Chapter 9
Water Supply Needs

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Needs are projected water demands in excess of existing supplies that would be physically and legally available during a repeat of the drought of record.

If Texas does not implement new water supply projects or management strategies, then homes, businesses, and agricultural enterprises throughout the state are projected to need an additional 3.7 million acre-feet of water in 2010. By 2030, this figure rises to nearly 5.9 million acre-feet, and by 2060 it increases to 8.8 million acre-feet. In 2060, slightly more than 85 percent of the state's population is projected to have water needs.

Needs of this magnitude are projected to cost businesses and workers approximately $9.1 billion worth of income in 2010. By 2060, this figure increases to roughly $98.4 billion. Forgone state and local business taxes associated with lost commerce is projected to amount to $466 million in 2010 and $5.4 billion in 2060.

Texas has one of the fastest growing populations in the nation. From 1950 to 2000, the number of people living in the state grew from about 8 million to nearly 21 million. By the year 2060, the state's population is projected to reach almost 46 million. Not only is Texas' population rapidly growing, but it also has one of the world's most robust economies. If Texas were an independent nation, its economy would rank eighth in the world when measured by gross national product. Rapid growth, combined with Texas' susceptibility to severe drought, makes water supply a crucial issue. If water infrastructure and water management strategies are not implemented, Texas could face serious social, economic, and environmental consequences—not only in our large metropolitan cities, but also in rural areas.

Water supply needs due to severe drought would likely curtail or eliminate economic activity in businesses and industries heavily reliant on water. For example, without water, farmers cannot irrigate, refineries cannot produce gasoline, and paper mills cannot make paper. Unreliable water supplies would not only have an immediate and real impact on business and industry, but they might also bias corporate decision makers against expanding or locating their businesses in Texas.

For all of the above reasons, it is important to analyze and understand how limited water supplies could affect communities throughout the state. To that end, TWDB identified "water needs" by comparing existing water supplies with projected demands to assess where and when water shortages could occur if water management strategies are not implemented. TWDB then analyzed the potential socioeconomic impacts of not meeting water needs.

9.1 Identification of Water Needs

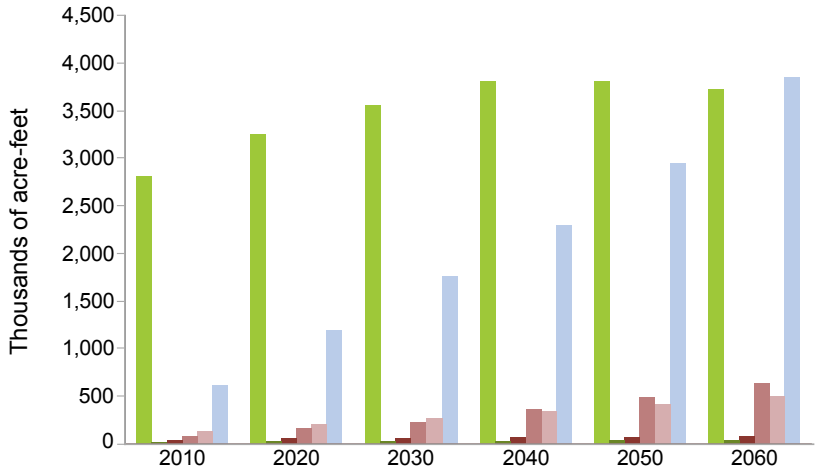
Simply stated, when existing water supplies are less than projected demands, there is a need for water. Planning groups identified water needs for both water user groups and major water providers. Water user groups are categorized as follows:

- **Municipal:** residential, commercial (nonindustrial businesses, such as restaurants and office buildings), and institutional water users (schools and government facilities) in communities with 500 people or more
- **County-other:** residential, commercial, and institutional water users in communities with less than 500 people or in unincorporated rural areas in a given county
- **Manufacturing:** industrial firms, such as food processors, paper mills, electronics manufacturers, aircraft assemblers, and petrochemical refineries
- **Mining:** key mining sectors in the state, such as coal, oil and gas, and aggregate producers
- **Steam-electric:** coal-fired and nuclear power generation plants
- **Livestock:** cattle ranches, feedlots, poultry farms, and other commercial animal operations
- **Irrigation:** commercial field crop production

Water use for all categories of water user groups except the municipal category was estimated at the county level. Municipal water user groups include communities with population of 500 or more. In total, there are 2,656 water user groups in the state. Planning groups estimate that 872 of these (33 percent) will have inadequate water supplies if drought of record conditions occur in 2010 (Table 9.1). By 2030, the number grows to 1,097 (41 percent) and increases to 1,198 in 2060 (45 percent). On average over the entire planning horizon, municipal needs account for slightly more than 30 percent of the total deficit (Figure 9.1).

Table 9.1. Water user groups with projected water supply needs for 2010-2060

Region	Year					
	2010	2020	2030	2040	2050	2060
A	21	23	24	25	26	26
B	8	8	9	9	8	8
C	200	270	279	281	284	284
D	18	23	28	33	38	39
E	12	12	12	13	14	14
F	54	55	52	53	55	55
G	101	110	115	124	127	131
H	239	249	253	254	253	257
I	36	47	53	57	61	70
J	4	5	5	5	4	4
K	50	62	80	84	90	94
L	60	68	78	80	84	83
M	30	41	48	51	62	62
N	8	10	11	12	13	13
O	29	40	48	51	54	56
P	2	2	2	2	2	2
Total water user groups with needs	872	1,025	1,097	1,134	1,175	1,198
Total water user groups	2,656	2,656	2,656	2,656	2,656	2,656
% of water user groups with needs	33	39	41	43	44	45



	2010	2020	2030	2040	2050	2060
Irrigation	2,809,198	3,252,414	3,567,944	3,805,806	3,802,266	3,730,325
Livestock	11,062	21,906	27,248	30,980	34,277	38,994
Mining	38,062	50,682	60,175	64,198	71,368	79,311
Steam-electric	75,791	159,067	235,862	363,222	483,314	639,084
Manufacturing	132,350	202,206	267,501	343,625	421,029	499,873
Municipal	610,650	1,190,004	1,765,034	2,293,038	2,946,373	3,844,993
Total	3,677,113	4,876,279	5,923,764	6,900,869	7,758,627	8,832,580

Figure 9.1. Water supply needs by water use category for 2010-2060. (Municipal needs include water user groups classified as County-other.)

Major water providers are entities, such as river authorities, municipal utility districts, and water supply corporations, that deliver and sell large amounts of raw or treated water for municipal and manufacturing use on a wholesale or retail basis. In 2010, projections indicate that 70 of the 161 major water providers (43 percent) in the state will have water needs, with the highest concentration occurring in Region C, which includes the Dallas-Fort Worth area (Table 9.2). By 2030, the number grows to 78 (48 percent) and increases to 84 in 2060 (52 percent).

TWDB also examined the volume of needs by water use category at the state level (Figure 9.1). In 2010, projected needs total nearly 3.7 million acre-feet, and most are for the irrigation (76 percent) and municipal (17 percent) water user groups. About 4 percent are for manufacturing. By 2030, needs rise substantially. Irrigation needs are projected to rise from 2.8 million acre-feet to 3.6 million and municipal needs from 0.6 million acre-feet to nearly 1.8 million. Manufacturing needs grow from 0.1 million acre-feet in 2010 to roughly 0.3 million in 2030. Steam-electric needs also rise from approximately 80,000 acre-feet in 2010 to nearly 240,000 in 2030. In the long term (through 2060), needs for irrigation are projected to stabilize at about 3.8 million; however, deficits for nonagricultural uses rise dramatically. For example, by 2060 municipal needs are projected to total about 3.8 million acre-feet (44 percent of the total), and slightly more than 85 percent of the state's population is projected to have unmet water needs.

The volume of water needs differs by region (Table 9.3). The greatest needs occur in Regions O and C. In Region O, most needs are for irrigation, while in Region C they are primarily for municipal water user groups. Region H also has a large volume of needs, particularly for municipal water users.

9.2 Socioeconomic Impacts of Not Meeting Water Needs

As part of the planning process, planning groups are required to evaluate the social and economic

Table 9.2. Major water providers with projected water supply needs for 2010-2060

Region	Year					
	2010	2020	2030	2040	2050	2060
A	3	3	4	4	4	4
B[a]	—	—	—	—	—	—
C	24	30	30	30	30	30
D	1	1	1	1	2	2
E	3	3	3	3	4	4
F	5	5	5	5	5	5
G	9	10	10	10	11	12
H	6	5	5	5	5	6
I	6	6	7	7	7	7
J[a]	—	—	—	—	—	—
K	2	2	2	2	2	2
L	5	5	5	5	5	5
M	1	1	1	1	1	1
N	1	1	1	1	2	2
O	3	3	3	3	3	3
P	1	1	1	1	1	1
Total major water providers with needs	70	76	78	78	82	84
Total major water providers	161	161	161	161	161	161
% of major water providers with needs	43	47	48	48	51	52

[a] There were no major water providers for Regions B and J.

Table 9.3. Water supply needs for 2010-2060

Region	Year and volume (acre-feet)					
	2010	2020	2030	2040	2050	2060
A	310,554	423,329	542,805	571,668	565,000	575,637
B	880	5,661	14,601	21,732	28,825	37,156
C	336,390	668,435	947,598	1,233,929	1,570,375	1,969,630
D	10,764	15,498	19,745	29,298	57,132	93,727
E	193,171	207,369	218,835	221,845	231,551	244,172
F	223,023	231,652	236,690	239,941	245,592	253,455
G	141,800	153,593	184,668	226,333	285,438	347,804
H	279,996	468,010	638,634	779,639	941,724	1,119,307
I	18,142	58,623	80,717	105,837	136,523	175,782
J	2,065	2,406	2,528	2,463	2,624	2,687
K	246,055	241,336	280,921	322,453	359,579	557,311
L	156,598	207,338	256,433	306,177	360,055	416,859
M	436,796	401,802	363,900	434,088	516,343	604,518
N	3,404	4,691	6,406	19,794	35,797	53,432
O	1,266,820	1,739,919	2,086,559	2,346,697	2,386,708	2,349,124
P	50,655	46,617	42,724	38,975	35,361	31,979
Total projected water needs	3,677,113	4,876,279	5,923,764	6,900,869	7,758,627	8,832,580

impacts of unmet water needs. To assist in that process and in response to requests from planning groups, TWDB designed and conducted socioeconomic impact analyses for each region.

Two components make up the overall approach: (1) an economic impact module and (2) a social impact module. Economic analysis addresses potential impacts of unmet water needs, including effects on residential water consumers and losses to regional economies from reduced economic output in agriculture, industry, and commerce.

Reported figures are scenarios that illustrate what could happen in a given year if (1) water supply infrastructure and/or water management strategies do not change through time and (2) conditions equivalent to the drought of record recur. These reported figures are probably conservative because they are based on estimated costs for a single year; however, a drought similar to the drought of record would likely persist several years. All impacts are presented in constant year 2000 dollars. Details regarding the methodology and assumptions for individual water use categories (such as municipal consumers, which include residential and commercial water users; manufacturing; steam-electric; mining; and agriculture) are available in regional water plans. Regional water plans are available at http://www.twdb.state.tx.us/rwpg/main-docs/2006RWPindex.asp.

The social component focuses on demographic effects, including changes in population and school enrollment. Methods are based on population projection models developed by TWDB for regional and state water planning. With the assistance of the Texas State Data Center, TWDB modified these models and applied them for use in this analysis. The social impact module incorporates results from the economic impact module and assesses how changes in a region's economy due to water shortages could affect patterns of migration in a region.

Variables for the estimated economic impacts include (Table 9.4)

- **regional income**—total payroll costs, including wages and salaries plus benefits paid by industries; corporate income; rental income; and interest payments to corporations and individuals in a given region;[1]
- **state and local business taxes**—sales, excise, fees, licenses, and other taxes paid during normal operation of an industry (does not include any type of income or ad valorem tax); and
- **jobs**—number of full- and part-time jobs, including self-employment.

If drought of record conditions recur and water management strategies identified in regional water plans are not implemented, planning areas could suffer significant losses. Assuming such

[1]Regional income is analogous to the commonly used measure of economic growth and prosperity in the United States and other nations known as gross domestic product.

Table 9.4. Annual economic losses from not meeting water supply needs for 2010-2060
(monetary figures reported in millions of dollars)

	2010	2020	2030	2040	2050	2060
Region A						
Regional income ($)	384	790	1,077	1,392	1,616	1,897
State and local business taxes ($)	24	50	68	86	99	127
Number of full- and part-time jobs	5,320	11,260	14,980	18,940	22,030	30,170
Region B						
Regional income ($)	4	4	4	4	4	4
State and local business taxes ($)	0.2	0.2	0.2	0.2	0.2	0.3
Number of full- and part-time jobs	50	50	50	50	60	60
Region C						
Regional income ($)	3,021	9,159	13,408	22,190	37,366	58,799
State and local business taxes ($)	128	351	515	866	1,391	2,506
Number of full- and part-time jobs	27,760	91,670	137,340	245,050	423,400	691,060
Region D						
Regional income ($)	135	145	175	209	267	321
State and local business taxes ($)	23	24	27	33	42	50
Number of full- and part-time jobs	1,060	1,150	1,460	1,740	2,190	2,590
Region E						
Regional income ($)	160	254	406	521	861	1,096
State and local business taxes ($)	8	11	32	33	79	105
Number of full- and part-time jobs	4,570	5,060	6,510	7,690	10,560	13,200
Region F						
Regional income ($)	475	573	637	797	877	962
State and local business taxes ($)	35	42	48	64	73	82
Number of full- and part-time jobs	8,020	9,130	9,970	13,240	14,380	15,660
Region G						
Regional income ($)	1,092	1,577	1,794	2,103	2,379	2,758
State and local business taxes ($)	39	55	63	83	105	141
Number of full- and part-time jobs	19,260	27,860	31,790	36,460	41,350	46,170
Region H						
Regional income ($)	2,450	4,466	7,597	9,904	11,812	15,394
State and local business taxes ($)	133	264	459	613	743	1,179
Number of full- and part-time jobs	27,970	54,670	97,290	124,720	149,830	187,670
Region I						
Regional income ($)	141	441	566	861	1,416	1,775
State and local business taxes ($)	17	62	77	106	193	236
Number of full- and part-time jobs	1,860	4,930	6,730	11,540	17,810	22,810
Region J						
Regional income ($)	6	7	8	8	9	9
State and local business taxes ($)	0.14	0.16	0.16	0.16	0.17	0.18
Number of full- and part-time jobs	50	60	60	65	70	70
Region K						
Regional income ($)	335	525	1,005	1,431	2,242	4,313
State and local business taxes ($)	8	16	40	84	117	248
Number of full- and part-time jobs	4,480	7,430	13,890	19,340	27,470-	49,380
Region L						
Regional income ($)	664	1,175	2,258	2,979	4,351	5,477
State and local business taxes ($)	32	62	118	154	258	335
Number of full- and part-time jobs	10,200	17,740	34,230	44,220	76,000	97,940

Table 9.4. (*Continued*)

	2010	2020	2030	2040	2050	2060
Region M						
Regional income ($)	164	354	585	873	1,364	2,025
State and local business taxes ($)	5	9	17	27	44	76
Number of full- and part-time jobs	3,610	5,630	8,700	11,460	18,080	26,870
Region N						
Regional income ($)	22	33	50	364	1,113	3,214
State and local business taxes ($)	3	5	7	33	85	233
Number of full- and part-time jobs	230	350	460	3,780	12,380	36,790
Region O						
Regional income ($)	103	175	273	351	380	387
State and local business taxes ($)	10	16	24	29	32	32
Number of full- and part-time jobs	4,410	7,030	12,550	13,550	13,510	13,690
Region P						
Regional income ($)	3	3	3	3	3	3
State and local business taxes ($)	0.30	0.30	0.30	0.30	0.30	0.30
Number of full- and part-time jobs	120	120	120	120	120	120
Total						
Regional income ($)	9,159	19,681	29,846	43,990	66,060	98,434
State and local business taxes ($)	466	968	1,496	2,212	3,262	5,351
Number of full- and part-time jobs	118,970	244,140	376,130	551,965	801,770	1,234,250

Note: Monetary impacts are reported in constant year 2000 dollars.

conditions took place statewide, models show that Texas businesses and workers could lose approximately $9.1 billion in 2010. By 2060 this figure increases to roughly $98.4 billion. Forgone state and local business taxes associated with lost commerce could amount to $466 million in 2010 and $5.4 billion in 2060. Lost jobs total approximately 119,000 in 2010 and 1.2 million in 2060.

The social impacts of unmet water needs include potential losses in population and school enrollment for each planning area (Table 9.5). Changes in population stem directly from the number of lost jobs estimated as part of the economic impact module. In other words, many—but not all—people would likely relocate due to a job loss, and some would be families with school age children. If drought of record conditions persisted statewide in all planning areas, models suggest that almost 180,000 people would relocate in 2010, and nearly 1.8 million would relocate in 2060.

Table 9.5. Annual social impacts from not meeting water supply needs for 2010-2060

	2010	2020	2030	2040	2050	2060
Region A						
Lost population	6,460	13,780	16,650	16,480	19,170	23,950
Declines in school enrollment	3,020	6,530	7,350	5,090	5,920	7,400
Region B[a]						
Lost population	—	—	—	—	—	—
Declines in school enrollment	—	—	—	—	—	—
Region C						
Lost population	38,580	130,760	199,560	356,720	616,690	1,007,010
Declines in school enrollment	8,710	30,070	46,460	83,300	144,110	235,540
Region D						
Lost population	1,850	2,000	2,540	3,020	3,810	4,520
Declines in school enrollment	480	520	650	780	980	1,170
Region E						
Lost population	7,960	8,820	11,350	13,400	18,410	23,020
Declines in school enrollment	2,060	2,280	2,940	3,470	4,770	5,970
Region F						
Lost population	13,830	15,920	17,360	23,080	25,070	27,450
Declines in school enrollment	3,590	4,130	4,500	5,990	6,500	7,120
Region G						
Lost population	26,770	39,730	46,200	53,070	60,220	73,350
Declines in school enrollment	6,050	9,130	10,750	12,390	14,070	17,150
Region H						
Lost population	42,745	82,070	144,920	185,360	221,950	269,610
Declines in school enrollment	10,490	20,150	35,590	45,530	54,520	66,220
Region I						
Lost population	3,240	8,590	11,740	20,120	31,050	39,770
Declines in school enrollment	840	2,230	3,040	5,220	8,050	10,310
Region J						
Lost population	90	110	110	110	130	130
Declines in school enrollment	30	30	30	30	40	40
Region K						
Lost population	6,320	10,500	19,600	27,300	38,770	69,700
Declines in school enrollment	1,610	2,670	4,980	6,940	9,850	17,710
Region L						
Lost population	14,230	25,080	49,180	62,970	107,830	138,890
Declines in school enrollment	3,620	6,370	12,500	16,000	27,390	35,280
Region M						
Lost population	12,150	16,500	19,070	24,770	34,650	53,160
Declines in school enrollment	3,160	4,280	4,950	6,420	8,980	13,790
Region N						
Lost population	400	610	800	6,580	21,590	64,140
Declines in school enrollment	100	150	200	1,700	5,600	16,640
Region O						
Lost population	5,320	8,480	14,830	10,730	11,550	11,700
Declines in school enrollment	2,490	4,020	6,560	3,320	3,570	3,620
Region P[a]						
Lost population	—	—	—	—	—	—
Declines in school enrollment	—	—	—	—	—	—
Total						
Lost population	179,945	362,950	553,910	803,710	1,210,890	1,806,400
Declines in school enrollment	46,250	92,560	140,500	196,180	294,350	437,960

[a] In Regions B and P, unmet needs relative to total water demand are small; thus, social impact models do not show significant changes in population or school enrollment in any year.


TEXAN

CROCKETT HOTEL