Chapter 4
Comparison of Water Demands with Water Supplies to Determine Needs

This chapter describes the comparison of estimated current water supply for drought-of-record conditions (from Chapter 3) and projected water demand (from Chapter 2). From this comparison, water needs (shortages) or surpluses under drought-of-record conditions have been estimated. Water shortages identified from this comparison are defined as first tier water needs. In addition, a secondary analysis was conducted to determine needs after conservation and direct reuse strategies have been implemented. Water shortages identified from this analysis are defined as second tier water needs. Listings of the first tier and second tier water needs by water user group are included in Appendices 4-A and 4-B respectively.

As discussed in Chapter 3, allocations of existing water supplies were based on the most restrictive of current water rights, contracts, water treatment capacities, available yields for surface water, and production capacities for groundwater. The allocation process did not directly address water quality issues, which were found to be minimal for the East Texas Regional Water Planning Area (ETRWPA). Water quality issues could potentially impact local usability of some water supplies, nonetheless.

The comparison of current water supply and projected water demand in the ETRWPA is evaluated on a regional basis, by county, by water user group (WUG) and by wholesale water provider (WWP). Section 4.1 presents a regional comparison of current and projected supplies, demands, and water needs. Section 4.2 presents a county-by-county comparison of current and projected first tier water needs. Section 4.3 presents the current and projected first tier water needs for each WUG. Section 4.4 discusses first tier water needs for the WWPs in the region. Section 4.5 discusses water needs for WUGs and WWPs, after savings from conservation and direct reuse strategies are applied (second tier water needs). An economic impact analysis of not meeting the region's projected water needs is summarized in Section 4.6.

4.1 Regional Comparison of Supplies and Demands

As discussed in Chapter 3, it is estimated that the ETRWPA has approximately 3.4 million acre-feet of fresh water supplies and 1.0 million acre-feet of brackish water supplies (4.4 million acre-feet total). However, not all of these water supplies have been developed for use by water user groups yet, i.e., no infrastructure has been developed to access these supplies. Undeveloped (or unconnected) water supplies are identified by comparing the supplies that are developed for each individual entity to use, to the total regional water supply sources. In the ETRPWA, the undeveloped fresh water supplies are estimated to be between 2.5 and 2.6 million ac-ft per year throughout the planning period. Additional infrastructure and/or contracts are needed to utilize these sources.

Table 4.1 and Figure 4.1 summarize and compare the total available, developed, and accessible water supplies to the total projected water demands over the planning period for the ETRWPA. Overall, the ETRWPA's developed supplies exceed the demands however, not all developed supplies are currently accessible to water users due to existing constraints in their individual supply, infrastructure and/or contracts with their providers. In order to accurately assess the water needs within the region, only currently accessible supplies were allocated to water users. Consequently, projected demands for water users exceed the accessible supplies throughout the planning horizon (2020-2070). Regional water needs are shown to be nearly 140,000 acre-feet in 2020 and to increase to nearly 206,000 acre-feet in 2070.

Table 4.1 Summary of Supply and Demand for the East Texas Regional Water Planning Area (ac-ft/yr)

	2020	2030	2040	2050	2060	2070
Total Freshwater Supplies	3,428,505	3,424,844	3,421,856	3,418,575	3,414,184	3,408,761
Developed WUG Supplies	839,729	849,993	854,547	859,548	864,991	871,472
Supplies Accessible to Meet WUG Demands	599,846	613,225	621,093	632,826	627,056	634,053
WUG Demands	738,081	793,495	798,814	811,072	826,138	839,601
Total Water Needs (Shortages)	**-139,221**	**-181,998**	**-182,791**	**-189,868**	**-199,082**	**-205,548**

Figure 4.1 Comparison of Regional Water Supplies to Demands

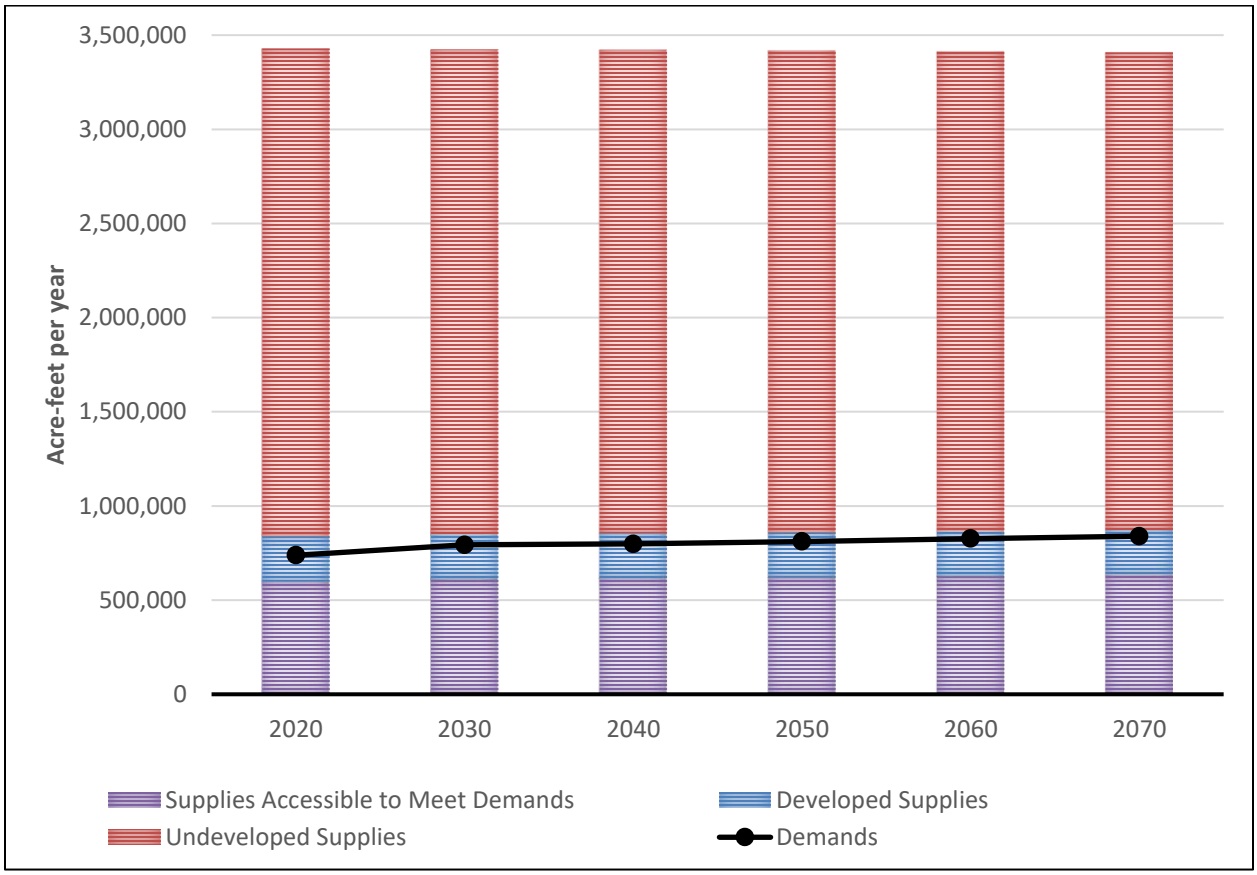
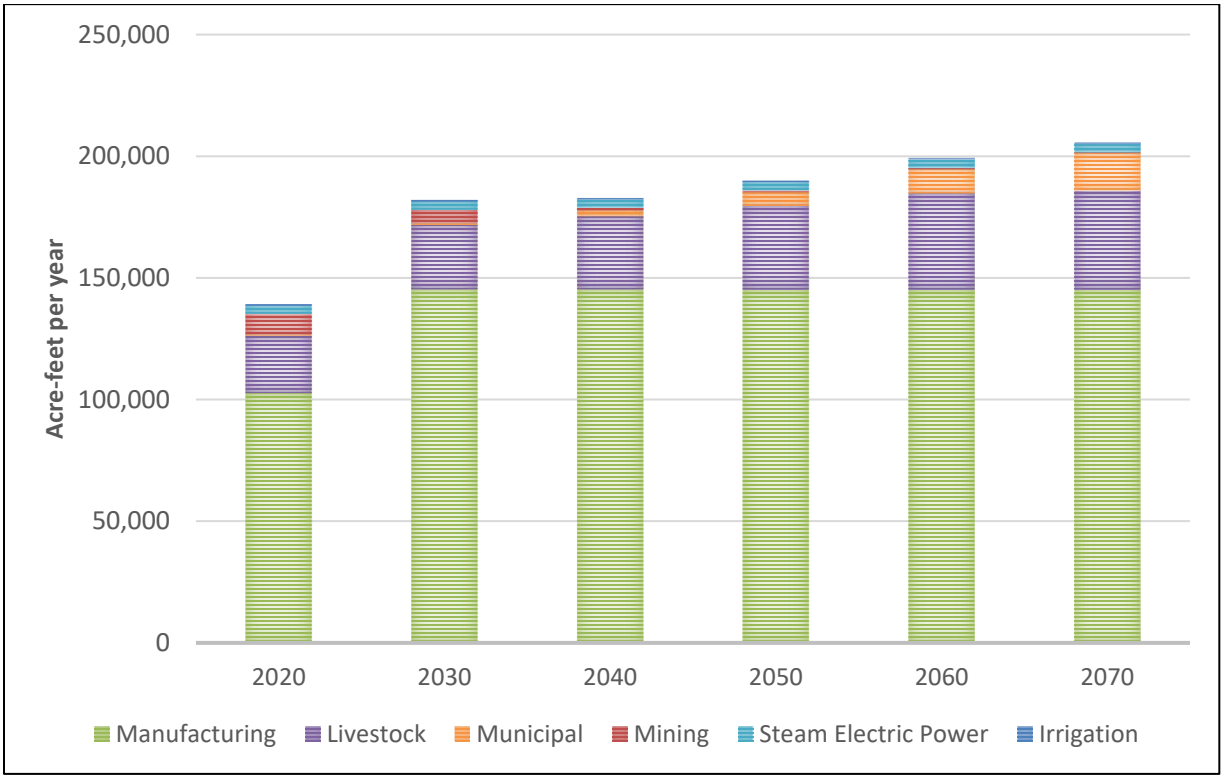


Table 4.2 and
Figure 4.2 summarize regional water needs by category of water use. On a regional basis, there are needs for each water use type. By far, the greatest needs are identified for manufacturing. Lesser needs are identified for municipal, livestock, steam electric power, mining, and irrigation categories. Most of the manufacturing needs are the result of considerable growth in demands and supplies that are limited to existing contract amounts. The steam electric power needs are for projected growth that currently does not have an identified source or infrastructure. Mining needs are largely associated with new mining demands associated with natural gas development and mining demands that have not been realized to date and do not have a current water supply.

Table 4.2 Summary of Projected Regional Needs by Water Use Type (ac-ft/yr)

Water Use Type	2020	2030	2040	2050	2060	2070
Municipal	-493	-864	-2,535	-5,811	-10,100	-15,501
Manufacturing	-102,587	-145,222	-145,205	-145,188	-145,171	-145,154
Mining	-8,413	-5,279	-903	-468	-308	-207
Steam Electric Power	-3,494	-3,494	-3,494	-3,494	-3,494	-3,494
Irrigation	-526	-526	-526	-526	-526	-526
Livestock	-23,708	-26,613	-30,128	-34,381	-39,483	-40,666
TOTAL	**-139,221**	**-181,998**	**-182,791**	**-189,868**	**-199,082**	**-205,548**

Figure 4.2 Projected Regional Needs by Water Use Type (ac-ft/yr)



4.2 First Tier Water Needs by County

First tier water needs are identified by comparing the current supplies allocated to water users from Chapter 3 to the projected demands from Chapter 2, in accordance with TWDB rules. Table 4.3 shows the projected first tier water needs by county for each decade of the planning period in acre-feet per year and Table 4.4 shows this information as a percentage of demand. In general, some shortages exist throughout the region. Fourteen counties are identified with needs over the planning horizon, with Jasper, Jefferson, Nacogdoches, San Augustine and Shelby counties having the largest projected needs by volume in 2070. As discussed previously, the region has sufficient developed supplies to meet these shortages, however, some of these supplies are unallocated due to existing constraints of individual entities. Figure 4.3 shows the amount of unallocated supplies by county in the region. The "Source-Balance" data table in Appendix 4-C lists each water source and the amount of water that is available for future use.

Table 4.3 Summary of Projected First Tier Water Needs by County (ac-ft/yr)

County	2020	2030	2040	2050	2060	2070
Anderson	0	0	0	0	0	0
Angelina	-1,922	-2,197	-2,022	-1,924	-1,849	-1,792
Cherokee	-238	-247	-210	-237	-292	-476
Hardin	0	0	0	0	0	0
Henderson*	-12	-29	-30	-32	-83	-286
Houston	0	0	0	0	0	-201
Jasper	-8,932	-8,932	-8,932	-8,932	-8,932	-8,932
Jefferson	-103,529	-145,904	-147,135	-149,713	-153,065	-157,006
Nacogdoches	-11,445	-9,374	-7,046	-7,607	-8,390	-9,517
Newton	-115	-59	0	0	0	0
Orange	-526	-526	-526	-526	-526	-526
Panola	-982	-982	-982	-982	-982	-982
Polk*	0	0	0	0	0	0
Rusk	-1,169	-1,530	-1,468	-1,417	-1,496	-1,613
Sabine	0	0	0	0	0	0
San Augustine	-3,555	-2,746	-1,866	-2,137	-2,438	-2,438
Shelby	-6,556	-8,836	-11,609	-14,992	-19,113	-19,123
Smith*	-241	-635	-965	-1,371	-1,906	-2,657
Trinity*	0	0	0	0	0	0
Tyler	0	0	0	0	0	0
TOTAL	**-139,221**	**-181,998**	**-182,791**	**-189,868**	**-199,082**	**-205,548**

*The counties marked with an asterisk are split between two water planning regions. The data presented in this table represents only the portion of those counties that are within the boundaries of Region I.

Table 4.4 Summary of Projected First Tier Water Needs by County (Percentage of Demand)

County	2020	2030	2040	2050	2060	2070
Anderson	0%	0%	0%	0%	0%	0%
Angelina	9%	10%	9%	9%	8%	8%
Cherokee	2%	2%	1%	1%	2%	3%
Hardin	0%	0%	0%	0%	0%	0%
Henderson*	0%	1%	1%	1%	2%	5%
Houston	0%	0%	0%	0%	0%	2%
Jasper	15%	12%	12%	12%	12%	12%
Jefferson	29%	38%	38%	38%	38%	39%
Nacogdoches	37%	31%	24%	25%	26%	28%
Newton	1%	1%	0%	0%	0%	0%
Orange	1%	1%	1%	1%	1%	1%
Panola	7%	7%	7%	8%	8%	8%
Polk*	0%	0%	0%	0%	0%	0%
Rusk	2%	2%	2%	2%	2%	2%
Sabine	0%	0%	0%	0%	0%	0%
San Augustine	50%	43%	37%	43%	48%	51%
Shelby	30%	37%	44%	51%	58%	58%
Smith*	1%	2%	2%	3%	4%	5%
Trinity*	0%	0%	0%	0%	0%	0%
Tyler	0%	0%	0%	0%	0%	0%
TOTAL	19%	23%	23%	23%	24%	24%

*The counties marked with an asterisk are split between two water planning regions. The data presented in this table represents only the portion of those counties that are within the boundaries of Region I.

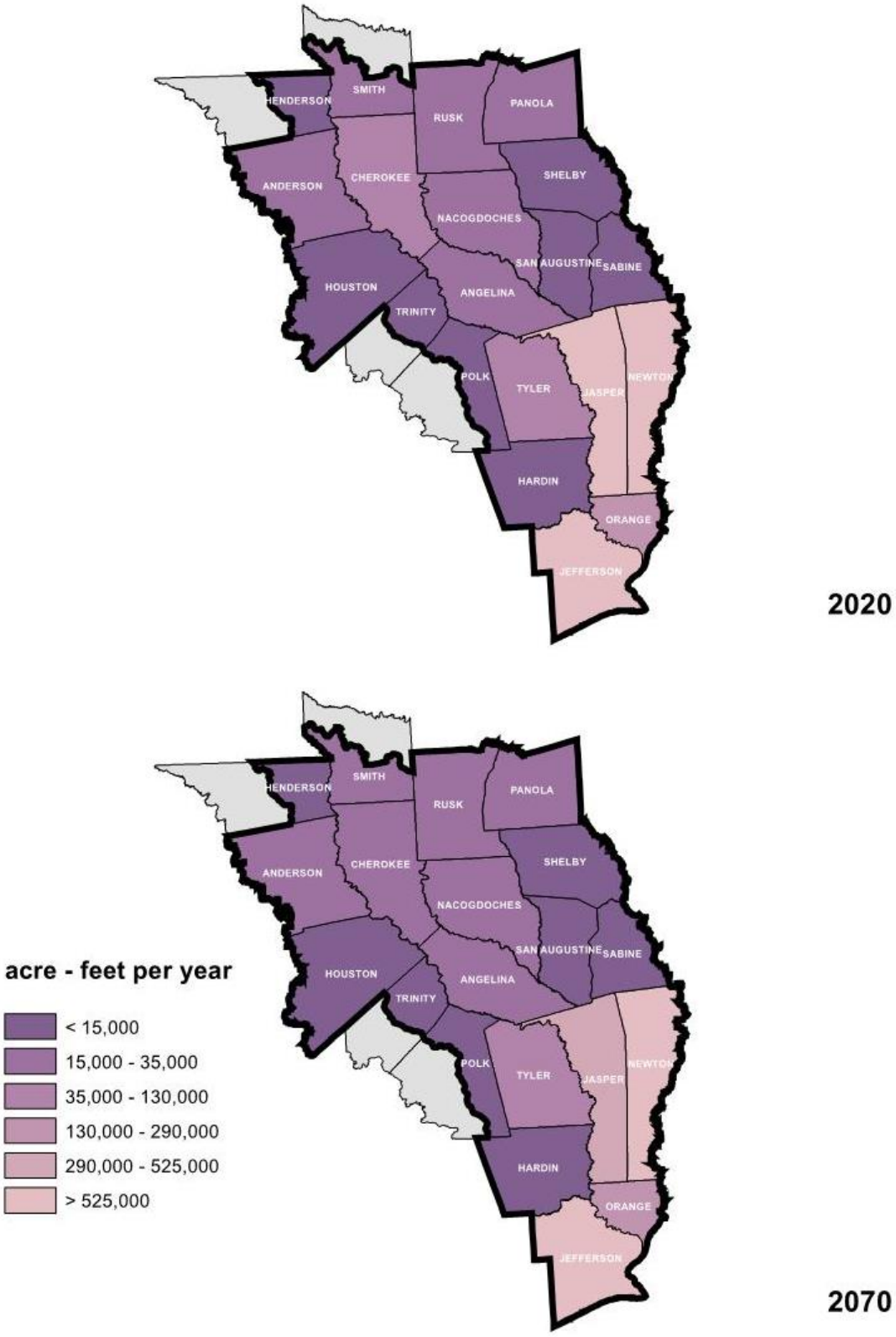


Figure 4.3: Unallocated Supplies

4.3 First Tier Water Needs by Water User Group

The comparison of first tier water needs by water user group is presented in Table 4.5. There are 40 different WUGs across 14 counties in the ETRWPA with identified needs that cannot be met by existing infrastructure and supply. These projected needs total nearly 206,000 acre-feet per year by 2070. This is approximately 40 percent of the projected needs identified in the 2016 East Texas Regional Water Plan. Specific needs are addressed in subsequent subsections.

Table 4.5 Water User Groups with Projected Needs (ac-ft/yr)

Water User Group	County	2020	2030	2040	2050	2060	2070
Manufacturing	Angelina	-1,449	-1,625	-1,625	-1,625	-1,625	-1,625
Mining	Angelina	-473	-572	-397	-299	-224	-167
County Total	**Angelina**	**-1,922**	**-2,197**	**-2,022**	**-1,924**	**-1,849**	**-1,792**
Alto Rural WSC	Cherokee	0	0	0	-65	-137	-215
Rusk	Cherokee	0	0	0	0	0	-122
Wright City WSC	Cherokee	0	0	0	-25	-71	-99
Mining	Cherokee	-238	-247	-210	-147	-84	-40
County Total	**Cherokee**	**-238**	**-247**	**-210**	**-237**	**-292**	**-476**
Chandler	Henderson	0	0	0	0	0	-118
Edom WSC	Henderson	-2	-3	-4	-5	-7	-9
Moore Station WSC	Henderson	0	0	0	0	-38	-111
R P M WSC	Henderson	0	-7	-16	-27	-38	-48
Mining	Henderson	-10	-19	-10	0	0	0
County Total	**Henderson**	**-12**	**-29**	**-30**	**-32**	**-83**	**-286**
Livestock	Houston	0	0	0	0	0	-201
County Total	**Houston**	**0**	**0**	**0**	**0**	**0**	**-201**
Livestock	Jasper	-8,932	-8,932	-8,932	-8,932	-8,932	-8,932
County Total	**Jasper**	**-8,932**	**-8,932**	**-8,932**	**-8,932**	**-8,932**	**-8,932**
Beaumont	Jefferson	0	0	-1,248	-3,843	-6,357	-9,218
County-Other	Jefferson	0	0	0	0	-855	-1,950
Manufacturing	Jefferson	-101,138	-143,513	-143,496	-143,479	-143,462	-143,447
Steam Electric Power	Jefferson	-2,391	-2,391	-2,391	-2,391	-2,391	-2,391
County Total	**Jefferson**	**-103,529**	**-145,904**	**-147,135**	**-149,713**	**-153,065**	**-157,005**
Cushing	Nacogdoches	0	0	0	0	-8	-30
D & M WSC	Nacogdoches	0	0	-32	-135	-251	-374
Livestock	Nacogdoches	-5,970	-6,399	-6,896	-7,472	-8,131	-9,113
Mining	Nacogdoches	-5,475	-2,975	-118	0	0	0
County Total	**Nacogdoches**	**-11,445**	**-9,374**	**-7,046**	**-7,607**	**-8,390**	**-9,517**

Water User Group	County	2020	2030	2040	2050	2060	2070
Mining	Newton	-115	-59	0	0	0	0
County Total	**Newton**	**-115**	**-59**	**0**	**0**	**0**	**0**
Irrigation	Orange	-526	-526	-526	-526	-526	-526
County Total	**Orange**	**-526**	**-526**	**-526**	**-526**	**-526**	**-526**
Livestock	Panola	-982	-982	-982	-982	-982	-982
County Total	**Panola**	**-982**	**-982**	**-982**	**-982**	**-982**	**-982**
Jacobs WSC	Rusk	0	0	0	0	0	-22
Overton	Rusk	-66	-122	-177	-241	-310	-384
Wright City WSC	Rusk	0	0	0	0	0	-21
Livestock	Rusk	0	0	-20	-51	-83	-83
Mining	Rusk	0	-305	-168	-22	0	0
Steam Electric Power	Rusk	-1,103	-1,103	-1,103	-1,103	-1,103	-1,103
County Total	**Rusk**	**-1,169**	**-1,530**	**-1,468**	**-1,417**	**-1,496**	**-1,613**
San Augustine	San Augustine	-120	-105	-92	-89	-89	-89
Livestock	San Augustine	-1,333	-1,539	-1,774	-2,048	-2,349	-2,349
Mining	San Augustine	-2,102	-1,102	0	0	0	0
County Total	**San Augustine**	**-3,555**	**-2,746**	**-1,866**	**-2,137**	**-2,438**	**-2,438**
Sand Hills WSC	Shelby	-65	-75	-85	-96	-107	-117
Livestock	Shelby	-6,491	-8,761	-11,524	-14,896	-19,006	-19,006
County Total	**Shelby**	**-6,556**	**-8,836**	**-11,609**	**-14,992**	**-19,113**	**-19,123**
Bullard	Smith	-141	-332	-526	-739	-956	-1,182
Crystal Systems Texas	Smith	0	0	0	-52	-164	-291
Lindale	Smith	-25	-136	-259	-384	-535	-696
Overton	Smith	-4	-7	-12	-18	-25	-32
R P M WSC	Smith	0	-2	-5	-11	-13	-17
Southern Utilities	Smith	-71	-74	-79	-83	-90	-98
Whitehouse	Smith	0	0	0	0	-39	-257
Manufacturing	Smith	0	-84	-84	-84	-84	-84
County Total	**Smith**	**-241**	**-635**	**-965**	**-1,371**	**-1,906**	**-2,657**
TOTAL Regional Shortage		**-139,221**	**-181,998**	**-182,791**	**-189,868**	**-199,072**	**-205,548**

Note: The Total Regional Needs are the sum of all shortages in the Region.

4.3.1 Identified Needs for Manufacturing

Manufacturing water needs in Jefferson county are projected to comprise around 80 percent of the region's first tier water needs throughout the planning horizon (2020-2070), with shortages ranging from over 101,000 ac-ft per year in 2020 to over 143,000 ac-ft per year in 2070. The large manufacturing needs in Jefferson county are due to increased demands associated with potential future liquid natural gas facilities. Water needs are also shown for manufacturing entities in Angelina and Smith counties due to increased demands above the current facilities' supplies.

4.3.2 Identified Needs for Municipal

A total of 20 municipal water user groups are shown to have a water shortage at some point during the planning horizon. WUGs in Jefferson county, such as the City of Beaumont and Jefferson county-Other, are projected to have the most significant municipal water needs in the latter half of the planning horizon. These municipal needs in Jefferson county are due a lack of developed supply, e.g., the City of Beaumont's current surface water treatment capacity limits the supply for projected future water demands. Municipal water needs over 100 ac-ft per year are also identified for the Cities of Bullard, Chandler, Lindale, Overton, San Augustine, Rusk, and Whitehouse. Other municipal users identified with needs exceeding 100 ac-ft per year include: Alto Rural WSC, D&M WSC, Crystal Systems Texas, Moore Station WSC, Sand Hills WSC, and Wright City WSC. All other municipal WUGS that show water shortages are below 100 ac-ft per year.

4.3.3 Identified Needs for Mining

Mining water needs over 2,000 ac-ft per year are identified in Nacogdoches and San Augustine counties in 2020; however, these needs diminish through the planning horizon as mining demands decrease. Additionally, mining needs are projected in five other counties (Angelina, Cherokee, Newton, Henderson, and Rusk). Most of these mining needs are also expected to decline over time. Several of these near-term mining needs are associated with renewed interest in natural gas exploration in the Haynesville/ Bossier Shale in East Texas.

4.3.4 Identified Needs for Livestock

Livestock water needs over 2,000 ac-ft per year are projected in Shelby, Nacogdoches, Jasper, and San Augustine counties. Many livestock water needs are expected to increase over time, particularly in Shelby county, where water needs are projected to increase from nearly 6,500 ac-ft per year in 2020 to over 19,000 ac-ft per year in 2070.

4.3.5 Identified Needs for Steam Electric Power

Steam electric power water needs exceeding 1,000 ac-ft per year are projected to occur in Jefferson and Rusk counties. Steam electric power shortages are primarily due to increases in demand above generation capacities of current facilities. Some of this demand is predicated on power facilities that are not going forward at this time but have the potential for development in the future.

4.3.6 Identified Needs for Irrigation

Irrigation water needs are only projected in Orange county.

4.4 First Tier Water Needs by Wholesale Water Provider

The comparison of first tier water needs for each WWP is presented in Appendix 4-E. Five WWPs were identified with projected needs in the ETRWPA over the planning cycle, while the rest of the WWPs have

either no needs or surplus of water above their demands. The WWPs with needs within the region are shown in Table 4.6 and discussed below. WWPs with surpluses within the region are shown in Table 4.7.

In addition to these providers, several WWPs are planning WMSs to increase the reliability of their supplies and to meet the needs of potential future customers. These providers and the recommended strategies are discussed in Chapter 5B.

Table 4.6 Wholesale Water Providers with Projected Regional Needs for Current Customers (ac-ft/yr)

Water Provider	2020	2030	2040	2050	2060	2070
Angelina and Neches River Authority	-45,254	-45,249	-45,249	-45,249	-45,249	-101,299
Athens Municipal Water Authority	1,564	1,100	786	366	-2,387	-5,567
Beaumont	0	0	-1,248	-3,843	-6,357	-9,218
Lufkin	-17,828	9,836	9,589	9,308	8,999	8,713
Upper Neches River Municipal Water Authority	-12,537	-14,114	-15,592	-17,174	-18,859	-21,159
Total	**-74,055**	**-48,427**	**-51,714**	**-56,592**	**-63,853**	**-128,530**

Note: The needs (shortages) shown above are only for current customers in Region I. Potential future customers may place additional demands on these providers. Positive values indicate a surplus, while negative values indicate a need.

Table 4.7 Wholesale Water Providers with Projected Regional Surpluses for Current Customers (ac-ft/yr)

Water Provider	2020	2030	2040	2050	2060	2070
Angelina-Nacogdoches WCID No. 1	15,340	14,635	5,601	4,861	3,426	1,401
Carthage	2,708	2,668	2,636	2,599	2,522	2,481
Center	1,620	1,507	1,405	1,299	1,191	1,090
Houston County WCID No. 1	1,234	1,171	1,171	1,171	1,171	1,171
Jacksonville	2,814	2,523	2,231	1,819	1,341	814
Lower Neches Valley Authority	797,837	768,221	766,496	764,358	762,310	761,573
Nacogdoches	12,861	11,794	10,731	9,563	8,290	6,966
Panola Co. Fresh Water Supply District No. 1	4,365	3,719	3,525	3,312	3,020	2,148
Sabine River Authority	999,279	999,279	999,279	999,279	999,279	999,279
Tyler	15,580	14,032	12,632	10,950	9,086	7,131
Total	**1,853,639**	**1,819,550**	**1,805,708**	**1,799,212**	**1,791,635**	**1,784,054**

Note: The surpluses shown above are only for current customers in Region I. Potential future customers may place additional demands on these providers. Port Arthur is not included in Table 4.5 and 4.6 because there is no shortage or surplus.

4.4.1 Angelina and Neches River Authority (ANRA)

ANRA is projected to have a water need of 101,299 ac-ft per year by Year 2070. ANRA has contractual demands for water from Lake Columbia that are estimated to begin by 2020 (assuming that Lake Columbia is completed by 2020). ANRA has no currently available water supply to meet these contractual demands. The potential management strategy to meet this shortage is the construction of Lake Columbia.

4.4.2 Athens Municipal Water Authority (AMWA)

The maximum projected need for AMWA is 5,567 ac-ft per year in Year 2070. Most of this need is associated with operational constraints of Lake Athens for the Athens Fish Hatchery. Several water management strategies are being considered for AMWA to meet this need, including reuse from return flows from the Athens Fish Hatchery and developing groundwater supplies from the Carrizo-Wilcox aquifer.

4.4.3 City of Beaumont

The City of Beaumont is projected to have a water need under drought-of-record conditions of 1,248 ac-ft per year beginning in Year 2040, growing to 9,218 ac-ft per year for Year 2070. Much of the projected needs are associated with increased demands for manufacturing needs and local growth.

4.4.4 City of Lufkin

The City of Lufkin has a projected water need of 17,828 ac-ft per year in 2020 due to having no infrastructure in place for its supply users other than LNVA.

4.4.5 Upper Neches River Municipal Water Authority (UNRMWA)

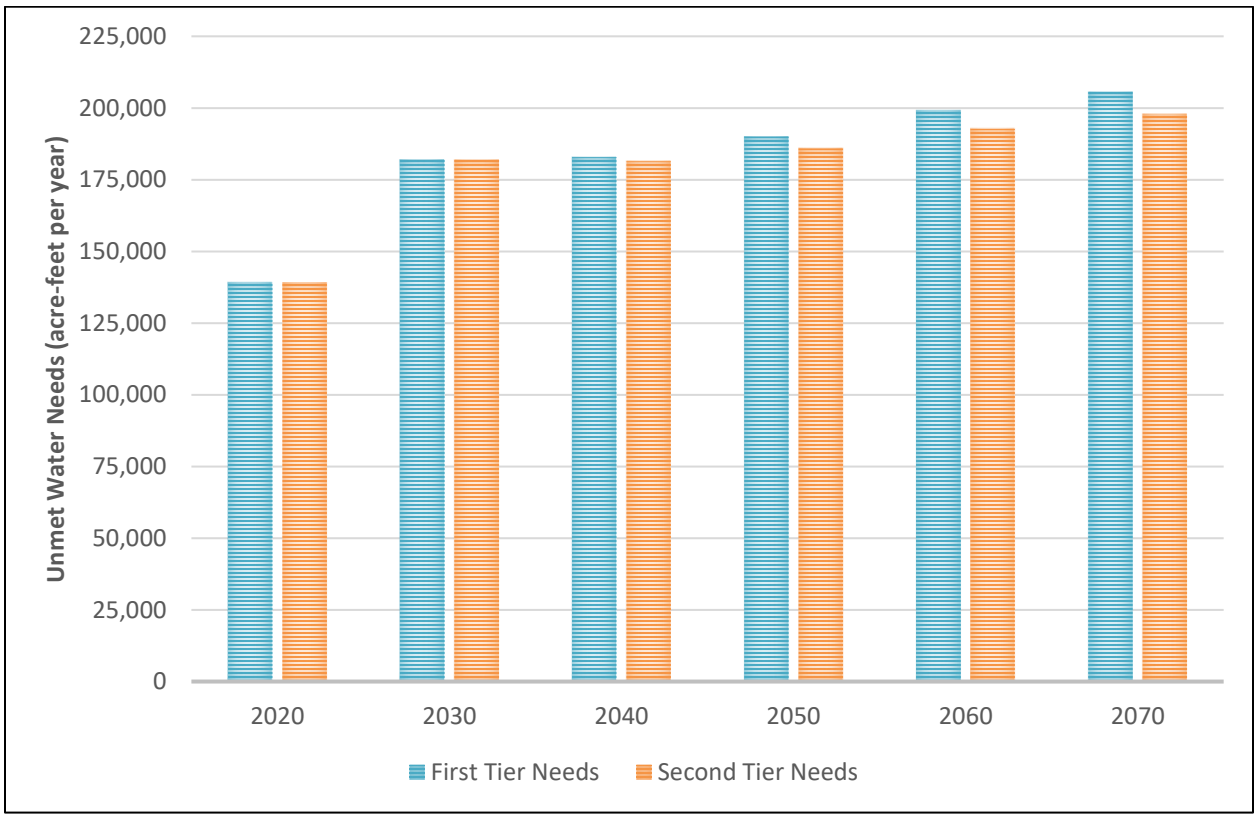
The UNRMWA has contractual demands that exceed the reliable supply from its Lake Palestine system. The long-term strategy to meet these demands and other potential future demands is to develop additional supplies in the Neches River basin.

4.5 Second Tier Water Needs Analysis

The Second Tier water needs analysis compares the currents and projects supplies and demands after reductions from conservation and direct reuse. Conservation and direct reuse are both characterized as water management strategies (WMS), which will be further discussed in Chapter 5B and Chapter 5C. Appendix 4-B contains listings of the second tier water needs by water user group and wholesale water provider.

Figure 4.4 illustrates the reduction of water needs within the region after applying conservation and direct reuse strategies. Conservation was applied to all municipal WUGs with a reported per-capita usage above 140 gallons per capita per day (GPCD), whether there was a need or not, therefore, needs were only reduced if an entity had a need. Overall, conservation and direct reuse decreased the total needs within the region by over 100 ac-ft per year (~0.1 percent) in 2020 and nearly 7,900 ac-ft per year (~3.9 percent) by 2070. A large portion of this reduction is attributed to the City of Beaumont's municipal conservation strategy.

Figure 4.4 Regional Secondary Needs Comparison



4.6 Socioeconomic Impact Analysis of Water Needs

Administrative rules in 31 TAC §357.10 require regional water planning groups to evaluable socioeconomic impacts of not meeting water needs as a part of the regional water planning process. The TWDB conducted a comprehensive socioeconomic analysis to assess the impacts of failing to meet projected water needs within the region. This analysis calculated the impacts of a severe drought occurring in a single year at each decadal period within Region I. It was assumed that all of the projected impacts were attributed to drought conditions. Under these assumptions, notable findings from TWDB socioeconomic impact analysis are summarized as follows:

- With the projected shortages, the region's projected 2020 population would be reduced by 12,571 people, which equates to approximately 1.1 percent of the total projected population.
- Without any additional supplies, the projected water needs would reduce the region's projected 2020 employment by approximately 68,468 jobs (11.5 percent reduction). This declines to around 51,585 lost jobs by 2070. The mining sector accounts for nearly 56 percent of these jobs losses in 2020 but only accounts for 5 percent by 2070. Conversely, the livestock sector accounts for approximately 38 percent of job losses in 2020 and increases to account for nearly 83 percent of job losses by 2070. Municipal and manufacturing sectors are the next biggest contributors, particularly in later decades.
- Without any additional supplies, the projected water needs would reduce the region's projected annual income by $9.3 billion in 2020, approximately 77 percent of which is within the mining industry. This represents nearly 16 percent of the region's current income. The loss in income reduces to approximately $3.9 billion in 2070, after mining is projected to decline.

The full socioeconomic impact analysis performed by the TWDB is attached in Appendix 4-G.