Coastal Bend Regional Water Planning Area

Regional Water Plan

Volume I
Executive Summary
and Regional Water Plan

Prepared for

Texas Water Development Board

Prepared by

Coastal Bend Regional Water Planning Group

with Administration by

Nueces River Authority

with Technical Assistance by

HDR

HDR Engineering, Inc.

In association with:
Naismith Engineering, Inc.
Texas A&M University
The Rodman Company
The Wellspec Company

January 2001

Coastal Bend Regional Water Planning Area

Regional Water Plan

Acknowledgements

The thoughtful consideration, input, public service, and direction of the members of the Coastal Bend Regional Water Planning Group is gratefully acknowledged in producing the water plan for this diverse planning area.

Coastal Bend Regional Water Planning Group

Voting Members

Co-Chair	Judge Josephine Miller, San Patricio County	County Representative
Co-Chair	Mr. Jerry Kane, Sam Kane Beef Processors	Industry Representative
Secretary	Dr. Patrick Hubert, Hubert Veterinary Clinic	Small Business Representative
	Mr. Scott Bledsoe, Live Oak UWCD	Water District Representative
	Mayor Arnold Cantu, City of Freer	Municipal Rep. (Resigned)
	W. Greg Carter, P.E., AEP-Central Power and Light	Electric Generating Utilities Rep.
	Mr. Billy Dick, City of Rockport	Municipal Representative
	Mr. Bernie DeLaune, Rancher	Small Business Representative
	Mr. Ben Figueroa	Public Representative
	Mr. Ariel Garcia, Nueces River Authority	River Authority Representative
	Mr. Robert Kunkel, Celanese Chemical Co.	Industry Representative
	Dr. David McNichols, Corpus Christi City Council	Municipal Representative
	Mr. Scott Murray, Central Power and Light	Electric Generating Utilities Rep. (Resigned)
	Mr. Bobby Nedbalek, Farmer	Agricultural Representative
	Mr. Bernard Paulson, Port Authority	Port Authorities Representative
	Dr. Jennifer Prouty, TX A&M University	Environmental Representative
	Mr. Gonzalo Sandoval, Central Power and Light	Electric Generating Utilities Rep. (Resigned)
	Ms. Carola Serrato, South Texas Water Authority	Water Utilities Representative
	Mr. Fausto Yturria, Rancher	Agricultural Representative

Non-Voting Members

Mr. Robert Flores	Texas Water Development Board
Mr. Vincente Guerra	Freer WCID
Mr. Jon Sunday	Texas Department of Agriculture
Mr. John Perez (Resigned)	Texas Department of Agriculture
Mr. Jim Tolan	Texas Parks and Wildlife Dept.
Mr. Dexter Svetlik, ASCFO	USDA – NRCS
Mr. Con Mims, Nueces River Authority	South Central Texas RWPG
Mr. Robert Fulbright	Rio Grande RWPG
Mr. Cole Rowland	Lower Colorado RWPG
Mr. James Gill	Texas Association of Nurserymen

The efforts, long hours, and diligence is specially noted and appreciated of these individuals:

Mr. James Dodson, Deputy Executive Director	Nueces River Authority
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Ms. Rocky Freund	Nueces River Authority
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Coastal Bend Regional Water Planning Area
Regional Water Plan

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Coastal Bend (Region N) Regional Water Plan

Executive Summary

Background

Senate Bill 1 was enacted by the 75th Session of the Texas Legislature in 1997. It specified that water plans be developed for regions of Texas and provided that future regulatory and financing decisions of the Texas Natural Resource Conservation Commission (TNRCC) and the Texas Water Development Board (TWDB) be consistent with approved regional water plans. As stated in Senate Bill 1, the purpose of this region-based planning effort is to:

> "Provide for the orderly development, management, and conservation of water resources and preparation for and response to drought conditions in order that sufficient water will be available at a reasonable cost to ensure public health, safety, and welfare; further economic development; and protect the agricultural and natural resources of that particular region."

The TWDB is the state agency designated to coordinate the overall statewide planning effort. The Coastal Bend Region, which is comprised of 11 counties (Figure ES-1), is one of the State's 16 planning regions established by the TWDB.

The 19-member Coastal Bend Regional Water Planning Group (RWPG) was appointed by the TWDB to represent a wide range of stakeholder interests and act as the steering and decision-making body of the regional planning effort. The RWPG designated the Nueces River Authority (NRA) as the administrative agency and principal contractor to receive a grant from the TWDB to develop the water plan. The RWPG selected HDR Engineering, Inc. as prime consultant for planning and engineering tasks for plan development.

The Coastal Bend RWPG's members represent 12 interests: the public, counties, municipalities, industries, agriculture, the environment, small businesses, electric-generating utilities, port authorities, river authorities, water districts, and water utilities. Table ES-1 lists the interest groups and individual members of the RWPG.

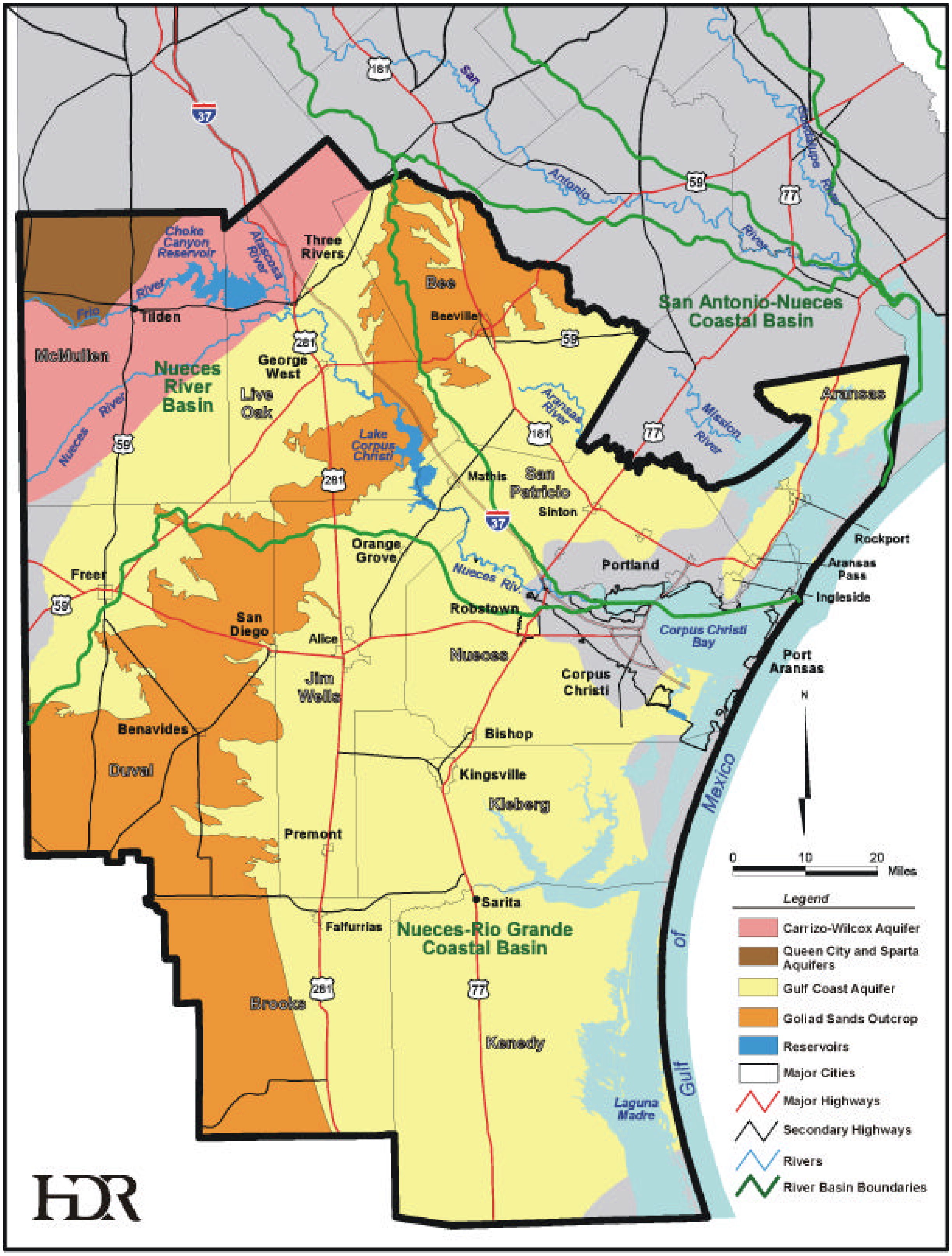


Figure ES-1. Coastal Bend Regional Water Planning Area

Table ES-1.
Coastal Bend RWPG Members
(as of January 2001)

Interest Group	Name	Entity
Agriculture	Mr. Bobby Nedbalek Mr. Fausto Yturria	Farmer Rancher
Counties	Judge Josephine Miller, Co-Chair	San Patricio County
Electric Generating Utilities	W. Greg Carter, P.E. Mr. Scott Murray (Resigned) Mr. Gonzalo Sandoval (Resigned)	AEP - Central Power and Light AEP - Central Power and Light AEP - Central Power and Light
Environmental	Dr. Jennifer Prouty	Texas A&M University
Industry	Mr. Jerry Kane, Co-Chair Mr. Robert Kunkel	Sam Kane Beef Processors Celanese Chemical Co.
Municipalities	Mayor Arnold Cantu (Resigned) Mr. Billy Dick Dr. David McNichols	City of Freer City of Rockport Corpus Christi City Council
Public	Mr. Ben Figueroa	
Port Authorities	Mr. Bernard Paulson	Port Authority
River Authorities	Mr. Ariel Garcia	Nueces River Authority
Small Business	Dr. Patrick Hubert, Secretary Mr. Bernie Delaune	Hubert Veterinary Clinic Rancher
Water Districts	Mr. Scott Bledsoe	Live Oak UWCD
Water Utilities	Ms. Carola Serrato	South Texas Water Authority

The planning horizon used in the plan is the 50-year period from 2000 to 2050. This planning period allows for long-term forecast of the prospective water situation, sufficiently in advance of needs, to allow for appropriate water management strategies to be implemented. As required in Senate Bill 1, the TWDB specified planning rules and guidelines (31 TAC 357.7 and 357.12) to focus the efforts and to provide for general consistency among the regions so that the regional plans can then be aggregated into an overall State Water Plan.

This executive summary and the accompanying *Regional Water Plan* convey water supply planning information, projected needs in the region, the RWPG proposed water plans to meet those needs, and other findings. The report is provided in two volumes. Figure ES-2 shows the contents of each volume.

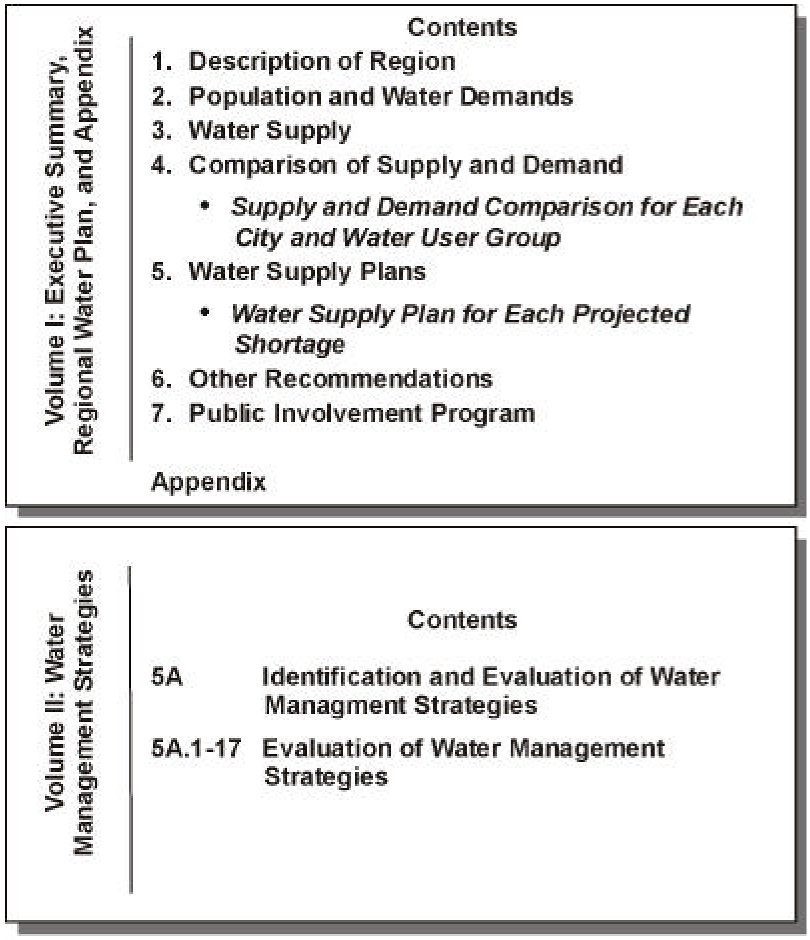


Figure ES-2. Plan Structure

Copies of Volumes I and II are filed at each County Clerk's office and at one public library in each county. Copies of individual sections can be obtained by calling the Nueces River Authority at (361) 825-3193.

In addition to the work contained in the two volumes of the *Regional Water Plan*, other important products produced as part of the Coastal Bend planning effort include:

1. A groundwater model of the Gulf Coast Aquifer was developed and applied for several possible management strategies. The model covers the portion of the aquifer underlying Region N (Coastal Bend), Region L (South Central), and Region P (Lavaca) planning areas. A detailed description of the model is included in Appendix C.
2. A water quality survey of the Lower Nueces River was undertaken to identify potential sources of poor quality water entering the Calallen Reservoir Pool. This work was performed by the Nueces River Authority staff in conjunction with HDR Engineering, with results summarized in Section 5A.3 of this report. Complete sampling results are included in Appendix G.
3. A reported entitled *Strategies to Enhance Water Conservation in the Coastal Bend Region* was prepared by Naismith Engineering, Inc. and is included in Appendix E.
4. Periodic newsletters were prepared by the Rodman Company and are included in Appendix F.
5. A Utility Service Area Map was prepared and is included in Appendix I.

Description of the Region

The area represented by the Coastal Bend Regional Water Planning Group ("Region N" or "Coastal Bend Region") includes the following counties: Aransas, Bee, Brooks, Duval, Jim Wells, Kenedy, Kleberg, Live Oak, McMullen, Nueces, and San Patricio (Figure ES-1). The Coastal Bend Region has three regional water providers: the City of Corpus Christi, the largest of the three, sells water to the remaining two regional water providers—South Texas Water Authority and San Patricio Municipal Water District (SPMWD). South Texas Water Authority provides water to cities and water supply corporations that supply both residential and commercial customers within the western portion of Nueces County as well as Kleberg County. SPMWD distributes water to cities, water districts, and water supply corporations providing water to residential, commercial, and industrial customers throughout the eastern half of San Patricio County and southern Aransas County. The major water demand areas are primarily municipal systems in the greater Corpus Christi area, as well as large industrial (manufacturing, steam-electric, and mining) users primarily located along the Corpus Christi and La Quinta Ship Channels. Based on state surveys[1] of industrial water use, industries in the Coastal Bend area are very efficient in their use of water. For example, petroleum refineries in the Coastal Bend area use on the average 60 percent less water to produce a barrel of refined crude oil than refineries in the Houston/Beaumont area.

The Coastal Bend Region depends mostly on surface water sources for municipal and industrial water supply use. The three major surface water resources include the Choke Canyon Reservoir/Lake Corpus Christi System (CCR/LCC System) in the Nueces River Basin and Lake Texana on the Navidad River in Jackson County. The water quality of these sources is generally good. However, there are some areas of concern, specifically within the Lower Nueces River and the Calallen Reservoir Pool, where the bulk of the region's water supply intakes are located.

There are some areas in the region that are dependent on groundwater. There are two major aquifers that lie beneath the region—the Carrizo-Wilcox and Gulf Coast Aquifers. The Gulf Coast Aquifer underlies all counties within the Coastal Bend Region and yields moderate to large amounts of both fresh and slightly saline water. The Carrizo-Wilcox Aquifer only underlies parts of McMullen, Live Oak, and Bee Counties and contains moderate to large amounts of either fresh or slightly saline water.

[1] Texas Water Development Board, "Industrial Water Use Efficiency Study," 1993.

In 1990, the population of the Coastal Bend Region was 492,829 and per capita income was $13,296.00. In 1996, the population of the Coastal Bend Region had grown to 530,290 and per capita income had risen to $16,890.00. The Corpus Christi Metropolitan Statistical Area (CCMSA), consisting of parts of Nueces and San Patricio Counties, accounts for 71 percent of the Coastal Bend Region's population and 76 percent of Total Person Income.

The primary economic activities within the Coastal Bend Region include oil/gas production and refining, petrochemical manufacturing, military installations, retail/trade, agriculture, and service industries including health services, tourism/recreation industries, and governmental agencies. Over 50 percent of all industries within the Coastal Bend Region are located within the CCMSA. The retail/trade sector had the biggest economic impact in 1997, with an economic contribution of $3.5 billion, while petrochemical and refining industries brought over $1.0 billion into the Coastal Bend Region's economy.

Population and Water Demand Projections

In July 1998, the TWDB published population and water demand projections[2] for each county in the state. In the Coastal Bend Region, population projections were developed for 31 cities with a population greater than 500. To account for people living outside the cities, projections were also developed for a 'county-other' category for each county. Requests for revisions to the population and municipal water demand projections were forwarded to the TWDB and adopted.

Population Projections

Figure ES-3 illustrates population growth in the entire Coastal Bend Regional Water Planning Area (RWPA) for 1990 and 1996 and projected growth for 2000, 2010, 2020, 2030, 2040, and 2050. In 2050, the population of the Coastal Bend RWPA is projected to be 943,912.

As can be seen in Figure ES-4, the average annual growth rate of the region over the 50-year planning period is 1.02 percent. Aransas, Nueces, and San Patricio Counties have growth rates higher than the regional average, while the other counties have lower growth rates than the average, and in the case of Kenedy and McMullen Counties, negative growth rates.

[2] The population and water demand projections were developed in consultation with the Texas Parks and Wildlife Department and Texas Natural Resources Conservation Commission. The completed projections are referred to as the 1997 Consensus Population and Water Demand Projections.

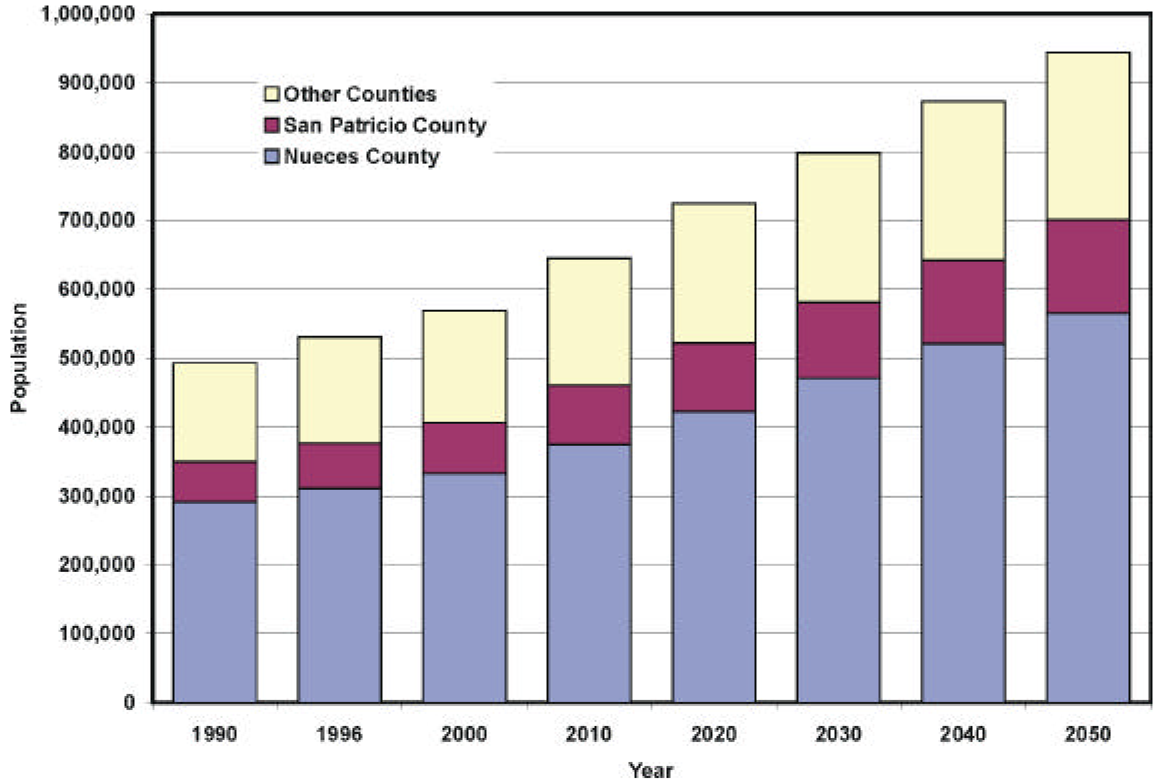


Figure ES-3. Historical and Projected Coastal Bend RWPA Population

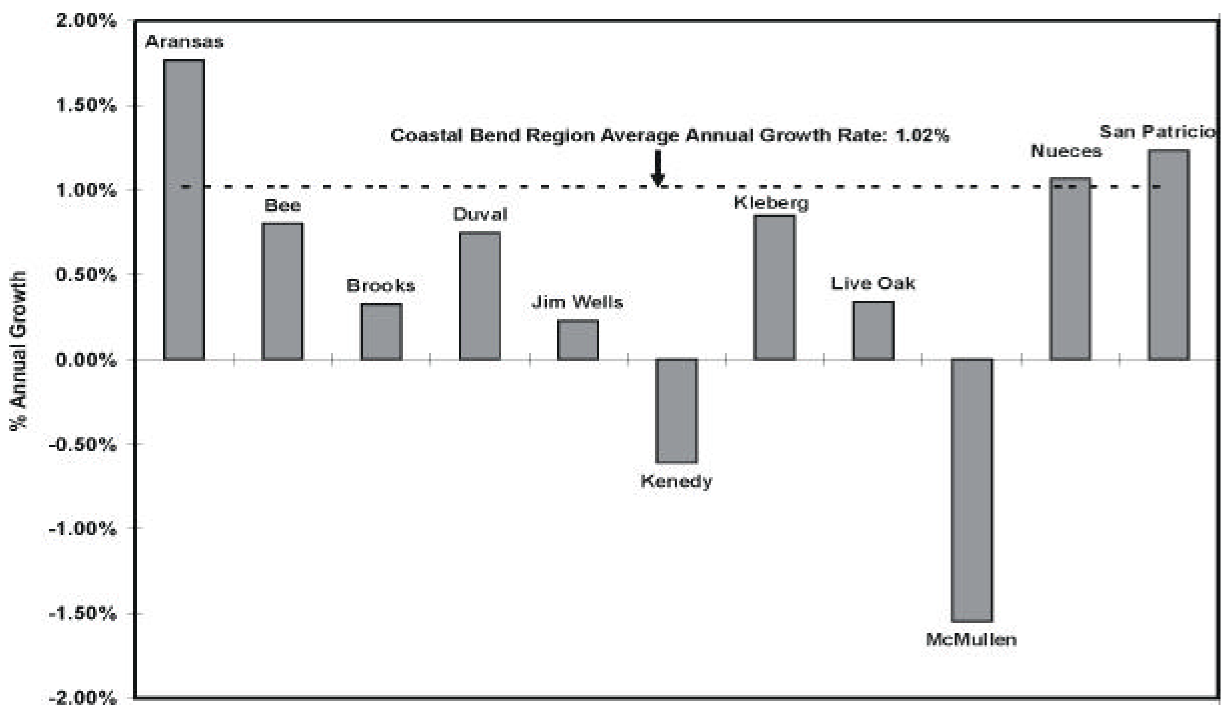


Figure ES-4. Percent Annual Population Growth Rate for 2000 through 2050 by County

Water Demand Projections

Water demand projections have been compiled for six categories of water use: (1) Municipal, (2) Manufacturing, (3) Steam-Electric Cooling, (4) Mining, (5) Irrigation, and (6) Livestock.

> **Water User Groups**
>
> Each of these consumptive water uses is termed a "water user group" in SB 1 lingo. Incorporated cities and County-Other category are water user groups within the Municipal Use category. Water demand projections and supplies have been estimated for all water user groups.

Total water use for the region is projected to increase from 223,797 acft in 2000 to 309,754 acft in 2050, a 38.4 percent increase. The trend in total water use is shown in Figure ES-5. The six types of water use and associated demands are shown for 2000 and 2050 in Figure ES-6. All categories of water use increase during the 2000 to 2050 period except for mining and irrigation, which decrease.

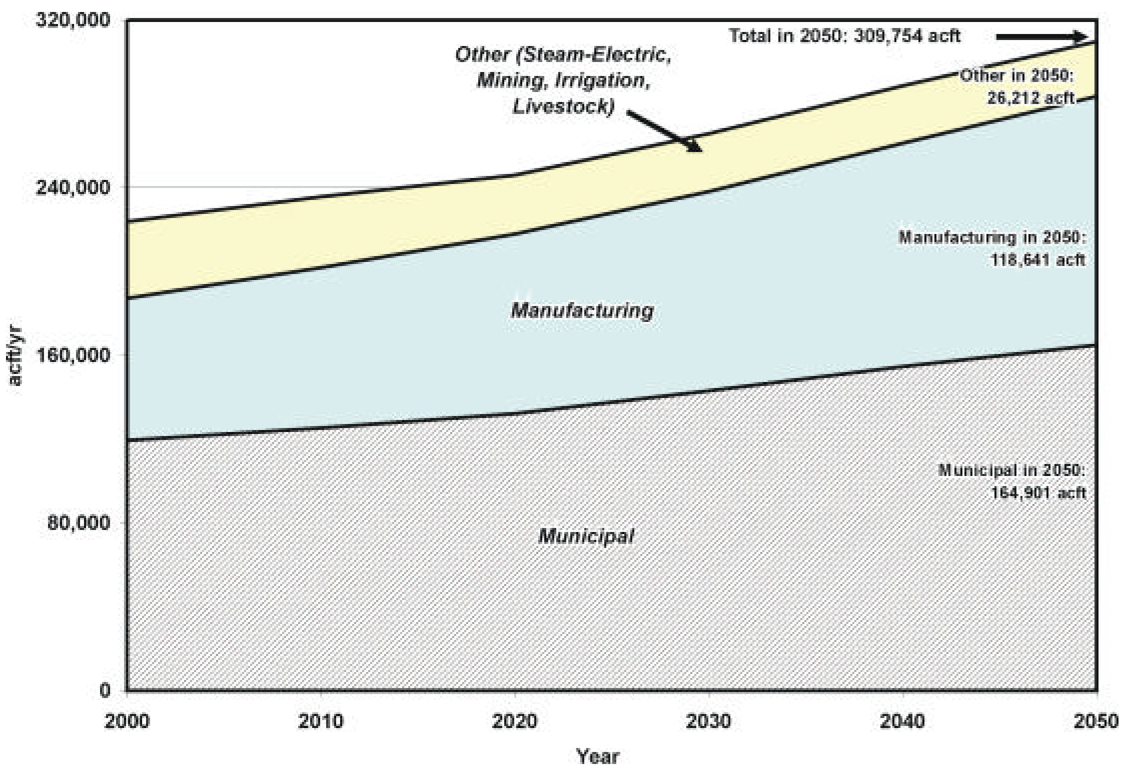


Figure ES-5. Projected Total Water Demand

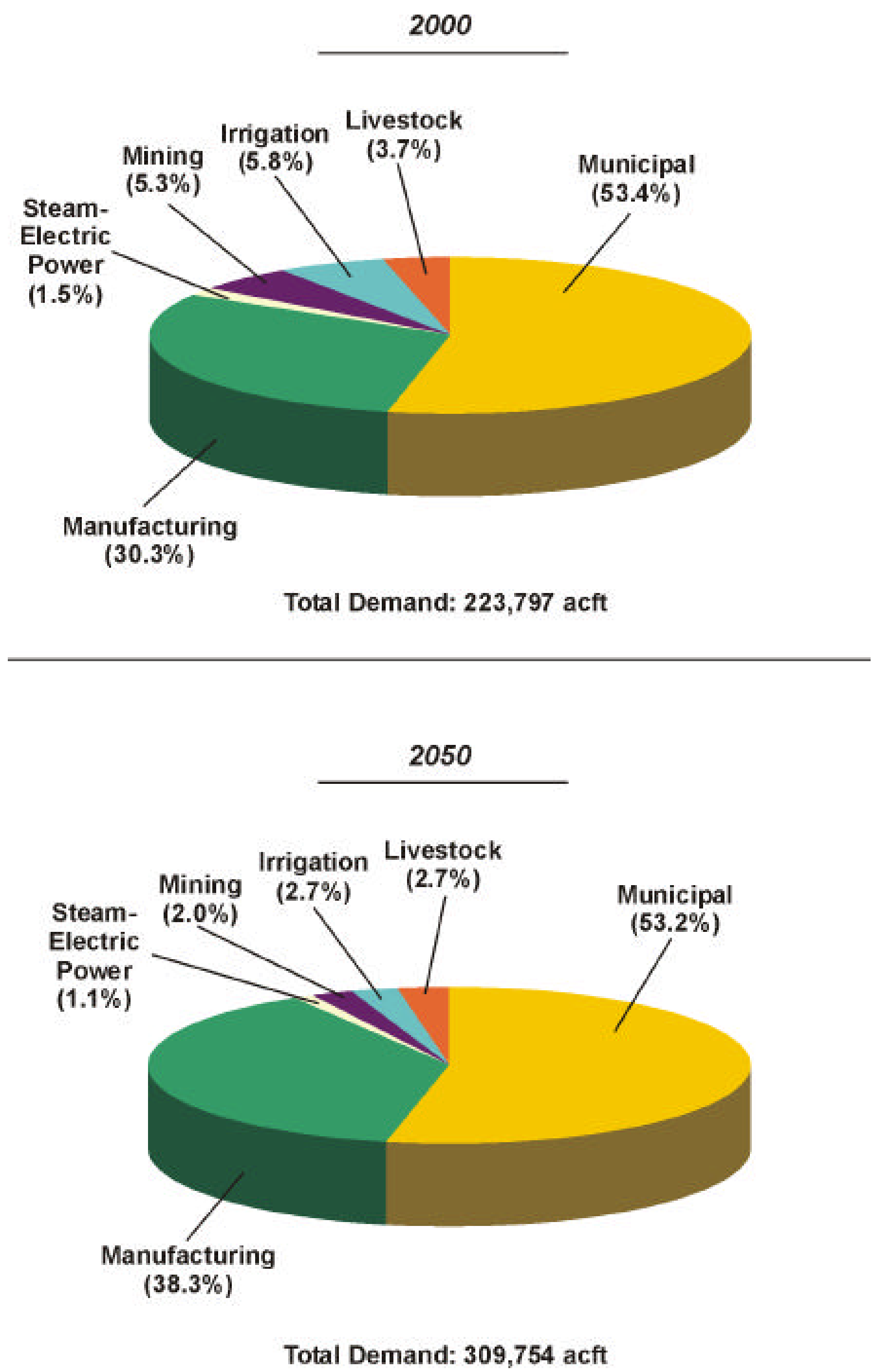


Figure ES-6. Total Water Demand by Type of Use

Municipal Use and Water Conservation

The 38.1 percent projected increase in municipal water demand over the 50-year planning horizon is lower than the projected population increase of 65.8 percent due to expected savings in per capita water use resulting from water conservation.

Water Supply

Surface Water Supplies

Streamflow in the Nueces River and its tributaries, along with reservoirs in the Nueces River Basin, comprise the most significant supply of surface water in the Coastal Bend Region. However, the supply of surface water varies greatly through the region due to the large variation in rainfall and a correspondingly large variation in evaporation rates. Water rights associated with major water supply reservoirs are owned by the City of Corpus Christi and the Nueces River Authority. The western and southern parts of the region are heavily dependent on groundwater sources, due to limited access to surface water supplies.

Many entities within the Coastal Bend Region obtain surface water through water supply contracts. The City of Corpus Christi is the largest provider of water supply contracts in the Region with 182,160 acft/yr available from its reservoir system (2000 sediment conditions), and 41,840 acft/yr available from Lake Texana in the Lavaca River Basin. Run-of-river and small municipal water rights provide 8,610 acft/yr of reliable water. Total supply from all surface water sources in year 2000 is 237,718 acft/yr of which 94 percent is provided by the City of Corpus Christi's supplies (Table ES-2).

Table ES-2.
Total Supply in 2000 from
All Surface Water Sources
(acft)

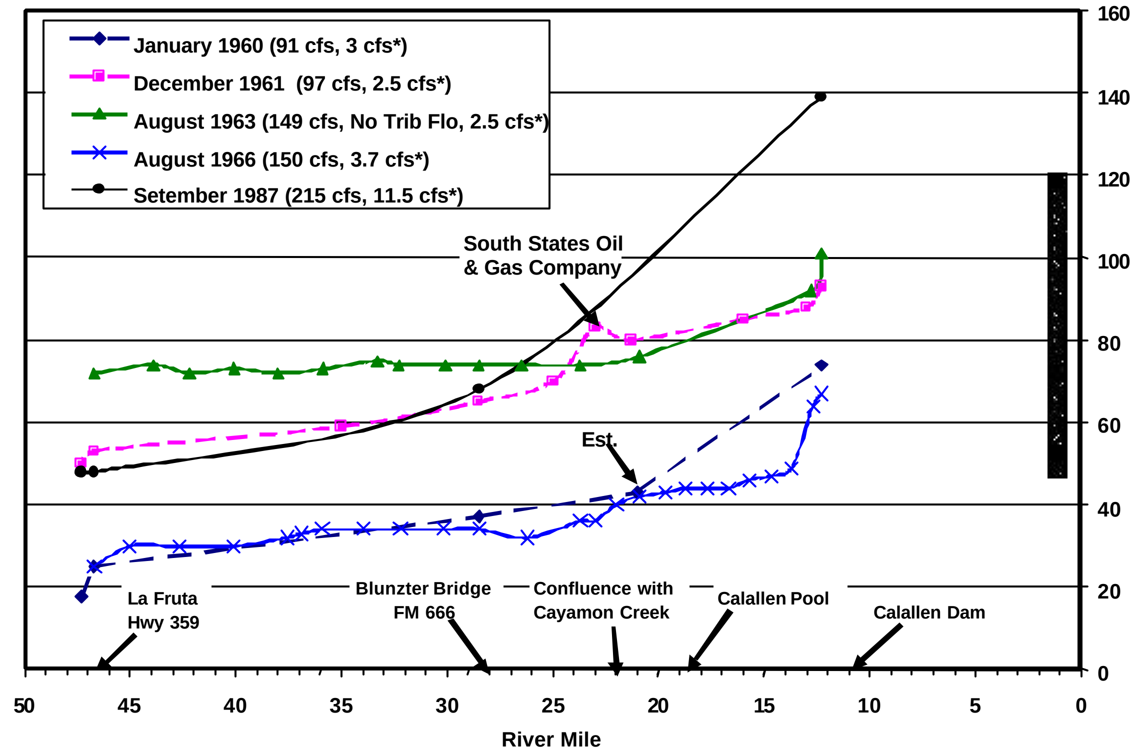
Municipal	145,906
Manufacturing	79,260
Steam-Electric	4,000
Mining	0
Irrigation	3,444
Livestock	5,108
Total	237,718

Groundwater Supplies

Two major aquifers and two minor aquifers underlie parts of the Coastal Bend planning region (Figure ES-1) and have a combined reliable yield of about 85,307 acft/yr. The two major aquifers include the Gulf Coast Aquifer, which supplies significant quantities of water throughout the region and the Carrizo-Wilcox Aquifer, which supplies water to the northwest portion of the study area in parts of McMullen, Live Oak, and Bee Counties (Figure ES-1). Portions of the Gulf Coast Aquifer are being pumped in excess of its estimated sustainable yield in some counties. In the northwestern part of the region, the Carrizo-Wilcox is a prolific aquifer with lesser quality water in most areas. Two minor aquifers, the Queen City and Sparta Aquifers, underlie McMullen County and provide moderate supplies to the region.

Water Quality

Previous studies by the U.S. Geological Survey (USGS) and others show a significant increase in the concentration of dissolved minerals occurring in the Lower Nueces River between Lake Corpus Christi and the Calallen Saltwater Barrier Dam, where the vast majority of the Region's surface water is diverted. Figure ES-7, which summarizes these past studies, shows that chloride concentrations at the Calallen Pool on the average are 2.5 times the level of chlorides in water released from Lake Corpus Christi. The results of these studies indicate that on the average about 60 percent of the increase in chlorides occurs upstream of the Calallen Pool and about 40 percent of the increase within the pool. Potential sources of minerals to the Calallen Pool include saltwater intrusion, groundwater seepage, and upstream sources of contamination from abandoned wells in adjacent oil fields and gravel washing operations. During the course of this study, a Nueces River sampling program was initiated to confirm the increase in mineral concentrations and to determine the source of dissolved minerals within the Calallen Pool. To date, the results of this sampling program strongly suggests that poor quality groundwater is entering the river and resulting in the increase. The effect of the high dissolved solids concentrations is two-fold and includes an increase in industrial water demands due to accelerated buildup of minerals in industrial cooling facilities, as well as high levels of bromides, which sometimes exceed drinking water standards. Since a large portion of the Region's water demands are for industrial use, improvements in water quality will result in reduced levels of water consumption and provide additional water conservation for the region. Reductions in bromide levels will help ensure Safe Drinking Water Act requirements can be achieved without having to resort to expensive treatment methods.



* Estimated groundwater and/or tributary inflow based upon chloride concentration of 1,700 mg/L

Figure ES-7. Summary of Historical Data — Chloride Content of the Lower Nueces River, Segment 2102

With the Mary Rhodes Pipeline now on-line, the volume of water being released from Lake Corpus Christi has been reduced. This has resulted in a recent increase in dissolved minerals to those entities withdrawing water from the Calallen Reservoir Pool that do not have access to the Lake Texana water for blending. Potential solutions identified in this report include: options to improve the water quality in the Calallen Reservoir Pool; options that will allow all diverters at the Calallen Pool to access the Lake Texana water for blending; the option of obtaining additional Lake Texana water for blending; and, an option delivering Lake Corpus Christi water to the City via a pipeline.

Supply and Demand Comparison

The Coastal Bend RWPG identified 20 individual cities and water user groups that showed unmet needs during drought of record supply conditions during the 50-year planning horizon. Figure ES-8 shows these water user groups with shortages for both the 2030 and 2050 timeframes.

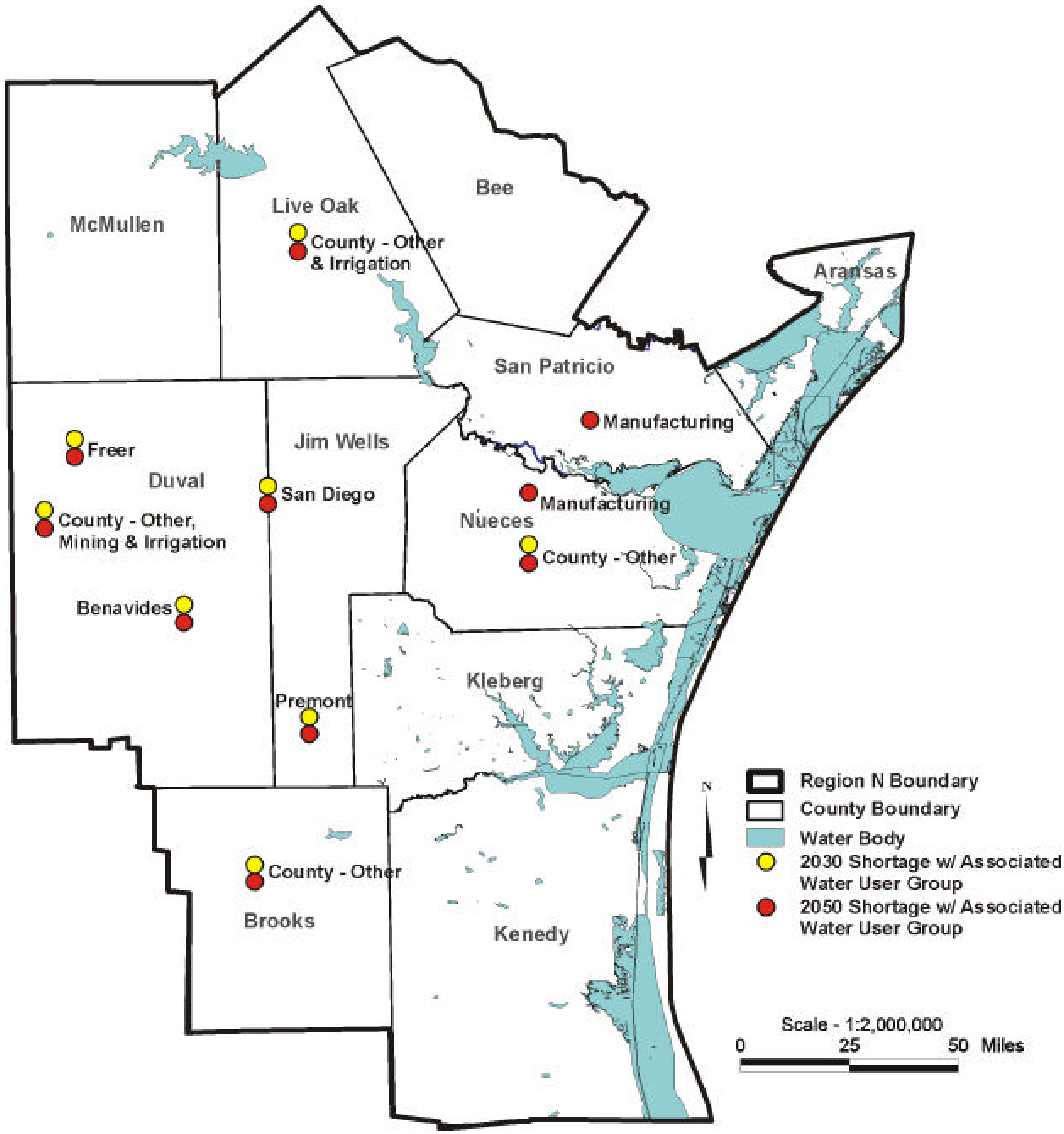


Figure ES-8. Location and Type of Use for 2030 and 2050 Water Supply Shortage

Eight of the eleven counties in the region have a projected shortage in at least one of the water user groups in the county. These are Aransas, Brooks, Duval, Jim Wells, Kleberg, Live Oak, Nueces and San Patricio. None of the water user groups in Bee, Kenedy, or McMullen Counties have shortages. Table ES-5 (at the end of this Executive Summary) is organized by county and information on each municipality and water use category in the county is listed. The tables can be examined for each county to determine which cities and water user groups have projected shortages.

Constraints on Water Supply

Water supplies are also affected by contractual arrangements and infrastructure constraints. Expiring contracts, and insufficient well capacity - each of these supply constraints was taken into account in estimating water supplies available to municipal water user groups. Consequently, the water supply listed for a given city may be less than the quantity in their water purchase contract or water right.

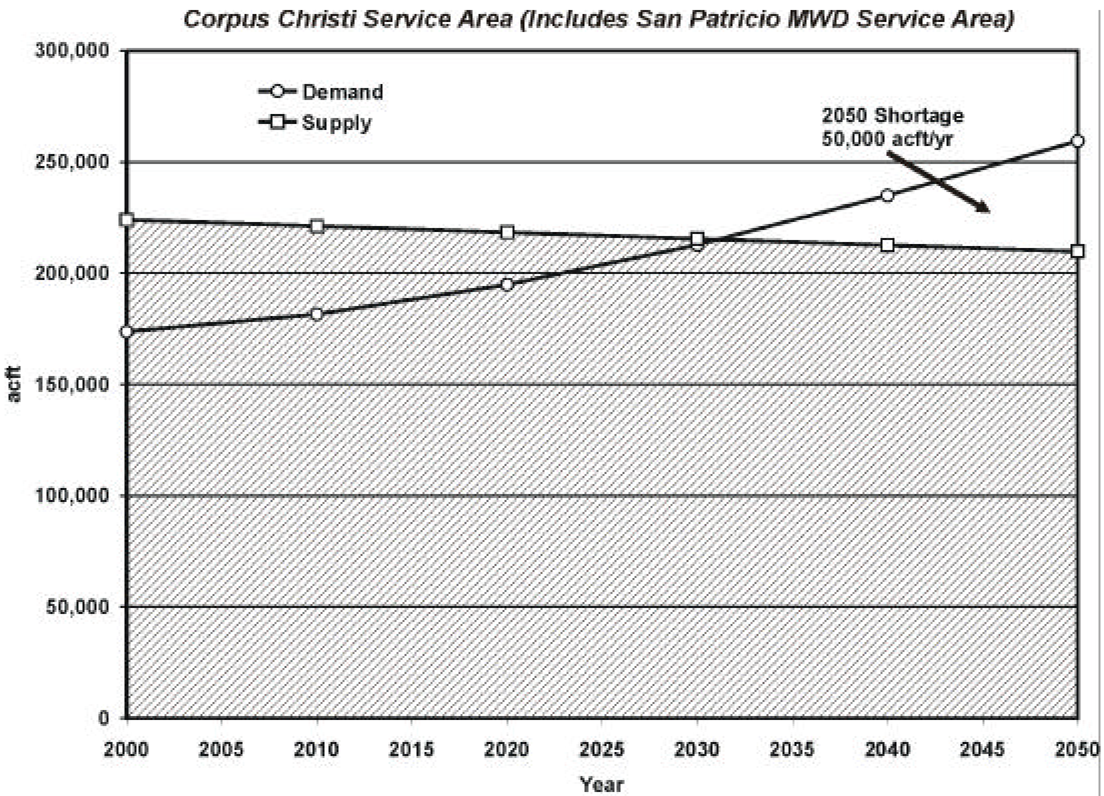
Major Water Providers

The Coastal Bend RWPG identified two Major Water Providers in the Region. These include the City of Corpus Christi, which today supplies about 77 percent of the Region's water demands, and the San Patricio Municipal Water District (a major customer of the City of Corpus Christi), which supplies about 13 percent of the Region's water demands. Figure ES-9 shows a comparison of water demands to currently available water supplies for each of these providers. Both Major Water Providers need additional supplies beginning about 2031.

By 2050, the Corpus Christi Service Area (which includes the San Patricio County Municipal Water District Service Area) is estimated to need approximately 50,000 acft of additional water supply.

Water Supply Strategies to Meet Needs

Numerous water management strategies were identified by the RWPG as potentially feasible to meet water supply shortages. The strategies are tabulated in Tables ES-3 and ES-4. Each strategy was evaluated by the consultant team and compared to criteria adopted by the RWPG. Table ES-3 summarizes potential strategies for the Corpus Christi Service Area, while Table ES-4 summarizes strategies to other service areas. Additionally, Figure ES-10 provides a graphical comparison of unit costs and quantities for significant strategies evaluated. Section 5A in Volume II contains sections discussing each of these possible strategies in detail.



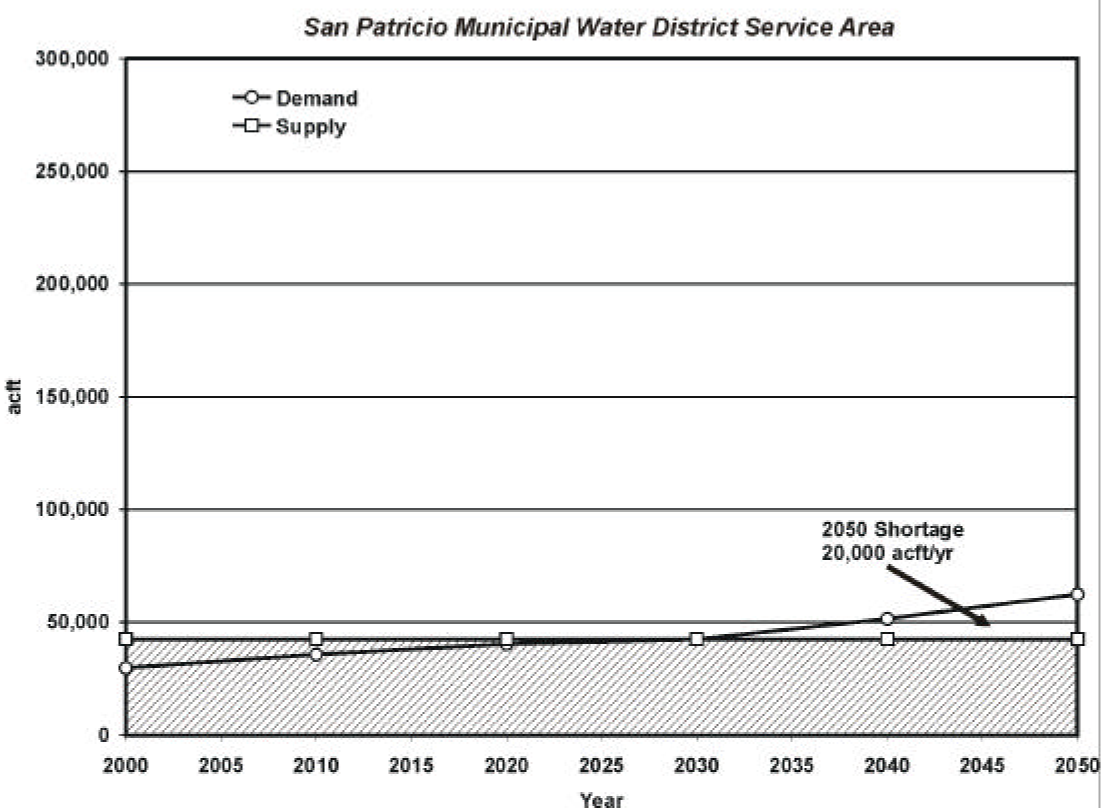


Figure ES-9. Water Supply vs. Demand for Major Water Providers

Water Plan Findings and Recommendations

Table ES-5 summarizes findings and recommendations for every water user group. The table also lists each municipality and water user group by county. Water demands are listed for years 2000, 2030, and 2050. Shortages are listed for years 2000, 2030, and 2050, along with recommended actions to meet these shortages. The recommended water supply plans are presented by county in greater detail in Section 5 of Volume I.

Future projects involving authorization from either the TNRCC and/or TWDB, which are not specifically addressed in the plan, are considered to be consistent with the plan under the following circumstances:

- TWDB receives applications for financial assistance for many types of water supply projects, including water conservation, and when appropriate, wastwater reuse strategies. Other projects involve repairing, replacing, or expanding treatment plants, pump stations, pipelines, and water storage facilities. The Coastal Bend RWPG considers projects that do not involve the development of or connection to a new water source to be consistent with the regional water plan even though not specifically recommended in the plan.
- TNRCC considers water rights applications for various types of uses (e.g., recreation, navigation, irrigation, hydroelectric power, indstrial, recharge, municipal, and others). Many of these applications are for small amounts of water, some are temporary, and some are even non-consumptive. Because waters of the Nueces River Basin are fully appropriated to the City of Corpus Christi and others, any new water rights application for consumptive water use from this Basin will need to protect the existing water rights or provide appropriate mitigation to existing water right owners. Throughout the Coastal Bend Region, the types of small projects that may arise are so unpredictible that the RWPG is of the opinion that each project should be considered by the TWDB and TNRCC on their merits, and that the Legislature foresaw this situation and provided appropriate language for each agency to deal with it.

  (Note: The provision related to TNRCC is found in Texas Water Code §11.134. It provides that the Commission shall grant an application to appropriate surface water, including amendments, only if the proposed appropriate addresses a water supply need in a manner consistent with an approved regional water plan. TNRCC may waive this requirement if conditions warrant. For TWDB funding, Texas Water Code §16.053(j) states that after January 5, 2002 TWDB may provide financial assistance to a water supply project only after the Board determines that the needs to be addressed by the project will be addressed in a manner that is consistent with that appropriate regional water plan. The TWDB may waive this providion if conditions warrant.)

Social and Economic Impacts of Not Meeting Projected Water Needs

If projected water needs are not met, the region could expect 18,010 fewer people in 2010, 19,009 fewer in 2030, and 344,522 fewer in 2050 under drought of record water supply conditions. The expected 2050 population under the unmet water need (shortage) condition would be 36.5 percent lower than the region's growth projection with adequate water supplies.

The estimated effect of projected water shortages upon income in the region, are $218 million per year in 2010, $230 million per year in 2030, and $4,915 million per year in 2050. If the water needs are left entirely unmet, the level of shortage in 2010 results in 8,084 fewer jobs than would be expected if the water needs of 2010 are fully met. The gap in job growth due to water shortages grows to 8,935 by 2030 and to 162,511 by 2050.

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Section 1
Description of the Region

1.1 Water Use Background

The area represented by the Coastal Bend Regional Water Planning Group ("Region N" or "Coastal Bend Region") includes the following counties: Aransas, Bee, Brooks, Duval, Jim Wells, Kenedy, Kleberg, Live Oak, McMullen, Nueces, and San Patricio (Figure 1-1). The Coastal Bend Region has three regional water providers: the City of Corpus Christi, the largest of the three, sells water to the remaining two regional water providers—South Texas Water Authority and San Patricio Municipal Water District (SPMWD). South Texas Water Authority provides water to cities and water supply corporations that supply both residential and commercial customers within the western portion of Nueces County as well as Kleberg County. SPMWD distributes water to cities, water districts, and water supply corporations providing water to residential, commercial, and industrial customers throughout eastern San Patricio County and Aransas County. SPMWD also sells water directly to large industrial facilities located on the La Quinta Ship Channel. Municipal and industrial water use accounts for the greatest amount of water demand in the Coastal Bend Region with water use for these uses totaling 88 percent of the region's total water use (Figure 1-2). The major water demand areas are primarily municipal systems in the greater Corpus Christi area, as well as large industrial (manufacturing, steam-electric, and mining) users primarily located along the Corpus Christi and La Quinta Ship Channels. Agriculture (irrigation and livestock) is the third largest category of water use in the region (Figure 1-2).

1.2 Water Resources and Quality

1.2.1 Surface Water Sources

The Coastal Bend Region depends mostly on surface water sources for municipal and industrial water supply use. The three major surface water resources include the Choke Canyon Reservoir/Lake Corpus Christi System (CCR/LCC System) in the Nueces River Basin and Lake Texana on the Navidad River in Jackson County. Water supply from Lake Texana is transported to the Coastal Bend Region via the newly constructed Mary Rhodes Pipeline. Based on Year 2010 sediment conditions and Phase II operating policy (the current operating policy until water

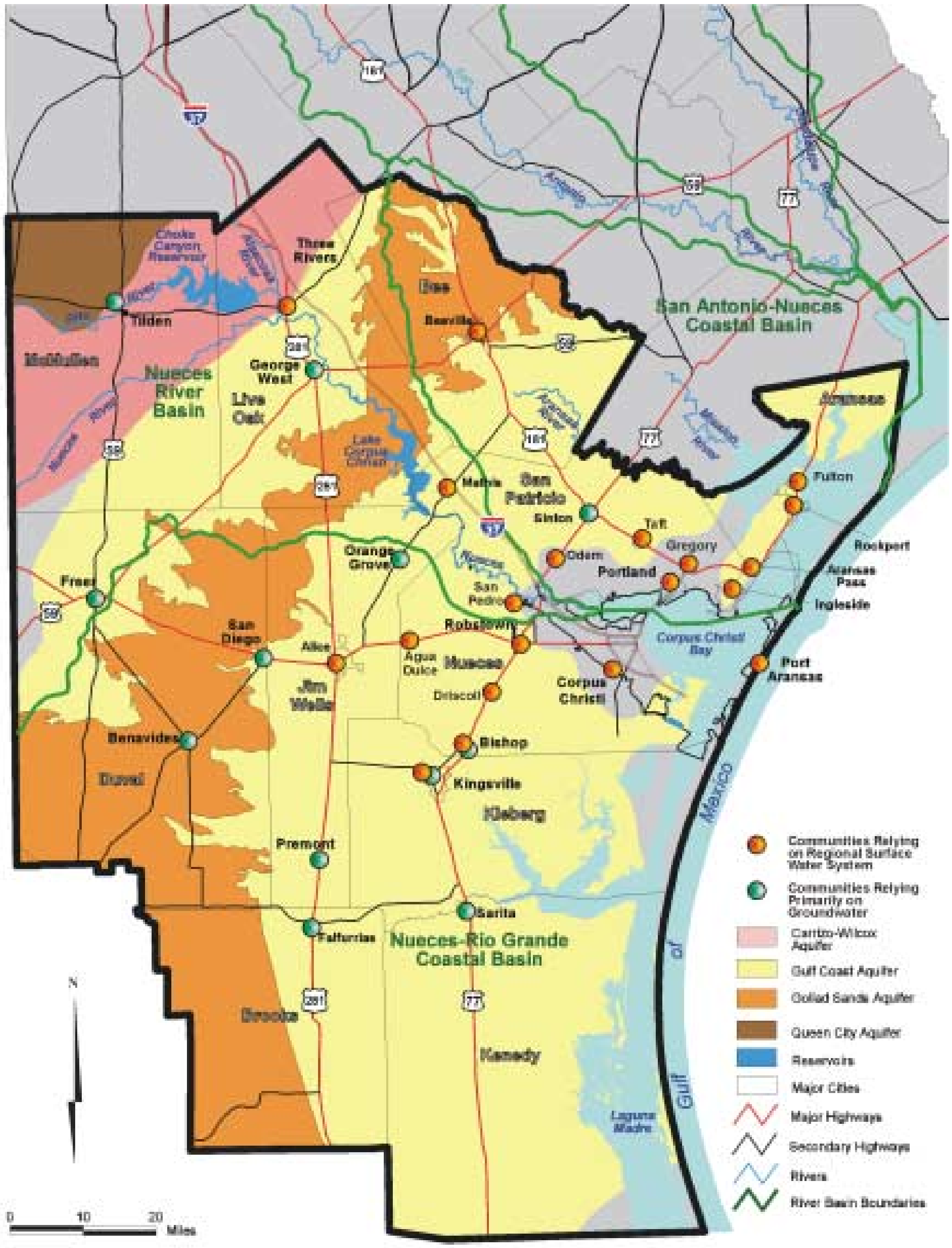

Figure 1-1. Water Providers in the Planning Region

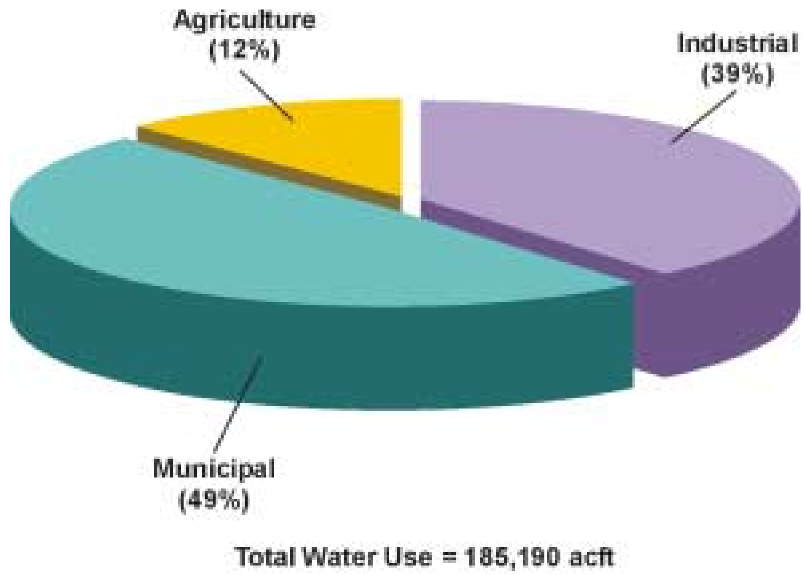

Figure 1-2. 1996 Water Use in the CBRWPA

demand exceeds 150,000 acre-feet), including the 1995 Agreed Order governing freshwater pass-throughs to Nueces Estuary, the CCR/LCC System has a firm annual yield of 167,800 acre-feet per year (acft/yr). The water supply from Lake Texana via the Mary Rhodes Pipeline is to provide the Coastal Bend Region with 41,840 acft/yr, according to the contract between the City of Corpus Christi and the Lavaca-Navidad River Authority.

In 1996, the Regional Assessment of Water Quality in the Nueces River Basin found that the water quality is generally good. However, there are some areas of concern. A few stream segments in the Nueces River Basin had elevated levels of dissolved solids, nutrients, and fecal coliforms (Table 1-1). Water quality in public water supply systems has been described as good.

The water quality of the water from Lake Texana has been reported as good. In fact, it exceeds the general quality of the water supply from the Nueces River Basin. However, because Lake Texana water is blended with Nueces River water prior to treatment, the higher Total Suspended Solids (TSS) levels in the Lake Texana water and the pH difference between the two different sources requires precise controls during the treatment process.

Table 1-1.
Water Quality Concerns

Surface Water Resource (stream segment number)	***Water Quality Concerns (1996 Assessment for Clean Rivers Program)***
Choke Canyon Reservoir (*2116*)	Nutrients, Dissolved Solids, Fecal Coliforms
Nueces/Lower Frio River (*2106*)	Fecal Coliforms
Lake Corpus Christi (*2103*)	Nutrients
Nueces River Below Lake Corpus Christi (*2102*)	Nutrients, Fecal Coliforms
Nueces River Tidal (*2101*)	None

1.2.2 Groundwater Sources

There are some areas in the region that are dependent on groundwater. There are two major aquifers that lie beneath the region—the Carrizo-Wilcox and Gulf Coast Aquifers (Figure 1-1). (Note: For in-depth descriptions of these aquifer systems the reader is referred to the extensive list of references in Appendix A.) The Carrizo-Wilcox Aquifer contains moderate to large amounts of either fresh or slightly saline water. Slightly saline water is defined as water that contains 1,000 to 3,000 milligrams per liter of dissolved solids. Although this aquifer reaches from the Rio Grande River north into Arkansas, it only underlies parts of McMullen and Live Oak Counties within the Coastal Bend Region. In this downdip portion of the Carrizo-Wilcox Aquifer, the water is softer, hotter (140 degrees Fahrenheit), and contains more dissolved solids.

The Gulf Coast Aquifer underlies all counties within the Coastal Bend Region and yields moderate to large amounts of both fresh and slightly saline water. The Gulf Coast Aquifer, extending from Northern Mexico to Florida, is comprised of four aquifer formations: Catahoula, Jasper, Evangeline, and Chicot. The Evangeline and Chicot Aquifers are the uppermost water formations within the Gulf Coast Aquifer system and, consequently, are the formations utilized most commonly. The Evangeline portion of the Gulf Coast Aquifer features the highly transmissive Goliad Sands. The Chicot portion of the Gulf Coast Aquifer is comprised of many different geologic formations; however, the Beaumont and Lissie formations are predominant in the Chicot Aquifer within the Coastal Bend area.

Within Texas, the Houston area is the largest user of the Gulf Coast Aquifer. Due to growing population and water demand in that area, over-pumping of the aquifer has resulted in subsidence of up to 9 feet being recorded in Harris County. While not as severe as in the Houston area, subsidence has been reported within the Gulf Coast Aquifer in the Coastal Bend Region. Areas in Kleberg County have recorded a 0.5-foot drop in elevation due to pumping of the Gulf Coast Aquifer. However, due to the increase in surface water use within Kleberg County, water levels of the aquifer are rising and the rate of subsidence has diminished. Water quality in the shallower parts of the aquifer is generally good, however there is saltwater intrusion occurring in the southeast portion of the aquifer along the coastline. It should also be noted that the water quality deteriorates moving southwestward towards the Texas-Mexico border.

1.2.3 Major Springs

There are no major springs in the Coastal Bend Region.

1.3 Economic Aspects

In 1990, the population of the Coastal Bend Region was 492,829 and per capita income was $13,296.00. In 1996, the population of the Coastal Bend Region had grown to 530,290 and per capita income had risen to $16,890.00. The Corpus Christi Metropolitan Statistical Area (CCMSA), consisting of parts of Nueces and San Patricio Counties, accounts for 71 percent of the Coastal Bend Region's population and 76 percent of Total Person Income (Figure 1-3).

The primary economic activities within the Coastal Bend Region include oil/gas production and refining, petrochemical manufacturing, military installations, retail/trade, agriculture, and service industries including health services, tourism/recreation industries, and governmental agencies. Over 50 percent of all industries within the Coastal Bend Region are located within the CCMSA. The retail/trade sector had the biggest economic impact in 1997, with an economic contribution of $3.5 billion, while petrochemical and refining industries brought over $1.0 billion into the Coastal Bend Region's economy.

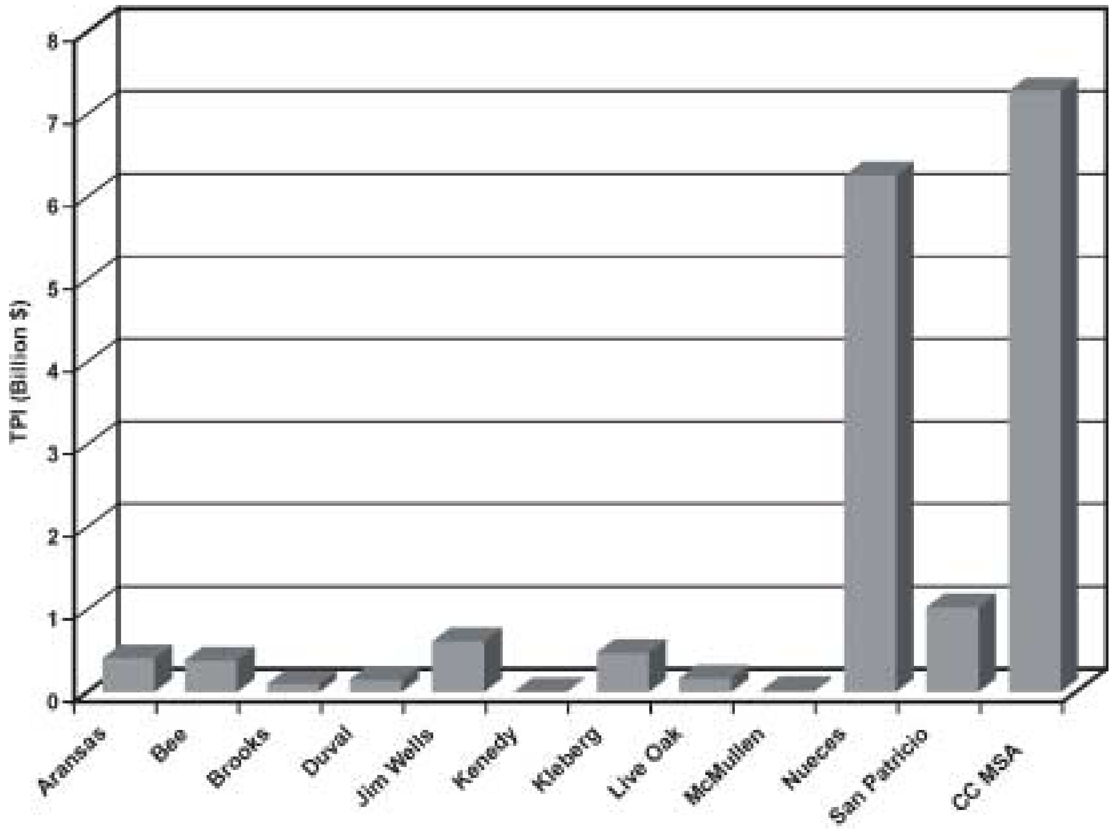

Figure 1-3. Total Personal Income (Earnings) by County

Service industries represent over 43 percent of all industries located in the Coastal Bend Region. The tourism/recreation industry generated over $500 million for the Coastal Bend Region and another $4.7 million was collected in hotel/motel taxes (Figure 1-4). A growing element of the Coastal Bend Regional economy is the health service industry. Health service industries account for only 19 percent of the service industries within the Region (Figure 1-5) but, in 1997, they contributed $898 million to the Coastal Bend Region and employed over 24,000 people. The Coastal Bend is becoming the major health care center for South Texas. Unemployment rates in the region in 1990 were between 6 and 7 percent, whereas in 1996 the unemployment rate ranged between 8 and 9 percent. In December 1998, the unemployment rate was 6.5 percent.

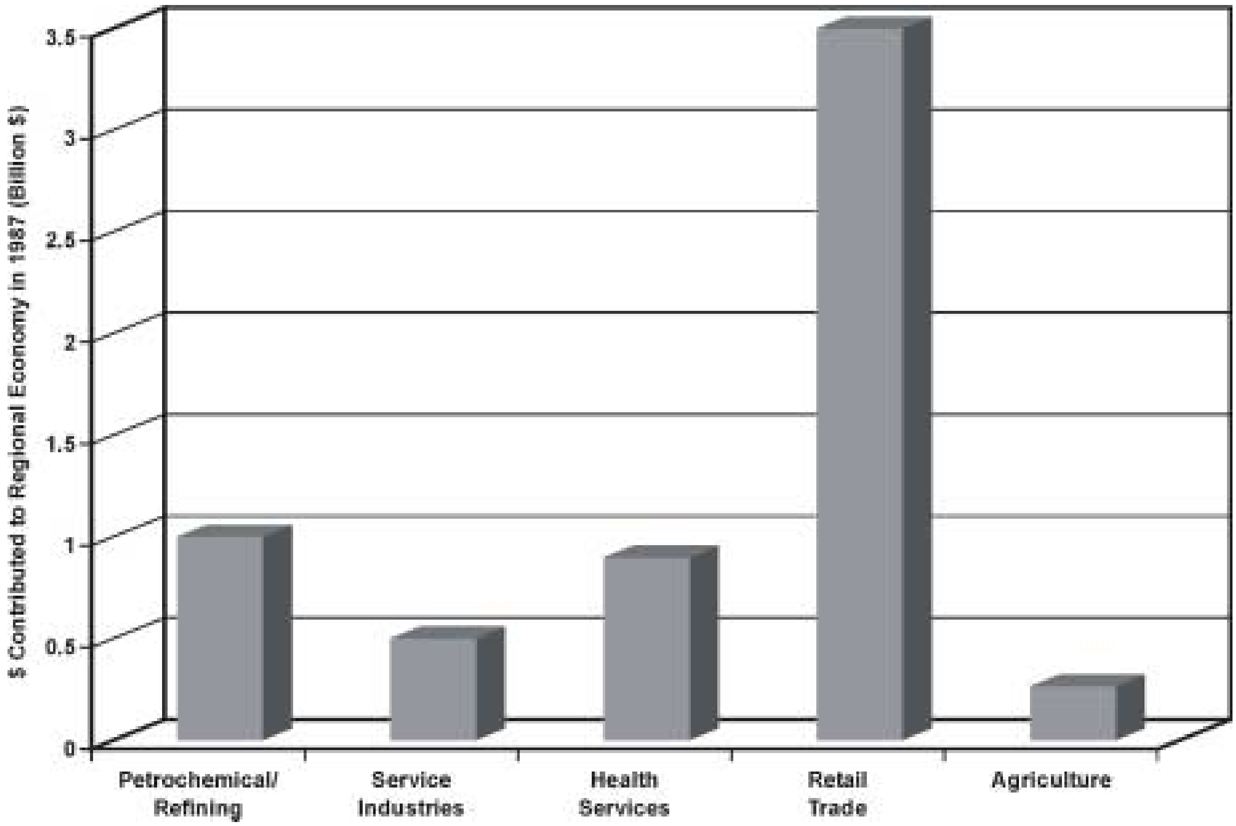

Figure 1-4. Industry Contributions to Region

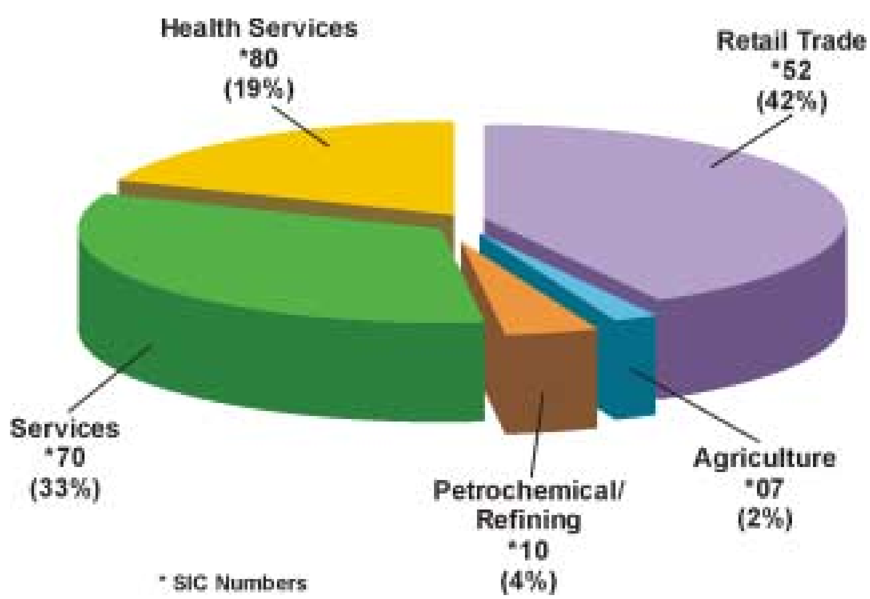

Figure 1-5. 1997 Percentages of Major Industry Employment in CBRWPA
Total Number – 169,900 employment

Agriculture accounts for a major portion of the land use within the Coastal Bend Regional Water Planning Area (CBRWPA). Of the cultivated land over 98 percent is dryland farming; approximately only 17,873 acres of the cultivated land is irrigated. The dominant crops of the region are corn, wheat, sorghum, cotton, and hay. Livestock is a major agricultural product of the Coastal Bend Region. In fact, livestock products made up 36 percent of the total market value of agriculture products in 1997 (Table 1-2).

Fishing is another industry that adds to the economic value of the Coastal Bend Region. In 1997, bay and gulf commercial fishing generated over $76 million in sales and value to the Coastal Bend. Also in 1997, over 30 percent of the state's total saltwater fishing was done within the Coastal Bend Region, adding to the tourism industry.

1.3.1 Identified Threats to Agricultural and Natural Resources

The Coastal Bend Region's agricultural business relies on groundwater for irrigation and water for livestock. The Coastal Bend Regional Water Planning Group has identified the continuing groundwater depletion as a threat to agricultural and natural resources.

1.4 Resource Aspects

While the Coastal Bend Region is well known for its valuable mineral resources, especially oil and gas, the area is also rich and diverse in living natural resources. The Coastal Bend Region contains ecosystems ranging from the South Texas Brush Country characterizing the inland portion of the Coastal Bend Region to the Coastal Sand Plains along the southern coastline and the Gulf Coast Prairies and Marshes along the northern coastline of the Coastal Bend Region (Figure 1-6).

Because the Coastal Bend Region is located along many migratory flyways, birds comprise a major portion of the wildlife population of the area. The area offers birds unique nesting and forage resources within its coastal prairies, wetlands, and riverine ecosystems. The threatened brown pelican and the endangered whooping crane use the Coastal Bend's natural resources both seasonally and year-round. The Coastal Bend Region is also home to other state and federally listed endangered and threatened species. These listed species include amphibians, reptiles, mammals, and vascular plants (Table 1-3).

Bay and estuary systems depend on freshwater inflows for maintaining habitats and productivity. Freshwater inflows provide a mixing gradient that establishes a range of salinity as

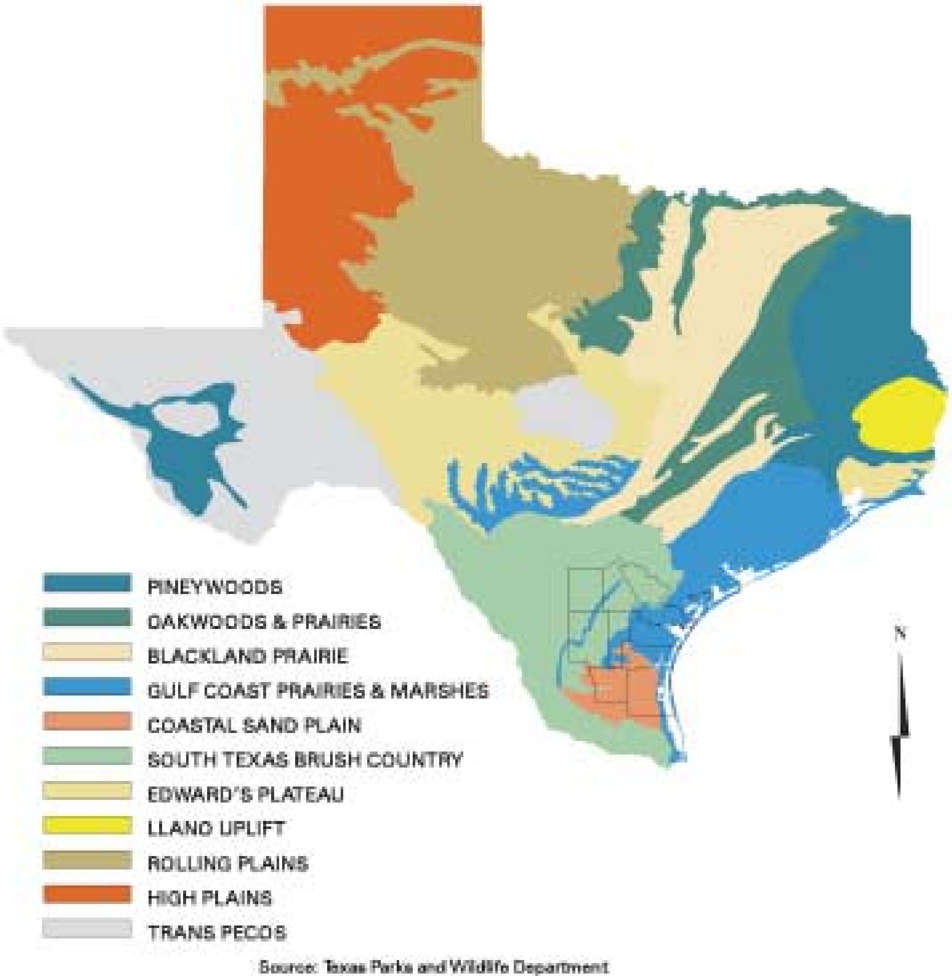

Figure 1-6. Natural Regions of Texas

well as nutrients that are important for productivity of estuarine systems. Also, freshwater inflows deposit sediments, which help maintain the deltas and barrier islands that protect the bays and marshes. Without freshwater inflows many plant and animal species could not survive. In accordance with an order issued by the TNRCC in 1995, the CCR/LCC System is operated to "pass through" a certain target amount of water each month in order to provide important freshwater inflows for Nueces Estuary.

Table 1-3.
Endangered and Threatened Species of the Coastal Bend Region

Scientific Name	Common Name	Classification
Ambrosia cheiranthifolia	South Texas Ambrosia	Endangered
Caretta caretta	Loggerhead Sea Turtle	Threatened
Chaadrius melodus	Piping Plover	Threatened
Echinocereus reichenbachii var. albertii	Black Lace Cactus	Endangered
Falco femoralis septentronalis	Northern Aplomado Falcon	Endangered
Felis pardalis	Ocelot	Endangered
Felis yagouaroundi cocomitli	Gulf Coast Jaguarundi	Endangered
Grus americana	Whooping Crane	Endangered
Hoffmannseggia tenella	Slender Rush Pea	Endangered
Lepidochelys kempii	Kemp’s Sea Turtle	Endangered
Numenius borealis	Eskimo Curlew	Endangered
Pelecanus occidentalis	Brown Pelican	Endangered
Sterna antillarum	Least Tern	Threatened
Tympanuchus cupido attwateri	Attwater’s Greater Prairie-Chicken	Endangered
Ursus americanus luteolus	Louisiana Black Bear	Threatened

Source: http://endangered.fws.gov/statl-r2.html

1.5 Water Quality Initiatives

The Clean Water Act of 1972 established a Federal program for restoring, maintaining, and protecting the nation's water resources. The Clean Water Act remains focused on eliminating discharge of pollutants into water resources and making rivers and streams fishable and swimmable. Water quality standards are to be met by industries, states, and communities under the Clean Water Act. Since the enactment of the Clean Water Act more than two-thirds of the nation's waters has become fishable and swimmable, as well as a noticeable decrease of wetland and soil loss. One aspect of the Clean Water Act is the National Pollution Discharge Elimination System (NPDES). This program regulates and monitors pollutant discharges into water resources. Whereas in the past the Environmental Protection Agency and the State of Texas each required separate permits to discharge (one under NPDES and one under state law), recently, the State of Texas has received delegation to administer a joint "TPDES" program.

In 1998, the Clean Water Action Plan (Plan) was initiated to meet the original goals of the Clean Water Act. The main priority of this Plan is to identify watersheds and their level of possible concern. The identification of these concerns has been defined within the Texas Unified Watershed Assessment (Assessment). Each watershed was then placed into one of four defined categories: *Category I*: Watersheds in need of restoration, *Category II*: Watersheds in need of preventive action to sustain water quality, *Category III*: Pristine Watersheds, and *Category IV*: Watersheds with insufficient data. Within the Nueces River Basin some areas of concern have been placed on the Clean Water Act 303(d) medium priority list; consequently both the TNRCC and Environmental Protection Agency are targeting these areas as a *Category I*.

The State of Texas has initiated other water quality programs. The Texas Clean Rivers Act of 1991 created the Clean Rivers Program within the TNRCC. The purpose of this program is to maintain and improve the water quality of the State of Texas's river basins with aid from river authorities and municipalities. The Clean Rivers Program encourages public education, watershed planning, and water conservation as well as provides technical assistance to identify pollutants and improve water quality in contaminated areas.

In the Coastal Bend Region, the Nueces River Authority (NRA), the Center for Coastal Studies at Texas A&M University-Corpus Christi (CCS), and the TNRCC share the responsibility for surface water monitoring under the Clean Rivers Program. Surface water monitoring within the Coastal Bend Region focuses on freshwater stream segments within the Nueces River Basin as well as local coastal waters. In 1999, the NRA and TNRCC coordinated sampling stations and divided stream segment stations amongst the three entities in order to eliminate sampling duplication. The NRA and TNRCC are also responsible for administering the Total Maximum Daily Load (TMDL) Program defined by the Clean Rivers Program as well as the 303(d) Listed Water Bodies program identified by the Clean Water Act. Under both the Clean Water Act and Clean Rivers Program, surface waters must be sampled and monitored for identification of pollutants and possible areas of concern. Currently, certain water segments within the Nueces River Basin are posing some concerns (Table 1-1).

1.6 State Water Plan

The Texas Water Development Board (TWDB) has developed statewide water plans and facilitated regional water planning throughout the state. In *Water for Texas 1997*, TWDB identified that solving the State's water supply problems would require a number of measures including: proper maintenance of current water infrastructures, new interbasin transfers of existing supplies, water conservation programs, expanded infrastructure to existing water supplies, reuse/return flows, new groundwater development, and new reservoir development. Most of these recommendations are applicable to the Coastal Bend Region.

Within the State Water Plan, the TWDB evaluated the water resources for the Coastal Bend Region and determined some possibilities that addressed the insufficient surface water supplies for the growing water demand. The TWDB recognized the Coastal Bend Region's needs for additional water supplies during prolonged periods of low rainfall. The TWDB defined two alternatives for additional water supply: the completion of the Mary Rhodes Pipeline (which was finished and brought on-line in the Fall of 1998) and the construction of a pipeline transporting water purchased from the Garwood Irrigation Company located on the Colorado River. The TWDB’s 1997 plan projected that, together, these pipelines should be adequate to meet the Coastal Bend Region’s water needs through the year 2040.

1.7 Water Planning in the Coastal Bend

Before this report there have been a number of regional water planning studies done for the Coastal Bend Region, focusing mainly on municipal and industrial water supply issues. (Refer to Appendix A for list of references.) The following is a summary of the major planning efforts in the last 10 years.

In 1989, the Coastal Bend Alliance of Mayors created a Regional Water Task Force. The Regional Water Task Force Final Report[1], issued in June of 1990, examined the historical and current regional water supply situation and made recommendations for water supply development in the area.

Throughout 1990 and 1991, TWDB, NRA, the City of Corpus Christi, Edwards Underground Water District, and the South Texas Water Authority sponsored a study[2] that focused on the development of additional water supplies within the Nueces River Basin. The objectives of the study centered upon determining the feasibility of constructing additional

[1] Rauschuber, et al., “Regional Water Task Force: Final Report,” Regional Water Conference. Coastal Bend Alliance of Mayors, Corpus Christi Area Economic Development Corporation, Port of Corpus Christi-Board of Trade, Dr. Manuel L. Ibanez, President, Texas A&I University, June 30, 1990.

[2] HDR Engineering, Inc. (HDR), et al., “Nueces River Basin Regional Water Supply Planning Study – Phase I,” Vols. 1,2, and 3, Nueces River Authority (NRA), et al., May 1991.

recharge structures for the Edwards Aquifer within the basin. The study was also concerned with the effects of the proposed recharge structures on the firm yield of the CCR/LCC System and the required inflows to the Nueces Estuary. The recommendations that emerged from this study determined that additional recharge structures would increase the recharge of the Edwards Aquifer. The study also recommended that additional evaluations consider water supply alternatives for the CCR/LCC System service area as well as a benefit/cost analysis of each additional recharge project. Finally, one of the most useful products to emerge from this study is the Lower Nueces River Basin and Estuary Model, which is still used for evaluating reservoir-operating alternatives.

In 1991, a joint investigation sponsored by the Lavaca-Navidad River Authority, the Alamo Conservation and Reuse District, and the City of Corpus Christi, studied additional water supplies for the cities of San Antonio and Corpus Christi. The study[3] addressed the feasibility of transferring water from Lake Texana (Palmetto Bend Project), developing Stage II of the Palmetto Bend Project, and acquiring water from the Colorado River. The cost and efficiency of the diversion projects that would deliver the water to both cities was examined as well. The final recommendation of this study was to purchase the water from Lake Texana and the Garwood Irrigation Company water rights in the Colorado River and construct diversion structures to both San Antonio and Corpus Christi.

In 1992, the TWDB and the cities of Houston, Corpus Christi, and San Antonio initiated the *Trans-Texas Water Program* to address the water supply needs for each of these cities. The Corpus Christi service area was comprised of virtually the same region as the Coastal Bend Region with the exceptions that Refugio and Atascosa Counties were included in the study and Kenedy County was excluded from the study. The City of Corpus Christi, the Port of Corpus Christi Authority, the Corpus Christi Board of Trade, the TWDB, and the Lavaca-Navidad River Authority sponsored the *Trans-Texas Water Program* study[4] for the Corpus Christi Service Area. In 1993, an interim report (*Phase I*) was issued to give an overview of the objectives of the *Program* for the Corpus Christi Service Area.

[3] HDR, "Regional Water Planning Study, Cost Update for Palmetto Bend Stage 2 and Yield Enhancement Alternative for Lake Texana and Palmetto Bend Stage 2," Lavaca-Navidad River Authority, et al., May 1991.
[4] HDR, et al., "Trans-Texas Water Program – Corpus Christi Study Area – Phase II Report," City of Corpus Christi, et al., September 1995.

Objectives of the Trans-Texas Program for the Corpus Christi Service Area:

- Determine water demands for a 50-year period (2000 through 2050)
- Identify possible water supply options that will meet the projected water demands
- Provide a general assessment of each water supply alternative as well as their cost and environmental impacts.

In Phase II, twenty-two different water supply alternatives were evaluated. Combinations of these alternatives would be necessary to meet the projected water demands. The 1995 report[5] on *Phase II* of the *Trans-Texas Water Program* study for the Corpus Christi Service Area recommended two integrated water supply plans (Plan A and Plan B). Both Plan A and Plan B recommended such water supply alternatives as the incorporation of changes in the CCR/LCC System operating policies and the 1995 Agreed Order for freshwater inflows to the Nueces Estuary. Other alternatives included additional water conservation practices within the service area and construction of pipelines from Lake Texana and the Colorado River. However, Plan A recommended the construction of an additional pipeline from Choke Canyon Reservoir to Lake Corpus Christi, whereas Plan B recommended obtaining additional water from the Colorado River as well as modifying the target operating elevation of Lake Corpus Christi. Each recommended plan from the *Trans-Texas Water Program* potentially provided the additional 100,000 acft that were projected as being needed in the study area by the year 2050.

In 1995, SPMWD sponsored a system evaluation study.[6] This study was developed in an effort to establish future water demands, evaluate SPMWD's current facilities and supplies, and recommend possible water supply alternatives for SPMWD's service area. The 1995 plan defined four water supply alternatives that would allow SPMWD to meet projected demands. These alternatives included: the purchasing of additional, or all, treated water from the City of Corpus Christi, expansion of SPMWD's existing facilities, or constructing a new water treatment facility near Odem or Portland. Phase I also recommended that a Phase II study be conducted for the preferred alternative to better identify the cost of the selected project, the time schedule commitment, any environmental issues, and the financial impact the alternative might have on the SPMWD. Based on the Phase II study, SPMWD began to upgrade their existing systems in 1997, including pipe refurbishment and construction of a microfiltration plant. In late 2000,

[5] Ibid.

[6] Naismith Engineering, Inc. (NEI), et al., "Study of System Capacity, Evaluation of System Condition, and Projections of Future Water Demands – Phase 1," San Patricio Municipal Water District, September 1995.

SPMWD finished building the microfiltration plant and pipeline that connects their facilities with the Mary Rhodes Pipeline which can divert an average of 7.5 MGD of Lake Texana water into a new 193 million-gallon above ground reservoir, where it is blended with incoming Nueces River water.

TWDB and NRA sponsored a regional water planning study to examine possible water supply alternatives for Duval and Jim Wells counties. The regional water supply study[7] recommended that Freer, San Diego, and Benavides initiate surface water projects to replace existing groundwater sources. The study also determined that it would be best for Premont and Orange Grove to remain on groundwater supplies.

The Coastal Bend Bays and Estuaries Program (CBBEP) has developed the Coastal Bend Bays Plan[8] (Bays Plan) for the Coastal Bend Region. This plan is a long term, comprehensive management plan designed to restore, maintain, and protect the Coastal Bend Region's bay and estuary ecosystems. Included within the Bays Plan is the allowance for coordination with the Regional Water Planning Group. The CBBEP does not possess taxing, federal, state, or local authority. Rather the CBBEP coordinates the implementation of the Bays Plan by providing limited amounts of technical and financial assistance towards meeting operating goals.

CBBEP Operating Goals:

- Understand the interdependence of the bays and estuaries with human uses;
- Maintain clean water quality for native living resources as well as providing clean waters for recreation;
- Maintain freshwater inflows;
- Preserve open spaces to meet growing populations; and
- Manage the region's bays and estuaries so they may survive catastrophic events and adapt to condition changes.

In 1998, the Texas Agricultural Extension Service published the *Wetland and Coastal Resources Information Manual for Texas*, 2nd Edition, which includes the Texas Wetland Plan. Initiated in April of 1994, the Texas Wetland Plan employs a non-regulatory, voluntary approach to conserving Texas' wetlands. The plan describes how wetlands have economic and ecological benefits, such as flood control, improved water quality, harvestable products, and habitat for fish, shellfish, and wildlife resources. It also identifies each type of wetland resource throughout the

[7] NEI, et al., "Regional Water Supply Study, Duval and Jim Wells Counties, Texas," NRA, et al., October 1996.
[8] "Coastal Bend Bays Plan," Coastal Bend Bays and Estuaries Program, August 1998.

State of Texas and then makes recommendations for conservation actions. The focus of the plan includes enhancing the landowner's ability to use existing incentive programs and other land use options through outreach and technical assistance, developing and encouraging land management options that provide an economic incentive for conserving existing wetlands or restoring former ones, and coordinating regional wetlands conservation efforts. The plan addresses each of these goals by utilizing such tools as education, economic incentives, statewide and regional conservation, assessment and evaluation, and coordination and funding activities.

1.8 Current Status of Water Resources Planning and Management

Currently, the Coastal Bend Region is planning to meet future water demands in a number of ways. The City of Corpus Christi has a contract to purchase 41,840 acft/yr from Lake Texana, which, as of 1998, is being delivered to the Region via the Mary Rhodes Pipeline. Also, the City of Corpus Christi has purchased 35,000 acft of water rights from the Garwood Irrigation Company to be transported to the Coastal Bend Region via an extension of the Mary Rhodes Pipeline or other interbasin transfer projects. Finally, the City of Corpus Christi is currently monitoring the proposed Tampa Bay, Florida desalination project to assess the feasibility of such a project within the Corpus Christi Service Area.

Besides extensive studies of the Coastal Bend Region's water needs and future resources, much of the Region has implemented the City of Corpus Christi's Water Conservation and Drought Contingency Plan. The City of Corpus Christi's Water Conservation Plan outlines a Drought Management Plan, which is implemented when current water supplies are threatened. The plan is broken into four hierarchical stages; each stage increases in severity of water conservation measures implemented as the threat of water shortage increases (Table 1-4).

Table 1-4.
City of Corpus Christi Drought Management Plan

<u>Condition 1 - Water Shortage Possibility: 10% Reduction Goal</u>

Implement or increase water demand reduction:

- Leak detection program
- Mandatory conservation operations for City government
- Eliminate wasted water running gutters
- Public communication
- Request voluntary reductions
- Restrict lawn watering to once a week
- Wastewater effluent available to public
- Establish Water Allocation and Review Committee

<u>Condition 2 - Water Shortage Watch: 15% Reduction Goal</u>

Implement or increase more drastic water demand reductions:

- Shut off ornamental fountains
- Repair or shut off faulty plumbing
- 14 day cycle of lawn watering
- No watering of golf courses, no use of fire hydrants except to fight fire, and no water use for dust control
- Water Allocation and Review Committee meets regularly

<u>Condition 3 - Water Shortage Warning: 25% Reduction Goal</u>

Drastic water demand reduction implemented:

- Water rationing based on number of residents per household
- Stop water use for ponds and lakes
- Stop water use for new agriculture
- Restaurants may only serve water upon request
- Limit new connections

<u>Condition 4 - Water Shortage Emergency: 35% Reduction Goal</u>

Emergency Actions Necessary

The City's Plan not only provides for reductions in water demand, but it also initiates the pumping of 16 water wells during drought conditions. Twelve of the wells are located near Lake Corpus Christi and four wells are on the Atascosa River near Campbellton. In addition, during drought conditions, both municipal and wholesale customers are subject to water allocation from the City of Corpus Christi. In turn, wholesale customers are responsible to impose similar allocations on their customers.

In response to rules adopted by TNRCC, the City of Corpus Christi evaluated their existing water conservation plan and amended it to meet those requirements by September 1, 1999. The main focus of the City of Corpus Christi's Water Conservation Plan is public information. The plan provides everyday water conservation tips, plumbing codes and retrofit programs, and educational demonstrations and programs for the public. The City of Corpus Christi's Water Conservation Plan recognizes its long-held conservation-based water rate structure, universal metering and a meter repair/replacement program, and leak detection program. Other programs outlined within the water conservation plan are such practices as reuse and recycling of wastewater and greywater, the establishment of landscape ordinances, and an outlined procedure to determine and control unaccounted-for water loss. The City of Corpus Christi's Water Conservation Plan not only recognizes the on-going water conservation practices within the City of Corpus Christi service area but it also defined water conservation goals.

City of Corpus Christi Water Conservation Goals:

- Maintain per capita water usage below the median for the previous 5-year per capita consumption for cities with populations greater than 50,000 situated in the central climatological region of the state;
- Limit unaccounted-for water from the City's system to no more than 15 percent (based on a moving 5-year average);
- Assist the Coastal Bend (“Region N”) Regional Water Planning Group in completing the SB1 Regional Water Plan; and
- Assist City customers in continuing efforts toward water conservation.

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Section 2
Current and Projected Population and Water Demand Data for the Region

2.1 Introduction

In July 1998, the Texas Water Development Board (TWDB) published population and water demand projections for each county in the state. Population projections were developed for cities and 'county-other', to capture those people living outside the cities, for each county. Water demand projections were developed by type of use: municipal for cities (along with a 'county-other' for each county), and countywide for manufacturing, steam-electric, mining, irrigation, and livestock. These figures, which are presented in this section for the 11-county Coastal Bend Regional Water Planning Area, are based on the recommendations of the 1997 State Water Plan. The population projections are a consensus-based "most-likely" scenario of growth, as determined by a Technical Advisory Committee consisting of state agencies, key interest groups, and the general public, based on recent and prospective growth trends and their professional opinions. The demand projections for each type of water use were made under various assumptions that will be addressed in each water-use section below.

Several of the cities within the Coastal Bend Regional Planning Area requested and received revisions to the TWDB's consensus-based population and water demand projections. The cities with both revised population and water demand projections include Rockport, Orange Grove, Aransas Pass, Ingleside, and Portland. For the City of Falfurrias only its water demand projections were revised. 'County-other' population and water demand projections for Aransas County and 'county-other' water demand projections for Brooks County were also revised. Additionally, manufacturing water demand projections for San Patricio County were revised. Appendix B contains figures for population, per capita water use, and water demand projections for each city and county-other and manufacturing (including steam-electric, if applicable), mining, and irrigation and livestock water demand projections for each county.

2.2 Population Projections

From 1980 to 1996, the population in the 11-county region grew by 62,303 (from 468,257 to 530,290), an increase of 13.2 percent (0.78 percent annually), as shown in Table 2-1. This compares with a statewide increase in population of 34.4 percent (1.87 percent

annually). The majority of the growth occurred in Nueces and San Patricio Counties, the two largest counties in the region. Combined, they accounted for 81 percent of the total increase, and in 1996 their populations totaled 71 percent of the region. In 1996, 58.5 percent of the region's total population lived in Nueces County, 12.4 percent in San Patricio County, 7.5 percent in Jim Wells County, 5.9 percent in Kleberg County, 5.2 percent in Bee County, and less than 5.0 percent in each of the remaining six counties.

The population in the 11-county region is projected to increase by 374,620 from 2000 to 2050, an increase of 65.8 percent (1.02 percent annually), as shown in Table 2-1. This compares to a statewide projected population growth in the same period of 81.3 percent (1.20 percent annually). The total population for the region in 2000 is 2.8 percent of the projected 20.2 million statewide. It declines slightly by 2050, to 2.6 percent of the projected 36.7 million statewide total. In 2050 it is projected that 59.9 percent of the population will live in Nueces County, 14.4 percent in San Patricio County, 5.9 percent in Kleberg County, 5.9 percent in Aransas County, and less than 5.0 percent in each of the remaining seven counties. Figure 2-1 shows the trend in population for the region from 1990 to 2050.

Aransas, Nueces, and San Patricio Counties are the fastest growing counties in the region, growing at an annual rate higher than the regional average of 1.02 percent (Figure 2-2). The population growth in those counties accounts for 87.4 percent of the total increase over the next 50 years. Bee, Brooks, Duval, Jim Wells, Kleberg and Live Oak Counties all have positive annual growth rates, but less than the regional average. The growth rates in Kenedy and McMullen Counties, the two smallest in the region, are negative, as their population declines over the 50-year period, from 485 to 357 and 792 to 363, respectively.

Corpus Christi and Kingsville are the two largest cities in the region, accounting for 57.8 percent of the total population in 2000, increasing to 62.4 percent of the total in 2050. These cities are also two of the fastest growing cities, growing by 76.5 percent and 60.6 percent, respectively. Population projections for the 28 cities in the region are shown in Table 2-2.

2.3 Water Demand Projections

The TWDB water demand projections have been compiled for each type of consumptive water use: municipal, manufacturing, steam-electric power, mining, irrigation, and livestock. In these consumptive types of water use there is a "loss" in water. In non-consumptive water use,

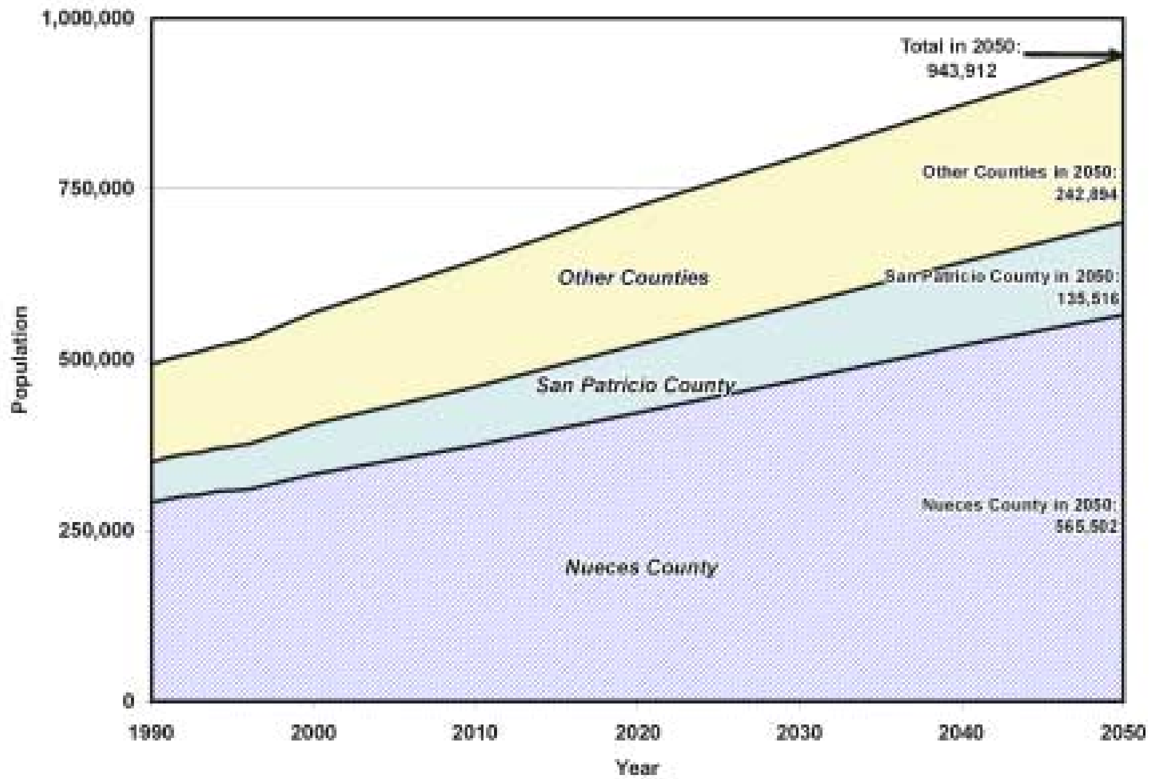

Figure 2-1. Coastal Bend Region Population

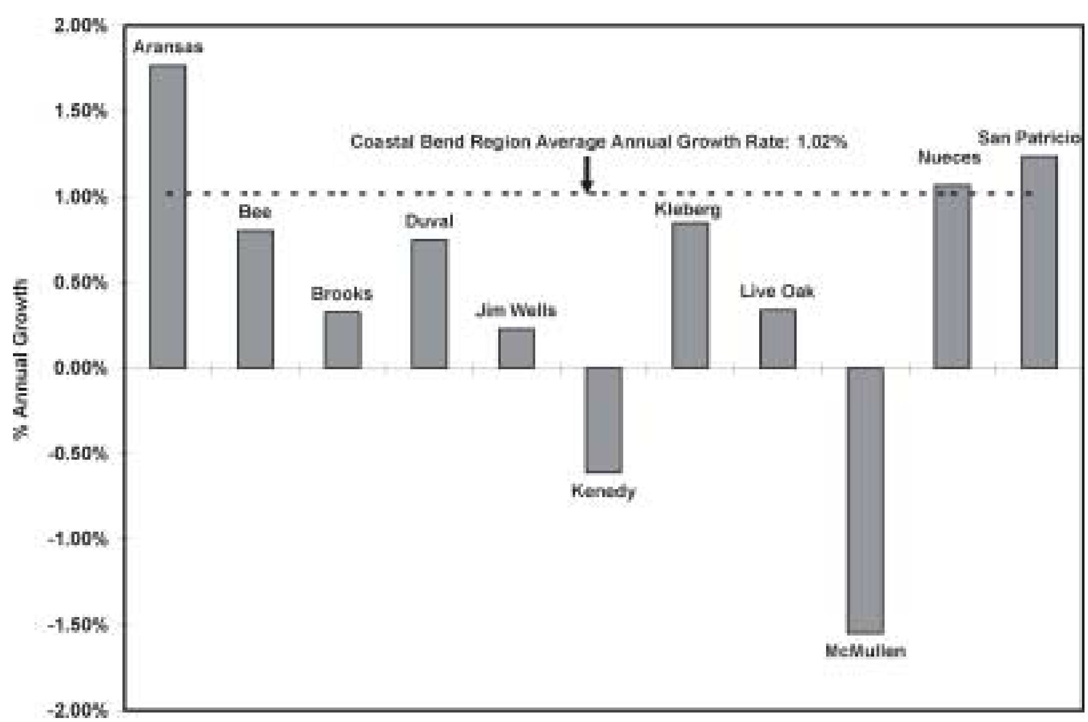

Figure 2-2. Percent Annual Population Growth Rate for 2000 through 2050 by County

such as navigation, hydroelectric generating, or recreation, there is little or no water loss. As shown in Table 2-3, total water use for the region is projected to increase by 85,957 acre-feet per year (acft/yr) between 2000 and 2050, from 223,797 acft/yr to 309,754 acft/yr, a 38.4 percent rise. Municipal, manufacturing and steam-electric water use are projected to increase, while irrigation use and mining use are projected to decline, and livestock use is unchanged. The trend in total water use for 2000 to 2050 is shown in Figure 2-3. In 2000, 53.4 percent of the projected total water use will be for municipal purposes, 30.3 percent for manufacturing, 1.5 percent for steam-electric water, 5.3 percent for mining, 5.8 percent for irrigation, and 3.7 percent for livestock. In 2050, municipal use as a percentage of the total is projected to decrease to 53.2 percent, manufacturing use to increase to 38.3 percent, steam-electric water use to decrease to 1.1 percent, mining use to decrease to 2.0 percent, and irrigation and livestock use to decrease to 2.7 percent each. These components of total water use for 2000 and 2050 are shown in Figure 2-4.

The Coastal Bend Region encompasses three river basins: the Nueces, the Nueces-Rio Grande, and the San Antonio-Nueces. Total water demand in each basin is shown in Table 2-3.

2.3.1 Municipal Water Demand

Water that is used by households (e.g., drinking, bathing, food preparation, dishwashing, laundry, flushing toilets, lawn watering and landscaping, swimming pools and hot tubs) commercial establishments (e.g., restaurants, car washes, hotels, laundromats, and office buildings) and for fire protection, public recreation and sanitation are all referred to as municipal water. This type of water must meet safe drinking water standards as specified by Federal and State laws and regulations.

The TWDB computes the municipal water demand projections by multiplying the projected population of an entity by the entity's projected per capita water use, adjusted for conservation savings. Again, projected population is the “most-likely” scenario. The projected per capita water use takes into account current plumbing, appliances, and other conservation technology, and is made under a below-normal rainfall scenario. The projected per capita water use is subjected to an “expected” scenario of water conservation strategies – installation of water-efficient plumbing fixtures and landscaping, public education, and the effects of the 1991

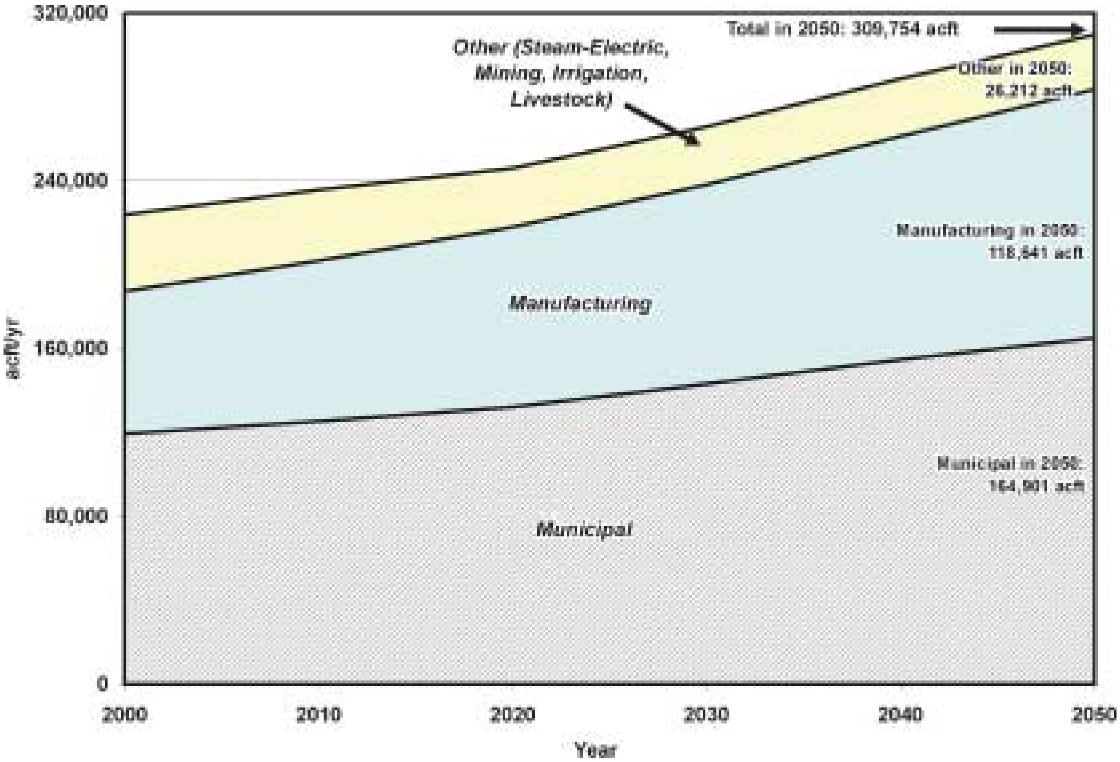

Figure 2-3. Coastal Bend Region Water Demand

State Water-Efficient Plumbing Act. This expected scenario represents feasible strategies for economically sound water conservation savings.[1] In most cases, applying a conservation scenario to the per capita use results in a declining per capita water use over time.

In 1996 total municipal use in the Coastal Bend Region was 90,710 acft/yr. By the year 2000 it is projected to be 119,464 acft/yr. Nueces and San Patricio Counties account for 74.5 percent of the total. Municipal use is projected to increase 38.0 percent to 164,901 acft in 2050 (Table 2-4). Aransas, Nueces, and San Patricio Counties will experience the largest increases, 96.4 percent, 44.8 percent, and 45.1 percent, respectively. By 2050, Nueces and San Patricio Counties will account for 89.9 percent of the total municipal water use in the region (Figure 2-5).

[1] Water demand for some cities were projected using an "advanced water conservation" scenario - active retrofit programs, aggressive assumptions on seasonal, dry-year urban irrigation, and other municipal uses.

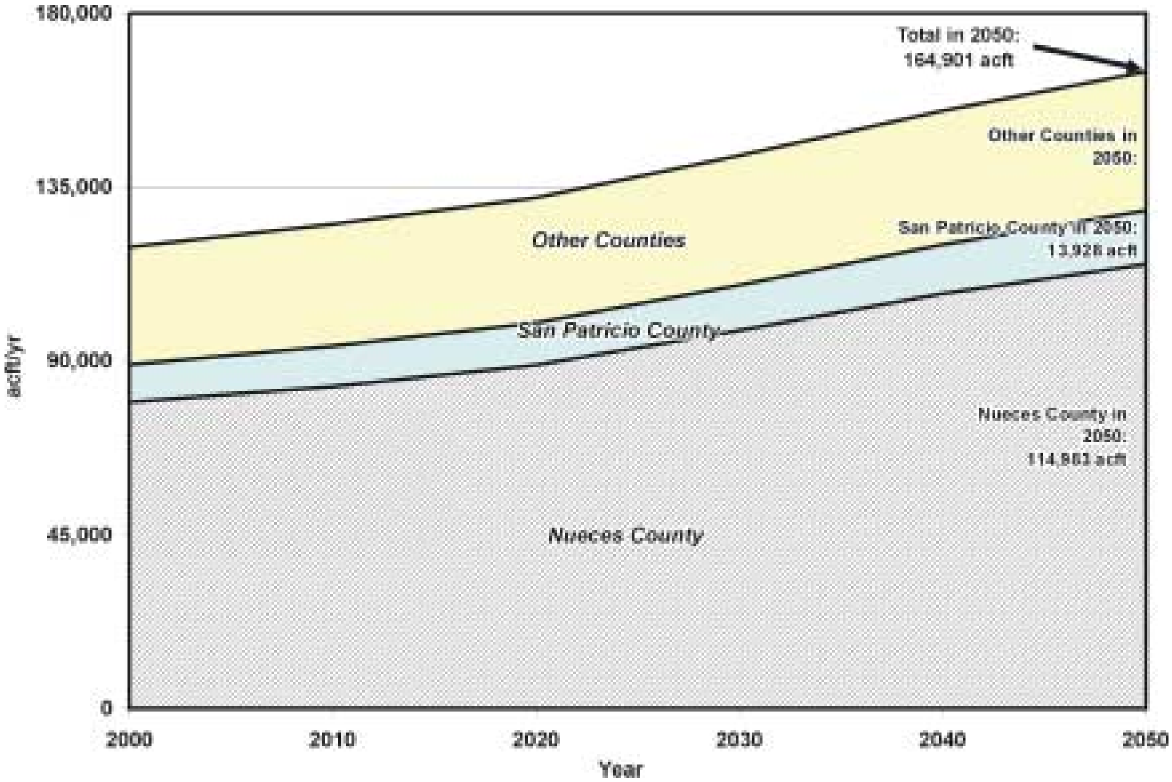

Figure 2-5. Coastal Bend Region Municipal Water Demand

The increase in municipal water demand correlates to the increase in the region's population. This is illustrated in the cities of Corpus Christi and Kingsville. Both will experience large increases in population, and as a result, in water use as well. Corpus Christi's water use is projected to increase 52.6 percent over the next 50 years while Kingsville's increase is projected to be 34.2 percent. However, the increase in water use for each of these cities is less than their respective increases in population. This is attributable to a declining per capita water use, which was subjected to an "advanced conservation" scenario. Per capita water use in Corpus Christi is projected to decline 13.5 percent, from 207 gallons per capita daily (gpcd) in 2000 to 179 gpcd in 2050. Per capita water use in Kingsville is projected to be 158 gpcd in 2000, declining 16.5 percent to 132 gpcd in 2050. Municipal water use projections for the 28 cities in the region are presented in Table 2-5. Population projections, per capita projections, and municipal water demand projections for each of the cities and 'county-other' are shown in the appendix.

2.3.2 Manufacturing Water Demand

Manufacturing is an integral part of the Texas economy, and for many industries, water plays a key role in the manufacturing process. Some of these processes require direct consumption of water as part of the products, others consume very little water but use a large quantity for cleaning and cooling. Whether the water is a product component or used to transport waste heat and materials, it is considered manufacturing water use. The water-using manufacturers in the 11-county Coastal Bend Region are food processing, chemicals, petroleum refining, stone and concrete, fabricated metal, and electronic and electrical equipment.

Of these industries present in the region, chemicals and petroleum refining are the largest and biggest water users. The chemical and petroleum refining industries employ approximately 10,000 people in Nueces and San Patricio Counties, primarily in the cities of Bishop and Corpus Christi.[2] They also accounted for 97.0 percent of the total manufacturing water use in 1996.

The TWDB projects manufacturing water demand by taking industry-specific water demand coefficients, adjusted for water-use efficiencies (recycling/reuse), and applying them to growth trends for each industry. These growth trends assume expansion of existing capacity and building of new facilities; continuation of historical trends of interaction between oil price changes and industrial activity; and that the makeup of each county's manufacturing base remains constant throughout the 50-year planning period.

In 1996, total manufacturing water use for Coastal Bend Region was 51,815 acft. Nueces and San Patricio Counties accounted for 96.4 percent of this total (Table 2-6). Manufacturing use is projected to be 67,785 acft in 2000 and 118,641 acft in 2050, an 75.0 percent increase. In 2050, Nueces and San Patricio Counties will account for 98.2 percent of the total manufacturing water use in the region (Figure 2-6). This projected increase can be attributed to continued growth in the petroleum refining industry in Nueces and San Patricio counties.

As noted previously, petroleum refining is one of the largest industries in the region, accounting for 60.7 percent of all manufacturing water use. Corpus Christi, in Nueces County, is home to nearly 13 percent of Texas' petroleum refining capacity. The refineries in the Corpus Christi area have implemented significant water conservation and water use efficiency

[2] "1999 Directory of Texas Manufacturers," Bureau of Business Research, The University of Texas at Austin, 1999.

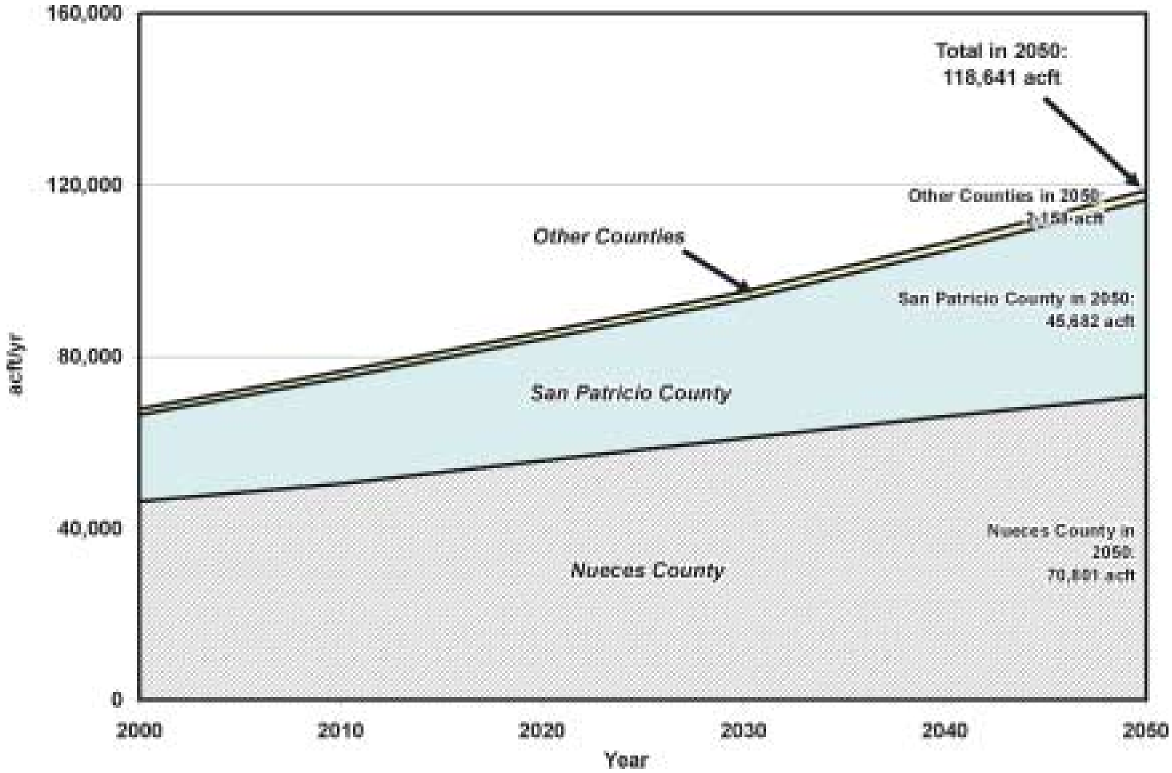

Figure 2-6. Coastal Bend Region Manufacturing Water Demand

improvement programs. These refineries use 46 gallons of water per barrel of crude petroleum refined, compared to the State average of 100 gallons per barrel refined.[3]

2.3.3 Steam-Electric Water Demand

Nueces County is the only county in the Coastal Bend Region with steam-electric power plants using fresh water for a portion of their cooling water needs. The projections for steam-electric power water demand are based on power generation projections – determined by population and manufacturing growth – and on power generation capacity and fresh water use for that projected capacity. The steam-electric generation process uses water in boilers and for cooling the generating equipment. The usual practice is to use freshwater with a very low concentration of dissolved solids for boiler feed water and to use either freshwater or saline water for power plant cooling purposes. At two of the three plants located in Corpus Christi in Nueces County, freshwater is used for the boiler feed and seawater is used for cooling. The use

[3] "Report of Water Use for Refineries and Selected Cities in Texas, 1976-1987," South Texas Water Authority, Kingsville, Texas, 1990.

of saltwater for cooling at AEP-CPL's Nueces Bay and Barney Davis Power Stations save approximately 5,400 and 6,300 acft/yr respectively in fresh water (1999 figures). At the third, freshwater is used for the boiler feed and cooling. Table 2-7 shows that in 1996, 3,039 acft/yr of freshwater was used. Projections for steam-electric demand in Nueces County above those projected by the TWDB include demands for planned expansions. The official TWDB projections for Nueces County steam-electric were underestimated according to AEP-CPL, and the RWPG adopted projections that include the additional demands projected by AEP-CPL after the TWDB deadline to revise demands. In 2050, steam-electric demands are projected by the RWPG to be 6,500 acft (Figure 2-7), although the steam-electric demands officially approved by the TWDB are 3,300 acft/yr.

2.3.4 Mining Water Demand

Projections for mining water demand are based on projected production of mineral commodities, and historic rates of water use, moderated by water requirements of technological processes used in mining.

In 1996 in all 11 counties of the planning area, 17,067 acft was used in the mining of sand, gravel, and in the production of crude oil. Water is required in the mining of these minerals either for processing, leaching to extract certain ores, controlling dust at the plant site, or for reclamation. Duval, Kleberg and Live Oak counties accounted for 87.9 percent of the 1996 total use (Table 2-8). Mining water use in 2000 is expected to be 11,969 acft and is projected to decline to 6,146 acft in 2050, a 49 percent decrease due to a projected decrease in crude oil production. Duval and Live Oak counties, which will decline at 39.6 percent and 40.4 percent, respectively, will account for 96.7 percent of the 2050 total use (Figure 2-8). Water use for mining is projected to be zero for Kleberg County in 2050.

2.3.5 Irrigation Water Demand

Irrigated crop production in Coastal Bend Region is practiced in 7 of the 11 counties. Of the 4,951 farms in the region in 1997, 162 had 17,873 acres of irrigated farmland.[4] The region receives about 29.2 inches or rainfall per year, which is generally adequate for dry-land crops. Irrigated cropland only accounts for 2.1 percent of all harvested cropland.[5] Major crops include

[4] U.S Department of Agriculture, 1997 Census of Agriculture.
[5] "1998-99 Texas Almanac", Mary G. Ramos, ed. Dallas Morning News, Inc., 1997.

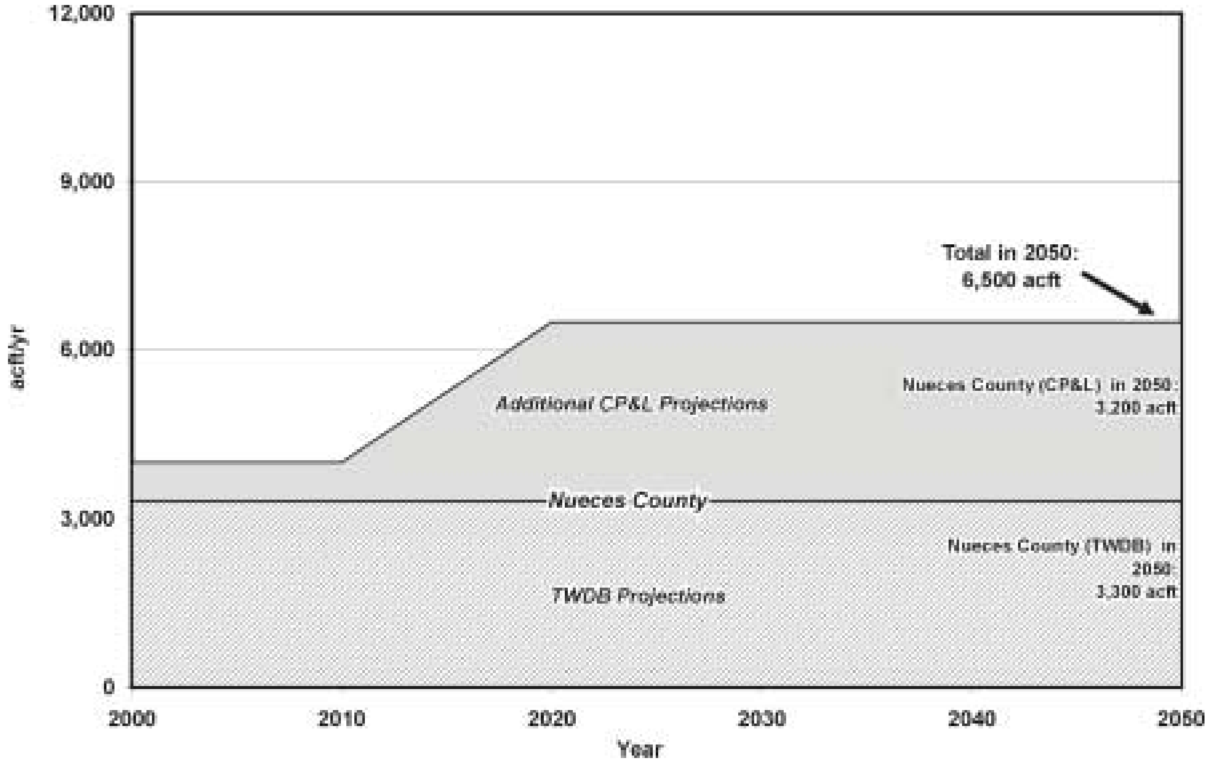

Figure 2-7. Coastal Bend Region Steam-Electric Water Demand

corn, cotton, sorghum, hay and wheat. Over 70 percent of the irrigated land in the region is irrigated with groundwater.

The irrigation water demand projections are based on specific assumptions regarding crop prices, crop yields, agricultural policy, and technological advances in irrigation systems. The projections were last updated in 1993, using 1990 data. The TWDB estimated 1996 total irrigated water use in the Coastal Bend Region at 12,115 acft (Table 2-9). Duval and Bee Counties accounted for 74.4 percent of that total. Irrigated water use is projected to decrease by 34.7 percent from 2000 to 2050, 13,009 acft to 8,496 acft (Figure 2-9). This decline is attributable to increased efficiencies in irrigation techniques and a decreasing dependence of agriculture in the region's economy.

2.3.6 Livestock Water Demand

In the 11-county Coastal Bend Region, the principal livestock type is beef cattle, with some dairy herds. Livestock drinking water is obtained from wells, stock watering tanks that are dug/constructed on the ranches, and streams that flow through the ranches.

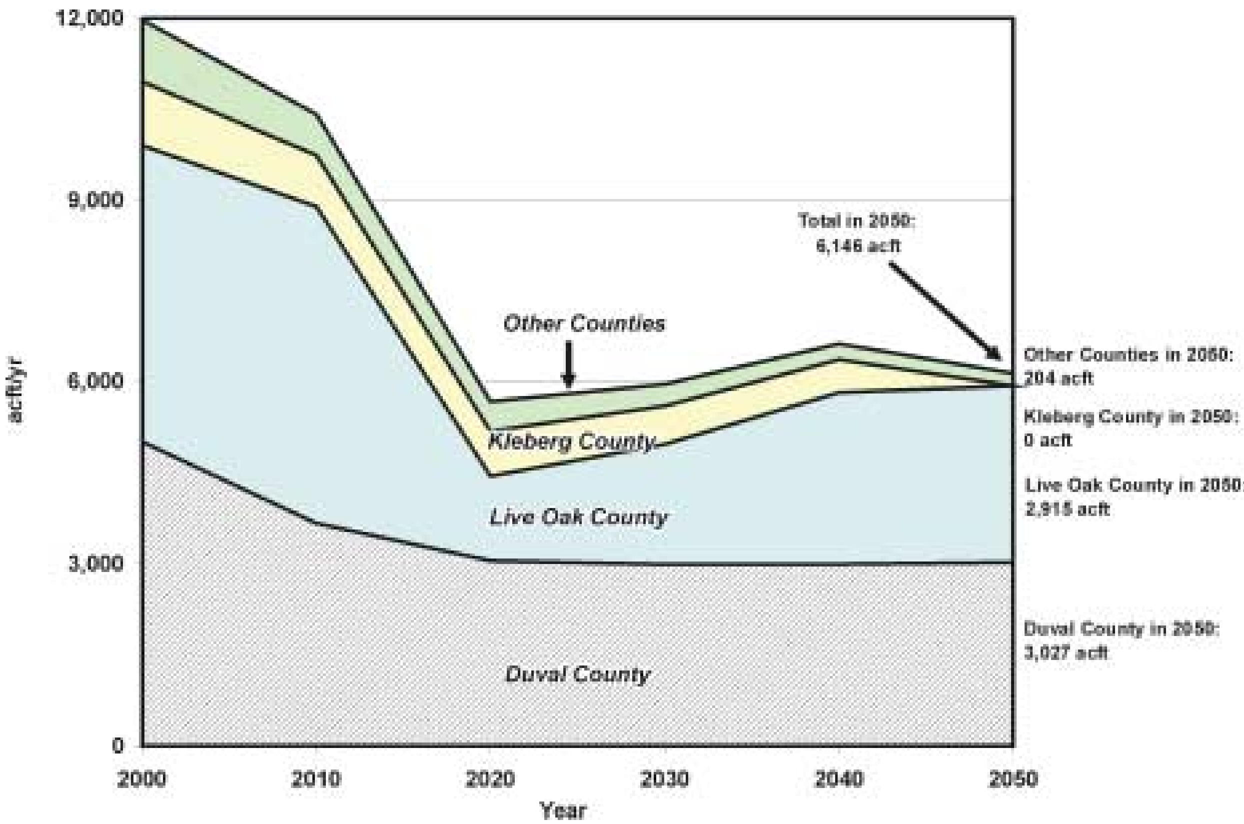

Figure 2-8. Coastal Bend Region Mining Water Demand

The livestock water demand projections are based upon estimates of the maximum carrying capacity of the rangeland of the area and the estimated number of gallons of water per head of livestock per day. In 1996, livestock water use for the Coastal Bend region was 10,443 acft: 20 percent in Kleberg County, 17 percent in Duval County, 17 percent in Live Oak County, 10 percent in Jim Wells County, and 36 percent in the remaining counties. From 2000 to 2050, water use for livestock use is projected to stay unchanged at 8,270 acft (Figure 2-10 and Table 2-10).

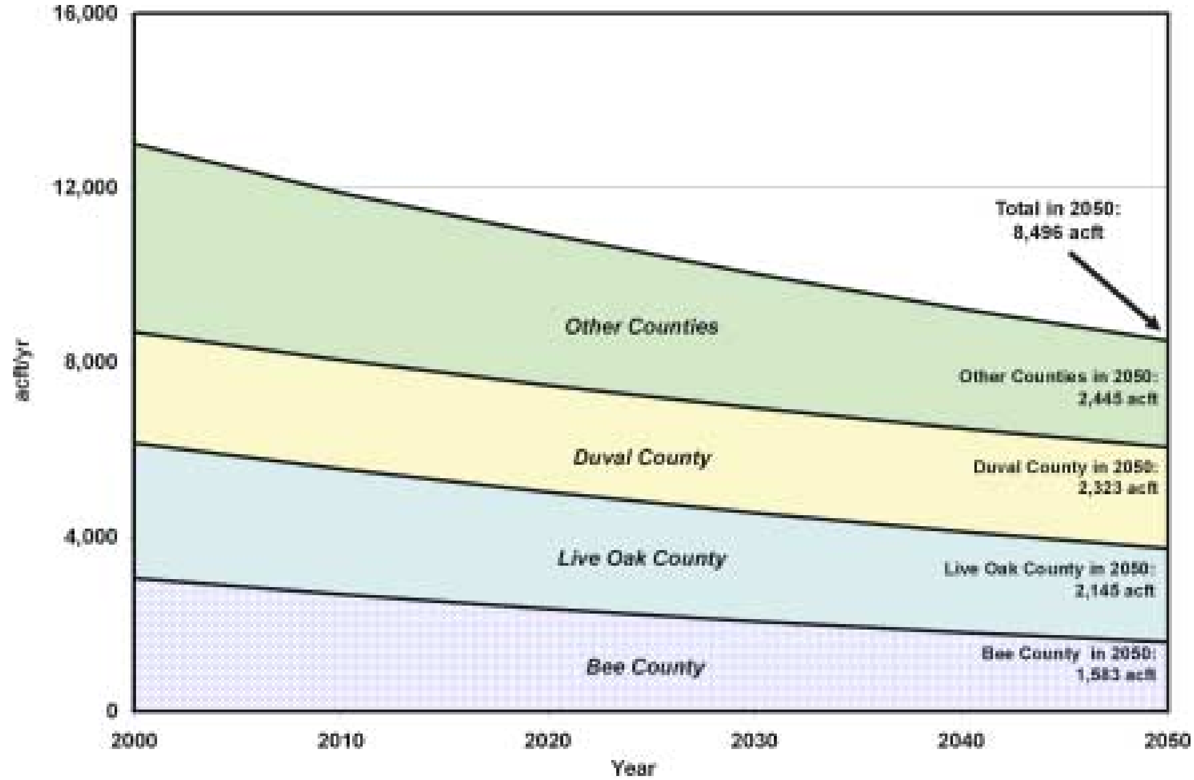

Figure 2-9. Coastal Bend Region Irrigation Water Demand

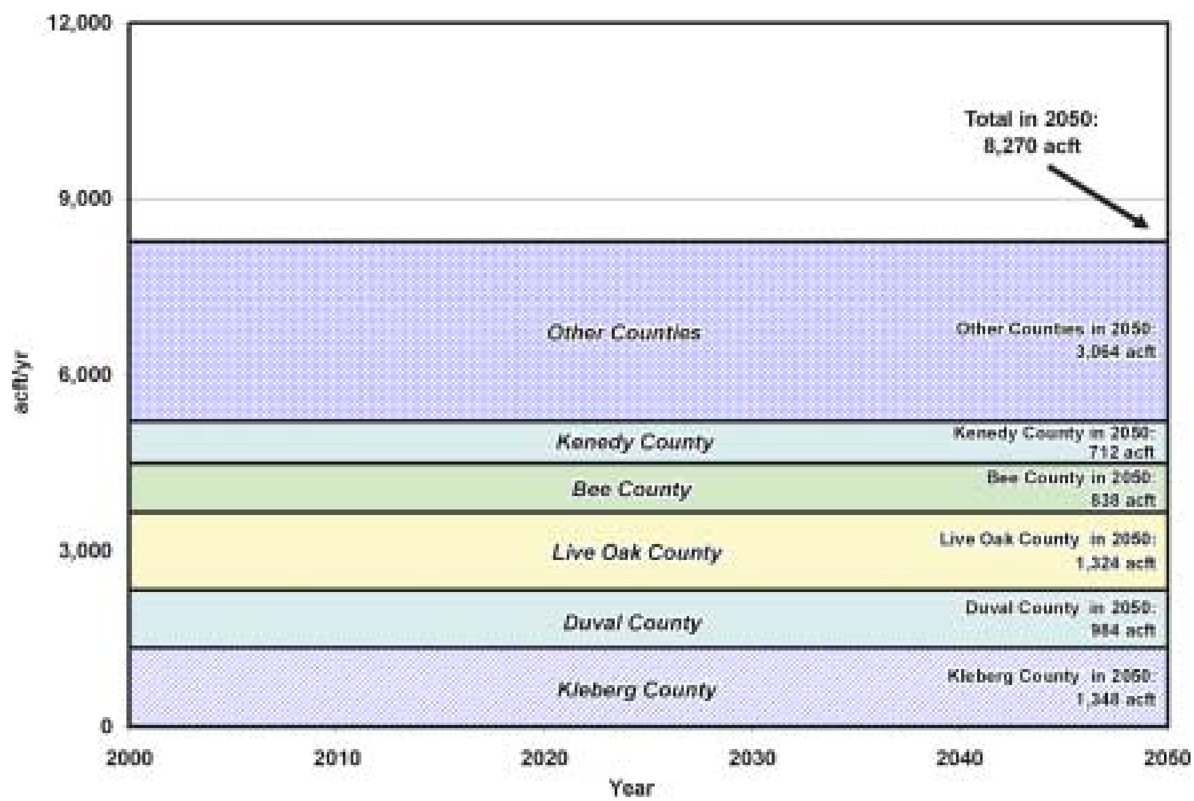

Figure 2-10. Coastal Bend Region Livestock Water Demand

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Section 3
Evaluation of Current
Water Supplies in the Region

3.1 Surface Water Supplies

The Coastal Bend Region is drained by three river basins: the Nueces River Basin, the San Antonio-Nueces Coastal Basin, and the Nueces-Rio Grande Coastal Basin (Figure 3-1). Streamflows in the two coastal basins are highly variable and intermittent and do not supply significant quantities of water. However, streamflow in the Nueces River and its tributaries, along with municipal and industrial water rights in the Nueces River Basin, comprise a significant supply of water in the Coastal Bend Region, as this basin drains about 17,000 square miles. These water rights provide authorization for an owner to divert, store and use the water, however, it does not guarantee that a dependable supply will be available from the water source. The availability of water to a water right is dependent on several factors including hydrologic conditions (i.e., rainfall, runoff, springflows), priority date of the water right, quantity of authorized storage, and any special conditions associated with the water right (i.e., instream flow conditions, maximum diversion rate). Because the Nueces River Basin is subject to periods of significant drought and low flows, storage is very important to help "firm up" water rights.

3.1.1 Texas Water Right System

The State of Texas owns the surface water within the state watercourses and is responsible for the appropriation of these waters. Surface water is currently allocated by the Texas Natural Resources Conservation Commission (TNRCC) for the use and benefit of all people of the state. Texas water law is based on the riparian and prior appropriation doctrines. The riparian doctrine extends from the Spanish and Mexican governments that ruled Texas prior to 1836. After 1840, the riparian doctrine provided landowners the rights to make reasonable use of water for irrigation or for other consumptive uses. In 1889, the prior appropriation doctrine was first adopted by Texas, which is based on the concept of "first in time is first in right." Over the years, the riparian and prior appropriation doctrines resulted in an essentially unmanageable system. Various types of water rights existed simultaneously and many rights were unrecorded. In 1967, the Texas Legislature passed the Water Rights Adjudication Act that merged the riparian water rights into the prior appropriation system, creating a unified water permit system.

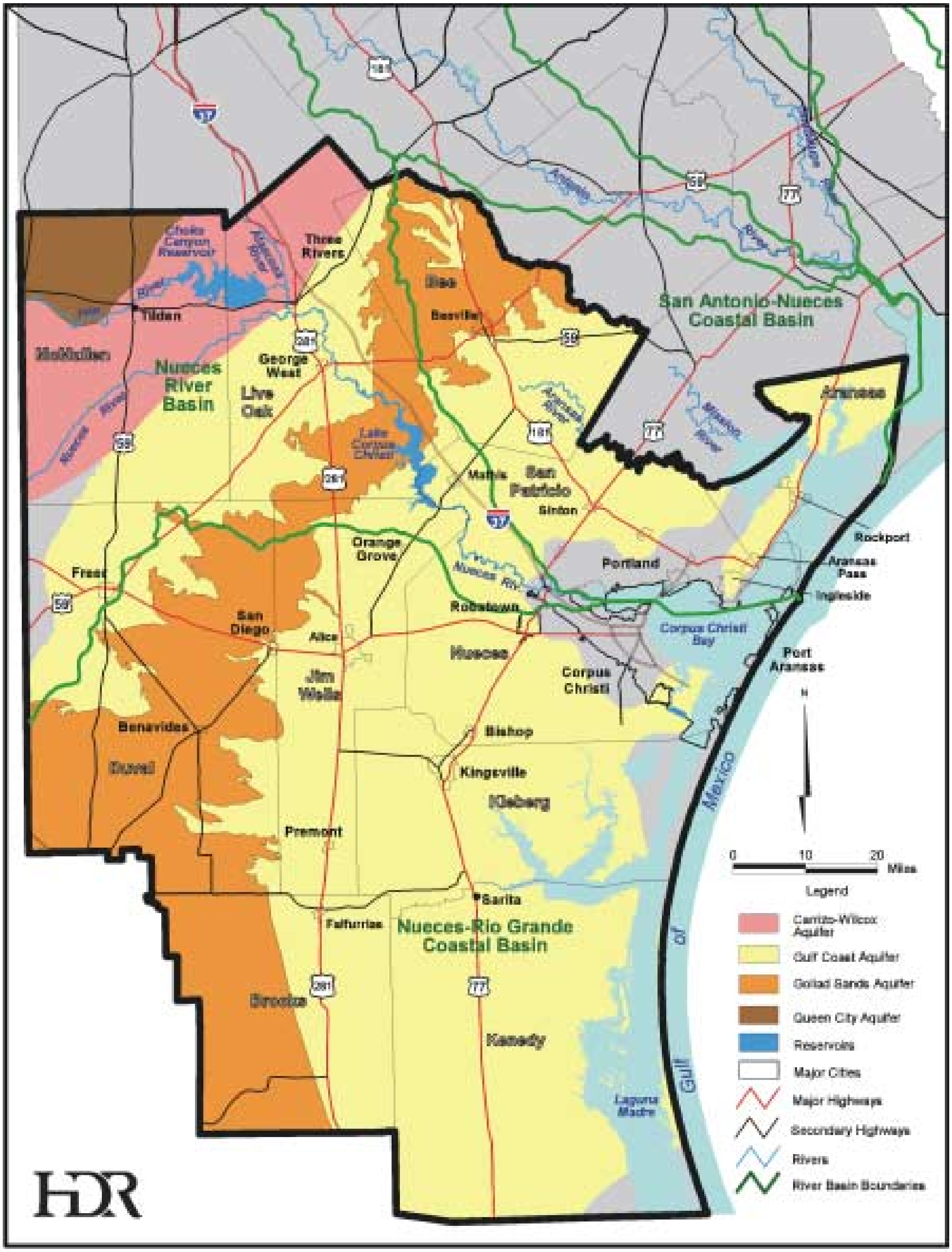

Figure 3-1. Watershed Boundaries and Aquifer Location Map

The adjudication process took many years, stretching into the late 1980s before it was finally completed. In the end, Certificates of Adjudication were issued for entities recognized as having legitimate water rights. Today, individuals or groups seeking a new water right must submit an application to the TNRCC. The TNRCC determines if the water right will be issued and under what conditions. The water rights grant a certain quantity of water to be diverted and/or stored, a priority date, location of diversion, and other restrictions. The priority date of a water right is essential to the operation of the water rights system. Each right is issued a priority date based on the date each right was filed at the TNRCC. When diverting or storing water for use, all water right holders must adhere to the priority system. A right holder must allow water to be passed to downstream senior water rights when conditions are such that the senior water rights would not be otherwise satisfied. Other restrictions may include a maximum diversion rate and instream flow restrictions to protect existing water rights and provide environmental flows for instream needs and needs of estuary systems. An example of the requirement for instream flows and freshwater flows for the Nueces Estuary are included in the Certificate of Adjudication Number (CA#)21-3214 for Choke Canyon Reservoir. Operations of the Choke Canyon Reservoir/Lake Corpus Christi System (CCR/LCC System) are governed, in part, by CA #21-3214, within which Special Conditions B and E state:

B. (Part)

> "Owners shall provide not less than 151,000 acft of water per annum for the estuaries by a combination of releases and spills from the reservoir system at Lake Corpus Christi Dam and return flows to the Nueces and Corpus Christi Bays and other receiving estuaries."

E.

> "Owners shall continuously maintain a minimum flow of 33 cubic feet per second below the dam at Choke Canyon Reservoir."

Special Condition B of CA #21-3214 further states:

> "Water provided to the estuaries from the reservoir system under this paragraph shall be released in such quantities and in accordance with such operational procedures as may be ordered by the Commission."

Hence, the certificate provided for a means to further establish specific rules governing operations of the CCR/LCC System with respect to maintaining freshwater inflows to the Nueces Estuary.

To address concerns about the health of the Nueces Estuary, a Technical Advisory Committee (TAC) chaired by the TNRCC was formed in 1990 to establish operational guidelines for the CCR/LCC System and desired monthly freshwater inflows to the Nueces Estuary. These operational guidelines were summarized in the 1992 Interim Order.[1] Implementation of this Order resulted in a substantial reduction in the firm yield of the CCR/LCC System available for municipal and industrial water users.

The 1992 Interim Order established a monthly schedule of desired freshwater inflows to Nueces Bay totaling 97,000 acft/yr to be satisfied by spills, return flows, runoff below Lake Corpus Christi, and/or dedicated releases from the CCR/LCC System. Mechanisms for relief from reservoir releases under the Interim Order were based on inflow banking, monthly salinity variation in upper Nueces Bay, and implementation of drought contingency measures tied to CCR/LCC System Storage.

The Nueces Estuary Advisory Council (NEAC) was formed under the 1992 Interim Order and charged with continued study of the interdependent relationship between the firm yield of the CCR/LCC System and the health of the Nueces Estuary. One of NEAC's primary goals was to evaluate the 1992 Interim Order and other alternative release policies and recommend a more permanent reservoir operations plan for providing freshwater inflows to the Nueces Estuary. This goal was to be achieved within 5 years of NEAC's formation.

The goal of recommending a more permanent reservoir operations plan was fulfilled on April 28, 1995 when the TNRCC issued an order regarding reservoir operations for freshwater inflows to the Nueces Estuary, known as the 1995 Agreed Order.[2] This Agreed Order is very similar to the Interim Order, with one major exception. Under the Agreed Order, monthly releases (pass-throughs) to the estuary were limited to CCR/LCC System inflows and stored water would not be required to meet estuary freshwater flow needs. All CCR/LCC System yield analyses presented as part of this study were performed using the 1995 Agreed Order.

3.1.2 Types of Water Rights

There are various types of water rights. Water rights are characterized as Certificates of Adjudication, permits, short-term permits, or temporary permits. Certificates of Adjudication

[1] Texas Water Commission, Interim Order Establishing Operational Procedures Pertaining to Special Condition B, Certificate of Adjudication No. 21-3214, held by the City of Corpus Christi, et al., March 9, 1992.

were issued in perpetuity for approved claims during the adjudication process. This type of water right was generally issued based on historical use rather than water availability. As a consequence, the amount of water to which rights on paper are entitled to generally exceeds the amount of water available during a drought. The TNRCC issues new permits only where normal flows are sufficient to meet the requested amount. Permits, like Certificates of Adjudication, are issued in perpetuity and may be bought and sold like other property interests. Short-term permits may be issued by the TNRCC in areas where waters are fully appropriated, but not yet being fully used. Term permits are usually issued for 10 years and may be renewed if, after 10 years, water in the basin is still not being used by other water right holders. Temporary permits are issued for up to 3 years. Temporary permits are issued mainly for roadway and other construction projects, where water is used to suppress dust, to compact soils, and to start the growth of new vegetation.

Water rights can include the right to divert and/or store the appropriated water. A run-of-river water right provides for the diversion of streamflows and generally does not include a significant storage volume for use during dry periods. A run-of-river right may be limited by streamflow, pumping rate, or diversion location.

Water rights that include provisions for storage of water allow a water right holder to impound streamflows for use at a later time. The storage provides water for use during dry periods, when water may not be available due to hydrologic conditions or because flows are required to be passed to downstream senior water rights.

Water rights are generally diverted and used within the river basin of origin. Water that is diverted from one river basin and used in another basin requires an interbasin transfer permit. One exception to this is that an interbasin transfer permit is not required for diversion of water from a river basin for use in an adjoining coastal basin, such as from the Nueces River Basin to either the San Antonio-Nueces or the Nueces-Rio Grande Coastal Basins.

While water rights permits have been granted in the past based on historical use, the supply available to a given water right during drought (especially reservoirs) is often less than the permitted diversion. The minimum annual availability of a water right to divert is often referred to as the firm yield of the supply. According to the TNRCC, the firm yield is defined as

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[2] TNRCC, Agreed Order Establishing Operational Procedures Pertaining to Special Condition B, Certificate of Adjudication No. 21-3214, held by City of Corpus Christi, et al., April 28, 1995.

"that amount of water, based upon a simulation utilizing historic streamflows, that the reservoir could have produced annually if it had been in place during the worst drought of record."[3] All surface water availabilities used in this study and presented in Section 3.3 are based on firm yield analyses.

3.1.3 Water Rights in the Nueces River Basin

A total of 267 water rights exist in the Nueces River Basin with a total authorized diversion and consumptive use of 533,000 acft/yr. It is important to note that a small percentage of the water rights make up a large percentage of the authorized diversion volume. In the Nueces River Basin, 4 water rights (1.5 percent) make up 483,444 acft/yr (91 percent) of the authorized diversion volume. The remaining 263 water rights primarily consist of small municipal, industrial, irrigation and recharge rights distributed throughout the river basin. Figure 3-2 shows the location of the four primary water rights in the Nueces Basin. Of note in this figure, the largest of the rights, by diversion volume, are located in the Coastal Bend Region.

[3] Texas Natural Resource Conservation Commission (TNRCC), "A Regulatory Guidance Document for Applications to Divert, Store, or Use State Water," RG-141, June 1995.

Major Water Rights*					
Water Right #	Owner	Diversion Rights (acft/yr)	Consumptive Rights (acft/yr)	Storage Rights	Notes
2464	City of Corpus Christi	304,898	304,898	300,000 1,175	Lake Corpus Christi Calallen Reservoir
3214	City of Corpus Christi, Nueces River Authority	139,000	139,000	700,000	Choke Canyon Reservoir
3082	Zavala-Dimmit Co. WCID #1	28,000	28,000	5,633	
2466	Nueces County WCID #3	11,546	11,546	0	

*Authorized Annual Diversions > 10,000 acft

Figure 3-2. Location of Major Water Rights in the Nueces River Basin

Municipal and industrial diversion rights represent 84 percent of all authorized diversion rights in the Nueces River Basin. Based in large part on water stored in the Choke Canyon Reservoir/Lake Corpus Christi (CCR/LCC) System, which is subsequently delivered via the Nueces River to Calallen Dam at Corpus Christi for diversion, the City of Corpus Christi and the Nueces River Authority hold 98 percent of these municipal and industrial rights in the basin. With the inclusion of the municipal water rights held by the Nueces County WCID No. 3, diverted from the Nueces River upstream of the Calallen Dam, the Coastal Bend Region includes over 99 percent of the Nueces River Basin municipal and industrial surface water rights permits. Table 3-1 summarizes the surface water rights in the Nueces River Basin included in the Coastal Bend Planning Region.

3.1.4 Coastal Basins

In addition to the Nueces River Basin, the Coastal Bend Regional Planning Area includes portions of two coastal river basins in Texas: the San Antonio-Nueces Coastal Basin and the Nueces-Rio Grande Coastal Basin. The San Antonio-Nueces Coastal Basin is located on the Texas Coast between the Nueces and Guadalupe-San Antonio River Basin. The drainage area of the basin is approximately 2,652 square miles, and it drains surface water runoff into Copano and Aransas Bays. The Nueces-Rio Grande Coastal Basin is located on the southern side of the Coastal Bend Region between the Nueces and Rio Grande Coastal Basins. This basin drains approximately 10,442 square miles into the Laguna Madre Estuary system. Combined, there are approximately 99 water rights in these two coastal basins authorizing diversions of approximately 1,841,000 acft/yr. Approximately 1,737,000 acft (94 percent) of the combined authorized diversions are from within the Coastal Bend Region Planning Area, and of these rights, 1,717,000 acft (99 percent) are industrial diversions for steam-electric and manufacturing processes from the bays and saline water bodies along the coast. Most of this water is used for cooling purposes and is returned to the source. Based on the size and locations of the remaining freshwater rights in these coastal basins and on the lack of a major river or reservoir in these basins, it is unlikely that any of these freshwater rights would be sustainable throughout an extended drought. Therefore none of these rights were considered as firm yield supplies for the planning region.

Table 3-1.
Nueces River Basin Water Rights in
the Coastal Bend Region

Water Right No.	Name	Annual Diversion Volume (acft/yr)	Reservoir Storage Capacity (acft)	Priority Date	Type of Use	Facility	County
2464	City of Corpus Christi	304,898	301,175	5/1913[1]	Municipal (51%) Industrial (49%) Irrigation (minimal) Mining (minimal)	Lake Corpus Christi (300,000 acft) and Calallen Dam (1,175 acft)	Nueces
2465A	Realty Traders & Exchange, Inc.	20	580	10/1952	Irrigation		San Patricio
2465B	Wayne Shambo	140	580	10/1952	Irrigation		San Patricio
2466	Nueces Co. WCID No. 3	11,546	0	2/1909[1]	Municipal (37%) Irrigation (63%)		Nueces
2467	Garnett T. & Patsy A. Brooks	221	0	2/1964	Irrigation		San Patricio
2468	CE Coleman Estate	27	0	2/1964	Irrigation		Nueces
2469	Ila M. Noakes Lindgreen	101	0	2/1964	Irrigation		Nueces
3141	Randy J. Corporron et. al.	8	0	12/1965	Irrigation		McMullen
3142	WL Flowers Machine & Welding Co.	132	100	12/1958	Irrigation		McMullen
3143	Ted W. True et. al.	220	40	12/1958	Irrigation		McMullen
3144	Edwin & Patsy Dunn Singer	120	285	2/1969	Recreation and Irrigation		McMullen
3204	Richard P. Horton	233	0	12/1963	Irrigation		McMullen
3205	Richard P. Horton	103	122	12/1963	Irrigation		McMullen
3206	James L. House Trust	123	0	12/1966	Irrigation		McMullen
3214	Nueces River Authority and City of Corpus Christi	139,000	700,000	7/1976	Municipal (43%) Industrial (57%) Irrigation (minimal)	Choke Canyon Reservoir	Nueces/ Live Oak
3215	City of Three Rivers	1,500	2,500	9/1914	Municipal (47%) Irrigation (53%)		Live Oak
4402	City of Taft	600	0	9/1983	Irrigation		San Patricio
5065	Diamond Shamrock Refining[2]	0	0	6/1986	Irrigation		Live Oak
5145	San Miguel Electric Co-Op, Inc.	300	335	12/1990	Industrial		McMullen
5258	Muriell E. McNeill	64	0	9/1989	Irrigation		Live Oak
5509	US Dept. of Interior[3]	0	0	12/1994	Other		San Patricio
5561	City of Mathis	50	0	11/1996	Irrigation		San Patricio
	TOTAL	459,406					

[1] Water right with multiple priority dates. Earliest date shown in table.

[2] Diamond Shamrock irrigation right is used for irrigation from onsite process water return flows. In effect, this permit is for a reuse project.

[3] The U.S. Department of the Interior has a permit to construct and maintain a notch and overflow channel from the Nueces River approximately 5 miles west-northwest of Corpus Christi, Texas for the purpose of redirecting flood flows on the Nueces River into the Rincon Bayou Watershed. The permit does not specify a volume of permissible diversion, and it terminates December 31, 2001.

3.1.5 Interbasin Transfer Permits

A number of interbasin transfer permits exist in the Coastal Bend Regional Planning Area. These permits include authorizations for diversions from river basins north of the planning region into the Nueces River Basin. Both major interbasin transfer permits provide water to the City of Corpus Christi and include supplies from the Lavaca-Navidad and Colorado River Basins. The City of Corpus Christi benefits from an interbasin transfer permit[4] and a contract with the Lavaca-Navidad River Authority (LNRA) to divert up to 41,840 acft/yr from Lake Texana in the Lavaca-Navidad River Basin to the City's O.N. Stevens Water Treatment Plant. This water is delivered to the City via the recently completed Mary Rhodes Pipeline. In addition, the pipeline was designed to convey a second interbasin transfer permit owned by the City of Corpus Christi. The second permit[5] allows the diversion of up to 35,000 acft/yr of run-of-river water on the Colorado River. Analyses of this water right, one of the most senior in the Colorado River Basin, indicate that approximately 32,000 acft/yr is available from this run-of-river right without off-channel storage.[6] Table 3-2 summarizes the major interbasin transfer permits in the Coastal Bend Region.

Table 3-2.
Summary of Major Interbasin Transfer Permits in the Coastal Bend Region

River Basin of Origin	*Name of Interbasin Transfer Permit Holder*	*Description*	*Authorized Diversion (acft/yr)*	*Priority Date*
Lavaca-Navidad	LNRA	Transfer from Lake Texana to lands adjacent river basins including the Nueces River Basin.	46,590[1]	5/1972
Colorado	City of Corpus Christi	Transfer from Garwood Irrigation Co. water right to the City of Corpus Christi.	35,000	11/1900

[1] City of Corpus Christi currently holds a contract with the Lavaca-Navidad River Authority to provide up to 41,840 acft/yr from Lake Texana to the City.

[4] TNRCC, Certificate of Adjudication No. 16-2095C, held by Lavaca-Navidad River Authority and Texas Water Development Board (TWDB), October 21, 1996.
[5] TNRCC, Certificate of Adjudication No. 14-5434B, held by the City of Corpus Christi (via the Garwood Irrigation Company), October 13, 1998.
[6] HDR Engineering, Inc., "Dependability and Impact Analyses of Corpus Christi's Purchase of the Garwood Irrigation Company Water Right," draft report for the City of Corpus Christi, September 1998.

3.1.6 Water Supply Contracts

Many entities within the Coastal Bend Region obtain surface water through water supply contracts. These supplies are usually obtained from entities that have surface water rights to provide a specified or unspecified quantity of water each year to a buyer for an established unit price. The City of Corpus Christi is the largest provider of water supply contracts in the Coastal Bend Region. The City of Corpus Christi supplies water from the CCR/LCC System, including water from Lake Texana via the Mary Rhodes Pipeline, to two major wholesale customers: the San Patricio Municipal Water District and the South Texas Water Authority. Each of these major wholesale customers in turn sells water to other entities within their service area. In addition to the two major wholesale customers, the City of Corpus Christi also provides wholesale raw surface water to a number of smaller customers. Within the Coastal Bend Region, the Nueces County WCID No. 3 also provides wholesale water supplies through contracts with a number of small municipalities and water supply corporations. Figure 3-3 summarizes the major contract relationships in the Coastal Bend Region. These relationships will be revisited in Chapter 4 when comparisons of supplies and demands in the region are presented.

3.1.7 Major Water Providers

The Coastal Bend Regional Water Planning Group (CBRWPG) has designated two entities as Major Water Providers. These include the City of Corpus Christi and the San Patricio Municipal Water District (SPMWD). Based on recent water use records, the City of Corpus Christi supplies about 53 percent of the municipal and industrial water demand in the region (not including supplies to SPMWD). The SPMWD purchases 100 percent of its water from the City of Corpus Christi and subsequently treats and distributes water to numerous entities. The SPMWD supplies about 20 percent of the municipal and industrial water demand in the region. No other single entity is currently providing more than 5 percent of the municipal and industrial water demand in the region. As for water supply planning, each Water User Group in the region was analyzed to the same level of detail to ensure that the needs of the entire region are met. If in the future the CBRWPG deems it necessary, the CBRWPG reserves the right to revisit major water provider designations during subsequent planning efforts.

3.2 Reliability of Surface Water Supply

Hydrologic conditions are a primary factor that affects the reliability of a water right. Severe drought periods have been experienced in all areas of the Coastal Bend Region. The drought of record for most areas of the region occurred in the 1950s with other smaller duration drought periods occurring in the 1960s, 1970s, and 1980s. With respect to the CCR/LCC System, recent studies indicate that the 1990s drought appears to be the most severe on record.[7] In fact, the two reservoirs in the CCR/LCC System have not yet fully recovered from the current drought indicating that the drought continues today.

The reliability of a water right is typically represented in terms of the percent of time that a specific quantity of water is available for diversion and use. Municipal and industrial water suppliers typically require a very high reliability for their water sources. In most cases, interruptions to water supply is not acceptable, requiring the reliability of the supply to be 100 percent of the time. Municipal and industrial supplies are commonly based on firm yield. Firm yield is defined as the quantity of water that can be diverted for use during a repeat of the most severe drought of record without interruption of service. For purposes of this study and as required by Texas Water Development Board (TWDB) rules, firm yield was used for municipal water supplies in order to provide a common basis for comparison.

The firm yield of run-of-river water rights was based on the minimum annual supply that could be diverted over a historical period of record. For reservoirs, the firm yield may decrease over time as a result of sedimentation. Rivers and streams naturally carry sediment from upstream to downstream. When a reservoir is constructed on the stream channel, the sediment will fall out of suspension and accumulate on the bottom of the reservoir. This accumulation reduces the volume of water that can be stored in the reservoir, which in turn reduces the firm yield available for diversion. Sedimentation rates for the CCR/LCC System have been measured over a period of time and estimated sedimentation rates are well documented.[8] For the 50-year planning period, the reduction in firm yield for future sedimentation was considered. Firm yield for the CCR/LCC System is presented for both the year 2000 and for the year 2050.

[7] HDR, "Water Supply Update for City of Corpus Christi Service Area," City of Corpus Christi, January 1999.

[8] HDR, Op. Cit., January 1999.

3.3 Surface Water Availability

Two computer models were used to evaluate the water rights in the Nueces River Basin and within the Coastal Bend Region. The first model was a version of the Water Rights Analysis Package (WRAP) computer model developed by HDR Engineering, Inc. (HDR) for the TNRCC as part of its Water Availability Modeling (WAM) Program.[9] The WRAP model is designed for use as a water resources management tool. The model can be used to evaluate the reliability of existing water rights and to determine unappropriated streamflow potentially available for a new water right permit. WRAP simulates the management and use of streamflow and reservoirs over a historical period of record, adhering to the water right priority system. The second model used in determining surface water rights availability in the Nueces River Basin was the Lower Nueces River Basin and Estuary Model (NUBAY) developed for the City of Corpus Christi under previous studies.[10] The NUBAY model focuses on the operations of the CCR/LCC System and is capable of simulating this system subject to the City of Corpus Christi's Phased Operations Plan and the 1995 Agreed Order governing freshwater inflow passage to the Nueces Estuary. The NUBAY model was used to estimate the firm yield of the CCR/LCC System and the WRAP model was used to determine the availability of water to all other rights on the Nueces River and its tributaries within the Coastal Bend Region. A summary of the water rights and their firm yield availability is presented in Table 3-3. These surface water supplies served as a basis for the supply and demand comparisons in Chapter 4.

3.4 Groundwater Availability

The Coastal Bend Region includes parts of four aquifers—two major (Gulf Coast and Carrizo-Wilcox Aquifers) and two minor (Queen City and Sparta Aquifers). Figure 3-1 shows the locations of the major aquifers. Table 3-4 summarizes the groundwater availability on a sustained yield basis, by aquifer, in the planning region. Of the four aquifers, the Gulf Coast Aquifer underlies each of the eleven counties in the planning region, is the primary groundwater resource in the Coastal Bend Region, and is capable of providing more than 85 percent of the region's groundwater supply.

[9] HDR, "Water Availability in the Nueces River Basin," TNRCC, October 1999.
[10] HDR, Op. Cit., January 1999.

Table 3-3.
Surface Water Rights Availability
Nueces River Basin Water Rights in the Coastal Bend Region

Water Right Owner	Annual Permitted Diversion Volume (acft/yr)	Firm Yield[1] (acft)	Type Of Use	Priority Date	County
City of Corpus Christi and Nueces River Authority	485,738[2]	209,700[3] (224,000)[4]	Municipal & Industrial	5/1913[5]	Nueces
Reality Traders & Exchange, Inc.	20	0	Irrigation	10/1952	San Patricio
Wayne Shambo	140	0	Irrigation	10/1952	San Patricio
Nueces Co. WCID No. 3	4,246 7,300 11,546	3,666 3,438 7,104	Municipal Irrigation	2/1909[5]	Nueces
Garnett T. & Patsy A. Brooks	221	0	Irrigation	2/1964	San Patricio
CE Coleman Estate	27	0	Irrigation	2/1964	Nueces
Ila M. Noakes Lindgreen	101	0	Irrigation	2/1964	Nueces
Randy J. Corporron et. al.	8	0	Irrigation	12/1965	McMullen
WL Flowers Machine & Welding Co.	132	6	Irrigation	12/1958	McMullen
Ted W. True et. al.	220	0	Irrigation	12/1958	McMullen
Edwin & Patsy Dunn Singer	120	0	Recreation & Irrigation	2/1969	McMullen
Richard P. Horton	336	0	Irrigation	12/1963	McMullen
James L. House Trust	123	0	Irrigation	12/1966	McMullen
City of Three Rivers	700 800 1,500	700 800 1,500	Municipal Industrial	9/1914	Live Oak
City of Taft	600	0	Irrigation	9/1983	San Patricio
Diamond Shamrock Refining	0[6]	0	Irrigation	6/1986	Live Oak
San Miguel Electric Co-Op, Inc.	300	0	Industrial	12/1990	McMullen
Muriell E. McNeill	64	0	Irrigation	9/1989	Live Oak
US Dept. of Interior	0[7]	0	Other	12/1994	San Patricio
City of Mathis	50	0	Irrigation	11/1996	San Patricio
TOTAL	501,246	218,310			

[1] Firm yield computed assuming 2050 sediment accumulation in all reservoirs.
[2] Corpus Christi annual permitted diversion includes CCR/LCC System (443,898 acft/yr) and LNRA contracts with Corpus Christi (41,840 acft/yr).
[3] Corpus Christi minimum annual supply equals computed 2050 firm yield of the CCR/LCC System with Lake Texana water as per HDR, "Water Supply Update for City of Corpus Christi Service Area," January 1999.
[4] Corpus Christi minimum annual supply in 2000 with Lake Texana water.
[5] Water right with multiple priority dates. Earliest date shown in table.
[6] Diamond Shamrock irrigation right is for irrigation from on-site process water return flows. In effect, this permit is for a reuse project.
[7] The U.S. Department of the Interior has a permit to construct and maintain a notch and overflow channel from the Nueces River approximately 5 miles west-northwest of Corpus Christi, Texas for the purpose of redirecting flood flows on the Nueces River into the Rincon Bayou Watershed. The permit does not specify a volume of permissible diversion, and it terminates December 31, 2001.

Table 3-4.
Groundwater Availability from Aquifers within the Coastal Bend Region

Aquifer	2050 Availability (acft/yr)
Gulf Coast	72,900[1]
Carrizo-Wilcox	10,702[2]
Queen City	1,105[2]
Sparta	600[2]
Total	85,307

[1] Source: Groundwater model analysis as part of CBRWPG (see Appendix C).
[2] TWDB, "Water for Texas," August 1997. (Data supporting the 1997 Texas State Water Plan.)

3.4.1 Gulf Coast Aquifer

The Gulf Coast Aquifer underlies all counties within the Coastal Bend Region and yields moderate to large amounts of fresh and slightly saline water. The Gulf Coast Aquifer, extending from Northern Mexico to Florida, is comprised of four water-bearing formations: Catahoula, Jasper, Evangeline, and Chicot. The Evangeline and Chicot Aquifers are the uppermost water-bearing formations, are the most productive and, consequently, are the formations utilized most commonly. The Evangeline Aquifer of the Gulf Coast Aquifer System features the highly transmissive Goliad Sands. The Chicot Aquifer is comprised of many different geologic formations; however, the Beaumont and Lissie formations are predominant in the Coastal Bend area.

As part of the planning process in the Coastal Bend Region, a three-dimensional numerical groundwater flow model was developed to simulate steady-state, predevelopment and developed flow in the Gulf Coast Aquifer along the south Texas Gulf Coast and to assist in the determination of groundwater availability for the region. Steady-state, predevelopment flow conditions represent the state of the aquifer prior to development as a water supply source. Under these conditions, inflow from recharge is assumed to be equal to outflow to adjacent aquifers or other discharge areas and no significant diversion (pumpage) from aquifer storage is occurring. Under developed flow conditions, existing well fields and measured drawdowns are used to calibrate the aquifer parameters. The model consists of five layers with 10,000-foot grid spacing and extends from the Navidad River to Willacy County and inland from the Gulf of Mexico to the updip limit of the Jasper Aquifer.

The study area consists of approximately 20,000 square miles, covering all or part of Lavaca, Jackson, Calhoun, DeWitt, Victoria, Karnes, Goliad, Refugio, Aransas, San Patricio, Bee, Live Oak, McMullen, Duval, Jim Wells, Nueces, Kleberg, Kenedy, Brooks, Jim Hogg, Webb, Starr, Hidalgo, and Willacy Counties in coastal Texas. For more detail regarding the new Gulf Coast Aquifer model development and application, please refer to Appendix C.

The calibrated and verified steady-state groundwater flow model discussed in Appendix C was used to run a number of groundwater availability simulations subject to acceptable drawdown and water quality constraints, as based on the following criteria adopted by the CBRWPG:

1. Long-term (sustainable) pumping simulations (i.e., steady-state model simulation).
2. In the unconfined aquifer:
    a. Water level declines were limited to no more than 125 feet below predevelopment levels; and
    b. A minimum saturated thickness of 150 feet.
3. In the confined aquifer:
    a. Water level declines were limited to no more than 250 feet below predevelopment levels; and
    b. Water level declines were not to exceed 62.5 percent of the elevation difference between predevelopment flow heads and the top of the aquifer.
4. Total dissolved solids concentrations less than 1,500 ppm.

Based on these criteria, the available groundwater for the planning region was determined. The resulting groundwater available by county in the Coastal Bend Region is presented in Table 3-5 and was adopted by the CBRWPG. It is important to note that these availabilities are long-term (sustainable) yields. In addition, should projects be proposed outside the CBRWPG setting, the CBRWPG requests that site-specific analyses be performed by the project participants to demonstrate to the CBRWPG that no long-term detrimental impacts to the aquifer will result from said “over-pumpage”.

Table 3-5.
Groundwater Available from
the Gulf Coast Aquifer
within the Coastal Bend Region

County	2050 Availability (acft/yr)
Aransas	450
Bee	14,900
Brooks	3,250
Duval	3,400
Jim Wells	5,750
Kenedy	12,700
Kleberg	9,700
Live Oak	4,750
McMullen	1,200
Nueces	2,100
San Patricio	14,700
Total	72,900

3.4.2 Carrizo-Wilcox Aquifer

Three counties within the Coastal Bend Region have significant Carrizo-Wilcox Aquifer reserves available to them. The Carrizo-Wilcox Aquifer contains moderate to large amounts of either fresh or slightly saline water. Slightly saline water is defined as water that contains 1,000 to 3,000 mg/L of dissolved solids. Although this aquifer reaches from the Rio Grande River north into Arkansas, it only underlies parts of McMullen, Live Oak, and Bee Counties within the Coastal Bend Region. In this downdip portion of the Carrizo-Wilcox Aquifer, the water is soft, hot (140 degrees Fahrenheit), and contains more dissolved solids than in updip parts of the aquifer. Long-term groundwater available from the Carrizo-Wilcox in the region is summarized in Table 3-6. Groundwater availabilities are based on TWDB analyses.[11]

[11] TWDB, "Water for Texas," August 1997. (Data supporting the 1997 Texas State Water Plan.)

Table 3-6.
Groundwater Available from
the Carrizo-Wilcox Aquifer
within the Coastal Bend Region

County	2050 Availability (acft/yr)
Bee	394
Live Oak	2,399
McMullen	7,909
Total	10,702

3.4.3 Queen City and Sparta Aquifers

The Queen City and Sparta Aquifers are classified by the TWDB as minor aquifers and underlie McMullen County. The Queen City is a thick sand and sandy clay aquifer and runs from its southern boundary in Frio and LaSalle Counties northeasterly towards Louisiana. The Queen City Aquifer supplies small to moderate amounts of either fresh or slightly saline water in the Coastal Bend Region. The Sparta Aquifer is composed of interbedded sands and clays that yield small to moderate quantities with fresh to slightly saline quality. Long-term groundwater available from these aquifers, as tabulated by the TWDB,[12] is summarized in Table 3-7.

Table 3-7.
Groundwater Available from
the Queen City and Sparta Aquifers
within the Coastal Bend Region

County	Aquifer	2050 Availability (acft/yr)
McMullen	Queen City	1,105
McMullen	Sparta	600
Total		1,705

[12] Ibid.

3.4.4 Summary of Groundwater Availability

Groundwater resources in the Coastal Bend Region are made up of supplies from the Gulf Coast, Carrizo-Wilcox, Queen City, and Sparta Aquifers. Long-term (sustainable) yield from the aquifers, based on recent modeling of the Gulf Coast Aquifer (Appendix C) and estimates from the TWDB,[13] are summarized in Table 3-8. These availabilities were used in supply and demand comparisons in Chapter 4.

Table 3-8.
Total Groundwater Available in the Coastal Bend Region by County

County	2050 Groundwater Availability (acft/yr)				
	Gulf Coast Aquifer	Carrizo-Wilcox Aquifer	Queen City Aquifer	Sparta Aquifer	Total
Aransas	450	0	0	0	450
Bee	14,900	394	0	0	15,294
Brooks	3,250	0	0	0	3,250
Duval	3,400	0	0	0	3,400
Jim Wells	5,750	0	0	0	5,750
Kenedy	12,700	0	0	0	12,700
Kleberg	9,700	0	0	0	9,700
Live Oak	4,750	2,399	0	0	7,149
McMullen	1,200	7,909	1,105	600	10,814
Nueces	2,100	0	0	0	2,100
San Patricio	14,700	0	0	0	14,700
Total	72,900	10,702	1,105	600	85,307

3.5 Drought Response

Texas Water Code Sections 16.053(e)(3)(A) and 31 TAC 357.5(e)(7) require that, for each source of water supply in the regional water planning area designated in accordance with 31 TAC 357.7(a)(1), the regional water plan shall identify: (A) factors specific to each source of

[13] Ibid.

water supply to be considered in determining whether to initiate a drought response; and (B) actions to be taken as part of the response. Table 3-9 summarizes the drought contingency plan of the City of Corpus Christi (a major water provider) and shows both trigger conditions and actions to be taken. Through water purchase agreements, the customers of the City of Corpus Christi are required to implement similar water conservation measures when conditions warrant. Table 3-10 includes a summary of drought contingency plans for entities supplied by groundwater, within the Region.

Supplies from other surface water sources such as run-of-river water rights are determined on the basis of minimum year availability and firm yield, respectively. Hence, the current surface water supplies presented herein are, by TWDB definition, dependable during drought. Factors that are typically considered in initiating drought response for surface water sources are streamflow and reservoir storage as they may be conveniently measured and monitored. In contrast to groundwater sources, water right priority with respect to other rights and special permit conditions regarding minimum instream flows can also be important factors in determining whether to initiate drought responses for surface water sources. In the Nueces River Basin, coordination with the TNRCC Watermaster is an essential drought response for all entities dependent upon surface water supply sources.

3.6 Potential for Emergency Transfers of Surface Water

TWDB Rules, Section 357.5(i) direct that the RWPG include recommendations for the emergency transfer of surface water and further direct that a determination be made of the portion of each right for non-municipal use that may be transferred without causing unreasonable damage to the property of the non-municipal water right holder. SB1, Section 3.03 amends Texas Water Code Section 11.139 and allows the Executive Director of TNRCC, after notice to the Governor, to issue emergency permits or temporarily suspend or amend permit conditions without notice or hearing to address emergency conditions for a limited period of not more than 120 days if an imminent threat to public health and safety exists. A person desiring to obtain an emergency authorization is required to justify the request to TNRCC. If TNRCC determines the request is justified, it may issue an emergency authorization without notice and hearing, or with notice and hearing, if practicable. Applicants for emergency authorizations are required to pay fair market value for the water they are allowed to divert, as well as any damages caused by the transfer. In transferring the quantity of water pursuant to an emergency authorization request, the Executive Director, or the TNRCC, shall allocate the requested quantity among two or more water rights held for purposes other than domestic or municipal purposes.

Surface water availability models have been developed for the streams of Coastal Bend Region (Region N) in which the locations, quantities, and firm yields of the surface water rights of the region have been determined (Table 3-3). The Regional Water Plan incorporates Table 3-3 as a primary source of information to water user groups and the TNRCC for use in cases of emergencies that result in a threat to public health and safety. Water user groups who are located in proximity to one or more existing surface water diversion permits for non-municipal use can readily estimate quantities of water that might be available for emergency use applications, and TNRCC may also consider Table 3-3 in its administration of this provision of SB1.

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

4.1 Introduction

In this section, the demand projections from Section 2 and the supply projections from Section 3 are brought together to estimate projected water needs in the Coastal Bend Region for the next 50 years. As a recap, Section 2 presented demand projections for six types of use: municipal, manufacturing, steam-electric, mining, irrigation, and livestock. The projections are for dry year demands. Municipal water demand projections are shown for each city with a population of more than 1,000 and for the County-Other category in each county. Section 3 presented surface water availability by water right and groundwater availability by aquifer.

In Section 4.3, for each of the eleven counties in the Coastal Bend Region there is a summary page that highlights specific supply and demand information, followed by two tables. The first table contains supply and demand comparisons for the six types of water use; the second table contains supply and demand comparisons for the municipal water user groups in the county.

Section 4.4 summarizes the water supply and demand picture for the entire region, focusing on those cities and other uses that have immediate and/or long-term needs.

4.2 Allocation Methodology

Surface water and groundwater availability was allocated among the six user groups using the methods explained below.

4.2.1 Surface Water Allocation

Surface water in the region available to meet projected demands consists of firm yield of reservoirs, dependable supply of run-of-river water rights through drought of record conditions, and local on-farm sources. Surface water rights were allocated as supplies to their stated type of use: municipal, industrial (manufacturing, steam-electric & mining), and irrigation. Municipal supply was further allocated among cities and other municipal water supply entities. This was done by obtaining water seller information (i.e., which right holders—a wholesaler—are reselling water to other water supply entities) and water purchase contract limits between buyers and sellers, provided by the TWDB. In most cases, for those cities purchasing water on a wholesale basis the contract amount remains constant through 2050. In some instances—Alice, Beeville, Bishop, Kingsville and Mathis—contract amounts were increased to meet demands, which is consistent with the terms of the present contracts. The tables also reflect San Patricio Municipal Water District (SPMWD) meeting the demands of its customers. It was also assumed that water associated with a wholesaler that is not re-sold, remains as an available supply to the wholesaler. In the case where a wholesaler's supply is deficient to meet its own demands and contract requirements, it was assumed that contracts were met in full, and any shortage is shown in the wholesaler's projections. For a diagram of how the surface water in the Coastal Bend Region is distributed, please refer to Figure 4-1.

Two situations deserve special attention. The City of Corpus Christi has 209,700 acft in available supply in 2050, through its own water right in the Choke Canyon Reservoir/Lake Corpus Christi (CCR/LCC) System and a contract with the Lavaca-Navidad River Authority from Lake Texana. The City also has a permit to divert up to 35,000 acft per year of run-of-river water under its interbasin transfer permit on the Colorado River (via the Garwood Irrigation Co.). While the City owns the water right on the Colorado River, it does not have the facilities to divert this water and convey it to the City. Therefore, under the rules governing the regional water planning process, this water is not a current water supply. The facilities to deliver Colorado River water to the region will be analyzed as a water supply option in Section 5 (see Section 5A.13).

From this availability—CCR/LCC System and Lake Texana—Corpus Christi supplies its municipal customers (Figure 4-1), manufacturing and steam-electric in Nueces County, and manufacturing in Aransas and San Patricio Counties. All remaining water is shown as an available supply to meet the City's own demands.

SPMWD has a contract to buy 42,594 acft of raw and treated water from the City of Corpus Christi. In addition to supplying it's municipal customers (Figure 4-1), SPMWD supplies manufacturing in Aransas and San Patricio Counties.

In most cases, local surface water supply from stock ponds and streams was shown to be available to meet livestock needs when groundwater supplies were insufficient to meet those demands. Generally, these ponds are not large enough to require a water rights permit (>200 acft of storage).

4.2.2 Groundwater Allocation

Total groundwater availability in the region was determined based on the long-term sustainable pumpage of each of the aquifers in the region. This total groundwater availability was shown for each county, by aquifer, in Table 3-8. For each county, total available groundwater was allocated among the six user groups—municipal, manufacturing, steam-electric, mining, irrigation, and livestock—in the following manner:

- Using TWDB records, user groups relying on groundwater supply were determined.
- Allocation percentages for each user group using groundwater were made based on their reported 1997 groundwater use.
- Allocation percentages were used to distribute sustainable groundwater pumpage estimates in each county to each user group in each county.

Groundwater distributed to municipal use was further redistributed to cities and County-Other. For each county, this was done in the following manner:

- Using TWDB records, cities and County-Other relying on groundwater supply were determined.
- Allocation percentages for each city and County-Other using groundwater were made based on reported 1997 groundwater use.
- Allocation percentages were used to distribute sustainable groundwater pumpage estimates to each municipality and County-Other category.
- For each city current well capacities were compared to peak daily demands; those cities with insufficient well capacities to meet peak daily demands have been footnoted in the Municipal Demand Tables (as per TWDB guidelines).

4.3 County Summaries – Comparison of Demand to Supply

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4.3.1 Comparison of Demand to Supply – Aranshas County

Demands

- For the period 2000 to 2050, municipal demand increases from 3,825 acft in 2000 to 7,513 acft in 2050.
- Manufacturing demand increases from 352 acft to 810 acft from 2000 to 2050
- There is no irrigation demand projected; livestock demand is constant at 38 acft.

Supplies

- Surface water is supplied from the CCR/LCC System by the City of Corpus Christi via the SPMWD.
- Groundwater supplies are from the Gulf Coast Aquifer.

Comparison of Demand to Supply

- There are sufficient municipal supplies through 2050.
- There are mining shortages through 2010, but due to decreasing demands, supplies beyond that point are sufficient to meet demands.

Table 4-1.
Aransas County
Population, Water Supply, and Water Demand Projections

Population Projection	2000	2010	2020	2030	2040	2050
	23,095	30,112	36,216	42,275	48,394	55,413

	Supply and Demand by Type of Use	2000 (acft)	2010 (acft)	2020 (acft)	2030 (acft)	2040 (acft)	2050 (acft)
Municipal	Municipal Demand	3,825	4,582	5,137	5,860	6,617	7,513
	Municipal Supply						
	Groundwater	258	258	258	258	258	258
	Surface water	3,567	4,324	4,879	5,602	6,359	7,255
	Total Municipal Supply	3,825	4,582	5,137	5,860	6,617	7,513
	Municipal Surplus (Shortage)	0	0	0	0	0	0
Industrial	Manufacturing Demand	352	430	497	572	684	810
	Manufacturing Supply						
	Groundwater	115	115	115	115	115	115
	Surface water	237	315	382	457	569	695
	Total Manufacturing Supply	352	430	497	572	684	810
	Manufacturing Surplus (Shortage)	0	0	0	0	0	0
	Steam-Electric Demand	0	0	0	0	0	0
	Steam-Electric Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	0	0	0	0	0	0
	Total Steam-Electric Supply	0	0	0	0	0	0
	Steam-Electric Surplus (Shortage)	0	0	0	0	0	0
	Mining Demand	119	85	57	29	14	7
	Mining Supply						
	Groundwater	73	73	73	73	73	73
	Surface water	0	0	0	0	0	0
	Total Mining Supply	73	73	73	73	73	73
	Mining Surplus (Shortage)	(46)	(12)	16	44	59	66
Agriculture	Irrigation Demand	0	0	0	0	0	0
	Irrigation Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	0	0	0	0	0	0
	Total Irrigation Supply	0	0	0	0	0	0
	Irrigation Surplus (Shortage)	0	0	0	0	0	0
	Livestock Demand	38	38	38	38	38	38
	Livestock Supply						
	Groundwater	4	4	4	4	4	4
	Surface water	34	34	34	34	34	34
	Total Livestock Supply	38	38	38	38	38	38
	Livestock Surplus (Shortage)	0	0	0	0	0	0
Total	Municipal & Industrial Demand	4,296	5,097	5,691	6,461	7,315	8,330
	Municipal & Industrial Supply						
	Groundwater	446	446	446	446	446	446
	Surface water	3,804	4,639	5,261	6,059	6,928	7,950
	Total Municipal & Industrial Supply	4,250	5,085	5,707	6,505	7,374	8,396
	Municipal & Industrial Surplus (Shortage)	(46)	(12)	16	44	59	66
	Agriculture Demand	38	38	38	38	38	38
	Agriculture Supply						
	Groundwater	4	4	4	4	4	4
	Surface water	34	34	34	34	34	34
	Total Agriculture Supply	38	38	38	38	38	38
	Agriculture Surplus (Shortage)	0	0	0	0	0	0
	Total Demand	4,334	5,135	5,729	6,499	7,353	8,368
	Total Supply						
	Groundwater	450	450	450	450	450	450
	Surface water	3,838	4,673	5,295	6,093	6,962	7,984
	Total Supply	4,288	5,123	5,745	6,543	7,412	8,434
	Total Surplus (Shortage)	(46)	(12)	16	44	59	66

Table 4-2.
Aransas County
Municipal Water Demand & Supply By City
(acft)

City	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
ARANSAS PASS (P)						
Demand	145	141	146	161	176	193
Supply	145	141	146	161	176	193
Groundwater	—	—	—	—	—	—
Surface water	145	141	146	161	176	193
Surplus (Shortage)	—	—	—	—	—	—
FULTON						
Demand	136	132	131	131	130	132
Supply	136	132	131	131	130	132
Groundwater	—	—	—	—	—	—
Surface water	136	132	131	131	130	132
Surplus (Shortage)	—	—	—	—	—	—
ROCKPORT						
Demand	1,734	1,888	2,080	2,339	2,656	3,001
Supply	1,734	1,888	2,080	2,339	2,656	3,001
Groundwater	—	—	—	—	—	—
Surface water	1,734	1,888	2,080	2,339	2,656	3,001
Surplus (Shortage)	—	—	—	—	—	—
COUNTY-OTHER						
Demand	1,810	2,421	2,780	3,229	3,655	4,187
Supply	1,810	2,421	2,780	3,229	3,655	4,187
Groundwater	258	258	258	258	258	258
Surface water	1,552	2,163	2,522	2,971	3,397	3,929
Surplus (Shortage)	—	—	—	—	—	—
Total for Aransas County						
Demand	3,825	4,582	5,137	5,860	6,617	7,513
Supply	3,825	4,582	5,137	5,860	6,617	7,513
Groundwater	258	258	258	258	258	258
Surface water	3,567	4,324	4,879	5,602	6,359	7,255
Surplus (Shortage)	—	—	—	—	—	—

(P) Indicates city is in multiple counties. Projections shown are for Aransas County portion only.

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4.3.2 Comparison of Demand to Supply – Bee County

Demands

- For the period 2000 to 2050, municipal demand increases from 4,443 acft in 2000 to 5,309 acft in 2050.
- Manufacturing demand increases from 1 acft to 3 acft from 2000 to 2050
- For the period 2000 to 2050, irrigation demand decreases from 3,048 acft to 1,583 acft; livestock demand is constant at 838 acft.

Supplies

- Surface water is provided to the City of Beeville from the City of Corpus Christi.
- Groundwater supplies are from the Gulf Coast and Carrizo-Wilcox Aquifers.

Comparison of Demand to Supply

- There are sufficient municipal, industrial, and agricultural supplies through 2050; overall surplus increases from 9,762 acft in 2000 to 11,072 acft in 2050 due primarily to projected decreases in irrigation demand.

Table 4-3. Bee County Population, Water Supply, and Water Demand Projections

Population Projection	2000	2010	2020	2030	2040	2050
	28,291	31,256	34,386	37,002	39,567	42,188

	Supply and Demand by Type of Use	2000 (acft)	2010 (acft)	2020 (acft)	2030 (acft)	2040 (acft)	2050 (acft)
Municipal	Municipal Demand	4,443	4,485	4,593	4,804	5,038	5,309
	Municipal Supply						
	Groundwater	10,032	10,032	10,032	10,032	10,032	10,032
	Surface water	2,408	2,422	2,542	2,712	2,898	3,097
	Total Municipal Supply	12,440	12,454	12,574	12,744	12,930	13,129
	Municipal Surplus (Shortage)	7,997	7,969	7,981	7,940	7,892	7,820
Industrial	Manufacturing Demand	1	1	2	2	2	3
	Manufacturing Supply						
	Groundwater	4	4	4	4	4	4
	Surface water	0	0	0	0	0	0
	Total Manufacturing Supply	4	4	4	4	4	4
	Manufacturing Surplus (Shortage)	3	3	2	2	2	1
	Steam-Electric Demand	0	0	0	0	0	0
	Steam-Electric Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	0	0	0	0	0	0
	Total Steam-Electric Supply	0	0	0	0	0	0
	Steam-Electric Surplus (Shortage)	0	0	0	0	0	0
	Mining Demand	24	14	8	3	0	0
	Mining Supply						
	Groundwater	124	124	124	124	124	124
	Surface water	0	0	0	0	0	0
	Total Mining Supply	124	124	124	124	124	124
	Mining Surplus (Shortage)	100	110	116	121	124	124
Agriculture	Irrigation Demand	3,048	2,674	2,345	2,058	1,805	1,583
	Irrigation Supply						
	Groundwater	4,710	4,710	4,710	4,710	4,710	4,710
	Surface water	0	0	0	0	0	0
	Total Irrigation Supply	4,710	4,710	4,710	4,710	4,710	4,710
	Irrigation Surplus (Shortage)	1,662	2,036	2,365	2,652	2,905	3,127
	Livestock Demand	838	838	838	838	838	838
	Livestock Supply						
	Groundwater	424	424	424	424	424	424
	Surface water	414	414	414	414	414	414
	Total Livestock Supply	838	838	838	838	838	838
	Livestock Surplus (Shortage)	0	0	0	0	0	0
Total	Municipal & Industrial Demand	4,468	4,500	4,603	4,809	5,040	5,312
	Municipal & Industrial Supply						
	Groundwater	10,160	10,160	10,160	10,160	10,160	10,160
	Surface water	2,408	2,422	2,542	2,712	2,898	3,097
	Total Municipal & Industrial Supply	12,568	12,582	12,702	12,872	13,058	13,257
	Municipal & Industrial Surplus (Shortage)	8,100	8,082	8,099	8,063	8,018	7,945
	Agriculture Demand	3,886	3,512	3,183	2,896	2,643	2,421
	Agriculture Supply						
	Groundwater	5,134	5,134	5,134	5,134	5,134	5,134
	Surface water	414	414	414	414	414	414
	Total Agriculture Supply	5,548	5,548	5,548	5,548	5,548	5,548
	Agriculture Surplus (Shortage)	1,662	2,036	2,365	2,652	2,905	3,127
	Total Demand	8,354	8,012	7,786	7,705	7,683	7,733
	Total Supply						
	Groundwater	15,294	15,294	15,294	15,294	15,294	15,294
	Surface water	2,822	2,836	2,956	3,126	3,312	3,511
	Total Supply	18,116	18,130	18,250	18,420	18,606	18,805
	Total Surplus (Shortage)	9,762	10,118	10,464	10,715	10,923	11,072

Table 4-4.
Bee County
Municipal Water Demand & Supply By City
(acft)

City	***2000***	***2010***	***2020***	***2030***	***2040***	***2050***
BEEVILLE						
Demand	2,408	2,422	2,542	2,712	2,898	3,097
Supply	2,408	2,422	2,542	2,712	2,898	3,097
Groundwater	—	—	—	—	—	—
Surface water	2,408	2,422	2,542	2,712	2,898	3,097
Surplus (Shortage)	—	—	—	—	—	—
COUNTY-OTHER						
Demand	2,035	2,063	2,051	2,092	2,140	2,212
Supply	10,032	10,032	10,032	10,032	10,032	10,032
Groundwater	10,032	10,032	10,032	10,032	10,032	10,032
Surface water	—	—	—	—	—	—
Surplus (Shortage)	7,997	7,969	7,981	7,940	7,892	7,820
Total for Bee County						
Demand	4,443	4,485	4,593	4,804	5,038	5,309
Supply	12,440	12,454	12,574	12,744	12,930	13,129
Groundwater	10,032	10,032	10,032	10,032	10,032	10,032
Surface water	2,408	2,422	2,542	2,712	2,898	3,097
Surplus (Shortage)	7,997	7,969	7,981	7,940	7,892	7,820

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4.3.3 Comparison of Demand to Supply – Brooks County

Demands

- For the period 2000 to 2050, municipal demand decreases from 3,374 acft in 2000 to 2,284 acft in 2050.
- Mining demand decreases from 129 acft to 55 acft from 2000 to 2050
- For the period 2000 to 2050, irrigation demand decreases from 340 acft to 292 acft; livestock demand is constant at 616 acft.

Supplies

- Surface water for livestock needs is provided from on-farm/local sources.
- Groundwater supplies are from the Gulf Coast Aquifer.

Comparison of Demand to Supply

- Due to limited groundwater availability, the City of Falfurrias has a shortage through 2010, but due to declining demand, the City shows a surplus from that point on through 2050.
- Due to limited groundwater availability, County-Other has an immediate and long-term shortage.
- There are sufficient mining supplies through 2050.
- There are sufficient agricultural supplies through 2050.

Table 4-5.
Brooks County
Population, Water Supply, and Water Demand Projections

Population Projection	2000	2010	2020	2030	2040	2050
	8,981	9,727	10,239	10,385	10,593	10,561

Supply and Demand by Type of Use		2000 (acft)	2010 (acft)	2020 (acft)	2030 (acft)	2040 (acft)	2050 (acft)
Municipal	Municipal Demand	3,374	3,113	3,005	2,738	2,511	2,284
	Municipal Supply						
	Groundwater	2,581	2,581	2,581	2,581	2,581	2,581
	Surface water	0	0	0	0	0	0
	Total Municipal Supply	2,581	2,581	2,581	2,581	2,581	2,581
	Municipal Surplus (Shortage)	(793)	(532)	(424)	(157)	70	297
Industrial	Manufacturing Demand	0	0	0	0	0	0
	Manufacturing Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	0	0	0	0	0	0
	Total Manufacturing Supply	0	0	0	0	0	0
	Manufacturing Surplus (Shortage)	0	0	0	0	0	0
	Steam-Electric Demand	0	0	0	0	0	0
	Steam-Electric Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	0	0	0	0	0	0
	Total Steam-Electric Supply	0	0	0	0	0	0
	Steam-Electric Surplus (Shortage)	0	0	0	0	0	0
	Mining Demand	129	108	92	78	65	55
	Mining Supply						
	Groundwater	130	130	130	130	130	130
	Surface water	0	0	0	0	0	0
	Total Mining Supply	130	130	130	130	130	130
	Mining Surplus (Shortage)	1	22	38	52	65	75
Agriculture	Irrigation Demand	340	329	320	310	301	292
	Irrigation Supply						
	Groundwater	475	475	475	475	475	475
	Surface water	0	0	0	0	0	0
	Total Irrigation Supply	475	475	475	475	475	475
	Irrigation Surplus (Shortage)	135	146	155	165	174	183
	Livestock Demand	616	616	616	616	616	616
	Livestock Supply						
	Groundwater	64	64	64	64	64	64
	Surface water	552	552	552	552	552	552
	Total Livestock Supply	616	616	616	616	616	616
	Livestock Surplus (Shortage)	0	0	0	0	0	0
Total	Municipal & Industrial Demand	3,503	3,221	3,097	2,816	2,576	2,339
	Municipal & Industrial Supply						
	Groundwater	2,711	2,711	2,711	2,711	2,711	2,711
	Surface water	0	0	0	0	0	0
	Total Municipal & Industrial Supply	2,711	2,711	2,711	2,711	2,711	2,711
	Municipal & Industrial Surplus (Shortage)	(792)	(510)	(386)	(105)	135	372
	Agriculture Demand	956	945	936	926	917	908
	Agriculture Supply						
	Groundwater	539	539	539	539	539	539
	Surface water	552	552	552	552	552	552
	Total Agriculture Supply	1,091	1,091	1,091	1,091	1,091	1,091
	Agriculture Surplus (Shortage)	135	146	155	165	174	183
	Total Demand	4,459	4,166	4,033	3,742	3,493	3,247
	Total Supply						
	Groundwater	3,250	3,250	3,250	3,250	3,250	3,250
	Surface water	552	552	552	552	552	552
	Total Supply	3,802	3,802	3,802	3,802	3,802	3,802
	Total Surplus (Shortage)	(657)	(364)	(231)	60	309	555

Table 4-6
Brooks County
Municipal Water Demand & Supply By City
(acft)

City	2000	2010	2020	2030	2040	2050
FALFURRIAS						
Demand	2,486	2,332	2,238	2,054	1,877	1,696
Supply	2,260	2,260	2,260	2,260	2,260	2,260
Groundwater	2,260	2,260	2,260	2,260	2,260	2,260
Surface water	—	—	—	—	—	—
Surplus (Shortage)	(226)	(72)	22	206	383	564
COUNTY-OTHER						
Demand	888	781	767	684	634	588
Supply	321	321	321	321	321	321
Groundwater	321	321	321	321	321	321
Surface water	—	—	—	—	—	—
Surplus (Shortage)	(567)	(460)	(446)	(363)	(313)	(267)
Total for Brooks County						
Demand	3,374	3,113	3,005	2,738	2,511	2,284
Supply	2,581	2,581	2,581	2,581	2,581	2,581
Groundwater	2,581	2,581	2,581	2,581	2,581	2,581
Surface water	—	—	—	—	—	—
Surplus (Shortage)	(793)	(532)	(424)	(157)	70	297

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4.3.4 Comparison of Demand to Supply – Duval County

Demands

- For the period 2000 to 2050, municipal demand increases from 2,407 acft in 2000 to 2,983 acft in 2050.
- Mining demand decreases from 5,012 acft to 3,027 acft from 2000 to 2050
- For the period 2000 to 2050, irrigation demand decreases from 2,540 acft to 2,323 acft; livestock demand is constant at 984 acft.

Supplies

- Surface water for livestock needs is provided from on-farm/local sources.
- Groundwater supplies are from the Gulf Coast Aquifer.

Comparison of Demand to Supply

- Due to limited groundwater availability, the cities of Benavides, Freer, San Diego, and the County-Other have immediate and long-term shortages.
- The cities of Benavides, Freer, and San Diego have well capacities less than their peak day demands.
- Due to limited groundwater availability, mining has an immediate and long-term shortage.
- Due to limited groundwater availability, irrigation has an immediate and long-term shortage.

Table 4-7.
Duval County
Population, Water Supply, and Water Demand Projections

Population Projection	2000	2010	2020	2030	2040	2050
	14,510	16,127	17,647	18,950	20,050	21,054

	Supply and Demand by Type of Use	2000 (acft)	2010 (acft)	2020 (acft)	2030 (acft)	2040 (acft)	2050 (acft)
Municipal	Municipal Demand	2,407	2,529	2,622	2,752	2,845	2,983
	Municipal Supply						
	Groundwater	382	382	382	382	382	382
	Surface water	0	0	0	0	0	0
	Total Municipal Supply	382	382	382	382	382	382
	Municipal Surplus (Shortage)	(2,025)	(2,147)	(2,240)	(2,370)	(2,463)	(2,601)
Industrial	Manufacturing Demand	0	0	0	0	0	0
	Manufacturing Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	0	0	0	0	0	0
	Total Manufacturing Supply	0	0	0	0	0	0
	Manufacturing Surplus (Shortage)	0	0	0	0	0	0
	Steam-Electric Demand	0	0	0	0	0	0
	Steam-Electric Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	0	0	0	0	0	0
	Total Steam-Electric Supply	0	0	0	0	0	0
	Steam-Electric Surplus (Shortage)	0	0	0	0	0	0
	Mining Demand	5,012	3,669	3,053	2,993	2,996	3,027
	Mining Supply						
	Groundwater	1,616	1,616	1,616	1,616	1,616	1,616
	Surface water	0	0	0	0	0	0
	Total Mining Supply	1,616	1,616	1,616	1,616	1,616	1,616
	Mining Surplus (Shortage)	(3,396)	(2,053)	(1,437)	(1,377)	(1,380)	(1,411)
Agriculture	Irrigation Demand	2,540	2,495	2,451	2,408	2,365	2,323
	Irrigation Supply						
	Groundwater	1,378	1,378	1,378	1,378	1,378	1,378
	Surface water	0	0	0	0	0	0
	Total Irrigation Supply	1,378	1,378	1,378	1,378	1,378	1,378
	Irrigation Surplus (Shortage)	(1,162)	(1,117)	(1,073)	(1,030)	(987)	(945)
	Livestock Demand	984	984	984	984	984	984
	Livestock Supply						
	Groundwater	24	24	24	24	24	24
	Surface water	960	960	960	960	960	960
	Total Livestock Supply	984	984	984	984	984	984
	Livestock Surplus (Shortage)	0	0	0	0	0	0
Total	Municipal & Industrial Demand	7,419	6,198	5,675	5,745	5,841	6,010
	Municipal & Industrial Supply						
	Groundwater	1,998	1,998	1,998	1,998	1,998	1,998
	Surface water	0	0	0	0	0	0
	Total Municipal & Industrial Supply	1,998	1,998	1,998	1,998	1,998	1,998
	Municipal & Industrial Surplus (Shortage)	(5,421)	(4,200)	(3,677)	(3,747)	(3,843)	(4,012)
	Agriculture Demand	3,524	3,479	3,435	3,392	3,349	3,307
	Agriculture Supply						
	Groundwater	1,402	1,402	1,402	1,402	1,402	1,402
	Surface water	960	960	960	960	960	960
	Total Agriculture Supply	2,362	2,362	2,362	2,362	2,362	2,362
	Agriculture Surplus (Shortage)	(1,162)	(1,117)	(1,073)	(1,030)	(987)	(945)
	Total Demand	10,943	9,677	9,110	9,137	9,190	9,317
	Total Supply						
	Groundwater	3,400	3,400	3,400	3,400	3,400	3,400
	Surface water	960	960	960	960	960	960
	Total Supply	4,360	4,360	4,360	4,360	4,360	4,360
	Total Surplus (Shortage)	(6,583)	(5,317)	(4,750)	(4,777)	(4,830)	(4,957)

Table 4-8.
Duval County
Municipal Water Demand & Supply By City
(acft)

City	2000	2010	2020	2030	2040	2050
BENAVIDES						
Demand	498	521	541	559	569	586
Supply	50	50	50	50	50	50
Groundwater	50	50	50	50	50	50
Surface water	—	—	—	—	—	—
Surplus (Shortage)	(448)	(471)	(491)	(509)	(519)	(536)
FREER						
Demand	723	777	824	892	953	1,035
Supply	109	109	109	109	109	109
Groundwater	109	109	109	109	109	109
Surface water	—	—	—	—	—	—
Surplus (Shortage)	(614)	(668)	(715)	(783)	(844)	(926)
SAN DIEGO (P)						
Demand	707	753	772	835	879	941
Supply	110	110	110	110	110	110
Groundwater(1)	110	110	110	110	110	110
Surface water	—	—	—	—	—	—
Surplus (Shortage)	(597)	(643)	(662)	(725)	(769)	(831)
COUNTY-OTHER						
Demand	479	478	485	466	444	421
Supply	113	113	113	113	113	113
Groundwater	113	113	113	113	113	113
Surface water	—	—	—	—	—	—
Surplus (Shortage)	(366)	(365)	(372)	(353)	(331)	(308)
Total for Duval County						
Demand	2,407	2,529	2,622	2,752	2,845	2,983
Supply	382	382	382	382	382	382
Groundwater	382	382	382	382	382	382
Surface water	—	—	—	—	—	—
Surplus (Shortage)	(2,025)	(2,147)	(2,240)	(2,370)	(2,463)	(2,601)

(P) Indicates city is in multiple counties. Projections shown are for Aransas County portion only.
(1) Current well capacities are insufficient to meet projected peak day demands.

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4.3.5 Comparison of Demand to Supply – Jim Wells County

Demands

- For the period 2000 to 2050, municipal demand decreases from 7,077 acft in 2000 to 6,881 acft in 2050.
- Mining demand decreases from 327 acft to 22 acft from 2000 to 2050
- For the period 2000 to 2050, irrigation demand decreases from 1,045 acft to 547 acft; livestock demand is constant at 1,073 acft.

Supplies

- Surface water is supplied from the CCR/LCC System by the City of Corpus Christi to the City of Alice; livestock needs are met with on-farm/local sources.
- Groundwater supplies are from the Gulf Coast Aquifer.

Comparison of Demand to Supply

- Due to limited groundwater availability and an increasing demand, the City of Premont has a shortage beginning after 2010 through 2050.
- The City of San Diego has well capacity less than their peak day demand.
- County-Other shows a small, immediate shortage, but because of decreasing demands, County-Other has a surplus after 2000 through 2050.
- There are sufficient mining supplies through 2050.
- There are sufficient industrial supplies through 2050.
- There are sufficient agricultural supplies through 2050.

Table 4-9.
Jim Wells County
Population, Water Supply, and Water Demand Projections

Population Projection	2000	2010	2020	2030	2040	2050
	40,882	43,726	45,874	46,243	46,214	45,788

Type	Supply and Demand by Type of Use	2000 (acft)	2010 (acft)	2020 (acft)	2030 (acft)	2040 (acft)	2050 (acft)
Municipal	Municipal Demand	7,077	7,093	7,069	7,056	6,947	6,881
	Municipal Supply						
	Groundwater	3,970	3,970	3,970	3,970	3,970	3,970
	Surface water	3,420	3,338	3,265	3,234	3,162	3,135
	Total Municipal Supply	7,390	7,308	7,235	7,204	7,132	7,105
	Municipal Surplus (Shortage)	313	215	166	148	185	224
Industrial	Manufacturing Demand	0	0	0	0	0	0
	Manufacturing Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	0	0	0	0	0	0
	Total Manufacturing Supply	0	0	0	0	0	0
	Manufacturing Surplus (Shortage)	0	0	0	0	0	0
	Steam-Electric Demand	0	0	0	0	0	0
	Steam-Electric Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	0	0	0	0	0	0
	Total Steam-Electric Supply	0	0	0	0	0	0
	Steam-Electric Surplus (Shortage)	0	0	0	0	0	0
	Mining Demand	327	212	148	102	59	22
	Mining Supply						
	Groundwater	553	553	553	553	553	553
	Surface water	0	0	0	0	0	0
	Total Mining Supply	553	553	553	553	553	553
	Mining Surplus (Shortage)	226	341	405	451	494	531
Agriculture	Irrigation Demand	1,045	918	806	708	622	547
	Irrigation Supply						
	Groundwater	1,076	1,076	1,076	1,076	1,076	1,076
	Surface water	0	0	0	0	0	0
	Total Irrigation Supply	1,076	1,076	1,076	1,076	1,076	1,076
	Irrigation Surplus (Shortage)	31	158	270	368	454	529
	Livestock Demand	1,073	1,073	1,073	1,073	1,073	1,073
	Livestock Supply						
	Groundwater	151	151	151	151	151	151
	Surface water	922	922	922	922	922	922
	Total Livestock Supply	1,073	1,073	1,073	1,073	1,073	1,073
	Livestock Surplus (Shortage)	0	0	0	0	0	0
Total	Municipal & Industrial Demand	7,404	7,305	7,217	7,158	7,006	6,903
	Municipal & Industrial Supply						
	Groundwater	4,523	4,523	4,523	4,523	4,523	4,523
	Surface water	3,420	3,338	3,265	3,234	3,162	3,135
	Total Municipal & Industrial Supply	7,943	7,861	7,788	7,757	7,685	7,658
	Municipal & Industrial Surplus (Shortage)	539	556	571	599	679	755
	Agriculture Demand	2,118	1,991	1,879	1,781	1,695	1,620
	Agriculture Supply						
	Groundwater	1,227	1,227	1,227	1,227	1,227	1,227
	Surface water	922	922	922	922	922	922
	Total Agriculture Supply	2,149	2,149	2,149	2,149	2,149	2,149
	Agriculture Surplus (Shortage)	31	158	270	368	454	529
	Total Demand	9,522	9,296	9,096	8,939	8,701	8,523
	Total Supply						
	Groundwater	5,750	5,750	5,750	5,750	5,750	5,750
	Surface water	4,342	4,260	4,187	4,156	4,084	4,057
	Total Supply	10,092	10,010	9,937	9,906	9,834	9,807
	Total Surplus (Shortage)	570	714	841	967	1,133	1,284

Table 4-10.
Jim Wells County
Municipal Water Demand & Supply By City
(acft)

City	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
ALICE						
Demand	3,420	3,338	3,265	3,234	3,162	3,119
Supply	3,420	3,338	3,265	3,234	3,162	3,135
Groundwater	—	—	—	—	—	—
Surface water	3,420	3,338	3,265	3,234	3,162	3,135
Surplus (Shortage)	—	—	—	—	—	—
ORANGE GROVE						
Demand	270	273	273	270	265	264
Supply	377	377	377	377	377	377
Groundwater	377	377	377	377	377	377
Surface water	—	—	—	—	—	—
Surplus (Shortage)	107	104	104	107	112	113
PREMONT						
Demand	1,040	1,152	1,292	1,432	1,485	1,557
Supply	1,230	1,230	1,230	1,230	1,230	1,230
Groundwater (1)	1,230	1,230	1,230	1,230	1,230	1,230
Surface water	—	—	—	—	—	—
Surplus (Shortage)	190	78	(62)	(202)	(255)	(327)
SAN DIEGO [(P)]						
Demand	141	135	134	131	128	126
Supply	165	165	165	165	165	165
Groundwater[(1)]	165	165	165	165	165	165
Surface water	—	—	—	—	—	—
Surplus (Shortage)	24	30	31	34	37	39
COUNTY-OTHER						
Demand	2,206	2,195	2,105	1,989	1,907	1,815
Supply	2,198	2,198	2,198	2,198	2,198	2,198
Groundwater	2,198	2,198	2,198	2,198	2,198	2,198
Surface water	—	—	—	—	—	—
Surplus (Shortage)	(8)	3	93	209	291	383
Total for Jim Wells County						
Demand	7,077	7,093	7,069	7,056	6,947	6,881
Supply	7,390	7,308	7,235	7,204	7,132	7,105
Groundwater	3,970	3,970	3,970	3,970	3,970	3,970
Surface water	3,420	3,338	3,265	3,234	3,162	3,135
Surplus (Shortage)	313	215	166	148	185	224

[(P)] Indicates city is in multiple counties. Projections shown are for Aransas County portion only.
[(1)] Current well capacities are insufficient to meet projected peak day demands.

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4.3.6 Comparison of Demand to Supply – Kenedy County

Demands

- For the period 2000 to 2050, municipal demand decreases from 61 acft in 2000 to 37 acft in 2050.
- Mining demand decreases from 3 acft to 0 acft from 2000 to 2050
- For the period 2000 to 2050 livestock demand is constant at 712 acft.

Supplies

- There are no surface water supplies in the county.
- Groundwater supplies are from the Gulf Coast Aquifer.

Comparison of Demand to Supply

- Due to abundant groundwater availability and small demands, the county has a surplus of about 11,900 acft through 2050.

Table 4-11. Kenedy County Population, Water Supply, and Water Demand Projections

Population Projection	2000	2010	2020	2030	2040	2050
	485	520	504	457	405	357

	Supply and Demand by Type of Use	2000 (acft)	2010 (acft)	2020 (acft)	2030 (acft)	2040 (acft)	2050 (acft)
Municipal	Municipal Demand	61	61	56	48	42	37
	Municipal Supply						
	Groundwater	6,735	6,735	6,735	6,735	6,735	6,735
	Surface water	0	0	0	0	0	0
	Total Municipal Supply	6,735	6,735	6,735	6,735	6,735	6,735
	Municipal Surplus (Shortage)	6,674	6,674	6,679	6,687	6,693	6,698
Industrial	Manufacturing Demand	0	0	0	0	0	0
	Manufacturing Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	0	0	0	0	0	0
	Total Manufacturing Supply	0	0	0	0	0	0
	Manufacturing Surplus (Shortage)	0	0	0	0	0	0
	Steam-Electric Demand	0	0	0	0	0	0
	Steam-Electric Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	0	0	0	0	0	0
	Total Steam-Electric Supply	0	0	0	0	0	0
	Steam-Electric Surplus (Shortage)	0	0	0	0	0	0
	Mining Demand	3	1	1	0	0	0
	Mining Supply						
	Groundwater	96	96	96	96	96	96
	Surface water	0	0	0	0	0	0
	Total Mining Supply	96	96	96	96	96	96
	Mining Surplus (Shortage)	93	95	95	96	96	96
Agriculture	Irrigation Demand	0	0	0	0	0	0
	Irrigation Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	0	0	0	0	0	0
	Total Irrigation Supply	0	0	0	0	0	0
	Irrigation Surplus (Shortage)	0	0	0	0	0	0
	Livestock Demand	712	712	712	712	712	712
	Livestock Supply						
	Groundwater	5,869	5,869	5,869	5,869	5,869	5,869
	Surface water	0	0	0	0	0	0
	Total Livestock Supply	5,869	5,869	5,869	5,869	5,869	5,869
	Livestock Surplus (Shortage)	5,157	5,157	5,157	5,157	5,157	5,157
Total	Municipal & Industrial Demand	64	62	57	48	42	37
	Municipal & Industrial Supply						
	Groundwater	6,831	6,831	6,831	6,831	6,831	6,831
	Surface water	0	0	0	0	0	0
	Total Municipal & Industrial Supply	6,831	6,831	6,831	6,831	6,831	6,831
	Municipal & Industrial Surplus (Shortage)	6,767	6,769	6,774	6,783	6,789	6,794
	Agriculture Demand	712	712	712	712	712	712
	Agriculture Supply						
	Groundwater	5,869	5,869	5,869	5,869	5,869	5,869
	Surface water	0	0	0	0	0	0
	Total Agriculture Supply	5,869	5,869	5,869	5,869	5,869	5,869
	Agriculture Surplus (Shortage)	5,157	5,157	5,157	5,157	5,157	5,157
	Total Demand	776	774	769	760	754	749
	Total Supply						
	Groundwater	12,700	12,700	12,700	12,700	12,700	12,700
	Surface water	0	0	0	0	0	0
	Total Supply	12,700	12,700	12,700	12,700	12,700	12,700
	Total Surplus (Shortage)	11,924	11,926	11,931	11,940	11,946	11,951

Table 4-12.
Kenedy County
Municipal Water Demand & Supply By City
(acft)

City	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
SARITA						
Demand	30	32	30	27	25	23
Supply	2,598	2,598	2,598	2,598	2,598	2,598
Groundwater	2,598	2,598	2,598	2,598	2,598	2,598
Surface water	—	—	—	—	—	—
Surplus (Shortage)	2,568	2,566	2,568	2,571	2,573	2,575
COUNTY-OTHER						
Demand	31	29	26	21	17	14
Supply	4,137	4,137	4,137	4,137	4,137	4,137
Groundwater	4,137	4,137	4,137	4,137	4,137	4,137
Surface water	—	—	—	—	—	—
Surplus (Shortage)	4,106	4,108	4,111	4,116	4,120	4,123
Total for Kenedy County						
Demand	61	61	56	48	42	37
Supply	6,735	6,735	6,735	6,735	6,735	6,735
Groundwater	6,735	6,735	6,735	6,735	6,735	6,735
Surface water	—	—	—	—	—	—
Surplus (Shortage)	6,674	6,674	6,679	6,687	6,693	6,698

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4.3.7 Comparison of Demand to Supply – Kleberg County

Demands

- For the period 2000 to 2050, municipal demand increases from 7,093 acft in 2000 to 8,860 acft in 2050.
- Mining demand decreases from 1,055 acft to 0 acft from 2000 to 2050
- For the period 2000 to 2050, irrigation demand decreases from 397 acft to 189 acft; livestock demand is constant at 1,348 acft.

Supplies

- Surface water is supplied from the CCR/LCC System by the City of Corpus Christi via the South Texas Water Authority (STWA); some livestock needs are met with on-farm/local sources.
- Groundwater supplies are from the Gulf Coast Aquifer.

Comparison of Demand to Supply

- The City of Kingsville supplies its own groundwater and purchases surface water from the STWA.
- County-Other, mostly reliant on groundwater, has an immediate shortage lasting through 2020.
- There are sufficient mining supplies through 2050.
- Irrigation has an immediate shortage lasting through 2020.

Table 4-13.
Kleberg County
Population, Water Supply, and Water Demand Projections

Population Projection	2000	2010	2020	2030	2040	2050
	36,272	42,058	46,262	49,750	52,585	55,313

	Supply and Demand by Type of Use	2000 (acft)	2010 (acft)	2020 (acft)	2030 (acft)	2040 (acft)	2050 (acft)
Municipal	Municipal Demand	7,093	7,532	7,759	8,167	8,521	8,860
	Municipal Supply						
	Groundwater	6,465	6,465	6,465	6,465	6,465	6,465
	Surface water	1,202	1,202	1,272	1,704	2,076	2,468
	Total Municipal Supply	7,667	7,667	7,737	8,169	8,541	8,933
	Municipal Surplus (Shortage)	574	135	(22)	2	20	73
Industrial	Manufacturing Demand	0	0	0	0	0	0
	Manufacturing Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	0	0	0	0	0	0
	Total Manufacturing Supply	0	0	0	0	0	0
	Manufacturing Surplus (Shortage)	0	0	0	0	0	0
	Steam-Electric Demand	0	0	0	0	0	0
	Steam-Electric Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	0	0	0	0	0	0
	Total Steam-Electric Supply	0	0	0	0	0	0
	Steam-Electric Surplus (Shortage)	0	0	0	0	0	0
	Mining Demand	1,055	844	739	633	542	0
	Mining Supply						
	Groundwater	2,627	2,627	2,627	2,627	2,627	2,627
	Surface water	0	0	0	0	0	0
	Total Mining Supply	2,627	2,627	2,627	2,627	2,627	2,627
	Mining Surplus (Shortage)	1,572	1,783	1,888	1,994	2,085	2,627
Agriculture	Irrigation Demand	397	343	295	255	220	189
	Irrigation Supply						
	Groundwater	291	291	291	291	291	291
	Surface water	0	0	0	0	0	0
	Total Irrigation Supply	291	291	291	291	291	291
	Irrigation Surplus (Shortage)	(106)	(52)	(4)	36	71	102
	Livestock Demand	1,348	1,348	1,348	1,348	1,348	1,348
	Livestock Supply						
	Groundwater	317	317	317	317	317	317
	Surface water	1,031	1,031	1,031	1,031	1,031	1,031
	Total Livestock Supply	1,348	1,348	1,348	1,348	1,348	1,348
	Livestock Surplus (Shortage)	0	0	0	0	0	0
Total	Municipal & Industrial Demand	8,148	8,376	8,498	8,800	9,063	8,860
	Municipal & Industrial Supply						
	Groundwater	9,092	9,092	9,092	9,092	9,092	9,092
	Surface water	1,202	1,202	1,272	1,704	2,076	2,468
	Total Municipal & Industrial Supply	10,294	10,294	10,364	10,796	11,168	11,560
	Municipal & Industrial Surplus (Shortage)	2,146	1,918	1,866	1,996	2,105	2,700
	Agriculture Demand	1,745	1,691	1,643	1,603	1,568	1,537
	Agriculture Supply						
	Groundwater	608	608	608	608	608	608
	Surface water	1,031	1,031	1,031	1,031	1,031	1,031
	Total Agriculture Supply	1,639	1,639	1,639	1,639	1,639	1,639
	Agriculture Surplus (Shortage)	(106)	(52)	(4)	36	71	102
	Total Demand	9,893	10,067	10,141	10,403	10,631	10,397
	Total Supply						
	Groundwater	9,700	9,700	9,700	9,700	9,700	9,700
	Surface water	2,233	2,233	2,303	2,735	3,107	3,499
	Total Supply	11,933	11,933	12,003	12,435	12,807	13,199
	Total Surplus (Shortage)	2,040	1,866	1,862	2,032	2,176	2,802

Table 4-14.
Kleberg County
Municipal Water Demand & Supply By City
(acft)

City	2000	2010	2020	2030	2040	2050
KINGSVILLE						
Demand	5,513	5,957	6,201	6,633	7,005	7,397
Supply	6,131	6,131	6,201	6,633	7,005	7,397
Groundwater	5,105	5,105	5,105	5,105	5,105	5,105
Surface water	1,026	1,026	1,096	1,528	1,900	2,292
Surplus (Shortage)	618	174	—	—	—	—
COUNTY-OTHER						
Demand	1,580	1,575	1,558	1,534	1,516	1,463
Supply	1,536	1,536	1,536	1,536	1,536	1,536
Groundwater	1,360	1,360	1,360	1,360	1,360	1,360
Surface water	176	176	176	176	176	176
Surplus (Shortage)	(44)	(39)	(22)	2	20	73
Total for Kleberg County						
Demand	7,093	7,532	7,759	8,167	8,521	8,860
Supply	7,667	7,667	7,737	8,169	8,541	8,933
Groundwater	6,465	6,465	6,465	6,465	6,465	6,465
Surface water	1,202	1,202	1,272	1,704	2,076	2,468
Surplus (Shortage)	574	135	(22)	2	20	73

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4.3.8 Comparison of Demand to Supply – Live Oak County

Demands

- For the period 2000 to 2050, municipal demand increases from 2,032 acft in 2000 to 2,054 acft in 2050.
- Manufacturing demands increase from 1,021 acft in 2000 to 1,345 acft in 2050.
- Mining demand decreases from 4,888 acft to 2,915 acft from 2000 to 2050.
- For the period 2000 to 2050, irrigation demand decreases from 3,097 acft to 2,145 acft; livestock demand is constant at 1,324 acft.
- Diamond Shamrock recently announced the development of a 700 MW co-generation power plant to be located in Live Oak County. At present, the TWDB projections show no anticipated steam-electric demand in the county. However, if the new co-generation plant is completed as scheduled, an additional 6,000 acft per year of demand could be required in Live Oak County beginning in 2010 and continuing throughout the planning period.

Supplies

- Surface water is supplied from the CCR/LCC System and by the City of Three Rivers water rights on the Nueces River; some livestock needs are met with on-farm/local sources.
- Groundwater supplies are from the Carrizo-Wilcox and Gulf Coast Aquifers.

Comparison of Demand to Supply

- There are sufficient municipal supplies to meet the demands of the cities in the county through 2050.
- Due to limited groundwater availability, County-Other shows an immediate and long-term shortage.
- Mining has a shortage through 2020.
- Irrigation has and immediate and long-term shortage.
- Livestock has sufficient supply through 2050.

Table 4-15.
Live Oak County
Population, Water Supply, and Water Demand Projections

Population Projection	2000	2010	2020	2030	2040	2050
	28,291	31,256	34,386	37,002	39,567	42,188

	Supply and Demand by Type of Use	2000 (acft)	2010 (acft)	2020 (acft)	2030 (acft)	2040 (acft)	2050 (acft)
Municipal	Municipal Demand	2,032	2,023	2,001	2,006	2,021	2,054
	Municipal Supply						
	Groundwater	1,277	1,277	1,277	1,277	1,277	1,277
	Surface water	4,063	4,063	4,063	4,063	4,063	4,063
	Total Municipal Supply	5,340	5,340	5,340	5,340	5,340	5,340
	Municipal Surplus (Shortage)	3,308	3,317	3,339	3,334	3,319	3,286
Industrial	Manufacturing Demand	1,021	1,088	1,137	1,171	1,261	1,345
	Manufacturing Supply						
	Groundwater	895	895	895	895	895	895
	Surface water	800	800	800	800	800	800
	Total Manufacturing Supply	1,695	1,695	1,695	1,695	1,695	1,695
	Manufacturing Surplus (Shortage)	674	607	558	524	434	350
	Steam-Electric Demand(1)	0	0	0	0	0	0
	Steam-Electric Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	0	0	0	0	0	0
	Total Steam-Electric Supply	0	0	0	0	0	0
	Steam-Electric Surplus (Shortage)	0	0	0	0	0	0
	Mining Demand	4,888	5,228	1,395	1,980	2,833	2,915
	Mining Supply						
	Groundwater	3,946	3,946	3,946	3,946	3,946	3,946
	Surface water	0	0	0	0	0	0
	Total Mining Supply	3,946	3,946	3,946	3,946	3,946	3,946
	Mining Surplus (Shortage)	(942)	(1,282)	2,551	1,966	1,113	1,031
Agriculture	Irrigation Demand	3,097	2,878	2,674	2,485	2,309	2,145
	Irrigation Supply						
	Groundwater	508	508	508	508	508	508
	Surface water	0	0	0	0	0	0
	Total Irrigation Supply	508	508	508	508	508	508
	Irrigation Surplus (Shortage)	(2,589)	(2,370)	(2,166)	(1,977)	(1,801)	(1,637)
	Livestock Demand	1,324	1,324	1,324	1,324	1,324	1,324
	Livestock Supply						
	Groundwater	523	523	523	523	523	523
	Surface water	801	801	801	801	801	801
	Total Livestock Supply	1,324	1,324	1,324	1,324	1,324	1,324
	Livestock Surplus (Shortage)	0	0	0	0	0	0
Total	Municipal & Industrial Demand	7,941	8,339	4,533	5,157	6,115	6,314
	Municipal & Industrial Supply						
	Groundwater	6,118	6,118	6,118	6,118	6,118	6,118
	Surface water	4,863	4,863	4,863	4,863	4,863	4,863
	Total Municipal & Industrial Supply	10,981	10,981	10,981	10,981	10,981	10,981
	Municipal & Industrial Surplus (Shortage)	3,040	2,642	6,448	5,824	4,866	4,667
	Agriculture Demand	4,421	4,202	3,998	3,809	3,633	3,469
	Agriculture Supply						
	Groundwater	1,031	1,031	1,031	1,031	1,031	1,031
	Surface water	801	801	801	801	801	801
	Total Agriculture Supply	1,832	1,832	1,832	1,832	1,832	1,832
	Agriculture Surplus (Shortage)	(2,589)	(2,370)	(2,166)	(1,977)	(1,801)	(1,637)
	Total Demand	12,362	12,541	8,531	8,966	9,748	9,783
	Total Supply						
	Groundwater	7,149	7,149	7,149	7,149	7,149	7,149
	Surface water	5,664	5,664	5,664	5,664	5,664	5,664
	Total Supply	12,813	12,813	12,813	12,813	12,813	12,813
	Total Surplus (Shortage)	451	272	4,282	3,847	3,065	3,030

(1) Does not include potential additional demand. Please see County Comparison on page 4-35 for further details.

Table 4-16.
Live Oak County
Municipal Water Demand & Supply By City
(acft)

City	2000	2010	2020	2030	2040	2050
GEORGE WEST						
Demand	560	567	563	566	571	584
Supply	605	605	605	605	605	605
Groundwater	605	605	605	605	605	605
Surface water	—	—	—	—	—	—
Surplus (Shortage)	45	38	42	39	34	21
THREE RIVERS						
Demand	439	438	434	436	441	448
Supply	4,063	4,063	4,063	4,063	4,063	4,063
Groundwater	—	—	—	—	—	—
Surface water	4,063	4,063	4,063	4,063	4,063	4,063
Surplus (Shortage)	3,624	3,625	3,629	3,627	3,622	3,615
COUNTY-OTHER						
Demand	1,033	1,018	1,004	1,004	1,009	1,022
Supply	672	672	672	672	672	672
Groundwater	672	672	672	672	672	672
Surface water	—	—	—	—	—	—
Surplus (Shortage)	(361)	(346)	(332)	(332)	(337)	(350)
Total for Bee County						
Demand	2,032	2,023	2,001	2,006	2,021	2,054
Supply	5,340	5,340	5,340	5,340	5,340	5,340
Groundwater	1,277	1,277	1,277	1,277	1,277	1,277
Surface water	4,063	4,063	4,063	4,063	4,063	4,063
Surplus (Shortage)	3,308	3,317	3,339	3,334	3,319	3,286

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4.3.9 Comparison of Demand to Supply – McMullen County

Demands

- For the period 2000 to 2050, municipal demand decreases from 167 acft in 2000 to 69 acft in 2050.
- Mining demand decreases from 165 acft to 8 acft from 2000 to 2050
- For the period 2000 to 2050 livestock demand is constant at 324 acft.

Supplies

- Surface water for livestock needs is met by on-farm/local sources.
- Groundwater supplies are from the Carrizo-Wilcox, Gulf Coast, Queen City, and Sparta Aquifers.

Comparison of Demand to Supply

- Due to abundant groundwater availability and small demands, the county has a surplus of about 10,000 acft through 2050.
- Groundwater availability is from four source aquifers: Gulf Coast (1,200 acft/yr); Carrizo-Wilcox (7,909 acft/yr); Queen City (1,105 acft/yr); and Sparta (600 acft/yr).
- The largest source, the Carrizo-Wilcox Aquifer, is somewhat difficult to access due to depth, water chemistry, and temperature (140° F).

Table 4-17.
McMullen County
Population, Water Supply, and Water Demand Projections

Population Projection	2000	2010	2020	2030	2040	2050
	792	769	700	577	463	363

	Supply and Demand by Type of Use	2000 (acft)	2010 (acft)	2020 (acft)	2030 (acft)	2040 (acft)	2050 (acft)
Municipal	Municipal Demand	167	155	134	108	87	69
	Municipal Supply						
	Groundwater	5,143	5,143	5,143	5,143	5,143	5,143
	Surface water	0	0	0	0	0	0
	Total Municipal Supply	5,143	5,143	5,143	5,143	5,143	5,143
	Municipal Surplus (Shortage)	4,976	4,988	5,009	5,035	5,056	5,074
Industrial	Manufacturing Demand	0	0	0	0	0	0
	Manufacturing Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	0	0	0	0	0	0
	Total Manufacturing Supply	0	0	0	0	0	0
	Manufacturing Surplus (Shortage)	0	0	0	0	0	0
	Steam-Electric Demand	0	0	0	0	0	0
	Steam-Electric Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	0	0	0	0	0	0
	Total Steam-Electric Supply	0	0	0	0	0	0
	Steam-Electric Surplus (Shortage)	0	0	0	0	0	0
	Mining Demand	165	66	34	23	12	8
	Mining Supply						
	Groundwater	5,028	5,028	5,028	5,028	5,028	5,028
	Surface water	0	0	0	0	0	0
	Total Mining Supply	5,028	5,028	5,028	5,028	5,028	5,028
	Mining Surplus (Shortage)	4,863	4,962	4,994	5,005	5,016	5,020
Agriculture	Irrigation Demand	0	0	0	0	0	0
	Irrigation Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	6	6	6	6	6	6
	Total Irrigation Supply	6	6	6	6	6	6
	Irrigation Surplus (Shortage)	6	6	6	6	6	6
	Livestock Demand	324	324	324	324	324	324
	Livestock Supply						
	Groundwater	643	643	643	643	643	643
	Surface water	0	0	0	0	0	0
	Total Livestock Supply	643	643	643	643	643	643
	Livestock Surplus (Shortage)	319	319	319	319	319	319
Total	Municipal & Industrial Demand	332	221	168	131	99	77
	Municipal & Industrial Supply						
	Groundwater	10,171	10,171	10,171	10,171	10,171	10,171
	Surface water	0	0	0	0	0	0
	Total Municipal & Industrial Supply	10,171	10,171	10,171	10,171	10,171	10,171
	Municipal & Industrial Surplus (Shortage)	9,839	9,950	10,003	10,040	10,072	10,094
	Agriculture Demand	324	324	324	324	324	324
	Agriculture Supply						
	Groundwater	643	643	643	643	643	643
	Surface water	6	6	6	6	6	6
	Total Agriculture Supply	649	649	649	649	649	649
	Agriculture Surplus (Shortage)	325	325	325	325	325	325
	Total Demand	656	545	492	455	423	401
	Total Supply						
	Groundwater	10,814	10,814	10,814	10,814	10,814	10,814
	Surface water	6	6	6	6	6	6
	Total Supply	10,820	10,820	10,820	10,820	10,820	10,820
	Total Surplus (Shortage)	10,164	10,275	10,328	10,365	10,397	10,419

Table 4-18.
McMullen County
Municipal Water Demand & Supply By City
(acft)

City	2000	2010	2020	2030	2040	2050
TILDEN						
Demand	117	110	99	84	70	58
Supply	996	996	996	996	996	996
Groundwater	996	996	996	996	996	996
Surface water	—	—	—	—	—	—
Surplus (Shortage)	879	886	897	912	926	938
COUNTY-OTHER						
Demand	50	45	35	24	17	11
Supply	4,147	4,147	4,147	4,147	4,147	4,147
Groundwater	4,147	4,147	4,147	4,147	4,147	4,147
Surface water	—	—	—	—	—	—
Surplus (Shortage)	4,097	4,102	4,112	4,123	4,130	4,136
Total for McMullen County						
Demand	167	155	134	108	87	69
Supply	5,143	5,143	5,143	5,143	5,143	5,143
Groundwater	5,143	5,143	5,143	5,143	5,143	5,143
Surface water	—	—	—	—	—	—
Surplus (Shortage)	4,976	4,988	5,009	5,035	5,056	5,074

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4.3.10 Comparison of Demand to Supply – Nueces County

Demands

- For the period 2000 to 2050, municipal demand increases from 79,386 acft in 2000 to 114,983 acft in 2050.
- Manufacturing demand increases from 46,247 acft in 2000 to 70,801 acft in 2050.
- Mining demand decreases from 144 acft in 2000 to 12 acft in 2050; steam-electric demand is constant at 3,300 acft..
- For the period 2000 to 2050, irrigation demand decreases from 1,495 acft to 713 acft; livestock demand is constant at 242 acft.
- After the projections for Steam-Electric water demand were approved by the RWPG and TWDB, AEP - CP&L provided additional information on estimates of future water demand for steam-electric purposes as follows: For years 2000 through 2010 - 700 acft/yr; For years 2020 through 2050 - 3,200 acft/yr. These numbers will be considered for inclusion in the next update of the Coastal Bend Regional Water Plan.

Supplies

- Surface water is supplied from the CCR/LCC System by the City of Corpus Christi, SPMWD, STWA, and Nueces County WCID No. 3; some livestock needs are met with on-farm/local sources.
- Groundwater supplies are from the Gulf Coast Aquifer.

Comparison of Demand to Supply

- There are sufficient municipal supplies to meet the demands of the cities in the county through 2050.
- County-Other, using both groundwater and surface water, has immediate and long-term shortages.
- Manufacturing has shortages beginning prior to 2040 and continuing through 2050.
- Mining has a small, near-term shortage.
- There are sufficient agricultural supplies through 2050.

Table 4-19.
Nueces County
Population, Water Supply, and Water Demand Projections

Population Projection	2000	2010	2020	2030	2040	2050
	332,581	374,552	422,288	470,779	520,861	565,502

	Supply and Demand by Type of Use	2000 (acft)	2010 (acft)	2020 (acft)	2030 (acft)	2040 (acft)	2050 (acft)
Municipal	Municipal Demand	79,386	83,267	88,896	97,815	107,352	114,983
	Municipal Supply						
	Groundwater	1,038	1,038	1,038	1,038	1,038	1,038
	Surface water	126,016	119,167	111,023	98,990	102,200	112,316
	Total Municipal Supply	127,054	120,205	112,061	100,028	103,238	113,354
	Municipal Surplus (Shortage)	47,668	36,938	23,165	2,213	(4,114)	(1,629)
Industrial	Manufacturing Demand	46,247	50,338	55,686	60,899	66,005	70,801
	Manufacturing Supply						
	Groundwater	928	928	928	928	928	928
	Surface water	45,319	49,410	54,758	59,971	53,543	41,982
	Total Manufacturing Supply	46,247	50,338	55,686	60,899	54,471	42,910
	Manufacturing Surplus (Shortage)	0	0	0	0	(11,534)	(27,891)
	Steam-Electric Demand (1)	3,300	3,300	3,300	3,300	3,300	3,300
	Steam-Electric Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	3,300	3,300	3,300	3,300	3,300	3,300
	Total Steam-Electric Supply	3,300	3,300	3,300	3,300	3,300	3,300
	Steam-Electric Surplus (Shortage)	0	0	0	0	0	0
	Mining Demand	144	93	57	28	16	12
	Mining Supply						
	Groundwater	65	65	65	65	65	65
	Surface water	0	0	0	0	0	0
	Total Mining Supply	65	65	65	65	65	65
	Mining Surplus (Shortage)	(79)	(28)	8	37	49	53
Agriculture	Irrigation Demand	1,495	1,289	1,112	958	826	713
	Irrigation Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	3,438	3,438	3,438	3,438	3,438	3,438
	Total Irrigation Supply	3,438	3,438	3,438	3,438	3,438	3,438
	Irrigation Surplus (Shortage)	1,943	2,149	2,326	2,480	2,612	2,725
	Livestock Demand	242	242	242	242	242	242
	Livestock Supply						
	Groundwater	69	69	69	69	69	69
	Surface water	173	173	173	173	173	173
	Total Livestock Supply	242	242	242	242	242	242
	Livestock Surplus (Shortage)	0	0	0	0	0	0
Total	Municipal & Industrial Demand	129,077	136,998	147,939	162,042	176,673	189,096
	Municipal & Industrial Supply						
	Groundwater	2,031	2,031	2,031	2,031	2,031	2,031
	Surface water	174,635	171,877	169,081	162,261	159,043	157,598
	Total Municipal & Industrial Supply	176,666	173,908	171,112	164,292	161,074	159,629
	Municipal & Industrial Surplus (Shortage)	47,589	36,910	23,173	2,250	(15,599)	(29,467)
	Agriculture Demand	1,737	1,531	1,354	1,200	1,068	955
	Agriculture Supply						
	Groundwater	69	69	69	69	69	69
	Surface water	3,611	3,611	3,611	3,611	3,611	3,611
	Total Agriculture Supply	3,680	3,680	3,680	3,680	3,680	3,680
	Agriculture Surplus (Shortage)	1,943	2,149	2,326	2,480	2,612	2,725
	Total Demand	130,814	138,529	149,293	163,242	177,741	190,051
	Total Supply						
	Groundwater	2,100	2,100	2,100	2,100	2,100	2,100
	Surface water	178,246	175,488	172,692	165,872	162,654	161,209
	Total Supply	180,346	177,588	174,792	167,972	164,754	163,309
	Total Surplus (Shortage)	49,532	39,059	25,499	4,730	(12,987)	(26,742)

(1) Does not include additional demand for AEP-CP&L as approved by RWPG. Please see County Comparison on page 4-43 for further details.

Table 4-20.
Nueces County
Municipal Water Demand & Supply By City
(acft)

City	2000	2010	2020	2030	2040	2050
AQUA DULCE						
Demand	95	86	76	73	69	69
Supply	121	121	121	121	121	121
Groundwater	—	—	—	—	—	—
Surface water	121	121	121	121	121	121
Surplus (Shortage)	26	35	45	48	52	52
ARANSAS PASS (P)						
Demand	3	3	3	3	3	3
Supply	3	3	3	3	3	3
Groundwater	—	—	—	—	—	—
Surface water	3	3	3	3	3	3
Surplus (Shortage)	—	—	—	—	—	—
BISHOP						
Demand	537	547	569	628	682	733
Supply	537	547	569	628	682	733
Groundwater	11	11	11	11	11	11
Surface water	526	536	558	617	671	722
Surplus (Shortage)	—	—	—	—	—	—
CORPUS CHRISTI						
Demand	68,713	72,549	77,853	86,139	95,052	104,884
Supply	119,710	112,817	104,470	92,105	95,052	104,884
Groundwater	—	—	—	—	—	—
Surface water	119,710	112,817	104,470	92,105	95,052	104,884
Surplus (Shortage)	50,997	40,268	26,617	5,966	—	—
DRISCOLL						
Demand	80	78	72	70	69	69
Supply	88	88	88	88	88	88
Groundwater	—	—	—	—	—	—
Surface water	88	88	88	88	88	88
Surplus (Shortage)	8	10	16	18	19	19
NORTH SAN PEDRO						
Demand	155	146	148	165	178	193
Supply	155	146	148	165	178	193
Groundwater	—	—	—	—	—	—
Surface water	155	146	148	165	178	193
Surplus (Shortage)	—	—	—	—	—	—
PORT ARANSAS						
Demand	1,544	1,578	1,759	2,032	2,241	2,474
Supply	1,544	1,578	1,759	2,032	2,241	2,474
Groundwater	—	—	—	—	—	—
Surface water	1,544	1,578	1,759	2,032	2,241	2,474
Surplus (Shortage)	—	—	—	—	—	—

Table 4-20
Nueces County
Municipal Water Demand & Supply By City
(acft) (Continued)

City	2000	2010	2020	2030	2040	2050
ROBSTOWN						
Demand	2,027	1,982	2,002	2,130	2,279	2,437
Supply	2,027	1,982	2,002	2,130	2,279	2,437
Groundwater	—	—	—	—	—	—
Surface water	2,027	1,982	2,002	2,130	2,279	2,437
Surplus (Shortage)	—	—	—	—	—	—
COUNTY-OTHER						
Demand	6,232	6,298	6,414	6,575	6,779	4,121
Supply	2,869	2,923	2,901	2,756	2,594	2,421
Groundwater	1,027	1,027	1,027	1,027	1,027	1,027
Surface water	1,842	1,896	1,874	1,729	1,567	1,394
Surplus (Shortage)	(3,363)	(3,375)	(3,513)	(3,819)	(4,185)	(1,700)
Total for Nueces County						
Demand	79,386	83,267	88,896	97,815	107,352	114,983
Supply	127,254	120,205	112,061	100,028	103,238	113,354
Groundwater	1,038	1,038	1,038	1,038	1,038	1,038
Surface water	126,016	119,167	111,023	98,990	102,200	112,316
Surplus (Shortage)	47,668	36,938	23,165	2,213	(4,114)	(1,629)
(P) Indicates city is in multiple counties. Projections shown are for Nueces County portion only.						

4.3.11 Comparison of Demand to Supply – San Patricio County

Demands

- For the period 2000 to 2050, municipal demand increases from 9,599 acft in 2000 to 13,928 acft in 2050.
- Manufacturing demand increases from 20,164 acft in 2000 to 45,682 acft in 2050.
- Mining remains relatively constant near 100 acft.
- For the period 2000 to 2050, irrigation demand decreases from 1,047 acft to 704 acft; livestock demand is constant at 771 acft.

Supplies

- Surface water is supplied from the CCR/LCC System by the City of Corpus Christi; the SPMWD has a contract to purchase 42,594 acft of water from the City of Corpus Christi; some livestock demands are met with on-farm/local sources.
- Groundwater supplies are from the Gulf Coast Aquifer

Comparison of Demand to Supply

- There are sufficient municipal water supplies through 2050.
- There is a projected manufacturing water supply shortage after the year 2030.
- There are sufficient agricultural supplies through the year 2050.

**Table 4-21.
San Patricio County
Population, Water Supply, and Water Demand Projections**

Population Projection	Year 2000	2010	2020	2030	2040	2050
	73,384	85,802	99,632	110,077	121,853	135,516

	Supply and Demand by Type of Use	2000 (acft)	2010 (acft)	2020 (acft)	2030 (acft)	2040 (acft)	2050 (acft)
Municipal	Municipal Demand	9,599	10,489	10,928	11,759	12,714	13,928
	Municipal Supply						
	Groundwater	12,330	12,330	12,330	12,330	12,330	12,330
	Surface water	5,930	6,503	6,616	7,208	7,911	8,667
	Total Municipal Supply	18,260	18,833	18,946	19,538	20,241	20,997
	Municipal Surplus (Shortage)	8,661	8,344	8,018	7,779	7,527	7,069
Industrial	Manufacturing Demand	20,164	24,645	28,330	32,414	38,535	45,682
	Manufacturing Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	32,904	31,462	30,546	32,545	30,845	27,088
	Total Manufacturing Supply	32,904	31,462	30,546	32,545	30,845	27,088
	Manufacturing Surplus (Shortage)	12,740	6,817	2,216	131	(7,690)	(18,594)
	Steam-Electric Demand	0	0	0	0	0	0
	Steam-Electric Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	0	0	0	0	0	0
	Total Steam-Electric Supply	0	0	0	0	0	0
	Steam-Electric Surplus (Shortage)	0	0	0	0	0	0
	Mining Demand	103	97	96	96	97	100
	Mining Supply						
	Groundwater	531	531	531	531	531	531
	Surface water	0	0	0	0	0	0
	Total Mining Supply	531	531	531	531	531	531
	Mining Surplus (Shortage)	428	434	435	435	434	431
Agriculture	Irrigation Demand	1,047	954	925	844	771	704
	Irrigation Supply						
	Groundwater	1,289	1,289	1,289	1,289	1,289	1,289
	Surface water	0	0	0	0	0	0
	Total Irrigation Supply	1,289	1,289	1,289	1,289	1,289	1,289
	Irrigation Surplus (Shortage)	242	335	364	445	518	585
	Livestock Demand	771	771	771	771	771	771
	Livestock Supply						
	Groundwater	550	550	550	550	550	550
	Surface water	221	221	221	221	221	221
	Total Livestock Supply	771	771	771	771	771	771
	Livestock Surplus (Shortage)	0	0	0	0	0	0
Total	Municipal & Industrial Demand	29,866	35,231	39,354	44,269	51,346	59,710
	Municipal & Industrial Supply						
	Groundwater	12,861	12,861	12,861	12,861	12,861	12,861
	Surface water	38,834	37,965	37,162	39,753	38,756	35,755
	Total Municipal & Industrial Supply	51,695	50,826	50,023	52,614	51,617	48,616
	Municipal & Industrial Surplus (Shortage)	21,829	15,595	10,669	8,345	271	(11,094)
	Agriculture Demand	1,818	1,725	1,696	1,615	1,542	1,475
	Agriculture Supply						
	Groundwater	1,839	1,839	1,839	1,839	1,839	1,839
	Surface water	221	221	221	221	221	221
	Total Agriculture Supply	2,060	2,060	2,060	2,060	2,060	2,060
	Agriculture Surplus (Shortage)	242	335	364	445	518	585
	Total Demand	31,684	36,956	41,050	45,884	52,888	61,185
	Total Supply						
	Groundwater	14,700	14,700	14,700	14,700	14,700	14,700
	Surface water	39,055	38,186	37,383	39,974	38,977	35,976
	Total Supply	53,755	52,886	52,083	54,674	53,677	50,676
	Total Surplus (Shortage)	22,071	15,930	11,033	8,790	789	(10,509)

Table 4-22.
San Patricio County
Municipal Water Demand & Supply By City
(acft)

City	2000	2010	2020	2030	2040	2050
ARANSAS PASS (P)						
Demand	954	1,300	1,064	1,177	1,321	1,482
Supply	954	1,300	1,064	1,177	1,321	1,482
Groundwater	—	—	—	—	—	—
Surface water	954	1,300	1,064	1,177	1,321	1,482
Surplus (Shortage)	—	—	—	—	—	—
GREGORY						
Demand	278	297	317	340	374	411
Supply	278	297	317	340	374	411
Groundwater	—	—	—	—	—	—
Surface water	278	297	317	340	374	411
Surplus (Shortage)	—	—	—	—	—	—
INGLESIDE						
Demand	791	838	912	1,028	1,176	1,345
Supply	791	838	912	1,028	1,176	1,345
Groundwater	—	—	—	—	—	—
Surface water	791	838	912	1,028	1,176	1,345
Surplus (Shortage)	—	—	—	—	—	—
MATHIS						
Demand	765	748	758	788	850	917
Supply	765	765	765	788	850	917
Groundwater	—	—	—	—	—	—
Surface water	765	765	765	788	850	917
Surplus (Shortage)	—	17	7	—	—	—
ODEM						
Demand	331	340	351	374	402	441
Supply	331	340	351	374	402	441
Groundwater	—	—	—	—	—	—
Surface water	331	340	351	374	402	441
Surplus (Shortage)	—	—	—	—	—	—
PORTLAND						
Demand	1,977	2,156	2,395	2,670	2,918	3,158
Supply	1,977	2,156	2,395	2,670	2,918	3,158
Groundwater	—	—	—	—	—	—
Surface water	1,977	2,156	2,395	2,670	2,918	3,158
Surplus (Shortage)	—	—	—	—	—	—
SINTON						
Demand	845	883	945	1,002	1,062	1,148
Supply	6,358	6,358	6,358	6,358	6,358	6,358
Groundwater	6,358	6,358	6,358	6,358	6,358	6,358
Surface water	—	—	—	—	—	—
Surplus (Shortage)	5,513	5,475	5,413	5,356	5,296	5,210

Table 4-22.
San Patricio County
Municipal Water Demand & Supply By City
(acft) (Continued)

City	2000	2010	2020	2030	2040	2050
TAFT						
Demand	454	433	433	442	466	497
Supply	454	433	433	442	466	497
Groundwater	—	—	—	—	—	—
Surface water	454	433	433	442	466	497
Surplus (Shortage)	—	—	—	—	—	—
TAFT SOUTHWEST						
Demand	262	237	225	223	233	241
Supply	262	237	225	223	233	241
Groundwater	—	—	—	—	—	—
Surface water	262	237	225	223	233	241
Surplus (Shortage)	—	—	—	—	—	—
COUNTY-OTHER						
Demand	2,942	3,257	3,528	3,715	3,912	4,288
Supply	6,090	6,109	6,126	6,138	6,143	6,147
Groundwater	5,972	5,972	5,972	5,972	5,972	5,972
Surface water	118	137	154	166	171	175
Surplus (Shortage)	3,148	2,852	2,598	2,423	2,231	1,859
Total for San Patricio County						
Demand	9,599	10,489	10,928	11,759	12,714	13,928
Supply	18,260	18,833	18,946	19,538	20,241	20,997
Groundwater	12,330	12,330	12,330	12,330	12,330	12,330
Surface water	5,930	6,503	6,616	7,208	7,911	8,667
Surplus (Shortage)	8,661	8,344	8,018	7,779	7,527	7,069
(P) Indicates city is in multiple counties. Projections shown are for San Patricio County portion only.						

4.4 Region Summary

When comparing total available supplies to total demands, the region shows a current surplus until after 2040. By the year 2050 there is a slight deficit of 1,029 acft (Table 4-23).

4.4.1 Municipal and Industrial Summary

Municipal and Industrial (Manufacturing, Steam-Electric, and Mining) shows a surplus of 93,590 acft in 2000. Due to increasing municipal and manufacturing demands, and decreasing surface water supply, by 2050 there is a shortage of 11,180 acft.

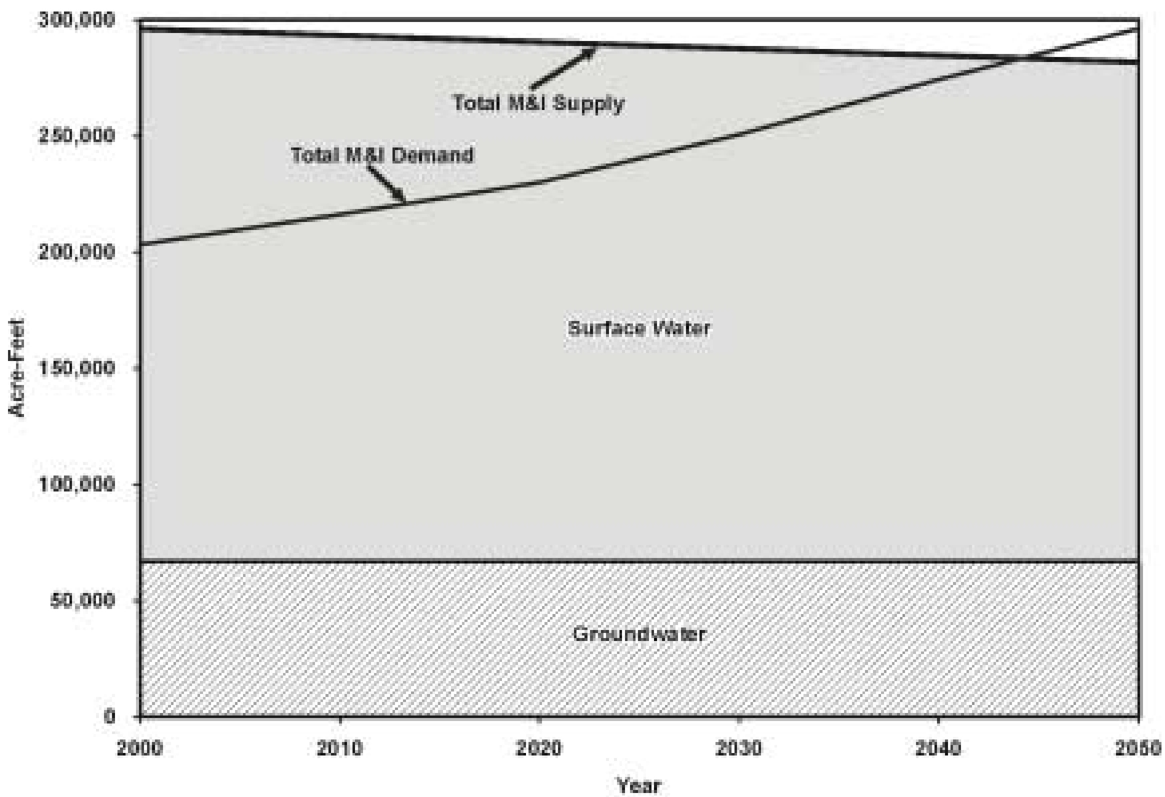

Figure 4-2. Municipal and Industrial Supply and Demand

Municipal demands account for 53 percent of total demands in the region, and there are sufficient supplies within the region to meet those demands. Surface water accounts for approximately 75 percent of 2050 municipal supplies, with groundwater accounting for 25 percent. Although there is a region-wide municipal surplus, several cities and County-Other's are experiencing near and/or long-term shortages. These shortages are summarized in Table 4-24.

Table 4-23.
Coastal Bend Region Summary
Population, Water Supply, and Water Demand Projections

Population Projection	Year 2000	2010	2020	2030	2040	2050
	569,292	645,175	724,702	797,761	872,568	943,912

Supply and Demand by Type of Use		Year 2000 (acft)	2010 (acft)	2020 (acft)	2030 (acft)	2040 (acft)	2050 (acft)
Municipal	Municipal Demand	119,464	125,329	132,200	143,113	154,695	164,901
	Municipal Supply						
	Groundwater	50,211	50,211	50,211	50,211	50,211	50,211
	Surface water	146,606	141,019	133,660	123,513	128,669	141,001
	Total Municipal Supply	196,817	191,230	183,871	173,724	178,880	191,212
	Municipal Surplus (Shortage)	77,353	65,901	51,671	30,611	24,185	26,311
Industrial	Manufacturing Demand	67,785	76,502	85,652	95,058	106,487	118,641
	Manufacturing Supply						
	Groundwater	1,942	1,942	1,942	1,942	1,942	1,942
	Surface water	79,260	81,987	86,486	93,773	85,757	70,565
	Total Manufacturing Supply	81,202	83,929	88,428	95,715	87,699	72,507
	Manufacturing Surplus (Shortage)	13,417	7,427	2,776	657	(18,788)	(46,134)
	Steam-Electric Demand	3,300	3,300	3,300	3,300	3,300	3,300
	Steam-Electric Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	3,300	3,300	3,300	3,300	3,300	3,300
	Total Steam-Electric Supply	3,300	3,300	3,300	3,300	3,300	3,300
	Steam-Electric Surplus (Shortage)	0	0	0	0	0	0
	Mining Demand	11,969	10,417	5,680	5,965	6,634	6,146
	Mining Supply						
	Groundwater	14,789	14,789	14,789	14,789	14,789	14,789
	Surface water	0	0	0	0	0	0
	Total Mining Supply	14,789	14,789	14,789	14,789	14,789	14,789
	Mining Surplus (Shortage)	2,820	4,372	9,109	8,824	8,155	8,643
Agriculture	Irrigation Demand	13,009	11,880	10,928	10,026	9,219	8,496
	Irrigation Supply						
	Groundwater	9,727	9,727	9,727	9,727	9,727	9,727
	Surface water	3,444	3,444	3,444	3,444	3,444	3,444
	Total Irrigation Supply	13,171	13,171	13,171	13,171	13,171	13,171
	Irrigation Surplus (Shortage)	162	1,291	2,243	3,145	3,952	4,675
	Livestock Demand	8,270	8,270	8,270	8,270	8,270	8,270
	Livestock Supply						
	Groundwater	8,638	8,638	8,638	8,638	8,638	8,638
	Surface water	5,108	5,108	5,108	5,108	5,108	5,108
	Total Livestock Supply	13,746	13,746	13,746	13,746	13,746	13,746
	Livestock Surplus (Shortage)	5,476	5,476	5,476	5,476	5,476	5,476
Total	Municipal & Industrial Demand	202,518	215,548	226,832	247,436	271,116	292,988
	Municipal & Industrial Supply						
	Groundwater	66,942	66,942	66,942	66,942	66,942	66,942
	Surface water	229,166	226,306	223,446	220,586	217,726	214,866
	Total Municipal & Industrial Supply	296,108	293,248	290,388	287,528	284,668	281,808
	Municipal & Industrial Surplus (Shortage)	93,590	77,700	63,556	40,092	13,552	(11,180)
	Agriculture Demand	21,279	20,150	19,198	18,296	17,489	16,766
	Agriculture Supply						
	Groundwater	18,365	18,365	18,365	18,365	18,365	18,365
	Surface water	8,552	8,552	8,552	8,552	8,552	8,552
	Total Agriculture Supply	26,917	26,917	26,917	26,917	26,917	26,917
	Agriculture Surplus (Shortage)	5,638	6,767	7,719	8,621	9,428	10,151
	Total Demand	223,797	235,698	246,030	265,732	288,605	309,754
	Total Supply						
	Groundwater	85,307	85,307	85,307	85,307	85,307	85,307
	Surface water	237,718	234,858	231,998	229,138	226,278	223,418
	Total Supply	323,025	320,165	317,305	314,445	311,585	308,725
	Total Surplus (Shortage)	99,228	84,467	71,275	48,713	22,980	(1,029)

Table 4-24.
Cities/County-Other with Projected Water Shortages

County/City	Projected Shortages (acft) 2000	2030	2050
Brooks County			
Falfurrias	*(226)*	*none*	*none*
County-Other	*(567)*	*(363)*	*(267)*
Duval County			
Benavides	(448)	(509)	(536)
Freer	(614)	(783)	(926)
San Diego (P)	(597)	(725)	(831)
County-Other	(366)	(353)	(308)
Jim Wells County			
Premont	none	(202)	(327)
County-Other	(8)	none	none
Kleberg County			
County-Other	(44)	none	none
Live Oak County			
County-Other	(361)	(332)	(350)
Nueces County			
County-Other	(3,363)	(3,819)	(1,700)

Manufacturing demands account for 38 percent of total demands in 2050. The majority of these demands, 98 percent, are in Nueces and San Patricio Counties. Aransas, Bee, and Live Oak Counties make up the remaining 2 percent. Surface water supplies are 98 percent of total manufacturing supplies in 2050; groundwater 2 percent. Region-wide there is a 46,134-acft manufacturing supply deficit in 2050.

Nueces and San Patricio Counties are both showing manufacturing shortages beginning between 2030 and 2040. In 2050 Nueces County has a shortage of 27,891 acft, while San Patricio County has a shortage of 18,594 acft (see Table 4-25). Manufacturing supplies for Nueces County are from Corpus Christi, while the manufacturing supplies for San Patricio County are from the SPMWD. Shortages in supplies provided by the City of Corpus Christi via the CCR/LCC System were accumulated in manufacturing demands in San Patricio and Nueces Counties.

Table 4-25.
Manufacturing with Projected Water Shortages

County/City	Projected Shortages (acft)		
	2000	2030	2050
Nueces County	none	none	(27,891)
San Patricio County	none	none	(18,594)

As for the remaining industrial demands, there are sufficient surface water supplies to meet the 3,300 acft steam-electric demand—1 percent of total 2050 demand—in Nueces County. Mining demand, 6,146 acft, accounts for only 2 percent of total demand in 2050. Region-wide there is sufficient groundwater to meet mining demands, however there are some shortages within the counties. Aransas, Live Oak, and Nueces Counties show near-term shortages to before 2020, but because of decreasing demands there are surpluses from 2020 through 2050. Duval County is showing current and long-term shortages; 3,396 acft in 2000 and 1,411 acft in 2050. Mining shortages are summarized below in Table 4-26.

Table 4-26.
Mining with Projected Water Shortages

County/City	Projected Shortages (acft)		
	2000	2030	2050
Aransas County	(46)	none	none
Duval County	(3,396)	(1,377)	(1,411)
Live Oak County	(942)	none	none
Nueces County	(79)	none	none

4.4.2 Agriculture Summary

Due to decreasing irrigation and livestock demand, agriculture is showing a current and long-term surplus; 5,638 acft in 2000, increasing to 10,151 acft in 2050. Irrigation demand decreases over the 50-year planning period and in 2050 represents 3 percent of total demand. Surface water supplies are 27 percent of total irrigation supplies with groundwater accounting for

73 percent of the total. In 2050 there is a 4,675 acft surplus region-wide in irrigation supplies. Several counties, however, experience irrigation shortages (Table 4-27). Duval County, currently using groundwater for irrigation needs, has an immediate shortage of 1,162 acft. The shortage continues through 2050, when it is 945 acft. Kleberg County, also using groundwater to meet its irrigation needs, experiences relatively small shortages through 2020. Live Oak County uses both groundwater and surface water to meet its needs and projections show large current and long-term shortages. In 2050 the shortage is 1,637 acft for Live Oak County.

Table 4-27.
Irrigation with Projected Water Shortages

	Projected Shortages (acft)		
County/City	***2000***	***2030***	***2050***
Duval County	(1,162)	(1,030)	(945)
Kleberg County	(106)	none	none
Live Oak County	(2,589)	(1,977)	(1,637)

Livestock demand remains constant at 8,270 acft over the 50-year planning period and in 2050 represents 3 percent of total demand. For each county, groundwater was allocated based on 1997 use. For those counties with insufficient groundwater availability, it was assumed local, on-farm surface water sources would be used to meet demands. The region as a whole has a constant 5,476-acft surplus.

4.4.3 Summary

Overall, the Coastal Bend Region has sufficient supplies to meet the demands of the six water user groups through 2040. By 2050 there is a shortage of 1,029 acft. However, as discussed in the previous section, various water user groups are showing shortages throughout the 50-year planning period. Those water groups with shortages in 2030 and 2050 are presented in Figure 4-3. In Section 5, various water supply options to meet these shortages are presented. Water Supply Plans to address each of the identified water shortages (Tables 4-24 through 4-27) are presented by county in Chapter 5.

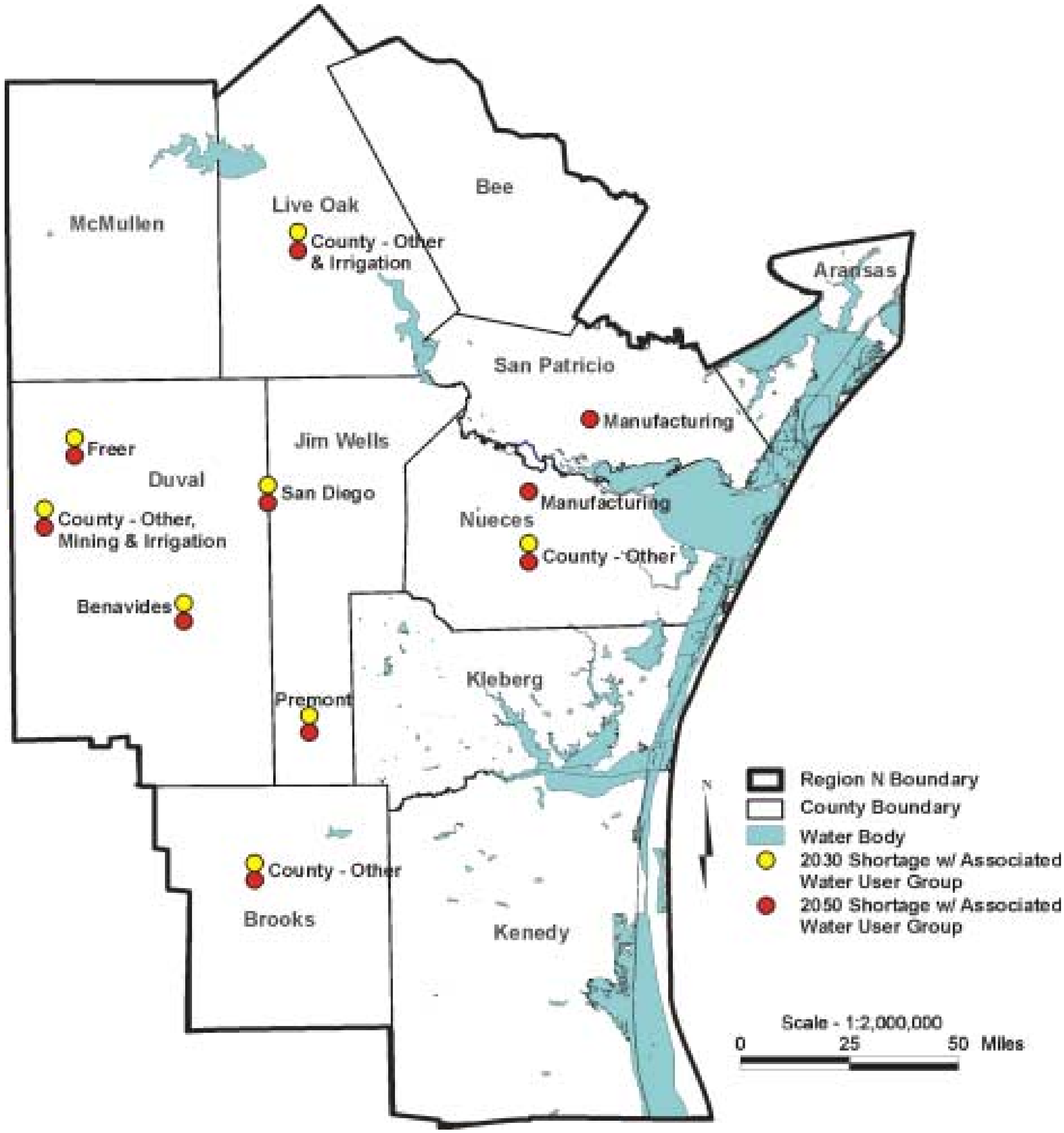

Figure 4-3. Location and Type of Use for 2030 and 2050 Water Supply Shortages

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Section 5
Water Supply Plans

5.1 Summary of Water Management Strategies

A total of 17 water management strategies were investigated during the development of the Coastal Bend Regional Water Plan. Many of these strategies include several water supply options within the main strategy. Strategies are summarized in Tables 5.1-1 and 5.1-2.

Table 5.1-1 shows potential strategies for the Corpus Christi service area and Table 5.1-2 shows potential strategies for other service areas. All strategies are compared with respect to four areas of concern: (1) additional water supply; (2) unit cost of treated water; (3) degree of water quality improvement; and (4) environmental issues and special concerns. A graphical comparison of how each significant strategy compares to the others with respect to unit cost and water supply quantity is shown in Figure 5.1-1. A detailed description of the analysis of each strategy is included in Section 5A in Volume II of this report (refer to Sections 5A.1 through 5A.17). In these detailed descriptions, each strategy was evaluated with respect to 10 impact categories, as required by TWDB rules. These categories are shown in Table 5.1-3.

Recommended plans to meet the specific needs of the cities and other water user groups during the planning period – 2000 through 2050 – are presented in the following sections. In addition, proposed plans to meet long-term needs – 2030 through 2050 – are presented for the projected shortages in Nueces and San Patricio Counties. The water management strategies summarized in Tables 5.1-1 and 5.1-2 and discussed in detail in Section 5A (Volume II of this report) provided the options for building each plan to meet the specific shortages. The plans are organized by county and water user group in the following sections (Sections 5.2 through 5.12). A summary of the plans for the Region's two Major Water Providers is presented in Section 5.13

Additionally, future projects involving authorization from either the TNRCC and/or TWDB which are not specifically addressed in the plan are considered to be consistent with the plan under the following circumstances:

1. TWDB receives applications for financial assistance for many types of water supply projects, including water conservation, and when appropriate, wastewater reuse strategies. Other projects involve repairing, replacing, or expanding treatment plants, pump stations, pipelines and water storage facilities. The RWPG considers projects that do not involve the development of or connection to a new water source to be consistent with the regional water plan even though not specifically recommended in the plan.

2. TNRCC considers water rights applications for various types of uses (e.g. recreation, navigation, irrigation, hydroelectric power, industrial, recharge, municipal and others). Many of these applications are for small amounts of water, some are temporary, and some are even non-consumptive. Because waters of the Nueces River Basin are fully appropriated to the City of Corpus Christi and others, any new water rights application for consumptive water use from this Basin will need to protect the existing water rights or provide appropriate mitigation to existing water right owners. Throughout the Coastal Bend Region the types of small projects that may arise are so unpredictable that the RWPG is of the opinion that each project should be considered by the TWDB and TNRCC on their merits, and that the Legislature foresaw this situation and provided appropriate language for each agency to deal with it.

(Note: The provision related to TNRCC is found in Texas Water Code §11.134. It provides that the Commission shall grant an application to appropriate surface water, including amendments, only if the proposed appropriate addresses a water supply need in a manner consistent with an approved regional water plan. TNRCC may waive this requirement if conditions warrant. For TWDB funding, Texas Water Code §16.053(j) states that after January 5, 2002 TWDB may provide financial assistance to a water supply project only after the Board determines that the needs to be addressed by the project will be addressed in a manner that is consistent with that appropriate regional water plan. The TWDB may waive this provision if conditions warrant.)

Table 5.1-3.
Summary of Impact Categories for
Evaluation of Water Management Strategies

a.	Quantity, reliability and cost of treated water
b.	Environmental factors
c.	State water resources
d.	Threats to agriculture and natural resources in region
e.	Recreational
f.	Comparison and consistency equities
g.	Interbasin transfers
h.	Third party social and economic impacts from voluntary redistribution of water
i.	Efficient use of existing water supplies and regional opportunities
j.	Effect on navigation

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5.2 Aransas County Water Supply Plan

Table 5.2-1 lists each water user group in Aransas County and their corresponding surplus or shortage in years 2030 and 2050. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 5.2-1.
Aransas County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2050 (acft/yr)	Comment
City of Aransas Pass	0	0	Supply equals demand
City of Fulton	0	0	Supply equals demand
City of Rockport	0	0	Supply equals demand
County-Other	0	0	Supply equals demand
Manufacturing	0	0	Supply equals demand
Steam-Electric	none	none	No demands projected
Mining	44	66	Projected shortages in 2000 and 2010 – see plan below
Irrigation	none	none	No demands projected
Livestock	0	0	Supply equals demand

[1] From Tables 4-1 and 4-2, Section 4 – Comparison of Water Demands with Water Supplies to Determine Needs.

5.2.1 City of Aransas Pass

The City of Aransas Pass is in Aransas, Nueces, and San Patricio Counties; consequently, its water demand and supply values are split into the tables for each county. Aransas Pass contracts with the San Patricio Municipal Water District (SPMWD) to purchase treated water from the CCR/LCC System. The contract allows the City to purchase only the water that it needs. No shortages are projected for the City of Aransas Pass and no changes in water supply are recommended.

5.2.2 City of Fulton

The City of Fulton has a contract with the SPMWD to purchase treated water from the CCR/LCC System. The contract allows the City to purchase only the water that it needs. No shortages are projected for the City of Fulton and no changes in water supply are recommended.

5.2.3 City of Rockport

The City of Rockport has a contract with the SPMWD to purchase treated water from the CCR/LCC System. The contract allows the City to purchase only the water that it needs. No shortages in annual water supplies are projected for the City of Rockport and no changes in water supplies are recommended. However, with the large summertime influx of visitors to the Rockport area, the City may consider the implementation of an ASR system at a future date to help meet peak day summer demands. This water management strategy is discussed in Section 5A.7 of this report.

5.2.4 County-Other

County-Other demands are met with groundwater from the Gulf Coast Aquifer and treated surface water from the CCR/LCC System purchased from the SPMWD. No shortages are projected for County-Other entities and no changes in water supply are recommended.

5.2.5 Manufacturing

There are small manufacturing water demands in Aransas County. These demands are met by groundwater from the Gulf Coast Aquifer and CCR/LCC System surface water purchased from the SPMWD. No shortages are projected for manufacturing and no changes in water supply are recommended.

5.2.6 Steam-Electric

No steam-electric demand exists or is projected for the county.

5.2.7 Mining

5.2.7.1 Description

- Source: Groundwater – Gulf Coast Aquifer
- Estimated Reliable Supply: 73 acft/yr
- System Description: Various mining operations

5.2.7.2 Options Considered

The Aransas County mining water user group has near-term shortages of 46 acft/yr in 2000 and 12 acft/yr in 2010. By the year 2014, supply and demand projections are equal and mining begins to show a projected surplus supply. Table 5.2-2 lists the water management strategies, references to the report section discussing the strategy, total project cost, and unit costs that were considered for meeting the shortage for mining in Aransas County.

Table 5.2-2.
Water Management Strategies Considered for Aransas County Mining

Option	Yield (acft/yr)	Approximate Cost[1]	
		Total	Unit ($/acft)
Small Desalt Plant (Section 5A.6.2)	112	$674,000[2]	$773[2]
System Interconnect to Refugio County Well Field (Section 5A.6.1)	50	$N/A[3]	$224[3]
System Interconnect to SPMWD	12 to 46	$N/A[4]	$225[4]
Short-term Overdrafting of Groundwater	12 to 46	$0[5]	$0[5]
No Action	—	$52,000[6]	$4,323[6]

[1] Unless otherwise noted, costs are Total Project Cost and Unit Cost ($/acft/yr) for treated water delivered to the water supply entity or entities. Unit cost is for full utilization of project capacity.
[2] Source of Cost Estimate: Section 5A.6. Table 5A.6-3, 0.1 MGD WTP, fully utilized.
[3] Assumed for near-term, Aransas County mining interests could tap into Refugio County Well Field Water Management Strategy (Section 5A.6.1) at the same cost of developing water for transmission to Nueces County.
[4] Cost to purchase water from the SPMWD. Cost only includes the purchase price of the water and does not include transmission facilities to deliver the water.
[5] Assuming existing well capacities adequate, no additional cost
[6] Economic Impact of not meeting 2010 shortage (i.e. "no action" alternative) as per TWDB estimates (see Appendix D).

5.2.7.3 Water Supply Plan

Working within the planning criteria established by the Coastal Bend RWPG and TWDB, the following water supply plan is recommended to meet the projected 2000 and 2010 shortages for the Aransas County mining:

- Short-term (approximately 14 years) overdrafting of the Gulf Coast Aquifer.

In addition to the management strategy listed above, the RWPG supports strategies for increased conservation and reuse of existing supplies. Additionally, the RWPG supports all management strategies listed in Table 5.2-2.

5.2.7.4 Costs

It is assumed that existing wells have adequate capacity to meet the needs of the mining users and, therefore, no additional cost to implement this plan is anticipated. The recommended Water Supply Plan, including anticipated costs, is summarized by decade in Table 5.2-3.

Table 5.2-3.
Recommended Plan Costs by Decade for Aransas County Mining

Plan Element	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Projected Surplus/(Shortage) (acft/yr)	(46)	(12)	16	44	59	66
Short-Term Overdrafting						
Supply From Plan Element (acft/yr)	46	12	-	-	-	-
Total Annual Cost ($/yr)	$0	$0	-	-	-	-
Total Unit Cost ($/acft)	$0	$0	-	-	-	-

5.2.8 Irrigation

No irrigation demand exists or is projected for the county.

5.2.9 Livestock

The livestock water demands in Aransas County are met by groundwater from the Gulf Coast Aquifer and surface water from local on-farm sources. No shortages are projected for livestock and no changes in water supply are recommended.

5.3 Bee County Water Supply Plan

Table 5.3-1 lists each water user group in Bee County and their corresponding surplus or shortage in years 2030 and 2050. All water user groups have an adequate supply, as shown in Table 5.3-1.

Table 5.3-1.
Bee County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1]		Comment
	2030 (acft/yr)	2050 (acft/yr)	
City of Beeville	0	0	Supply equals demand
County-Other	7,940	7,820	Projected surplus
Manufacturing	2	1	Projected surplus
Steam-Electric	none	none	No demands projected
Mining	121	124	Projected surplus
Irrigation	2,652	3,127	Projected surplus
Livestock	0	0	Supply equals demand

[1] From Tables 4-3 and 4-4, Section 4 – Comparison of Water Demands with Water Supplies to Determine Needs.

5.3.1 City of Beeville

The City of Beeville contracts with the Corpus Christi to purchase raw water from the CCR/LCC System. The contract allows the City to purchase only the water that it needs. No shortages are projected for the City of Beeville and no changes in water supply are recommended.

5.3.2 County-Other

County-Other demands are met with groundwater from the Carrizo-Wilcox and Gulf Coast Aquifers. No shortages are projected for County-Other entities and no changes in water supply are recommended.

5.3.3 Manufacturing

There are small manufacturing water demands in Bee County. These demands are met by groundwater from the Gulf Coast Aquifer. No shortages are projected for manufacturing and no changes in water supply are recommended.

5.3.4 Steam-Electric

No steam-electric demand exists or is projected for the county.

5.3.5 Mining

There are small mining water demands in Bee County. These demands are met by groundwater from the Gulf Coast Aquifer. No shortages are projected for mining and no changes in water supply are recommended.

5.3.6 Irrigation

Irrigation demands in Bee County are declining over the planning period. These demands are met by groundwater from the Gulf Coast Aquifer. No shortages are projected for irrigation and no changes in water supply are recommended.

5.3.7 Livestock

The livestock water demands in Bee County are met by groundwater from the Gulf Coast Aquifer and surface water from local on-farm sources. No shortages are projected for livestock and no changes in water supply are recommended.

5.4 Brooks County Water Supply Plan

Table 5.4-1 lists each water user group in Brooks County and their corresponding surplus or shortage in years 2030 and 2050. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 5.4-1.
Brooks County Surplus/(Shortage)

Water User Group	*Surplus/(Shortage)*[1] 2030 (acft/yr)	2050 (acft/yr)	*Comment*
City of Falfurrias	206	564	Projected shortages in 2000 and 2010 – see plan below
County-Other	(363)	(267)	Projected shortage – see plan below
Manufacturing	none	none	No demands projected
Steam-Electric	none	none	No demands projected
Mining	52	75	Projected surplus
Irrigation	165	183	Projected surplus
Livestock	0	0	Supply equals demand

[1] From Tables 4-5 and 4-6, Section 4 – Comparison of Water Demands with Water Supplies to Determine Needs.

5.4.1 City of Falfurrias

5.4.1.1 Description

- Source: Groundwater - Gulf Coast Aquifer
- Estimated Reliable Supply: 2,260 acft/yr of suitable, quality groundwater
- System Description: 7 wells

5.4.1.2 Options Considered

The City of Falfurrias has near-term shortages of 226 acft/yr in 2000 and 72 acft/yr in 2010. By the year 2018, supply and demand projections are equal and the City begins to show a projected surplus supply. Table 5.4-2 lists the water management strategies, references to the report sections discussing the strategy, total project cost, and unit costs that were considered for meeting the City of Falfurrias' shortages.

Table 5.4-2.
Water Management Strategies Considered for the City of Falfurrias

Option	Yield (acft/yr)	Approximate Cost[1] Total	Approximate Cost[1] Unit ($/acft)
Small Desalt Plant (Section 5A.6.2)	112	$674,000[2]	$773[2]
Voluntary Reallocation of Groundwater from Mining and Irrigation Surplus (Section 5A.10)	136	$0[3]	$0[3]
System Interconnect (Section 5A.17)	1120	$3,651,000[4]	$941[4]
Short-term Overdrafting of Groundwater	90	$0[5]	$0[5]
No Action	—	$2,107,000[6]	$29,271[6]

[1] Unless otherwise noted, costs are Total Project Cost and Unit Cost ($/acft/yr) for treated water delivered to the water supply entity or entities. Unit cost is for full utilization of project capacity.
[2] Source of Cost Estimate: Section 5A.6. Table 5A.6-3, 0.1 MGD WTP, fully utilized.
[3] Existing well capacities adequate, no additional cost.
[4] Source of Cost Estimate: Section 5A.17. Unit Cost is for incremental increase in cost to carry interconnection between Alice and Premont on to Falfurrias (Tables 5A.17-8 and 5A.17-9). Interconnect could also be made with STWA System near Kingsville.
[5] Existing well capacities adequate, no additional cost.
[6] Economic Impact of not meeting 2010 shortage (i.e., "no action" alternative) as per TWDB estimates (see Appendix D).

5.4.1.3 Water Supply Plan

Working within the planning criteria established by the Coastal Bend RWPG and TWDB, the following water supply plan is recommended to meet the projected 2000 and 2010 shortages for the City of Falfurrias:

- Voluntary Reallocation from Mining and Irrigation surplus; and,
- Short-term (approximately 6 years) overdrafting of the Gulf Coast Aquifer.

In addition to the management strategies listed above, the RWPG supports strategies for increased conservation and reuse of existing supplies. Additionally, the RWPG supports all management strategies listed in Table 5.4-2.

5.4.1.4 Costs

The City of Falfurrias currently has adequate well capacity to meet its needs and, therefore, no additional cost to implement this plan is anticipated. The recommended Water Supply Plan including anticipated costs is summarized by decade in Table 5.4-3.

Table 5.4-3.
Recommended Plan Costs by Decade for the City of Falfurrias

Plan Element	2000	2010	2020	2030	2040	2050
Projected Surplus/(Shortage) (acft/yr)	(226)	(72)	22	206	383	564
Voluntary Reallocation (Mining and Irrigation)						
Supply From Plan Element (acft/yr)	136	72	-	-	-	-
Annual Cost ($/yr)	$0	$0	-	-	-	-
Unit Cost ($/acft)	$0	$0	-	-	-	-
Short-term Overdrafting						
Supply From Plan Element (acft/yr)	90	-	-	-	-	-
Annual Cost ($/yr)	$0	-	-	-	-	-
Unit Cost ($/acft)	$0	-	-	-	-	-
Total Annual Cost ($/yr)	$0	$0	-	-	-	-
Total Unit Cost ($/acft)	$0	$0	-	-	-	-

5.4.1.5 Reallocation of Surplus City of Falfurrias Supplies

Part of the City of Falfurrias surplus has been reallocated to County-Other use, as shown in Table 5.4-4.

Table 5.4-4.
Reallocation of Surplus Supplies by Decade for the City of Falfurrias

Plan Element	2000	2010	2020	2030	2040	2050
Original Projected Surplus[1] (acft/yr)	0	0	22	206	383	564
Reallocated Surplus (acft/yr)	0	0	22[2]	146[2]	74[2]	9[2]
Remaining Projected Surplus (acft/yr)	0	0	0	60	309	555

1 Includes any surplus created with the implementation of the recommended plan (Table 5.4-3).
2 Reallocated to County-Other (Section 5.4.2).

5.4.2 County-Other

5.4.2.1 Description

- Source: Groundwater - Gulf Coast Aquifer
- Estimated Reliable Supply: 321 acft/yr
- System Description: Individual Wells

5.4.2.2 Options Considered

The County-Other supply in Brooks County shows a projected shortage of 567 acft/yr in 2000 and 267 acft/yr in 2050. Near-term shortages (2000) are about 65 percent of demand, and demands are projected to be approximately 45 percent short in 2050. Table 5.4-5 lists the water management strategies, references to the report sections discussing the strategy, total project cost, and unit costs that were considered for meeting the Brooks County-Other shortages.

Table 5.4-5.
Water Management Strategies Considered for Brooks County-Other

Option	Yield (acft/yr)	Approximate Cost[1]	
		Total	Unit ($/acft)
Small Desalt Plant (Section 5A.6.2)	560	$1,519,000[2]	$397[2]
Voluntary Reallocation of Groundwater from Mining and Irrigation Surplus (Section 5A.10)	136 to 258	$0[3]	$0[3]
Voluntary Reallocation of Groundwater from City of Falfurrias Surplus (Section 5A.10)	9 to 146	$0[3]	$0[3]
System Interconnect (Section 5A.17)	1120	$3,651,000[4]	$941[4]
Short-term Overdrafting of Groundwater	567	$0[5]	$0[5]
No Action	-	$7,689,000[6]	$21,182[6]

[1] Unless otherwise noted, costs are Total Project Cost and Unit Cost ($/acft/yr) for treated water delivered to the water supply entity or entities. Unit cost is for full utilization of project capacity.
[2] Source of Cost Estimate: Section 5A.6. Table 5A.6-3, 0.5 MGD WTP, fully utilized (does not included distribution system costs for a regional WTP).
[3] Assuming existing well capacities adequate, no additional cost.
[4] Source of Cost Estimate: Section 5A.17. Unit Cost is for incremental increase in cost to carry interconnection between Alice and Premont on to Falfurrias (Tables 5A.17-8 and 5A.17-9). Interconnects could also be made with STWA system near Kingsville. Assumption made that this strategy could provide water to County-Other water users adjacent to the potable water transmission pipeline. Does not include additional distribution system pipeline costs.
[5] Assuming existing well capacities adequate, no additional cost.
[6] Economic Impact of not meeting 2030 shortage (i.e., “no action” alternative) as per TWDB estimates (see Appendix D).

5.4.2.3 Water Supply Plan

Working within the planning criteria established by the Coastal Bend RWPG and TWDB, the following water supply plan is recommended to meet the projected near-term and long-term shortages for Brooks County-Other:

- Voluntary Reallocation from Mining and Irrigation surplus;
- Voluntary Reallocation of City of Falfurrias surplus; and,
- Short-term (approximately 30 years) overdrafting of the Gulf Coast Aquifer.

In addition to the management strategies listed above, the RWPG supports strategies for increased conservation and reuse of existing supplies. Additionally, the RWPG supports all management strategies listed in Table 5.4-5.

5.4.2.4 Costs

The function of the County-Other demand projection category is to capture the demands of single-family rural municipal demands, as well as demands for small rural water supply systems. The nature of this category, therefore, makes it difficult to determine well and distribution system capacities. Due to this limitation and the fact that the plan is made up of reallocating and overdrafting the groundwater resources in Brooks County, no additional costs can be reasonably calculated for the County-Other water plan in Brooks County. The recommended Water Supply Plan, including anticipated costs, is summarized by decade in Table 5.4-6.

Table 5.4-6.
Recommended Plan Costs by Decade for Brooks County-Other

Plan Element	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Projected Surplus/(Shortage) (acft/yr)	(567)	(460)	(446)	(363)	(313)	(267)
Voluntary Reallocation (Mining and Irrigation)						
Supply From Plan Element (acft/yr)	-	96	193	217	239	258
Annual Cost ($/yr)	-	$0	$0	$0	$0	$0
Unit Cost ($/acft)	-	$0	$0	$0	$0	$0
Voluntary Reallocation (City of Falfurrias)						
Supply From Plan Element (acft/yr)	-	-	22	146	74	9
Annual Cost ($/yr)	-	-	$0	$0	$0	$0
Unit Cost ($/acft)	-	-	$0	$0	$0	$0
Short-term Overdrafting						
Supply From Plan Element (acft/yr)	567	364	231	-	-	-
Annual Cost ($/yr)	$0	$0	$0	-	-	-
Unit Cost ($/acft)	$0	$0	$0	-	-	-
Total Annual Cost ($/yr)	$0	$0	$0	$0	$0	$0
Total Unit Cost ($/acft)	$0	$0	$0	$0	$0	$0

5.4.3 Manufacturing

No manufacturing demand exists or is projected for Brooks County.

5.4.4 Steam-Electric

No steam-electric demand exists or is projected for Brooks County.

5.4.5 Mining

The mining demands are met with groundwater from the Gulf Coast Aquifer. No shortages are projected for Brooks County mining. Projected surplus supply through 2050 has been reallocated to the City of Falfurrias (2000 to 2020) and County-Other (2020 to 2050) to mitigate near-term and long-term shortages for these water user groups (Table 5.4-7).

Table 5.4-7.
Reallocation of Surplus Supplies by Decade for Brooks County Mining

Plan Element	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Original Projected Surplus (acft/yr)	1	22	38	52	65	75
Reallocated Surplus (acft/yr)	1[1]	22[2]	38[2]	52[2]	65[2]	75[2]
Remaining Projected Surplus (acft/yr)	0	0	0	0	0	0

1 Reallocated to City of Falfurrias.
2 Reallocated to Brooks County-Other.

5.4.6 Irrigation

The irrigation demands are met with groundwater from the Gulf Coast Aquifer. No shortages are projected for Brooks County irrigation. Projected surplus supply through 2050 has been reallocated to the City of Falfurrias (2000 to 2020) and County-Other (2020 to 2050) to mitigate near-term and long-term shortages for these water user groups (Table 5.4-8).

Table 5.4-8.
Reallocation of Surplus Supplies by Decade for Brooks County Irrigation

Plan Element	2000	2010	2020	2030	2040	2050
Original Projected Surplus (acft/yr)	135	146	155	165	174	183
Reallocated Surplus (acft/yr)	135[1]	146[2]	155[3]	165[3]	174[3]	183[3]
Remaining Projected Surplus (acft/yr)	0	0	0	0	0	0

[1] Reallocated to City of Falfurrias.
[2] Reallocated 72 acft/yr to City of Falfurrias and 74 acft/yr to Brooks County-Other.
[3] Reallocated to Brooks County-Other.

5.4.7 Livestock

The livestock water demands in Brooks County are met by groundwater from the Gulf Coast Aquifer and surface water from local on-farm sources. No shortages are projected for Brooks County livestock and no changes in water supply are recommended.

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5.5 Duval County Water Supply Plan

Table 5.5-1 lists each water user group in Duval County and their corresponding surplus or shortage in years 2030 and 2050. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 5.5-1.
Duval County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2050 (acft/yr)	Comment
City of Benavides	(509)	(536)	Projected shortage – see plan below
City of Freer	(783)	(926)	Projected shortage – see plan below
City of San Diego	(725)	(831)	Projected shortage – see plan below
County-Other	(353)	(308)	Projected shortage – see plan below
Manufacturing	none	none	No demands projected
Steam-Electric	none	none	No demands projected
Mining	(1,377)	(1,411)	Projected shortage – see plan below
Irrigation	(1,030)	(945)	Projected shortage – see plan below
Livestock	0	0	Supply equals demand

[1] From Tables 4-7 and 4-8, Section 4 – Comparison of Water Demands with Water Supplies to Determine Needs.

5.5.1 City of Benavides

5.5.1.1 Description

- Source: Groundwater - Gulf Coast Aquifer
- Estimated Reliable Supply: 50 acft/yr of suitable, quality groundwater
- System Description: 4 wells

5.5.1.2 Options Considered

The City of Benavides has near-term shortages of 509 acft/yr by 2030. This shortage grows to over 536 acft/yr by 2050. Shortages are about 90 percent of demand. Table 5.5-2 lists the water management strategies, references to the report sections discussing the strategy, total project cost, and unit costs that were considered for meeting the City of Benavides' shortages.

Table 5.5-2.
Water Management Strategies Considered for the City of Benavides

Option	Yield (acft/yr)	Approximate Cost[1] Total	Approximate Cost[1] Unit ($/acft)
Small Desalt Plant (Section 5A.6.2)	560	$2,570,000[2]	$531[2]
Voluntary Reallocation of Groundwater from Mining and Irrigation Surplus in Jim Wells County[3] (Section 5A.10)	564	$303,000[4]	$39[4]
System Interconnect (Section 5A.17)	560	$4,063,000[5]	$1,121[5]
Short-term Overdrafting of Groundwater	191	$0[6]	$0[6]
No Action	-	$16,787,000[7]	$32,981[7]

[1] Unless otherwise noted, costs are Total Project Cost and Unit Cost ($/acft/yr) for treated water delivered to the water supply entity or entities. Unit cost is for full utilization of project capacity.
[2] Source of Cost Estimate: Section 5A.6. Table 5A.6-3, 1.0 MGD WTP, producing 0.5 MGD annual average. Additional capacity (0.5 MGD) is needed for peaking due to limited groundwater supply available (50 acft/yr).
[3] Due to close proximity of the City of Benavides to Jim Wells County and the abundance of surplus groundwater in Jim Wells County, it was assumed that the City could either make use of Jim Wells County groundwater utilizing their existing wells or through an additional new well field in Jim Wells County.
[4] If additional wells are needed in Jim Wells County; costs of wells in well field are included, costs of transmission facilities are not.
[5] Source of Cost Estimate: Section 5A.17. Unit Cost is for incremental increase in cost to carry interconnection between Alice and San Diego and Benavides (Tables 5A.17-4 and 5A.17-6). Interconnect could also be made with STWA system near Kingsville.
[6] Existing well capacities adequate for overdrafting (up to 191 acft/yr) and existing (50 acft/yr) groundwater allocation, no additional costs.
[7] Economic Impact of not meeting 2030 shortage (i.e., "no action" alternative) as per TWDB estimates (see Appendix D).

5.5.1.3 Water Supply Plan

Working within the planning criteria established by the Coastal Bend RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages for the City of Benavides:

- Voluntary Reallocation from Jim Wells County Mining and Irrigation surplus; and,
- Short-term (approximately 9 years) overdrafting of the Gulf Coast Aquifer.

In addition to the management strategies listed above, the RWPG supports strategies for increased conservation and reuse of existing supplies. Additionally, the RWPG supports all management strategies listed in Table 5.5-2.

5.5.1.4 Costs

The City of Benavides currently has adequate well capacity for near-term overdrafting (up to 191 acft per year) and existing groundwater allocation (50 acft per year); therefore, no additional cost to implement the overdrafting component of the plan is anticipated. However, voluntary reallocation of Jim Wells County groundwater will require additional well capacity. The recommended Water Supply Plan including anticipated costs is summarized by decade in Table 5.5-3

a. Voluntary Reallocation of Groundwater:
   - Cost Source: New wells in Jim Wells County
   - Date to be Implemented: By year 2005
   - Annual Cost: $21,995 per year fully utilized (not including transmission costs from Jim Wells County)

Table 5.5-3.
Recommended Plan Costs by Decade for the City of Benavides

Plan Element	***2000***	***2010***	***2020***	***2030***	***2040***	***2050***
Projected Surplus/(Shortage) (acft/yr)	(448)	(471)	(491)	(509)	(519)	(536)
Voluntary Reallocation						
Supply From Plan Element (acft/yr)	257	471	491	509	519	536
Annual Cost ($/yr)	$21,995[1]	$21,995[1]	$21,995[1]	$21,995[1]	$0[3]	$0[3]
Unit Cost ($/acft)	$86[2]	$47[2]	$45[2]	$43[2]	$0[3]	$0[3]
Short-Term Overdrafting						
Supply From Plan Element (acft/yr)	191	-	-	-	-	-
Annual Cost ($/yr)	$0	-	-	-	-	-
Unit Cost ($/acft)	$0	-	-	-	-	-
Total Annual Cost ($/yr)	$21,995	$21,995	$21,995	$21,995	$0	$0
Total Unit Cost ($/acft)	$49	$47	$45	$43	$0	$0

[1] Assumes additional Jim Wells County wells are needed; costs of wells in well field are included, costs of transmission facilities, power, O&M, etc. are not.
[2] Unit cost of new wells is based on actual projected use.
[3] Debt for new wells in Jim Wells County will be paid for but there will be some power and O&M costs throughout the life of the wells.

5.5.2 City of Freer

5.5.2.1 Description

- Source: Groundwater - Gulf Coast Aquifer
- Estimated Reliable Supply: 109 acft/yr of suitable, quality groundwater
- System Description: Served by Freer WCID; 6 wells.

5.5.2.2 Options Considered

The City of Freer has near-term shortages of 783 acft/yr by 2030. This shortage grows to 926 acft/yr by 2050. Shortages are about 90 percent of demand. Table 5.5-4 lists the water management strategies, references to the report sections discussing the strategy, total project cost, and unit costs that were considered for meeting the City of Freer's shortages.

Table 5.5-4.
Water Management Strategies Considered for the City of Freer

Option	*Yield (acft/yr)*	*Approximate Cost*[1]	
		Total	*Unit ($/acft)*
Small Desalt Plant (Section 5A.6.2)	840	$3,350,000[2]	$485[2]
Voluntary Reallocation of Groundwater from Carrizo-Wilcox and Queen City Aquifers in McMullen County[3] (Section 5A.10)	1000[4]	$869,500[5]	$63[5]
System Interconnect (Section 5A.17)	896	$7,455,000[6]	$1,278[6]
No Action	-	$22,919,000[7]	$29,271[7]

1 Unless otherwise noted, costs are Total Project Cost and Unit Cost ($/acft/yr) for treated water delivered to the water supply entity or entities. Unit cost is for full utilization of project capacity.
2 Source of Cost Estimate: Section 5A.6. Table 5A.6-3, 1.5 MGD WTP, producing 0.75 MGD annual average. Additional capacity (0.75 MGD) is needed for peaking due to limited groundwater supply available (109 acft/yr). Note that additional WTP capacity or more potable water storage will be needed by 2040 in order to cover increasing demands.
3 Due to close proximity of the City of Freer to McMullen County and the abundance of surplus groundwater in McMullen County, it was assumed that the City could make use of McMullen County groundwater via a new well field.
4 Approximately 10 percent of surplus groundwater in McMullen County.
5 Additional wells in McMullen County, does not include transmission costs, which could be substantial.
6 Source of Cost Estimate: Section 5A.17. Unit Cost is for incremental increase in cost to carry interconnection between Alice and San Diego and Freer (Tables 5A.17-5 and 5A.17-6).
7 Economic Impact of not meeting 2030 shortage (i.e., "no action" alternative) as per TWDB estimates (see Appendix D).

5.5.2.3 Water Supply Plan

Working within the planning criteria established by the Coastal Bend RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages for the City of Freer:

- Prior to 2030:
  - Use of a small desalination water treatment plant in conjunction with poor-quality groundwater in the region.
- After 2030 and through 2050:
  - Expand desalination water treatment plant; or
  - Construct system interconnect.

The selection of a well field and pipeline to Carrizo-Wilcox sources in McMullen County is limited as an option due to the anticipated large transmission costs from a suitable location in McMullen County to the City of Freer (approximately 50 miles).

In addition to the management strategies listed above, the RWPG supports strategies for increased conservation and reuse of existing supplies. Additionally, the RWPG supports all management strategies listed in Table 5.5-4.

5.5.2.4 Costs

Costs of the recommended plan for the City of Freer to meet 2030 shortages are:

a. Small Desalination Water Treatment Plant:
   - Cost Source: Section 5A.6
   - Date to be Implemented: By year 2005
   - Annual Cost: $407,000 per year

The recommended Water Supply Plan including anticipated costs is summarized by decade in Table 5.5-5.

Table 5.5-5.
Recommended Plan Costs by Decade for the City of Freer

Plan Element	***2000***	***2010***	***2020***	***2030***	***2040***	***2050***
Projected Surplus/(Shortage) (acft/yr)	(614)	(668)	(715)	(783)	(844)	(926)
Desalt Plant						
Supply From Plan Element (acft/yr)	840	840	840	840	840[1]	840[1]
Annual Cost ($/yr)	$407,000[2]	$407,000[2]	$407,000[2]	$407,000[2]	$164,000[3]	$164,000[3]
Unit Cost ($/acft)	$485[4]	$485[4]	$485[4]	$485[4]	$195[4]	$195[4]

[1] Additional treatment capacity may be needed by 2040.
[2] Annual cost includes debt service, O&M, power and treated water costs.
[3] Annual cost includes O&M, power and treated water costs.
[4] Unit costs assume full average annual utilization (0.75 MGD) of desalt plant.

5.5.3 City of San Diego

The City of San Diego is in both Duval and Jim Wells Counties; consequently, its demands and supplies are split into the tables for each county. The descriptions below are to mitigate the shortages in Duval County.

5.5.3.1 Description

- Source: Groundwater - Gulf Coast Aquifer
- Estimated Reliable Supply: 110 acft/yr of suitable, quality groundwater
- System Description: 6 wells

5.5.3.2 Options Considered

The City of San Diego has near-term shortages of 725 acft/yr by 2030. This shortage grows to 831 acft/yr by 2050. Shortages are about 88 percent of demand throughout the period. Table 5.5-6 lists the water management strategies, references to the report sections discussing the strategy, total project cost, and unit costs that were considered for meeting the City of San Diego's shortages.

Table 5.5-6.
Water Management Strategies Considered for the City of San Diego (in Duval County)

Option	Yield (acft/yr)	Approximate Cost[1] Total	Approximate Cost[1] Unit ($/acft)
Small Desalt Plant (Section 5A.6.2)	700	$3,000,000[2]	$503[2]
Voluntary Reallocation of Groundwater from City of San Diego Surplus in Jim Wells County[3] (Section 5A.10)	24 to 39	$0[4]	$0[4]
System Interconnect (Section 5A.17)	974	$3,364,000[5]	$762[5]
No Action	-	$21,221,000[6]	$29,271[6]

[1] Unless otherwise noted, costs are Total Project Cost and Unit Cost ($/acft/yr) for treated water delivered to the water supply entity or entities. Unit cost is for full utilization of project capacity.
[2] Source of Cost Estimate: Section 5A.6. Table 5A.6-3, 1.25 MGD WTP, producing 0.625 MGD annual average. Additional capacity (0.625 MGD) is needed for peaking due to limited groundwater supply available (110 acft/yr).
[3] The City of San Diego is in two counties, Duval and Jim Wells Counties.
[4] Existing well capacities adequate, no additional cost.
[5] Source of Cost Estimate: Section 5A.17. Unit Cost is for cost for interconnection between Alice and San Diego (Table 5A.17-6).
[6] Economic Impact of not meeting 2030 shortage (i.e., "no action" alternative) as per TWDB estimates (see Appendix D).

5.5.3.3 Water Supply Plan

Working within the planning criteria established by the Coastal Bend RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages for the City of San Diego:

- Voluntary Reallocation of City of San Diego surplus from Jim Wells County; and,
- System Interconnect to City of Alice in Jim Wells County.

In addition to the management strategies listed above, the RWPG supports strategies for increased conservation and reuse of existing supplies. Additionally, the RWPG supports all management strategies listed in Table 5.5-6.

5.5.3.4 Costs

Costs of the recommended plan for the City of San Diego to meet 2030 shortages are:

a. Voluntary Reallocation of groundwater:
   - Cost Source: No additional cost
   - Date to be Implemented: 2000
   - Annual Cost: No additional cost

b. System Interconnect to the City of Alice:
   - Cost Source: Section 5A.17
   - Date to be Implemented: By year 2005
   - Annual Cost: $742,000 per year

The recommended Water Supply Plan including anticipated costs is summarized by decade in Table 5.5-7.

Table 5.5-7.
Recommended Plan Costs by Decade for the City of San Diego (in Duval County)

Plan Element	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Projected Surplus/(Shortage) (acft/yr)	(597)	(643)	(662)	(725)	(769)	(831)
Voluntary Reallocation						
Supply From Plan Element (acft/yr)	24	30	31	34	37	39
Annual Cost ($/yr)	$0	$0	$0	$0	$0	$0
Unit Cost ($/acft)	$0	$0	$0	$0	$0	$0
System Interconnect						
Supply From Plan Element (acft/yr)	573	613	631	691	732	792
Annual Cost ($/yr)	$742,000[1]	$742,000[1]	$742,000[1]	$742,000[1]	$498,000[2]	$498,000[2]
Unit Cost ($/acft)	$762[3]	$762[3]	$762[3]	$762[3]	$511[3]	$511[3]
Total Annual Cost ($/yr)	$742,000	$742,000	$742,000	$742,000	$498,000	$498,000
Total Unit Cost ($/acft)	$762	$762	$762	$762	$511	$511

[1] Annual cost includes debt service, O&M, power and treated water costs.
[2] Annual cost includes O&M, power, and treated water costs.
[3] Unit costs assumes full utilization of system interconnect.

5.5.4 County-Other

5.5.4.1 Description

- Source: Groundwater - Gulf Coast Aquifer
- Estimated Reliable Supply: 113 acft/yr of suitable, quality groundwater
- System Description: Individual Wells and Small Water Supply Systems.

5.5.4.2 Options Considered

The County-Other supply in Duval County shows a projected shortage of 366 acft/yr in 2000 and 308 acft/yr in 2050. Shortages are approximately 75 percent of demand throughout the 50-year planning horizon. Table 5.5-8 lists the water management strategies, references to the report sections discussing the strategy, total project cost, and unit costs that were considered for meeting the Duval County-Other shortages.

Table 5.5-8.
Water Management Strategies Considered for Duval County-Other

Option	Yield (acft/yr)	Approximate Cost[1]	
		Total	Unit ($/acft)
Small Desalt Plant (Section 5A.6.2)	336	$1,519,000[2]	$635[2]
System Interconnect (Section 5A.17)	90	$5,459,000[3]	$5,545[3]
Overdrafting of Groundwater	308 to 372	$0[4]	$0[4]
No Action	-	$7,477,000[5]	$21,182[5]

[1] Unless otherwise noted, costs are Total Project Cost and Unit Cost ($/acft/yr) for treated water delivered to the water supply entity or entities. Unit cost is for full utilization of project capacity.
[2] Source of Cost Estimate: Section 5A.6. Table 5A.6-3, 0.5 MGD WTP, producing 0.3 MGD annual average. Additional capacity (0.2 MGD) is needed for peaking due to limited groundwater supply available (113 acft/yr).
[3] Source of Cost Estimate: Section 5A.17. Unit Cost is for incremental increase in cost to carry interconnection between Alice and San Diego, Freer, & Benavides on to Realitos & Concepcion (Tables 5A.17-2 and 5A.17-3).
[4] Assuming existing well capacities adequate, no additional cost.
[5] Economic Impact of not meeting 2030 shortage (i.e., “no action” alternative) as per TWDB estimates (see Appendix D).

5.5.4.3 Water Supply Plan

Working within the planning criteria established by the Coastal Bend RWPG and TWDB, the following water supply plan is recommended to meet the projected near-term and long-term shortages for Duval County-Other:

- Overdrafting of the Gulf Coast Aquifer.

In addition to the management strategy listed above, the RWPG supports strategies for increased conservation and reuse of existing supplies. Additionally, the RWPG supports all management strategies listed in Table 5.5-8.

5.5.4.4 Costs

The function of the County-Other demand projection category is to capture the demands of single-family rural municipal demands, as well as demands for small rural water supply systems. The nature of this category, therefore, makes it difficult to determine well and distribution system capacities. Due to this limitation and the fact that the plan is made up of reallocating and overdrafting the groundwater resources in Duval County, no costs can be reasonably calculated for the County-Other water plan. The recommended Water Supply Plan including anticipated costs is summarized by decade in Table 5.5-9.

Table 5.5-9.
Recommended Plan Costs by Decade for Duval County-Other

Plan Element	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Projected Surplus/(Shortage) (acft/yr)	(366)	(365)	(372)	(353)	(331)	(308)
Overdrafting Groundwater						
Supply From Plan Element (acft/yr)	366	365	372	353	331	308
Annual Cost ($/yr)	$0	$0	$0	$0	$0	$0
Unit Cost ($/acft)	$0	$0	$0	$0	$0	$0

5.5.5 Manufacturing

No manufacturing demand exists or is projected for Duval County.

5.5.6 Steam-Electric

No steam-electric demand exists or is projected for Duval County.

5.5.7 Mining

5.5.7.1 Description

- Source: Groundwater - Gulf Coast Aquifer
- Estimated Reliable Supply: 1616 acft/yr of suitable, quality groundwater
- System Description: Various mining operations.

5.5.7.2 Options Considered

The mining supply in Duval County shows a projected shortage of 3,396 acft/yr in 2000 and 1,411 acft/yr in 2050. Shortages are approximately 68 percent of demand in 2000 and approximately 47 percent long-term (2050). Table 5.5-10 lists the water management strategies, references to the report sections discussing the strategy, total project cost, and unit costs that were considered for meeting the Duval County mining shortages.

Table 5.5-10.
Water Management Strategies Considered for Duval County Mining

Option	*Yield (acft/yr)*	*Approximate Cost*[1]	
		Total	*Unit ($/acft)*
Use of Non-Potable Groundwater	2000[2]	$0[2]	$0[2]
Recycle and Reuse Groundwater	1500 to 2500[3]	$0[3]	$0[3]
No Action	-	$5,952,000[4]	$4,323[4]

[1] Unless otherwise noted, costs are Total Project Cost and Unit Cost ($/acft/yr) for treated water delivered to the water supply entity or entities. Unit cost is for full utilization of project capacity.
[2] Abundant non-potable groundwater reserved exist in Duval County (Appendix C). Assumed use of up to one-half of the shortage to be supplied by non-potable water. Assumed no additional cost for wells. Existing wells assumed to be able to handle this supply.
[3] Majority of the mining demand in Duval County is thought to be Uranium mining in which a significant portion of the process water is recycled and used again. Assumed that up to one-half of the shortage demand can be met through recycling. Assumed this could be done with existing facilities, therefore, no additional cost.
[4] Economic Impact of not meeting 2030 shortage (i.e., “no action” alternative) as per TWDB estimates (see Appendix D).

5.5.7.3 Water Supply Plan

Working within the planning criteria established by the Coastal Bend RWPG and TWDB, the following water supply plan is recommended to meet the projected near-term and long-term shortages for Duval County mining:

- Use of non-potable groundwater from the Gulf Coast Aquifer; and,
- Use of recycling and reuse programs for mining process water.

In addition to the management strategies listed above, the RWPG supports strategies for increased conservation and reuse of existing supplies.

5.5.7.4 Costs

It is assumed that due to the large near-term (2000) deficits in water supply, the mining operations are already operating in a manner similar to that described for the Duval County Mining Water Supply Plan. Therefore, no additional capital costs can be reasonably calculated for the mining water plan. The recommended Water Supply Plan including anticipated costs is summarized by decade in Table 5.5-11.

Table 5.5-11. Recommended Plan Costs by Decade for Duval County Mining

Plan Element	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Projected Surplus/(Shortage) (acft/yr)	(3,396)	(2,053)	(1,437)	(1,377)	(1,380)	(1,411)
Use of Non-Potable Groundwater						
Supply From Plan Element (acft/yr)	1,780	1,026	719	688	690	705
Annual Cost ($/yr)	$0	$0	$0	$0	$0	$0
Unit Cost ($/acft)	$0	$0	$0	$0	$0	$0
Recycle and Reuse of Groundwater						
Supply From Plan Element (acft/yr)	1,616	1,027	718	689	690	706
Annual Cost ($/yr)	$0	$0	$0	$0	$0	$0
Unit Cost ($/acft)	$0	$0	$0	$0	$0	$0
Total Annual Cost ($/yr)	$0	$0	$0	$0	$0	$0
Total Unit Cost ($/acft)	$0	$0	$0	$0	$0	$0

5.5.8 Irrigation

5.5.8.1 Description

- Source: Groundwater - Gulf Coast Aquifer
- Estimated Reliable Supply: 1378 acft/yr
- System Description: Various on-farm irrigation systems

5.5.8.2 Options Considered

The irrigation supply in Duval County shows a projected shortage of 1,162 acft/yr in 2000 and 945 acft/yr in 2050. Shortages are approximately 46 percent of demand in 2000 and approximately 41 percent long-term (2050). Table 5.5-12 lists the water management strategies, references to the report sections discussing the strategy, total project cost, and unit costs that were considered for meeting the Duval County Irrigation shortages. In addition to the strategies shown in Table 5.5-12, individual irrigators could choose to alter their fields and grow crops more suitable to dry land farming techniques. Of the factors that effect such a decision (suitable water availability, market prices for dry land farming crops, tolerance for risk on the part of the farmer, etc.), only water availability is somewhat definable. The other factors that impact the choice to pursue dry land farming are impossible to predict with any confidence and therefore, no costs for changing to dry land farming were tabulated.

Table 5.5-12.
Water Management Strategies Considered for Duval County Irrigation

Option	***Yield (acft/yr)***	***Approximate Cost[1]***	
		Total	***Unit ($/acft)***
Irrigation Conservation (Section 5A.2)	1,356[2]	$610,000[2]	$33[2]
No Action	-	$49,000[3]	$48[3]

[1] Unless otherwise noted, costs are Total Project Cost and Unit Cost ($/acft/yr) for treated water delivered to the water supply entity or entities. Unit cost is for full utilization of project capacity.
[2] Source of Cost Estimate: Section 5A.2. Irrigation Conservation is the sum of conservation due to LEPA and Surge Irrigation improvements on the appropriate acreage within the county and a weighted unit cost.
[3] Economic Impact of not meeting 2030 shortage (i.e., "no action" alternative) as per TWDB estimates (see Appendix D).

5.5.8.3 Water Supply Plan

Working within the planning criteria established by the Coastal Bend RWPG and TWDB, the following water supply plan is recommended to meet the projected near-term and long-term shortages for Duval County Irrigation:

- Irrigation Conservation (LEPA/Surge).

In addition to the management strategy listed above, the RWPG supports strategies for increased conservation and reuse of existing supplies.

5.5.8.4 Costs

Costs of the recommended plan for Duval County Irrigators to meet 2030 shortages are:

a. Irrigation Conservation (LEPA/Surge):
- Cost Source: Section 5A.2
- Date to be Implemented: 2005
- Annual Cost: $38,000 per year

The recommended Water Supply Plan including anticipated costs is summarized by decade in Table 5.5-13.

Table 5.5-13.
Recommended Plan Costs by Decade for Duval County Irrigation

Plan Element	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Projected Surplus/(Shortage) (acft/yr)	(1,162)	(1,117)	(1,073)	(1,030)	(987)	(945)
Irrigation Conservation (LEPA/Surge)						
Supply From Plan Element (acft/yr)	1,162	1,162	1,162	1,162	1,162	1,162
Total Annual Cost ($/yr)	$38,000[1]	$38,000[1]	$38,000[1]	$38,000[1]	$38,000[1]	$38,000[1]
Total Unit Cost ($/acft)	$33	$33	$33	$33	$33	$33

[1] Annual cost includes debt service and O&M costs assumed to last in perpetuity.

5.5.9 Livestock

The livestock water demands in Duval County are met by groundwater from the Gulf Coast Aquifer and surface water from local on-farm sources. No shortages are projected for Duval County livestock and no changes in water supply are recommended.

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5.6 Jim Wells County Water Supply Plan

Table 5.6-1 lists each water user group in Jim Wells County and their corresponding surplus or shortage in years 2030 and 2050. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections. Water supply plans are also presented for some entities that need pumping/conveyance facilities to utilize their existing water resources, or to become a regional provider.

Table 5.6-1.
Jim Wells County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2050 (acft/yr)	Comment
City of Alice	0	16	Projected surplus
City of Orange Grove	107	113	Projected surplus
City of Premont	(202)	(327)	Projected shortage – see plan below
City of San Diego	34	39	Projected surplus (from Jim Wells' supplies, see Section 5.5 for other sources from Duval County)
County-Other	209	383	Projected shortage in 2000 – see plan below
Manufacturing	none	none	No demands projected
Steam-Electric	none	none	No demands projected
Mining	451	531	Projected surplus
Irrigation	368	529	Projected surplus
Livestock	0	0	Supply equals demand

[1] From Tables 4-9 and 4-10, Section 4 – Comparison of Water Demands with Water Supplies to Determine Needs.

5.6.1 City of Alice

The City of Alice has a contract to purchase water from the City of Corpus Christi via Lake Corpus Christi. The City also maintains a small reservoir in town, Lake Alice, which serves as temporary storage of waters from Lake Corpus Christi. This reservoir is fed naturally by a small watershed and has no effective firm yield. No shortages are projected for the City of Alice and no changes in water supply are recommended.

5.6.2 City of Orange Grove

The City of Orange Grove's water supply is from the Gulf Coast Aquifer. No shortages are projected for the City of Orange Grove and no changes in water supply are recommended.

5.6.3 City of Premont

5.6.3.1 Description

- Source: Groundwater - Gulf Coast Aquifer
- Estimated Reliable Supply: 1,230 acft/yr of suitable, quality groundwater
- System Description: 4 wells

5.6.3.2 Options Considered

The City of Premont has near-term shortages of 62 acft/yr by 2020. This shortage grows to 327 acft/yr by 2050. Near-term shortages are about 4 percent of demand, and long-term shortages (2050) are approximately 21 percent of demand. Table 5.6-2 lists the water management strategies, references to the report sections discussing the strategy, total project cost, and unit costs that were considered for meeting the City of Premont's shortages.

Table 5.6-2.
Water Management Strategies Considered for the City of Premont

Option	Yield (acft/yr)	Approximate Cost[1]	
		Total	Unit ($/acft)
Small Desalt Plant (Section 5A.6.2)	280	$1,000,000[2]	$500[2]
Voluntary Reallocation of Groundwater from Irrigation Surplus (Section 5A.10)	62 to 327	$0[3]	$0[3]
System Interconnect (Section 5A.17)	1,434	$7,430,000[4]	$863[4]
No Action	-	$6,662,000[5]	$32,981[5]

[1] Unless otherwise noted, costs are Total Project Cost and Unit Cost ($/acft/yr) for treated water delivered to the water supply entity or entities. Unit cost is for full utilization of project capacity.
[2] Source of Cost Estimate: Section 5A.6. Table 5A.6-3, 0.25 MGD WTP, fully utilized.
[3] Assuming existing well capacities are adequate, no additional cost.
[4] Source of Cost Estimate: Section 5A.17. Unit Cost is cost to carry interconnection between Alice and Premont (Table 5A.17-8).
[5] Economic Impact of not meeting 2030 shortage (i.e., "no action" alternative) as per TWDB estimates (see Appendix D).

5.6.3.3 Water Supply Plan

Working within the planning criteria established by the Coastal Bend RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages for the City of Premont:

- Voluntary Reallocation of Irrigation surplus.

In addition to the management strategy listed above, the RWPG supports strategies for increased conservation and reuse of existing supplies. Additionally, the RWPG supports all management strategies listed in Table 5.6-2.

5.6.3.4 Costs

The City of Premont currently has adequate well capacity to meet its needs. Therefore, no additional cost to implement this plan is anticipated. The recommended Water Supply Plan including anticipated costs is summarized by decade in Table 5.6-3.

Table 5.6-3.
Recommended Plan Costs by Decade for the City of Premont

Plan Element	***2000***	***2010***	***2020***	***2030***	***2040***	***2050***
Projected Surplus/(Shortage) (acft/yr)	0	0	(62)	(202)	(255)	(327)
Voluntary Reallocation						
Supply From Plan Element (acft/yr)	-	-	62	202	255	327
Total Annual Cost ($/yr)	-	-	$0	$0	$0	$0
Total Unit Cost ($/acft)	-	-	$0	$0	$0	$0

5.6.4 City of San Diego

The City of San Diego is in both Duval and Jim Wells Counties; consequently, its water demand and supply values are split into the tables in each county. San Diego's supply is groundwater from the Gulf Coast Aquifer. The manner in which the demands and supplies were allocated between the counties shows a shortage to supply for San Diego in Duval County and a small surplus in supply in Jim Wells County. Table 5.6-4 shows the reallocation of Jim Wells County surplus for the City of San Diego to the City's Duval County supply (Section 5.5-3).

Table 5.6-4.
Reallocation of Surplus Supplies by Decade for the City of San Diego in Jim Wells County

Plan Element	2000	2010	2020	2030	2040	2050
Original Projected Surplus (acft/yr)	24	30	31	34	37	39
Reallocated Surplus (acft/yr) [1]	24	30	31	34	37	39
Remaining Projected Surplus (acft/yr)	0	0	0	0	0	0

[1] Reallocated to City of San Diego supplies in Duval County.

5.6.5 County-Other

County-Other shows a small projected shortage of 8 acft in 2000. The shortage is small and expected to disappear by 2010. Therefore, the recommended plan to mitigate this shortage is to overdraft the Gulf Coast Aquifer (the groundwater source for County-Other in Jim Wells County).

5.6.6 Manufacturing

No manufacturing demand exists or is projected for the county.

5.6.7 Steam-Electric

No steam-electric demand exists or is projected for the county.

5.6.8 Mining

Mining demands in Jim Wells County are met by groundwater from the Gulf Coast Aquifer. No shortages are projected for Jim Wells County mining. Projected surplus supply through 2050 has been reallocated to the City of Benavides in Duval County to mitigate near-term and long-term shortages (Table 5.6-5).

Table 5.6-5.
Reallocation of Surplus Supplies by Decade for Jim Wells County Mining

Plan Element	2000	2010	2020	2030	2040	2050
Original Projected Surplus (acft/yr)	226	341	405	451	494	531
Reallocated Surplus (acft/yr) [1]	226	341	405	451	494	531
Remaining Projected Surplus (acft/yr)	0	0	0	0	0	0

[1] Reallocated to City of Benavides, Duval County (see Section 5.5.1).

5.6.9 Irrigation

Irrigation demands in Jim Wells County are met by groundwater from the Gulf Coast Aquifer. No shortages are projected for Jim Wells County Irrigation. Projected surplus supply through 2050 has been reallocated to the City of Benavides in Duval County and to the City of Premont in Jim Wells County to mitigate near-term and long-term shortages (Table 5.6-6).

Table 5.6-6.
Reallocation of Surplus Supplies by Decade for Jim Wells County Irrigation

Plan Element	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Original Projected Surplus (acft/yr)	31	158	270	368	454	529
Reallocated Surplus (acft/yr)	31[1]	130[1]	148[2]	260[3]	280[4]	332[5]
Remaining Projected Surplus (acft/yr)	0	28	122	108	174	197

[1] Reallocated to City of Benavides, Duval County (see Section 5.5.1).
[2] Reallocated 86 acft to City of Benavides, Duval County (see Section 5.5.1) and 62 acft to City of Premont (Section 5.6.3).
[3] Reallocated 58 acft to City of Benavides, Duval County (see Section 5.5.1) and 202 acft to City of Premont (Section 5.6.3).
[4] Reallocated 25 acft to City of Benavides, Duval County (see Section 5.5.1) and 255 acft to City of Premont (Section 5.6.3).
[5] Reallocated 5 acft to City of Benavides, Duval County (see Section 5.5.1) and 327 acft to City of Premont (Section 5.6.3).

5.6.10 Livestock

The livestock water demands in Jim Wells County are met by groundwater from the Gulf Coast Aquifer and surface water from local on-farm sources. No shortages are projected for Jim Wells County livestock and no changes in water supply are recommended.

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5.7 Kenedy County Water Supply Plan

Table 5.7-1 lists each water user group in Kenedy County and their corresponding surplus or shortage in years 2030 and 2050. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections. Water supply plans are also presented for some entities that need pumping/conveyance facilities to utilize their existing water resources, or to become a regional provider.

Table 5.7-1.
Kenedy County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	2050 (acft/yr)	Comment
City of Sarita	2,571	2,575	Projected surplus – see plan below
County-Other	4,116	4,123	Projected surplus
Manufacturing	none	none	No demands projected
Steam-Electric	none	none	No demands projected
Mining	96	96	Projected surplus
Irrigation	none	none	No demands projected
Livestock	5,157	5,157	Projected surplus

[1] From Tables 4-11 and 4-12, Section 4 – Comparison of Water Demands with Water Supplies to Determine Needs.

5.7.1 City of Sarita

The City of Sarita meets its demands with groundwater pumped from the Gulf Coast Aquifer. The Sarita WSC owns and operates the well that serves the city. This well has a capacity of 0.42 MGD, or 235 acft/yr. The surplus listed above in Table 5.7-1 includes the groundwater allocated to the City. The City does not have the well capacity to pump all of the allocated groundwater, and given its relatively small demands, does not need to access this surplus. No shortages are projected for the City of Sarita and no changes in water supply are recommended.

5.7.2 County-Other

County-Other demands are met with groundwater from the Gulf Coast Aquifer. No shortages are projected for County-Other entities and no changes in water supply are recommended.

5.7.3 Manufacturing

No manufacturing demand exists or is projected for the county.

5.7.4 Steam-Electric

No steam-electric demand exists or is projected for the county.

5.7.5 Mining

There are small mining water demands in Kenedy County which diminish to zero by 2030. These demands are met by groundwater from the Gulf Coast Aquifer. No shortages are projected for mining and no changes in water supply are recommended.

5.7.6 Irrigation

No irrigation demand exists or is projected for the county.

5.7.7 Livestock

The livestock water demands in Kenedy County are met by groundwater from the Gulf Coast Aquifer. No shortages are projected for livestock and no changes in water supply are recommended.

5.8 Kleberg County Water Supply Plan

Table 5.8-1 lists each water user group in Kleberg County and their corresponding surplus or shortage in years 2030 and 2050. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 5.8-1.
Kleberg County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1]		Comment
	2030 (acft/yr)	2050 (acft/yr)	
City of Kingsville	0	0	Supply equals demand
County-Other	2	73	Projected shortages in 2000, 2010, and 2020 – see plan below.
Manufacturing	none	none	No demands projected
Steam-Electric	none	none	No demands projected
Mining	1,994	2,627	Projected surplus
Irrigation	36	102	Projected shortages in 2000, 2010, and 2020 – see plan below.
Livestock	0	0	Supply equals demand

[1] From Tables 4-13 and 4-14, Section 4 – Comparison of Water Demands with Water Supplies to Determine Needs.

5.8.1 City of Kingsville

The City of Kingsville has a contract with the South Texas Water Authority (STWA) to purchase treated surface water from the CCR/LCC System. The City also has five wells with a combined capacity of 6.3 MGD, or 7,055 acft/yr, that pump groundwater from the Gulf Coast Aquifer. This capacity is well above Kingsville's groundwater allocation of 5,105 acft/yr. The current contract between the City and the STWA allows Kingsville to purchase as much as 10 percent above what it has purchased in the previous 12 months. This feature of the contract was used in 2020 and beyond to ensure sufficient water supplies to meet the City's needs through 2050.

5.8.2 County-Other

5.8.2.1 Description

- Source: Surface Water - CCR/LCC System via STWA
  Groundwater - Gulf Coast Aquifer
- Estimated Reliable Supply: 176 acft/yr (surface water)
  1,360 acft/yr (groundwater)
- System Description: Individual Wells and Small Water Supply Systems

5.8.2.2 Options Considered

County-Other demands in Kleberg County have near-term shortages of 44 acft/yr in 2000. This shortage diminishes to zero by 2029. Near-term shortages are about 35 percent of demand. Table 5.8-2 lists the water management strategies, references to the report section discussing the strategy, total project cost, and unit costs that were considered for meeting the shortage for County-Other in Kleberg County.

Table 5.8-2.
Water Management Strategies Considered for Kleberg County-Other

Option	Yield (acft/yr)	Approximate Cost[1]	
		Total	Unit ($/acft)
Voluntary Reallocation of Groundwater from Mining Surplus (Section 5A.10)	22 to 44	$0[2]	$0[2]
System Interconnect (Section 5A.17)	728	$7,153,000[3]	$1,262[3]
No Action	-	$466,000[4]	$21,182[4]

[1] Unless otherwise noted, costs are Total Project Cost and Unit Cost ($/acft/yr) for treated water delivered to the water supply entity or entities. Unit cost is for full utilization of project capacity.
[2] Assuming existing well capacities are adequate, no additional cost.
[3] Source of Cost Estimate: Section 5A.17. Unit Cost is cost to carry interconnection between STWA and Riviera & Sarita (Kenedy County) (Table 5A.17-10).
[4] Economic Impact of not meeting 2020 shortage (i.e., “no action” alternative) as per TWDB estimates (see Appendix D).

5.8.2.3 Water Supply Plan

Working within the planning criteria established by the Coastal Bend RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages for County-Other in Kleberg County:

- Voluntary Reallocation of Mining surplus.

In addition to the management strategy listed above, the RWPG supports strategies for increased conservation and reuse of existing supplies. Additionally, the RWPG supports all management strategies listed in Table 5.8-2.

5.8.2.4 Costs

The function of the County-Other demand projection category is to capture the demands of single family rural municipal demands as well as demands for small rural water supply systems. The nature of this category, therefore, makes it difficult to determine well and distribution system capacities. Due to this limitation and the fact that the plan is made up of reallocating the groundwater resources in Kleberg County, no additional costs can be reasonably calculated for the County-Other water plan. The recommended Water Supply Plan including anticipated costs is summarized by decade in Table 5.8-3.

Table 5.8-3.
Recommended Plan Costs by Decade for Kleberg County-Other

Plan Element	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Projected Surplus/(Shortage) (acft/yr)	(44)	(39)	(22)	2	20	73
Voluntary Reallocation						
Supply From Plan Element (acft/yr)	44	39	22	-	-	-
Annual Cost ($/yr)	$0	$0	$0	-	-	-
Unit Cost ($/acft)	$0	$0	$0	-	-	-
Total Annual Cost ($/yr)	$0	$0	$0	-	-	-
Total Unit Cost ($/acft)	$0	$0	$0	-	-	-

5.8.3 Manufacturing

No manufacturing demand exists or is projected for the county.

5.8.4 Steam-Electric

No steam-electric demand exists or is projected for the county.

5.8.5 Mining

Mining water demands in Kleberg County are met by groundwater from the Gulf Coast Aquifer. No shortages are projected for mining and no changes in water supply are recommended. Part of the mining surplus has been reallocated to County-Other and Irrigation use in the county (see Table 5.8-4).

Table 5.8-4.
Reallocation of Surplus Supplies by Decade for Kleberg County Mining

Plan Element	2000	2010	2020	2030	2040	2050
Original Projected Surplus (acft/yr)	1,572	1,783	1,888	1,994	2,085	2,627
Reallocated Surplus (acft/yr)	150[1]	91[2]	26[3]	0	0	0
Remaining Projected Surplus (acft/yr)	1,422	1,692	1,862	1,994	2,085	2,627

[1] Reallocated 44 acft to County-Other (Section 5.8.2) and 106 acft to Irrigation (Section 5.8.6).
[2] Reallocated 39 acft to County-Other (Section 5.8.2) and 52 acft to Irrigation (Section 5.8.6).
[3] Reallocated 22 acft to County-Other (Section 5.8.2) and 4 acft to Irrigation (Section 5.8.6).

5.8.6 Irrigation

5.8.6.1 Description

- Source: Groundwater - Gulf Coast Aquifer
- Estimated Reliable Supply: 291 acft/yr
- System Description: Various on-farm irrigation systems

The irrigation demands in Kleberg County are diminishing over the 50-year planning period. Supply is from the Gulf Coast Aquifer. There is a current shortage that lasts through 2021.

5.8.6.2 Options Considered

Irrigation demands in Kleberg County have near-term shortages of 106 acft/yr in 2000 diminishing to zero by 2021. Near-term shortages are about 25 percent of demand. Table 5.8-5 lists the water management strategies, references to the report section discussing the strategy, total project cost, and unit costs that were considered for meeting the shortage for Irrigation in Kleberg County. In addition to the strategies shown in Table 5.8-5, individual irrigators could choose to alter their fields and grow crops more suitable to dry land farming techniques. Of the factors that effect such a decision (suitable water availability, market prices for dry land farming crops, tolerance for risk on the part of the farmer, etc.), only water availability is somewhat definable. The other factors that impact the choice to pursue dry land farming are impossible to predict with any confidence and therefore, no costs for changing to dry land farming were tabulated.

Table 5.8-5.
Water Management Strategies Considered for Kleberg County Irrigation

Option	*Yield (acft/yr)*	*Approximate Cost*[1]	
		Total	*Unit ($/acft)*
Irrigation Conservation (Section 5A.2)	125[2]	$174,700[2]	$102[2]
Voluntary Reallocation of Groundwater from Mining Surplus (Section 5A.10)	4 to 106[3]	$0[3]	$0[3]
No Action	-	$193[4]	$48[4]

[1] Unless otherwise noted, costs are Total Project Cost and Unit Cost ($/acft/yr) for treated water delivered to the water supply entity or entities. Unit cost is for full utilization of project capacity.
[2] Source of Cost Estimate: Section 5A.2. Irrigation Conservation is the sum of conservation due to LEPA and Surge Irrigation improvements on the appropriate acreage within the county and a weighted unit cost.
[3] Assuming existing well capacities are adequate, no additional cost.
[4] Economic Impact of not meeting 2020 shortage (i.e. "no action" alternative) as per TWDB estimates (see Appendix D).

5.8.6.3 Water Supply Plan

Working within the planning criteria established by the Coastal Bend RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages for Kleberg County Irrigation:

- Voluntary Reallocation of Mining surplus.

In addition to the management strategy listed above, the RWPG supports strategies for increased conservation and reuse of existing supplies. Additionally, the RWPG supports all management strategies listed in Table 5.8-5.

5.8.6.4 Costs

The function of the Irrigation demand projection category is to summarize the demands of the irrigating interests throughout the county. The nature of this category, therefore, makes it difficult to determine well and distribution system capacities for individual systems. Due to this limitation and the fact that the plan is made up of reallocating the groundwater resources in

Kleberg County, no additional costs can be reasonably calculated for the Irrigation water plan. The recommended Water Supply Plan including anticipated costs is summarized by decade in Table 5.8-6.

Table 5.8-6.
Recommended Plan Costs by Decade for Kleberg County Irrigation

Plan Element	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Projected Surplus/(Shortage) (acft/yr)	(106)	(52)	(4)	2	20	73
Voluntary Reallocation						
Supply From Plan Element (acft/yr)	106	52	4	-	-	-
Annual Cost ($/yr)	$0	$0	$0	-	-	-
Unit Cost ($/acft)	$0	$0	$0	-	-	-
Total Annual Cost ($/yr)	$0	$0	$0	-	-	-
Total Unit Cost ($/acft)	$0	$0	$0	-	-	-

5.8.7 Livestock

The livestock demands in Kleberg County are met by groundwater from the Gulf Coast Aquifer and surface water from local on-farm sources. No shortages are projected for manufacturing and no changes in water supply are recommended.

5.9 Live Oak County Water Supply Plan

Table 5.9-1 lists each water user group in Live Oak County and their corresponding surplus or shortage in years 2030 and 2050. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 5.9-1.
Live Oak County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2050 (acft/yr)	Comment
City of George West	39	21	Projected surplus
City of Three Rivers	3,627	3,615	Projected surplus
County-Other	(332)	(350)	Projected shortage – see plan below.
Manufacturing	524	350	Projected surplus
Steam-Electric	none	none	No demands projected
Mining	1,966	1,031	Projected shortages in 2000 & 2010 – see plan below.
Irrigation	(1,977)	(1,637)	Projected shortage – see plan below.
Livestock	0	0	Supply equals demand

[1] From Tables 4-15 and 4-16, Section 4 – Comparison of Water Demands with Water Supplies to Determine Needs.

5.9.1 City of George West

The City of George West's demands are met with groundwater from the Gulf Coast Aquifer. No shortages are projected for George West and no changes in water supply are recommended.

5.9.2 City of Three Rivers

The City of Three River's demands are met with surface water rights on the Nueces River. No shortages are projected for Three Rivers and no changes in water supply are recommended.

5.9.3 County-Other

5.9.3.1 Description

- Source: Groundwater - Gulf Coast Aquifer
- Estimated Reliable Supply: 672 acft per year
- System Description: Individual Wells and Small Water Supply Systems

5.9.3.2 Options Considered

County-Other demand in Live Oak County has shortages of approximately 330 to 360 acft/yr throughout the 50-year planning period. This shortage is approximately 35 percent of demand. Table 5.9-2 lists the water management strategies, references to the report section discussing the strategy, total project cost, and unit costs that were considered for meeting the shortage for County-Other in Live Oak County.

Table 5.9-2.
Water Management Strategies Considered for Live Oak County-Other

Option	Yield (acft/yr)	Approximate Cost[1]	
		Total	Unit ($/acft)
Small Desalt Plant (Section 5A.6)	560	$1,519,000[2]	$397[2]
Voluntary Reallocation of Groundwater from Manufacturing Surplus (Section 5A.10)	332 to 361	$0[3]	$0[3]
System Interconnect (Section 5A.17)	330 to 360	N/A	$762[4]
No Action	-	$7,032,000[5]	$21,182[5]

1 Unless otherwise noted, costs are Total Project Cost and Unit Cost ($/acft per year) for treated water delivered to the water supply entity or entities. Unit cost is for full utilization of project capacity.
2 Source of Cost Estimate: Section 5A.6. Table 5A.6-3, 0.5 MGD WTP, fully utilized.
3 Assuming existing well capacities are adequate, no additional cost.
4 Cost based on system interconnections unit costs for similar systems between Alice and San Diego (Section 5A.17, Table 5A.17-6).
5 Economic Impact of not meeting 2030 shortage (i.e., "no action" alternative) as per TWDB estimates (see Appendix D).

5.9.3.3 Water Supply Plan

Working within the planning criteria established by the Coastal Bend RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages for County-Other in Live Oak County:

- Voluntary Reallocation of Manufacturing surplus.

In addition to the management strategy listed above, the RWPG supports strategies for increased conservation and reuse of existing supplies. Additionally, the RWPG supports all management strategies listed in Table 5.9-2.

5.9.3.4 Costs

The function of the County-Other demand projection category is to capture the demands of single family rural municipal demands as well as demands for small rural water supply systems. The nature of this category, therefore, makes it difficult to determine well and distribution system capacities. Due to this limitation and the fact that the plan is made up of reallocating the groundwater resources in Live Oak County, no additional costs can be reasonably calculated for the County-Other water plan. The recommended Water Supply Plan including anticipated costs is summarized by decade in Table 5.9-3.

Table 5.9-3.
Recommended Plan Costs by Decade for Live Oak County-Other

Plan Element	2000	2010	2020	2030	2040	2050
Projected Surplus/(Shortage) (acft/yr)	(361)	(346)	(332)	(332)	(337)	(350)
Voluntary Reallocation						
Supply From Plan Element (acft/yr)	361	346	332	332	337	350
Total Annual Cost ($/yr)	$0	$0	$0	$0	$0	$0
Total Unit Cost ($/acft)	$0	$0	$0	$0	$0	$0

5.9.4 Manufacturing

Manufacturing demands in Live Oak County are met with surface water from the CCR/LCC System and with groundwater pumped from the Gulf Coast Aquifer. There are no shortages in manufacturing use in Live Oak County and no changes in water supply are recommended. Part of the manufacturing surplus has been reallocated to County-Other and Irrigation use (Table 5.9-4).

Table 5.9-4.
Reallocation of Surplus Supplies by Decade for Live Oak County Manufacturing

Plan Element	2000	2010	2020	2030	2040	2050
Original Projected Surplus (acft/yr)	674	607	558	524	434	350
Reallocated Surplus (acft/yr)	674[1]	607[2]	332[3]	332[3]	337[3]	350[3]
Remaining Projected Surplus (acft/yr)	0	0	226	192	97	0

1 Reallocated 361 acft to County-Other (Section 5.9.3) and 313 acft to Irrigation (Section 5.9.7).
2 Reallocated 346 acft to County-Other (Section 5.9.3) and 261 acft to Irrigation (Section 5.9.7).
3 Reallocated to County-Other (Section 5.9.3).

5.9.5 Steam-Electric

No steam-electric demand exists or is currently projected for the county according to the TWDB. It should be noted that during the Coastal Bend Regional Water Planning process, Diamond Shamrock announced the development of a 700 MW co-generation power plant to be located in Live Oak County. At present, the TWDB projections show no anticipated steam-electric demand in the county. However, if the new co-generation plant is completed as scheduled, an additional 6,000 acft/yr of demand could be required in Live Oak County beginning in 2010 and continuing throughout the planning period.

5.9.6 Mining

5.9.6.1 Description

- Source: Groundwater - Gulf Coast and Carrizo-Wilcox Aquifers
- Estimated Reliable Supply: 3,946 acft per year
- System Description: Various mining operations

5.9.6.2 Options Considered

The mining supply in Live Oak County shows a projected shortage of 942 acft per year in 2000 diminishing to zero in 2013. After 2013 through the remaining planning period, mining shows a surplus supply. Shortages are approximately 19 percent of demand in 2000. Table 5.9-5 lists the water management strategies, references to the report sections discussing the strategy, total project cost, and unit costs that were considered for meeting the Live Oak County mining shortages.

Table 5.9-5.
Water Management Strategies Considered for Live Oak County Mining

Option	***Yield (acft/yr)***	***Approximate Cost[1]***	
		Total	***Unit ($/acft)***
Use of Non-Potable Groundwater	650[2]	$0[2]	$0[2]
Recycle and Reuse Groundwater	650[3]	$0[3]	$0[3]
No Action	—	$5,541,000[4]	$4,323[4]

[1] Unless otherwise noted, costs are Total Project Cost and Unit Cost ($/acft per year) for treated water delivered to the water supply entity or entities. Unit cost is for full utilization of project capacity.
[2] Abundant non-potable groundwater reserved exist in Live Oak County (Appendix C). Assumed use of up to one-half of the shortage to be supplied by non-potable water. Assumed no additional cost for wells. Existing wells should be able to handle this situation.
[3] Majority of the mining demand in Live Oak County is thought to be Uranium mining in which a significant portion of the process water is recycled and used again. Assumed that up to one-half of the shortage demand can be met through recycling. Assumed this could be done with existing facilities, therefore, no additional cost.
[4] Economic Impact of not meeting 2010 shortage (i.e., "no action" alternative) as per TWDB estimates (see Appendix D).

5.9.6.3 Water Supply Plan

Working within the planning criteria established by the Coastal Bend RWPG and TWDB, the following water supply plan is recommended to meet the projected near-term and long-term shortages for Live Oak County mining:

- Use of non-potable groundwater from the Gulf Coast Aquifer; and,
- Use of recycling and reuse programs for mining process water.

In addition to the management strategies listed above, the RWPG supports strategies for increased conservation and reuse of existing supplies.

5.9.6.4 Costs

It is assumed that due to the large near-term (2000) deficits in water supply, the mining operations are already operating in a manner similar to that described for the Live Oak County Mining Water Supply Plan. Therefore, no additional capital costs can be reasonably calculated for the mining water plan. The recommended Water Supply Plan including anticipated costs is summarized by decade in Table 5.9-6.

Table 5.9-6.
Recommended Plan Costs by Decade for Live Oak County Mining

Plan Element	2000	2010	2020	2030	2040	2050
Projected Surplus/(Shortage) (acft/yr)	(942)	(1,282)	2,551	1,966	1,113	1,031
Use of Non-Potable Groundwater						
Supply From Plan Element (acft/yr)	471	641	-	-	-	-
Annual Cost ($/yr)	$0	$0	-	-	-	-
Unit Cost ($/acft)	$0	$0	-	-	-	-
Recycle and Reuse Groundwater						
Supply From Plan Element (acft/yr)	471	641	-	-	-	-
Annual Cost ($/yr)	$0	$0	-	-	-	-
Unit Cost ($/acft)	$0	$0	-	-	-	-
Total Annual Cost ($/yr)	$0	$0	-	-	-	-
Total Unit Cost ($/acft)	$0	$0	-	-	-	-

5.9.6.5 Reallocation of Surplus Mining Supplies

Part of the manufacturing surplus has been reallocated to irrigation use (Table 5.9-7).

Table 5.9-7.
Reallocation of Surplus Supplies by Decade for Live Oak County Mining

Plan Element	2000	2010	2020	2030	2040	2050
Original Projected Surplus[1] (acft/yr)	0	0	2,551	1,966	1,113	1,031
Reallocated Surplus (acft/yr)	0	0	1,945[2]	1,756[2]	1,113[2]	1,031[2]
Remaining Projected Surplus (acft/yr)	0	0	606	210	0	0

[1] Includes any surplus created with the implementation of the recommended plan (Table 5.9-6).
[2] Reallocated to Irrigation (Section 5.9.7).

5.9.7 Irrigation

5.9.7.1 Description

- Source: Groundwater - Gulf Coast and Carrizo-Wilcox Aquifers
- Estimated Reliable Supply: 508 acft per year
- System Description: Various on-farm irrigation systems

5.9.7.2 Options Considered

The Irrigation supply in Live Oak County shows a projected shortage of 2,589 acft per year in 2000 and 1,637 acft/yr in 2050. Shortages are approximately 84 percent and 76 percent of demand in 2000 and 2050, respectively. Table 5.9-8 lists the water management strategies, references to the report sections discussing the strategy, total project cost, and unit costs that were considered for meeting the Live Oak County Irrigation shortages. In addition to the strategies shown in Table 5.9-8, individual irrigators could choose to alter their fields and grow crops more suitable to dry land farming techniques. Of the factors that effect such a decision (suitable water availability, market prices for dry land farming crops, tolerance for risk on the part of the farmer, etc.), only water availability is somewhat definable. The other factors that impact the choice to pursue dry land farming are impossible to predict with any confidence and therefore, no costs for changing to dry land farming were tabulated.

Table 5.9-8.
Water Management Strategies Considered for Live Oak County Irrigation

Option	*Yield (acft/yr)*	*Approximate Cost[1]*	
		Total	*Unit ($/acft)*
Irrigation Conservation (Section 5A.2)	221[2]	$126,000[2]	$41[2]
Voluntary Reallocation of Groundwater from Manufacturing and Mining Surplus (Section 5A.10)	261 to 1,945	$0[3]	$0[3]
No Action	-	$95,000[4]	$48[4]

[1] Unless otherwise noted, costs are Total Project Cost and Unit Cost ($/acft per year) for treated water delivered to the water supply entity or entities. Unit cost is for full utilization of project capacity.
[2] Source of Cost Estimate: Section 5A.2. Irrigation Conservation is the sum of conservation due to LEPA and Surge Irrigation improvements on the appropriate acreage within the county.
[3] Assuming existing well capacities are adequate, no additional cost.
[4] Economic Impact of not meeting 2030 shortage (i.e. “no action” alternative) as per TWDB estimates (see Appendix D).

5.9.7.3 Water Supply Plan

Working within the planning criteria established by the Coastal Bend RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages for Irrigation in Live Oak County:

- Irrigation Conservation (LEPA/Surge);
- Voluntary Reallocation of Manufacturing and Mining surplus; and,
- Dry Land Farming/Un-met Needs

In addition to the management strategies listed above, the RWPG supports strategies for increased conservation and reuse of existing supplies.

5.9.7.4 Costs

Costs of the recommended plan for Live Oak County Irrigation to meet shortages (including the potential costs of not meeting shortages) are:

a. Irrigation Conservation (LEPA/Surge):
   - Cost Source: Section 5A.2
   - Date to be Implemented: 2005
   - Annual Cost: $9,100 per year

b. Voluntary Reallocation:
   - Cost Source: Section 5A.10
   - Date to be Implemented: 2000
   - Annual Cost: $0 per year

c. Cost of Un-met demands:
   - Cost Source: Appendix D
   - Date to be Implemented: 2000
   - Annual Cost: Up to $98,600 per year (2000)

The recommended Water Supply Plan including anticipated costs is summarized by decade in Table 5.9-9.

Table 5.9-9.
Recommended Plan Costs by Decade for Live Oak County Irrigation

Plan Element	2000	2010	2020	2030	2040	2050
Projected Surplus/(Shortage) (acft/yr)	(2,589)	(2,370)	(2,166)	(1,977)	(1,801)	(1,637)
Irrigation Conservation						
Supply From Plan Element (acft/yr)	221	221	221	221	221	221
Annual Cost ($/yr)	$9,100	$9,100	$9,100	$9,100	$9,100	$9,100
Unit Cost ($/acft)	$41	$41	$41	$41	$41	$41
Voluntary Reallocation (Manufacturing and Mining)						
Supply From Plan Element (acft/yr)	313	261	1,945	1,756	1,113	1,031
Annual Cost ($/yr)	$0	$0	$0	$0	$0	$0
Unit Cost ($/acft)	$0	$0	$0	$0	$0	$0
Un-Met Needs						
Supply From Plan Element (acft/yr)	2,055	1,888	-	-	467	385
Annual Cost ($/yr)	$98,600	$90,600	-	-	$22,400	$18,500
Unit Cost ($/acft)	$48	$48	-	-	$48	$48
Total Annual Cost ($/yr)	$107,700	$99,700	$9,100	$9,100	$31,500	$27,600
Total Unit Cost ($/acft) [1]	$47	$47	$41	$41	$46	$46

[1] Weighted average unit cost of the one or two management strategies which have associated total annual costs.

5.9.8 Livestock

The livestock demands in Live Oak County are met by groundwater from the Carrizo-Wilcox and Gulf Coast Aquifers and surface water from local on-farm sources. No shortages are projected for manufacturing and no changes in water supply are recommended.

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5.10 McMullen County Water Supply Plan

Table 5.10-1 lists each water user group in McMullen County and their corresponding surplus or shortage in years 2030 and 2050. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 5.10-1.
McMullen County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1]		Comment
	2030 (acft/yr)	2050 (acft/yr)	
City of Tilden	912	938	Projected surplus – see plan below
County-Other	4,123	4,136	Projected surplus
Manufacturing	none	none	No demands projected
Steam-Electric	none	none	No demands projected
Mining	5,005	5,020	Projected surplus
Irrigation	6	6	Projected surplus
Livestock	319	319	Projected surplus

[1] From Tables 4-17 and 4-18, Section 4 – Comparison of Water Demands with Water Supplies to Determine Needs.

5.10.1 City of Tilden

The City of Tilden meets its demands with groundwater pumped from the Carrizo-Wilcox Aquifer. McMullen WCID#1 owns and operates the well that serves the City. This well has a capacity of 0.28 MGD, or 161 acft/yr. The surplus listed above in Table 5.10-1 includes the groundwater allocated to the City. The City does not have the well capacity to pump all of the allocated groundwater, and given its relatively small demands, does not need to access this surplus. No shortages are projected for the City of Tilden and no changes in water supply are recommended.

5.10.2 County-Other

County-Other demands are met with groundwater from the Carrizo-Wilcox, Gulf Coast, Queen City and Sparta Aquifers. No shortages are projected for County-Other entities and no changes in water supply are recommended.

5.10.3 Manufacturing

No manufacturing demand exists or is projected for the county.

5.10.4 Steam-Electric

No steam-electric demand exists or is projected for the county.

5.10.5 Mining

There are small mining water demands in McMullen County, which are effectively zero by 2050. These demands are met by groundwater from the Carrizo-Wilcox and Gulf Coast Aquifers. No shortages are projected for mining and no changes in water supply are recommended.

5.10.6 Irrigation

No irrigation demand exists or is projected for the county. The small surplus supply shown in Table 5.10-1 indicates that there has been small irrigation use in the past in the county.

5.10.7 Livestock

The livestock water demands in McMullen County are met by groundwater from the Carrizo-Wilcox, Gulf Coast, Queen City and Sparta Aquifers. No shortages are projected for manufacturing and no changes in water supply are recommended.

5.11 Nueces County Water Supply Plan

Table 5.11-1 lists each water user group in Nueces County and their corresponding surplus or shortage in years 2030 and 2050. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections. Water supply plans are also presented for some entities that need pumping/conveyance facilities to utilize their existing water resources, or to become a regional provider.

Table 5.11-1.
Nueces County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1]		Comment
	2030 (acft/yr)	2050 (acft/yr)	
City of Agua Dulce	48	52	Projected surplus
City of Aransas Pass	0	0	Supply equals demand
City of Bishop	0	0	Supply equals demand
City of Corpus Christi	5,966	0	Projected surplus through 2030, then supply equals demand
City of Driscoll	18	19	Projected surplus
City of North San Pedro	0	0	Supply equals demand
City of Port Aransas	0	0	Supply equals demand
City of Robstown	0	0	Supply equals demand
County-Other	(3,819)	(1,700)	Projected shortage – see plan below
Manufacturing	0	(27,891)	Projected shortage – see plan below
Steam-Electric	0	0	Supply equals demand
Mining	37	53	Projected shortage in 2000 and 2010 – see plan below
Irrigation	2,480	2,725	Projected surplus
Livestock	0	0	Supply equals demand

[1] From Tables 4-19 and 4-20, Section 4 – Comparison of Water Demands with Water Supplies to Determine Needs.

5.11.1 City of Agua Dulce

The City of Agua Dulce has a contract with the South Texas Water Authority (STWA) to purchase treated surface water from the CCR/LCC System. No shortages are projected for the City of Agua Dulce and no changes in water supply are recommended.

5.11.2 City of Aransas Pass

The City of Aransas Pass is in Aransas, Nueces and San Patricio Counties, consequently, it's water demand and supply values are split into the tables for each county. Aransas Pass contracts with the San Patricio Municipal Water District (SPMWD) to purchase treated water from the CCR/LCC System. The contract allows the City to purchase only the water that it needs. No shortages are projected for the City of Aransas Pass and no changes in water supply are recommended.

5.11.3 City of Bishop

The City of Bishop has a contract with the South Texas Water Authority (STWA) to purchase treated surface water from the CCR/LCC System. The current contract allows Bishop to purchase as much as 10 percent above what it has purchased in the previous 12 months. Additionally, the City pumps groundwater from the Gulf Coast Aquifer. No shortages are projected for the City of Bishop and no changes in water supply are recommended.

5.11.4 City of Corpus Christi

The City of Corpus Christi meets its demands with its own water rights in the CCR/LCC System and through a contract with the Lavaca-Navidad River Authority (LNRA) that provides water from Lake Texana. Although no shortages are projected for the City's own municipal needs, the City also provides surface water to the SPMWD, STWA, and manufacturing and steam-electric water user groups in Nueces and San Patricio Counties. The City's contract with LNRA expires in 2035, however, it is anticipated that this contract will be renewed when it expires. Therefore, water supply tables in Section 4 and in the water supply plans for Nueces County Manufacturing (Section 5.11.10) and San Patricio County Manufacturing (Section 5.12.11) include Lake Texana contract water as existing supply throughout the 50-year planning horizon.

In addition to these water supply sources, the City has a permit to divert up to 35,000 acft/yr of run-of-river water under its interbasin transfer permit on the Colorado River (via the Garwood Irrigation Co). While the City owns the water right on the Colorado River, it does not have the facilities to divert and convey this water to the City. In the long-term (beyond

2030) the City will have to access this water – either directly or via a trade – to help offset the manufacturing shortages in Nueces and San Patricio Counties.

5.11.5 City of Driscoll

The City of Driscoll has a contract with the South Texas Water Authority (STWA) to purchase treated surface water from the CCR/LCC System. No shortages are projected for the City of Driscoll and no changes in water supply are recommended.

5.11.6 City of North San Pedro

The City of North San Pedro has a contract with the Nueces County WCID #3 to purchase treated surface water from the Nueces River. No shortages are projected for the City of North San Pedro and no changes in water supply are recommended.

5.11.7 City of Port Aransas

The Nueces County WCID #4, which has contracts with the City of Corpus Christi and the SPMWD to purchase treated surface water from the CCR/LCC System, serves the City of Port Aransas. No shortages are projected for the City of Port Aransas and no changes in water supply are recommended.

5.11.8 City of Robstown

The City of Robstown has a contract with the Nueces County WCID #3 to purchase treated surface water from the Nueces River. No shortages are projected for the City of Robstown and no changes in water supply are recommended.

5.11.9 County-Other

5.11.9.1 Description

- Source: Surface Water – CCR/LCC System (via Corpus Christi, SPMWD, & STWA)
– Nueces River (via Nueces County WCID #3)
Groundwater – Gulf Coast Aquifer
- Estimated Reliable Supply: 1,896 to 1,394 acft/yr (surface water)
1,027 acft/yr (groundwater)
- System Description: Individual Wells and Small Water Supply Systems

5.11.9.2 Options Considered

County-Other demand in Nueces County has shortages of approximately 3,363 acft/yr (54 percent of demand) in 2000 increasing to a peak shortage of 4,185 acft/yr (62 percent of demand) in 2040. Table 5.11-2 lists the water management strategies, references to the report section discussing the strategy, total project cost, and unit costs that were considered for meeting the shortage for County-Other in Nueces County.

Table 5.11-2.
Water Management Strategies Considered for Nueces County-Other

Option	Yield (acft/yr)	Approximate Cost[1]	
		Total	Unit ($/acft)
Manufacturing Conservation (Section 5A.3)	1,200 to 2,800	$0[2]	$225[2]
Small Desalt Plant (Section 5A.6)	3,360	$5,564,000[3]	$281[3]
Alternative CCR/LCC Operating Policies (Section 5A.8)	13,100	$29,358,000[4]	$438[4]
Pipeline between CCR and LCC (Section 5A.9)	30,700	$88,725,000[5]	$484[5]
Additional Lake Texana (Interruptible) Water (Section 5A.10)	approx. 1,600	$N/A[6]	$335[6]
Reallocation of Nueces County WCID #3 Irrigation Surplus (Section 5A.10)	up to 2,725	$N/A[7]	$225[7]
Garwood Pipeline (Section 5A.13)	35,000	$83,250,000[8]	$478[8]
System Interconnect Nueces River Supplies	4,000	N/A[9]	$225[9]
Short-term Overdrafting of Groundwater	3,363	$0[10]	$0[10]
No Action	-	$80,893,000[11]	$21,182[11]

1 Unless otherwise noted, costs are Total Project Cost and Unit Cost ($/acft/yr) for treated water delivered to the water supply entity or entities. Unit cost is for full utilization of project capacity.
2 Source of Cost Estimate: Section 5A.3. Table 5A.3-6. Unit cost of $225/acft is to treat water for municipal use.
3 Source of Cost Estimate: Section 5A.6. Table 5A.6-3, 3 MGD WTP, fully utilized.
4 Source of Cost Estimate: Section 5A.8. Table 5A.8-7. Unit cost of $225/acft for treatment + $213/acft for raw water supply.
5 Source of Cost Estimate: Section 5A.9. Table 5A.9-4. Unit cost = $225/acft for treatment + $259/acft for raw water supply development.
6 Facilities exist (Mary Rhodes Pipeline) to deliver the water, only cost would be the purchase costs from LNRA for Lake Texana Interruptible supplies and treatment costs for City of Corpus Christi. Unit cost = $225/acft for treatment + $110/acft for annual raw water cost.
7 Unit cost include estimated wholesale treated water costs only. Cost of delivery to County-Other users not included.
8 Source of Cost Estimate: Section 5A.13. Table 5A.13-2. Unit cost = $225/acft for treatment + $253/acft for raw water supply development.
9 Unit cost includes estimated wholesale treated water costs for water from Corpus Christi, STWA or Nueces County WCID #3. Cost of delivery to County-Other users not included.
10 Assuming existing well capacities are adequate, no additional cost
11 Economic Impact of not meeting 2030 shortage (i.e., “no action” alternative) as per TWDB estimates (see Appendix D).

5.11.9.3 Water Supply Plan

Working within the planning criteria established by the Coastal Bend RWPG and TWDB, the following water supply plan is recommended to meet the projected 2000 through 2050 shortages for County-Other in Nueces County:

- Prior to 2030:
  - Short-term (approximately six years) Overdrafting of the Gulf Coast Aquifer.
  - Reallocation of Irrigation surplus from Nueces County WCID #3.
  - Manufacturing Conservation (until water is needed by manufacturing in 2030).
- After 2030:
  - Additional (Interruptible) Lake Texana Water.

In addition to the management strategies listed above, the RWPG supports strategies for increased conservation and reuse of existing supplies. Additionally, the RWPG supports all management strategies listed in Table 5.11-2.

5.11.9.4 Costs

Costs of the Recommended Plan for County-Other to meet the near-term shortages are:

a. Short-term Overdrafting of Groundwater:
   - Cost Source: no additional costs
   - Date to be Implemented: By year 2000
   - Annual Cost: $0 per year

b. Reallocation of Irrigation surplus from Nueces County WCID #3:
   - Cost Source: Section 5A.10
   - Date to be Implemented: By year 2010
   - Annual Cost: Up to $588,000 per year (2040)

c. Manufacturing Conservation:
   - Cost Source: Section 5A.3
   - Date to be Implemented: By year 2010
   - Annual Cost: Up to $301,000 per year (2030)

d. Additional (Interruptible) Lake Texana Water:
   - Cost Source: Section 5A.10
   - Date to be Implemented: By year 2040
   - Annual Cost: $527,000 per year

The recommended Water Supply Plan including anticipated costs is summarized by decade in Table 5.11-3.

Table 5.11-3.
Recommended Plan Costs by Decade for Nueces County-Other

Plan Element	***2000***	***2010***	***2020***	***2030***	***2040***	***2050***
Projected Surplus/(Shortage) (acft/yr)	(3,363)	(3,375)	(3,513)	(3,819)	(4,185)	(1,700)
Short-Term Overdrafting						
Supply From Plan Element (acft/yr)	3,363	-	-	-	-	-
Annual Cost ($/yr)	$0	-	-	-	-	-
Unit Cost ($/acft)	$0	-	-	-	-	-
Reallocation of Irrigation Surplus from Nueces County WCID #3						
Supply From Plan Element (acft/yr)	-	2,149	2,326	2,480	2,612	1,700
Annual Cost ($/yr)	-	$484,000	$523,000	$558,000	$588,000	$383,000
Unit Cost ($/acft)	-	$225	$225	$225	$225	$225
Manufacturing Conservation						
Supply From Plan Element (acft/yr)	-	1,226	1,187	1,339	-	-
Annual Cost ($/yr)	-	$276,000	$267,000	$301,000	-	-
Unit Cost ($/acft)	-	$225	$225	$225	-	-
Additional (Interruptible) Lake Texana Water						
Supply From Plan Element (acft/yr)	-	-	-	-	1,573	-
Annual Cost ($/yr)	-	-	-	-	$527,000	-
Unit Cost ($/acft)	-	-	-	-	$335	-
Total Annual Cost ($/yr)	$0	$760,000	$790,000	$859,000	$1,115,000	$383,000
Total Unit Cost ($/acft)	$0	$225	$225	$225	$266	$225

5.11.10 Manufacturing

5.11.10.1 Description

The City of Corpus Christi provides the surface water for manufacturing in Nueces County from the CCR/LCC System. Additional manufacturing supplies are from the Gulf Coast Aquifer. The City also provides surface water for manufacturing in San Patricio County. *In the* *analysis that follows, the manufacturing needs of Nueces and San Patricio Counties are considered jointly*. A shortage in manufacturing supply occurs beginning in 2031.

5.11.10.2 Options Considered

Near-term (through 2030) Manufacturing supplies in Nueces and San Patricio Counties show surplus supplies. Beginning in 2031, shortages begin to appear and grow to a combined 46,485 acft/yr in 2050 (27,891 acft/yr in Nueces County and 18,594 acft/yr in San Patricio County). Table 5.11-4 lists the water management strategies, references to the report section discussing the strategy, total project cost, and unit costs that were considered for meeting the shortage for manufacturing in Nueces and San Patricio Counties.

5.11.10.3 Water Supply Plan

Working within the planning criteria established by the Coastal Bend RWPG and TWDB, the following water supply plan is one potential plan to meet the projected 2031 through 2050 shortages for manufacturing in Nueces and San Patricio Counties:

- Manufacturing Conservation.
- Garwood Pipeline.
- Aquifer Storage and Recovery.

In addition to the management strategies listed above, the RWPG supports strategies for increased conservation and reuse of existing supplies. Additionally, the RWPG supports all management strategies listed in Table 5.11-4.

Table 5.11-4.
Water Management Strategies Considered for Manufacturing in Nueces & San Patricio Counties

Option	Yield (acft/yr)	Approximate Cost[1]	
		Total	Unit ($/acft)
Manufacturing Conservation (Section 5A.3)	up to 3,800	$2,073,000[2]	$268[2]
Reclaimed Wastewater (Section 5A.4)	variable	variable[3]	variable[3]
Refugio County Groundwater (Section 5A.6)	28,000	$38,223,000[4]	$224[4]
Aquifer Storage and Recovery (ASR) (Section 5A.7)	11,198	$14,118,000[5]	$267[5]
Alternative CCR/LCC Operating Policies (Section 5A.8)	13,100	$29,358,000[6]	$438[6]
Pipeline between CCR and LCC (Section 5A.9)	30,700	$88,725,000[7]	$484[7]
Additional Lake Texana (Interruptible) Water (Section 5A.10)	approx. 1,600	$N/A[8]	$335[8]
Sediment Removal from LCC (Section 5A.11)	9,000	$19,550,000[9]	$3,629[9]
Stage II Lake Texana (Palmetto Bend) (Section 5A.12)	23,000	$138,056,000[10]	$753[10]
Garwood Pipeline (Section 5A.13)	35,000	$83,250,000[11]	$478[11]
Desalination of Seawater (Section 5A.16)	112,016	$614,630,500[12]	$963[12]
No Action	-	$2,071,000,000[13]	$41,688[13]

[1] Unless otherwise noted, costs are Total Project Cost and Unit Cost ($/acft/yr) for treated water delivered to the water supply entity or entities. Unit cost is for full utilization of project capacity.
[2] Source of Cost Estimate: Section 5A.3. Tables 5A.3-2 and 5A.3-6. Blended cost of treatment ($225/acft) for entire 3,800 acft and $165/acft to develop 1,000 acft of raw water supply.
[3] See Section 5A.4.
[4] Source of Cost Estimate: Section 5A.6. Table 5A.6-2.
[5] Source of Cost Estimate: Section 5A.7. Unit cost = $167/acft for raw water supply + $100/acft for treatment.
[6] Source of Cost Estimate: Section 5A.8. Table 5A.8-7. Unit Cost = $225/acft for treatment + $213/acft for raw water supply.
[7] Source of Cost Estimate: Section 5A.9. Table 5A.9-4. Unit cost = $225/acft for treatment + $259/acft for raw water supply development.
[8] Source of Cost Estimate: Facilities exist (Mary Rhodes Pipeline) to deliver the water, only cost would be the purchase costs from LNRA for Lake Texana Interruptible supplies and treatment costs for City of Corpus Christi. Unit cost = $225/acft for treatment + $110/acft for annual raw water cost.
[9] Source of Cost Estimate: Section 5A.11. Table 5A.11-7. Unit cost = $225/acft for treatment + $3,404/acft for raw water supply development.
[10] Source of Cost Estimate: Section 5A.12. Table 5A.12-7, cost of construction of the dam and delivery to Lake Texana. Unit cost = $225/acft for treatment + $528/acft for raw water supply development.
[11] Source of Cost Estimate: Section 5A.13. Table 5A.13-2. Unit cost = $225/acft for treatment + $253/acft for raw water supply development.
[12] Source of Cost Estimate: Section 5A.16. Table 5A.16-4, 100 MGD WTP delivering potable water to O.N. Stevens WTP for distribution.
[13] Economic Impact of not meeting 2050 shortage (i.e., "no action" alternative) as per TWDB estimates for no action in both Nueces and San Patricio Counties (see Appendix D).

5.11.10.4 Costs

Costs of the Potential Plan for Manufacturing to meet the long-term shortages are:

a. Manufacturing Conservation:
- Cost Source: Section 5A.3
- Date to be Implemented: By year 2031
- Annual Cost: Up to $1,018,000 per year (2050)

b. Garwood Pipeline:
- Cost Source: Section 5A.13
- Date to be Implemented: By year 2031
- Annual Cost: Up to $16,740,000 per year (2050)

c. Aquifer Storage and Recovery:
- Cost Source: Section 5A.7
- Date to be Implemented: By year 2050
- Annual Cost: $2,990,000 per year

Table 5.11-5.
Potential Plan Costs by Decade for Manufacturing in Nueces & San Patricio Counties

Plan Element	2000	2010	2020	2030	2040	2050
Projected Surplus/(Shortage)[1] (acft/yr)	-	-	-	-	(19,224)	(46,485)
Manufacturing Conservation (Blending & Calallan Outlet)						
Supply From Plan Element (acft/yr)	-	-	-	-	3,300	3,800
Annual Cost ($/yr)	-	-	-	-	$884,000	$1,018,000
Unit Cost ($/acft)	-	-	-	-	$268	$268
Garwood Pipeline						
Supply From Plan Element (acft/yr)	-	-	-	-	15,924	35,000
Annual Cost ($/yr)	-	-	-	-	$12,448,000	$16,740,000
Unit Cost ($/acft)	-	-	-	-	$782	$478
ASR Projects						
Supply From Plan Element (acft/yr)	-	-	-	-	-	11,200
Annual Cost ($/yr)	-	-	-	-	-	$2,990,000
Unit Cost ($/acft)	-	-	-	-	-	$267
Total Annual Cost ($/yr)	-	-	-	-	$13,332,000	$20,748,000
Total Unit Cost ($/acft)	-	-	-	-	$694	$415

[1] Surplus/(Shortage) includes both Nueces and San Patricio Counties.

5.11.11 Steam-Electric

After the projections for Steam-Electric water demand were approved by the RWPG and TWDB, AEP - CP&L provided additional information on estimates of future water demand for steam-electric purposes as follows: For years 2000 through 2010 - 700 acft/yr; For years 2020 through 2050 - 3,200 acft/yr. These numbers will be considered for inclusion in the next update of the Coastal Bend Regional Water Plan.

5.11.12 Mining

5.11.12.1 Description of Supply

- Source: Groundwater – Gulf Coast Aquifer
- Estimated Reliable Supply: 65 acft/yr
- System Description: Various mining operations

5.11.12.2 Options Considered

The Nueces County mining water user group has near-term shortages of 79 acft/yr and 28 acft/yr in 2000 and 2010, respectively. By the year 2017, supply and demand projections are equal and mining begins to show a projected surplus supply. Near-term shortages are about 55 percent of demand. Table 5.11-6 lists the water management strategies, references to the report section discussing the strategy, total project cost, and unit costs that were considered for meeting the shortage for mining in Nueces County.

Table 5.11-6.
Water Management Strategies Considered for Nueces County Mining

Option	Yield (acft/yr)	Approximate Cost[1]	
		Total	Unit ($/acft)
Short-term Overdrafting of Groundwater	79	$0[2]	$0[2]
No Action	-	$121,000[3]	$4,323[3]

[1] Unless otherwise noted, costs are Total Project Cost and Unit Cost ($/acft/yr) for treated water delivered to the water supply entity or entities. Unit cost is for full utilization of project capacity.
[2] Assuming existing well capacities adequate, no additional cost.
[3] Economic Impact of not meeting shortage in 2010 (i.e., "no action" alternative) as per TWDB estimates (see Appendix D).

5.11.12.3 Water Supply Plan

Working within the planning criteria established by the Coastal Bend RWPG and TWDB, the following water supply plan is recommended to meet the projected 2000 and 2010 shortages for the Nueces County mining:

- Short-term (approximately 17 years) Overdrafting of the Gulf Coast Aquifer.

In addition to the management strategy listed above, the RWPG supports strategies for increased conservation and reuse of existing supplies.

5.11.12.4 Costs

Tabulating the details regarding actual well and system capacities for the users included in Nueces County mining is beyond the scope of the water supply planning effort. Therefore, it was assumed that existing wells have adequate capacity to meet the full needs of the users and therefore, no additional cost to implement this plan is anticipated. The recommended Water Supply Plan including anticipated costs is summarized by decade in Table 5.11-7.

Table 5.11-7.
Recommended Plan Costs by Decade for Nueces County Mining

Plan Element	2000	2010	2020	2030	2040	2050
Projected Surplus/(Shortage) (acft/yr)	(79)	(28)	16	44	59	66
Short-Term Overdrafting						
Supply From Plan Element (acft/yr)	79	28	-	-	-	-
Total Annual Cost ($/yr)	$0	$0	-	-	-	-
Total Unit Cost ($/acft)	$0	$0	-	-	-	-

5.11.13 Irrigation

Irrigation demands in Nueces County are met with surface water from the Nueces County WCID #3 and with groundwater pumped from the Gulf Coast Aquifer. There are no shortages in irrigation use in Live Oak County and no changes in water supply are recommended. Part of the irrigation surplus has been reallocated to Nueces County-Other (see Table 5.11-8).

Table 5.11-8.
Reallocation of Surplus Supplies by Decade for Nueces County Irrigation

Plan Element	2000	2010	2020	2030	2040	2050
Original Projected Surplus (acft/yr)	1,943	2,149	2,326	2,480	2,612	1,700
Reallocated Surplus (acft/yr)[1]	0	2,149	2,326	2,480	2,612	1,700
Remaining Projected Surplus (acft/yr)	1,943	0	0	0	0	0

[1] Reallocated to Nueces County-Other.

5.11.14 Livestock

The livestock demands in Nueces County are met by groundwater from the Gulf Coast Aquifer and surface water from local on-farm sources. No shortages are projected for manufacturing and no changes in water supply are recommended.

5.12 San Patricio County Water Supply Plan

Table 5.12-1 lists each water user group in San Patricio County and their corresponding surplus or shortage in years 2030 and 2050. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections. Water supply plans are also presented for some entities that need pumping/conveyance facilities to utilize their existing water resources, or to become a regional provider.

Table 5.12-1.
San Patricio County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2050 (acft/yr)	Comment
City of Aransas Pass	0	0	Supply equals demand
City of Gregory	0	0	Supply equals demand
City of Ingleside	0	0	Supply equals demand
City of Mathis	0	0	Supply equals demand
City of Odem	0	0	Supply equals demand
City of Portland	0	0	Supply equals demand
City of Sinton	5,356	5,210	Projected surplus
City of Taft	0	0	Supply equals demand
City of Taft Southwest	0	0	Supply equals demand
County-Other	2,423	1,859	Projected surplus
Manufacturing	131	(18,594)	Projected shortage – see plan below
Steam-Electric	none	none	No demands projected
Mining	435	431	Projected surplus
Irrigation	445	585	Projected surplus
Livestock	0	0	Supply equals demand

[1] From Tables 4-21 and 4-22, Section 4 – Comparison of Water Demands with Water Supplies to Determine Needs.

5.12.1 City of Aransas Pass

The City of Aransas Pass is in Aransas, Nueces and San Patricio Counties, consequently, its water demand and supply values are split into the tables for each county. Aransas Pass contracts with the San Patricio Municipal Water District (SPMWD) to purchase treated water from the CCR/LCC System. The contract allows the City to purchase only the water that it needs. No shortages are projected for the City of Aransas Pass and no changes in water supply are recommended.

5.12.2 City of Gregory

The City of Gregory has a contract with the SPMWD to purchase treated water from the CCR/LCC System. The contract allows the City to purchase only the water that it needs. No shortages are projected for the City of Gregory and no changes in water supply are recommended.

5.12.3 City of Ingleside

The City of Ingleside has a contract with the SPMWD to purchase treated water from the CCR/LCC System. The contract allows the City to purchase only the water that it needs. No shortages are projected for the City of Ingleside and no changes in water supply are recommended.

5.12.4 City of Mathis

The City of Mathis has a contract with the City of Corpus Christ to purchase raw water from the CCR/LCC System. The contract allows the City to purchase only the water that it needs. No shortages are projected for the City of Mathis and no changes in water supply are recommended.

5.12.5 City of Odem

The City of Odem has a contract with the SPMWD to purchase treated water from the CCR/LCC System. The contract allows the City to purchase only the water that it needs. No shortages are projected for the City of Odem and no changes in water supply are recommended.

5.12.6 City of Portland

The City of Portland has a contract with the SPMWD to purchase treated water from the CCR/LCC System. The contract allows the City to purchase only the water that it needs. No shortages are projected for the City of Portland and no changes in water supply are recommended.

5.12.7 City of Sinton

The City of Sinton meets its demands with groundwater pumped from the Gulf Coast Aquifer. The City has three wells with a total capacity of 3.67 MGD, or 2,055 acft/yr. The surplus listed above in Table 5.12-1 includes the groundwater allocated to the City. The City does not have the well capacity to pump all of the allocated groundwater, but does have sufficient well capacity to meet its projected demands. No shortages are projected for the City of Sinton and no changes in water supply are recommended

5.12.8 City of Taft

The City of Taft has a contract with the SPMWD to purchase treated water from the CCR/LCC System. The contract allows the City to purchase only the water that it needs. No shortages are projected for the City of Taft and no changes in water supply are recommended.

5.12.9 City of Taft Southwest

The City of Taft Southwest has a contract with the SPMWD to purchase treated water from the CCR/LCC System. The contract allows the City to purchase only the water that it needs. No shortages are projected for the City of Taft Southwest and no changes in water supply are recommended.

5.12.10 County-Other

County-Other demands are met with surface water from the CCR/LCC System provided via the SPMWD and groundwater from the Gulf Coast Aquifer. No shortages are projected for County-Other entities and no changes in water supply are recommended.

5.12.11 Manufacturing

5.12.11.1 Description

The SPMWD provides surface water for manufacturing in San Patricio County. The SPMWD obtains water from both the CCR/LCC System and Lake Texana through a contract with the City of Corpus Christi. *In the analysis that follows, the manufacturing needs of Nueces and San Patricio Counties are considered jointly*. Additional manufacturing supplies in Nueces County are from the Gulf Coast Aquifer. A shortage in manufacturing supply occurs beginning in 2031.

5.12.11.2 Options Considered

Near-term (through 2030) Manufacturing supplies in Nueces and San Patricio Counties show surplus supplies. Beginning in 2031, shortages begin to appear and grow to a combined 46,485 acft/yr in 2050 (27,891 acft/yr in Nueces County and 18,594 acft/yr in San Patricio County). Table 5.12-2 lists the water management strategies, references to the report section discussing the strategy, total project cost, and unit costs that were considered for meeting the shortage for manufacturing in Nueces and San Patricio Counties.

5.12.11.3 Water Supply Plan

Working within the planning criteria established by the Coastal Bend RWPG and TWDB, the following water supply plan is one potential plan to meet the projected 2031 through 2050 shortages for manufacturing in Nueces and San Patricio Counties:

- Manufacturing Conservation.
- Garwood Pipeline.
- Aquifer Storage and Recovery

In addition to the management strategies listed above, the RWPG supports strategies for increased conservation and reuse of existing supplies. Additionally, the RWPG supports all management strategies listed in Table 5.12-2.

Table 5.12-2.
Water Management Strategies Considered for Manufacturing in Nueces & San Patricio Counties

Option	Yield (acft/yr)	Approximate Cost[1]	
		Total	Unit ($/acft)
Manufacturing Conservation (Section 5A.3)	up to 3,800	$2,073,000[2]	$268[2]
Reclaimed Wastewater (Section 5A.4)	variable	variable[3]	variable[3]
Refugio County Groundwater (Section 5A.6)	28,000	$38,223,000[4]	$224[4]
Aquifer Storage and Recovery (ASR) (Section 5A.7)	11,198	$14,118,000[5]	$267[5]
Alternative CCR/LCC Operating Policies (Section 5A.8)	13,100	$29,358,000[6]	$438[6]
Pipeline between CCR and LCC (Section 5A.9)	30,700	$88,725,000[7]	$484[7]
Additional Lake Texana (Interruptible) Water (Section 5A.10)	approx. 1,600	$N/A[8]	$335[8]
Sediment Removal from LCC (Section 5A.11)	9,000	$19,550,000[9]	$3,629[9]
Stage II Lake Texana (Palmetto Bend) (Section 5A.12)	23,000	$138,056,000[10]	$753[10]
Garwood Pipeline (Section 5A.13)	35,000	$83,250,000[11]	$478[11]
Desalination of Seawater (Section 5A.16)	112,016	$614,630,500[12]	$963[12]
No Action	-	$2,071,000,000[13]	$41,688[13]

[1] Unless otherwise noted, costs are Total Project Cost and Unit Cost ($/acft/yr) for treated water delivered to the water supply entity or entities. Unit cost is for full utilization of project capacity.
[2] Source of Cost Estimate: Section 5A.3. Tables 5A.3-2 and 5A.3-6. Blended cost of treatment ($225/acft) for entire 3,800 acft and $165/acft to develop 1,000 acft of raw water supply.
[3] See Section 5A.4.
[4] Source of Cost Estimate: Section 5A.6. Table 5A.6-2.
[5] Source of Cost Estimate: Section 5A.7. Unit cost = $167/acft for raw water supply + $100/acft for treatment.
[6] Source of Cost Estimate: Section 5A.8. Table 5A.8-7. Unit Cost = $225/acft for treatment + $213/acft for raw water supply.
[7] Source of Cost Estimate: Section 5A.9. Table 5A.9-4. Unit cost = $225/acft for treatment + $259/acft for raw water supply development.
[8] Source of Cost Estimate: Facilities exist (Mary Rhodes Pipeline) to deliver the water, only cost would be the purchase costs from LNRA for Lake Texana Interruptible supplies and treatment costs for City of Corpus Christi. Unit cost = $225/acft for treatment + $110/acft for annual raw water cost.
[9] Source of Cost Estimate: Section 5A.11. Table 5A.11-7. Unit cost = $225/acft for treatment + $3,404/acft for raw water supply development.
[10] Source of Cost Estimate: Section 5A.12. Table 5A.12-7, cost of construction of the dam and delivery to Lake Texana. Unit cost = $225/acft for treatment + $528/acft for raw water supply development.
[11] Source of Cost Estimate: Section 5A.13. Table 5A.13-2. Unit cost = $225/acft for treatment + $253/acft for raw water supply development.
[12] Source of Cost Estimate: Section 5A.16. Table 5A.16-4, 100 MGD WTP delivering potable water to O.N. Stevens WTP for distribution.
[13] Economic Impact of not meeting 2050 shortage (i.e., “no action” alternative) as per TWDB estimates for no action in both Nueces and San Patricio Counties (see Appendix D).

5.12.11.4 Costs

Costs of the Potential Plan for Manufacturing to meet the long-term shortages are:

a. Manufacturing Conservation:
   - Cost Source: Section 5A.3
   - Date to be Implemented: By year 2031
   - Annual Cost: Up to $1,018,000 per year (2050)

b. Garwood Pipeline:
   - Cost Source: Section 5A.13
   - Date to be Implemented: By year 2031
   - Annual Cost: Up to $16,740,000 per year (2050)

c. Aquifer Storage and Recovery:
   - Cost Source: Section 5A.7
   - Date to be Implemented: By year 2050
   - Annual Cost: $2,990,000 per year

Table 5.12-3.
Potential Plan Costs by Decade for Manufacturing in Nueces & San Patricio Counties

Plan Element	2000	2010	2020	2030	2040	2050
Projected Surplus/(Shortage)[1] (acft/yr)	-	-	-	-	(19,224)	(46,485)
Manufacturing Conservation (Blending & Calallan Outlet)						
Supply From Plan Element (acft/yr)	-	-	-	-	3,300	3,800
Annual Cost ($/yr)	-	-	-	-	$884,000	$1,018,000
Unit Cost ($/acft)	-	-	-	-	$268	$268
Garwood Pipeline						
Supply From Plan Element (acft/yr)	-	-	-	-	15,924	35,000
Annual Cost ($/yr)	-	-	-	-	$12,448,000	$16,740,000
Unit Cost ($/acft)	-	-	-	-	$782	$478
ASR Projects						
Supply From Plan Element (acft/yr)	-	-	-	-	-	11,200
Annual Cost ($/yr)	-	-	-	-	-	$2,990,000
Unit Cost ($/acft)	-	-	-	-	-	$267
Total Annual Cost ($/yr)	-	-	-	-	$13,332,000	$20,748,000
Total Unit Cost ($/acft)	-	-	-	-	$694	$415

[1] Surplus/(Shortage) includes both Nueces and San Patricio Counties.

5.12.12 Steam-Electric

No steam-electric demand exists or is projected for the county.

5.12.13 Mining

The mining demands in San Patricio County are met by groundwater from Gulf Coast Aquifer. No shortages are projected for mining and no changes in water supply are recommended.

5.12.14 Irrigation

The irrigation demands in San Patricio County are met by groundwater from Gulf Coast Aquifer. No shortages are projected for irrigation and no changes in water supply are recommended.

5.12.15 Livestock

The livestock water demands in San Patricio County are met by groundwater from the Gulf Coast Aquifer and surface water from local on-farm sources. No shortages are projected for livestock and no changes in water supply are recommended.

5.13 Major Water Provider Water Supply Plans

Table 5.13-1 lists each major water provider and their corresponding surplus or shortage in years 2030 and 2050. For each major water provider with a projected shortage, a water supply plan has been developed.

Table 5.13-1.
Major Water Provider Surplus/(Shortage)

Major Water Provider	***Surplus/(Shortage)[1]*** ***2030 (acft/yr)***	***Surplus/(Shortage)[1]*** ***2050 (acft/yr)***	***Comment***
City of Corpus Christi	5,966	(27,891)	Projected shortage – see plan below
San Patricio MWD	131	(18,594)	Projected shortage – see plan below

[1] Surplus/(Shortage) for each major water provided calculated by taking total surface water availability less municipal retail and wholesale demands, and/or steam-electric demands, and/or manufacturing demands.

5.13.1 City of Corpus Christi

As the primary provider of surface water to the Coastal Bend Region, the City of Corpus Christi has been designated by the RWPG as one of the two Major Water Providers in the region. Corpus Christi has 209,700 acft in available supply in 2050 through its own water right in the CCR/LCC System and a contract with LNRA from Lake Texana. This availability constitutes 94 percent of the total surface water availability in the region. Additionally, the City has a permit to divert up to 35,000 acft per year run-of-river water under its interbasin transfer permit on the Colorado River (via the Garwood Irrigation Co.). While the City owns the water right on the Colorado River, it does not have the facilities to divert and covey this water to the City, and therefore the 35,000 acft is not included in the surface water availability in the region.

The City provides treated and raw water from the CCR/LCC System to the following water user groups and other entities:

Table 5.13-2.
Purchasers of Water from the City of Corpus Christi

Water User Group / Entity	*County*
San Patricio MWD	San Patricio
South Texas Water Authority	Kleberg
City of Alice	Jim Wells
City of Beeville	Bee
City of Mathis	San Patricio
City of Three Rivers	Live Oak
Nueces County WCID #4 (Port Aransas)	Nueces
Violet WSC	Nueces
Steam-Electric	Nueces
Manufacturing	Nueces

A comparison of Corpus Christi's demand and supply is presented in Section 5.11.4 and is an analysis of the City's retail municipal demands and supplies available to meet those demands. The shortage listed in Table 5.13-1 reflects all of the City's demands – both municipal retail and wholesale, as well as steam-electric and manufacturing demands. The shortage begins in 2031 and is due to large manufacturing demands in Nueces and San Patricio County. For a list of the water management strategies available to meet these shortages, refer to the water supply plan for manufacturing in Nueces and San Patricio Counties in Section 5.11.10.

5.13.2 San Patricio Municipal Water Distict

The San Patricio Municipal Water District (SPMWD) is the other Major Water Provider in the region, as designated by the RWPG. SPMWD has a contract with the City of Corpus Christi to purchase water from both the CCR/LCC System and Lake Texana. SPMWD treats this water and provides it to the following water user groups and other entities:

Table 5.13-3.
Purchasers of Water from San Patricio MWD

Water User Group / Entity	***County***
City of Aransas Pass	Aransas, Nueces, San Patricio
City of Gregory	San Patricio
City of Ingelside	San Patricio
City of Odem	San Patricio
City of Portland	San Patricio
City of Rockport	Aransas
City of Taft	San Patricio
Nueces County WCID #4 (Port Aransas)	Nueces
Rincon WSC	Nueces, San Patricio
Seaboard WSC	San Patricio
Manufacturing	San Patricio
Individual Residences	San Patricio

The shortage listed in Table 5.13-1 reflects all of SPMWD's demands – both municipal retail and wholesale, as well as manufacturing demands. The shortage begins in 2031 and is due to large manufacturing demands in Nueces and San Patricio County. For the water management strategies available to meet these shortages, refer to the water supply plan for manufacturing in Nueces and San Patricio Counties in Section 5.11.10.

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Section 6
Additional Recommendations

Each of the 16 regional water planning groups may make recommendations to the TWDB regarding legislative and regional policy recommendations; identification of sites uniquely suited for reservoirs; and, identification of unique ecological stream segments. The following are the Coastal Bend RWPG's recommendations regarding these matters.

6.1 Legislative and Regional Policy Recommendations

Under the authority of Senate Bill 1, the Coastal Bend RWPG has developed the following legislative and regional policy recommendations:

General Policy Statement:

I. The Texas Legislature is urged to declare that: i) all water resources of the State are hydrologically inter-related and should be managed on a "conjunctive use" basis, wherever possible; ii) existing water supplies should be more efficiently and effectively used through improved conservation and system operating policies; and iii) water re-use should be promoted, wherever practical, through changes in state and local regulations.

Interbasin Transfers:

I. The Texas Legislature is urged to repeal the "Junior Rights" provision and the additional application requirements for interbasin transfers that were included in Senate Bill 1.

II. The Texas Legislature is urged to specifically exclude the interbasin transfer of water originating from seawater desalination facilities from requirements for interbasin transfer permits.

Desalination:

I. Amend Interbasin Transfer Provisions in SB1.

II. The Texas Legislature is urged to direct the TNRCC to investigate the current regulatory status of the "concentrate" or "reject water" produced during the desalination of brackish ground water, brackish surface water and seawater, and to facilitate the re-classification, if necessary, of these waste products so that safe, economical methods of disposal will be available to encourage the application of these technologies in Texas.

III. The Texas Legislature is urged to direct the TNRCC to work with the TWDB and TPWD to develop information on the potential environmental impacts of concentrate discharges from seawater desalination facilities and to facilitate the permitting of these discharges into coastal waters where site specific information shows that no environmental damage would occur.

IV. The Texas Legislature is urged to amend state laws governing the procurement of professional services by public agencies in order to allow municipalities, water districts, river authorities and other public entities to utilize alternatives to the traditional "Design-Bid-Build" methods for public work projects, including desalination facilities.

V. The Texas Legislature is urged to appropriate new funds to the TWDB for the State Participation Program and to direct that these funds be used to assist in the construction and operation of desalination facilities designed to provide alternative water supply sources for meeting the current and future water demands of regions throughout Texas.

Groundwater Management:

I. The Texas Legislature is urged to encourage a regional approach to the management of groundwater resources wherever feasible, while also recognizing and encouraging local decision-making related to groundwater resource allocation issues.

II. The TWDB, TNRCC, and the Texas Railroad Commission are urged to expand and intensify their activities in collecting, managing, and disseminating information on groundwater conditions and aquifer characteristics throughout Texas.

III. The Texas Railroad Commission is urged to cooperate with TWDB and TNRCC to encourage oil and gas well drillers to furnish e-logs, well logs and other information that might be available on shallow, groundwater bearing formations to facilitate the better identification of aquifer characteristics.

IV. In addition to expanded state monitoring and data management related to groundwater, a regional resource center should be established to specifically support and facilitate groundwater management activities in the Coastal Bend area by providing additional monitoring, data management, research and outreach capabilities.

V. The Texas Legislature is urged to appropriate additional funds for the TWDB to continue and expand their statewide groundwater data program and to appropriate new funds, through regional institutions such as Texas A&M University-Corpus Christi, for a regional research center to support research, data collection, monitoring, modeling and outreach related to groundwater management activities in the Coastal Bend region of Texas.

VI. The Texas Legislature is urged to make funds available through regional water planning groups and groundwater management districts to educate the citizens of Texas about groundwater issues, as well as the powers and benefits of groundwater management districts.

Regional Water Resources Data Collection and Information Management:

I. The Texas Legislature is urged to amend SB1 to allow State funding of on-going regional water resources data collection and information management activities under the sponsorship of regional water planning groups.

II. A "Regional Water Resources Information Management System" for the Coastal Bend area should be established under the sponsorship of the Coastal Bend RWPG.

III. The TWDB is urged to provide SB1 planning funds, through the Coastal Bend RWPG, to support activities to develop and maintain a "Regional Water Resources Information Management System" for the Coastal Bend area.

Interim Role of the Coastal Bend RWPG:

I. The Coastal Bend RWPG should play a role in facilitating public information/public education activities that promote a wider understanding of state and regional water issues and the importance of long-range regional water planning.

II. The Texas Legislature is urged to appropriate monies to the TWDB to provide continued support for regional water planning group activities in the period after the regional water management plan has been submitted.

III. Public entities in the Coastal Bend Water Planning Region are urged to provide their share of continued funding for the administrative support activities that facilitate the Coastal Bend RWPG activities.

Additional Legislative and Policy Recommendations Based on Comments:

I. The Texas Legislature is urged to provide additional funding for initiatives for improved irrigation efficiency and perhaps the creation of a water conservation revenue program to make it economically feasible for farms to convert from irrigated to dry land production.

II. The Texas Legislature should consider providing additional clarification to the Regional Planning Groups with respect to the implications of designating a stream segment as "ecologically unique" or as "uniquely suited for reservoirs."

6.2 Identification of Sites Uniquely Suited for Reservoirs

No sites uniquely suited for reservoirs were identified by the Coastal Bend RWPG within the Coastal Bend Region at this time.

6.3 Identification of River and Stream Segments Meeting Criteria for Unique Ecological Value

A Subcommittee of the Coastal Bend RWPG met on two separate occasions to consider TPWD's recommendations regarding the identification of river and stream segments which meet criteria for unique ecological value. The Coastal Bend RWPG approved the Subcommittee's suggestion that no river or stream segments within the Coastal Bend Region be identified at this time.

6.4 Additional Recommendations

The following additional recommendations are under consideration by the Coastal Bend RWPG:

- Continued studies of the interaction of groundwater and surface water along the Lower Nueces River should be undertaken to identify alternatives to improve water quality to entities diverting water from this stream segment.
- Studies of the potential to develop a large-scale, multi-year ASR system in the Gulf Coast Aquifer should be undertaken to help drought-proof the Region.
- The Region should seriously consider the purchase of the 4,500 acft/yr of interruptible water currently available from the Lavaca-Navidad River Authority from Lake Texana to increase water supply and improve water quality.
- Options that will maximize the benefits of using treated wastewater to enhance the productivity of the Nueces Estuary should be evaluated. This would allow other water now used for this purpose to be conserved.
- Studies of desalination options to further reduce the costs of using seawater and/or brackish groundwater should be undertaken.
- Studies addressing the potential for saltwater intrusion to adversely affect local groundwater supplies should be undertaken.
- Studies should be undertaken to analyze the effects/costs of new EPA Safe Drinking Water Act requirements regarding the treatment of arsenic and other problematic constituents in groundwater on users in the Coastal Bend Region.
- Studies should be undertaken to optimize and reduce, if possible, the costs of water system interconnects for the cities of San Diego, Freer, Benavides, Premont, and Falfurrias, to improve the quantity and quality of potable water available to these cities. Additionally, an evaluation of a regional desalination facility should be evaluated that would treat poor quality groundwater and improve the quality of potable water to these cities.
- Studies should be undertaken to identify opportunities/costs to develop regional groundwater systems that could utilize poor quality groundwater in conjunction with

a desalination treatment plant to more effectively manager groundwater resources within the Coastal Bend Region.

Additional Recommendations Based on Comments:

- A detailed inventory of irrigation systems, crops, and acreage should be undertaken to more accurately estimate irrigation demands in the region.
- Hydrologic models of the CCR/LCC Reservoir System should be updated when the current drought ends and the yields of the system reevaluated along with the potential benefits of options to divert Nueces River water into Choke Canyon Reservoir.
- Environmental studies of the segments of the Frio and Nueces River downstream of Choke Canyon Reservoir and upstream of Lake Corpus Christi should be undertaken to fully evaluate the potential impacts of reduced instream flows associated with the option to construct a pipeline between the two reservoirs.
- The Coastal Bend Region should work with Region P on environmental studies associated with the potential construction of Stage II of Lake Texana.
- The Coastal Bend Region should perform environmental field studies of potentially unique stream segments and potential unique reservoir sites provided additional clarification is provided by the Texas Legislature.

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Section 7
Plan Adoption

7.1 Public Involvement Program

The public involvement program was incorporated at the onset of the Coastal Bend Regional Water Planning Group (RWPG) water planning process in order to maximize the opportunity for public review and input into the process of developing the water plan as well as critique the Initially Prepared Regional Water Plan.

The public involvement program included:

- A public relations specialist on the technical consultant team;
- An opportunity at all RWPG meetings for the public to comment on any aspect of the plan or planning process;
- Quarterly newsletters (see Appendix F):
  - 1. May 1999
  - 2. November 1999
  - 3. February 2000
  - 4. May 2000
  - 5. September 2000
- Public Meetings were held in five locations around the region:

May 23, 2000 at 7:00 p.m.
County Annex
1500 E. King
Kingsville, Texas

May 24, 2000 at 7:00 p.m.
TAMU Extension Center
10345 Agnes
Corpus Christi, Texas

May 30, 2000 at 7:00 p.m.
Live Oak County Courthouse
301 Houston
George West, Texas

May 31, 2000 at 7:00 p.m.
Juvenile Center
599 South FM 1329
San Diego, Texas

June 1, 2000 at 7:00 p.m.
Community Center
2000 Billy G. Webb Driver
Portland, Texas

Public Hearing for Initially Prepared Plan
September 28, 2000
TAMU Extension Center
10345 Agnes
Corpus Christi, Texas

- Press releases and notices of public meetings; and
- Dedicated website for Coastal Bend RWPG information.

7.2 Coordination with Water Supply Entities

An informational meeting for water supply entities was held to provide information regarding Senate Bill 1 and the Coastal Bend RWPG water management planning process.

May 12, 2000 at 11:30 a.m.
Joe Cotten's BBQ
Highway 77
Robstown, Texas

Representatives from water supply entities within the Coastal Bend RWPG were also regularly notified of all Coastal Bend RWPG meetings and public informational meetings.

7.2.1 Coastal Bend RWPG Meetings

The Coastal Bend Regional Water Planning Group (CBRWPG) met approximately once every month since the inception of the planning process in order to facilitate and direct the water planning of the region. The following is a summary of the RWPG meetings:

Coastal Bend RWPG Meetings	
March 27, 1998	July 8, 1999
April 9, 1998	August 12, 1999
May 14, 1998	October 14, 1999
June 11, 1998	November 11, 1999
July 16, 1998	January 20, 2000
July 30, 1998	March 9, 2000
September 10, 1998	May 11, 2000
October 8, 1998	June 22, 2000
November 12, 1998	July 20, 2000
January 14, 1999	August 24, 2000
March 11, 1999	November 9, 2000
May 13, 1999	December 18, 2000

The CBRWPG also designated several subcommittees in order to expedite more specific work efforts and further increase the effectiveness and timeliness of the planning process. The following summarizes these committee and subcommittee meetings.

Subcommittee on Procuring Professional Services for the CBRWPG

- June 3, 1998
- June 9, 1998
- June 19, 1998

Executive Committee Meetings

- June 19, 1998
- September 18, 1998
- March 19, 1998
- August 17, 2000
- October 19, 2000
- January 3, 2001

Subcommittee on Membership of Coastal Bend RWPG

- June 22, 1998

Joint Executive Committee Meetings

- January 14, 2000
- April 20, 2000
- June 15, 2000

Advisory Panel on Unique Stream Segments/Reservoir Sites

- April 4, 2000

Subcommittee on Policy Recommendations

- July 20, 2000

7.3 Coordination with Other Regions

A Joint Executive Committee Meeting between the Coastal Bend RWPG and the Rio Grande RWPG was held in an effort to share information regarding water supply and water management strategies.

January 14, 2000 at 10:30 a.m.
Mr. Roberts Restaurant
1201 South Highway 281
Falfurrias, Texas

Two Joint Executive Committee Meetings between the Coastal Bend RWPG and the South Central Texas RWPG were held in an effort to share information regarding water supply and water management strategies.

April 20, 2000 at 11:30 a.m.
Nolan Ryan's Waterfront Restaurant
State Highway 72
Three Rivers, Texas

June 15, 2000 at 10:00 a.m.
Club Room of Refugio City Hall
613 Commerce Street
Refugio, Texas