

ES.1 Key Findings

The Region F Water Plan projects population and water demands over a fifty-year planning horizon and seeks to identify possible strategies to avoid potential water shortages in the region. Due to drought in the Colorado River Basin, the estimated surface water availability has declined from previous estimates. This has resulted in the development of other supplies and reduced reliance on surface water in the region. For some areas, the only source of water is groundwater. Continued and increased demands on groundwater affect the long-term availability of many Region F aquifers. Groundwater availability in the region has increased overall from the 2016 Water Plan, but there continues to be areas with insufficient surface water and groundwater. Also, water quality is significant concern in the region for both surface water and groundwater sources. As entities continue to stress existing water sources, the impacts to quality will increase and the usability of the water will decline. To address this concern, there are several advanced treatment strategies recommended in the region. Irrigation continues to be largest user of water in Region F, but the ability to fully meet this demand during drought is limited. Irrigation conservation is estimated to provide up to 35 percent of the projected water need, but there remains a regional unmet need of 16,900 acre-feet per year by 2070. The increased mining activities in the region has had multiple impacts to water demands, including spurring population growth and economic activities in both rural and urban communities, which increase associated water demands. As the region looks to meet its projected needs, conservation, additional groundwater development, and advanced treatment will become greater integral components of the region's water supplies.

Key Findings

- Continued interest in oil and gas development has increased the demand for water, directly for mining operations and for communities experiencing increased population growth.
- Conservation (municipal, irrigation, and mining) accounts for one quarter to one third of the future water supply in Region F.
- Additional groundwater development is a major water supply strategy, accounting for 20 to 30 percent of new supplies for the region.

ES.2 Current Water Needs and Supplies in Region F

As of the 2010 census, the population of Region F was 623,354. The three most populous counties in Region F, Ector, Midland, and Tom Green, have 62 percent of the region's population. Seven cities in Region F had a population of more than 10,000 people as of year 2010. These seven cities include 60 percent of the population in Region F. Since 2010 some communities have experienced substantial growth, mostly due to the increased activities in the oil and gas industry in the Permian Basin. Some of these increases are not accurately reflected in the population projection for the 2021 Region F Water Plan. As a result, the plan recognizes the additional water demands on these communities by including water management strategies to meet the anticipated needs.

2.1.1 Physical Setting

Most of Region F is located in the upper portion of the Colorado Basin and in the Pecos portion of the Rio Grande Basin. A small portion of the region is in the Brazos Basin. Figure ES- 1. shows the major streams in Region F.

Precipitation increases from west to east across the region, as does the average runoff. Evaporation increases from southeast to northwest. The patterns of rainfall, runoff, and evaporation result in more abundant water supplies in the eastern portion of the region.

Region F includes 17 major water supply reservoirs that provide most of the region’s surface water supply. Four major aquifers and ten minor aquifers provide groundwater supplies to Region F. Springs have historically played an important role in water supply; however, over time most of the springs have greatly diminished and only contribute to water supply in specific locations.

ES.2.1 Current Sources of Water

The Region F surface water supplies are associated primarily with major reservoirs. Region F does not import a significant amount of surface water from outside the region. However, Region F exports surface water to the cities of Sweetwater and Abilene, both in the Brazos G Region. The City of Sweetwater owns and operates Oak Creek Reservoir in Region F. The City of Abilene has a contract to purchase water out of O.H. Ivie Reservoir in Region F. Surface water supplies have historically been an important source of water for municipal use and is the primary source for many communities.

Based on historic groundwater estimates (2012-2016), approximately 60 percent of the water used in Region F is supplied by groundwater. Fourteen aquifers provide groundwater supplies in Region F. Region F has 16 Underground Water Conservation Districts

(GCDs) that oversee the use of water from the aquifers in the region. Twelve of these GCDs formed an alliance known as the West Texas Regional Groundwater Alliance that promotes conservation, preservation, and beneficial use of water in Region F.

ES.2.2 Water Providers in Region F

Water providers in Region F are classified by use type and can be grouped into municipal and non-municipal water users. Non-municipal water users are aggregated by county and include irrigation, livestock, manufacturing, mining, and steam electric power. Municipal water user groups are defined by water utilities that provide 100 acre-feet per year or more to retail customers. A major water provider is an entity that provides a significant amount of water in the region. In Region F, there are 95 municipal water user groups and five major water providers. The major water providers include the Colorado River Municipal Water District, Brown County Water Improvement District Number 1, Midland, Odessa, and San Angelo.

ES.3 Projected Need for Water

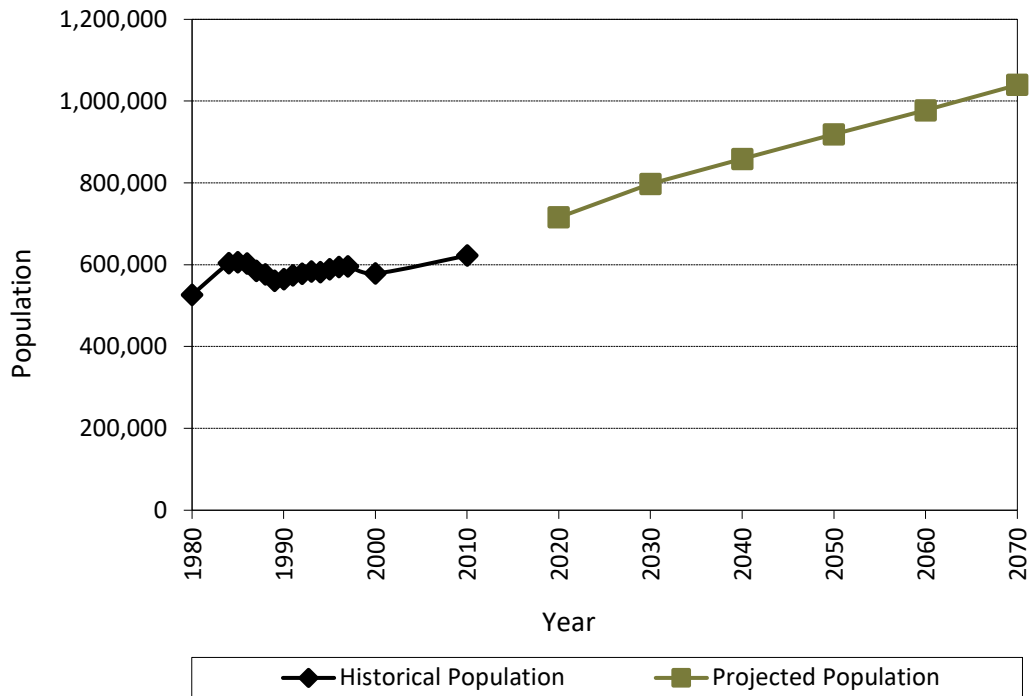
ES.3.1 Population Projections

The population of Region F as shown on Table ES- 1 is projected to grow from 715,773 in the year 2020 to 1,039,502 in 2070, which equates to an average growth rate of 0.90 percent per year. The population projections were developed by the Texas Water Development Board (TWDB). The relative distribution of population in Region F is expected to remain stable throughout the planning period. All but three of the counties are generally rural counties and are expected to remain so into the future. The distribution of the projected population by county and city is discussed in Chapter 2. Figure ES- 2 shows the historical and projected population for Region F.

Table ES- 1
Region F Population Projections

Population Projections	2020	2030	2040	2050	2060	2070
Region F Total	715,773	797,589	858,726	918,597	977,543	1,039,502

Figure ES- 2
Historical and Projected Population in Region F



ES.3.2 Demand Projections

Table ES-2 shows the projected demands for water by category of use in Region F. The total historical water use was about 625,000 acre-feet in the year 2010 and is projected to be as much as 765,150 acre-feet in 2020. The significant increase in water use between the historical year 2010 data and the year 2020 projections is primarily due to increases in mining demands. While the increased mining activity is anticipated to continue over an extended period, the projected demands begin to decline in 2040 and return to near historical levels by 2070.

The largest water user in Region F is irrigated agriculture. This use type accounts for over 62 percent of the projected water use in 2020. While the demand projections do not decline over the planning period, it is possible that some irrigation water use will be converted to other use types as the need for water increases. Other non-municipal water demands are expected to remain steady over the planning period. Municipal water use increases as population increases.

Figure ES- 3
Projected Water Demand in Region F by Use Category

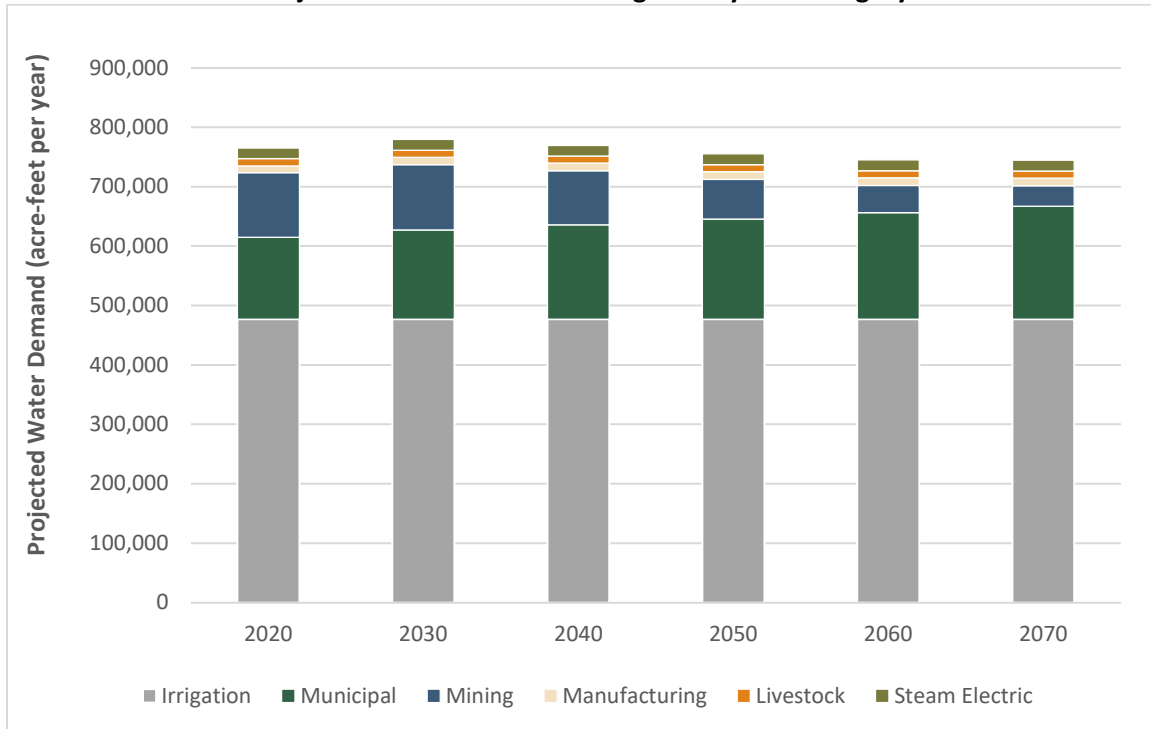


Table ES- 2
Water Demands by Use Type (acre-feet per year)

Demands	2020	2030	2040	2050	2060	2070
Municipal	137,727	150,060	158,957	168,702	179,098	190,290
Manufacturing	11,591	12,607	12,607	12,607	12,607	12,607
Irrigation	476,941	476,941	476,941	476,941	476,941	476,941
Steam Electric	18,092	18,092	18,092	18,092	18,092	18,092
Mining	108,841	109,847	90,970	66,812	46,251	34,478
Livestock	11,958	11,958	11,958	11,958	11,958	11,958
Region F Total	765,150	779,505	769,525	755,112	744,947	744,366

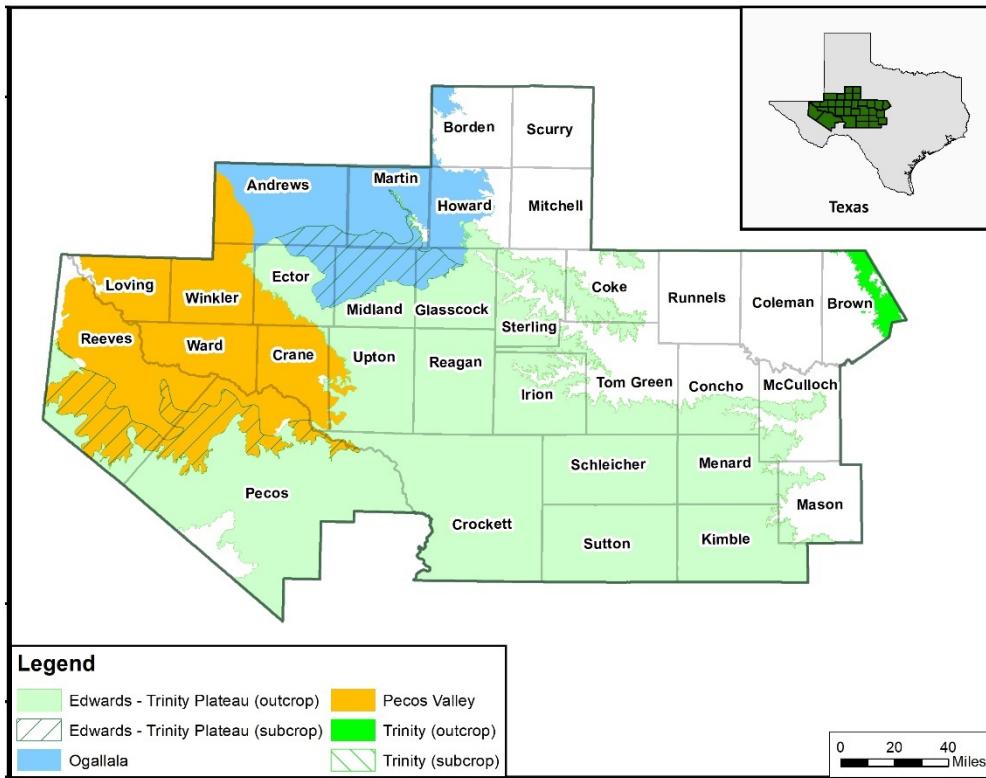
ES.3.3 Water Supply Analysis

As required by TWDB rules, the available surface water supplies are derived from Water Availability Models (WAMs), Full Authorization Run (Run 3). The WAMs were developed by the Texas Commission on Environmental Quality (TCEQ). Three WAMs are available in Region F: (a) the Colorado WAM, which covers most of the central and eastern portions of the region, (b) the Rio Grande WAM, which covers the Pecos Basin, and (c) the Brazos WAM. The WAMs allocate water based on priority without regard to geographic location, agreements between water right holders, or type of use. As a result, the Colorado WAM significantly

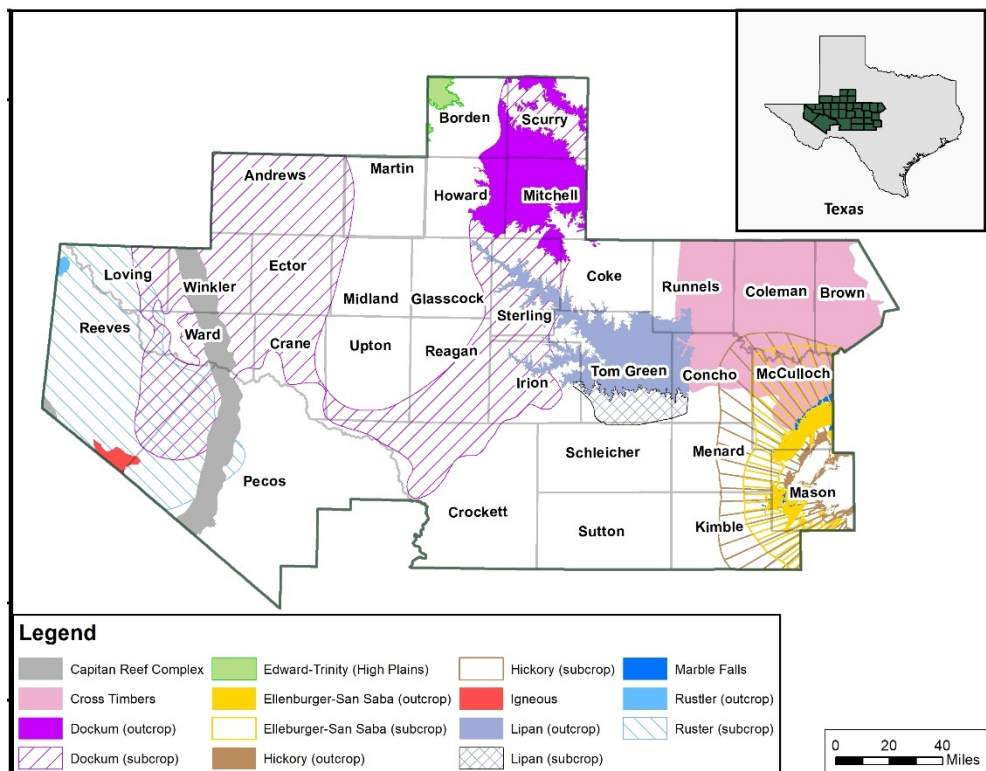
underestimates the total surface water supply in Region F as currently operated.

Groundwater provides most of the irrigation water used in the region, as well as a significant portion of the water used for municipal and other purposes. Groundwater is primarily found in four major and ten minor aquifers that vary in quantity and quality (Figure ES- 4 and Figure ES- 5). Total groundwater supply is determined using the Modeled Available Groundwater (MAG) value as determined by the TWDB.

**Figure ES- 4
Major Aquifer Map**



**Figure ES- 5
Minor Aquifer Map**



The total amount of water available in Region F is approximately 1.3 million acre-feet per year as shown on Figure ES- 6. This includes over 1.1 million acre-feet of groundwater. However, not all the water supplies in the region are currently available to users. Water supply may be limited by the yield of reservoirs, well field capacity, aquifer characteristics, water quality, water

rights, permits, contracts, regulatory restrictions, raw water delivery infrastructure or water treatment capacity.

Table ES- 3 shows the supplies available to water users by use type. The total amount of water currently available to users in Region F is less than 730,000 acre-feet per year in 2020 and less than 670,000 acre-feet per year by 2070.

Figure ES- 6
Water Availability by Source Type

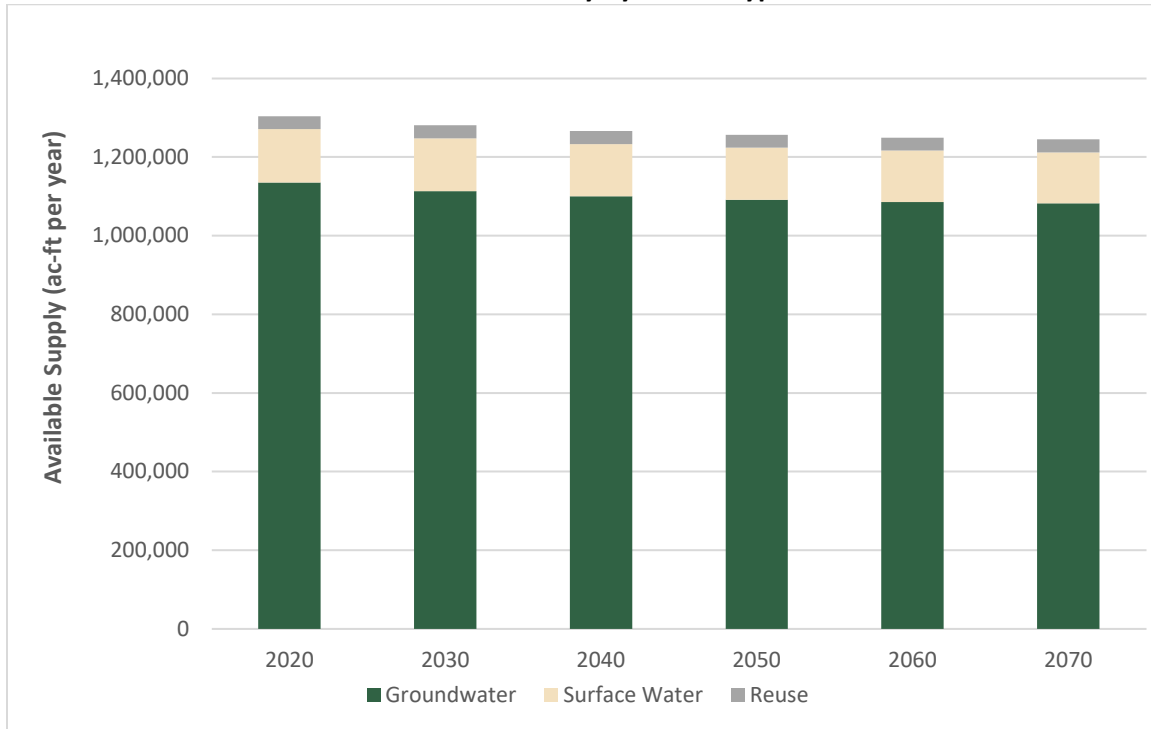


Table ES- 3
Existing Supplies by Use Type (acre-feet per year)

Existing Supplies	2020	2030	2040	2050	2060	2070
Irrigation	467,747	463,419	461,774	459,907	456,369	453,708
Manufacturing	11,544	12,442	12,388	11,950	10,919	10,736
Mining	89,083	89,809	76,117	59,194	51,824	45,852
Municipal	142,164	133,797	137,490	137,348	137,150	136,899
Steam Electric	5,298	5,428	5,428	5,292	5,169	5,053
Livestock	12,053	12,045	12,037	12,023	12,012	12,002
Region F Total	727,889	716,940	705,234	685,714	673,443	664,250

ES.3.4 Comparison of Supply and Demand

shows a comparison of the available water supply to Region F and projected demands. With a projected 2070 demand of 744,366 acre-feet per year and declining water supplies, Region F has a projected regional shortage of about 103,300 acre-feet per year by 2070. Most of this need is associated with municipal water use, which some users rely heavily on surface water supplies. The subordination strategy that better reflects current operations in the Colorado River Basin will meet some of the municipal water need but not all of it.

Irrigation and steam electric power are the other use categories with needs greater than 10,000 acre-feet per year. Irrigation needs are mainly due to limitations in groundwater availability; while the projected steam electric power needs are associated with demands that may no longer be needed due to changes in cooling processes or facilities that may not be constructed.

Figure ES- 7
Comparison of Supply and Demand (acre-feet per year)

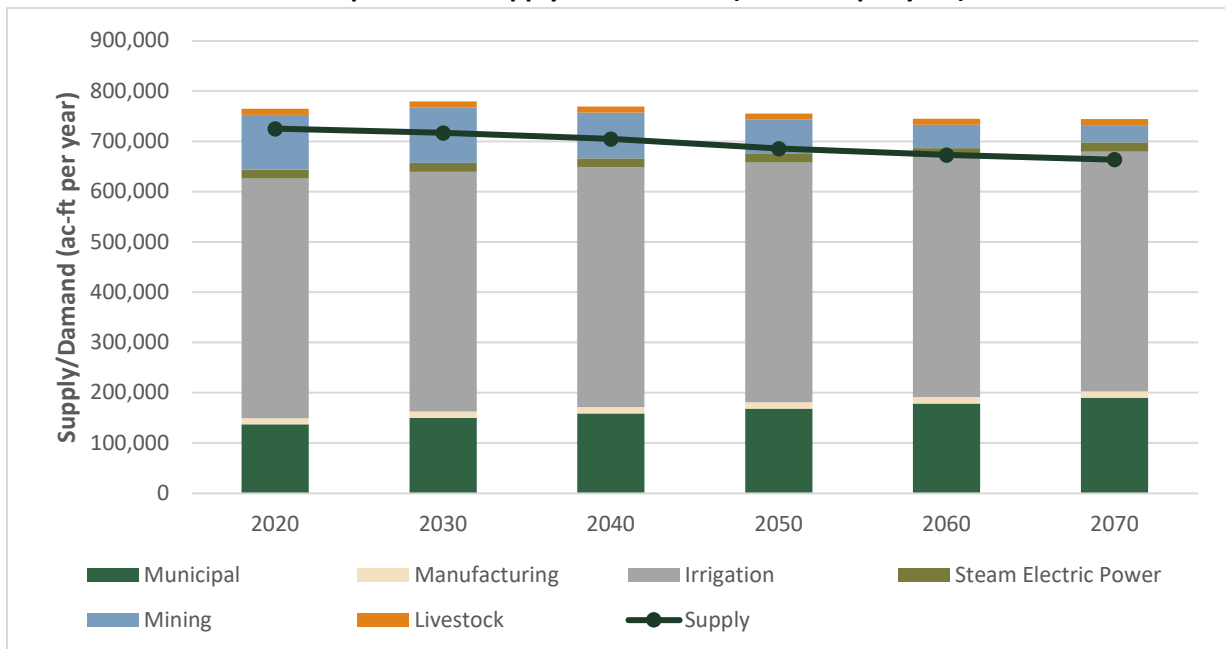


Table ES- 4
Needs by Use Type (acre-feet per year)

Need	2020	2030	2040	2050	2060	2070
Municipal	14,431	19,143	24,233	34,038	44,548	55,875
Manufacturing	1,112	1,226	1,269	1,488	1,688	1,871
Irrigation	13,529	17,957	19,544	21,240	24,585	27,060
Livestock	9	17	25	39	50	60
Mining	21,261	21,357	17,834	13,588	7,077	5,407
Steam Electric Power	12,794	12,678	12,678	12,800	12,923	13,039
Region F Total	63,136	72,378	75,583	83,193	90,871	103,312

ES.3.5 Socio-Economic Impact of Not Meeting Projected Water Needs

According to the comparison of supply and demand, Region F could face significant shortages in water supply over the planning period for some water users. To assess the potential socio-economic impacts of these shortages, the TWDB conducted an evaluation of failing to meet the projected water needs in

Region F. The TWDB's analysis calculated the impacts of a severe drought occurring in a single year at each decadal period in Region F. The findings of this study are summarized below:

- With the projected shortages, the region's projected 2020 population would be reduced by approximately 2.6 percent.
- The region may experience 23 percent reduction in employment in 2020. The mining sector accounts for 96 percent of these jobs losses in 2020.
- The region's projected annual income in 2020 would be reduced by \$19.6 billion, approximately 95 percent of which is within the mining industry. This represents nearly 40 percent of the region's current income.
- Economic impacts decline over time as the projected needs decrease.

ES.4 Identification and Selection of Water Management Strategies

The Region F Water Planning Group identified and evaluated a wide variety of potentially feasible water management strategies in developing this plan. Water supply availability, costs and environmental impacts were determined for conservation and reuse efforts, the connection of existing supplies, and the development of new supplies.

As required by the TWDB regulations, the evaluation of water management strategies was an equitable comparison of all feasible strategies and considered the following factors:

- Evaluation of quantity, reliability, and cost of water diverted and treated
- Environmental factors
- Impacts on other water resources and on threats to agricultural and natural resources
- Significant issues affecting feasibility
- Consideration of other water management strategies affected

ES.4.1 Water Conservation

The Region F Water Planning Group considered three major categories of water conservation: municipal, mining, and irrigation. Overall, it is estimated that nearly 66,000 acre-feet of water could be conserved annually by 2070 in Region F.

Municipal water conservation is recommended for all individual municipal water user groups and county-other groups that have a shortage. The total water savings from municipal conservation is estimated to be 2,853 acre-feet per year in 2020 and is projected to grow to 4,261 acre-feet per year by 2070. This reduces the projected municipal water needs by 11 and 6 percent, respectively, for those with needs. It also places less demand on limited water sources for municipal water users with enough supplies.

The recommended water conservation activities for municipal water users in Region F are:

- Education and outreach programs,
- Reduction of unaccounted for water through water audits and leak repair,
- Water rate structures that discourage water waste,
- Ordinances prohibiting the waste of water
- Landscape ordinances (for entities >20,000), and
- Time of day watering limits (for entities >20,000).

The two other conservation strategies, irrigation and mining conservation, provide approximately 28,444 acre-feet of water savings in 2020 and is projected to increase to 60,232 acre-feet by 2070. The irrigation conservation activities evaluated as part of this plan focus on efficient irrigation practices. Mining conservation focuses on the treatment and reuse of flowback water from fracking operations.

ES.4.2 Water Management Strategies

In addition to conservation, subordination of surface water in the Colorado River Basin and groundwater development are two of the major strategies in Region F. The subordination strategy, which was developed in conjunction with the Lower Colorado Region (Region K), reserves nearly 44,000 acre-feet of surface water for use in Region F in 2070. New groundwater development projects planned in Region F will provide approximately over 25,000 acre-feet of additional reliable supply in 2020, increasing to over 60,000 acre-feet of supply in 2070. This strategy is recommended for both smaller users as well as major water providers.

Figure ES- 8 shows the supplies from water management strategies by type for 2020 and 2070.

Table ES- 5 lists recommended water management strategies for Region F. In total, the Region F plan includes recommended water management strategies to develop or preserve over 200,000 acre-feet per year of additional supplies by 2070, including new well fields, reuse, new or additional treatment, and voluntary redistribution. Alternative water management strategies are included in summary Table ES- 6.

Figure ES- 8
Distribution of Supplies from Recommended Water Management Strategies

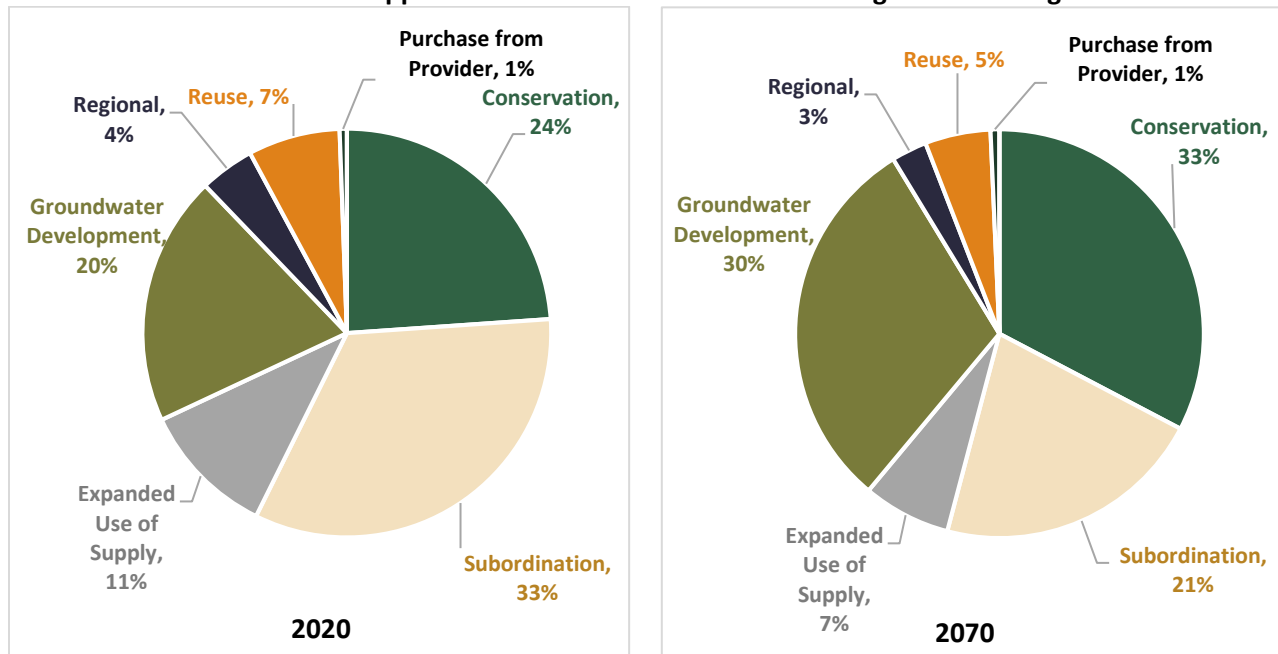


Table ES- 5
Recommended Water Management Strategies

Entity	County Used	Expected Online Date	Capital Cost	First Decade Unit Cost (\$ per ac-ft per yr)	Total Yield						Last Decade Unit Cost (\$ per ac-ft per yr)	
					2020	2030	2040	2050	2060	2070		
Brush Control												
BCWID	Multiple	2020	\$0	\$390	400	400	400	400	400	400	400	\$390
San Angelo	Multiple	2020	\$0	\$489	60	60	60	60	60	60	60	\$489
UCRA	Multiple	2020	\$0	\$850	90	90	90	90	90	90	90	\$850
Develop Cross Timbers Aquifer Supplies												
Mining	Brown	2020	\$2,440,000	\$948	210	210	210	210	210	210	210	\$129
Develop Edwards-Trinity Plateau Aquifer Supplies												
Junction	Kimble	2020	\$3,634,000	\$822	370	370	370	370	370	370	370	\$130
Manufacturing	Kimble	2020	\$1,621,000	\$274	500	500	500	500	500	500	500	\$46
Balmorhea	Reeves	2020	\$1,948,000	\$1,053	150	150	150	150	150	150	150	\$140
Develop Hickory Aquifer Supplies												
San Angelo	Ector	2030	\$55,491,000	\$2,321	1,040	1,040	3,040	3,040	3,040	3,040	3,040	\$1,037
Menard	Menard	2020	\$3,287,000	\$3,820	200	200	200	200	200	200	200	\$160
Develop Other Aquifer Supplies												
Bronte	Coke	2020	\$23,694,000	\$2,424	800	800	800	800	800	800	800	\$340
Manufacturing	Scurry	2020	\$677,000	\$356	160	160	160	160	160	160	160	\$56
Develop Pecos Valley Aquifer Supplies												
CRMWD	Multiple	2050	\$168,324,000	\$849	0	0	0	22,400	22,400	22,400	22,400	\$321
County-Other	Midland	2020	\$24,557,000	\$738	2,800	2,800	2,800	2,800	2,800	2,800	2,800	\$121
Pecos County WCID #1	Pecos	2020	\$3,630,000	\$1,224	250	250	250	250	250	250	250	\$204
Mining	Reeves	2020	\$17,465,000	\$173	10,400	10,400	10,400	10,400	10,400	10,400	10,400	\$54
Grandfalls	Ward	2050	\$2,410,000	\$1,245	0	0	0	155	155	155	155	\$148
Dredging River Intake												
Junction	Kimble	2020	\$7,505,000	\$2,112	250	250	250	250	250	250	250	\$0
Groundwater Strategies												
CRMWD	Multiple	2030	\$10,440,000	\$102	0	755	2,650	6,450	8,516	10,498	10,498	\$76
Pecos	Reeves	2020	\$43,107,000	\$427	8,960	8,960	8,960	8,960	8,960	8,960	8,960	\$89

Entity	County Used	Expected Online Date	Capital Cost	First Decade Unit Cost (\$ per ac-ft per yr)	Total Yield						Last Decade Unit Cost (\$ per ac-ft per yr)
					2020	2030	2040	2050	2060	2070	
Sonora	Sutton	2020	\$437,000	\$1,000	35	35	35	35	35	35	\$114
Irrigation Conservation											
Irrigation	Andrews	2020	\$1,548,000	\$21	1,018	2,037	2,037	2,037	2,037	2,037	\$0
Irrigation	Borden	2020	\$224,000	\$21	147	295	295	295	295	295	\$0
Irrigation	Brown	2020	\$494,000	\$21	406	650	650	650	650	650	\$0
Irrigation	Coke	2020	\$63,000	\$21	34	69	83	83	83	83	\$0
Irrigation	Coleman	2020	\$35,000	\$21	23	47	47	47	47	47	\$0
Irrigation	Concho	2020	\$410,000	\$21	245	490	539	539	539	539	\$0
Irrigation	Crockett	2020	\$15,000	\$21	7	14	20	20	20	20	\$0
Irrigation	Ector	2020	\$86,000	\$21	38	76	113	113	113	113	\$0
Irrigation	Glasscock	2020	\$1,558,000	\$21	2,050	2,050	2,050	2,050	2,050	2,050	\$0
Irrigation	Howard	2020	\$575,000	\$21	344	688	757	757	757	757	\$0
Irrigation	Irion	2020	\$120,000	\$21	53	105	158	158	158	158	\$0
Irrigation	Kimble	2020	\$242,000	\$21	133	266	319	319	319	319	\$0
Irrigation	Martin	2020	\$4,160,000	\$21	1,825	3,649	5,474	5,474	5,474	5,474	\$0
Irrigation	Mason	2020	\$566,000	\$21	248	497	745	745	745	745	\$0
Irrigation	McCulloch	2020	\$265,000	\$21	116	232	349	349	349	349	\$0
Irrigation	Menard	2020	\$418,000	\$21	183	366	549	549	549	549	\$0
Irrigation	Midland	2020	\$2,064,000	\$21	905	1,811	2,716	2,716	2,716	2,716	\$0
Irrigation	Mitchell	2020	\$194,000	\$21	256	256	256	256	256	256	\$0
Irrigation	Pecos	2020	\$16,341,000	\$21	7,167	14,335	21,502	21,502	21,502	21,502	\$0
Irrigation	Reagan	2020	\$2,512,000	\$21	1,102	2,203	3,305	3,305	3,305	3,305	\$0
Irrigation	Reeves	2020	\$6,719,000	\$21	2,947	5,894	8,841	8,841	8,841	8,841	\$0
Irrigation	Runnels	2020	\$283,000	\$21	155	311	373	373	373	373	\$0
Irrigation	Schleicher	2020	\$83,000	\$21	91	109	109	109	109	109	\$0
Irrigation	Scurry	2020	\$747,000	\$21	378	756	983	983	983	983	\$0
Irrigation	Sterling	2020	\$102,000	\$21	45	90	135	135	135	135	\$0
Irrigation	Sutton	2020	\$128,000	\$21	56	112	168	168	168	168	\$0
Irrigation	Tom Green	2020	\$3,875,000	\$21	2,125	4,249	5,099	5,099	5,099	5,099	\$0
Irrigation	Upton	2020	\$1,186,000	\$21	520	1,040	1,560	1,560	1,560	1,560	\$0

Entity	County Used	Expected Online Date	Capital Cost	First Decade Unit Cost (\$ per ac-ft per yr)	Total Yield						Last Decade Unit Cost (\$ per ac-ft per yr)
					2020	2030	2040	2050	2060	2070	
Irrigation	Ward	2020	\$360,000	\$21	158	316	474	474	474	474	\$0
Irrigation	Winkler	2020	\$400,000	\$21	175	351	526	526	526	526	\$0
Mining Conservation (Recycling)											
Mining	Andrews	2020	\$5,540,000	\$632	277	260	222	176	135	104	\$0
Mining	Borden	2020	\$780,000	\$1,117	29	39	33	21	10	5	\$0
Mining	Brown	2020	\$1,340,000	\$654	66	66	67	67	66	66	\$0
Mining	Coke	2020	\$400,000	\$632	20	20	18	16	14	12	\$0
Mining	Coleman	2020	\$100,000	\$632	5	4	4	4	3	3	\$0
Mining	Concho	2020	\$400,000	\$632	20	20	18	15	13	12	\$0
Mining	Crane	2020	\$720,000	\$1,173	26	35	36	29	22	17	\$0
Mining	Crockett	2020	\$6,300,000	\$632	315	315	43	24	7	3	\$0
Mining	Ector	2020	\$600,000	\$733	28	30	27	22	18	15	\$0
Mining	Glasscock	2020	\$4,960,000	\$632	248	248	189	134	88	63	\$0
Mining	Howard	2020	\$2,860,000	\$632	143	143	101	59	25	13	\$0
Mining	Irion	2020	\$6,440,000	\$632	322	322	231	28	14	7	\$0
Mining	Kimble	2020	\$20,000	\$632	1	1	1	1	1	1	\$0
Mining	Loving	2020	\$10,500,000	\$632	525	525	462	378	301	238	\$0
Mining	Martin	2020	\$6,040,000	\$632	302	302	227	49	27	14	\$0
Mining	Mason	2020	\$860,000	\$632	43	40	30	24	19	16	\$0
Mining	McCulloch	2020	\$7,500,000	\$632	375	351	279	236	203	176	\$0
Mining	Menard	2020	\$920,000	\$632	46	45	40	35	30	26	\$0
Mining	Midland	2020	\$8,900,000	\$632	445	445	344	231	46	32	\$0
Mining	Mitchell	2020	\$620,000	\$970	25	31	27	21	16	12	\$0
Mining	Pecos	2020	\$10,780,000	\$632	539	539	539	434	67	52	\$0
Mining	Reagan	2020	\$8,900,000	\$632	445	445	323	62	24	8	\$0
Mining	Reeves	2020	\$17,640,000	\$632	882	882	847	693	546	434	\$0
Mining	Runnels	2020	\$220,000	\$632	11	11	10	9	8	7	\$0
Mining	Schleicher	2020	\$620,000	\$903	26	31	24	16	10	6	\$0
Mining	Scurry	2020	\$680,000	\$1,617	20	32	34	25	17	12	\$0
Mining	Sterling	2020	\$800,000	\$931	33	40	34	22	11	6	\$0

Entity	County Used	Expected Online Date	Capital Cost	First Decade Unit Cost (\$ per ac-ft per yr)	Total Yield						Last Decade Unit Cost (\$ per ac-ft per yr)
					2020	2030	2040	2050	2060	2070	
Mining	Sutton	2020	\$640,000	\$1,595	19	30	32	24	16	11	\$0
Mining	Tom Green	2020	\$980,000	\$792	44	45	47	47	48	49	\$0
Mining	Upton	2020	\$2,020,000	\$632	101	101	80	53	32	22	\$0
Mining	Ward	2020	\$1,600,000	\$632	80	80	71	55	38	25	\$0
Mining	Winkler	2020	\$980,000	\$1,315	33	49	42	32	22	16	\$0
Municipal Conservation											
Airline Mobile Home Park	Midland	2020	\$0	\$1,263	7	7	8	9	10	10	\$1,134
Andrews	Andrews	2020	\$0	\$952	45	55	96	111	129	150	\$592
County-Other	Andrews	2020	\$0	\$1,080	14	15	17	18	20	21	\$821
Ballinger	Runnels	2020	\$0	\$1,107	12	12	12	12	12	12	\$1,101
Bangs	Brown	2020	\$0	\$1,221	8	8	8	8	8	8	\$2,189
Balmorhea	Reeves	2020	\$0	\$2,472	2	2	2	2	2	2	\$1,214
Barstow	Ward	2020	\$0	\$3,068	1	1	1	1	1	1	\$2,731
Big Lake	Reagan	2020	\$0	\$1,139	10	12	12	13	13	14	\$1,079
Big Spring	Howard	2020	\$0	\$557	131	138	140	139	139	139	\$620
Brady	McCulloch	2020	\$0	\$988	18	18	19	19	19	19	\$930
Bronte	Coke	2020	\$0	\$1,647	3	3	3	3	3	3	\$1,647
Brookesmith SUD	Brown	2020	\$0	\$705	25	25	25	25	25	25	\$688
Brownwood	Brown	2020	\$0	\$937	61	91	91	91	91	91	\$735
Coahoma	Howard	2020	\$0	\$1,222	8	8	8	8	8	8	\$1,203
Coleman	Coleman	2020	\$0	\$1,065	15	15	15	15	15	15	\$1,061
County-Other	Coleman	2020	\$0	\$5,095	1	1	1	1	1	1	\$1,138
Coleman County SUD	Coleman	2020	\$0	\$1,144	10	10	10	10	10	10	\$5,161
Colorado City	Mitchell	2020	\$0	\$1,054	16	18	18	18	18	19	\$938
Concho Rural WSC	Tom Green	2020	\$0	\$894	20	21	22	23	24	24	\$1,821
County-Other	Concho	2020	\$0	\$1,836	3	3	3	3	3	3	\$714
Crockett County WCID	Crockett	2020	\$0	\$1,106	12	13	13	13	13	13	\$1,070
Crane	Crane	2020	\$0	\$1,120	11	12	13	13	14	14	\$1,083

Entity	County Used	Expected Online Date	Capital Cost	First Decade Unit Cost (\$ per ac-ft per yr)	Total Yield						Last Decade Unit Cost (\$ per ac-ft per yr)
					2020	2030	2040	2050	2060	2070	
DADS SLC	Tom Green	2020	\$0	\$4,116	1	1	1	1	1	1	\$4,116
Early	Brown	2020	\$0	\$1,176	9	9	9	9	9	9	\$1,170
Ector County Utility District	Ector	2020	\$0	\$292	60	84	94	125	137	149	\$598
Eden	Concho	2020	\$0	\$1,541	4	4	4	4	4	4	\$1,518
El Dorado	Schleicher	2020	\$0	\$1,283	6	6	6	6	6	6	\$1,283
Fort Stockton	Pecos	2020	\$0	\$484	36	39	42	44	46	48	\$363
Goodfellow AFB	Tom Green	2020	\$0	\$1,222	8	9	9	10	10	11	\$1,123
Grandfalls	Ward	2020	\$0	\$2,804	1	1	1	1	2	2	\$2,509
Greater Gardendale WSC	Ector	2020	\$0	\$1,108	12	13	15	17	19	20	\$859
Greenwood Water	Midland	2020	\$0	\$1,716	3	3	4	4	4	5	\$1,430
Iraan	Pecos	2020	\$0	\$1,501	4	4	5	5	5	5	\$1,351
Junction	Kimble	2020	\$0	\$1,206	8	8	8	8	8	8	\$1,203
Kermit	Winkler	2020	\$0	\$964	18	18	19	19	19	19	\$916
Loraine	Mitchell	2020	\$0	\$2,138	2	2	2	2	2	2	\$2,039
Madera Valley WSC	Reeves	2020	\$0	\$1,425	5	5	5	6	6	6	\$1,330
Mason	Mason	2020	\$0	\$1,278	7	7	7	7	7	7	\$1,278
McCamey	Upton	2020	\$0	\$1,264	7	7	8	8	8	8	\$1,203
Menard	Menard	2020	\$0	\$1,442	5	5	5	5	5	5	\$1,442
Mertzon	Irion	2020	\$0	\$1,886	3	3	3	3	3	3	\$1,875
Midland	Midland	2020	\$0	\$436	631	755	816	882	944	1012	\$428
Miles	Runnels	2020	\$0	\$1,730	3	3	3	3	3	3	\$1,614
Mitchell County Utility	Mitchell	2020	\$0	\$1,407	5	5	5	5	5	6	\$1,068
Millersview-Doole WSC	Tom Green	2020	\$0	\$1,088	13	14	14	14	14	15	\$1,347
Monahans	Ward	2020	\$0	\$763	23	24	25	26	27	27	\$645
North Runnels WSC	Runnels	2020	\$0	\$1,407	5	5	5	5	5	5	\$1,375
Odessa	Ector	2020	\$0	\$440	568	680	752	829	905	990	\$427
Pecos	Reeves	2020	\$0	\$607	29	31	33	34	35	35	\$498

Entity	County Used	Expected Online Date	Capital Cost	First Decade Unit Cost (\$ per ac-ft per yr)	Total Yield						Last Decade Unit Cost (\$ per ac-ft per yr)
					2020	2030	2040	2050	2060	2070	
Pecos WCID	Pecos	2020	\$0	\$1,166	9	10	11	11	12	12	\$1,716
Pecos County Fresh Water	Pecos	2020	\$0	\$1,985	2	2	3	3	3	3	\$1,099
Rankin	Upton	2020	\$0	\$1,848	3	3	3	3	3	3	\$1,690
Richland SUD	McCulloch	2020	\$0	\$1,712	3	3	3	3	3	3	\$1,665
Robert Lee	Coke	2020	\$0	\$1,672	3	3	3	3	3	3	\$1,672
County-Other	Runnels	2020	\$0	\$1,953	2	2	2	2	2	2	\$1,988
San Angelo	Tom Green	2020	\$0	\$448	459	532	558	592	629	668	\$444
Snyder	Scurry	2020	\$0	\$957	41	47	51	55	59	93	\$1,606
Santa Anna	Coleman	2020	\$0	\$1,623	3	4	4	4	4	4	\$589
County-Other	Scurry	2020	\$0	\$863	20	22	24	26	28	30	\$720
Sonora	Sutton	2020	\$0	\$1,187	9	9	9	10	10	10	\$1,152
Southwest Sandhills WSC	Ward	2020	\$0	\$863	20	22	24	26	28	30	\$589
Stanton	Martin	2020	\$0	\$1,199	8	9	10	10	11	11	\$1,124
Sterling City	Sterling	2020	\$0	\$1,759	3	3	3	3	3	3	\$1,718
Tom Green County FWSD 3	Tom Green	2020	\$0	\$1,616	3	4	4	4	5	5	\$1,409
Wickett	Ward	2020	\$0	\$2,487	2	2	2	2	2	2	\$2,240
Wink	Winkler	2020	\$0	\$1,665	3	4	4	4	4	5	\$1,449
Winters	Runnels	2020	\$0	\$1,191	8	9	9	9	9	9	\$1,183
Zephyr WSC	Brown	2020	\$0	\$1,091	13	13	13	13	13	13	\$1,087
New or Additional Treatment											
<i>Bronte</i>	<i>Coke</i>	<i>2020</i>	<i>\$10,270,000</i>	<i>\$1,720</i>	<i>800</i>	<i>800</i>	<i>800</i>	<i>800</i>	<i>800</i>	<i>800</i>	<i>\$816</i>
<i>Odessa</i>	<i>Ector</i>	<i>2020</i>	<i>\$83,062,000</i>	<i>\$1,111</i>	<i>15,700</i>	<i>15,700</i>	<i>15,700</i>	<i>15,700</i>	<i>15,700</i>	<i>15,700</i>	<i>\$738</i>
<i>Big Spring</i>	<i>Howard</i>	<i>2020</i>	<i>\$104,651,000</i>	<i>\$1,128</i>	<i>830</i>	<i>0</i>	<i>0</i>	<i>878</i>	<i>1,671</i>	<i>2,420</i>	<i>\$471</i>
Brady	McCulloch	2020	\$29,719,000	\$2,069	1,200	1,200	1,200	1,200	1,200	1,200	\$327
Mason	Mason	2020	\$2,605,000	\$856	700	700	700	700	700	700	\$594
Midland	Multiple	2020	\$60,804,000	\$1,266	8,500	8,500	8,500	8,500	8,500	8,500	\$763
Pecos	Reeves	2030	\$27,680,000	\$754	3,360	3,360	3,360	3,360	3,360	3,360	\$319

Entity	County Used	Expected Online Date	Capital Cost	First Decade Unit Cost (\$ per ac-ft per yr)	Total Yield						Last Decade Unit Cost (\$ per ac-ft per yr)
					2020	2030	2040	2050	2060	2070	
Rehabilitation/Replacement of Pipeline											
<i>Bronte</i>	<i>Coke</i>	2020	\$9,896,000	\$1,748	450	450	450	450	450	450	\$202
<i>Pecos County WCID #1</i>	<i>Pecos</i>	2020	\$26,102,000	\$2,767	750	750	750	750	750	750	\$317
Reuse											
Bangs	Brown	2020	\$581,000	\$1,816	25	25	25	25	25	25	\$176
Menard	Menard	2020	\$696,500	\$820	67	67	67	67	67	67	\$88
Steam Electric Power	Mitchell	2020	\$8,642,000	\$1,428	500	500	500	500	500	500	\$212
San Angelo	Multiple	2020	\$116,861,000	\$1,250	8,400	8,400	8,400	8,400	8,400	8,400	\$269
Pecos	Reeves	2030	\$29,541,000	\$4,961		925	925	925	925	925	\$2,443
Pecos	Reeves	2020	\$8,707,000	\$1,286	560	560	560	560	560	560	\$191
Subordination											
Ballinger	Runnels	2020	\$0	\$0	794	751	750	748	753	791	\$0
County-Other	Runnels	2020	\$0	\$0	23	21	19	18	18	19	\$0
North Runnels WSC	Runnels	2020	\$0	\$0	86	86	87	87	87	89	\$0
Brady	McCulloch	2020	\$0	\$0	841	841	841	841	841	841	\$0
Steam Electric Power	Mitchell	2020	\$0	\$0	1,170	1,156	1,142	1,128	1,114	1,100	\$0
Junction	Kimble	2020	\$0	\$0	250	250	250	250	250	250	\$0
Manufacturing	Kimble	2020	\$0	\$0	228	228	228	228	228	228	\$0
Abilene	Taylor, Jones	2020	\$0	\$0	329	359	391	421	453	483	\$0
Midland	Midland	2020	\$0	\$0	2,173	359	391	421	453	483	\$0
Millersview-Doole WSC	Tom Green	2020	\$0	\$0	52	0	0	0	9	62	\$0
Odessa	Ector	2020	\$0	\$0	2,451	0	0	3,492	7,263	11,493	\$0
Ector County Utility District	Ector	2020	\$0	\$0	234	0	0	332	694	1,097	\$0
Irrigation	Ector	2020	\$0	\$0	157	0	0	162	312	449	\$0
Irrigation	Midland	2020	\$0	\$0	3	0	0	2	6	8	\$0
Manufacturing	Ector	2020	\$0	\$0	186	0	0	199	381	551	\$0
Steam Electric Power	Ector	2020	\$0	\$0	109	0	0	114	219	316	\$0

Entity	County Used	Expected Online Date	Capital Cost	First Decade Unit Cost (\$ per ac-ft per yr)	Total Yield						Last Decade Unit Cost (\$ per ac-ft per yr)
					2020	2030	2040	2050	2060	2070	
Big Spring	Howard	2020	\$0	\$0	611	0	0	647	1,233	1,785	\$0
Coahoma	Howard	2020	\$0	\$0	51	0	0	56	105	152	\$0
Manufacturing	Howard	2020	\$0	\$0	147	0	0	153	293	424	\$0
Steam Electric Power	Howard	2020	\$0	\$0	21	0	0	22	40	59	\$0
Snyder	Scurry	2020	\$0	\$0	194	0	0	256	524	814	\$0
County-Other	Scurry	2020	\$0	\$0	29	0	0	31	59	85	\$0
Rotan	Fisher	2020	\$0	\$0	18	0	0	17	32	46	\$0
Stanton	Martin	2020	\$0	\$0	31	0	0	33	62	90	\$0
Irrigation	Coleman	2020	\$0	\$0	400	400	400	400	400	400	\$0
Coleman	Coleman	2020	\$0	\$0	1,319	1,296	1,276	1,255	1,227	1,200	\$0
Coleman County SUD	Coleman	2020	\$0	\$0	227	225	218	214	215	215	\$0
County-Other	Coleman	2020	\$0	\$0	24	22	22	21	21	21	\$0
Manufacturing	Coleman	2020	\$0	\$0	2	2	2	2	2	2	\$0
County-Other	Tom Green	2020	\$0	\$0	70	70	70	70	70	70	\$0
Bronte	Coke	2020	\$0	\$0	212	210	209	207	207	207	\$0
Robert Lee	Coke	2020	\$0	\$0	237	239	240	240	240	240	\$0
San Angelo	Tom Green	2020	\$0	\$0	1,875	1,819	1,766	1,709	1,656	1,600	\$0
Upper Colorado River Authority	Tom Green	2020	\$0	\$0	43	37	33	30	27	23	\$0
Goodfellow Air Force Base	Tom Green	2020	\$0	\$0	44	42	40	38	35	33	\$0
Manufacturing	Tom Green	2020	\$0	\$0	37	36	32	29	26	22	\$0
Winters	Runnels	2020	\$0	\$0	100	99	98	98	98	97	\$0
Brady Creek (non-allocated)	McCulloch	2020	\$0	\$0	1,109	1,069	1,029	989	949	909	\$0
BCWID (non-allocated)	Brown	2020	\$0	\$0	5,440	5,466	5,492	5,518	5,544	5,570	\$0
CRMWD (non-allocated)	Tom Green	2020	\$0	\$0	20,122	26,330	26,355	20,868	15,167	8,954	\$0
Oak Creek (non-allocated)	Coke	2020	\$0	\$0	576	539	502	467	430	393	\$0

Entity	County Used	Expected Online Date	Capital Cost	First Decade Unit Cost (\$ per ac-ft per yr)	Total Yield						Last Decade Unit Cost (\$ per ac-ft per yr)
					2020	2030	2040	2050	2060	2070	
Lake Colorado City (non-allocated)	Mitchell	2020	\$0	\$0	1,800	1,750	1,700	1,650	1,600	1,550	\$0
Voluntary Transfer (Purchase)											
Robert Lee	Coke	2020	\$0	\$0	80	80	80	80	80	80	\$0
Concho Rural WSC	Ector	2020	\$0	\$0	50	50	50	50	50	50	\$0
Greater Gardendale WSC	Ector	2020	\$6,078,000	\$3,730	0	375	445	445	445	445	\$2,769
Winters	Runnels	2020	\$974,000	\$668	220	220	220	220	220	220	\$355
County-Other	Scurry	2020	\$0	\$0	373	414	447	491	547	607	\$0
Water Audits and Leak Repairs											
Brookesmith SUD	Brown	2020	\$1,737,000	\$1,509	81	81	79	78	78	78	\$1,584
Coleman	Coleman	2020	\$1,074,800	\$1,282	59	58	57	57	57	57	\$1,340
Millersview-Doole WSC	Tom Green	2020	\$965,800	\$1,045	65	66	65	66	67	68	\$1,076
Sonora	Sutton	2020	\$679,900	\$451	106	112	114	116	117	118	\$438
Zephyr WSC	Brown	2020	\$944,700	\$3,498	19	19	18	18	18	18	\$3,732
Weather Modification											
Irrigation	Crocket	2020	\$0	\$0.47	1	1	1	1	1	1	\$0.47
Irrigation	Irion	2020	\$0	\$0.21	202	202	202	202	202	202	\$0.21
Irrigation	Pecos	2020	\$0	\$5.45	106	106	106	106	106	106	\$5.45
Irrigation	Reagan	2020	\$0	\$0.19	1,869	1,869	1,869	1,869	1,869	1,869	\$0.19
Irrigation	Reeves	2020	\$0	\$1.13	326	326	326	326	326	326	\$1.13
Irrigation	Schleicher	2020	\$0	\$0.23	275	275	275	275	275	275	\$0.23
Irrigation	Sterling	2020	\$0	\$0.39	48	48	48	48	48	48	\$0.39
Irrigation	Sutton	2020	\$0	\$0.45	34	34	34	34	34	34	\$0.45
Irrigation	Tom Green	2020	\$0	\$0.44	2,007	2,007	2,007	2,007	2,007	2,007	\$0.44
Irrigation	Ward	2020	\$0	\$0.57	259	259	259	259	259	259	\$0.57

Note: Grey italics indicates projects that are needed to access supplies from other strategies and are not included in the total to avoid double counting.

Table ES- 6
Alternative Water Management Strategies

Entity	County Used	Capital Cost	First Decade Unit Cost (\$ per ac-ft per yr)	Total Yield						Last Decade Unit Cost (\$ per ac-ft/per yr)
				2020	2030	2040	2050	2060	2070	
Desalination										
San Angelo	Tom Green	\$70,709,000	\$1,062	11,210	11,210	11,210	11,210	11,210	11,210	\$615
Develop Capitan Reef Complex Aquifer Supplies										
Odessa	Ector	\$154,165,000	\$2,168	8,400	8,400	8,400	8,400	8,400	8,400	\$884
Develop Dockum Aquifer Supplies										
Colorado City	Mitchell	\$3,744,000	\$1,824	170	170	170	170	170	170	\$276
Develop Edwards-Trinity Plateau Aquifer Supplies										
Andrews	Andrews	\$24,927,000	\$891	2,600	2,600	2,600	2,600	2,600	2,600	\$217
County-Other	Andrews	\$751,000	\$252	250	250	250	250	250	250	\$40
Livestock	Andrews	\$327,000	\$433	60	60	60	60	60	60	\$50
Manufacturing	Andrews	\$349,000	\$243	210	210	210	210	210	210	\$43
Robert Lee	Coke	\$4,154,000	\$4,293	75	75	75	75	75	75	\$400
Robert Lee	Coke	\$7,272,000	\$3,756	75	75	75	75	75	75	\$556
San Angelo	Tom Green	\$102,100,000	\$1,800	4,500	4,500	4,500	4,500	4,500	4,500	\$209
Develop Ellenburger-San Saba Aquifer Supplies										
BCWID #1	Brown	\$13,947,000	\$12,553	806	806	806	806	806	806	\$1,336
Develop Ogallala Aquifer Supplies										
Andrews	Andrews	\$15,663,000	\$496	2,810	2,810	2,810	2,810	2,810	2,810	\$104
Great Plains	Andrews, Gaines	\$676,000	\$190	200	200	200	200	200	200	\$55
Develop Other Aquifer Supplies										
Bronte	Coke	\$2,666,000	\$2,787	75	75	75	75	75	75	\$280
Develop Additional Groundwater Supplies										
CRMWD	Western Region F Counties	\$147,558,000	\$1,348	10,000	10,000	10,000	10,000	10,000	10,000	\$310
Odessa	Ector	\$826,808,000	\$3,249	28,000	28,000	28,000	28,000	28,000	28,000	\$1,172
San Angelo	Tom Green	\$327,576,000	\$2,604	10,800	10,800	10,800	10,800	10,800	10,800	\$470

Entity	County Used	Capital Cost	First Decade Unit Cost (\$ per ac-ft per yr)	Total Yield						Last Decade Unit Cost (\$ per ac-ft/per yr)
				2020	2030	2040	2050	2060	2070	
New or Additional Water Treatment										
Robert Lee	Coke	\$6,541,000	\$2,657	335	335	335	335	335	335	\$1,284
Potable Reuse with Aquifer Storage and Recovery										
Pecos	Reeves	\$34,456,000	\$6,790	0	695	695	695	695	695	\$3,301
Regional Water Management Strategies										
Bronte, Ballinger, Winters, Robert Lee (Lake Brownwood)	Coke, Runnels	\$115,443,000	\$3,904	2,802	2,802	2,802	2,802	2,802	2,802	\$1,005
Bronte, Ballinger, Winters, Robert Lee (Lake Fort Phantom Hill)	Coke, Runnels	\$103,328,000	\$7,606	1,155	1,155	1,155	1,155	1,155	1,155	\$1,312
Voluntary Transfer (Purchase)										
Greater Gardendale WSC	Ector	\$2,946,000	\$2,355	0	375	445	445	445	445	\$1,890
Midland	Midland	\$0	\$0	4000	4000	4000	4000	4000	4000	\$0
Grandfalls	Ector	\$0	\$0	0	0	0	155	155	155	\$0

Note: Grey italics indicates projects that are needed to access supplies from other strategies and are not included in the total to avoid double counting.

No sources were over allocated as a part of this plan. The source balance report that demonstrates this is included in Appendix I.

Despite the best efforts to meet all projected water needs, there are several unmet needs in Region F. Most of these unmet needs are due to limitations of groundwater availability supplies and the lack of cost-effective alternative sources of water, especially in Andrews, Loving, and Scurry Counties. For Andrews County, which does not have a GCD to manage groundwater, water users intend to meet their needs with groundwater. Some irrigation needs may be met in non-drought years or producers will implement changes, such as dryland farming. Unmet water needs for Region F are summarized in Table ES-7.

Table ES- 7
Unmet Needs Summary (acre-feet per year)

Water User	2020	2030	2040	2050	2060	2070
Municipal	163	519	819	1,457	2,192	3,068
Manufacturing	31	59	87	134	174	209
Livestock	9	17	25	39	50	60
Irrigation	10,686	13,152	14,342	15,315	16,154	16,896
Mining	5,956	6,052	3,219	1,717	895	894
Steam Electric Power	11,008	11,022	11,036	11,050	11,064	11,078
Multiple	42	67	75	117	151	182
Total	27,895	30,888	29,604	29,829	30,680	32,387