	1005	1005	197	01	20	0	0	0	0	0	
LIVESTOCK	ROBERTS	RED	011005197	A	1005	1005	197	02	0	0	0	0	0	0	
MANUFACTURING	ROBERTS	CANADIAN	011001197	A	1001	1001	197	01	0	0	0	0	0	0	
MANUFACTURING	ROBERTS	RED	011001197	A	1001	1001	197	02	0	0	0	0	0	0	
MIAMI	ROBERTS	CANADIAN	010594000	A	0594	0403	197	01	0	0	6	19	31	41	
MINING	ROBERTS	CANADIAN	011003197	A	1003	1003	197	01	0	0	0	0	0	0	
MINING	ROBERTS	RED	011003197	A	1003	1003	197	02	2	1	3	4	4	4	
STEAM ELECTRIC POWER	ROBERTS	CANADIAN	011002197	A	1002	1002	197	01	0	0	0	0	0	0	
STEAM ELECTRIC POWER	ROBERTS	RED	011002197	A	1002	1002	197	02	0	0	0	0	0	0	
COUNTY-OTHER	SHERMAN	CANADIAN	010996211	A	0996	0757	211	01	0	0	0	0	0	0	

Table 7: Comparison of Demands to Current Water Supplier by City and Category

WUGNAME	COUNTYNAME	BASINNAME	WUGNUM	RWPG	SEQ#	CITY#	COUNTY#	BASIN#	2000	2010	2020	2030	2040	2050	Comments
IRRIGATION	SHERMAN	CANADIAN	011004211	A	1004	1004	211	01	0	0	0	0	0	0	
LIVESTOCK	SHERMAN	CANADIAN	011005211	A	1005	1005	211	01	0	0	0	0	0	0	
MANUFACTURING	SHERMAN	CANADIAN	011001211	A	1001	1001	211	01	0	0	0	0	0	0	
MINING	SHERMAN	CANADIAN	011003211	A	1003	1003	211	01	0	0	0	0	0	0	
STEAM ELECTRIC POWER	SHERMAN	CANADIAN	011002211	A	1002	1002	211	01	0	0	0	0	0	0	
STRATFORD	SHERMAN	CANADIAN	010864000	A	0864	0584	211	01	0	0	0	0	0	0	
COUNTY-OTHER	WHEELER	RED	010996242	A	0996	0757	242	02	291	307	324	334	343	346	
IRRIGATION	WHEELER	RED	011004242	A	1004	1004	242	02	3	2	1	1	1	1	
LIVESTOCK	WHEELER	RED	011005242	A	1005	1005	242	02	1,024	921	765	685	599	507	
MANUFACTURING	WHEELER	RED	011001242	A	1001	1001	242	02	0	0	0	0	0	0	
MINING	WHEELER	RED	011003242	A	1003	1003	242	02	55	114	134	146	152	155	
SHAMROCK	WHEELER	RED	010822000	A	0822	0554	242	02	0	0	0	0	-252	-321	
STEAM ELECTRIC POWER	WHEELER	RED	011002242	A	1002	1002	242	02	0	0	0	0	0	0	
WHEELER	WHEELER	RED	010961000	A	0961	0646	242	02	0	-22	-275	-272	-268	-268	

Table 8: Comparison of Water Demands with Current Water Supplies by Major Water Provider of Municipal and Manufacturing Water

Major Water Provider Name	Major Water Provider Number	County Number	Basin Number	n2000	n2010	n2020	n2030	n2040	n2050		WUGNAME	Source
Amarillo	17600	188	01	0	0	0	0	-2,944	-8,126	based on maximum use scenario, does not include Roberts well field	Amarillo	Amarillo System
Amarillo	17600	188	02	0	0	0	0	-2,198	-6,065	based on maximum use scenario, does not include Roberts well field	Amarillo	Amarillo System
Amarillo	17600	191	02	0	0	0	0	-5,319	-15,612	based on maximum use scenario, does not include Roberts well field	Amarillo	Amarillo System
Amarillo	17600	188	01	0	0	0	0	0	0		ASARCO, INC.	Amarillo System
Amarillo	17600	191	02	0	0	0	0	0	0	5 mgd contract limitation. Assume average day = 2.5 mgd.	City of Canyon	Amarillo System
Amarillo	17600	188	02	891	684	467	239	0	-252	Contract with IBP	IBP, Inc.	Amarillo System
Amarillo	17600	191	02	0	0	0	0	0	0		TPWD	Amarillo System
CRMWA	10	117	01	0	0	0	0	0	0		AGRIUM	CRMWA System
CRMWA	10	188	01	0	0	0	0	0	0		Amarillo	CRMWA System
CRMWA	10	188	02	0	0	0	0	0	0		Amarillo	CRMWA System
CRMWA	10	191	02	0	0	0	0	0	0		Amarillo	CRMWA System
CRMWA	10	117	01	0	0	0	0	0	0		City of Borger	CRMWA System
CRMWA	10	223	14	0	0	0	0	0	0		City of Brownfield	CRMWA System
CRMWA	10	058	14	0	0	0	0	0	0		City of Lamesa	CRMWA System
CRMWA	10	110	12	0	0	0	0	0	0		City of Levelland	CRMWA System
CRMWA	10	152	12	0	0	0	0	0	0		City of Lubbock WTP	CRMWA System
CRMWA	10	058	14	0	0	0	0	0	0		City of Odonnell	CRMWA System
CRMWA	10	153	14	0	0	0	0	0	0		City of Odonnell	CRMWA System
CRMWA	10	090	01	0	0	0	0	0	0		City of Pampa	CRMWA System
CRMWA	10	095	12	0	0	0	0	0	0		City of Plainview	CRMWA System
CRMWA	10	152	12	0	0	0	0	0	0		City of Slaton	CRMWA System
CRMWA	10	153	12	0	0	0	0	0	0		City of Tahoka	CRMWA System
CRMWA	10	188	01	0	0	0	0	0	0		Southwestern Public Service	CRMWA System
CRMWA	10			23,367	13,855	13,132	12,643	12,970	13,178	Unallocated water, limited to CRMWA customers	unassigned	CRMWA System
Greenbelt M&IWA	20	038	02	0	0	0	0	0	0		City of Childress	Greenbelt Reservoir
Greenbelt M&IWA	20	065	02	0	0	0	0	0	0		City of Clarendon	Greenbelt Reservoir
Greenbelt M&IWA	20	078	02	0	0	0	0	0	0		City of Crowell	Greenbelt Reservoir
Greenbelt M&IWA	20	065	02	0	0	0	0	0	0		City of Hedley	Greenbelt Reservoir
Greenbelt M&IWA	20	096	02	0	0	0	0	0	0		City of Memphis	Greenbelt Reservoir
Greenbelt M&IWA	20	099	02	0	0	0	0	0	0		City of Quanah	Greenbelt Reservoir
Greenbelt M&IWA	20		02	0	0	0	0	0	0	No needs for RRA, so records consolidated.	Red River Authority	Greenbelt Reservoir
Greenbelt M&IWA	20			3,708	3,612	3,549	3,436	3,298	3,144	Unallocated water, limited to GM&IWA customers	unassigned	Greenbelt Reservoir

WUGNAME:	Claude
STRATEGY:	Install 2 new wells
AMOUNT (ac-ft/yr):	268

Construction Costs	Costs
Water Wells (2)	$145,800
Connection to Transmission System	$160,000
6-in Pipeline to Claude	$285,120
Pumpstation, building and appurtenances	$315,000
Ground Storage (.25 MG)	$100,000
Subtotal - Construction Costs	*$1,005,920*
Engineering and Contingencies	$301,776
Mitigation and Permitting	$10,059
ROW Land Acquisition	$3,600
Water Rights Purchase	$231,000
Subtotal	*$1,552,355*
Interest During Construction	$33,635
Total Capital Project Costs	**$1,585,990**
Annual Costs	
Debt Service - Total Capital	$115,220
Operation and Maintenance	
Pipelines	$4,451
Pumpstations/Wells	$11,520
Surface Water Treatment	
Pumping Costs	$6,427
Total Annual Costs	**$137,619**
Annual Cost ($ per acre-foot)	**$513.50**
Annual Cost ($ per 1000 gallons)	**$1.58**

WUGNAME:	Groom
STRATEGY:	Install 1 new wells in city
AMOUNT (ac-ft/yr):	121

Construction Costs	Costs
Water Wells (1)	$130,200
Connection to Existing System	$80,000
Subtotal - Construction Costs	*$210,200*
Engineering and Contingencies	$63,060
Mitigation and Permitting	$2,102
ROW Land Acquisition	$0
Water Rights Purchase	$17,500
Subtotal	*$292,862*
Interest During Construction	$6,345
Total Capital Project Costs	**$299,207**
Annual Costs	
Debt Service - Total Capital	$21,737
Operation and Maintenance	
Pipelines	$800
Pumpstations/Wells	$3,255
Surface Water Treatment	
Pumping Costs	$2,408
Total Annual Costs	**$28,200**
Annual Cost ($ per acre-foot)	**$233.06**
Annual Cost ($ per 1000 gallons)	**$0.72**

WUGNAME:	Panhandle
STRATEGY:	Install 2 new wells
AMOUNT (ac-ft/yr):	933

Construction Costs	Costs
Water Wells (2)	$386,400
Connection to Existing System	$200,000
Subtotal - Construction Costs	*$586,400*
Engineering and Contingencies	$175,920
Mitigation and Permitting	$5,864
ROW Land Acquisition	$0
Water Rights Purchase	$101,150
Subtotal	*$869,334*
Interest During Construction	$18,836
Total Capital Project Costs	**$888,170**
Annual Costs	
Debt Service - Total Capital	$64,525
Operation and Maintenance	
Pipelines	$2,000
Pumpstations/Wells	$9,660
Surface Water Treatment	
Pumping Costs	$24,916
Total Annual Costs	**$101,100**
Annual Cost ($ per acre-foot)	**$108.36**
Annual Cost ($ per 1000 gallons)	**$0.33**

WUGNAME:	Skellytown
STRATEGY:	Install 1 new well in city
AMOUNT (ac-ft/yr):	64

Construction Costs	Costs
Water Wells (1)	$115,200
Connection to Existing System	$50,000
Subtotal - Construction Costs	*$165,200*
Engineering and Contingencies	$49,560
Mitigation and Permitting	$1,652
ROW Land Acquisition	$0
Water Rights Purchase	$76,650
Subtotal	*$293,062*
Interest During Construction	$6,350
Total Capital Project Costs	**$299,412**
Annual Costs	
Debt Service - Total Capital	$21,752
Operation and Maintenance	
Pipelines	$500
Pumpstations/Wells	$2,880
Surface Water Treatment	
Pumping Costs	$1,709
Total Annual Costs	**$26,841**
Annual Cost ($ per acre-foot)	**$419.39**
Annual Cost ($ per 1000 gallons)	**$1.29**

WUGNAME:	White Deer
STRATEGY:	Install 2 new wells in city
AMOUNT (ac-ft/yr):	281

Construction Costs	Costs
Water Wells (2)	$356,400
Connection to Existing System	$160,000
Subtotal - Construction Costs	*$516,400*
Engineering and Contingencies	$154,920
Mitigation and Permitting	$5,164
ROW Land Acquisition	$0
Water Rights Purchase	$22,575
Subtotal	*$699,059*
Interest During Construction	$15,147
Total Capital Project Costs	**$714,206**
Annual Costs	
Debt Service - Total Capital	$51,886
Operation and Maintenance	
Pipelines	$1,600
Pumpstations/Wells	$8,910
Surface Water Treatment	
Pumping Costs	$7,504
Total Annual Costs	**$69,900**
Annual Cost ($ per acre-foot)	**$248.76**
Annual Cost ($ per 1000 gallons)	**$0.76**

WUGNAME:	McLean
STRATEGY:	Install 2 new wells within 1.5 miles
AMOUNT (ac-ft/yr):	246

Construction Costs	Costs
Water Wells (2)	$188,400
Connection to Transmission System	$160,000
6-inch Pipeline from Well to McLean	$142,560
Pumpstation, building and appurtenances	$315,000
Ground Storage (.1 MG)	$42,000
Subtotal - Construction Costs	$847,960
Engineering and Contingencies	$254,388
Mitigation and Permitting	$8,480
ROW Land Acquisition	$2,727
Water Rights Purchase	$136,500
Subtotal	*$1,250,055*
Interest During Construction	$27,085
Total Capital Project Costs	**$1,277,140**
Annual Costs	
Debt Service - Total Capital	$92,783
Operation and Maintenance	
Pipelines	$1,600
Pumpstations/Wells	$4,710
Surface Water Treatment	
Pumping Costs	$6,588
Total Annual Costs	**$105,680.98**
Annual Cost ($ per acre-foot)	**$429.60**
Annual Cost ($ per 1000 gallons)	**$1.32**

WUGNAME:	Gruver	
STRATEGY:	Develop exiting water rights and new rights	
AMOUNT (ac-ft/yr):	372	

Construction Costs	Cost
Water Wells (2)	$273,600
Connection to Existing System	$160,000
6-in Pipeline to Gruver	$475,200
Pumpstation, building and appurtenances	$519,200
Ground Storage (0.1 MG)	$42,000
Subtotal - Construction Costs	*$433,600*
Engineering and Contingencies	$130,080
Mitigation and Permitting	$4,336
ROW Land Acquisition	$6,000
Water Rights Purchase	$178,500
Subtotal	*$752,516*
Interest During Construction	$16,305
Total Capital Project Costs	**$768,821**
Annual Costs	
Debt Service - Total Capital	$55,854
Operation and Maintenance	
Pipelines	$6,352
Pumpstations	$19,820
Surface Water Treatment	$0
Pumping Costs	$15,181
Total Annual Costs	**$97,207.03**
Annual Cost ($ per acre-foot)	**$261.31**
Annual Cost ($ per 1000 gallons)	**$0.80**

WUGNAME:	Gruver
STRATEGY:	Palo Duro project
AMOUNT (ac-ft/yr):	200

Construction Costs	Cost
Palo Duro Transmission Project	$58,680,274
Percentage of Total Capital - City of Gruver	$1,872,376
Annual Costs	
Debt Service - Total Capital	$136,026
Operation and Maintenance	
Pipelines	$6,167
Pumpstations	$7,001
Surface Water Treatment	$29,116
Purchased Water from PDRA	$13,686
Pumping Costs	$13,643
Total Annual Costs	**$205,639**
Annual Cost ($ per acre-foot)	**$1,028.20**
Annual Cost ($ per 1000 gallons)	**$3.16**

WUGNAME:	Canadian	
STRATEGY:	Develop new water rights	
AMOUNT (ac-ft/yr):	641	

Construction Costs	Cost
Water Wells (2)	$80,400
Connection to Transmission System	$160,000
10-in Pipeline to Canadian	$739,200
Pumpstation, building and appurtenances	$388,200
Ground Storage (.5 MG)	$156,000
Subtotal - Construction Costs	*$1,523,800*
Engineering and Contingencies	$457,140
Mitigation and Permitting	$15,238
ROW Land Acquisition	$6,000
Water Rights Purchase	$413,000
Subtotal	*$2,415,178*
Interest During Construction	$52,330
Total Capital Project Costs	**$2,467,508**
Annual Costs	
Debt Service - Total Capital	$179,262
Operation and Maintenance	
Pipelines	$7,592
Pumpstations	$11,715
Surface Water Treatment	$0
Pumping Costs	$11,121
Total Annual Costs	**$209,690**
Annual Cost ($ per acre-foot)	**$327.13**
Annual Cost ($ per 1000 gallons)	**$1.00**

WUGNAME:	Cactus
STRATEGY:	Develop new well field
AMOUNT (ac-ft/yr):	1,735

Construction Costs	Cost
Water Wells (4)	$626,400
Connection to Existing System	$800,000
16-in Pipeline to Cactus	$976,800
Pumpstation, building and appurtenances	$681,000
Ground Storage (1 MG)	$275,000
Subtotal - Construction Costs	*$3,359,200*
Engineering and Contingencies	$1,007,760
Mitigation and Permitting	$33,592
ROW Land Acquisition	$9,090
Water Rights Purchase	$711,900
Subtotal	*$5,121,542*
Interest During Construction	$110,968
Total Capital Project Costs	**$5,232,510**
Annual Costs	
Debt Service - Total Capital	$380,136
Operation and Maintenance	
Pipelines	$20,518
Pumpstations / Wells	$32,685
Surface Water Treatment	$0
Pumping Costs	$51,182
Total Annual Costs	$484,521
Annual Cost ($ per acre-foot)	**$279.26**
Annual Cost ($ per 1000 gallons)	**$0.86**

WUGNAME:	Cactus
STRATEGY:	Palo Duro Project
AMOUNT (ac-ft/yr):	2,000

Construction Costs	Cost
Palo Duro Transmission Project	$58,680,274
Percentage of Total Capital - City of Cactus	**$18,723,763**

Annual Costs	
Debt Service - Total Capital	$1,360,261
Operation and Maintenance	
Pipelines	$61,672
Pumpstations	$70,014
Surface Water Treatment	$291,161
Purchased Water from PDRA	$136,857
Pumping Costs	$136,427
Total Annual Costs	**$2,056,393**
Annual Cost ($ per acre-foot)	**$1,028.20**
Annual Cost ($ per 1000 gallons)	**$3.16**

WUGNAME:	Dumas
STRATEGY:	Develop new water rights
AMOUNT (ac-ft/yr):	1,367

Construction Costs	Cost
Water Wells (3)	$431,100
Connection to Existing System	$300,000
8-in Pipeline to Dumas	$1,082,400
Pumpstation, building and appurtenances	$519,200
Ground Storage (.5 MG)	$156,000
Subtotal - Construction Costs	*$2,488,700*
Engineering and Contingencies	$746,610
Mitigation and Permitting	$24,887
ROW Land Acquisition	$9,090
Water Rights Purchase	$567,000
Subtotal	*$3,836,287*
Interest During Construction	$83,121
Total Capital Project Costs	**$3,919,408**
Annual Costs	
Debt Service - Total Capital	$284,741
Operation and Maintenance	
Pipelines	$15,384
Pumpstations	$23,758
Surface Water Treatment	$0
Pumping Costs	$37,436
Total Annual Costs	**$361,317.80**
Annual Cost ($ per acre-foot)	**$264.31**
Annual Cost ($ per 1000 gallons)	**$0.81**

WUGNAME:	Dumas
STRATEGY:	Palo Duro project
AMOUNT (ac-ft/yr):	2,560

Construction Costs	Cost
Palo Duro Transmission Project	$58,680,274
Percentage of Total Capital - City of Dumas	**$23,966,417**
Annual Costs	
Debt Service - Total Capital	$1,741,134
Operation and Maintenance	
Pipelines	$78,940
Pumpstations	$89,618
Surface Water Treatment	$372,687
Purchased Water from PDRA	$175,177
Pumping Costs	$174,626
Total Annual Costs	**$2,632,183**
Annual Cost ($ per acre-foot)	**$1,028.20**
Annual Cost ($ per 1000 gallons)	**$3.16**

WUGNAME:	Sunray
STRATEGY:	Install 2 new wells within 5 miles
AMOUNT (ac-ft/yr):	440

Construction Costs	Cost
Water Wells (2)	$267,000
Connection to Existing System	$160,000
8-in Pipeline to Sunray	$633,600
Pumpstation, building and appurtenances	$519,200
Ground Storage (.5 MG)	$156,000
Subtotal - Construction Costs	*$1,735,800*
Engineering and Contingencies	$520,740
Mitigation and Permitting	$17,358
ROW Land Acquisition	$6,000
Water Rights Purchase	$252,350
Subtotal	*$2,532,248*
Interest During Construction	$54,866
Total Capital Project Costs	**$2,587,114**
Annual Costs	
Debt Service - Total Capital	$187,951
Operation and Maintenance	
Pipelines	$7,936.00
Pumpstations	$19,655.00
Surface Water Treatment	$0
Pumping Costs	$14,047
Total Annual Costs	**$229,588.83**
Annual Cost ($ per acre-foot)	**$521.79**
Annual Cost ($ per 1000 gallons)	**$1.60**

WUGNAME:	Sunray
STRATEGY:	Palo Duro Project
AMOUNT (ac-ft/yr):	500

Construction Costs	Cost
Palo Duro Transmission Project	$58,680,274
Percentage of Total Capital - City of Sunray	**$4,680,941**
Annual Costs	
Debt Service - Total Capital	$340,065
Operation and Maintenance	
Pipelines	$15,418
Pumpstations	$17,504
Surface Water Treatment	$72,790
Purchased Water from PDRA	$34,214
Pumping Costs	$34,107
Total Annual Costs	**$514,098.20**
Annual Cost ($ per acre-foot)	**$1,028.20**
Annual Cost ($ per 1000 gallons)	**$3.16**

WUGNAME:	Perryton
STRATEGY:	Develop existing and new water rights
AMOUNT (ac-ft/yr):	2,482

Construction Costs	Cost
Water Wells (5)	$765,000
Connection to Existing System	$400,000
Connection to New System	$300,000
16-in Pipeline to Perryton	$1,082,400
Pumpstation, building and appurtenances	$761,900
Ground Storage (1 MG)	$275,000
Subtotal - Construction Costs	*$3,584,300*
Engineering and Contingencies	$1,075,290
Mitigation and Permitting	$35,843
ROW Land Acquisition (30-ft)	$9,090
Water Rights Purchase	$642,600
Subtotal	$5,347,123
Interest During Construction	$115,856
Total Capital Project Costs	**$5,462,979**
Annual Costs	
Debt Service - Total Capital	$396,879
Operation and Maintenance	
Pipelines	$14,824
Pumpstations/Wells	$38,173
Surface Water Treatment	
Pumping Costs	$87,059
Total Annual Costs	**$536,935**
Annual Cost ($ per acre-foot)	**$216.33**
Annual Cost ($ per 1000 gallons)	**$0.66**

WUGNAME:	Vega
STRATEGY:	Develop additional supply in Deaf Smith Co.
AMOUNT (ac-ft/yr):	245

Construction Costs	Cost
Water Wells (2)	$146,400
Connection to Transmission System	$160,000
6-in Pipeline to Vega	$475,200
Pumpstation, building and appurtenances	$388,200
Ground Storage (.1 MG)	$75,000
Subtotal - Construction Costs	*$1,244,800*
Engineering and Contingencies	$373,440
Mitigation and Permitting	$12,448
ROW Land Acquisition	$6,000
Water Rights Purchase	$51,100
Subtotal	*$1,687,788*
Interest During Construction	$36,569
Total Capital Project Costs	**$1,724,357**
Annual Costs	
Debt Service - Total Capital	$125,273
Operation and Maintenance	
Pipelines	$4,952
Pumpstations/ Wells	$13,365
Surface Water Treatment	$0
Pumping Costs	$8,943
Total Annual Costs	**$152,533**
Annual Cost ($ per acre-foot)	**$622.58**
Annual Cost ($ per 1000 gallons)	**$1.91**

WUGNAME:	Amarillo	
STRATEGY:	Develop Roberts Co well field for city needs	
AMOUNT (ac-ft/yr):	30,000	
Construction Costs		Cost
Water Wells (30)		$4,212,000
Connection to Transmission System		$10,692,000
54-in Pipeline from Well Field to Amarillo		$50,529,600
Pumpstation, building and appurtenances (3)		$42,000,000
Storage Tank (3 x 8 MG)		$4,200,000
Subtotal - Construction Costs		*$111,633,600*
Engineering and Contingencies		$33,490,080
Mitigation and Permitting		$1,116,336
ROW Land Acquisition		$158,400
Water Rights Purchase		$0
Subtotal		*$146,398,416*
Interest During Construction		$8,431,524
Total Capital Project Costs		**$154,829,940**
Annual Costs		
Debt Service - Total Capital		$11,248,227
Operation and Maintenance		
Pipelines		$612,216
Pumpstations/Wells		$1,155,300
Surface Water Treatment		
Pumping Costs		$4,068,790
Total Annual Costs		**$17,084,532**
Annual Cost ($ per acre-foot)		**$569.48**
Annual Cost ($ per 1000 gallons)		**$1.75**

WUGNAME:	Amarillo
STRATEGY:	Develop Roberts Co wellfield for city/customer needs
AMOUNT (ac-ft/yr):	45,000
Construction Costs	Cost
Water Wells (40)	$5,616,000
Connection to Transmission System	$14,256,000
66-in Pipeline from Well Field to Amarillo	$73,529,280
Pumpstation, building and appurtenances	$52,200,000
Storage Tank (3 x 8 MG)	$4,500,000
Subtotal - Construction Costs	*$150,101,280*
Engineering and Contingencies	$45,030,384
Mitigation and Permitting	$1,501,013
ROW Land Acquisition	$158,400
Water Rights Purchase	$0
Subtotal	*$196,791,077*
Interest During Construction	$11,333,788
Total Capital Project Costs	**$208,124,865**
Annual Costs	
Debt Service - Total Capital	$15,120,045
Operation and Maintenance	
Pipelines	$877,853
Pumpstations/ Wells	$1,445,400
Surface Water Treatment	
Pumping Costs	$5,572,823
Total Annual Costs	**$23,016,120**
Annual Cost ($ per acre-foot)	**$511.47**
Annual Cost ($ per 1000 gallons)	**$1.57**

WUGNAME:	Canyon	
STRATEGY:	Develop new groundwater rights	
AMOUNT (ac-ft/yr):	772	

Construction Costs	Cost
Water Wells (3)	$189,900
Connection to Existing System	$250,000
Connection to New System	$200,000
10-in Pipeline to Canyon	$739,200
Pumpstation, building and appurtenances	$519,200
Ground Storage (.5 MG)	$156,000
Subtotal - Construction Costs	*$2,054,300*
Engineering and Contingencies	$616,290
Mitigation and Permitting	
ROW Land Acquisition	
Water Rights Purchase	
Subtotal	*$2,670,590*
Interest During Construction	$57,864
Total Capital Project Costs	**$2,728,454**
Annual Costs	
Debt Service - Total Capital	$198,219
Operation and Maintenance	
Pipelines	$7,592
Pumpstations/Wells	$17,728
Surface Water Treatment	$0
Pumping Costs	$17,933
Total Annual Costs	**$241,472**
Annual Cost ($ per acre-foot)	**$312.79**
Annual Cost ($ per 1000 gallons)	**$0.96**

WUGNAME:	Lake Tanglewood
STRATEGY:	Develop existing and new water rights
AMOUNT (ac-ft/yr):	305

Construction Costs	Cost
Water Wells (3)	$188,100
Connection to Existing System	$200,000
Connection to New System	$160,000
8-in Pipeline to Lake Tanglewood	$633,600
Pumpstation, building and appurtenances	$315,000
Ground Storage (.25 MG)	$100,000
Subtotal - Construction Costs	*$388,100*
Engineering and Contingencies	$116,430
Mitigation and Permitting	$3,881
ROW Land Acquisition	$6,000
Water Rights Purchase	$521,500
Subtotal	*$1,035,911*
Interest During Construction	$22,445
Total Capital Project Costs	**$1,058,356**
Annual Costs	
Debt Service - Total Capital	$76,888
Operation and Maintenance	
Pipelines	$6,536
Pumpstations/ Wells	$12,578
Surface Water Treatment	$0
Pumping Costs	$8,267
Total Annual Costs	**$104,269**
Annual Cost ($ per acre-foot)	**$341.87**
Annual Cost ($ per 1000 gallons)	**$1.05**

WUGNAME:	Shamrock
STRATEGY:	Install 2 new wells, 12 miles transmission
AMOUNT (ac-ft/yr):	321

Construction Costs	Cost
Water Wells (2)	$105,600
Connection to Existing Wells	$160,000
8-in Pipeline from Well to Shamrock	$1,520,640
Pumpstation, building and appurtenances	$388,200
Ground Storage (.25 MG)	$100,000
Subtotal - Construction Costs	*$2,274,440*
Engineering and Contingencies	$682,332
Mitigation and Permitting	$22,744
ROW Land Acquisition	$14,400
Water Rights Purchase	$116,550
Subtotal	*$3,110,466*
Interest During Construction	$67,394
Total Capital Project Costs	**$3,177,861**
Annual Costs	
Debt Service - Total Capital	$230,868
Operation and Maintenance	
Pipelines	$16,806
Pumpstations/Wells	$47,721
Surface Water Treatment	
Pumping Costs	$6,099
Total Annual Costs	**$301,495**
Annual Cost ($ per acre-foot)	**$939.24**
Annual Cost ($ per 1000 gallons)	**$2.88**

WUGNAME:	Wheeler
STRATEGY:	Install 2 new wells, 15 miles transmission
AMOUNT (ac-ft/yr):	275

Construction Costs	Cost
Water Wells (2)	$105,600
Connection to Transmission System	$160,000
8-in Pipeline from Well toWheeler	$1,900,800
Pumpstation, building and appurtenances	$388,200
Ground Storage (.1 MG)	$42,000
Subtotal - Construction Costs	*$2,491,000*
Engineering and Contingencies	$747,300
Mitigation and Permitting	$24,910
ROW Land Acquisition	$18,000
Water Rights Purchase	$340,900
Subtotal	*$3,622,110*
Interest During Construction	$78,480
Total Capital Project Costs	**$3,700,590**
Annual Costs	
Debt Service - Total Capital	$268,844
Operation and Maintenance	
Pipelines	$20,608
Pumpstations/Wells	$12,345
Surface Water Treatment	
Pumping Costs	$5,129
Total Annual Costs	**$306,925**
Annual Cost ($ per acre-foot)	**$1,116.09**
Annual Cost ($ per 1000 gallons)	**$3.43**

WUGNAME:	Dallam - Livestock
STRATEGY:	Develop new water rights
AMOUNT (ac-ft/yr):	16,796

Construction Costs	Cost
Water Wells (105)	$7,875,000
Subtotal - Construction Costs	*$7,875,000*
Engineering and Contingencies	$2,362,500
Mitigation and Permitting	$78,750
Water Rights Purchase	$4,858,700
Subtotal	*$15,174,950*
Interest During Construction	$328,796
Total Capital Project Costs	**$15,503,746**
Annual Costs	
Debt Service - Total Capital	$1,126,330
Operation and Maintenance	
Pipelines	$0
Pumpstations	$196,875
Surface Water Treatment	$0
Pumping Costs	$742,795
Total Annual Costs	**$2,066,000**
Annual Cost ($ per acre-foot)	**$123.01**
Annual Cost ($ per 1000 gallons)	**$0.38**

WUGNAME:	Moore - Livestock
STRATEGY:	Develop new water rights
AMOUNT (ac-ft/yr):	9,786

Construction Costs	Cost
Water Wells (61)	$4,575,000
Subtotal - Construction Costs	*$4,575,000*
Engineering and Contingencies	$1,372,500
Mitigation and Permitting	$45,750
ROW Land Acquisition	$0
Water Rights Purchase	$1,810,200
Subtotal	*$7,803,450*
Interest During Construction	$169,077
Total Capital Project Costs	**$7,972,527**
Annual Costs	
Debt Service - Total Capital	$579,195
Operation and Maintenance	
Pipelines	
Pumpstations	$114,375
Surface Water Treatment	$0
Pumping Costs	$432,781
Total Annual Costs	**$1,126,351**
Annual Cost ($ per acre-foot)	**$115.10**
Annual Cost ($ per 1000 gallons)	**$0.35**

WUGNAME:	Randall - Livestock
STRATEGY:	Develop new water rights
AMOUNT (ac-ft/yr):	3,407

Construction Costs	Cost
Water Wells (12)	$378,000
Subtotal - Construction Costs	*$378,000*
Engineering and Contingencies	$113,400
Mitigation and Permitting	$3,780
ROW Land Acquisition	
Water Rights Purchase	$2,191,000
Subtotal	*$2,686,180*
Interest During Construction	$58,201
Total Capital Project Costs	**$2,744,381**
Annual Costs	
Debt Service - Total Capital	$199,376
Operation and Maintenance	
Pipelines	
Pumpstations	$9,450
Surface Water Treatment	$0
Pumping Costs	$66,644
Total Annual Costs	**$275,470**
Annual Cost ($ per acre-foot)	**$80.85**
Annual Cost ($ per 1000 gallons)	**$0.25**

WUGNAME:	Manufacturing - Dallam County
STRATEGY:	Purchase additional water rights and install 1 new well
AMOUNT (ac-ft/yr):	232

Construction Costs	Cost
Water Wells (1)	$82,000
Connection to Existing System	$100,000
Subtotal - Construction Costs	*$182,000*
Engineering/ Contingencies @ 30%	$54,600
ROW costs	$0
Water rights purchase	$50,750
Subtotal	*$287,350*
Interest during construction	$6,226
Total Capital Project Costs	**$293,576**
Annual Costs	
Debit Service (30 years)	$21,328
Operation and Maintenance	$3,050
Pumping costs	$5,138
Treatment Costs	$0
Water Purchase Costs	$0
Total Annual Costs	**$29,516**
Annual Cost ($ per acre-feet)	**$127.23**
Annual Cost ($ per 1000 gallons)	**$0.39**

WUGNAME:	Manufacturing - Moore County
STRATEGY:	13 new wells in Moore Co. near demands
AMOUNT (ac-ft/yr):	9,429

Construction Costs	Cost
Water Wells (13)	$1,157,000
Connection to Existing System	$1,300,000
Subtotal - Construction Costs	*$2,457,000*
Engineering/ Contingencies @ 30%	$737,100
ROW costs	$0
Water rights purchase	$6,074,950
Subtotal	*$9,269,050*
Interest during construction	$200,829
Total Capital Project Costs	**$9,469,879**
Annual Costs	
Debit Service (30 years)	$687,976
Operation and Maintenance	$41,925
Pumping costs	$240,958
Treatment Costs	$0
Water Purchase Costs	$0
Total Annual Costs	**$970,860**
Annual Cost ($ per acre-feet)	**$102.97**
Annual Cost ($ per 1000 gallons)	**$0.32**

WUGNAME:	Manufacturing - Potter County
STRATEGY:	2 new wells in Potter Co. near demands
AMOUNT (ac-ft/yr):	690

Construction Costs	Cost
Water Well	$92,800
Connection to Manufacturing System	$200,000
Subtotal - Construction Costs	*$292,800*
Engineering/ Contingencies @ 30%	$87,840
ROW costs	$0
Water rights purchase	$306,250
Subtotal	*$686,890*
Interest during construction	$14,883
Total Capital Project Costs	**$701,773**
Annual Costs	
Debit Service (30 years)	$50,983
Operation and Maintenance	$4,320
Pumping costs	$10,403
Treatment Costs	$0
Water Purchase Costs	$0
Total Annual Costs	**$65,706**
Annual Cost ($ per acre-feet)	**$95.23**
Annual Cost ($ per 1000 gallons)	**$0.29**

WUGNAME:	Manufacturing - Randall County
STRATEGY:	Purchase additional water rights and install 1 new well
AMOUNT (ac-ft/yr):	173

Construction Costs	Cost
Water Well	$42,200
Connection to Existing System	$100,000
Subtotal - Construction Costs	*$142,200*
Engineering/ Contingencies @ 30%	$42,660
ROW costs	$0
Water rights purchase	$122,500
Subtotal	*$307,360*
Interest during construction	$0
Total Capital Project Costs	**$307,360**
Annual Costs	
Debit Service (30 years)	$22,329
Operation and Maintenance	$2,055
Pumping costs	$2,432
Treatment Costs	$0
Water Purchase Costs	$0
Total Annual Costs	**$26,816**
Annual Cost ($ per acre-feet)	**$155.01**
Annual Cost ($ per 1000 gallons)	**$0.48**

WUGNAME:	Steam Electric Power - Moore County
STRATEGY:	Purchase additional water rights
AMOUNT (ac-ft/yr):	200

Construction Costs	Cost
Water Well	$76,400
Connection to Existing System	$100,000
Subtotal - Construction Costs	*$176,400*
Engineering/ Contingencies @ 30%	$52,920
ROW costs	$0
Water rights purchase	$105,000
Subtotal	*$334,320*
Interest during construction	$0
Total Capital Project Costs	**$334,320**
Annual Costs	
Debit Service (30 years)	$24,288
Operation and Maintenance	$2,910
Pumping costs	$4,515
Treatment Costs	$0
Water Purchase Costs	$0
Total Annual Costs	**$31,713**
Annual Cost ($ per acre-feet)	**$158.56**
Annual Cost ($ per 1000 gallons)	**$0.49**

WUGNAME:	Steam Electric Power - Potter County
STRATEGY:	Pipeline for treated effluent to power station
AMOUNT (ac-ft/yr):	15,860

Construction Costs	Cost
30-inch Transmission Line	$5,612,160
Pump Station Improvements	$700,000
Conflicts	$821,100
Subtotal - Construction Costs	*$7,133,260*
Engineering/ Contingencies @ 30%	$2,139,978
ROW costs	$0
Water rights purchase	$0
Subtotal	*$9,273,238*
Interest during construction	$386,385
Total Capital Project Costs	**$9,659,623**
Annual Costs	
Debit Service (30 years)	$701,761
Operation and Maintenance	$73,622
Pumping costs	$132,291
Treatment Costs	$0
*Water Purchase Costs**	*$1,033,663*
Total Annual Costs	**$1,941,336**
Annual Cost ($ per acre-feet)	**$122.40**
Annual Cost ($ per 1000 gallons)	**$0.38**

*** purchase costs to be confirmed with Amarillo**

WUGNAME:	Mining - Potter County
STRATEGY:	3 new wells in Dockum Aquifer located near demands
AMOUNT (ac-ft/yr):	410

Construction Costs	Cost
Water Wells (3)	$180,000
Connection to System	$300,000
Subtotal - Construction Costs	*$480,000*
Engineering/ Contingencies @ 30%	$144,000
ROW costs	$0
Water rights purchase	$210,000
Subtotal	*$834,000*
Interest during construction	$18,070
Total Capital Project Costs	**$852,070**

Annual Costs	
Debit Service (30 years)	$61,902
Operation and Maintenance	$7,500
Pumping costs	$7,509
Treatment Costs	$0
Water Purchase Costs	$0
Total Annual Costs	**$76,911**
Annual Cost ($ per acre-feet)	**$187.59**
Annual Cost ($ per 1000 gallons)	**$0.58**

WUGNAME:	Mining - Oldham County
STRATEGY:	New well field in Dockum Aquifer (2 wells)
AMOUNT (ac-ft/yr):	311

Construction Costs	Cost
Water Wells (2)	$120,000
Connection to System	$200,000
Subtotal - Construction Costs	*$320,000*
Engineering/ Contingencies @ 30%	$96,000
ROW costs	$0
Water rights purchase	$84,000
Subtotal	*$500,000*
Interest during construction	$10,833
Total Capital Project Costs	**$510,833**

Annual Costs	
Debit Service (30 years)	$37,111
Operation and Maintenance	$5,000
Pumping costs	$5,696
Treatment Costs	$0
Water Purchase Costs	$0
Total Annual Costs	**$47,807**
Annual Cost ($ per acre-feet)	**$153.72**
Annual Cost ($ per 1000 gallons)	**$0.47**

WUGNAME:	County-Other in Randall County
STRATEGY:	18 new wells installed near demand source
AMOUNT (ac-ft/yr):	5,738

Construction Costs	Cost
Water Well	$1,128,600
Connection to Distribution System	$1,800,000
Subtotal - Construction Costs	*$2,928,600*
Engineering/ Contingencies @ 30%	$878,580
ROW costs	$0
Water rights purchase	$3,675,000
Subtotal	*$7,482,180*
Interest during construction	$162,114
Total Capital Project Costs	**$7,644,294**
Annual Costs	
Debit Service (30 years)	$555,350
Operation and Maintenance	$46,215
Pumping costs	$111,931
Treatment Costs	$0
Water Purchase Costs	$0
Total Annual Costs	**$713,496**
Annual Cost ($ per acre-feet)	**$124.35**
Annual Cost ($ per 1000 gallons)	**$0.38**

WUGNAME:	County-Other in Potter County
STRATEGY:	10 new wells installed near demand source
AMOUNT (ac-ft/yr):	1,528

Construction Costs	Cost
Water Well	$696,000
Connection to Distribution System	$1,000,000
Subtotal - Construction Costs	*$1,696,000*
Engineering/ Contingencies @ 30%	$508,800
ROW costs	$0
Water rights purchase	$787,500
Subtotal	*$2,992,300*
Interest during construction	$64,833
Total Capital Project Costs	**$3,057,133**

Annual Costs	
Debit Service (30 years)	$222,097
Operation and Maintenance	$27,400
Pumping costs	$32,800
Treatment Costs	$0
Water Purchase Costs	$0
Total Annual Costs	**$282,298**
Annual Cost ($ per acre-feet)	**$184.75**
Annual Cost ($ per 1000 gallons)	**$0.57**

FACTORS FOR INTEREST DURING CONSTRUCTION

factor (6 months)	0.02167
Factor (12 months)	0.04167
factor (18 months)	0.05759
factor (24 months)	0.07819
factor (36 month construction)	0.1188

EXAMPLE:

Interest during construction for a project with:
18 months construction

capital costs	$1,000,000
Interest during const	$57,593

Panhandle Water Planning Project
Task 5 Addendum

Water Management Strategies for Reducing Irrigation Demands in Region A (All 21 Counties)

Prepared for

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Water Management Strategies for Reducing Irrigation Demands in Region A

The Agricultural Demands and Projections Subcommittee of the Panhandle Water Planning Group for Region A developed water management strategies for potentially reducing irrigation demands to retain 50 percent of the groundwater currently in the Ogallala Aquifer over the 50 year period of 2000 to 2050. These strategies include the use of the North Plains Potential Evapotranspiration Network (NPPET) to schedule irrigation, changes in crop variety, irrigation equipment efficiency improvements, changes in crop types, implementation of conservation tillage methods, precipitation enhancement and conversion of irrigated land to dryland. Each of these practices is presented in Table 1 with the anticipated annual water savings in acre-inches and the expected percentage of acres by decade that would be shifted to these methods.

The water management strategies need to be focused on Dallam, Moore, Oldham, Potter, Randall and Sherman Counties that are projected to have water availability reductions of greater than 50 percent by 2050. However, water management strategies for reducing irrigation demands in all 21 counties of Region A were analyzed. According to the "Comparison of Current Water Supplies to Demands" in Task 4, by the year 2050 the deficits for irrigation in these counties in acre-feet could be: Dallam, -381,008 acre-feet; Moore, -200,576; Oldham, -25,948; Potter, -13,877; Randall, -47,214; and Sherman, -194,797 acre-feet (PWPG, 2000). It means that in year 2050 total water shortage for irrigation in these six counties will be 863,421 acre-feet. Seven potential water management strategies for reducing irrigation demands in all counties are suggested to conserve groundwater in the Ogallala Aquifer.

Table 1. Seven water management strategies for reducing irrigation demands in Dallam, Moore, Oldham, Potter, Randall and Sherman Counties to conserve groundwater in the Ogallala Aquifer over the time period of 2000 to 2050.

Water Management Strategy	Assumed Annual Regional Water Savings (ac-in)	Assumed Baseline Use Year 2000	Goal for Adoption 2010	Goal for Adoption 2020	Goal for Adoption 2030	Goal for Adoption 2040	Goal for Adoption 2050
Use of NPPET	2	20%	70%	90%	90%	90%	90%
Change in Crop Variety	2	10%	40%	70%	70%	70%	70%
Irrigation Equip Changes	3	55%	75%	95%	95%	95%	95%
Change in Crop Type	5	0%	20%	40%	40%	40%	40%
Conservation Tillage Methods	2	50%	60%	70%	70%	70%	70%
Precipitation Enhancement	1	0%	100%	100%	100%	100%	100%
Irrigated to Dryland Farming	12-14	0%	5%	10%	15%	15%	15%

The irrigated acres that are utilized in the water management strategies for all 21 counties of Region A are obtained from the Texas Agricultural Statistics Service (TASS, 1998). The total 1997 irrigated acres for these counties are 1,363,438 acres, Table 2.

Table 2. Irrigated acres by crop for Dallam, Moore, Oldham, Potter, Randall and Sherman Counties of Region A in 1997.

County	Corn	Cotton	Hay	Pasture	Peanuts	Sorghum	Soybeans	Wheat	Total Acres
					acres				
Armstrong	1,200	800	60	316	0	2,100	0	5,000	9,476
Carson	15,200	0	200	14,410	0	23,400	3,700	36,100	93,010
Childress	0	1,700	410	350	459	467	0	100	3,486
Collingsworth	750	5,200	670	969	10,200	1,600	0	1,400	20,789
Dallam	157,000	0	8,000	14,588	0	8,000	700	96,300	284,588
Donley	2,500	1,200	1,336	2,705	2,800	1,400	225	377	12,543
Gray	7,100	0	730	711	0	5,100	1,500	19,900	35,041
Hall	1,500	10,700	609	560	2,100	163	0	155	15,787
Hansford	49,000	0	1,500	5,017	0	21,800	9,400	106,400	193,117
Hartley	87,400	0	2,200	9,990	0	8,200	900	30,600	139,290
Hemphill	0	425	449	1,241	0	206	0	2,100	4,421
Hutchinson	14,500	0	25	2,113	0	4,200	915	6,500	28,253
Lipscomb	2,200	0	9,190	2,570	0	1,900	880	7,900	24,640
Moore	87,800	0	0	13,805	0	22,000	1,900	45,900	171,405
Ochiltree	17,000	0	259	0	0	12,300	4,400	23,500	57,459
Oldham	862	0	0	520	0	10,500	0	18,300	30,182
Potter	971	0	0	2,948	0	1,500	0	22,800	28,219
Randall	5,500	100	2,185	6,570	0	14,800	0	17,700	46,855
Roberts	2,100	0	0	832	0	2,000	0	3,400	8,332
Sherman	70,700	300	1,072	6,283	0	20,500	50	53,300	152,205
Wheeler	960	600	100	642	807	906	0	325	4,340
Total	524,243	21,025	28,995	87,140	16,366	163,042	24,570	498,057	1,363,438

Use of the Potential Evapotranspiration Network for Scheduling Irrigation

It is assumed that by utilizing the North Plains Potential Evapotranspiration Network (NPPET) two acre-inches of groundwater will be saved annually. Additionally, it is assumed that in the baseline year of 2000 that 20 percent of the irrigated acres utilize the potential evapotranspiration (PET) crop water use information. The expectation is that 70 percent of the irrigated acres from 2001 to 2010 and 90 percent of the irrigated acres from 2011 to 2050 will use the PET irrigation recommendations. The estimated water savings from adopting this strategy are presented in Table 3.

Table 3. Estimated water savings in acre-feet for the next 50 years (2000-2050) for all counties of Region A using the North Plains Potential Evapotranspiration Network (NPPET) for scheduling irrigation.

County	Irrigated Acres[1]	Annual Water Savings (acre-feet) during each decade				
		2010	2020	2030	2040	2050
Armstrong	9,476	790	1,106	1,106	1,106	1,106
Carson	93,010	7,751	10,851	10,851	10,851	10,851
Childress	3,486	291	407	407	407	407
Collingsworth	20,789	1,732	2,425	2,425	2,425	2,425
Dallam	284,588	23,716	33,202	33,202	33,202	33,202
Donley	12,543	1,045	1,463	1,463	1,463	1,463
Gray	35,041	2,920	4,088	4,088	4,088	4,088
Hall	15,787	1,316	1,842	1,842	1,842	1,842
Hansford	193,117	16,093	22,530	22,530	22,530	22,530
Hartley	139,290	11,608	16,251	16,251	16,251	16,251
Hemphill	4,421	368	516	516	516	516
Hutchinson	28,253	2,354	3,296	3,296	3,296	3,296
Lipscomb	24,640	2,053	2,875	2,875	2,875	2,875
Moore	171,405	14,284	19,997	19,997	19,997	19,997
Ochiltree	57,459	4,788	6,704	6,704	6,704	6,704
Oldham	30,182	2,515	3,521	3,521	3,521	3,521
Potter	28,219	2,352	3,292	3,292	3,292	3,292
Randall	46,855	3,905	5,466	5,466	5,466	5,466
Roberts	8,332	694	972	972	972	972
Sherman	152,205	12,684	17,757	17,757	17,757	17,757
Wheeler	4,340	362	506	506	506	506
Total Region A	1,363,438	113,620	159,068	159,068	159,068	159,068

[1]Irrigated acres were calculated and obtained from Task 2.

Change in Crop Variety

It is assumed that by shifting from a long season crop to a short season crop, two acre-inches per year of irrigation water will be conserved per acre. The two crops examined in this analysis are corn and sorghum. For both crops, it is assumed in the baseline year of 2000 that 10 percent of the acres will be planted to the short season variety. It is expected that from 2001 to 2010 and from 2011 to 2050, 40 percent and 70 percent, respectively, of the irrigated acres will be planted to the short season varieties. The estimated water savings when converting from long season corn to short season is presented in Table 4. The potential water savings when changing from long season sorghum to short season sorghum is presented in Table 5.

Table 4. Estimated water savings in acre-feet for the next 50 years (2000-2050) for all 21 counties of Region A by changing from long season corn to short season corn varieties.

County	Irrigated Corn Acres[1]	Annual Water Savings (acre-feet) during each decade				
		2010	2020	2030	2040	2050
Armstrong	1,200	60	120	120	120	120
Carson	15,200	760	1,520	1,520	1,520	1,520
Childress	0	0	0	0	0	0
Collingsworth	750	38	75	75	75	75
Dallam	157,000	7,850	15,700	15,700	15,700	15,700
Donley	2,500	125	250	250	250	250
Gray	7,100	355	710	710	710	710
Hall	1,500	75	150	150	150	150
Hansford	49,000	2,450	4,900	4,900	4,900	4,900
Hartley	87,400	4,370	8,740	8,740	8,740	8,740
Hemphill	0	0	0	0	0	0
Hutchinson	14,500	725	1,450	1,450	1,450	1,450
Lipscomb	2,200	110	220	220	220	220
Moore	87,800	4,390	8,780	8,780	8,780	8,780
Ochiltree	17,000	850	1,700	1,700	1,700	1,700
Oldham	862	43	86	86	86	86
Potter	971	49	97	97	97	97
Randall	5,500	275	550	550	550	550
Roberts	2,100	105	210	210	210	210
Sherman	70,700	3,535	7,070	7,070	7,070	7,070
Wheeler	960	48	96	96	96	96
Total	524,243	26,212	52,424	52,424	52,424	52,424

[1]Irrigated corn acres were calculated and obtained from Task 2.

Table 5. Estimated water savings in acre-feet for the next 50 years (2000-2050) for all 21 counties of Region A by changing from long season sorghum to short season sorghum varieties.

County	Irrigated Sorghum Acres[1]	Annual Water Savings (acre-feet) during each decade				
		2010	2020	2030	2040	2050
Armstrong	2,100	105	210	210	210	210
Carson	23,400	1,170	2,340	2,340	2,340	2,340
Childress	467	23	47	47	47	47
Collingsworth	1,600	80	160	160	160	160
Dallam	8,000	400	800	800	800	800
Donley	1,400	70	140	140	140	140
Gray	5,100	255	510	510	510	510
Hall	163	8	16	16	16	16
Hansford	21,800	1,090	2,180	2,180	2,180	2,180
Hartley	8,200	410	820	820	820	820
Hemphill	206	10	21	21	21	21
Hutchinson	4,200	210	420	420	420	420
Lipscomb	1,900	95	190	190	190	190
Moore	22,000	1,100	2,200	2,200	2,200	2,200
Ochiltree	12,300	615	1,230	1,230	1,230	1,230
Oldham	10,500	525	1,050	1,050	1,050	1,050
Potter	1,500	75	150	150	150	150
Randall	14,800	740	1,480	1,480	1,480	1,480
Roberts	2,000	100	200	200	200	200
Sherman	20,500	1,025	2,050	2,050	2,050	2,050
Wheeler	906	45	91	91	91	91
Total	163,042	8,152	16,304	16,304	16,304	16,304

[1]Irrigated sorghum acres were calculated and obtained from Task 2.

Irrigation Equipment Changes

It is assumed that the incorporation of more efficient irrigation equipment/technology in a farming/ranching operation would provide another method of conserving groundwater. The application efficiencies of furrow irrigation, surge flow, low elevation sprinkler application (LESA), low energy precision application (LEPA), and drip are 60 percent, 75 percent, 88 percent, 95 percent, and 97 percent, respectively (New, 1999). The system with the higher efficiency rating is considered more efficient because it leads to less water usage while maintaining the same yields.

It is assumed that 55 percent of irrigated agriculture is already utilizing the more efficient distribution systems in the base year of 2000. It is expected that by 2010 an additional 20 percent of the farming/ranching operations will use methods such as surge flow, LESA and LEPA. In the years 2011 to 2050, it is anticipated that 95 percent of the irrigated crops will be under these irrigation methods. However, it is assumed that 5 percent of furrow irrigated acres will be converted to drip irrigation by 2010. This conversion will increase to 10 percent and 15 percent by 2020 and 2030, respectively.

Furrow irrigated acres for corn, cotton, hay, pasture, peanuts, sorghum, soybeans and wheat all counties of Region A in 1997 are located in Table 6 (Almas, et al., 2000). An analysis of irrigation equipment changes has been done for corn, pasture, sorghum, soybeans and wheat. Cotton, hay and peanuts were not included because of their small number of irrigated acres.

Table 6. Furrow irrigated acres for corn, cotton, hay, pasture, peanuts, sorghum, soybeans and wheat in all counties of Region A in 1997.

County	Corn	Cotton	Hay	Pasture	Peanuts	Sorghum	Soybeans	Wheat	County Totals
Armstrong	913	609	46	241	0	1,598	0	3,805	7,212
Carson	10,827	0	142	10,264	0	16,667	2,635	25,713	66,249
Childress	0	0	0	0	0	0	0	0	0
Collingsworth	218	1,511	195	281	2,963	465	0	407	6,039
Dallam	46,662	0	2,378	4,336	0	2,378	208	28,622	84,583
Donley	193	97	101	212	212	102	19	29	965
Gray	4,104	0	422	411	0	2,948	867	11,504	20,257
Hall	0	0	0	0	0	0	0	0	0
Hansford	31,446	0	963	3,220	0	13,990	6,032	68,282	123,932
Hartley	1,548	0	50	175	0	150	25	549	2,497
Hemphill	0	71	75	207	0	34	0	350	736
Hutchinson	6,011	0	10	876	0	1,741	379	2,695	11,713
Lipscomb	96	0	393	107	0	85	43	341	1,065
Moore	30,242	0	0	4,755	0	7,578	654	15,810	59,040
Ochiltree	9,029	0	138	0	0	6,533	2,337	12,482	30,519
Oldham	795	0	0	480	0	9,682	0	16,875	27,832
Potter	950	0	0	2,884	0	1,468	0	22,307	27,609
Randall	4,119	75	1,636	4,921	0	11,085	0	13,257	35,093
Roberts	391	0	0	155	0	373	0	633	1,552
Sherman	3,252	13	49	289	0	943	2	2,452	7,000
Wheeler	0	0	0	0	0	0	0	0	0
Total Region A	150,798	2,375	6,597	33,812	3,175	77,820	13,203	226,112	513,893

Two methodologies for calculating water savings in acre-feet when shifting from furrow irrigated crops to surge flow, LESA, LEPA, and DRIP are used. One approach utilizes the PET irrigation water use estimates by crop and county that were developed in Task 2. The water use estimates are presented in Appendix A. The second approach uses a flat rate of 3 acre-inches per crop per year for all crops in all counties.

Conversion of furrow to surge flow saves a total of 2,593,584 acre-feet of water over fifty years using the PET water use estimates whereas LESA and LEPA conserve 4,061,619 acre-feet and 4,407,145 acre-feet, respectively, Table 7. Drip results in water savings of 1,514,845 acre-feet over next fifty years with the assumption that 5 percent of furrow irrigated acres will be converted till 2010. This conversion will increase to 10 percent and 15 percent in 2020 and 2030, respectively. There is an increase in water savings of 56.60 percent using LESA and 69.92 percent using LEPA over surge flow.

Table 7. Water savings in acre-feet for corn, pasture, sorghum, soybeans and wheat for the next 50 years (2001-2050) for all counties when shifting from furrow irrigation to surge flow, LESA, LEPA, and DRIP using the PET water use estimates, and 3 acre-inches per year.

Irrigation System/ Crop	Corn	Pasture	Sorghum	Soybeans	Wheat	Total for 5 crops
	----------	----------	----------	acre-feet	----------	----------
PET Water Use Basis						
Furrow to Surge Flow[1]	1,232,028	377,298	320,518	29,031	634,709	2,593,584
Furrow to LESA[1]	1,928,861	591,194	502,179	45,436	993,950	4,061,619
Furrow to LEPA[1]	2,093,173	641,385	544,891	49,240	1,078,457	4,407,145
Furrow to DRIP[2]	697,724	226,408	192,329	17,386	380,998	1,514,845
3 ac-in/year Basis	678,591	152,154	350,190	59,414	1,017,504	2,257,853

[1] 20 percent additional furrow irrigated acres to be converted to surge flow, LESA, and LEPA by 2010 and 40 percent by 2020.
[2] 5 percent furrow irrigated acres to be converted to drip by 2010, 10 percent by 2020, and 15 percent by 2030.

The total water savings for wheat for 50 years is 634,709 acre-feet using surge flow, 993,950 acre-feet using LESA, 1,078,457 acre-feet using LEPA, and 380,998 acre-feet using DRIP, Table 7. There is an increase of 56.60 percent in water savings when changing from surge flow to LESA and an increase of 69.92 percent when shifting from surge flow to LEPA.

The estimated water savings due to the change in irrigation equipment from furrow irrigation to surge flow, LESA, LEPA and drip for 21 counties of Region A are presented in Tables 8 to 11, respectively. The change in irrigation equipment from furrow to MESA is not included in the water saving analysis in this strategy. The water saving estimates for the four irrigation equipment changes are based on the PET irrigation water requirements developed in Task 2. The county with the largest number of furrow irrigated acres i.e., 122,969 (corn, pasture, sorghum, soybeans and wheat) is Hansford County while Donley County has 555 furrow irrigated acres for corn, pasture, sorghum, and wheat. The estimated water savings by county and by decade are further subdivided by crop (corn, pasture, sorghum, soybeans and wheat) and are located in Appendix B, Tables 1 through 20.

Table 8. Estimated water savings in acre-feet by county by decade when shifting furrow irrigated crops to surge flow[1] using PET irrigation water requirements that incorporates application efficiencies.

County	Furrow Irrigated Acres	Annual Water Savings for selected years					Total for 50 years
		2010	2020	2030	2040	2050	
				acre-feet			
Armstrong	6,557	276	552	552	552	552	24,849
Carson	66,107	3,953	7,907	7,907	7,907	7,907	355,815
Childress	0	0	0	0	0	0	0
Collingsworth	1,371	90	181	181	181	181	8,132
Dallam	82,205	6,516	13,032	13,032	13,032	13,032	586,438
Donley	555	48	95	95	95	95	4,297
Gray	19,835	708	1,416	1,416	1,416	1,416	63,701
Hall	0	0	0	0	0	0	0
Hansford	122,969	4,567	9,133	9,133	9,133	9,133	410,987
Hartley	2,447	209	417	417	417	417	18,776
Hemphill	590	29	57	57	57	57	2,572
Hutchinson	11,703	1,036	2,073	2,073	2,073	2,073	93,275
Lipscomb	672	29	57	57	57	57	2,582
Moore	59,040	4,120	8,240	8,240	8,240	8,240	370,796
Ochiltree	30,381	1,483	2,967	2,967	2,967	2,967	133,495
Oldham	27,832	1,467	2,934	2,934	2,934	2,934	132,008
Potter	27,609	1,427	2,855	2,855	2,855	2,855	128,460
Randall	33,382	2,266	4,533	4,533	4,533	4,533	203,985
Roberts	1,552	64	129	129	129	129	5,794
Sherman	6,938	529	1,058	1,058	1,058	1,058	47,624
Wheeler	0	0	0	0	0	0	0
Total	501,746	28,818	57,635	57,635	57,635	57,635	2,593,584

[1] 20 percent additional furrow irrigated acres to be converted to surge flow by 2010 and 40 percent by 2020.

Table 9. Estimated water savings in acre-feet by county by decade when shifting furrow irrigated crops to LESA[1] using PET irrigation water requirements that incorporates application efficiencies.

County	Furrow Irrigated Acres	Annual Water Savings for selected years					Total For 50 years
		2010	2020	2030	2040	2050	
				acre-feet			
Armstrong	6,557	433	865	865	865	865	38,934
Carson	66,107	6,191	12,383	12,383	12,383	12,383	557,225
Childress	0	0	0	0	0	0	0
Collingsworth	1,371	142	283	283	283	283	12,742
Dallam	82,205	10,200	20,400	20,400	20,400	20,400	918,022
Donley	555	75	150	150	150	150	6,731
Gray	19,835	1,110	2,220	2,220	2,220	2,220	99,905
Hall	0	0	0	0	0	0	0
Hansford	122,969	7,146	14,292	14,292	14,292	14,292	643,155
Hartley	2,447	327	654	654	654	654	29,426
Hemphill	590	45	90	90	90	90	4,034
Hutchinson	11,703	1,624	3,248	3,248	3,248	3,248	146,150
Lipscomb	672	45	90	90	90	90	4,046
Moore	59,040	6,454	12,908	12,908	12,908	12,908	580,849
Ochiltree	30,381	2,324	4,649	4,649	4,649	4,649	209,202
Oldham	27,832	2,297	4,594	4,594	4,594	4,594	206,708
Potter	27,609	2,236	4,473	4,473	4,473	4,473	201,269
Randall	33,382	3,551	7,102	7,102	7,102	7,102	319,601
Roberts	1,552	101	202	202	202	202	9,069
Sherman	6,938	828	1,657	1,657	1,657	1,657	74,551
Wheeler	0	0	0	0	0	0	0
Total	501,746	45,129	90,258	90,258	90,258	90,258	4,061,619

[1] 20 percent additional furrow irrigated acres to be converted to LESA by 2010 and 40 percent by 2020.

Table 10. Estimated water savings in acre-feet by county by decade when shifting furrow irrigated crops to LEPA[1] using PET irrigation water requirements that incorporates application efficiencies.

County	Furrow Irrigated Acres	Annual Water Savings for selected years					Total for 50 years
		2010	2020	2030	2040	2050	
				acre-feet			
Armstrong	6,557	469	938	938	938	938	42,226
Carson	66,107	6,716	13,431	13,431	13,431	13,431	604,402
Childress	0	0	0	0	0	0	0
Collingsworth	1,371	154	307	307	307	307	13,833
Dallam	82,205	11,066	22,131	22,131	22,131	22,131	995,915
Donley	555	81	162	162	162	162	7,307
Gray	19,835	1,203	2,406	2,406	2,406	2,406	108,288
Hall	0	0	0	0	0	0	0
Hansford	122,969	7,760	15,519	15,519	15,519	15,519	698,376
Hartley	2,447	355	709	709	709	709	31,920
Hemphill	590	49	97	97	97	97	4,377
Hutchinson	11,703	1,763	3,526	3,526	3,526	3,526	158,662
Lipscomb	672	49	98	98	98	98	4,390
Moore	59,040	7,003	14,007	14,007	14,007	14,007	630,306
Ochiltree	30,381	2,523	5,045	5,045	5,045	5,045	227,026
Oldham	27,832	2,491	4,983	4,983	4,983	4,983	224,226
Potter	27,609	2,424	4,849	4,849	4,849	4,849	218,200
Randall	33,382	3,855	7,710	7,710	7,710	7,710	346,942
Roberts	1,552	109	219	219	219	219	9,835
Sherman	6,938	899	1,798	1,798	1,798	1,798	80,914
Wheeler	0	0	0	0	0	0	0
Total	501,746	48,968	97,937	97,937	97,937	97,937	4,407,145

[1] 20 percent additional furrow irrigated acres to be converted to LEPA by 2010 and 40 percent by 2020.

Table 11. Estimated water savings in acre-feet by county by decade when shifting furrow irrigated crops to DRIP[1] using PET irrigation water requirements that incorporates application efficiencies.

County	Furrow Irrigated Acres	Annual Water Savings for selected years					Total for 50 years
		2010	2020	2030	2040	2050	
				acre-feet			
Armstrong	6,557	122	244	366	366	366	14,656
Carson	66,107	1,753	3,506	5,259	5,259	5,259	210,375
Childress	0	0	0	0	0	0	0
Collingsworth	1,371	40	80	121	121	121	4,823
Dallam	82,205	2,811	5,623	8,434	8,434	8,434	337,376
Donley	555	21	42	63	63	63	2,526
Gray	19,835	310	620	929	929	929	37,172
Hall	0	0	0	0	0	0	0
Hansford	122,969	2,005	4,010	6,016	6,016	6,016	240,621
Hartley	2,447	90	180	270	270	270	10,798
Hemphill	590	13	26	39	39	39	1,545
Hutchinson	11,703	449	897	1,346	1,346	1,346	53,840
Lipscomb	672	13	25	38	38	38	1,524
Moore	59,040	1,785	3,571	5,356	5,356	5,356	214,243
Ochiltree	30,381	647	1,294	1,941	1,941	1,941	77,620
Oldham	27,832	657	1,315	1,972	1,972	1,972	78,892
Potter	27,609	640	1,280	1,920	1,920	1,920	76,803
Randall	33,382	1,009	2,018	3,028	3,028	3,028	121,106
Roberts	1,552	28	56	85	85	85	3,388
Sherman	6,938	229	459	688	688	688	27,537
Wheeler	0	0	0	0	0	0	0
Total	501,746	12,624	25,247	37,871	37,871	37,871	1,514,845

[1]Five percent furrow irrigated acres to be converted to drip by 2010, 10 percent by 2020, and 15 percent by 2030.

The investment needs to be made in more efficient irrigation technologies to capture estimated water savings. The investment costs for the alternative irrigation systems at four pumping lift levels including the well, pump, engine and distribution system costs are presented in Table 12. Furrow requires the least capital investment, $62,690 ($391.81 per acre), at 250 feet lift but is considered the most labor-intensive method of irrigation, as the pipes are often moved manually. A furrow system can easily be converted to surge flow by adding surge valves to the system. Surge flow requires an investment of $65,890 ($411.81 per acre) for a 250 feet lift. Additional investment to change from furrow to surge flow is only $20 per acre but application efficiency is improved from 60.00 percent to 75.00 percent.

The investment costs required for MESA, LESA, and LEPA are $79,740 ($637.92 per acre), $84,350 ($674.80 per acre), and $86,012 ($688.10 per acre), respectively for a 250 feet lift. MESA can be converted to LESA with an additional investment of $36.88 per acre. Converting LESA to LEPA requires an additional investment of $13.30 per acre. Drip requires the highest capital investment; however, it is considered the least labor-intensive method of irrigation due to automation.

At a pumping lift of 550 feet, the furrow system requires an investment of $110,077 ($687.98 per acre) for the well, pump, engine and distribution system on 160 acres where the subsurface drip requires an investment of $216,784 ($1,354.90 per acre) to irrigate the same number of acres. Additional investment cost above furrow for LESA, LEPA, and drip at 350 feet lift is $303.98, $317.28, and $666.92 per acre, respectively. The additional investment cost is also presented in Table 12.

Operating costs have two components, fixed and variable costs. The fixed costs include depreciation, taxes, insurance and interest charges associated with the investment. The variable costs are comprised of fuel charges, lubrication, maintenance, repair charges and labor costs. The annual fixed costs are calculated for corn using an average water requirement of 18.82 acre-inches per acre. These costs are shown in Table 13 for four pumping lift levels for each irrigation system.

The fixed costs range from $1.38 per acre-inch at 250 feet to $2.33 per acre-inch at 550 feet for furrow. The fixed costs to pump and distribute an acre-inch of water with MESA, LESA, and LEPA at 250 feet lift are $2.84, $3.51, and $3.90, respectively. Per acre-inch fixed costs at 550 feet lift with MESA, LESA, and LEPA increase to $4.43, $5.30, and $5.82, respectively. The fixed costs per acre-inch range from $5.17 at 250 feet to $6.71 at 550 feet for drip.

The variable costs per acre-inch of water pumped at four pumping lifts under each alternative irrigation system are calculated. Variable costs include fuel, lubrication, maintenance, repair charges and labor costs. The variable costs are also presented in Table 13. The variable costs range from $3.49 per acre-inch at 250 feet to $5.65 per acre-inch at 550 feet for furrow. The variable costs range from $3.33 at 250 feet to $5.56 at 550 feet for drip.

Table 12. Investment costs for alternative irrigation systems at four pumping lift levels, Region A.

Irrigation System/ Lift	Well	Pump	Engine	Distribution System	Total Investment	Acres Irrigated	Investment Cost	Additional Investment Cost above Furrow
			Dollars			acres	$/acre	
Furrow								
250’	18,700	14,040	3,500	26,450	62,690	160	391.81	
350’	23,625	19,610	5,000	26,450	74,685	160	466.78	
450’	28,000	23,520	5,500	26,450	83,470	160	521.69	
550’	34,312	29,315	20,000	26,450	110,077	160	687.98	
Surge Flow								
250’	18,700	14,040	3,500	29,650	65,890	160	411.81	20.00
350’	23,625	19,610	5,000	29,650	77,885	160	486.78	20.00
450’	28,000	23,520	5,500	29,650	86,670	160	541.69	20.00
550’	34,312	29,315	20,000	29,650	113,277	160	707.98	20.00
MESA								
250’	18,700	14,040	3,500	43,500	79,740	125	637.92	246.11
350’	23,625	19,610	5,000	43,500	91,735	125	733.88	267.10
450’	28,000	23,520	5,500	43,500	100,520	125	804.16	282.47
550’	34,312	29,315	20,000	43,500	127,127	125	1,017.02	329.04
LESA								
250’	18,700	14,040	3,500	48,110	84,350	125	674.80	282.99
350’	23,625	19,610	5,000	48,110	96,345	125	770.76	303.98
450’	28,000	23,520	5,500	48,110	105,130	125	841.04	319.35
550’	34,312	29,315	20,000	48,110	131,737	125	1,053.90	365.92
LEPA								
250’	18,700	14,040	3,500	49,772	86,012	125	688.10	296.29
350’	23,625	19,610	5,000	49,772	98,007	125	784.06	317.28
450’	28,000	23,520	5,500	49,772	106,792	125	854.34	332.65
550’	34,312	29,315	20,000	49,772	133,399	125	1,067.19	379.21
DRIP								
250’	18,700	14,040	3,500	133,157	169,397	160	1,058.73	666.92
350’	23,625	19,610	5,000	133,157	181,392	160	1,133.70	666.92
450’	28,000	23,520	5,500	133,157	190,177	160	1,188.61	666.92
550’	34,312	29,315	20,000	133,157	216,784	160	1,354.90	666.92

Table 13. Total pumping costs using natural gas as fuel to pump water from the Ogallala aquifer at four levels of pumping lifts for six irrigation systems, Region A.

System/Lift	250'	350'	450'	550'
	Dollars/acre-inch			
FF				
Fixed Cost	1.38	1.71	1.92	2.33
Variable Cost	3.49	4.20	4.93	5.65
Total Cost	4.87	5.91	6.85	7.98
SF				
Fixed Cost	1.81	2.22	2.49	3.00
Variable Cost	3.69	4.41	5.16	5.88
Total Cost	5.50	6.63	7.65	8.88
MESA				
Fixed Cost	2.84	3.39	3.74	4.43
Variable Cost	3.31	4.03	4.88	5.55
Total Cost	6.15	7.42	8.62	9.98
LESA				
Fixed Cost	3.51	4.13	4.53	5.30
Variable Cost	3.32	4.06	4.83	5.59
Total Cost	6.83	8.19	9.36	10.89
LEPA				
Fixed Cost	3.90	4.56	4.99	5.82
Variable Cost	3.38	4.12	4.90	5.67
Total Cost	7.28	8.68	9.89	11.49
DRIP				
Fixed Cost	5.17	5.70	6.05	6.71
Variable Cost	3.33	4.06	4.81	5.56
Total Cost	8.50	9.76	10.86	12.27

Change in Crop Type

One method of reducing groundwater use is changing the crop type that is planted. The assumption is that corn acres will be converted to sorghum, cotton or soybean acres, soybean acres will be diverted to wheat acres, sorghum acres will be shifted to wheat acres at the rate of 20 percent by 2010 and 40 percent by 2020. Irrigated acres will be changed to dryland acres at the rate of 5 percent by 2010, 10 percent by 2020, and 15 percent by 2030-2050.

Two methodologies for calculating water savings in acre-feet are examined for six cropping alternatives. One approach utilizes the difference in PET irrigation water use estimates by crop and county that were developed in Task 2 that incorporates the application efficiency rating. The water use estimates are presented in Appendix A. The second approach uses a flat rate of water savings of 5 acre-inches per year irrespective of crop type.

The estimated water savings by county and decade when changing from a high water use crop to an intermediate or low water use crop are located in Tables 14 through 18. When shifting

322,833 irrigated corn acres to sorghum, cotton or soybeans, there is water saving of 4,556,012, 5,285,830, and 5,769,420 acre-feet, respectively, for the time period of 2000 to 2050. There is water saving of 403,660 acre-feet when converting 77,300 acres of sorghum to wheat. There is an additional water saving of 3,830 acre-feet upon changing 2,650 soybean acres to wheat acres.

Table 14. Estimated water savings in acre-feet by county by decade when converting from irrigated corn to irrigated sorghum using the PET irrigation water requirement that incorporates application efficiencies.

County	Irrigated Corn Acres	Annual water savings for selected years					Total For 50 years
		2010	2020	2030	2040	2050	
				acre-feet			
Armstrong	1,200	195	390	390	390	390	17,550
Carson	15,200	2,348	4,697	4,697	4,697	4,697	211,356
Childress	0	0	0	0	0	0	0
Collingsworth	750	138	275	275	275	275	12,375
Dallam	157,000	23,864	47,728	47,728	47,728	47,728	2,147,760
Donley	2,500	422	844	844	844	844	37,988
Gray	7,100	1,065	2,130	2,130	2,130	2,130	95,850
Hall	1,500	218	437	437	437	437	19,643
Hansford	49,000	6,378	12,756	12,756	12,756	12,756	574,035
Hartley	87,400	13,867	27,735	27,735	27,735	27,735	1,248,072
Hemphill	0	0	0	0	0	0	0
Hutchinson	14,500	2,811	5,621	5,621	5,621	5,621	252,953
Lipscomb	2,200	358	715	715	715	715	32,175
Moore	87,800	13,814	27,628	27,628	27,628	27,628	1,243,248
Ochiltree	17,000	2,839	5,678	5,678	5,678	5,678	255,510
Oldham	862	153	305	305	305	305	13,732
Potter	971	169	339	339	339	339	15,235
Randall	5,500	969	1,938	1,938	1,938	1,938	87,203
Roberts	2,100	293	587	587	587	587	26,397
Sherman	70,700	11,654	23,307	23,307	23,307	23,307	1,048,835
Wheeler	960	171	342	342	342	342	15,379
Total	524,243	81,725	163,451	163,451	163,451	163,451	7,355,293

Table 15. Estimated water savings in acre-feet by county by decade when converting from irrigated corn to irrigated cotton using the PET irrigation water requirement that incorporates application efficiencies.

County	Irrigated Corn Acres	Annual water savings for selected years					Total For 50 years
		2010	2020	2030	2040	2050	
				acre-feet			
Armstrong	1,200	220	441	441	441	441	19,836
Carson	15,200	2,792	5,583	5,583	5,583	5,583	251,256
Childress	0	0	0	0	0	0	0
Collingsworth	750	141	282	282	282	282	12,679
Dallam	157,000	28,783	57,567	57,567	57,567	57,567	2,590,500
Donley	2,500	469	938	938	938	938	42,225
Gray	7,100	1,266	2,532	2,532	2,532	2,532	113,955
Hall	1,500	256	511	511	511	511	22,995
Hansford	49,000	7,807	15,615	15,615	15,615	15,615	702,660
Hartley	87,400	15,878	31,755	31,755	31,755	31,755	1,428,990
Hemphill	0	0	0	0	0	0	0
Hutchinson	14,500	3,207	6,414	6,414	6,414	6,414	288,623
Lipscomb	2,200	403	807	807	807	807	36,300
Moore	87,800	15,248	30,496	30,496	30,496	30,496	1,372,314
Ochiltree	17,000	3,222	6,443	6,443	6,443	6,443	289,935
Oldham	862	170	339	339	339	339	15,257
Potter	971	188	376	376	376	376	16,910
Randall	5,500	1,074	2,149	2,149	2,149	2,149	96,690
Roberts	2,100	354	708	708	708	708	31,878
Sherman	70,700	13,268	26,536	26,536	26,536	26,536	1,194,123
Wheeler	960	200	401	401	401	401	18,029
Total	524,243	94,946	189,892	189,892	189,892	189,892	8,545,154

Table 16. Estimated water savings in acre-feet by county by decade when converting from irrigated corn to irrigated soybeans using the PET irrigation water requirement that incorporates application efficiencies.

County	Irrigated Corn Acres	Annual water savings for selected years					Total for 50 years
		2010	2020	2030	2040	2050	
		acre-feet					
Armstrong	1,200	247	494	494	494	494	22,230
Carson	15,200	3,063	6,126	6,126	6,126	6,126	275,652
Childress	0	0	0	0	0	0	0
Collingsworth	750	154	309	309	309	309	13,894
Dallam	157,000	31,008	62,015	62,015	62,015	62,015	2,790,675
Donley	2,500	518	1,037	1,037	1,037	1,037	46,650
Gray	7,100	1,381	2,762	2,762	2,762	2,762	124,286
Hall	1,500	272	544	544	544	544	24,458
Hansford	49,000	8,003	16,007	16,007	16,007	16,007	720,300
Hartley	87,400	17,320	34,640	34,640	34,640	34,640	1,558,779
Hemphill	0	0	0	0	0	0	0
Hutchinson	14,500	3,284	6,569	6,569	6,569	6,569	295,583
Lipscomb	2,200	443	887	887	887	887	39,897
Moore	87,800	16,565	33,130	33,130	33,130	33,130	1,490,844
Ochiltree	17,000	3,417	6,834	6,834	6,834	6,834	307,530
Oldham	862	193	385	385	385	385	17,326
Potter	971	216	431	431	431	431	19,401
Randall	5,500	1,230	2,460	2,460	2,460	2,460	110,715
Roberts	2,100	376	752	752	752	752	33,831
Sherman	70,700	14,894	29,788	29,788	29,788	29,788	1,340,472
Wheeler	960	208	415	415	415	415	18,691
Total	524,243	102,791	205,582	205,582	205,582	205,582	9,251,212

Table 17. Estimated water savings in acre-feet by county by decade when converting from irrigated sorghum to irrigated wheat using the PET irrigation water requirement that incorporates application efficiencies.

County	Irrigated Sorghum Acres	Annual water savings for selected years					Total For 50 years
		2010	2020	2030	2040	2050	
		acre-feet					
Armstrong	2,100	167	334	334	334	334	15,026
Carson	23,400	1,513	3,026	3,026	3,026	3,026	136,188
Childress	467	43	86	86	86	86	3,867
Collingsworth	1,600	134	267	267	267	267	12,024
Dallam	8,000	455	909	909	909	909	40,920
Donley	1,400	128	256	256	256	256	11,529
Gray	5,100	409	818	818	818	818	36,797
Hall	163	6	13	13	13	13	577
Hansford	21,800	0	0	0	0	0	0
Hartley	8,200	421	842	842	842	842	37,884
Hemphill	206	19	38	38	38	38	1,727
Hutchinson	4,200	537	1,074	1,074	1,074	1,074	48,321
Lipscomb	1,900	166	331	331	331	331	14,906
Moore	22,000	1,082	2,163	2,163	2,163	2,163	97,350
Ochiltree	12,300	779	1,558	1,558	1,558	1,558	70,110
Oldham	10,500	611	1,222	1,222	1,222	1,222	54,968
Potter	1,500	99	199	199	199	199	8,933
Randall	14,800	1,019	2,037	2,037	2,037	2,037	91,686
Roberts	2,000	94	188	188	188	188	8,460
Sherman	20,500	1,220	2,440	2,440	2,440	2,440	109,778
Wheeler	906	106	212	212	212	212	9,527
Total	163,042	9,006	18,013	18,013	18,013	18,013	810,575

Table 18. Estimated water savings in acre-feet by county by decade when converting from irrigated soybeans to irrigated wheat using the PET irrigation water requirement that incorporates application efficiencies.

County	Irrigated Soybeans Acres	Annual water savings for selected years					Total for 50 years
		2010	2020	2030	2040	2050	
		acre-feet					
Armstrong	0	0	0	0	0	0	0
Carson	3,700	65	131	131	131	131	5,883
Childress	0	0	0	0	0	0	0
Collingsworth	0	0	0	0	0	0	0
Dallam	700	8	16	16	16	16	714
Donley	225	12	24	24	24	24	1,073
Gray	1,500	54	107	107	107	107	4,815
Hall	0	0	0	0	0	0	0
Hansford	9,400	0	0	0	0	0	0
Hartley	900	11	21	21	21	21	959
Hemphill	0	0	0	0	0	0	0
Hutchinson	915	87	174	174	174	174	7,837
Lipscomb	880	42	85	85	85	85	3,815
Moore	1,900	34	68	68	68	68	3,050
Ochiltree	4,400	129	258	258	258	258	11,616
Oldham	0	0	0	0	0	0	0
Potter	0	0	0	0	0	0	0
Randall	0	0	0	0	0	0	0
Roberts	0	0	0	0	0	0	0
Sherman	50	1	1	1	1	1	62
Wheeler	0	0	0	0	0	0	0
Total	24,570	442	885	885	885	885	39,823

The anticipated water savings by decade (2000-2050) and by county when shifting irrigated acres to dryland acres, at the assumed rate of 5 percent by 2010, 10 percent by 2020, and 15 percent by 2030-2050, for the six counties are presented in Table 19. Dallam County has the largest number of irrigated acres, 276,588, and Potter County has the smallest number of irrigated acres, 28,219. Subsequently, the largest estimated water savings will occur in Dallam County at 2,190,914 acre-feet for the 50 years and the smallest water savings will result in Potter County at 145,863 acre-feet.

Table 19. Estimated water savings in acre-feet by county by decade when converting from irrigated crops to dryland using the PET irrigation water requirement that incorporates application efficiencies.

County	Irrigated Acres	Annual water savings for selected years					Total for 50 years
		2010	2020	2030	2040	2050	
				acre-feet			
Armstrong	8,616	302	605	907	907	907	36,275
Carson	92,810	4,623	9,246	13,869	13,869	13,869	554,759
Childress	917	56	112	168	168	168	6,737
Collingsworth	4,719	195	390	585	585	585	23,397
Dallam	276,588	18,258	36,515	54,773	54,773	54,773	2,190,914
Donley	7,207	514	1,027	1,541	1,541	1,541	61,624
Gray	34,311	1,021	2,042	3,062	3,062	3,062	122,497
Hall	2,378	130	260	391	391	391	15,630
Hansford	191,617	5,928	11,856	17,784	17,784	17,784	711,366
Hartley	137,090	9,786	19,572	29,358	29,358	29,358	1,174,308
Hemphill	3,547	143	286	430	430	430	17,183
Hutchinson	28,228	2,084	4,168	6,253	6,253	6,253	250,107
Lipscomb	15,450	556	1,112	1,668	1,668	1,668	66,712
Moore	171,405	9,969	19,939	29,908	29,908	29,908	1,196,320
Ochiltree	57,200	2,328	4,657	6,985	6,985	6,985	279,418
Oldham	30,182	1,324	2,649	3,973	3,973	3,973	158,939
Potter	28,219	1,216	2,431	3,647	3,647	3,647	145,863
Randall	44,570	2,523	5,046	7,569	7,569	7,569	302,761
Roberts	8,332	288	575	863	863	863	34,530
Sherman	150,833	9,579	19,159	28,738	28,738	28,738	1,149,519
Wheeler	2,833	203	406	609	609	609	24,377
Totals	1,297,052	71,027	142,054	213,081	213,081	213,081	8,523,236

Water savings from the change in crop type by crop for 50 years are summarized in Table 20. Estimated water savings due to conversion of irrigated crop acres to dryland farming in six counties of Region A are also given in Table 20. It is anticipated that conversion of irrigated land into dryland farming in six counties will result in estimated water savings of 5,144,315 acre-feet over next 50 years.

Table 20. Water savings in acre-feet when changing crop types for the next 50 years (2001-2050) for all 21 counties in Region A using PET water use estimates calculated in Task 2 that incorporates the application efficiency rating for each system, and 5 acre-inches per year.

Water Savings Approach/Crop change Scenario	Corn Converted to Sorghum	Corn Converted to Cotton	Corn Converted to Soybeans	Sorghum Converted to Wheat	Soybeans Converted To Wheat	Irrigated Converted to Dryland Crop acres
	---------------------------cumulative acre-feet----------------------------					
Using PET Water	7,355,293	8,545,154	9,251,212	810,575	39,823	8,523,236
Using 5 ac-in/yr.	3,931,823	3,931,823	3,931,823	1,222,815	184,275	3,242,630

Implementing Conservation Tillage Methods

It is assumed that two acre-inches of groundwater on an annual basis will be saved by implementing conservation tillage methods. In the initial year of 2000, it is assumed that 50 percent of the acres will already be utilizing these conservation practices. It is also anticipated that 60 percent of the acres in the years 2001 to 2010 and 70 percent of the acres in the years 2011 to 2050 will be under conservation tillage. The expected total water savings for 2001 to 2050 are located in Table 21.

Table 21. Estimated water savings in acre-feet for irrigated acres for the next 50 years (2001-2050) in all counties of Region A by implementing conservation tillage.

County	Irrigated Acres[1]	Annual Water Savings (acre-feet)				
		2010	2020	2030	2040	2050
Armstrong	9,476	158	316	316	316	316
Carson	93,010	1,550	3,100	3,100	3,100	3,100
Childress	3,486	58	116	116	116	116
Collingsworth	20,789	346	693	693	693	693
Dallam	284,588	4,743	9,486	9,486	9,486	9,486
Donley	12,543	209	418	418	418	418
Gray	35,041	584	1,168	1,168	1,168	1,168
Hall	15,787	263	526	526	526	526
Hansford	193,117	3,219	6,437	6,437	6,437	6,437
Hartley	139,290	2,322	4,643	4,643	4,643	4,643
Hemphill	4,421	74	147	147	147	147
Hutchinson	28,253	471	942	942	942	942
Lipscomb	24,640	411	821	821	821	821
Moore	171,405	2,857	5,714	5,714	5,714	5,714
Ochiltree	57,459	958	1,915	1,915	1,915	1,915
Oldham	30,182	503	1,006	1,006	1,006	1,006
Potter	28,219	470	941	941	941	941
Randall	46,855	781	1,562	1,562	1,562	1,562
Roberts	8,332	139	278	278	278	278
Sherman	152,205	2,537	5,074	5,074	5,074	5,074
Wheeler	4,340	72	145	145	145	145
Total	1,363,438	22,724	45,448	45,448	45,448	45,448

[1]Irrigated acres were calculated and obtained from Task 2.

Precipitation Enhancement

The remaining water management strategy is precipitation enhancement. It is assumed that there will be no acres utilizing precipitation enhancement in the baseline year of 2000. However, it is expected that 100 percent of the acres will be using this technology for the years 2001 to 2050. The estimated water saving is one acre-inch annually. The estimated water savings are presented in Table 22.

Table 22. Estimated water savings in acre-feet for the next 50 years (2000-2050) for all counties of Region A by using precipitation enhancement.

County	Irrigated Acres[1]	Annual Water Savings (acre-feet)				
		2010	2020	2030	2040	2050
Armstrong	9,476	790	790	790	790	790
Carson	93,010	7,751	7,751	7,751	7,751	7,751
Childress	3,486	291	291	291	291	291
Collingsworth	20,789	1,732	1,732	1,732	1,732	1,732
Dallam	284,588	23,716	23,716	23,716	23,716	23,716
Donley	12,543	1,045	1,045	1,045	1,045	1,045
Gray	35,041	2,920	2,920	2,920	2,920	2,920
Hall	15,787	1,316	1,316	1,316	1,316	1,316
Hansford	193,117	16,093	16,093	16,093	16,093	16,093
Hartley	139,290	11,608	11,608	11,608	11,608	11,608
Hemphill	4,421	368	368	368	368	368
Hutchinson	28,253	2,354	2,354	2,354	2,354	2,354
Lipscomb	24,640	2,053	2,053	2,053	2,053	2,053
Moore	171,405	14,284	14,284	14,284	14,284	14,284
Ochiltree	57,459	4,788	4,788	4,788	4,788	4,788
Oldham	30,182	2,515	2,515	2,515	2,515	2,515
Potter	28,219	2,352	2,352	2,352	2,352	2,352
Randall	46,855	3,905	3,905	3,905	3,905	3,905
Roberts	8,332	694	694	694	694	694
Sherman	152,205	12,684	12,684	12,684	12,684	12,684
Wheeler	4,340	362	362	362	362	362
	1,363,438	113,620	113,620	113,620	113,620	113,620

[1]Irrigated acres were calculated and obtained from Task 2.

Summary of Costs and Estimated Water Savings of six Water Management Strategies

This section includes a brief description of the methodology to estimate the cost to implement each proposed water management strategy. The estimated costs are represented in terms of 1999-dollar values. The investment cost for PET, change in irrigation equipment, and cost for conversion of irrigated land to dryland is amortized over 25 years at 6 percent interest rate to assess annualized cost for these strategies. The estimated cost of water saved is equal to annual cost divided by estimated water saved.

North Plains Potential Evapotranspiration (NPPET) Network is one of the most successful water management programs in Texas. Producers in Region A use it to make irrigation decisions on an estimated 20 percent of the irrigated land. Currently, there are ten stations located throughout the Region. The network is assumed to be expanded to serve 70 percent and 90 percent of the irrigated acres by 2010 and 2020, respectively. To meet this objective six additional stations will be added at an estimated cost of $76,000 or $0.06 per acre. The annual cost for maintaining all stations has been estimated at $171,500 or $0.13 per acre. This results in an amortized cost to implement this strategy of $0.1347 per acre per year resulting in an estimated cost of $0.81 per acre-foot/acre/year of water savings. These results are presented in Table 23.

Table 23. Cost estimates for implementation of proposed strategies and corresponding estimated cost of water savings from each water management strategy.

Strategy	Cost of Implementation of Strategy	Annual Cost	Water Savings	Cost/ac-ft
	$/ac	$/ac	ac-ft/ac/year	$/ac-ft/ac/yr
PET				
Capital cost $0.06/ac	0.06	0.0047		
Maintenance cost $0.13/ac/yr		0.1300		
Total		0.1347	0.17	0.81
Crop Variety				
Long Season Corn to Short Season Corn	17.97	17.97	0.17	107.82
Long Season Sorghum to Short Season Sorghum	2.76	2.76	0.17	16.56
Equipment Change				
Furrow to Surge	20.00	1.56	0.34	4.60
Furrow to LESA	303.98	23.78	0.54	44.04
Furrow to LEPA	317.28	24.82	0.59	42.07
Furrow to DRIP	666.92	52.17	0.66	79.05
Crop Type				
Corn to Sorghum	102.26	102.26	0.75	136.35
Corn to Cotton	46.36	46.36	0.92	50.57
Corn to Soybeans	105.50	105.50	0.96	110.09
Sorghum to Wheat	20.53	20.53	0.27	76.99
Soybeans to Wheat	17.29	17.29	0.06	296.40
Irrigated to Dry-land	584.00	45.68	0.98	46.61
Conservation Tillage		6.25	0.17	37.43
Precipitation Enhancement		0.09	0.08	1.08

Two scenarios in the change in crop variety strategy include moving from long season corn to short season corn and from long season sorghum to short season sorghum. The estimated water saving from these strategies was assumed to be two acre-inches per acre. It has been assumed that there will be 15 percent loss of yield with the change in crop variety and there will be 15 percent savings on fertilizer cost along with yield and water related savings in variable cost. The net loss of income from long season corn to short season corn has been estimated at $17.97 per acre. Hence, the cost of water saved is $107.82 per acre-foot. Shifting long season sorghum to short season sorghum resulted in a net loss in income of $2.76 per acre and an estimated cost of water saving of $16.56 per acre-foot.

The additional investment in dollars for converting furrow irrigation to surge flow, LESA, LEPA, and drip is $20.00, $303.98, $317.28, and $666.92 per acre, respectively. The corresponding annualized cost per acre for each strategy is $1.56, $23.78, $24.82, and $52.17, respectively. The estimated water saving in acre-foot/acre/year from furrow to surge flow is 0.34, from furrow to LESA is 0.54, from furrow to LEPA is 0.59, and from furrow to drip is 0.66. The estimated cost of water saving for each alternative is $4.60, $44.04, $42.07, and $79.05 per acre-foot/acre/year, respectively. The results indicate that surge flow has the lowest investment cost and the lowest water saving. However, it is more labor intensive than LESA, LEPA and DRIP. That is the reason for low adoption rate of surge flow. Drip irrigation has the highest investment cost and the highest water savings but it is the most expensive method in terms of cost of water saved. The cost of water saved using sprinkler irrigation is approximately half of the cost of water saved from drip. Sprinkler irrigation has benefits of savings from field operations, labor, and chemigation in addition to water savings. These are some of the reasons for the accelerated adoption rate of center pivot irrigation in the region.

Six scenarios are evaluated for change in crop type. The conversions include shifting from corn to sorghum, corn to cotton, corn to soybeans, sorghum to wheat, soybeans to wheat, and irrigated crops to dryland crops. The loss in income is calculated for each crop type conversion. The gain in variable cost is also calculated for each change. The net loss of income is calculated by subtracting gain in variable cost from loss of income. The net loss in income is the cost of water saved except conversion from irrigated to dryland scenario.

It is assumed that value of irrigated land with good and fair water is $1,050 and $600 per acre, respectively (Texas Chapter of American Society of Farm Managers and Rural Appraisers, 2000). Composite of irrigated acres in six counties indicates 52 percent of high water use and 48 percent medium water use. The value of dry cropland is $250 per acre. The net loss in value of land for high and medium water use is $800 and $350 per acre, respectively. Using the composite, net loss in value of land is estimated at $584 per acre. The net loss in land value is the cost of water saving from converting irrigated land to dryland farming. This amount is amortized for 25 years at 6 percent interest to assess annualized cost. The estimated cost, water saved and cost of water saved from each scenario is presented in Table 23.

The net loss of income from corn to sorghum, corn to cotton, corn to soybeans, sorghum to wheat, soybeans to wheat, and irrigated to dryland farming has been estimated at $102.26, $46.36, $105.50, $20.53, $17.29, and $45.68 per acre/year, respectively. The estimated water savings for these crop type changes are 0.75, 0.92, 0.96, 0.27, 0.06, and 0.98 acre-foot/acre/year, respectively. Hence, the cost of water saved is $136.35, $50.57, $110.09, $76.99, $296.40, and $46.61 per acre-foot/acre/year. These results indicate that conversion of irrigated land to dryland farming is the most economical option in terms of cost of water savings. The second and third economical crop type changes are moving from corn to cotton and sorghum to wheat, respectively. However, both of these alternatives face limited feasibility since cotton may not be able to be successfully grown on corn ground and sorghum and wheat do not compete for the same water with respect to pumping season. Converting soybean acres to wheat results in a negligible quantity of water saved per acre. Hence, it is the most expensive alternative to save water.

Implementing conservation tillage methods such as no till and minimum tillage is assumed to save two acre-inches of groundwater on an annual basis. It is assumed that the conservation tillage costs 25 percent above the cost of conventional tillage. It is important to note that the cost of conservation tillage relative to conventional tillage is highly variable depending on recurrent weed pressure, conservation practices utilized, and fuel prices. The cost of conservation tillage is assumed to be $6.25 per acre/year. This results in a cost of water saved of $37.43 per acre-foot/acre/year.

Precipitation enhancement efforts are being implemented in seven areas of Texas. There are two water districts in Region A in early phases of development. The budget analysis of existing programs indicates an average cost around nine cents per acre (PRPC, 2000). The same has been assumed in this report. The estimated water saving is one acre-inch annually. Hence, the cost of water saved from this strategy is $1.08 per acre-foot/acre/year.

Estimated Economic Value of Water to Irrigated Crop Producers, Region A

The accurate assessment of the value of water or an irrigated producer's ability to pay for the water is very difficult without knowing the producer's specific situation. An individual producer's ability to pay for water depends on the crop grown, well depth, fuel cost, age and type of equipment used, tillage systems employed, market price, soil productivity among other factors. Therefore, any assessment made should be viewed as approximate and not definitive.

Two breakeven water prices are calculated by crop in this analysis, each with a specific significance. The first breakeven price is where the price of water makes gross receipts equal variable costs (out-of-pocket expenditures after adjusting for the best dryland alternative). At this price a producer is indifferent whether he irrigates or not in a given crop season. If the price of water is higher than the breakeven, the producer is better off to shut the pumps off and go dryland. Conversely, if the price is lower then the producer is better off to pump.

The second breakeven price calculated refers to the price a producer could pay for water and cover total cost. Total cost includes all variable cost (out-of-pocket expenses) and the fixed cost associated with depreciation and repairs of farming and irrigation equipment and land costs. Paying above this breakeven over the long term jeopardizes the producer's ability to remain a viable irrigated operation.

The costs, yields and associated water requirements for the projected 2000 crop budgets published by the Texas Agricultural Extension Service for the area were used in this analysis. Budgets were adjusted to reflect five-year price averages and the newly developed irrigation costs

(Task 4). All crops analyzed were assumed to be under LESA systems utilizing natural gas as power source at the rate of $2.71 per mcf with a lift of 350 feet. The crop characteristics, costs and return assumptions are given in Table 24.

Table 24. Crop characteristics, cost, and return assumptions for calculating breakeven water prices.

Crop	Ac-in applied	Yield	Unit	Five-year Price	Gross Receipts	Variable Cost	Return over VC	Total Cost
	--------------------------------------Irrigated Crops--------------------------------------							
Peanuts	13	2.25	ton	325.00	731.25	445.57	285.68	655.58
Cotton[1]	12	650	lbs	0.70	496.60	348.55	148.05	527.24
Corn	20	200	bu	2.78	556.00	339.66	216.34	528.12
Wheat[2]	15	65	bu	3.51	276.15	167.35	108.80	297.93
Hay-alfalfa	24	5.5	ton	106.24	584.32	285.36	298.96	518.21
Soybeans	16	50	bu	5.66	283.00	179.66	103.34	321.73
Sorghum	14	70	cwt	4.36	305.20	188.35	116.85	338.01
	------------------------------------Dryland Alternatives------------------------------------							
Cotton[1]		275	lbs	0.70	210.10	198.06	12.04	291.21
Sorghum		22	bu	4.36	95.92	60.47	35.45	96.99
Wheat[2]		18	bu	3.51	78.93	37.54	41.39	72.07

[1]Gross receipts for cotton include a value for cottonseed.
[2]Gross receipts for wheat include a grazing income.

In addition, it is assumed that farm program payments scheduled to cease in 2002 will be continued in some form. Future farm program payments were assumed to be equivalent to the management fee assessed against the crops above the cost of farm labor. Therefore, management fee and farm program payments were assumed to offset each other and not included in this analysis.

Two scenarios were considered in this analysis. Scenario 1 assumed five-year average prices existed, natural gas price of $2.71 per mcf and cost structure presented in the 2000 Extension budgets for the area. Scenario 2 utilizes the same assumptions with the exceptions of natural gas prices at $4.00 per mcf and crop prices 10 percent below the five-year average. Scenario 2 was developed to provide insight into the impact of low prices and high energy costs similar to this year on irrigated producers.

The results of these two scenarios are given in Table 25. In Scenario 1, the breakeven price producers could pay for an acre-inch ranged from $8.11 for soybeans to $23.08 for peanuts before it became profitable to go to the best dryland alternative. These breakeven prices represent the prices producers could pay to end up with the same return over out-of-pocket expenses (variable costs) as a dryland producer. The relatively large difference between the projected pumping cost ($4.06) and the breakeven costs suggest little curtailing of pumping would occur.

Table 25. Estimated breakeven water prices for irrigated crop producers in Region A.

	Scenario 1[a]				Scenario 2[b]			
Crop	Break-even VC Water Price[c]	Estimated VC of water	Break-even TC Water Price	Estimated TC of water	Break-even VC Water Price[c]	Estimated VC of water	Break-even TC Water Price	Estimated TC of water
	---------------------$/ac-in-----------------------				---------------------$/ac-in-----------------------			
Peanuts	23.08	4.06	14.01	8.19	18.07	5.30	8.39	9.43
Cotton	13.2	4.06	5.64	8.19	9.72	5.30	1.50	9.43
Corn	12.96	4.06	9.58	8.19	10.56	5.30	6.80	9.43
Wheat	8.75	4.06	9.64	8.19	7.76	5.30	5.22	9.43
Hay-alfalfa	16.52	4.06	10.95	8.19	12.81	5.30	8.51	9.43
Soybeans	8.11	4.06	5.77	8.19	6.84	5.30	4.00	9.43
Sorghum	9.66	4.06	10.53	8.19	8.05	5.30	3.67	9.43

[a] Scenario 1 assumes 5-year average prices and natural gas price at $2.71/mcf.

[b] Scenario 2 assumes commodity prices 10 percent below 5-year price averages and natural gas price at $4.00/mcf.

[c] Variable cost (VC) breakeven price was calculated by utilizing the return over VC of the irrigated crop subtracting the return over VC of the dryland alternative crop and dividing by the acre-inches applied.

The second breakeven price calculated in Scenario 1 refers to the maximum an irrigated producer could pay for water to recover total cost. Total cost includes all variable costs and fixed costs associated with replacement of farming equipment, irrigation equipment and land charges. Most of the crops analyzed had a breakeven between $9.50-$11.00 per acre-inch. The estimated total cost per acre-inch of $8.19 suggests producers receive $1.50-$3.00 per acre-inch premium for irrigating over the long-term. No inferences can be made about the relative ranking of crops since small changes in the cost structure or water applied could easily affect rankings.

Further delineation of irrigation costs can provide implications for the ability of irrigated producers to pay for imported water over the long-term. Fuel comprises $2.61 of the $4.06 variable cost. Therefore, irrigated producers could pay $2.61 per acre-inch for water delivered to the pivot and still maintain their long-term returns to irrigation. The maximum a producer could pay under this scenario would be $4.11-$5.61 per acre-inch and still remain viable in the long run. The amount an irrigated producer could pay for the imported water could increase approximately $1.50 per acre-inch if he relied totally on imported water thus eliminating the need for investment in a well and pump.

The second scenario is presented simply to reflect the impact of lower commodity prices (10 percent lower than five-year average) and higher gas prices ($4.00 per mcf) similar to what is occurring this year. Again the variable cost breakeven for water are above the estimated variable cost of pumping water ($5.30) suggesting producers will still irrigate. However, the relative narrow difference in these values suggests that marginally productive acreage will leave production. Furthermore water applications have diminishing marginal returns, i.e., each additional acre-inch applied results in a smaller increase in production. Therefore, there will be a tendency for producers to skip or eliminate an application or two.

If the conditions presented in Scenario 2 persisted for an extended period of time, irrigated agriculture is in trouble. The breakeven price producers could pay for water to cover total cost ($1.50-$8.51 per acre-inch) was below the estimated cost of water ($9.43 per acre-inch) for every crop analyzed suggesting the long-term viability of irrigating these crops is questionable under a low priced commodity and high fuel price scenario.

In summary, most irrigated crop producers appear to receive $1.50-$3.00 per acre-inch return beyond the cost of irrigating. If this margin was maintained, producers could pay $2.61 per acre-inch for imported water delivered to the pivot or a maximum of $4.11-$5.61 (1.50 + 2.61 and 3.00 +2.61, respectively) per acre-inch before it wouldn't pay to irrigate. The amount a producer may be willing to pay could increase approximately $1.50 per acre-inch if they totally depend on imported water thus not having the well and pump costs. A situation like the current year with below average commodity prices and higher natural gas prices will result in a reduction in water pumped. If these conditions persist over extended period of time the viability of irrigated agriculture in the region is questionable.

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Appendix A

Table 1. Irrigation water requirements in acre-inches for corn, cotton, hay, pasture, peanuts, sorghum, soybeans, and wheat for Dallam, Moore, Oldham, Potter, Randall and Sherman Counties, 1997.

Irrigation Water Requirements by Crop and by County, 1997								
County	Corn	Cotton	Hay	Pasture	Peanuts	Sorghum	Soybeans	Wheat
				acre-inches				
Armstrong	18.92	7.90	36.47	27.18	11.33	9.17	6.57	4.40
Carson	18.92	7.90	34.02	25.16	11.63	9.65	6.83	5.77
Childress	19.33	7.92	33.27	24.41	11.44	9.67	6.64	4.15
Collingsworth	17.41	6.14	30.60	22.21	9.71	6.41	5.06	12.43
Dallam	20.32	9.32	31.83	23.71	13.27	11.20	8.47	7.79
Donley	18.24	6.98	32.27	23.66	10.59	8.11	5.80	2.62
Gray	16.89	6.19	30.38	22.10	9.70	7.89	5.22	3.08
Hall	13.68	3.46	24.17	17.02	6.65	4.95	2.81	2.59
Hansford	12.45	2.89	23.49	16.61	6.06	4.64	2.65	5.67
Hartley	20.10	9.20	35.69	26.85	12.87	10.58	8.21	7.50
Hemphill	17.48	9.49	31.43	22.90	9.99	7.67	5.21	2.08
Hutchinson	24.01	10.74	37.23	28.36	14.71	12.38	10.42	4.71
Lipscomb	17.25	6.25	31.34	22.86	9.89	7.50	5.16	2.27
Moore	18.20	7.78	32.84	23.34	11.15	8.76	6.88	5.81
Ochiltree	18.53	7.16	33.61	24.84	11.07	8.51	6.47	4.71
Oldham	22.66	10.86	39.22	29.73	14.45	12.04	9.26	8.55
Potter	21.83	10.22	38.24	28.75	13.73	11.37	8.51	7.40
Randall	21.94	10.22	38.17	28.68	13.74	11.37	8.52	7.24
Roberts	14.42	4.30	26.48	18.93	7.56	6.04	3.68	3.22
Sherman	21.05	9.79	37.42	28.18	13.37	11.16	8.41	7.59
Wheeler	21.63	9.11	34.78	26.15	13.24	10.95	8.65	3.94

Appendix B

Table 1. Estimated water savings in acre-feet by county by decade when shifting furrow irrigated corn to corn under surge flow using PET irrigation water requirements that incorporates application efficiencies.

County	Furrow Irrigated Acres	Annual Savings, 75 %acres converted	Annual Savings, 95 %acres converted	2010	2020	2030	2040	2050	Total for 50 years
Armstrong	913	86	173	865	1,729	1,729	1,729	1,729	7,781
Carson	10,827	1,025	2,050	10,249	20,498	20,498	20,498	20,498	92,243
Childress	0	0	0	0	0	0	0	0	0
Collingsworth	218	19	38	190	379	379	379	379	1,706
Dallam	46,662	4,744	9,488	47,440	94,880	94,880	94,880	94,880	426,960
Donley	193	18	35	176	352	352	352	352	1,584
Gray	4,104	347	694	3,468	6,937	6,937	6,937	6,937	31,214
Hall	0	0	0	0	0	0	0	0	0
Hansford	31,446	1,960	3,920	19,601	39,202	39,202	39,202	39,202	176,409
Hartley	1,548	156	311	1,556	3,111	3,111	3,111	3,111	14,002
Hemphill	0	0	0	0	0	0	0	0	0
Hutchinson	6,011	721	1,443	7,214	14,427	14,427	14,427	14,427	64,923
Lipscomb	96	8	17	83	166	166	166	166	746
Moore	30,242	2,752	5,504	27,521	55,041	55,041	55,041	55,041	247,686
Ochiltree	9,029	837	1,673	8,367	16,735	16,735	16,735	16,735	75,306
Oldham	795	90	180	901	1,802	1,802	1,802	1,802	8,108
Potter	950	104	207	1,037	2,074	2,074	2,074	2,074	9,334
Randall	4,119	452	904	4,518	9,035	9,035	9,035	9,035	40,658
Roberts	391	28	56	282	565	565	565	565	2,541
Sherman	3,252	343	685	3,425	6,851	6,851	6,851	6,851	30,829
Wheeler	0	0	0	0	0	0	0	0	0
Total Region A	150,798	13,689	27,378	136,892	273,784	273,784	273,784	273,784	1,232,028

Table 2. Estimated water savings in acre-feet by county by decade when shifting furrow irrigated corn to corn under LESA using PET irrigation water requirements that incorporates application efficiencies.

County	Furrow Irrigated Acres	Annual Savings, 75 %acres converted	Annual Savings, 95 %acres converted	2010	2020	2030	2040	2050	Total for 50 years
Armstrong	913	135	271	1,353	2,706	2,706	2,706	2,706	12,179
Carson	10,827	1,604	3,208	16,041	32,083	32,083	32,083	32,083	144,373
Childress	0	0	0	0	0	0	0	0	0
Collingsworth	218	30	59	297	594	594	594	594	2,673
Dallam	46,662	7,427	14,854	74,271	148,542	148,542	148,542	148,542	668,437
Donley	193	28	55	276	551	551	551	551	2,481
Gray	4,104	543	1,086	5,432	10,863	10,863	10,863	10,863	48,884
Hall	0	0	0	0	0	0	0	0	0
Hansford	31,446	3,066	6,132	30,659	61,319	61,319	61,319	61,319	275,935
Hartley	1,548	244	488	2,438	4,876	4,876	4,876	4,876	21,943
Hemphill	0	0	0	0	0	0	0	0	0
Hutchinson	6,011	1,130	2,260	11,301	22,603	22,603	22,603	22,603	101,712
Lipscomb	96	13	26	130	260	260	260	260	1,168
Moore	30,242	4,310	8,619	43,096	86,191	86,191	86,191	86,191	387,860
Ochiltree	9,029	1,311	2,622	13,108	26,215	26,215	26,215	26,215	117,970
Oldham	795	141	282	1,411	2,822	2,822	2,822	2,822	12,698
Potter	950	162	325	1,625	3,249	3,249	3,249	3,249	14,621
Randall	4,119	708	1,416	7,078	14,157	14,157	14,157	14,157	63,706
Roberts	391	44	88	442	884	884	884	884	3,978
Sherman	3,252	536	1,072	5,360	10,721	10,721	10,721	10,721	48,243
Wheeler	0	0	0	0	0	0	0	0	0
Total Region A	150,798	21,432	42,864	214,318	428,636	428,636	428,636	428,636	1,928,861

Table 3. Estimated water savings in acre-feet by county by decade when shifting furrow irrigated corn to corn under LEPA using PET irrigation water requirements that incorporates application efficiencies.

County	Furrow Irrigated Acres	Annual Savings, 75 %acres converted	Annual Savings, 95 %acres converted	2010	2020	2030	2040	2050	Total for 50 years
Armstrong	913	147	294	1,469	2,938	2,938	2,938	2,938	13,220
Carson	10,827	1,741	3,483	17,413	34,826	34,826	34,826	34,826	156,715
Childress	0	0	0	0	0	0	0	0	0
Collingsworth	218	32	64	322	645	645	645	645	2,902
Dallam	46,662	8,057	16,114	80,570	161,140	161,140	161,140	161,140	725,132
Donley	193	30	60	299	598	598	598	598	2,692
Gray	4,104	589	1,178	5,890	11,780	11,780	11,780	11,780	53,009
Hall	0	0	0	0	0	0	0	0	0
Hansford	31,446	3,328	6,656	33,280	66,560	66,560	66,560	66,560	299,519
Hartley	1,548	264	529	2,645	5,289	5,289	5,289	5,289	23,801
Hemphill	0	0	0	0	0	0	0	0	0
Hutchinson	6,011	1,227	2,455	12,273	24,546	24,546	24,546	24,546	110,458
Lipscomb	96	14	28	141	282	282	282	282	1,267
Moore	30,242	4,678	9,355	46,775	93,550	93,550	93,550	93,550	420,975
Ochiltree	9,029	1,422	2,844	14,221	28,443	28,443	28,443	28,443	127,992
Oldham	795	153	306	1,531	3,063	3,063	3,063	3,063	13,783
Potter	950	176	352	1,762	3,525	3,525	3,525	3,525	15,860
Randall	4,119	768	1,537	7,683	15,365	15,365	15,365	15,365	69,143
Roberts	391	48	96	479	958	958	958	958	4,313
Sherman	3,252	582	1,164	5,821	11,642	11,642	11,642	11,642	52,390
Wheeler	0	0	0	0	0	0	0	0	0
Total Region A	150,798	23,257	46,515	232,575	465,150	465,150	465,150	465,150	2,093,173

Table 4. Estimated water savings in acre-feet by county by decade when shifting furrow irrigated corn to corn under DRIP using PET irrigation water requirements that incorporates application efficiencies.

County	Furrow Irrigated Acres	Annual Savings, 5 % acres converted	Annual Savings, 10 % acres converted	Annual Saving, 15 %acres converted	2010	2020	2030	2040	2050	Total for 50 years
Armstrong	913	37	73	110	367	734	1,102	1,102	1,102	4,407
Carson	10,827	435	871	1,306	4,353	8,706	13,060	13,060	13,060	52,238
Childress	0	0	0	0	0	0	0	0	0	0
Collingsworth	218	8	16	24	81	161	242	242	242	967
Dallam	46,662	2,014	4,029	6,043	20,143	40,285	60,428	60,428	60,428	241,711
Donley	193	7	15	22	75	150	224	224	224	897
Gray	4,104	147	294	442	1,472	2,945	4,417	4,417	4,417	17,670
Hall	0	0	0	0	0	0	0	0	0	0
Hansford	31,446	832	1,664	2,496	8,320	16,640	24,960	24,960	24,960	99,840
Hartley	1,548	66	132	198	661	1,322	1,983	1,983	1,983	7,934
Hemphill	0	0	0	0	0	0	0	0	0	0
Hutchinson	6,011	307	614	920	3,068	6,137	9,205	9,205	9,205	36,819
Lipscomb	96	4	7	11	35	70	106	106	106	422
Moore	30,242	1,169	2,339	3,508	11,694	23,388	35,081	35,081	35,081	140,325
Ochiltree	9,029	356	711	1,067	3,555	7,111	10,666	10,666	10,666	42,664
Oldham	795	38	77	115	383	766	1,149	1,149	1,149	4,594
Potter	950	44	88	132	441	881	1,322	1,322	1,322	5,287
Randall	4,119	192	384	576	1,921	3,841	5,762	5,762	5,762	23,048
Roberts	391	12	24	36	120	240	359	359	359	1,438
Sherman	3,252	146	291	437	1,455	2,911	4,366	4,366	4,366	17,463
Wheeler	0	0	0	0	0	0	0	0	0	0
Total Region A	150,798	5,814	11,629	17,443	58,144	116,287	174,431	174,431	174,431	697,724

Table 5. Estimated water savings in acre-feet by county by decade when shifting furrow irrigated pasture to pasture under surge flow using PET irrigation water requirements that incorporates application efficiencies.

County	Furrow Irrigated Acres	Annual Savings, 75 %acres converted	Annual Savings, 95 %acres converted	2010	2020	2030	2040	2050	Total for 50 years
Armstrong	241	33	65	327	653	653	653	653	2,940
Carson	10,264	1,292	2,583	12,915	25,831	25,831	25,831	25,831	116,239
Childress	0	0	0	0	0	0	0	0	0
Collingsworth	281	31	62	312	625	625	625	625	2,812
Dallam	4,336	514	1,028	5,138	10,276	10,276	10,276	10,276	46,241
Donley	212	25	50	251	502	502	502	502	2,258
Gray	411	45	91	454	908	908	908	908	4,088
Hall	0	0	0	0	0	0	0	0	0
Hansford	3,220	267	534	2,672	5,345	5,345	5,345	5,345	24,051
Hartley	175	24	47	235	470	470	470	470	2,116
Hemphill	207	24	47	237	473	473	473	473	2,129
Hutchinson	876	124	248	1,242	2,485	2,485	2,485	2,485	11,182
Lipscomb	107	12	24	122	245	245	245	245	1,101
Moore	4,755	555	1,110	5,548	11,095	11,095	11,095	11,095	49,929
Ochiltree	0	0	0	0	0	0	0	0	0
Oldham	480	71	143	713	1,426	1,426	1,426	1,426	6,416
Potter	2,884	415	830	4,149	8,297	8,297	8,297	8,297	37,337
Randall	4,921	705	1,411	7,053	14,106	14,106	14,106	14,106	63,477
Roberts	155	15	29	147	293	293	293	293	1,320
Sherman	289	41	81	407	814	814	814	814	3,663
Wheeler	0	0	0	0	0	0	0	0	0
Total Region A	33,812	4,192	8,384	41,922	83,844	83,844	83,844	83,844	377,298

Table 6. Estimated water savings in acre-feet by county by decade when shifting furrow irrigated pasture to pasture under LESA using PET irrigation water requirements that incorporates application efficiencies.

County	Furrow Irrigated Acres	Annual Savings, 75 %acres converted	Annual Savings, 95 %acres converted	2010	2020	2030	2040	2050	Total For 50 years
Armstrong	241	51	102	512	1,024	1,024	1,024	1,024	4,607
Carson	10,264	2,024	4,047	20,237	40,474	40,474	40,474	40,474	182,133
Childress	0	0	0	0	0	0	0	0	0
Collingsworth	281	49	98	490	980	980	980	980	4,408
Dallam	4,336	805	1,610	8,050	16,100	16,100	16,100	16,100	72,450
Donley	212	39	79	393	786	786	786	786	3,536
Gray	411	71	142	712	1,424	1,424	1,424	1,424	6,406
Hall	0	0	0	0	0	0	0	0	0
Hansford	3,220	419	838	4,191	8,382	8,382	8,382	8,382	37,718
Hartley	175	37	74	368	736	736	736	736	3,313
Hemphill	207	37	74	371	741	741	741	741	3,335
Hutchinson	876	195	389	1,946	3,892	3,892	3,892	3,892	17,516
Lipscomb	107	19	38	192	383	383	383	383	1,724
Moore	4,755	869	1,739	8,694	17,388	17,388	17,388	17,388	78,245
Ochiltree	0	0	0	0	0	0	0	0	0
Oldham	480	112	223	1,116	2,233	2,233	2,233	2,233	10,048
Potter	2,884	649	1,299	6,494	12,989	12,989	12,989	12,989	58,450
Randall	4,921	1,106	2,211	11,055	22,110	22,110	22,110	22,110	99,497
Roberts	155	23	46	230	460	460	460	460	2,069
Sherman	289	64	128	638	1,275	1,275	1,275	1,275	5,740
Wheeler	0	0	0	0	0	0	0	0	0
Total Region A	33,812	6,569	13,138	65,688	131,376	131,376	131,376	131,376	591,194

Table 7. Estimated water savings in acre-feet by county by decade when shifting furrow irrigated pasture to pasture under LEPA using PET irrigation water requirements that incorporates application efficiencies.

County	Furrow Irrigated Acres	Annual Savings, 75 %acres converted	Annual Savings, 95 %acres converted	2010	2020	2030	2040	2050	Total for 50 years
Armstrong	241	56	111	556	1,111	1,111	1,111	1,111	5,000
Carson	10,264	2,195	4,390	21,948	43,895	43,895	43,895	43,895	197,529
Childress	0	0	0	0	0	0	0	0	0
Collingsworth	281	53	106	532	1,063	1,063	1,063	1,063	4,784
Dallam	4,336	874	1,747	8,736	17,473	17,473	17,473	17,473	78,628
Donley	212	43	85	426	853	853	853	853	3,838
Gray	411	77	154	772	1,544	1,544	1,544	1,544	6,948
Hall	0	0	0	0	0	0	0	0	0
Hansford	3,220	455	909	4,545	9,090	9,090	9,090	9,090	40,906
Hartley	175	40	80	399	799	799	799	799	3,594
Hemphill	207	40	80	402	804	804	804	804	3,620
Hutchinson	876	211	422	2,111	4,222	4,222	4,222	4,222	19,000
Lipscomb	107	21	42	208	416	416	416	416	1,871
Moore	4,755	943	1,886	9,431	18,862	18,862	18,862	18,862	84,878
Ochiltree	0	0	0	0	0	0	0	0	0
Oldham	480	121	242	1,212	2,423	2,423	2,423	2,423	10,904
Potter	2,884	705	1,409	7,047	14,094	14,094	14,094	14,094	63,425
Randall	4,921	1,200	2,400	11,998	23,997	23,997	23,997	23,997	107,986
Roberts	155	25	50	249	499	499	499	499	2,243
Sherman	289	69	138	692	1,384	1,384	1,384	1,384	6,229
Wheeler	0	0	0	0	0	0	0	0	0
Total Region A	33,812	7,126	14,253	71,265	142,530	142,530	142,530	142,530	641,385

Table 8. Estimated water savings in acre-feet by county by decade when shifting furrow irrigated pasture to pasture under DRIP using PET irrigation water requirements that incorporates application efficiencies.

County	Furrow Irrigated Acres	Annual Savings, 5 % acres converted	Annual Savings, 10 % acres converted	Annual Saving, 15 %acres converted	2010	2020	2030	2040	2050	Total for 50 years
Armstrong	241	15	29	44	147	294	441	441	441	1,765
Carson	10,264	581	1,162	1,744	5,812	11,624	17,436	17,436	17,436	69,743
Childress	0	0	0	0	0	0	0	0	0	0
Collingsworth	281	14	28	42	141	281	422	422	422	1,688
Dallam	4,336	231	462	694	2,312	4,625	6,937	6,937	6,937	27,749
Donley	212	11	23	34	113	226	339	339	339	1,355
Gray	411	20	41	61	204	409	613	613	613	2,452
Hall	0	0	0	0	0	0	0	0	0	0
Hansford	3,220	120	241	361	1,203	2,407	3,610	3,610	3,610	14,440
Hartley	175	11	21	32	106	211	317	317	317	1,269
Hemphill	207	11	21	32	106	213	319	319	319	1,278
Hutchinson	876	56	112	168	559	1,118	1,676	1,676	1,676	6,706
Lipscomb	107	6	11	17	55	110	165	165	165	660
Moore	4,755	250	499	749	2,496	4,993	7,489	7,489	7,489	29,957
Ochiltree	0	0	0	0	0	0	0	0	0	0
Oldham	480	32	64	96	321	641	962	962	962	3,848
Potter	2,884	187	373	560	1,866	3,733	5,599	5,599	5,599	22,396
Randall	4,921	318	635	953	3,176	6,352	9,528	9,528	9,528	38,111
Roberts	155	7	13	20	66	132	198	198	198	792
Sherman	289	18	37	55	183	367	550	550	550	2,199
Wheeler	0	0	0	0	0	0	0	0	0	0
Total Region A	33,812	1,887	3,774	5,660	18,867	37,735	56,602	56,602	56,602	226,408

Table 9. Estimated water savings in acre-feet by county by decade when shifting furrow irrigated sorghum to sorghum under surge flow using PET irrigation water requirements that incorporates application efficiencies.

County	Furrow Irrigated Acres	Annual Savings, 75 %acres converted	Annual Savings, 95 %acres converted	2010	2020	2030	2040	2050	Total for 50 years
Armstrong	1,598	73	147	733	1,465	1,465	1,465	1,465	6,593
Carson	16,667	806	1,611	8,056	16,112	16,112	16,112	16,112	72,503
Childress	0	0	0	0	0	0	0	0	0
Collingsworth	465	15	30	149	297	297	297	297	1,339
Dallam	2,378	133	266	1,332	2,663	2,663	2,663	2,663	11,984
Donley	102	4	8	41	83	83	83	83	372
Gray	2,948	116	233	1,165	2,329	2,329	2,329	2,329	10,481
Hall	0	0	0	0	0	0	0	0	0
Hansford	13,990	324	648	3,241	6,482	6,482	6,482	6,482	29,169
Hartley	150	8	16	79	159	159	159	159	713
Hemphill	34	1	3	13	26	26	26	26	118
Hutchinson	1,741	108	215	1,077	2,153	2,153	2,153	2,153	9,690
Lipscomb	85	3	6	32	64	64	64	64	287
Moore	7,578	332	664	3,322	6,643	6,643	6,643	6,643	29,895
Ochiltree	6,533	278	555	2,777	5,553	5,553	5,553	5,553	24,989
Oldham	9,682	583	1,165	5,826	11,651	11,651	11,651	11,651	52,431
Potter	1,468	83	167	834	1,668	1,668	1,668	1,668	7,507
Randall	11,085	630	1,260	6,300	12,600	12,600	12,600	12,600	56,699
Roberts	373	11	22	112	225	225	225	225	1,011
Sherman	943	53	105	527	1,053	1,053	1,053	1,053	4,739
Wheeler	0	0	0	0	0	0	0	0	0
Total Region A	77,820	3,561	7,123	35,613	71,226	71,226	71,226	71,226	320,518

Table 10. Estimated water savings in acre-feet by county by decade when shifting furrow irrigated sorghum to sorghum under LESA using PET irrigation water requirements that incorporates application efficiencies.

County	Furrow Irrigated Acres	Annual Savings, 75 %acres converted	Annual Savings, 95 %acres converted	2010	2020	2030	2040	2050	Total for 50 years
Armstrong	1,598	115	230	1,148	2,296	2,296	2,296	2,296	10,333
Carson	16,667	1,261	2,522	12,612	25,223	25,223	25,223	25,223	113,504
Childress	0	0	0	0	0	0	0	0	0
Collingsworth	465	23	47	233	466	466	466	466	2,099
Dallam	2,378	208	417	2,084	4,169	4,169	4,169	4,169	18,760
Donley	102	6	13	65	130	130	130	130	583
Gray	2,948	182	365	1,823	3,646	3,646	3,646	3,646	16,407
Hall	0	0	0	0	0	0	0	0	0
Hansford	13,990	508	1,017	5,083	10,166	10,166	10,166	10,166	45,747
Hartley	150	12	25	124	249	249	249	249	1,118
Hemphill	34	2	4	21	41	41	41	41	185
Hutchinson	1,741	169	338	1,689	3,378	3,378	3,378	3,378	15,201
Lipscomb	85	5	10	50	100	100	100	100	450
Moore	7,578	520	1,041	5,203	10,407	10,407	10,407	10,407	46,831
Ochiltree	6,533	436	871	4,355	8,711	8,711	8,711	8,711	39,198
Oldham	9,682	913	1,827	9,134	18,268	18,268	18,268	18,268	82,204
Potter	1,468	131	261	1,306	2,612	2,612	2,612	2,612	11,755
Randall	11,085	987	1,973	9,865	19,731	19,731	19,731	19,731	88,789
Roberts	373	18	35	176	353	353	353	353	1,587
Sherman	943	83	165	825	1,650	1,650	1,650	1,650	7,426
Wheeler	0	0	0	0	0	0	0	0	0
Total Region A	77,820	5,580	11,160	55,798	111,595	111,595	111,595	111,595	502,179

Table 11. Estimated water savings in acre-feet by county by decade when shifting furrow irrigated sorghum to sorghum under LEPA using PET irrigation water requirements that incorporates application efficiencies.

County	Furrow Irrigated Acres	Annual Savings, 75 %acres converted	Annual Savings, 95 %acres converted	2010	2020	2030	2040	2050	Total for 50 years
Armstrong	1,598	125	249	1,247	2,493	2,493	2,493	2,493	11,220
Carson	16,667	1,367	2,733	13,667	27,334	27,334	27,334	27,334	123,005
Childress	0	0	0	0	0	0	0	0	0
Collingsworth	465	25	51	253	507	507	507	507	2,280
Dallam	2,378	226	453	2,263	4,526	4,526	4,526	4,526	20,365
Donley	102	7	14	70	141	141	141	141	633
Gray	2,948	198	395	1,975	3,951	3,951	3,951	3,951	17,778
Hall	0	0	0	0	0	0	0	0	0
Hansford	13,990	553	1,105	5,526	11,052	11,052	11,052	11,052	49,735
Hartley	150	14	27	135	270	270	270	270	1,215
Hemphill	34	2	4	22	45	45	45	45	201
Hutchinson	1,741	183	366	1,831	3,662	3,662	3,662	3,662	16,481
Lipscomb	85	5	11	54	109	109	109	109	488
Moore	7,578	565	1,129	5,645	11,291	11,291	11,291	11,291	50,809
Ochiltree	6,533	473	945	4,726	9,451	9,451	9,451	9,451	42,530
Oldham	9,682	991	1,982	9,908	19,817	19,817	19,817	19,817	89,175
Potter	1,468	142	284	1,419	2,837	2,837	2,837	2,837	12,768
Randall	11,085	1,072	2,143	10,715	21,431	21,431	21,431	21,431	96,437
Roberts	373	19	38	191	382	382	382	382	1,721
Sherman	943	89	179	894	1,789	1,789	1,789	1,789	8,049
Wheeler	0	0	0	0	0	0	0	0	0
Total Region A	77,820	6,054	12,109	60,543	121,087	121,087	121,087	121,087	544,891

Table 12. Estimated water savings in acre-feet by county by decade when shifting furrow irrigated sorghum to sorghum under DRIP using PET irrigation water requirements that incorporates application efficiencies.

County	Furrow Irrigated Acres	Annual Savings, 5 % acres converted	Annual Savings, 10 % acres converted	Annual Savings, 15 %acres converted	2010	2020	2030	2040	2050	Total For 50 years
Armstrong	1,598	33	66	99	330	659	989	989	989	3,956
Carson	16,667	362	724	1,085	3,618	7,236	10,855	10,855	10,855	43,418
Childress	0	0	0	0	0	0	0	0	0	0
Collingsworth	465	7	13	20	67	134	201	201	201	804
Dallam	2,378	60	120	180	599	1,199	1,798	1,798	1,798	7,193
Donley	102	2	4	6	19	37	56	56	56	223
Gray	2,948	52	105	157	523	1,047	1,570	1,570	1,570	6,280
Hall	0	0	0	0	0	0	0	0	0	0
Hansford	13,990	146	293	439	1,463	2,926	4,389	4,389	4,389	17,558
Hartley	150	4	7	11	36	71	107	107	107	428
Hemphill	34	1	1	2	6	12	18	18	18	71
Hutchinson	1,741	49	97	146	485	971	1,456	1,456	1,456	5,824
Lipscomb	85	1	3	4	14	29	43	43	43	172
Moore	7,578	149	299	448	1,493	2,987	4,480	4,480	4,480	17,922
Ochiltree	6,533	125	250	376	1,252	2,504	3,757	3,757	3,757	15,026
Oldham	9,682	262	524	787	2,622	5,245	7,867	7,867	7,867	31,468
Potter	1,468	38	75	113	375	751	1,126	1,126	1,126	4,505
Randall	11,085	284	567	851	2,836	5,672	8,508	8,508	8,508	34,030
Roberts	373	5	10	15	51	101	152	152	152	607
Sherman	943	24	47	71	237	474	711	711	711	2,843
Wheeler	0	0	0	0	0	0	0	0	0	0
Total Region A	77,820	1,603	3,206	4,808	16,027	32,055	48,082	48,082	48,082	192,329

Table 13. Estimated water savings in acre-feet by county by decade when shifting furrow irrigated soybeans to soybeans under surge flow using PET irrigation water requirements that incorporates application efficiencies.

County	Furrow Irrigated Acres	Annual Savings, 75 %acres converted	Annual Savings, 95 %acres converted	2010	2020	2030	2040	2050	Total for 50 years
Armstrong	0	0	0	0	0	0	0	0	0
Carson	2,635	90	180	900	1,801	1,801	1,801	1,801	8,104
Childress	0	0	0	0	0	0	0	0	0
Collingsworth	0	0	0	0	0	0	0	0	0
Dallam	208	9	18	88	176	176	176	176	793
Donley	19	1	1	6	11	11	11	11	50
Gray	867	23	45	227	454	454	454	454	2,042
Hall	0	0	0	0	0	0	0	0	0
Hansford	6,032	80	161	804	1,609	1,609	1,609	1,609	7,239
Hartley	25	1	2	10	21	21	21	21	92
Hemphill	0	0	0	0	0	0	0	0	0
Hutchinson	379	20	40	198	396	396	396	396	1,781
Lipscomb	43	1	2	11	22	22	22	22	100
Moore	654	22	45	225	449	449	449	449	2,022
Ochiltree	2,337	76	151	756	1,511	1,511	1,511	1,511	6,801
Oldham	0	0	0	0	0	0	0	0	0
Potter	0	0	0	0	0	0	0	0	0
Randall	0	0	0	0	0	0	0	0	0
Roberts	0	0	0	0	0	0	0	0	0
Sherman	2	0	0	1	2	2	2	2	8
Wheeler	0	0	0	0	0	0	0	0	0
Total Region A	13,203	323	645	3,226	6,451	6,451	6,451	6,451	29,031

Table 14. Estimated water savings in acre-feet by county by decade when shifting furrow irrigated soybeans to soybeans under LESA using PET irrigation water requirements that incorporates application efficiencies.

County	Furrow Irrigated Acres	Annual Savings, 75 %acres converted	Annual Savings, 95 %acres converted	2010	2020	2030	2040	2050	Total for 50 years
Armstrong	0	0	0	0	0	0	0	0	0
Carson	2,635	141	282	1,410	2,820	2,820	2,820	2,820	12,690
Childress	0	0	0	0	0	0	0	0	0
Collingsworth	0	0	0	0	0	0	0	0	0
Dallam	208	14	28	138	276	276	276	276	1,242
Donley	19	1	2	9	17	17	17	17	78
Gray	867	35	71	354	708	708	708	708	3,187
Hall	0	0	0	0	0	0	0	0	0
Hansford	6,032	126	251	1,257	2,514	2,514	2,514	2,514	11,311
Hartley	25	2	3	16	32	32	32	32	145
Hemphill	0	0	0	0	0	0	0	0	0
Hutchinson	379	31	62	310	620	620	620	620	2,788
Lipscomb	43	2	3	17	35	35	35	35	157
Moore	654	35	70	352	705	705	705	705	3,171
Ochiltree	2,337	118	237	1,184	2,368	2,368	2,368	2,368	10,657
Oldham	0	0	0	0	0	0	0	0	0
Potter	0	0	0	0	0	0	0	0	0
Randall	0	0	0	0	0	0	0	0	0
Roberts	0	0	0	0	0	0	0	0	0
Sherman	2	0	0	1	3	3	3	3	12
Wheeler	0	0	0	0	0	0	0	0	0
Total Region A	13,203	505	1,010	5,048	10,097	10,097	10,097	10,097	45,436

Table 15. Estimated water savings in acre-feet by county by decade when shifting furrow irrigated soybeans to soybeans under LEPA using PET irrigation water requirements that incorporates application efficiencies.

County	Furrow Irrigated Acres	Annual Savings, 75 %acres converted	Annual Savings, 95 %acres converted	2010	2020	2030	2040	2050	Total for 50 years
Armstrong	0	0	0	0	0	0	0	0	0
Carson	2,635	153	306	1,529	3,057	3,057	3,057	3,057	13,757
Childress	0	0	0	0	0	0	0	0	0
Collingsworth	0	0	0	0	0	0	0	0	0
Dallam	208	15	30	150	300	300	300	300	1,348
Donley	19	1	2	9	19	19	19	19	84
Gray	867	38	77	384	769	769	769	769	3,460
Hall	0	0	0	0	0	0	0	0	0
Hansford	6,032	136	271	1,357	2,715	2,715	2,715	2,715	12,216
Hartley	25	2	3	17	35	35	35	35	157
Hemphill	0	0	0	0	0	0	0	0	0
Hutchinson	379	34	67	336	671	671	671	671	3,021
Lipscomb	43	2	4	19	38	38	38	38	170
Moore	654	38	77	383	766	766	766	766	3,446
Ochiltree	2,337	129	257	1,285	2,571	2,571	2,571	2,571	11,568
Oldham	0	0	0	0	0	0	0	0	0
Potter	0	0	0	0	0	0	0	0	0
Randall	0	0	0	0	0	0	0	0	0
Roberts	0	0	0	0	0	0	0	0	0
Sherman	2	0	0	1	3	3	3	3	13
Wheeler	0	0	0	0	0	0	0	0	0
Total Region A	13,203	547	1,094	5,471	10,942	10,942	10,942	10,942	49,240

Table 16. Estimated water savings in acre-feet by county by decade when shifting furrow irrigated soybeans to soybeans under DRIP using PET irrigation water requirements that incorporates application efficiencies.

County	Furrow Irrigated Acres	Annual Savings, 5 % acres converted	Annual Savings, 10 % acres converted	Annual Savings, 15 % acres converted	2010	2020	2030	2040	2050	Total for 50 years
Armstrong	0	0	0	0	0	0	0	0	0	0
Carson	2,635	41	81	122	405	810	1,216	1,216	1,216	4,862
Childress	0	0	0	0	0	0	0	0	0	0
Collingsworth	0	0	0	0	0	0	0	0	0	0
Dallam	208	4	8	12	40	79	119	119	119	475
Donley	19	0	0	1	2	5	7	7	7	30
Gray	867	10	20	31	102	204	306	306	306	1,223
Hall	0	0	0	0	0	0	0	0	0	0
Hansford	6,032	36	72	108	359	719	1,078	1,078	1,078	4,313
Hartley	25	0	1	1	5	9	14	14	14	55
Hemphill	0	0	0	0	0	0	0	0	0	0
Hutchinson	379	9	18	27	89	178	267	267	267	1,068
Lipscomb	43	0	1	1	5	10	15	15	15	60
Moore	654	10	20	30	101	203	304	304	304	1,217
Ochiltree	2,337	34	68	102	340	680	1,020	1,020	1,020	4,078
Oldham	0	0	0	0	0	0	0	0	0	0
Potter	0	0	0	0	0	0	0	0	0	0
Randall	0	0	0	0	0	0	0	0	0	0
Roberts	0	0	0	0	0	0	0	0	0	0
Sherman	2	0	0	0	0	1	1	1	1	5
Wheeler	0	0	0	0	0	0	0	0	0	0
Total Region A	13,203	145	290	435	1,449	2,898	4,347	4,347	4,347	17,386

Table 17. Estimated water savings in acre-feet by county by decade when shifting furrow irrigated wheat to wheat under surge flow using PET irrigation water requirements that incorporates application efficiencies.

County	Furrow Irrigated Acres	Annual Savings, 75 %acres converted	Annual Savings, 95 %acres converted	2010	2020	2030	2040	2050	Total for 50 years
Armstrong	3,805	84	167	837	1,674	1,674	1,674	1,674	7,535
Carson	25,713	741	1,483	7,414	14,828	14,828	14,828	14,828	66,726
Childress	0	0	0	0	0	0	0	0	0
Collingsworth	407	25	51	253	506	506	506	506	2,275
Dallam	28,622	1,116	2,232	11,162	22,325	22,325	22,325	22,325	100,462
Donley	29	0	1	4	8	8	8	8	34
Gray	11,504	176	353	1,764	3,528	3,528	3,528	3,528	15,876
Hall	0	0	0	0	0	0	0	0	0
Hansford	68,282	1,935	3,869	19,346	38,693	38,693	38,693	38,693	174,118
Hartley	549	21	41	206	412	412	412	412	1,853
Hemphill	350	4	7	36	72	72	72	72	325
Hutchinson	2,695	63	127	633	1,267	1,267	1,267	1,267	5,699
Lipscomb	341	4	8	39	77	77	77	77	348
Moore	15,810	458	917	4,585	9,170	9,170	9,170	9,170	41,264
Ochiltree	12,482	293	587	2,933	5,866	5,866	5,866	5,866	26,399
Oldham	16,875	723	1,446	7,228	14,456	14,456	14,456	14,456	65,054
Potter	22,307	825	1,651	8,254	16,507	16,507	16,507	16,507	74,283
Randall	13,257	479	959	4,795	9,589	9,589	9,589	9,589	43,151
Roberts	633	10	20	102	205	205	205	205	921
Sherman	2,452	93	186	932	1,864	1,864	1,864	1,864	8,386
Wheeler	0	0	0	0	0	0	0	0	0
Total Region A	226,112	7,052	14,105	70,523	141,047	141,047	141,047	141,047	634,709

Table 18. Estimated water savings in acre-feet by county by decade when shifting furrow irrigated wheat to wheat under LESA using PET irrigation water requirements that incorporate application efficiencies.

County	Furrow Irrigated Acres	Annual Savings, 75 %acres converted	Annual Savings, 95 %acres converted	2010	2020	2030	2040	2050	Total for 50 years
Armstrong	3,805	131	263	1,313	2,626	2,626	2,626	2,626	11,816
Carson	25,713	1,161	2,323	11,614	23,228	23,228	23,228	23,228	104,524
Childress	0	0	0	0	0	0	0	0	0
Collingsworth	407	40	79	396	792	792	792	792	3,563
Dallam	28,622	1,746	3,492	17,459	34,918	34,918	34,918	34,918	157,132
Donley	29	1	1	6	12	12	12	12	54
Gray	11,504	278	556	2,780	5,560	5,560	5,560	5,560	25,021
Hall	0	0	0	0	0	0	0	0	0
Hansford	68,282	3,027	6,054	30,272	60,543	60,543	60,543	60,543	272,444
Hartley	549	32	65	323	646	646	646	646	2,907
Hemphill	350	6	11	57	114	114	114	114	514
Hutchinson	2,695	99	199	993	1,985	1,985	1,985	1,985	8,933
Lipscomb	341	6	12	61	122	122	122	122	547
Moore	15,810	719	1,439	7,194	14,387	14,387	14,387	14,387	64,742
Ochiltree	12,482	460	919	4,597	9,195	9,195	9,195	9,195	41,377
Oldham	16,875	1,131	2,261	11,306	22,613	22,613	22,613	22,613	101,757
Potter	22,307	1,294	2,588	12,938	25,876	25,876	25,876	25,876	116,443
Randall	13,257	751	1,502	7,512	15,024	15,024	15,024	15,024	67,610
Roberts	633	16	32	159	319	319	319	319	1,434
Sherman	2,452	146	292	1,459	2,918	2,918	2,918	2,918	13,130
Wheeler	0	0	0	0	0	0	0	0	0
Total Region A	226,112	11,044	22,088	110,439	220,878	220,878	220,878	220,878	993,950

Table 19. Estimated water savings in acre-feet by county by decade when shifting furrow irrigated wheat to wheat under LEPA using PET irrigation water requirements that incorporate application efficiencies.

County	Furrow Irrigated Acres	Annual Savings, 75 %acres converted	Annual Savings, 95 %acres converted	2010	2020	2030	2040	2050	Total for 50 years
Armstrong	3,805	142	284	1,421	2,841	2,841	2,841	2,841	12,786
Carson	25,713	1,260	2,520	12,599	25,199	25,199	25,199	25,199	113,395
Childress	0	0	0	0	0	0	0	0	0
Collingsworth	407	43	86	430	859	859	859	859	3,868
Dallam	28,622	1,894	3,788	18,938	37,876	37,876	37,876	37,876	170,441
Donley	29	1	1	6	13	13	13	13	58
Gray	11,504	301	602	3,010	6,020	6,020	6,020	6,020	27,092
Hall	0	0	0	0	0	0	0	0	0
Hansford	68,282	3,289	6,578	32,889	65,778	65,778	65,778	65,778	296,001
Hartley	549	35	70	350	701	701	701	701	3,154
Hemphill	350	6	12	62	124	124	124	124	556
Hutchinson	2,695	108	216	1,078	2,156	2,156	2,156	2,156	9,701
Lipscomb	341	7	13	66	132	132	132	132	593
Moore	15,810	780	1,560	7,800	15,599	15,599	15,599	15,599	70,197
Ochiltree	12,482	499	999	4,993	9,986	9,986	9,986	9,986	44,935
Oldham	16,875	1,226	2,453	12,263	24,525	24,525	24,525	24,525	110,363
Potter	22,307	1,402	2,803	14,016	28,033	28,033	28,033	28,033	126,147
Randall	13,257	815	1,631	8,153	16,306	16,306	16,306	16,306	73,376
Roberts	633	17	35	173	346	346	346	346	1,558
Sherman	2,452	158	316	1,582	3,163	3,163	3,163	3,163	14,234
Wheeler	0	0	0	0	0	0	0	0	0
Total Region A	226,112	11,983	23,966	119,829	239,657	239,657	239,657	239,657	1,078,457

Table 20. Estimated water savings in acre-feet by county by decade when shifting furrow irrigated wheat to wheat under DRIP using PET irrigation water requirements that incorporate application efficiencies.

County	Furrow Irrigated Acres	Annual Savings, 5 % acres converted	Annual Savings, 10 % acres converted	Annual Savings, 15 %acres converted	2010	2020	2030	2040	2050	Total for 50 years
Armstrong	3,805	38	75	113	377	755	1,132	1,132	1,132	4,528
Carson	25,713	334	669	1,003	3,343	6,685	10,028	10,028	10,028	40,113
Childress	0	0	0	0	0	0	0	0	0	0
Collingsworth	407	11	23	34	114	227	341	341	341	1,364
Dallam	28,622	502	1,004	1,506	5,021	10,041	15,062	15,062	15,062	60,248
Donley	29	0	0	1	2	3	5	5	5	20
Gray	11,504	80	159	239	796	1,591	2,387	2,387	2,387	9,548
Hall	0	0	0	0	0	0	0	0	0	0
Hansford	68,282	871	1,741	2,612	8,706	17,412	26,118	26,118	26,118	104,471
Hartley	549	9	19	28	93	185	278	278	278	1,112
Hemphill	350	2	3	5	16	33	49	49	49	196
Hutchinson	2,695	29	57	86	285	570	856	856	856	3,422
Lipscomb	341	2	3	5	17	35	52	52	52	210
Moore	15,810	207	414	621	2,068	4,137	6,205	6,205	6,205	24,822
Ochiltree	12,482	132	264	396	1,321	2,642	3,963	3,963	3,963	15,852
Oldham	16,875	325	650	975	3,248	6,497	9,745	9,745	9,745	38,982
Potter	22,307	372	744	1,115	3,718	7,436	11,154	11,154	11,154	44,614
Randall	13,257	216	432	648	2,160	4,319	6,479	6,479	6,479	25,917
Roberts	633	5	9	14	46	92	138	138	138	551
Sherman	2,452	42	84	126	419	838	1,257	1,257	1,257	5,027
Wheeler	0	0	0	0	0	0	0	0	0	0
Total Region A	226,112	3,175	6,350	9,525	31,750	63,500	95,249	95,249	95,249	380,998

Water User Group:	City of Claude - Armstrong County				
	2000	**2010**	**2020**	**2030**	**2040**
Population (number of persons)	1,253	1,335	1,410	1,476	1,478
Water Demand (ac-ft/yr)	265	266	267	274	268
Current Supply (ac-ft/yr)	265	266	267	124	0
Supply - Demand (ac-ft/yr)	0	0	0	-150	-268
Recommended Short Term Strategy - Install new wells (ac-ft/yr)	0	0	0	150	268
Long Term Strategy (ac-ft/yr)	None identified				

2050
1,480
267
0
-267
267

Water User Group:	City of Groom - Carson County				
	2000	**2010**	**2020**	**2030**	**2040**
Population (number of persons)	655	658	648	600	545
Water Demand (ac-ft/yr)	180	173	163	149	132
Current Supply (ac-ft/yr)	180	173	163	149	81
Supply - Demand (ac-ft/yr)	0	0	0	0	-51
Recommended Short Term Strategy (ac-ft/yr)	None identified				
Long Term Strategy - Install new well (ac-ft/yr)	0	0	0	0	51

Water User Group:	City of Panhandle - Carson County				
	2000	**2010**	**2020**	**2030**	**2040**
Population (number of persons)	2,469	3,750	4,104	4,281	4,401
Water Demand (ac-ft/yr)	589	844	879	902	913
Current Supply (ac-ft/yr)	589	844	879	902	175
Supply - Demand (ac-ft/yr)	0	0	0	0	-738
Recommended Short Term Strategy (ac-ft/yr)	None identified				
Long Term Strategy - Install new wells (ac-ft/yr)	0	0	0	0	738

Water User Group:	City of Skellytown - Carson County				
	2000	**2010**	**2020**	**2030**	**2040**
Population (number of persons)	666	667	650	572	564
Water Demand (ac-ft/yr)	88	83	76	64	61
Current Supply (ac-ft/yr)	88	83	32	0	0
Supply - Demand (ac-ft/yr)	0	0	-44	-64	-61
Recommended Short Term Strategy - Install new well (ac-ft/yr)	0	0	44	64	61
Long Term Strategy (ac-ft/yr)	None identified				

Water User Group:	City of White Deer - Carson County				
	2000	**2010**	**2020**	**2030**	**2040**
Population (number of persons)	1,231	1,341	1,391	1,445	1,477
Water Demand (ac-ft/yr)	266	275	271	275	276
Current Supply (ac-ft/yr)	266	275	271	275	228
Supply - Demand (ac-ft/yr)	0	0	0	0	-48
Recommended Short Term Strategy (ac-ft/yr)	None identified				
Long Term Strategy - Install new wells (ac-ft/yr)	0	0	0	0	45

2050
501
121
0
-121
121

2050
4,523
933
0
-933
933

2050
556
59
0
-59
59

2050
1,510
281
0
-281
267

Water User Group:	**Irrigation - Dallam County**					
	2000	**2010**	**2020**	**2030**	**2040**	**2050**
Population (number of persons)						
Water Demand (ac-ft/yr)	386,403	386,403	386,403	386,403	386,403	386,403
Current Supply (ac-ft/yr)	386,403	386,403	386,403	112,427	5,432	5,440
Supply - Demand (ac-ft/yr)	0	0	0	-273,976	-380,971	-380,963
Recommended Short Term Strategy (ac-ft/yr)	0	71,091	104,236	104,236	104,236	104,236
Long Term Strategy (ac-ft/yr)	None identified					

Water User Group:	**Livestock - Dallam County**					
	2000	**2010**	**2020**	**2030**	**2040**	**2050**
Population (number of persons)						
Water Demand (ac-ft/yr)	6,973	10,737	12,234	13,799	15,590	17,644
Current Supply (ac-ft/yr)	6,973	10,737	12,234	13,799	848	848
Supply - Demand (ac-ft/yr)	0	0	0	0	-14,742	-16,796
Recommended Short Term Strategy - Develop water rights as needed (ac-ft/yr)	0	0	0	0	14,742	16,796
Long Term Strategy (ac-ft/yr)	None identified					

Water User Group:	**Manufacturing - Dallam County**					
	2000	**2010**	**2020**	**2030**	**2040**	**2050**
Population (number of persons)						
Water Demand (ac-ft/yr)	235	235	235	235	235	235
Current Supply (ac-ft/yr)	235	235	235	235	3	3
Supply - Demand (ac-ft/yr)	0	0	0	0	-232	-232
Recommended Short Term Strategy - Purchase additional water rights (ac-ft/yr)	0	0	0	0	232	232
Long Term Strategy (ac-ft/yr)	None identified					

Water User Group:	City of Lefors - Gray County				
	2000	**2010**	**2020**	**2030**	**2040**
Population (number of persons)	638	603	559	517	500
Water Demand (ac-ft/yr)	120	107	95	85	80
Current Supply (ac-ft/yr)	120	88	0	0	0
Supply - Demand (ac-ft/yr)	0	-19	-95	-85	-80
Recommended Short Term Strategy - Install new well (ac-ft/yr)	0	19	95	85	80
Long Term Strategy (ac-ft/yr)	None identified				

Water User Group:	Manufacturing - Gray County				
	2000	**2010**	**2020**	**2030**	**2040**
Population (number of persons)					
Water Demand (ac-ft/yr)	3,947	4,225	4,332	4,407	4,692
Current Supply (ac-ft/yr)	3,947	4,225	4,332	4,407	4,692
Supply - Demand (ac-ft/yr)	0	0	0	0	0
Recommended Short Term Strategy (ac-ft/yr)	None identified				
Long Term Strategy - Supply provided by Pampa's Ogallala well field (ac-ft/yr)	0	0	0	0	0

Water User Group:	**City of McClean - Gray County**				
	2000	**2010**	**2020**	**2030**	**2040**
Population (number of persons)	891	931	970	868	850
Water Demand (ac-ft/yr)	266	266	265	232	226
Current Supply (ac-ft/yr)	266	266	19	0	0
Supply - Demand (ac-ft/yr)	0	0	-246	-232	-226
Recommended Short Term Strategy - Install new wells (ac-ft/yr)	0	0	246	232	226
Long Term Strategy (ac-ft/yr)	None identified				

2050
488
78
0
-78
78

2050
4,967
4,910
-57
57

2050
832
220
0
-220
220

Water User Group:	**City of Gruver - Hansford County**				
	2000	**2010**	**2020**	**2030**	**2040**
Population (number of persons)	1,216	1,280	1,297	1,278	1,247
Water Demand (ac-ft/yr)	377	381	372	361	346
Current Supply (ac-ft/yr)	377	86	0	0	0
Supply - Demand (ac-ft/yr)	0	-295	-372	-361	-346
Recommended Short Term Strategy - Develop existing water rights and Palo Dura Reservoir (ac-ft/yr)	0	295	372	361	346
Long Term Strategy (ac-ft/yr)	None identified				

2050
1,202
334
0
-334
334

Water User Group:	**City of Canadian - Hemphill County**				
	2000	**2010**	**2020**	**2030**	**2040**
Population (number of persons)	2,604	2,757	2,789	2,725	2,665
Water Demand (ac-ft/yr)	683	692	669	641	615
Current Supply (ac-ft/yr)	683	692	470	0	0
Supply - Demand (ac-ft/yr)	0	0	-199	-641	-615
Recommended Short Term Strategy - Install new wells (ac-ft/yr)	0	0	199	641	615
Long Term Strategy (ac-ft/yr)	None identified				

2050
2,606
601
0
-601
601

Water User Group:	**City of Cactus - Moore County**					
	2000	**2010**	**2020**	**2030**	**2040**	**2050**
Population (number of persons)	2,500	2,871	3,279	3,921	4,717	5,673
Water Demand (ac-ft/yr)	445	476	511	592	703	838
Current Supply (ac-ft/yr)	445	476	511	0	0	0
Supply - Demand (ac-ft/yr)	0	0	0	-592	-703	-838
Recommended Short Term Strategy - Install new wells and Palo Duro Reservoir (ac-ft/yr)	0	0	0	400	500	500
Long Term Strategy (ac-ft/yr)	None identified					

Water User Group:	**County Other - Moore County**					
	2000	**2010**	**2020**	**2030**	**2040**	**2050**
Population (number of persons)	1,879	1,969	2,017	1,996	1,991	2,053
Water Demand (ac-ft/yr)	453	452	441	427	419	430
Current Supply (ac-ft/yr)	453	452	441	0	0	0
Supply - Demand (ac-ft/yr)	0	0	0	-427	-419	-430
Recommended Short Term Strategy - Supplied by Sunray and Dumas (ac-ft/yr)	0	0	0	427	419	430
Long Term Strategy (ac-ft/yr)	None identified					

Water User Group:	**City of Dumas - Moore County**					
	2000	**2010**	**2020**	**2030**	**2040**	**2050**
Population (number of persons)	14,620	16,451	18,312	19,942	21,443	23,057
Water Demand (ac-ft/yr)	2,833	3,022	3,200	3,418	3,603	3,848
Current Supply (ac-ft/yr)	2,833	3,022	3,200	0	0	0
Supply - Demand (ac-ft/yr)	0	0	0	-3,418	-3,603	-3,848
Recommended Short Term Strategy - Install new wells and Palo Duro Reservoir (ac-ft/yr)	0	0	0	858	1,043	1,288
Long Term Strategy (ac-ft/yr)	None identified					

Water User Group:	Irrigation - Moore County					
	2000	**2010**	**2020**	**2030**	**2040**	**2050**
Population (number of persons)						
Water Demand (ac-ft/yr)	200,579	200,579	200,579	200,579	200,579	200,579
Current Supply (ac-ft/yr)	200,582	200,582	179,184	3	3	3
Supply - Demand (ac-ft/yr)	3	3	-21,395	-200,576	-200,576	-200,576
Recommended Short Term Strategy - No strategy identified (ac-ft/yr)	0	39,529	56,202	56,202	56,202	56,202
Long Term Strategy (ac-ft/yr)	None identified					

Water User Group:	**Livestock - Moore County**					
	2000	**2010**	**2020**	**2030**	**2040**	**2050**
Population (number of persons)						
Water Demand (ac-ft/yr)	3,510	7,158	8,105	9,059	10,146	11,386
Current Supply (ac-ft/yr)	3,510	7,158	8,893	1,600	1,600	1,600
Supply - Demand (ac-ft/yr)	0	0	0	-7,459	-8,546	-9,786
Recommended Short Term Strategy - Develop water rights or import water from nearby counties (ac-ft/yr)	0	0	0	7,459	8,546	9,786
Long Term Strategy (ac-ft/yr)	None identified					

Water User Group:	**Manufacturing - Moore County**					
	2000	**2010**	**2020**	**2030**	**2040**	**2050**
Population (number of persons)						
Water Demand (ac-ft/yr)	7,238	7,712	8,035	8,269	8,863	9,429
Current Supply (ac-ft/yr)	7,238	7,712	8,035	0	0	0
Supply - Demand (ac-ft/yr)	0	0	0	-8,269	-8,863	-9,429
Recommended Short Term Strategy - Groundwater, Palo Duro Reservoir, and Treated Effluent (ac-ft/yr)	2,000	2,000	2,205	8,269	8,863	9,429
Long Term Strategy (ac-ft/yr)	None identified					

Water User Group:	Steam Electric Power - Moore County					
	2000	**2010**	**2020**	**2030**	**2040**	**2050**
Population (number of persons)						
Water Demand (ac-ft/yr)	200	200	200	200	200	200
Current Supply (ac-ft/yr)	200	200	200	0	0	0
Supply - Demand (ac-ft/yr)	0	0	0	-200	-200	-200
Recommended Short Term Strategy - Purchase water rights (ac-ft/yr)	0	0	0	200	200	200
Long Term Strategy (ac-ft/yr)	None identified					

Water User Group:	City of Sunray - Moore County					
	2000	**2010**	**2020**	**2030**	**2040**	**2050**
Population (number of persons)	1,902	2,271	2,678	3,022	3,267	3,532
Water Demand (ac-ft/yr)	492	560	630	701	750	807
Current Supply (ac-ft/yr)	492	560	630	0	0	0
Supply - Demand (ac-ft/yr)	0	0	0	-701	-750	-807
Recommended Short Term Strategy - Install new wells and Palo Duro Reservoir (ac-ft/yr)	0	0	0	701	750	807
Long Term Strategy (ac-ft/yr)	None identified					

Water User Group:	City of Perryton - Ochiltree				
	2000	**2010**	**2020**	**2030**	**2040**
Population (number of persons)	8,071	8,566	8,863	8,824	8,708
Water Demand (ac-ft/yr)	2,468	2,504	2,482	2,432	2,370
Current Supply (ac-ft/yr)	2,468	986	0	0	0
Supply - Demand (ac-ft/yr)	0	-1,518	-2,482	-2,432	-2,370
Recommended Short Term Strategy - Install new wells (ac-ft/yr)	0	1,518	2,482	2,432	2,370
Long Term Strategy (ac-ft/yr)	None identified				

2050
8,594
2,320
0
-2,320
2,320

Water User Group:	County Other - Oldham County					
	2000	**2010**	**2020**	**2030**	**2040**	**2050**
Population (number of persons)	1,462	1,538	1,529	1,476	1,402	1,302
Water Demand (ac-ft/yr)	2,496	2,492	2,479	2,467	2,450	2,439
Current Supply (ac-ft/yr)	2,496	2,492	2,479	2,467	2,450	144
Supply - Demand (ac-ft/yr)	0	0	0	0	0	-2,295
Recommended Short Term Strategy (ac-ft/yr)	None identified					
Long Term Strategy - Adrian (ac-ft/yr)	0	0	0	0	0	2,295

Water User Group:	Irrigation - Oldham County					
	2000	**2010**	**2020**	**2030**	**2040**	**2050**
Population (number of persons)						
Water Demand (ac-ft/yr)	26,497	26,497	26,497	26,497	26,497	26,497
Current Supply (ac-ft/yr)	26,497	26,497	26,497	26,497	24,069	549
Supply - Demand (ac-ft/yr)	0	0	0	0	-2,428	-25,948
Recommended Short Term Strategy (ac-ft/yr)	None identified					
Long Term Strategy (ac-ft/yr)	0	8,549	13,075	13,075	13,075	13,075

Water User Group:	Mining - Oldham County (Red Basin Only)					
	2000	**2010**	**2020**	**2030**	**2040**	**2050**
Population (number of persons)						
Water Demand (ac-ft/yr)	271	279	287	296	305	314
Current Supply (ac-ft/yr)	271	279	287	296	305	3
Supply - Demand (ac-ft/yr)	0	0	0	0	0	-311
Recommended Short Term Strategy (ac-ft/yr)	None identified					
Long Term Strategy - Install new wells (ac-ft/yr)	0	0	0	0	0	311

Water User Group:	City of Vega - Oldham County					
	2000	**2010**	**2020**	**2030**	**2040**	**2050**
Population (number of persons)	931	1,000	1,034	1,055	1,016	978
Water Demand (ac-ft/yr)	265	273	269	270	255	245
Current Supply (ac-ft/yr)	265	273	269	270	255	0
Supply - Demand (ac-ft/yr)	0	0	0	0	0	-245
Recommended Short Term Strategy (ac-ft/yr)	None identified					
Long Term Strategy - Install new wells (ac-ft/yr)	0	0	0	0	0	245

Table 11: Potentially Feasible Water Management Strategies

A Major Water Provider Name (If Applicable)	B Water User Group Name	C Major Water Provider (TWDB Alpha Number)	D Water User Group Identifier	E Regional Water Planning Group Letter	F Sequence Number for Water User Group	G City Number for Water User Group	H County Number for Water User Group	I Basin Number for Water User Group	J Type of Water Supply	K Regional Water Planning Group of Source	L County Number of Source	M Basin Number of Source	N Specific Source Identifier	O Name of Specific Source	P Total Capital Cost	Q Year 2000 (Cost/Ac-ft)	R Year 2010 (Cost/Ac-ft)	S Year 2020 (Cost/Ac-ft)	T Year 2030 (Cost/Ac-ft)	U Year 2040 (Cost/Ac-ft)	V Year 2050 (Cost/Ac-ft)	W Year 2000 Value of Total Supply from Strategy (Ac-ft)	X Year 2010 Value of Total Supply from Strategy (Ac-ft)	Y Year 2020 Value of Total Supply from Strategy (Ac-ft)	Z Year 2030 Value of Total Supply from Strategy (Ac-ft)	AA Year 2040 Value of Total Supply from Strategy (Ac-ft)	BB Year 2050 Value of Total Supply from Strategy (Ac-ft)	Comments	County Name	Basin
	CLAUDE		010173000	A	0173	0114	006	02	4j8	A	006	02	00621	Ogallala	$1,585,990	$0	$0	$0	$514	$514	$514	0	0	0	150	268	267	Install 2 new wells within 3 miles of City	ARMSTRONG	RED
	GROOM		010365000	A	0365	0875	033	02	4j9	A	033	02	03321	Ogallala	$299,207	$0	[illegible]	[illegible]	[illegible]	$233	$233	0	0	0	0	51	121	Install one new well within City	CARSON	RED
	PANHANDLE		010675000	A	0675	0453	033	02	4j10	A	033	02	03321	Ogallala	$888,170	$0	[illegible]	[illegible]	[illegible]	$108	$108	0	0	0	0	716	933	Install 2 new wells within City	CARSON	RED
	SKELLYTOWN		010834000	A	0834	0960	033	01	4j11	A	033	01	03321	Ogallala	$299,412	$0	[illegible]	[illegible]	[illegible]	$439	$80	0	0	64	64	61	59	Install one new well within City	CARSON	CANADIAN
	WHITE DEER		010962000	A	0962	0647	033	01	4j12	A	033	01	03321	Ogallala	$714,206	$0	[illegible]	[illegible]	[illegible]	$249	$249	0	0	0	0	45	267	Install 2 new wells within City	CARSON	CANADIAN
	WHITE DEER		010962000	A	0962	0647	033	02	4j12	A	033	02	03321	Ogallala		$0	[illegible]	[illegible]	[illegible]	$249	$249	0	0	0	0	3	14	Install 2 new wells within City	CARSON	RED
	IRRIGATION		011004056	A	1004	1004	056	01	4a1	A	056	01	38056	Other Conservation County 056	$0	$0	[illegible]	[illegible]	[illegible]	$108	$108	0	7,850	15,700	15,700	15,700	15,700	Irrigation Strategies - Short Season Corn	DALLAM	CANADIAN
	IRRIGATION		011004056	A	1004	1004	056	01	4a5	A	056	01	38056	Other Conservation County 056	$0	$0	[illegible]	[illegible]	[illegible]	$325	$325	0	400	800	800	800	800	Irrigation Strategies - Short Season Sorghum	DALLAM	CANADIAN
	IRRIGATION		011004056	A	1004	1004	056	01	4a2	A	056	01	38056	Other Conservation County 056	$0	$0	[illegible]	[illegible]	[illegible]	$135	$135	0	23,864	47,728	47,728	47,728	47,728	Irrigation Strategies - Irrigated Corn to Irrigated Sorghum	DALLAM	CANADIAN
	IRRIGATION		011004056	A	1004	1004	056	01	4a3	A	056	01	38056	Other Conservation County 056	$17,075	$0	[illegible]	[illegible]	[illegible]	$1	$1	0	23,716	33,202	33,202	33,202	33,202	Irrigation Strategies - NPET	DALLAM	CANADIAN
	IRRIGATION		011004056	A	1004	1004	056	01	4a4	A	056	01	38056	Other Conservation County 056	$10,432,928	$0	[illegible]	[illegible]	[illegible]	$37	$37	0	11,066	22,132	22,132	22,132	22,132	Irrigation Strategies - LEPA	DALLAM	CANADIAN
	IRRIGATION		011004056	A	1004	1004	056	01	4a6	A	056	01	38056	Other Conservation County 056	$0	$0	[illegible]	[illegible]	[illegible]	$38	$38	0	4,743	9,486	9,486	9,486	9,486	Irrigation Strategies - Tillage	DALLAM	CANADIAN
	IRRIGATION		011004056	A	1004	1004	056	01	4l	A	056	01	37056	Precipitation Enhancement County 056	$0	$0	[illegible]	[illegible]	[illegible]	$1	$1	0	23,716	23,716	23,716	23,716	23,716	Irrigation Strategies - Precipitation Enhancement	DALLAM	CANADIAN
	LIVESTOCK		011005056	A	1005	1005	056	01	4k	A	056	01	05621	Ogallala	$15,503,746	$0	[illegible]	[illegible]	[illegible]	$140	$56	0	0	0	0	14,742	16,796	Develop water rights as needed or import water from nearby counties	DALLAM	CANADIAN
	MANUFACTURING		011001056	A	1001	1001	056	01	4j26	A	056	01	05621	Ogallala	$293,576	$0	[illegible]	[illegible]	[illegible]	$127	$127	0	0	0	0	232	232	Texline purchases additional water rights to protect their existing supplies	DALLAM	CANADIAN
	LEFORS		010515000	A	0515	0898	090	02	4j	A	090	02	09021	Ogallala	$0	$0	[illegible]	[illegible]	[illegible]	$0	$0	0	19	95	87	80	78	Installed new well this year - no new strategy needed	GRAY	RED
	MANUFACTURING		011001090	A	1001	1001	090	01	4j	A	090	01	09021	Ogallala		$0	[illegible]	[illegible]	[illegible]	$0	$0	0	0	0	0	0	57	Supply assumed provided by Pampa's Ogallala well field. No entry where information not available to determine cost for supply.	GRAY	CANADIAN
[illegible]																														

TWDB Table 12: Recommended Management Strategies by City and Category

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X		
Water User Group Name	Water User Group Identifier	Regional Water Planning Group Letter	Sequence Number for Water User Group	City Number for Water User Group	County Number for Water User Group	Basin Number for Water User Group	Name of Water Management Strategy	Type of Water Supply	Major Water Provider Number (TWDB Alpha	Regional Water Planning Group of Source	County Number of Source	Basin Number of Source	Specific Source Identifier	Name of Specific Source	Total Capital Cost	Year 2000 Value of Total Supply from	Year 2010 Value of Total Supply from	Year 2020 Value of Total Supply from	Year 2030 Value of Total Supply from	Year 2040 Value of Total Supply from	Year 2050 Value of Total Supply from	Exception from Meeting Needs	Scenario Number for Meeting Long Term Needs (Blank if only one listed)	County Name	Basin
CLAUDE	010173000	A	0173	0114	006	2	Install 2 new wells within 3 miles of City	4j8		A	006	02	00621	Ogallala	$1,585,990	0	0	0	150	268	267			ARMSTRONG	RED
GROOM	010365000	A	0365	0875	033	2	Install one new well within City	4j9		A	033	02	03321	Ogallala	$299,207	0	0	0	0	51	121			CARSON	RED
PANHANDLE	010675000	A	0675	0453	033	2	Install 2 new wells within City	4j10		A	033	02	03321	Ogallala	$888,170	0	0	0	0	738	933			CARSON	RED
SKELLYTOWN	010834000	A	0834	0960	033	1	Install one new well within City	4j11		A	033	01	03321	Ogallala	$299,412	0	0	44	64	61	59			CARSON	CANADIAN
WHITE DEER	010962000	A	0962	0647	033	1	Install 2 new wells within City	4j12		A	033	01	03321	Ogallala	$714,206	0	0	0	0	45	267			CARSON	CANADIAN
WHITE DEER	010962000	A	0962	0647	033	2	Install 2 new wells within City	4j12		A	033	02	03321	Ogallala		0	0	0	0	3	14			CARSON	RED
COUNTY-OTHER	010996056	A	0996	0757	056	1	Supply provided by Dalhart	4j13		A	103	01	10321	Ogallala		0	0	0	121	173	172			DALLAM	CANADIAN
IRRIGATION	011004056	A	1004	1004	056	1	Irrigation Strategies - Short Season Corn	4a1		A	056	01	38056	Other Conservation County 056	$0	0	7,850	15,700	15,700	15,700	15,700	a	DAI-1	DALLAM	CANADIAN
IRRIGATION	011004056	A	1004	1004	056	1	Irrigation Strategies - NPET	4a3		A	056	01	38056	Other Conservation County 056	$17,075	0	23,716	33,202	33,202	33,202	33,202	a	DAI-4	DALLAM	CANADIAN
IRRIGATION	011004056	A	1004	1004	056	1	Irrigation Strategies - LEPA	4a4		A	056	01	38056	Other Conservation County 056	$10,432,928	0	11,066	22,132	22,132	22,132	22,132	a	DAI-5	DALLAM	CANADIAN
IRRIGATION	011004056	A	1004	1004	056	1	Irrigation Strategies - Tillage	4a6		A	056	01	38056	Other Conservation County 056	$0	0	4,743	9,486	9,486	9,486	9,486	a	DAI-6	DALLAM	CANADIAN
IRRIGATION	011004056	A	1004	1004	056	1	Irrigation Strategies - Precipitation Enhancement	4l		A	056	01	37056	Precipitation Enhancement County 056	$0	0	23,716	23,716	23,716	23,716	23,716	a	DAI-7	DALLAM	CANADIAN
LIVESTOCK	011005056	A	1005	1005	056	1	Develop water rights as needed or import water from nearby counties	4k		A	056	01	37056	Ogallala	$15,503,746	0	0	0	0	14,742	16,796			DALLAM	CANADIAN
MANUFACTURING	011001056	A	1001	1001	056	1	Texline purchases additional water rights to protect their existing supplies	4j26		A	056	01	05621	Ogallala	$293,576	0	0	0	0	232	232			DALLAM	CANADIAN
LEFORS	010515000	A	0515	0898	090	2	Installed new well this year - no new strategy needed	4j		A	090	02	09021	Ogallala	$0	0	19	95	85	80	78			GRAY	RED
MANUFACTURING	011001090	A	1001	1001	090	1	Supply assumed provided by Pampa"s Ogallala well field	4j		A	090	01	09021	Ogallala		0	0	0	0	0	57			GRAY	CANADIAN
MCLEAN	010578000	A	0578	0380	090	2	Install 2 new wells within 1.5 miles	4j14		A	090	02	09021	Ogallala	$1,277,140	0	0	246	232	226	220			GRAY	RED
GRUVER	010368000	A	0368	0256	098	1	develop existing water rights and additional water rights (2 wells)	4j3		A	098	01	09821	Ogallala	$768,821	0	295	372	161	146	134			HANSFORD	CANADIAN
GRUVER	010368000	A	0368	0256	098	1	Palo Duro Reservoir	4d		A	098	01	09821	Ogallala	$1,872,376	0	0	0	200	200	200			HANSFORD	CANADIAN
CANADIAN	010142000	A	0142	0093	106	1	Install 2 new wells within 5 miles	4j15		A	106	01	10621	Ogallala	$2,467,508	0	0	199	641	615	601			HEMPHILL	CANADIAN
CACTUS	010134000	A	0134	0762	171	1	Palo Duro Reservoir project	4d		A	171	01	01020	Palo Duro Reservoir	$18,723,763	0	0	0	400	500	500	a		MOORE	CANADIAN
CACTUS	010134000	A	0134	0762	171	1	Install 4 new wells (will also provide for portion of manufacturing)	4j6		A	171	01	17121	Ogallala	$5,232,510	0	0	0	192	203	338			MOORE	CANADIAN
COUNTY-OTHER	010996171	A	0996	0757	171	1	supply provided by Sunray and Dumas. See strategies for source	4e1		A	171	01	01020	Palo Duro Reservoir		0	0	0	150	150	150	a	MOC-1	MOORE	CANADIAN
COUNTY-OTHER	010996171	A	0996	0757	171	1	supply provided by Sunray, Dumas, Fritch, and new rural wells if needed.	4e2		A	171	01	17121	Ogallala		0	0	0	277	269	280	a	MOC-2	MOORE	CANADIAN
DUMAS	010255171	A	0255	0170	171	1	Palo Duro Reservoir project	4d		A	171	01	01020	Palo Duro Reservoir	$23,966,417	0	0	0	2,510	2,510	2,510			MOORE	CANADIAN
DUMAS	010255171	A	0255	0170	171	1	Install 3 new wells	4j5		A	171	01	17121	Ogallala	$3,919,408	0	0	0	908	1,093	1,338	a		MOORE	CANADIAN
IRRIGATION	011004171	A	1004	1004	171	1	Irrigation Strategies - Short Season Sorghum	4a5		A	171	01	38171	Other Conservation County 171	$0	0	1,100	2,200	2,200	2,200	2,200	a	MOI-2	MOORE	CANADIAN
IRRIGATION	011004171	A	1004	1004	171	1	Irrigation Strategies - NPET	4a3		A	171	01	38171	Other Conservation County 171	$10,284	0	14,284	19,997	19,997	19,997	19,997	a	MOI-4	MOORE	CANADIAN
IRRIGATION	011004171	A	1004	1004	171	1	Irrigation Strategies - LEPA	4a4		A	171	01	38171	Other Conservation County 171	$7,492,758	0	7,004	14,007	14,007	14,007	14,007	a	MOI-5	MOORE	CANADIAN
IRRIGATION	011004171	A	1004	1004	171	1	Irrigation Strategies - Tillage	4a6		A	171	01	38171	Other Conservation County 171	$0	0	2,857	5,714	5,714	5,714	5,714	a	MOI-6	MOORE	CANADIAN
IRRIGATION	011004171	A	1004	1004	171	1	Irrigation Strategies - Precipitation Enhancement	4l		A	171	01	38171	Other Conservation County 171	$0	0	14,284	14,284	14,284	14,284	14,284	a	MOI-7	MOORE	CANADIAN

TWDB Table 12: Recommended Management Strategies by City and Category

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X		
Water User Group Name	Water User Group Identifier	Regional Water Planning Group Letter	Sequence Number for Water User Group	City Number for Water User Group	County Number for Water User Group	Basin Number for Water User Group	Name of Water Management Strategy	Type of Water Supply	Major Water Provider Number (TWDB Alpha	Regional Water Planning Group of Source	County Number of Source	Basin Number of Source	Specific Source Identifier	Name of Specific Source	Total Capital Cost	Year 2000 Value of Total Supply from	Year 2010 Value of Total Supply from	Year 2020 Value of Total Supply from	Year 2030 Value of Total Supply from	Year 2040 Value of Total Supply from	Year 2050 Value of Total Supply from	Exception from Meeting Needs	Scenario Number for Meeting Long Term Needs (Blank if only one listed)	County Name	Basin
LIVESTOCK	011005171	A	1005	1005	171	1	Develop water rights as needed or import water from nearby counties	4j40		A	171	01	37171	Precipitation Enhancement County 171	$7,972,527	0	0	0	7,459	8,546	9,786			MOORE	CANADIAN
MANUFACTURING	011001171	A	1001	1001	171	1	Palo Duro reservoir via Cactus	4d		A	171	01	01020	Palo Duro Reservoir		0	0	0	1,100	1,300	1,500		MOM-1	MOORE	CANADIAN
MANUFACTURING	011001171	A	1001	1001	171	1	Groundwater via new supplies	4j29		A	171	01	17121	Ogallala	$9,469,879	0	0	0	2,938	3,083	3,174		MOM-2	MOORE	CANADIAN
MANUFACTURING	011001171	A	1001	1001	171	1	Groundwater via Cactus	4j6		A	171	01	17121	Ogallala		0	0	0	1,800	1,800	1,800		MOM-3	MOORE	CANADIAN
MANUFACTURING	011001171	A	1001	1001	171	1	treated effluent (currently used, but was not included in supply) assume 5% increase of TE use every 5 years.	4b1		A	171	01	36012	Reuse: BaZoCou 01-02-171	$0	2,000	2,000	2,205	2,431	2,680	2,955		MOM-4	MOORE	CANADIAN
STEAM ELECTRIC POWER	011002171	A	1002	1002	171	1	purchase additional water rights	4j33		A	171	01	17121	Ogallala	$334,320	0	0	0	200	200	200			MOORE	CANADIAN
SUNRAY	010872000	A	0872	0588	171	1	Install 2 new wells	4j7		A	171	01	17121	Ogallala	$2,587,114	0	0	0	701	750	807			MOORE	CANADIAN
SUNRAY	010872000	A	0872	0588	171	1	Palo Duro Reservoir project	4d		A	171	01	01020	Palo Duro Reservoir	$4,680,941	0	0	0	400	400	400			MOORE	CANADIAN
PERRYTON	010689000	A	0689	0461	179	1	Install 5 new wells	4j22		A	179	01	17921	Ogallala	$5,462,979	0	1,518	2,482	2,432	2,370	2,320			OCHILTREE	CANADIAN
COUNTY-OTHER	010996180	A	0996	0757	180	1	correction with Boys Ranch	4e3		A	180	01		no strategy needed	$0	0	0	0	0	0	2,273		OLC-1	OLDHAM	CANADIAN
COUNTY-OTHER	010996180	A	0996	0757	180	2	Adrian	4e3		A	180	02	18021	Ogallala	$0	0	0	0	0	0	22		OLC-2	OLDHAM	RED
IRRIGATION	011004180	A	1004	1004	180	1	Irrigation Strategies - Short Season Sorghum	4a5		A	180	01	38180	Other Conservation County 180	$0	0	499	998	998	998	998	a	OLI-2	OLDHAM	CANADIAN
IRRIGATION	011004180	A	1004	1004	180	2	Irrigation Strategies - Short Season Sorghum	4a5		A	180	02	38180	Other Conservation County 180		0	26	53	53	53	53	a	OLI-2	OLDHAM	RED
IRRIGATION	011004180	A	1004	1004	180	1	Irrigation Strategies - NPET	4a3		A	180	01	38180	Other Conservation County 180	$1,811	0	2,389	3,345	3,345	3,345	3,345	a	OLI-4	OLDHAM	CANADIAN
IRRIGATION	011004180	A	1004	1004	180	2	Irrigation Strategies - NPET	4a3		A	180	02	38180	Other Conservation County 180		0	126	176	176	176	176	a	OLI-4	OLDHAM	RED
IRRIGATION	011004180	A	1004	1004	180	1	Irrigation Strategies - LEPA	4a4		A	180	01	38180	Other Conservation County 180	$3,532,215	0	2,491	4,983	4,983	4,983	4,983	a	OLI-5	OLDHAM	CANADIAN
IRRIGATION	011004180	A	1004	1004	180	2	Irrigation Strategies - LEPA	4a4		A	180	02	38180	Other Conservation County 180		0	125	249	249	249	249	a	OLI-5	OLDHAM	RED
IRRIGATION	011004180	A	1004	1004	180	1	Irrigation Strategies - Tillage	4a6		A	180	01	38180	Other Conservation County 180	$0	0	478	956	956	956	956	a	OLI-6	OLDHAM	CANADIAN
IRRIGATION	011004180	A	1004	1004	180	2	Irrigation Strategies - Tillage	4a6		A	180	02	38180	Other Conservation County 180			25	50	50	50	50	a	OLI-6	OLDHAM	RED
IRRIGATION	011004180	A	1004	1004	180	1	Irrigation Strategies - Precipitation Enhancement	4l		A	180	01	37180	Precipitation Enhancement County 180	$0	0	2,389	2,389	2,389	2,389	2,389	a	OLI-7	OLDHAM	CANADIAN
IRRIGATION	011004180	A	1004	1004	180	2	Irrigation Strategies - Precipitation Enhancement	4l		A	180	02	37180	Precipitation Enhancement County 180			126	126	126	126	126	a	OLI-7	OLDHAM	RED
MINING	011003180	A	1003	1003	180	2	Additional wells in Dockum aquifer	4j36		A	180	NA	18026	Dockum	$510,833	0	0	0	0	0	311			OLDHAM	RED
VEGA	010928000	A	0928	0622	180	1	Install new well in Deaf Smith County	4j16		A	059	01	05921	Ogallala	$1,727,357	0	0	0	0	0	61			OLDHAM	CANADIAN
VEGA	010928000	A	0928	0622	180	2	See Vega Canadian Basin for strategy	4j16		A	059	02	05921	Ogallala		0	0	0	0	0	184			OLDHAM	RED
AMARILLO	010020000	A	0020	0014	188	1	Roberts County well field	4j1	17600	A	197	01	19721	Ogallala	$154,829,940	0	0	0	0	8,400	8,400			POTTER	CANADIAN
AMARILLO	010020000	A	0020	0014	188	2	See Amarillo Canadian Basin for strategy	4j1	17600	A	197	01	19721	Ogallala		0	0	0	0	6,300	6,300			POTTER	RED
AMARILLO	010020000	A	0020	0014	188	1	Roberts County well field	4j2	17600	A	197	01	19721	Ogallala		0	0	0	0	10,694	10,083			POTTER	CANADIAN
AMARILLO	010020000	A	0020	0014	188	2	Roberts County well field	4j2	17600	A	197	01	19721	Ogallala		0	0	0	0	8,021	7,563			POTTER	RED
COUNTY-OTHER	010996188	A	0996	0757	188	1	Roberts County well field	4j2	17600	A	197	01	19721	Ogallala		0	0	0	0	1,094	1,260			POTTER	CANADIAN
COUNTY-OTHER	010996188	A	0996	0757	188	2	Roberts County well field	4j2	17600	A	197	01	19721	Ogallala		0	0	0	0	270	268			POTTER	RED
COUNTY-OTHER	010996188	A	0996	0757	188	1	Install ten new wells	4j23		A	188	01	18821	Ogallala	$3,057,133	0	0	0	169	545	1,375			POTTER	CANADIAN
COUNTY-OTHER	010996188	A	0996	0757	188	2	See Potter County-Other Canadian Basin for strategy	4j23		A	188	02	18821	Ogallala		0	0	0	19	61	153			POTTER	RED
IRRIGATION	011004188	A	1004	1004	188	1	Irrigation Strategies - Short Season Sorghum	4a5		A	188	01	38188	Other Conservation County 188	$0	0	68	135	135	135	135		POI-2	POTTER	CANADIAN
IRRIGATION	011004188	A	1004	1004	188	2	Irrigation Strategies - Short Season Sorghum	4a5		A	188	02	38188	Other Conservation County 188		0	8	15	15	15	15		POI-2	POTTER	RED
IRRIGATION	011004188	A	1004	1004	188	1	Irrigation Strategies - NPET	4a3		A	188	01	38188	Other Conservation County 188	$1,693	0	2,117	2,963	2,963	2,963	2,963		POI-4	POTTER	CANADIAN

TWDB Table 12: Recommended Management Strategies by City and Category

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X		
Water User Group Name	Water User Group Identifier	Regional Water Planning Group Letter	Sequence Number for Water User Group	City Number for Water User Group	County Number for Water User Group	Basin Number for Water User Group	Name of Water Management Strategy	Type of Water Supply	Major Water Provider Number (TWDB Alpha	Regional Water Planning Group of Source	County Number of Source	Basin Number of Source	Specific Source Identifier	Name of Specific Source	Total Capital Cost	Year 2000 Value of Total Supply from	Year 2010 Value of Total Supply from	Year 2020 Value of Total Supply from	Year 2030 Value of Total Supply from	Year 2040 Value of Total Supply from	Year 2050 Value of Total Supply from	Exception from Meeting Needs	Scenario Number for Meeting Long Term Needs (Blank if only one listed)	County Name	Basin
IRRIGATION	011004188	A	1004	1004	188	2	Irrigation Strategies - NPET	4a3		A	188	02	38188	Other Conservation County 188		0	235	329	329	329	329		POI-4	POTTER	RED
IRRIGATION	011004188	A	1004	1004	188	1	Irrigation Strategies - LEPA	4a4		A	188	01	38188	Other Conservation County 188	$3,503,913	0	2,183	4,363	4,363	4,363	4,363		POI-5	POTTER	CANADIAN
IRRIGATION	011004188	A	1004	1004	188	2	Irrigation Strategies - LEPA	4a4		A	188	02	38188	Other Conservation County 188		0	243	485	485	485	485		POI-5	POTTER	RED
IRRIGATION	011004188	A	1004	1004	188	1	Irrigation Strategies - Tillage	4a6		A	188	01	38188	Other Conservation County 188	$0	0	423	847	847	847	847		POI-6	POTTER	CANADIAN
IRRIGATION	011004188	A	1004	1004	188	2	Irrigation Strategies - Tillage	4a6		A	188	02	38188	Other Conservation County 188		0	47	94	94	94	94		POI-6	POTTER	RED
IRRIGATION	011004188	A	1004	1004	188	1	Irrigation Strategies - Precipitation Enhancemen	4l		A	188	01	37188	Precipitation Enhancement County 188	$0	0	2,117	2,117	2,117	2,117	2,117		POI-7	POTTER	CANADIAN
IRRIGATION	011004188	A	1004	1004	188	2	Irrigation Strategies - Precipitation Enhancemen	4l		A	188	02	37188	Precipitation Enhancement County 188		0	235	235	235	235	235		POI-7	POTTER	RED
MANUFACTURING	011001188	A	1001	1001	188	1	Install two new wells	4b2		A	188	01	18821	Ogallala	$701,773	0	0	0	0	402	719			POTTER	CANADIAN
MANUFACTURING	011001188	A	1001	1001	188	1	Roberts County well field	4j2	17600	A	197	01	19721	Ogallala		0	0	0	0	602	777			POTTER	CANADIAN
MINING	011003188	A	1003	1003	188	1	Dockum aquifer	4j37		A	188	NA	18826	Dockum	$852,070	0	0	0	0	193	231			POTTER	CANADIAN
MINING	011003188	A	1003	1003	188	2	See Potter Mining Canadian Basin for strategy	4j37		A	188	NA	18826	Dockum		0	0	0	124	158	179			POTTER	RED
STEAM ELECTRIC POWER	011002188	A	1002	1002	188	1	Increase of wastewater effluent from Amarillo	4b4		A	188	01	36014	Reuse: BaZoCou 01-02-188	$9,659,623	0	7,700	8,900	10,500	12,300	15,859		POS-1	POTTER	CANADIAN
AMARILLO	010020000	A	0020	0014	188	2	See Amarillo Canadian Basin for strategy	4j1	17600	A	197	01	19721	Ogallala		0	0	0	0	15,300	15,300			RANDALL	RED
AMARILLO	010020000	A	0020	0014	191	2	Roberts County well field	4j2	17600	A	197	01	19721	Ogallala	$208,124,865	0	0	0	0	19,478	18,366			RANDALL	RED
CANYON	010145000	A	0145	0096	191	2	Roberts County well field	4j2	17600	A	197	01	19721	Ogallala		0	0	0	0	479	772			RANDALL	RED
CANYON	010145000	A	0145	0096	191	2	Install three new wells	4j17		A	191	02	19121	Ogallala	$2,728,454	0	0	107	248	479	772			RANDALL	RED
COUNTY-OTHER	010996191	A	0996	0757	191	1	Roberts County well field	4j2	17600	A	197	01	19721	Ogallala		0	0	0	0	543	629			RANDALL	CANADIAN
COUNTY-OTHER	010996191	A	0996	0757	191	2	Roberts County well field	4j2	17600	A	197	01	19721	Ogallala		0	0	0	0	3,671	5,109			RANDALL	RED
COUNTY-OTHER	010996191	A	0996	0757	191	1	Install 18 additional wells in Randall Co	4j24		A	191	01	19121	Ogallala	$7,644,294	0	0	0	59	543	629			RANDALL	CANADIAN
COUNTY-OTHER	010996191	A	0996	0757	191	2	See County Other Randall Canadian Basin	4j24		A	191	02	19121	Ogallala		0	0	0	0	3,670	5,109			RANDALL	RED
IRRIGATION	011004191	A	1004	1004	191	1	Irrigation Strategies - Short Season Sorghum	4a5		A	191	01	38191	Other Conservation County 191	$0	0	725	1,450	1,450	1,450	1,450	*	RAI-2	RANDALL	CANADIAN
IRRIGATION	011004191	A	1004	1004	191	2	Irrigation Strategies - Short Season Sorghum	4a5		A	191	02	38191	Other Conservation County 191		0	15	30	30	30	30	*	RAI-2	RANDALL	RED
IRRIGATION	011004191	A	1004	1004	191	1	Irrigation Strategies - NPET	4a3		A	191	01	38191	Other Conservation County 191	$2,811	0	3,827	5,357	5,357	5,357	5,357	*	RAI-4	RANDALL	CANADIAN
IRRIGATION	011004191	A	1004	1004	191	2	Irrigation Strategies - NPET	4a3		A	191	02	38191	Other Conservation County 191		0	78	109	109	109	109	*	RAI-4	RANDALL	RED
IRRIGATION	011004191	A	1004	1004	191	1	Irrigation Strategies - LEPA	4a4		A	191	01	38191	Other Conservation County 191	$4,236,576	0	3,778	7,557	7,557	7,557	7,557	*	RAI-5	RANDALL	CANADIAN
IRRIGATION	011004191	A	1004	1004	191	2	Irrigation Strategies - LEPA	4a4		A	191	02	38191	Other Conservation County 191		0	77	154	154	154	154	*	RAI-5	RANDALL	RED
IRRIGATION	011004191	A	1004	1004	191	1	Irrigation Strategies - Tillage	4a6		A	191	01	38191	Other Conservation County 191	$0	0	765	1,531	1,531	1,531	1,531	*	RAI-6	RANDALL	CANADIAN
IRRIGATION	011004191	A	1004	1004	191	2	Irrigation Strategies - Tillage	4a6		A	191	02	38191	Other Conservation County 191		0	16	31	31	31	31	*	RAI-6	RANDALL	RED
IRRIGATION	011004191	A	1004	1004	191	1	Irrigation Strategies - Precipitation Enhancemen	4l		A	191	01	37191	Precipitation Enhancement County 191	$0	0	3,827	3,827	3,827	3,827	3,827	*	RAI-7	RANDALL	CANADIAN
IRRIGATION	011004191	A	1004	1004	191	2	Irrigation Strategies - Precipitation Enhancemen	4l		A	191	02	37191	Precipitation Enhancement County 191		0	78	78	78	78	78	*	RAI-7	RANDALL	RED
LAKE TANGLEWOOD	010500000	A	0500	0895	191	2	Install three new wells	4j18		A	191	02	19121	Ogallala	$1,058,356	0	12	305	303	294	282			RANDALL	RED
LIVESTOCK	011005191	A	1005	1005	191	1	Develop water rights as needed or import water from nearby counties	4j41		A	191	01	19121	Ogallala	$9,653,252	0	0	0	2	31	34			RANDALL	CANADIAN
LIVESTOCK	011005191	A	1005	1005	191	2	Develop water rights as needed or import water from nearby counties	4j41		A	191	02	19121	Ogallala		0	0	0	0	2,570	3,373			RANDALL	RED
MANUFACTURING	011001191	A	1001	1001	191	2	Install one new well	4b3		A	191	02	19121	Ogallala	$307,360	0	0	0	0	149	182			RANDALL	RED

TWDB Table 12: Recommended Management Strategies by City and Category

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X		
Water User Group Name	Water User Group Identifier	Regional Water Planning Group Letter	Sequence Number for Water User Group	City Number for Water User Group	County Number for Water User Group	Basin Number for Water User Group	Name of Water Management Strategy	Type of Water Supply	Major Water Provider Number (TWDB Alpha	Regional Water Planning Group of Source	County Number of Source	Basin Number of Source	Specific Source Identifier	Name of Specific Source	Total Capital Cost	Year 2000 Value of Total Supply from	Year 2010 Value of Total Supply from	Year 2020 Value of Total Supply from	Year 2030 Value of Total Supply from	Year 2040 Value of Total Supply from	Year 2050 Value of Total Supply from	Exception from Meeting Needs	Scenario Number for Meeting Long Term Needs (Blank if only one listed)	County Name	Basin
MANUFACTURING	011001191	A	1001	1001	191	2	Roberts County well field	4j2	17600	A	197	01	19721	Ogallala		0	0	0	0	148	173			RANDALL	RED
SHAMROCK	010822000	A	0822	0554	242	2	Two new wells in Ogallala	4j20		A	242	02	24221	Ogallala	$3,177,861	0	0	0	0	252	321			WHEELER	RED
WHEELER	010961000	A	0961	0646	242	2	Install one new wel	4j21		A	242	02	24221	Ogallala	$3,700,590	0	22	275	272	268	268			WHEELER	RED

TWDB Table 13: Recommended Management Strategies by Major Provider of Municipal and Manufacturing Water

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
Major Water Provider Name	**Major Water Provider Number (TWDB Alpha Number)**	**Basin Number for Basin of Use**	**Type of Water Supply**	**Regional Water Planning Group of Source**	**County Number of Source**	**Basin Number of Source**	**Name of Water Management Strategy**	**Specific Source Identifier**	**Name of Specific Source**	**Total Capital Cost**	**Year 2000 Value of Total Supply from Strategy**	**Year 2010 Value of Total Supply from Strategy**	**Year 2020 Value of Total Supply from Strategy**	**Year 2030 Value of Total Supply from Strategy**	**Year 2040 Value of Total Supply from Strategy**	**Year 2050 Value of Total Supply from Strategy**	**Exception from Meeting Needs**	**Scenario Number for Meeting Long-Term Needs (Blank if only one listed)**
AMARILLO	17600	01	4j1	A	197	01	Roberts County well field	19721	Ogallala	$208,207,294	0	0	0	0	8,400	8,400		
AMARILLO	17600	02	4j1	A	197	01	Roberts County well field	19721	Ogallala		0	0	0	0	6,300	6,300		
AMARILLO	17600	01	4j2	A	197	01	Roberts County well field	19721	Ogallala		0	0	0	0	10,694	10,083		
AMARILLO	17600	02	4j2	A	197	01	Roberts County well field	19721	Ogallala		0	0	0	0	8,021	7,563		
AMARILLO	17600	01	4j2	A	197	01	Roberts County well field	19721	Ogallala		0	0	0	0	1,094	1,260		
AMARILLO	17600	02	4j2	A	197	01	Roberts County well field	19721	Ogallala		0	0	0	0	270	268		
AMARILLO	17600	01	4j2	A	197	01	Roberts County well field	19721	Ogallala		0	0	0	0	602	777		
AMARILLO	17600	02	4j1	A	197	01	Roberts County well field	19721	Ogallala		0	0	0	0	15,300	15,300		
AMARILLO	17600	02	4j2	A	197	01	Roberts County well field	19721	Ogallala		0	0	0	0	19,478	18,366		
AMARILLO	17600	02	4j2	A	197	01	Roberts County well field	19721	Ogallala		0	0	0	0	479	772		
AMARILLO	17600	01	4j2	A	197	01	Roberts County well field	19721	Ogallala		0	0	0	0	543	629		
AMARILLO	17600	02	4j2	A	197	01	Roberts County well field	19721	Ogallala		0	0	0	0	3,671	5,109		
AMARILLO	17600	02	4j2	A	197	01	Roberts County well field	19721	Ogallala		0	0	0	0	148	173		

Panhandle Water Planning Group
Public Participation Activities

Event	Date	Notes	Presenter	Group Type	
Chamber Outreach Tour	3/3/1998	SB 1 Education	PRPC	1	
Desk and Derrick Club - Pampa	5/21/1998	Plan Education	CE	1	
Pampa Rotary Club	10/16/1998	Plan Education	CE	1	
Perryton Chamber @ Lobo	12/16/1998	Plan Education	PRPC	1	
Pampa Rotary	1/6/1999	Plan Education	PRPC	1	
Chamber Outreach Tour	1/12/1999	Plan Education	PRPC	1	
Miami Lions Club	1/12/1999	Plan Education	VC	1	
Perryton Rotary	2/18/1999	Plan Education	PRPC	1	
Spearman Rotary	5/30/1999	Plan Education	PRPC	1	
Panhandle Rotary Club	6/8/1999	Plan Education	CE	1	
Chamber Legislative Affairs	2/9/2000	Plan Education	PRPC	1	
Chamber Outreach Tour	2/10/2000	Plan Education	PRPC	1	
Follett Lions Club	4/13/2000	Plan Education	VC	1	
League of Women Voters	4/15/2000	Plan Education	CE	1	
Pampa Rotary Club	5/31/2000	Plan Education	CE	1	
Chamber Outreach Tour	7/11/2000	Plan Education	PRPC	1	
Panhandle Lions Club	8/22/2000	Plan Education	CE	1	
Perryton Lions Club	10/17/2000	Plan Education	*PRPC*	1	
Chamber Committee Mtg	11/9/2000	Plan Education	PRPC	1	
Golden K Kiwanis	11/17/2000	Plan Education	PRPC	1	
Pampa Rotary Club	12/20/2000	Plan Education	PRPC	1	**21**
McLean City Council	2/11/1999	Plan Education	PRPC	2	
PDRA Board Mtg	9/14/1999	Plan Education	PRPC	2	
Childress Co. Commissioners Ct	10/12/1999	Plan Education	PRPC	2	
GMIWA	12/16/1999	Plan Education	PRPC	2	
PDRA Board Mtg	2/8/2000	Plan Education	PRPC	2	
Perryton City Council	5/2/2000	Plan Education	PRPC	2	
CRMWA Board Mtg	7/12/2000	Plan Education	PRPC	2	
Panhandle City Council	10/12/2000	Plan Education	CE	2	**8**
USDA-ARS Ag-Day - Bushland	8/12/1998	Plan Education	CE	3	
Carson County Extension	10/6/1998	Plan Education	CE	3	
Roberts County Range Tour	10/7/1998	Plan Education	VC	3	
Oldham County Extension Planning Committee	11/17/1998	Plan Education	VC	3	
Dumas Trip	12/15/1998	Plan Education	PRPC	3	
Panhandle Agricultural Council - TAMU	3/25/1999	Plan Education	CE	3	
North Rolling Plains Field Day	6/16/1999	Plan Education	PRPC	3	
TSCRA Conference	6/29/1999	Plan Education	CE	3	
Gray County Extension Service	8/5/1999	Plan Education	CE	3	
Extension Area Wheat Producers Meeting	8/6/1999	Plan Education	VC	3	
Roberts County Extension - Ag. Comm.	8/24/1999	Plan Education	CE	3	
Range and Pasture Field Day - Roberts County	9/28/1999	Plan Education	VC	3	
Panhandle Farm Mgmt. Symposium	12/1/1999	Plan Education	PRPC	3	
Moore Co. Ag. Day	12/7/1999	Plan Education	PRPC	3	
WTAMU Ag. Appraisal Students	4/25/2000	Plan Education	CE	3	
Regional Farm Bureau Conference	7/21/2000	Plan Education	CE	3	
Texas Cattle Feeders Ass'n Meeting	8/15/2000	Plan Education	CE	3	
Gray County Farm Bureau Convention	8/24/2000	Plan Education	CE	3	
Gray-Roberts Ag. Committee	9/8/2000	Plan Education	CE	3	
Carson County Farm Bureau	9/27/2000	Plan Education	CE	3	
Randall County Extension	11/14/2000	Plan Education	PRPC	3	
Moore Co. Ag. Day	12/5/2000	Plan Education	PRPC	3	
Dalhart Area Chamber Ag Presentation	12/7/2000	Plan Education	PRPC	3	
Potter County Extension Service	12/14/2000	Plan Education	PRPC	3	**24**

Codes

1 Civic Group
2 Gov't Entity
3 Ag Group
4 Media Event
5 Special Interest
6 Public Info
7 Public Hearing
8 Workshops

Panhandle Water Planning Group
Public Participation Activities

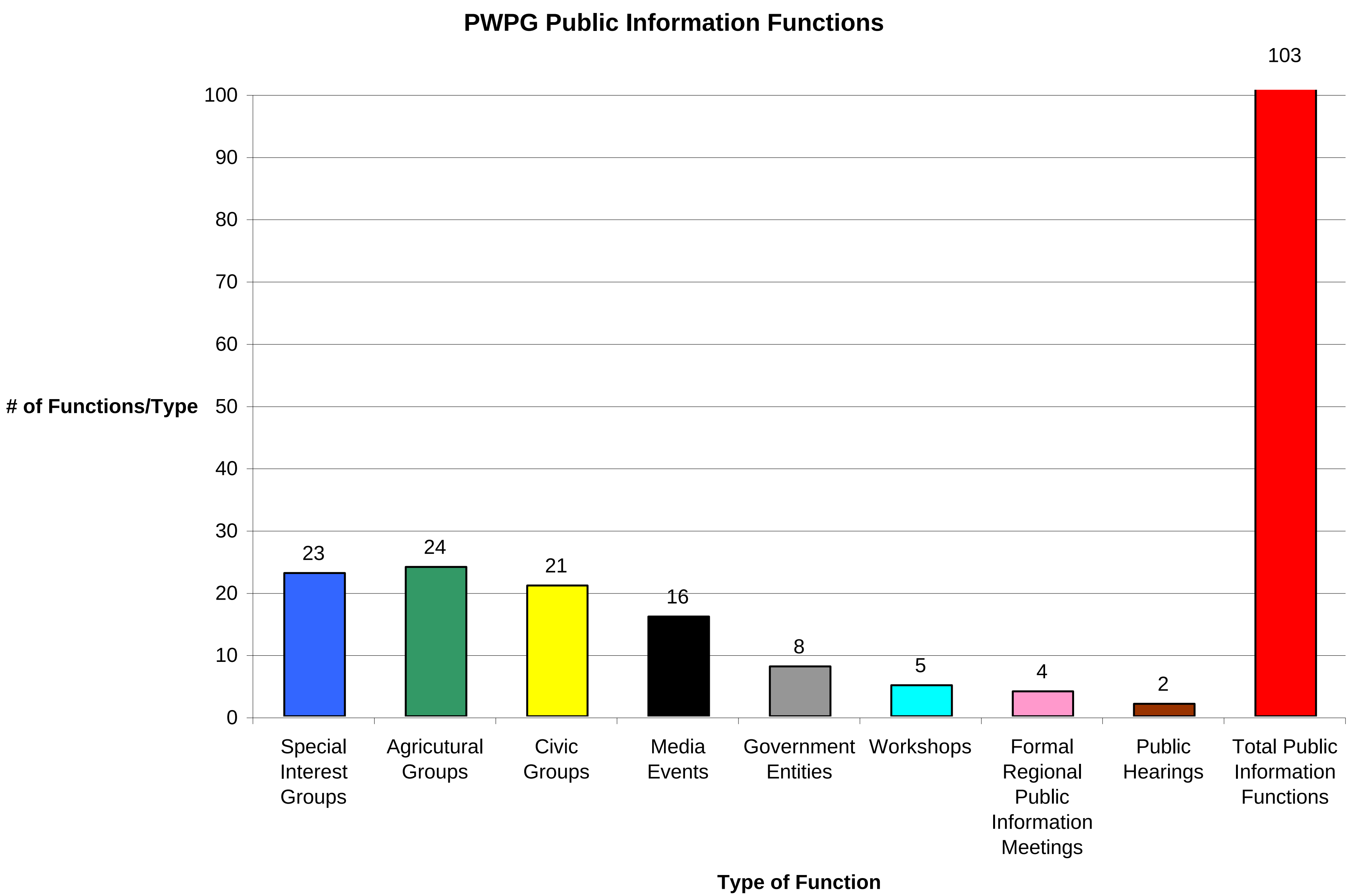
Event	Date	Notes	Presenter	Group Type	
KVII - TV Interview	11/4/1998	Plan Education	CE	4	
Shae Dodson (Channel7)	11/7/1998	Media Education	PRPC	4	
KEYE Radio	4/14/1999	Media Education	PRPC	4	
KGNC AM	6/14/1999	Formal Public Meeting - PWPG	PRPC	4	
Kevin Welch - AGN	3/8/2000	Formal Public Meeting - PWPG	PRPC	4	
KGNC AM	3/20/2000	Formal Public Meeting - PWPG	PRPC	4	
Chip Kanelis	4/5/2000	Media Education	PRPC	4	
News of Texas	5/24/2000	Plan Education	PRPC	4	
KACV-TV	7/10/2000	Media Education	PRPC	4	
KGNC AM - Radio Interview	7/31/2000	Plan Education	CE	4	
KGNC AM	8/4/2000	Public Hearing/Plan Adoption	PRPC	4	
KGNC AM	9/18/2000	Public Hearing/Plan Adoption	PRPC	4	
KGNC AM	9/20/2000	Public Hearing/Plan Adoption	PRPC	4	
A/C Water Conference	11/18/2000	Plan Education	PRPC	4	
NGWA - New Orleans	1/8/2001	Plan Education	PRPC	4	
KGNC AM	12/12/2000	Plan Adoption	PRPC	4	**16**
Panhandle Conference of Mayors	1/22/1998	SB 1 Education	PRPC	5	
North Rolling Plains RC&D Directors	6/11/1998	Plan Education	VC	5	
Rural Development Outreach - Miami	8/25/1998	SB 1 Education	PRPC	5	
North Rolling Plains RC&D Directors	9/16/1998	Plan Education	VC	5	
Dairy Day - Pampa	9/22/1998	Plan Education	CE	5	
TML Quarterly Mayors Mtg	1/21/1999	Plan Education	PRPC	5	
County Judges & Comm. Meeting	3/12/1999	Plan Education	PRPC	5	
Wheeler County Extension Planning Committee	3/22/1999	Plan Education	VC	5	
Roberts County Extension - Planning Committee	4/20/1999	Plan Education	VC	5	
Randall County Extension Planning Committee	4/22/1999	Plan Education	VC	5	
Potter Futures Forum	4/29/1999	Public Participation	PRPC	5	
Wheeler County Extension Planning Committee	5/12/1999	Plan Education	VC	5	
Carson County Extension Planning Committee	5/17/1999	Plan Education	VC	5	
NRP - Pampa	5/26/1999	Plan Education	PRPC	5	
North Rolling Plains RC&D Directors	5/26/1999	Plan Education	VC	5	
TAEX - Focus Group - Futures Forum	6/10/1999	Public Participation	PRPC	5	
PCMA Presentation	7/30/1999	Plan Education	PRPC	5	
Conference of mayors	1/20/2000	Plan Education	PRPC	5	
Panhandle Conference of Mayors	1/22/2000	SB 1 Education	PRPC	5	
North Rollng Plains RC&D Directors	3/8/2000	Plan Education	VC	5	
High Plains RC&D Directors - Amarillo	8/24/2000	Plan Education	VC	5	
Amarillo College Water Forum	11/18/2000	Plan Education	PRPC	5	
County Judges & Comm. Meeting	9/22/2000	Plan Education	PRPC	5	**23**
Public Part. Mtg - PIN	6/15/1999	Formal Public Meeting - PWPG	PRPC	6	
Public Part Mtg-Dumas	3/21/2000	Formal Public Meeting - PWPG	PRPC	6	
Public Part Mtg-Pampa	3/23/2000	Formal Public Meeting - PWPG	PRPC	6	
Public Part. Mtg - PIN	7/27/2000	Formal Public Meeting - PWPG	PRPC	6	**4**
Public Hearing-Scope of Work	6/30/1998	Public Hearing - Scope of Work	PRPC	7	
Public Hearing	9/19/2000	Public Hearing/Plan Adoption	PRPC	7	**2**
TNRCC Drought Management Workshop	5/18/1999	Workshop	PRPC	8	
AWWA Mtg	5/20/1999	Workshop	PRPC	8	
Depserados (emmett autrey	1/13/2000	Workshop	PRPC	8	
Drought Contingency Workshop	4/4/2000	Workshop	PRPC	8	
PWPG Workshop	7/9/2000	Plan Education	PRPC	8	**5**

Codes

1 Civic Group
2 Gov't Entity
3 Ag Group
4 Media Event
5 Special Interest
6 Public Info
7 Public Hearing
8 Workshops

Data Set

Special Interest Groups	23	count	103
Agricutural Groups	24		
Civic Groups	21		
Media Events	16		
Government Entities	8		
Workshops	5		
Formal Regional Public Information Meetings	4		
Public Hearings	2		
Total Public Information Functions	103		


PWPG Public Information Functions
# of Functions/Type
0
10
20
30
40
50
60
70
80
90
100
23
24
21
16
8
5
4
2
103
Special Interest Groups
Agricutural Groups
Civic Groups
Media Events
Government Entities
Workshops
Formal Regional Public Information Meetings
Public Hearings
Total Public Information Functions
Type of Function

PWPG and Committee Meetings

Date	Meeting	Type
4/20/1998	Executive Committee	1
7/17/1998	Funding Committee	1
7/22/1998	Scope Committee	1
9/15/1998	Scope Committee	1
9/18/1998	Scope Committee	1
11/12/1998	Consultant Committee	1
11/12/1998	Contact Committee	1
1/5/1999	Consultant Committee	1
1/18/1999	Public Participation Committee	1
2/12/1999	Consultant Committee	1
2/22/1999	Consultant Committee	1
3/1/1999	Consultant Committee	1
3/5/1999	Consultant Committee	1
3/11/1999	Consultant Committee	1
4/7/1999	Public Participation Committee	1
4/27/1999	Municipal and Industrial Demands & Projections Committee	1
5/6/1999	Modeling Committee	1
5/12/1999	Agricultural Demands & Projections Committee	1
5/12/1999	Public Participation Committee	1
7/8/1999	Agricultural Demands & Projections Committee	1
7/8/1999	Municipal and Industrial Demands & Projections Committee	1
9/8/1999	Agricultural Demands & Projections Committee	1
9/8/1999	Municipal and Industrial Demands & Projections Committee	1
9/13/1999	Modeling Committee	1
10/21/1999	Agricultural Demands & Projections Committee	1
10/21/1999	Municipal and Industrial Demands & Projections Committee	1
11/15/1999	Ag and Model Committee	1
12/15/1999	Modeling Committee	1
1/11/2000	Modeling Committee	1
2/3/2000	Executive Committee	1
2/18/2000	Agricultural Demands & Projections Committee	1
2/18/2000	Municipal and Industrial Demands & Projections Committee	1
2/29/2000	Modeling Committee	1
2/29/2000	Public Participation Committee	1
3/15/2000	Public Participation Committee	1
4/11/2000	Agricultural Demands & Projections Committee	1
4/13/2000	Municipal and Industrial Demands & Projections Committee	1
4/14/2000	Modeling Committee	1
4/25/2000	Executive Committee	1
4/26/2000	Agricultural Demands & Projections Committee	1
4/27/2000	Municipal and Industrial Demands & Projections Committee	1
5/5/2000	Agricultural Demands & Projections Committee	1
5/5/2000	Municipal and Industrial Demands & Projections Committee	1
5/10/2000	Modeling Committee	1
6/6/2000	Agricultural Demands & Projections Committee	1

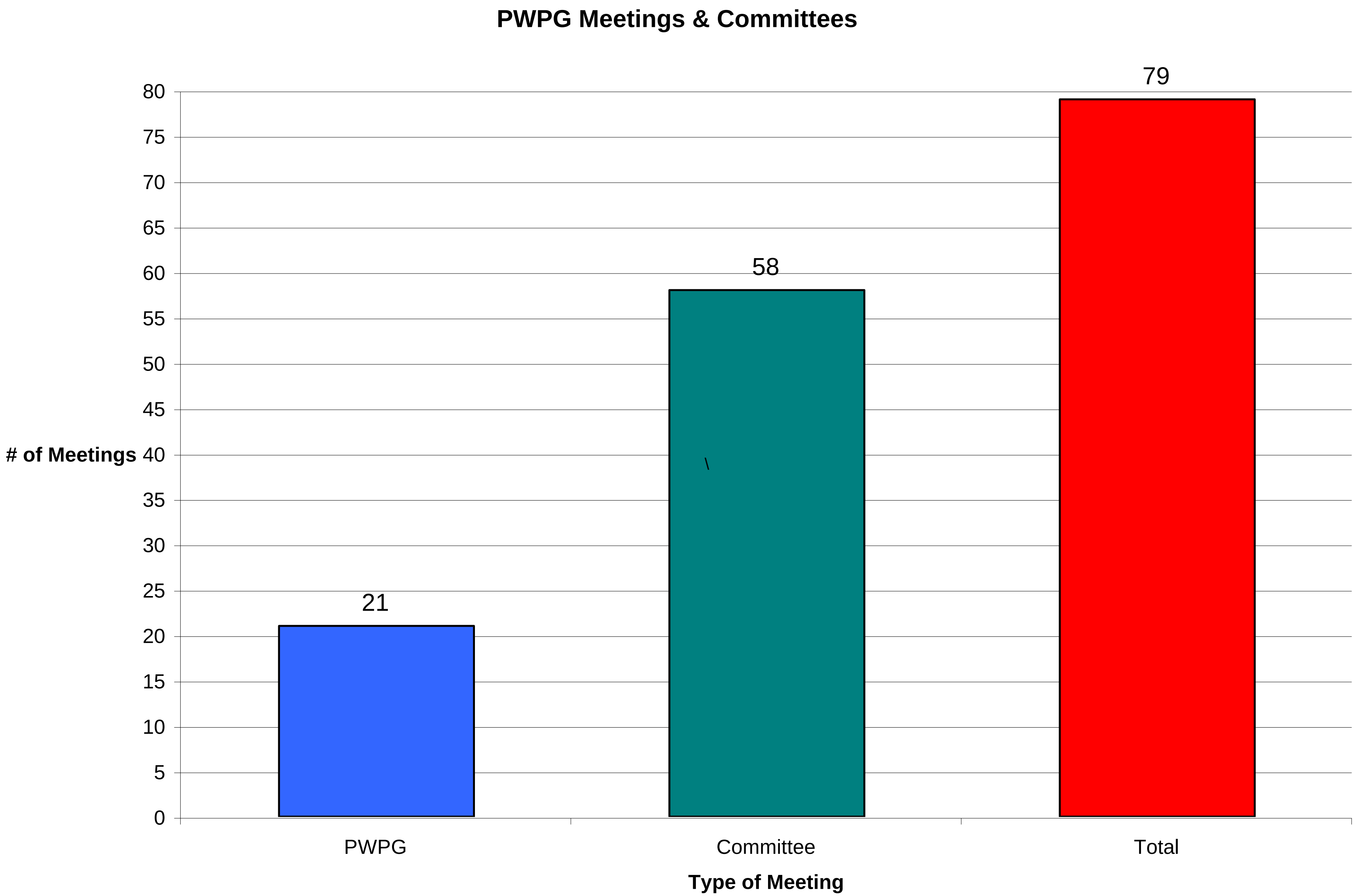
Codes

1	PWPG
2	Committee
3	Other

PWPG and Committee Meetings

Date	Meeting	Type		Codes	
6/21/2000	Municipal and Industrial Demands & Projections Committee	1			
6/21/2000	Public Participation Committee	1		1	PWPG
6/22/2000	Agricultural Demands & Projections Committee	1		2	Committee
7/5/2000	Agricultural Demands & Projections Committee	1		3	Other
7/5/2000	Municipal and Industrial Demands & Projections Committee	1			
7/13/2000	Public Participation Committee	1			
8/29/2000	Executive Committee	1			
8/31/2000	Public Participation Committee	1			
9/25/2000	Executive Committee	1			
10/3/2000	Executive Committee	1			
10/30/2000	Executive Committee	1			
11/9/2000	Executive Committee	1			
12/12/2000	Modeling Committee	1	**58**		
3/13/1998	ICB Meeting	2			
3/24/1998	ICB Meeting	2			
4/27/1998	PWPG Meeting	2			
6/16/1998	PWPG Meeting	2			
7/28/1998	PWPG Meeting	2			
10/27/1998	PWPG Meeting	2			
1/26/1999	PWPG Meeting	2			
3/23/1999	PWPG Meeting	2			
5/25/1999	PWPG Meeting	2			
7/15/1999	PWPG Meeting	2			
9/16/1999	PWPG Meeting	2			
11/23/1999	PWPG Meeting	2			
1/11/2000	PWPG Meeting	2			
2/29/2000	PWPG Meeting	2			
3/27/2000	PWPG Meeting	2			
5/10/2000	PWPG Meeting	2			
6/13/2000	PWPG Meeting	2			
7/5/2000	PWPG Meeting	2			
8/3/2000	PWPG Meeting	2			
11/9/2000	PWPG Meeting	2			
12/12/2000	PWPG Meeting	2	**21**		
		Total	**79**		

PWPG	21
Committee	58
Total	79


PWPG Meetings & Committees
# of Meetings
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
21
58
79
PWPG
Committee
Total
Type of Meeting

Panhandle Water Planning Group
Cumulative Expense Record
Time/Mileage Expenses

	Hours Expended	Value of Hours Expended	Miles Traveled	Value of Miles Traveled	Total Meeting Expenses
Panhandle Water Planning Group Meetings	2276.80	$ 85,380.00	48,583.07	$ 13,603.26	$ 98,983.26
Sub-Group (Committee Meetings)	1322.20	$ 49,582.50	26,942.50	$ 7,543.90	$ 57,126.40
Cumulative Totals	**3599.00**	**$ 134,962.50**	**75,525.57**	**$ 21,147.16**	**$ 156,109.66**

PWPG Total does not include ICB Meeting or 3/24/98 Meeting

PANHANDLE WATER PLANNING GROUP

REPRESENTATIVE	INTEREST GROUP	COUNTY OF RESIDENCE/INTEREST
Therese Abraham	PUBLIC	Hemphill
Judge Vernon Cook	COUNTY	Roberts
Dan Coffey	MUNICIPALITY	Potter/Randall
David Landis	MUNICIPALITY	Ochiltree
Bill Hallerberg	INDUSTRY	Gray
Mike Page	INDUSTRY	Hutchinson
Frank Simms	AGRICULTURAL	Carson
Rudie Tate	AGRICULTURAL	Collingsworth, Hall, Childress, Donley
Janet Tregellas	AGRICULTURAL	Lipscomb
B.A. Donelson	AGRICULTURAL	Sherman
Dr. Nolan Clark	ENVIRONMENTAL	Potter
Grady Skaggs	ENVIRONMENTAL	Oldham
Inge Brady	ENVIRONMENTAL	Randall
Rusty Gilmore	SMALL BUSINESS	Dallam
Gale Henslee	ELEC. GENERATOR	Potter
Jim Derington	RIVER AUTHORITIES	Hansford
Richard Bowers	WATER DISTRICTS	Moore & others
Bobbie Kidd	WATER DISTRICTS	Donley & others
C.E. Williams	WATER DISTRICTS	Carson & others
John Williams	WATER DISTRICTS	Hutchinson & others
Charles Cooke	WATER UTILITIES	Hutchinson
Dr. John Sweeten	HIGHER EDUCATION	Potter & Randall
Kent Satterwhite	NON-VOTING	
Mickey Black	NON-VOTING	
Stefan Schuster	NON-VOTING	
Charles Munger	NON-VOTING	
Ronald Bertrand	NON-VOTING	

PANHANDLE WATER PLANNING GROUP COMMITTEES

OFFICERS

Office	Member	Interest Group	Entity	County
Chairman	C.E. Williams	Water Districts	Panhandle Ground Water Conservation District	Carson
Vice-Chairman	Vernon Cook	Counties	Roberts County	Roberts
Secretary	Dan Coffey	Municipalities	City of Amarillo	Potter/Randall

EXECUTIVE COMMITTEE

Charge: As Defined in Bylaws

Office	Member	Interest Group	Entity	County
Chairman	C.E. Williams	Water Districts	Panhandle Ground Water Conservation District	Carson
Vice-Chairman	Vernon Cook	Counties	Roberts County	Roberts
Secretary	Dan Coffey	Municipalities	City of Amarillo	Potter/Randall
At-Large	John Williams	Water Districts	Canadian River Municipal Water Authority	Hutchinson
At-Large	Nolan Clark	Environmental	USDA/ARS	Potter

SCOPE OF WORK COMMITTEE

Charge: Revised and refine SOW and Budget in accordance with TWDB negotiations with PWPG approval

Member	Interest Group	County
C.E. Williams	Water Districts	Carson
Vernon Cook	Counties	Roberts
Dan Coffey	Municipalities	Potter/Randall
John Williams	Water Districts	Hutchinson
Nolan Clark	Environmental	Potter
Bobbie Kidd	Water Districts	Donley
Richard Bowers	Water Districts	Moore
Trish Neusch	Environmental	Potter
Gale Henslee	Elec. Generating	Potter
Jim Derington	River Authorities	Hansford

CONTACT COMMITTEE

Charge: Complete local funding proposal and initiate collection of funds as approved by PWPG

Member	Interest Group	County
Vernon Cook	Counties	Roberts
Dan Coffey	Municipalities	Potter/Randall
Richard Bowers	Water Districts	Moore
Bill Hallerberg	Industries	Gray
Charles Cooke	Water Utilities	Hutchinson
C.E. Williams	Water Districts	Carson

CONSULTANT SELECTION COMMITTEE

Charge: Design and issue RFQ's in accordance with PWPG instruction and approval

Member	Interest Group	County
C.E. Williams	Water Districts	Carson
Dan Coffey	Municipalities	Potter/Randall
John Williams	Water Districts	Hutchinson
Vernon Cook	Counties	Roberts
Nolan Clark	Environmental	Potter
Jim Derington	River Authorities	Hansford
Richard Bowers	Water Districts	Moore

MODELING COMMITTEE

Charge: Oversee daily development and integration of Regional Groundwater Model and present to PWPG for approval

Member	Interest Group	County
John Williams	Water Districts	Hutchinson
Charles Cooke	Water Utilities	Hutchinson
Rusty Gilmore	Small Business	Dallam
Gale Henslee	Elec. Generating	Potter/Randall
Frank Simms	Agriculture	Carson
Ben Weinheimer	*Agriculture*	*Potter*
Grady Skaggs	Environmental	Oldham
Richard Bowers	Water Districts	Moore
Dan Coffey	Municipalities	Potter/Randall
C.E. Williams	Water Districts	Carson
Mike Page	Industrial	Hutchinson

PUBLIC PARTICIPATION COMMITTEE

Charge: Oversee and implement approved public participation activities of the PWPG and its consultants, including PWPG website

Member	Interest Group	County
Vernon Cook	Counties	Roberts
Charles Cooke	Water Utilities	Hutchinson
Janet Tregellas	Agriculture	Lipscomb
Danelle Barber	*Water Districts*	*Moore*
John Sweeten	Higher Education	Potter
B.A. Donelson	Agriculture	Sherman
Jim Derington	River Authorities	Hansford
Kent Satterwhite	Water Districts	Hutchinson
Inge Brady	Environmental	Randall
Bill Hallerberg	Industrial	Gray

AGRICULTURAL DEMANDS & PROJECTIONS COMMITTEE

Charge: Oversee and provide review of ag-related demand, projection, and strategy data for presentation to PWPG

Member	Interest Group	County
Nolan Clark	Environmental	Potter
John Sweeten	Higher Education	Potter
Rusty Gilmore	Small Business	Dallam
Mickey Black	USDA/NRCS	Lubbock
Frank Simms	Agriculture	Carson
Richard Bowers	Water Districts	Moore
Rudie Tate	Agriculture	Collingsworth
C.E. Williams	Water Districts	Carson
Ben Weinheimer	*TCFA*	*Potter*

MUNICIPAL AND INDUSTRIAL DEMAND & PROJECTIONS COMMITTEE

Charge: Oversee and provide review of all non-ag related demand, projection and strategy data for presentation to PWPG

Member	Interest Group	County
Dan Coffey	Municipalities	Potter/Randall
John Williams	Water Districts	Hutchinson
David Landis	Municipalities	Ochiltree
Gale Henslee	Elec. Generating	Potter/Randall
Bobbie Kidd	Water Districts	Donley
Mike Page	Industrial	Hutchinson
C.E. Williams	Water Districts	Carson

Panhandle Water Planning Group
Public Hearing and Submitted Comments & Responses

Submitted By	General Topic	PWPG Approved Response	Action
Combs - Texas Dept. of Agriculture	Include Legislative Recommendation to provide state funded initiatives to improve irrigation efficiency; conservation tillage; precipitation enhancement; encourage water conservation reserve; funding for NPPET; (agreement with ag demand reduction strategies)	PWPG appreciates the comments from Commissioner Combs. Recommendations to provide state funded initiatives are included in Chapters 5 and 6 of the IPP.	No additional Action Required
Artho	Comment on ag water savings by converting crops and use of conservation tillage, Offer of resources to work on federal policy	Strategies to reduce demands for irrigated agriculture are included in Task 5. PWPG appreciates the support of the Grain Sorghum Producers Board in seeking legislation to implement proposed strategies.	No additional Action Required
Corcoran	Comment on decline of static water levels in his area, possibly due to increased irrigation	Your area of water level information was used by the PWPG and the Groundwater District. Decline is most likely due to increased irrigation.	No additional Action Required
Drake	Define How Much of the Ag $ Benefit Stays in Panhandle	High Plains Trade area direct benefit of ag $ = 3.249 billion (Amosson).	No additional Action Required
Drake	Define How Many people, companies, etc receive Ag $ Benefit	All individuals in the region benefit. Direct income =$3.249 billion, 12-13 billion in economic activity and 100,000 jobs (Amosson, 1996).	No additional Action Required
Drake	Justify Use of aquifer to feed cattle	Livestock activities provide over $1.76 billion in cash receipts in High Plains trade area alone.	No additional Action Required
Huseman	Encourage use of Humic Acid to enhance effects of irrigation; consider switch from sprinkler to drip irrigation	Research through TAEX indicates that there is no benefit from adding humic acid at practical commercial rates. Conversion from sprinkler to drip irrigation is included in IPP, as is cost data. Other efficient irrigation methodology is also included in IPP.	No additional Action Required
Presley	Develop Water Bank to convert Irrigated Ag to dryland	This issue is generally addressed under Section 6.3 of the IPP requesting the creation of a water conservation reserve program. The benefits of this program are obvious and it is hoped that regional water planning groups would be included in the development of such a federal or state program.	No additional Action Required
Lindsey	Concern over ag requirements for water plan, especially 50 years below normal rainfall as relates to model and affect on results	Irrigation demands used in IPP were developed using average rainfall. Initial data from TWDB used dry year rainfall. Municipal and Industrial demands are dry year numbers as provided by TWDB.	No additional Action Required
Yanke/Yanke Farms	need value added crops for irrigation; add more drip systems (use checkoff money and water district to purchase drip equipment and maximize efficiency and minimize cost	See sections 6.1, 6.2, 6.3, 6.4 in Initially Prepared Plan. Recommendations are included to improve efficiency and minimize cost.	No additional Action Required

Panhandle Water Planning Group
Public Hearing and Submitted Comments & Responses

Submitted By	General Topic	PWPG Approved Response	Action
Yanke/Yanke Farms	question as to whether municipal conservation was included, i.e.: landscaping, total municipal use, reuse, etc. Mentioned systems for confined animal feeding systems, recycled water, etc. Written comment also submitted	All municipalities applying for state revolving loans will be required to develop and implement a conservation program. Municipalities utilize technology concerning irrigation and landscaping to more effectively use water. Reclaimed water is in use, PWPG recommends that regulations be revised to make effluent reuse easier in Task 6.	No additional Action Required
Claughton	Have on-going water saving plan to conserve municipal water use; include information on daily activities; adjust rates to encourage conservation;	Water savings plans are currently in practice throughout the region and are required of certain water suppliers. Several agencies currently promote and publicize conservation ideas and strategies. With 89% of the water in the region going to irrigation, municipal conservation will be addressed and encouraged simultaneously with irrigation and other uses. Recommendations re: this comment are in Task 6, IPP.	No additional Action Required
Micou	RWPG Provide educational tool on pollution and slow recharge of aquifer; education on steps by local and state officers to protect and restore disappearing wetlands and creeks; education on how recharge actually occurs; describe effects of existent and possible contracts to sell water to other areas	PWPG is requesting educational components in Task 6, IPP; Outside scope of IPP, will be examined in future updates; See section 6.3, IPP re: Local groundwater districts and PWPG evaluation of existent and possible contracts as presented.	No additional Action Required
Pitner/PRPC	Recommend that funding for public information outreach, including tech assistance; funding for ongoing maintenance and development of Website and other activities be included	Chapter 6, paragraph 6.3 is intended to cover the request. A more detailed request in 6.3 could be made by adding "and would include funds to continue public information efforts for website preparation, presentations, and coordination with other regions and parties.	No additional Action Required
Robinson/TAEX	Include funding request for TAEX Agri-Partner program for collecting ag water use data	Type of funding requested is included under following legislative recommendations "data on agricultural water use"; "funding for implementation of water supply strategies"; Provide funding for NP-PET network and integration into statewide network". Task 6 recommendations in IPP cover funding for further data collection on Agricultural water usage.	No additional Action Required
Robinson/TAEX	Include funding request for "Water on Wheels" education curriculum for approximately 7,000 4th grade students	Task 6, IPP recommendations note request for funding to further educational efforts.	No additional Action Required
Seewald	Education of public regarding detrimental effects of urban sprawl, particularly along watersheds; playas; and slow rate of recharge to Ogallala	Urban sprawl in the PWPG area is not currently an issue, especially regarding water sheds. Certain elements are outside scope of IPP. Recharge issues covered in IPP under description of Ogallala Aquifer, section 1 and 3 (Ogallala Groundwater Model).	No additional Action Required

Panhandle Water Planning Group
Public Hearing and Submitted Comments & Responses

Submitted By	General Topic	PWPG Approved Response	Action
Yanke/Yanke Farms	Develop education programs for schools and tv that run for free and specify that a % of all spots must run in normal day and evening tv	Education programs are currently available. Area Groundwater Districts sponsor education programs for public schools. TAMU system is working on water education. TV ads would be wide-reaching, lack authority to mandate participation by media. Comment V, October 9 letter to Pedersen address comment.	No additional Action Required
Claughton	wants municipal conservation to preserve water addressed, specifically education	PWPG has recommendations in Task 6, IPP to cover issues regarding conservation and education, see also above comment.	No additional Action Required
Cloud/ U.S. Fish & Wildlife Service	Offer of Assistance to determine potential effects of individual projects as a result of Federal fish and wildlife requirements; offer to provide tech assistance on avoidance of impacts on candidate species; note that no environmental impacts of Sweetwater Creek Reservoir or Lelia Lake Creek reservoir sites; recommend these impacts be considered; recommend figures 5-1 through 5-4 be corrected to avoid duplication	PWPG has no direct implementation authority and can not therefore implement strategies. Implementing agencies will obtain appropriate authorities and abide by appropriate regulations. PWPG appreciates offer of assistance and encourages implementing agencies to coordinate with USFWS. Feasibility studies of any potential reservoir project will include environmental impacts. Figures 5-1 through 5-4 will be removed from IPP.	Action as noted, No additional Action Required
Drake, S	Eliminate lagoon system at hog farms	Lagoon systems, in Confined Animal Feeding Operations are regulated by the Texas Natural Resource Conservation Commission.	No additional Action Required
Gramstorff	Potential hog farm contamination of aquifer (lagoons); help irrigators with wise use of water and low water use crops; legislation to prevent sale of water to other areas?	See Above. Second topic - Section 5.5.2 and 5.5.5 through 5.5.8 identify strategies to lower crop water application/use. PWPG supports local control of groundwater through locally controlled Groundwater Conservation Districts.	No additional Action Required
Seewald	Address Degradation of Water Shed	IPP does not address this issue specifically. Currently, issue is outside of the scope of work. Issue could be added to next planning cycle.	No additional Action Required
VanZandt	Add honey locust, eastern red cedar; chinaberry; western soapberry; Russian olive; Chinese elm; and hackberry to page I-34, 1.5.2	PWPG will expand discussion on brush species contained in Task 1.5.2	Action as noted.
Yanke/Yanke Farms	Define water use for animal consumption and other uses - add systems to wastewater treatment, especially hog farms reference attached	Values for these numbers are included in Table 2, Appendix, IPP.	No additional Action Required
Yanke/Yanke Farms	designate monitor wells near each hog facility to test pathogens on quarterly basis	Authority to designate monitoring wells near confined animal feeding operations belongs to TNRCC.	No additional Action Required

Panhandle Water Planning Group
Public Hearing and Submitted Comments & Responses

Submitted By	General Topic	PWPG Approved Response	Action
Yanke/Yanke Farms	water conservation/land conservation conflict (streamflow & erosion)	Water conservation and soil conservation issues are not in conflict. Landowners may modify creek beds through brush removal. NRCS encourages grassed water ways. Less erosion = more water for streamflow or recharge. No-till practices increase stored water and runoff.	No additional Action Required
Charles Bowers	Comments on behalf of PGWD and support for all activities, not just agriculture. Support for efforts of PWPG, Recommends studies beyond 50 year planning horizon.	Comment appreciated. Plan will be reviewed and revised every five years resulting in a continuous plan.	No additional Action Required
VanZandt	Does Model include wells installed in Wheeler County during last three years?	No, model uses estimates of distribution of irrigation pumpage from 1994 surveys. Future updates will include more up-to-date information.	No additional Action Required
Yanke/Yanke Farms	gather data on ogallala recharge	Available date to date was used in construction of Ogallala Groundwater Model. TWDB is further studying recharge and revised information will be included in future efforts.	No additional Action Required
Yanke/Yanke Farms	Define conservation measures for municipal use and make xeriscaping and conservation landscape engineering the norm	Conservation measures are at the forefront of water planning. Municipal conservation is included by statute. PWPG recommends breaking conservation out for individual evaluation. (Task 6, IPP)	No additional Action Required
Sweeten, TAES	Request to enter "Preliminary Economic Analysis of Brush Control Practices for Increased Water Yield in the Canadian Watershed"	COMMENT WITHDRAWN BY COMMENTOR	No additional Action Required
Kent Camp	Is judicious containment and usage of water currently in region is in the structure of the Regional Water Plan? Concerns on water resources from without rather than within the region	Judicious usage of water in region is included in IPP. Containment of water is not in plan. Comment is noted and action would be under oversight of relevant Groundwater Conservation Districts.	No additional Action Required
Barnett/LAID	Delete Recommendation for Funding on Sweetwater Creek Feasibility	SB1 mandates identification of alternative water supplies. Evaluation of potential Sweetwater creek reservoir site is only method to determine if it is a potential supply.	No additional Action Required
Barnett/LAID	Indicated concern on behalf of LAID regarding Sweetwater Creek Reservoir; Note that Wheeler County apparently has adequate groundwater for 50 years; therefore, concern on why Sweetwater Creek Reservoir Feasibility study is included. Concern over feasibility study prior to Compact issues being resolved.	Wheeler County Surface Water Board has requested this feasibility because of water quality, not quantity. Compact issues are to be resolved between the states, which are the parties to the Compact.	No additional Action Required
Finsterwald	Support to work out Sweetwater Creek Reservoir Issue and to ensure adequate water for Wheeler County		

Panhandle Water Planning Group
Public Hearing and Submitted Comments & Responses

Submitted By	General Topic	PWPG Approved Response	Action
Hefley/Wheeler County	Inclusion of Sweetwater Creek Reservoir in Regional Plan	Comments Combined due to common issues. These issues are included in the IPP and the PWPG has recommended that funding to evaluate, among other, interstate coordination, etc., is also included.	No additional Action Required
Herd/City of Wheeler	Importance of Sweetwater Creek Reservoir site to Wheeler		
Hill/Wheeler Water Supply District	Thank you to PWPG for including Sweetwater Creek Reservoir	PWPG recognizes limited surface water resources in the region and utilization of such water where available and in accordance with applicable regulations.	No additional Action Required
Jayroe/OK State	Recommend no action to adversely impact lake levels at Altus-Lugert beyond current conditions; ensure compliance with Red River Compact	Inclusion of potential project in IPP enables continued negotiations and possible development within bounds of Compact. Any potential reservoir will be in full compliance with Red River Compact and other regulatory authorities.	No additional Action Required
Kirby	Pleased with Red River Salinity Control support; Wants to protect LAID interests in water quality and quantity from Sweetwater & North Fork. Offer to share data on reverse osmosis plants and joint meetings to discuss Sweetwater Creek Reservoir. Pleased with recommendations to TNRCC	Water quantity and quality are vital aspects of water planning. These issues will be vital components of any future agreements. Planning and coordination of salinity control projects is outside the authority of the PWPG. PWPG recognizes importance of salinity control projects in Red basin.	No additional Action Required
Looper/City of Canadian	Expressed concern over potential influence from OK on Regional Water Planning Issues as related to water rights for municipalities, especially in light of Red River Compact	Comment appreciated. PWPG believes water rights issues re: Sweetwater Creek are in the purview of the Red River Compact Commission.	No additional Action Required
Mathis/OWRB	Pleased to See References to Canadian & Red River Compacts	PWPG appreciates the comments from Mr. Mathis/OWRB. PWPG recognizes role of Canadian & Red River Compacts in allocating surface water rights in the region.	No additional Action Required
Muller/LAID	Sweetwater Creek Reservoir Concern, work within R.R. Compact and with Oklahoma	Any permit issued for possible construction would comply with terms of the Red River Compact. Also, discussions are currently under-way between relevant parties to reach agreement on Compact provisions.	No additional Action Required
Muller/LAID	Protect Oklahoma interests in waters from Sweetwater Creek	PWPG is required to identify future water sources and to evaluate and project demands and availability for 50 years. Any future reservoir sites will be in accordance with applicable contracts and agreements. PWPG encourages LAID to implement more conservation practices.	No additional Action Required
Robbins	Sweetwater Creek Reservoir - Wants mutual cooperation between states-advance notice before construction of reservoir	Several items must occur before construction of any reservoir. PWPG requested funds to Sweetwater Creek site for feasibility study only. PWPG also requested reservation of all potential future reservoir sites in the region.	No additional Action Required

Panhandle Water Planning Group
Public Hearing and Submitted Comments & Responses

Submitted By	General Topic	PWPG Approved Response	Action
VanZandt	Support Sweetwater Creek Site	The PWPG has addressed the Potential Sweetwater Creek Reservoir Site in Tasks 5 and 6 of the IPP.	No additional Action Required
Wilson/TCFA	Reconsider all proposals for construction of pipelines serving communities; industries; and livestock feeding facilities in PWPG and LERWPG	See revised section 6.4, IPP. PWPG has continued consideration of proposals into next Planning Cycle.	No additional Action Required
Candler/ E.R.A.C.	Detailed info on items identified by Yanke (Comment 23), no actionable comment	No response necessary. Information added to Public Comment files	No additional Action Required
Drake	Define & Expose true beneficiaries of strip-mining on Ogallala	Groundwater is regulated by Groundwater Districts. Benefit to region is approximately $3.249 billion per year. Further knowledge on subject is lacking.	No additional Action Required
Drake, S	consider local use of water rather than cities to the south of the Panhandle	Movement of surface water is regulated through the state of Texas. Movement of groundwater is regulated only by local groundwater districts. PWPG has no authority to regulate movement. PWPG has addressed the issue of groundwater and is reluctant to include in IPP due to the fact the Ogallala is finite and is only practical source of groundwater for large areas of the region. PWPG will consider all reasonable strategies to use water locally.	No additional Action Required
Martin	Regulate Domestic Wells on less than 5 acres	Domestic and Livestock wells <17.5 gpm are exempt from groundwater regulation. "Future of Groundwater Committee" has recommended removing exemptions on acreages <10 acres. If this occurs, groundwater districts could regulate referenced situations. Texas Department of Licensing & Regulations regulates domestic wells.	No additional Action Required
Yanke/Yanke Farms	note possible conflict with TNRCC on planning groups	PWPG believes that it is important to include Texas Natural Resource Conservation Commission on Regional Water Planning Groups to add coordination on relevant issues. Potential conflict is noted. TNRCC recommendation in Task 6, IPP.	No additional Action Required

WATER PLANNING - LOCAL CONTRIBUTIONS
Contributing Entities
Total Contributions Received - 115,382
Entities Contributing - 110

Cities	Counties	Groundwater Districts	Surface Water Districts	Water Utilities	Private Entities
DARROUZETT	DALLAM	HIGH PLAINS	CANADIAN RIVER MUNICIPAL WATER AUTHORITY	CHERRY AVE MOBILE HOME PARK	PHILLIPS PETROLEUM
STINNETT	SHERMAN	NORTH PLAINS	GREENBELT MUNICIPAL AND INDUSTRIAL WATER AUTHORITY	TCW SUPPLY	AGRIUM
WHEELER	LIPSCOMB	PANHANDLE	PALO DURO RIVER AUTHORITY	WAKA WSC	ENGINEERED CARBONS
BORGER	ROBERTS	DALLAM		BEACON WEST	TEXAS FARM INC.
DODSON	HALL	COLLINGSWORTH		LAKEVIEW WSC	NEW CENTURY SERV.
FRITCH	HEMPHILL	HEMPHILL		PALODURO TRAILER PART	TEXAS CATTLE FEEDERS
HAPPY	CARSON			MOORTEX WATER SUPPLY	CELANESE
PANANDLE	COLLINGSWORTH			RRA CAREY-NORTHFIELD WS	GRAIN SORGHUM PRODUCERS
TEXLINE	HUTCHINSON			RRA NORTHEAST CHILDRESS WS	PREMIUM STANDARD FARMS
WELLINGTON	OCHILTREE			RRA SAID WS	
HEDLEY	MOORE			RRA TURKEY-ESTELLINE WS	
CLAUDE	HARTLEY			RRA-CLUB LAKE WATER SYS.	
GRUVER	OLDHAM			RRA-DODSON WATER SUPPLY SYS.	
BOOKER	POTTER			RRA-GARDEN VALLEY WS	
HIGGINS	CHILDRESS			RRA-GREENBELT LAKE LOTS	
WHITE DEER	DONLEY			RRA-HOWARDWICK WATER SUPPLY	
GROOM	RANDALL			RRA-NEWLIN WATER SYSTEM	
MIAMI				RRA-SAMNORWOOD WATER SYSTEM	
SHAMROCK				RRA-KIRKLAND-LAZARE WS	
CACTUS				RRA-TELL-CEE VEE WS	
CANYON				SUNDAY CANYON WSC	
CHILDRESS				MORSE UTILITY COMP.	
MEMPHIS				CAL FARLEY'S FAMILY PROGRAM	
TEXHOMA				FARNSWORTH WSC	
TIMBERCREEK CANYON				PALO DURO CLUB	
VEGA				SIESTA ESTATES MOBILE HOME PARK	
CANADIAN				WASHBURN COMMUNITY WATER SUPPLY	
PAMPA				*DOUBLE DIAMOND ESTATES - BRINSON*	
SPEARMAN				HI TEXAS WATER CORP	
STRATFORD				AMBERWOOD WATER SYSTEMS	
BISHOP HILLS				GREENBELT MIWA	
ESTELLINE				PANHANDLE UTILITY COMPANY	
PERRYTON					
CLARENDON					
DUMAS					
DALHART					
AMARILLO					
FOLLETT					
SUNRAY					
MCLEAN					
ADRIAN					
MOBEETIE					
LEFORS					