Coastal Bend Regional Water Planning Area Region N

Initially Prepared 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 Engineering, Inc.
Susan Roth

March 2025

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Coastal Bend RWPG Members during 2026 Plan Development

Interest Group	Name	Entity
Voting Members		
Agriculture	Mr. Charles Ring	Rancher
	Mr. Chuck Burns	Rancher
Counties	Mr. Lavoyger J. Durham	-
	Mr. Bill Stockton (prior to Oct 7, 2021)	-
Electric Generating Utilities	Mr. William Griffin (beginning February 22, 2024) Mr. Gary Eddins (prior to February 22, 2024)	-
Environmental	Ms. Teresa Carrillo	Coastal Bend Bays Foundation
	Mr. James Dodson (beginning Oct 7, 2021) Mr. Jace Tunnell (prior to Oct 7, 2021)	UT Marine Science Institute
Groundwater Management Areas	Mr. Lonnie Stewart, Secretary	GMA 13
	Mr. Mark Sugarek	GMA 15
	Mr. Andy Garza	GMA 16
Industry	Mr. Joe Almaraz	Valero
	Aron Baggett (beginning March 3, 2022) Mr. Robert Kunkel (prior to March 3, 2022)	Oxychem Lyondell Basell
Municipal	Mr. Mark Scott	-
	Mr. Esteban Ramos (beginning Oct 7, 2021) Ms. Barbara Reaves (prior to Oct 7, 2021)	City of Corpus Christi City of Alice
Other	Mr. Gene Camargo (beginning March 3, 2022) Mr. John Burris (prior to Oct 7, 2021)	City of Rockport -
	Mr. Carl Crull, P.E.	Crull Engineering LLC
Public	Ms. Anna Aldridge (beginning February 22, 2024) Ms. Donna Rosson (prior to February 22, 2024)	Hanson -
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-	Mr. Tomas Dominguez	USDA – NRCS
Liaison, South Central Texas RWPG	Mr. Carl Crull, P.E.	Crull Engineering LLC
Liaison, Rio Grande RWPG	Andy Garza	GMA 16
Administrator	Mr. Travis Pruski	Nueces River Authority

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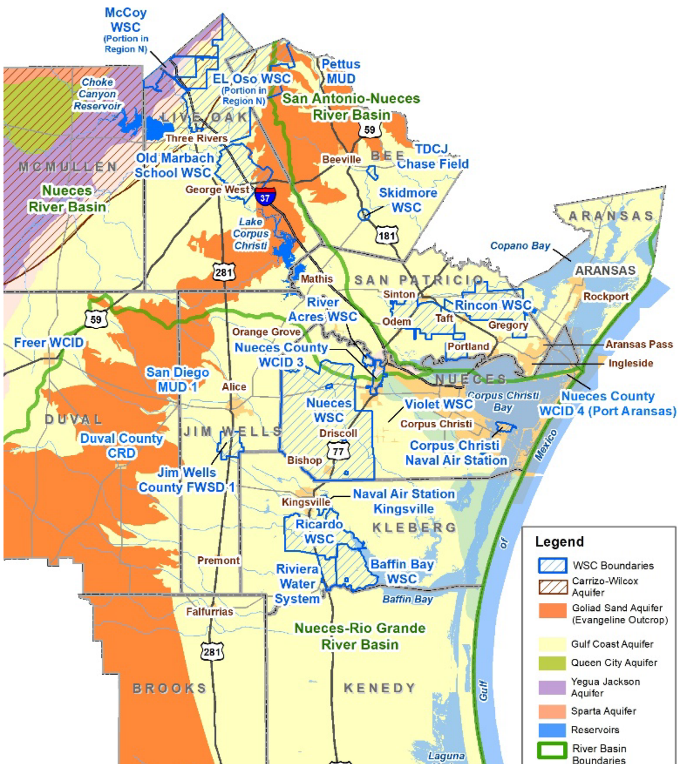
Acronyms and Abbreviations

°F	Fahrenheit
ac-ft	acre-feet
ac-ft/yr	acre-feet per year
ASR	aquifer storage and recovery
BMP	best management practice
CBBEP	Coastal Bend Bays and Estuaries Program
CBRWPG	Coastal Bend Regional Water Planning Group
CCR/LCC System	Choke Canyon Reservoir/Lake Corpus Christi System
CCWSM	Corpus Christi Water Supply Model
cfs	cubic feet per second
CGCGAM	Central Gulf Coast Groundwater Availability Model
DCP	drought contingency plan
DFC	desired future condition
DOR	drought of record
EPA	U.S. Environmental Protection Agency
FWSD	fresh water supply district
GAM	Groundwater Availability Model
GBRA	Guadalupe-Blanco River Authority
GCD	groundwater conservation district
GMA	Groundwater Management Area
gpcd	gallons per person per day
gpm	gallons per minute
HDR	HDR Engineering, Inc.
mg/L	milligrams per liter
MAG	Modeled Available Groundwater
MRP	Mary Rhodes Pipeline
MUD	municipal utility district
MWD	municipal water district
MWP	major water provider
NEAC	Nueces Estuary Advisory Council
NPDES	National Pollutant Discharge Elimination System
PCCA	Port of Corpus Christi Authority
PWS	Public Water System database
SPMWD	San Patricio Municipal Water District
STWA	South Texas Water Authority
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TDS	total dissolved solids
TPDES	Texas Pollutant Discharge Elimination System
TPWD	Texas Parks and Wildlife Department
TSS	total suspended solids
TWDB	Texas Water Development Board
UCM	Unified Costing Model

USFWS	U.S. Fish and Wildlife Service
WAM	Water Availability Model
WCAC	Water Conservation Advisory Council
WCID	water control and improvement district
WSC	water supply corporation
WTP	water treatment plant
WUS	water use survey
WWP	wholesale water provider
WWTP	wastewater treatment plant



Executive Summary

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Executive Summary

ES.1 Background

Since 1957, the Texas Water Development Board (TWDB) has been charged with preparing a comprehensive and flexible long-term plan for the development, conservation, and management of the State's water resources. The TWDB produced the current state water plan, *2022 State Water Plan*, which is based on approved regional water plans pursuant to requirements of Senate Bill 1 (SB1), enacted in 1997 by the 75th Legislature. As stated in SB1, the purpose of the regional water 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."*

SB1 also provides that future regulatory and financing decisions of the Texas Commission on Environmental Quality (TCEQ) and the TWDB be consistent with approved regional plans.

The TWDB divided the state into 16 planning regions and appointed members to the regional planning groups. As shown is Figure ES.1, the Coastal Bend Region includes 11 counties. The Coastal Bend Regional Water Planning Group (CBRWPG) has a total of 20 voting members. The members represent 13 interests (agriculture, counties, electric generating utilities, environmental, Groundwater Management Areas [GMAs], industries, municipalities, other, public, river authorities, small business, water districts, and water utilities), serve without pay, and are responsible for the development of the Coastal Bend Regional Water Plan (Table ES.1). Mr. Scotty Bledsoe has served since CBRWPG inception in the late 1990s. The CBRWPG adopted bylaws to govern its operations and, in accordance with its bylaws, selected the Nueces River Authority to serve as its administrative agency.

Pursuant to Regional and State Water Planning Guidelines (Texas Administrative Code [TAC], Title 31, Part 10, Chapters 357 and 358), the CBRWPG has developed the 2001, 2006, 2011, 2016, and 2021 Coastal Bend (Region N) regional water plans, which the TWDB subsequently integrated into *Water for Texas* – 2002, 2007, 2012, 2017, and 2022 respectively. *The 2026 Coastal Bend Regional Water Plan*, of which this executive summary is a part, represents the sixth update as presently required to occur on a 5-year cycle. The TWDB will integrate this regional water plan into a state water plan to be issued in 2027. The *2026 Coastal Bend Regional Water Plan* was developed under the direction of the CBRWPG and adopted by the planning group on February 27, 2025. This report presents the results of a five-year planning effort to develop a plan for water supply for the region through 2080.This executive summary and the accompanying *2026 Coastal Bend Region Regional Water Plan* convey water supply planning information, projected population and water demands, projected needs in the region, proposed water management strategies to meet those needs, and other findings. Table ES.2 shows the contents of the plan.

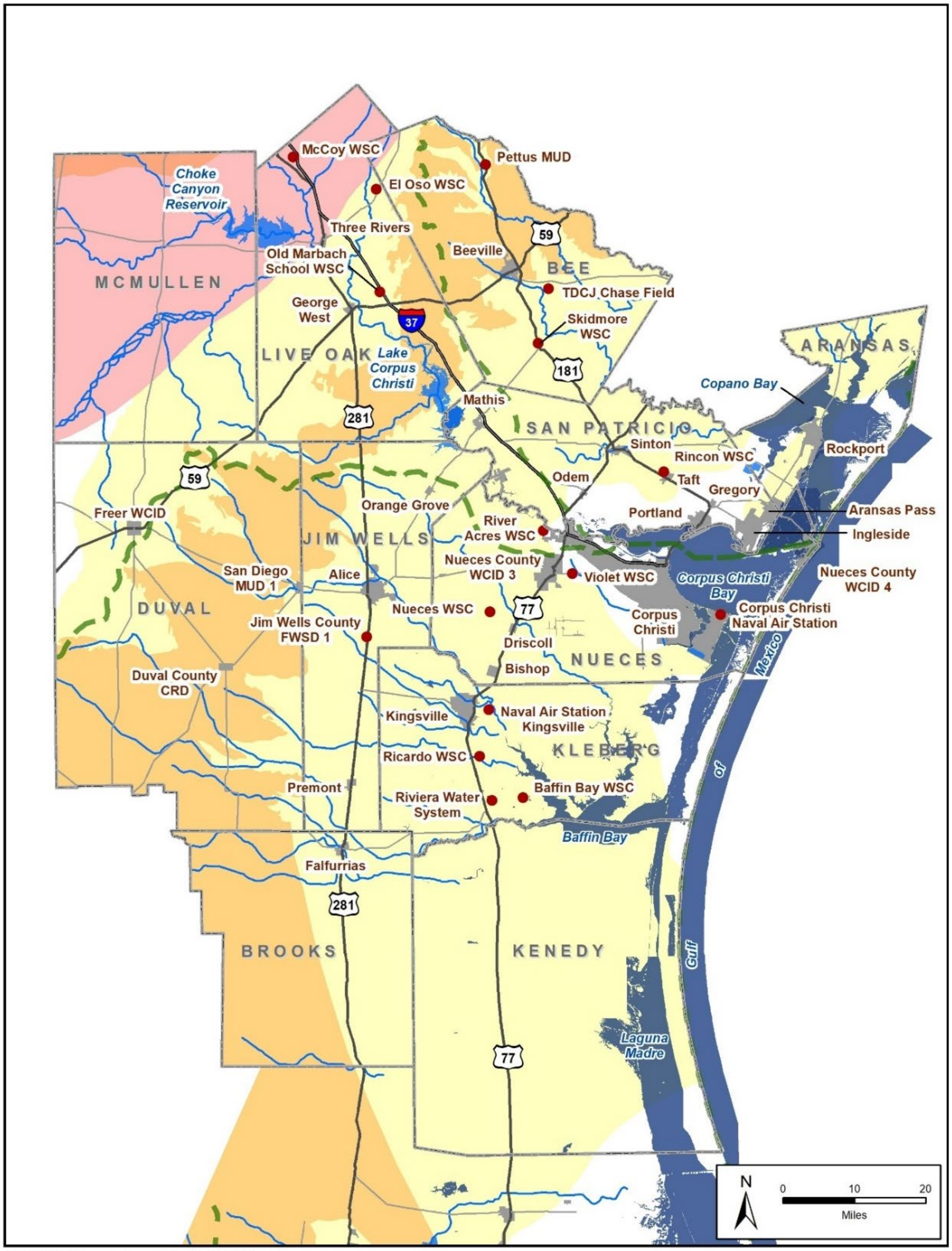

Figure ES.1.
Coastal Bend Regional Water Planning Area

Table ES.1.
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Administrator	Mr. Travis Pruski	Nueces River Authority

***Table ES.2.
Plan Structure***

Volume I	Executive Summary, Regional Water Plan, and Appendices
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Chapter 1	Planning Area Description
Chapter 2	Population and Water Demand Projections
Chapter 3	Water Supply Analysis
Chapter 4A	Identification of Water Needs
Chapter 4B	Infeasible Water Management Strategies in the 2021 Regional Water Plan
Chapter 5	Water Management Strategies and Evaluations
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	Oso Regional WWTP Reuse
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5B.6	Seawater Desalination
	Corpus Christi- Inner Harbor
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5B.7	Brackish Groundwater Desalination
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	Ricardo Well Project
5B.10	Regional Water Treatment Plant Expansion
	O.N. Stevens Plant Improvements
	Mary Rhodes Rehabilitation
	SPMWD Project No. 1- New WTP (20 MGD) at Plant D
	SPMWD- Project No 2- New Intake, PS and Raw Water Transmission on Nueces
	SPMWD- Project No 3- New PS at Mary Rhodes Pipeline & Transmission Rehab
5B.11	Nueces River Diversion to Choke Canyon Reservoir
5B.12	Lake Corpus Christi Sediment Removal
5C	Conservation Recommendations
Chapter 6	Impacts of Regional Water Plan and Consistency with Protection of Resources

Volume I	Executive Summary, Regional Water Plan, and Appendices
Chapter 7	Drought Response Information, Activities, and Recommendations
Chapter 8	Unique Sites and Policy Recommendations
Chapter 9	Implementation and Comparison to Previous Regional Water Plans
Chapter 10	Public Participation and Plan Adoption
Appendices	--

The *2026 Coastal Bend Region Regional Water Plan*'s required database (DB27) reports can be accessed through the TWDB Database Reports application at https://www3.twdb.texas.gov/apps/SARA/reports/list and following the steps below.

1. Enter '2026 Regional Water Plan' into the "Report Name" field to filter to all DB27 reports associated with the 2026 Regional Water Plans
2. Click on the report name hyperlink to load the desired report
3. Enter the planning region letter parameter, click view report

The reports available for access in DB27 are listed below.

1. WUG Population
2. WUG Water Demand
3. Source Availability
4. WUG Existing Water Supply
5. WUG Needs/Surplus
6. WUG Second Tier Identified Water Need
7. WUG Data Comparison to 2021 RWP
8. Source Data Comparison to 2021 RWP
9. WUG Unmet Needs
10. Recommended WUG Water Management Strategies
11. Recommended Projects Associated with Water Management Strategies
12. Alternative WUG Water Management Strategies
13. Alternative Projects Associated with Water Management Strategies
14. WUG Management Supply Factor
15. Recommended Water Management Strategy Supply Associated with a new or amended IBT Permit
16. WUG Recommended WMS Supply Associated with a new or amended IBT Permit and Total Recommended Conservation WMS Supply
17. Sponsored Recommended WMS Supplies Unallocated to WUGs
18. MWP Existing sales and Transfers
19. MWP WMS Summary

ES.2 Description of the Region

The area represented by the 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 four current regional wholesale water providers

(WWPs): the City of Corpus Christi, San Patricio Municipal Water District (SPMWD), South Texas Water Authority (STWA), and Nueces County Water Control and Improvement District #3 (Nueces County WCID #3). The City of Corpus Christi, the largest of the four, sells water to two of the other regional water providers — SPMWD and STWA. The City of Corpus Christi and the SPMWD distribute water to cities, water districts, and water supply corporations for residential, commercial, and industrial customers. STWA provides water to the western portion of Nueces County as well as Kleberg County. The smallest regional wholesale water provider, Nueces County WCID #3, provides water to the City of Robstown and River Acres WSC. Two potential regional WWPs, the Nueces River Authority and Port of Corpus Christi Authority (PCCA), have been identified as potentially providing water supplies to the region during the 50-year planning period through 2080; therefore, they are also designated as WWPs.

The major water demand areas are primarily municipal systems in the greater Corpus Christi area and large industrial (manufacturing, steam-electric, and mining) users primarily located along the Corpus Christi and La Quinta Ship Channels. Based on state surveys of industrial water use, industries in the Coastal Bend area are very efficient in their water use. For example, petroleum refineries in the Coastal Bend area use, on 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 major surface water supply source is the regional Choke Canyon/Lake Corpus Christi/Lake Texana/Mary Rhodes Pipeline Phase II system (Corpus Christi Regional Water Supply System) through the City of Corpus Christi. Surface water supply relationships are discussed in greater detail in Chapter 3.

The Coastal Bend Region depends on groundwater supplies for irrigation, mining, and less populated municipal areas that are not served by the Corpus Christi Regional Water Supply System. There are two major aquifers that lie beneath the region — the Carrizo and Gulf Coast aquifers. The Gulf Coast Aquifer is the predominant aquifer for groundwater supplies, providing about 95 percent of the groundwater used in the region. 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 Aquifer underlies parts of McMullen, Live Oak, and Bee counties and contains moderate to large amounts of either fresh or slightly saline water. Only McMullen County developed a modeled available groundwater (MAG) estimate for the Carrizo Aquifer. The Queen City, Sparta, and Yegua-Jackson aquifers are minor aquifers and underlie parts of McMullen County. McMullen County did not develop a MAG estimate for the Sparta or Yegua-Jackson aquifers.

According to estimates provided by the TWDB, the historical population of the Coastal Bend Region was 575,933 in 2020. In 2030, the population of the Coastal Bend Region is projected to be 593,187. The regional average per capita income in 2022 was $53,796, ranging from $34,707 in Bee County to $118,594 in McMullen County.[1] The Corpus Christi Metropolitan Statistical Area (MSA), consisting of Aransas, Nueces, and San Patricio counties, accounts for

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[1] U.S. Department of Commerce Bureau of Economic Analysis, Regional Economic Information System (REIS) Database, 2017.

77 percent of the Coastal Bend Region's population and 81 percent of the total personal income. In 2022, the total personal income in the Coastal Bend Region was nearly $30.4 billion.

The primary economic activities within the Coastal Bend Region include transportation and warehousing, oil/gas extraction and mining services, manufacturing, agriculture, forestry, fishing and hunting. In 2021, industries employed 180,918 people in the Coastal Bend Region with annual compensation to employees of over $8.2 billion.[2] The service industries sector had the biggest economic impact in 2021, with a total compensation to employees of $3.09 billion. The service industries sector includes information, public administration, educational, health care, social services businesses, finance and insurance, and real estate. In 2021, 48 percent of the local workforce was employed by this sector. The oil and gas extraction, manufacturing, construction, and retail/wholesale trade sector is also a large contributor to the local economy. In 2021, 18% (32,865 people) of the local workforce was employed by this sector, receiving total compensation of $2.23 billion. Retail/wholesale trade employs 33,961 people within the region (19 percent of the local workforce) and has a general annual compensation to employees of $1.31 billion. Agriculture, forestry, fishing, and hunting also add to the economic value of the Coastal Bend Region.

ES.3 Population and Water Demand Projections

For the *2026 Coastal Bend Regional Water Plan*, the TWDB issued population and water demand projections to the Coastal Bend Region based on 2020 census data, with 0.5 and 1.0 migration scenarios. The CBRWPG requested the higher of the two migration scenario projections on May 18, 2023, for population and municipal water demand. At that same meeting, the CBRWPG recommended revising water demand for Nueces and San Patricio County manufacturing users higher than TWDB draft projections. The TWDB staff considered the CBRWPG request. The TWDB Board adopted their staff recommendations on November 9 2023, which was 11,998 acre-feet (ac-ft) lower than the CBRWPG requested revision for San Patricio County's 2080 manufacturing water demand projection.

ES.3.1 Population Projections

Figure ES.2 illustrates population growth in the entire Coastal Bend Region for 2020 and projected growth through 2080. In 2080, the population of the Coastal Bend Regional Water Planning Area is projected to be 592,173.

As can be seen in Figure ES.3, the TWDB projects that the region's average annual growth rate from 2020 to 2080 to be 0.12 percent. Bee, Brooks, Duval, Jim Wells, Kleberg, Nueces, and San Patricio counties are projected to have positive growth rates to 2080, while the other counties are projected to have declining growth rates. If projected industrial growth occurs, then the actual annual growth rates may be higher.

[2] 2021 United States Census Bureau, 2021 Economic Annual Survey County Business Patterns, CB1700CBP, October 2023.

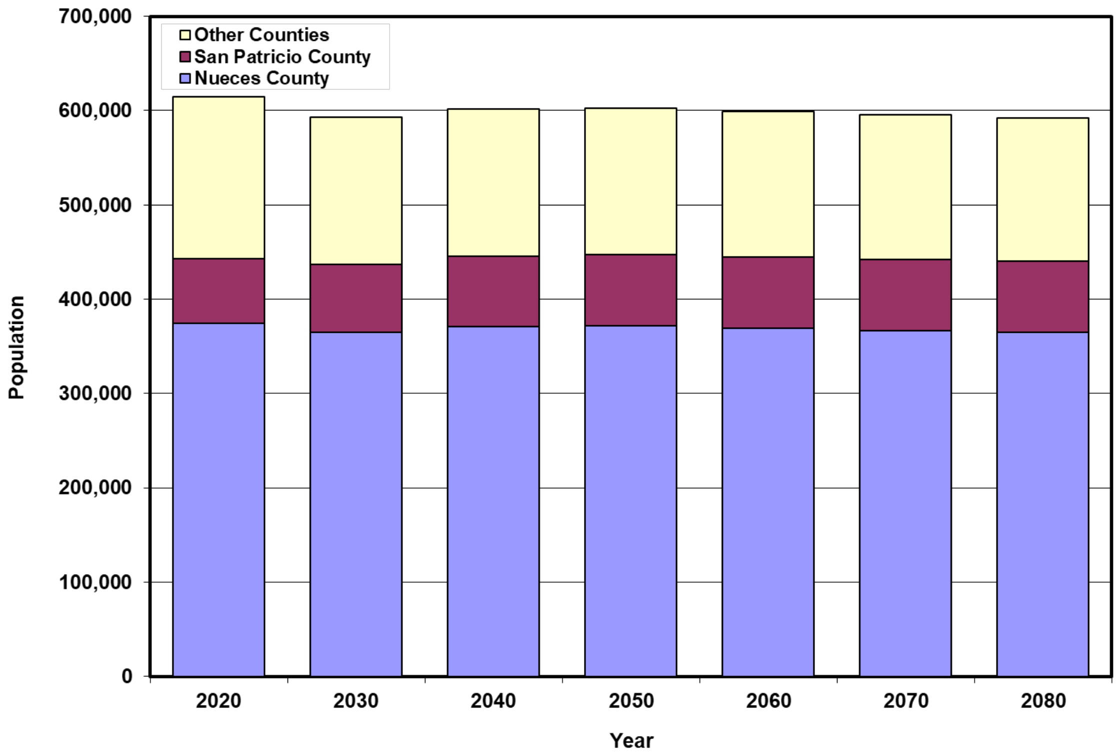


Figure ES.2.
Historical and Projected Coastal Bend Regional Water Planning Area Population

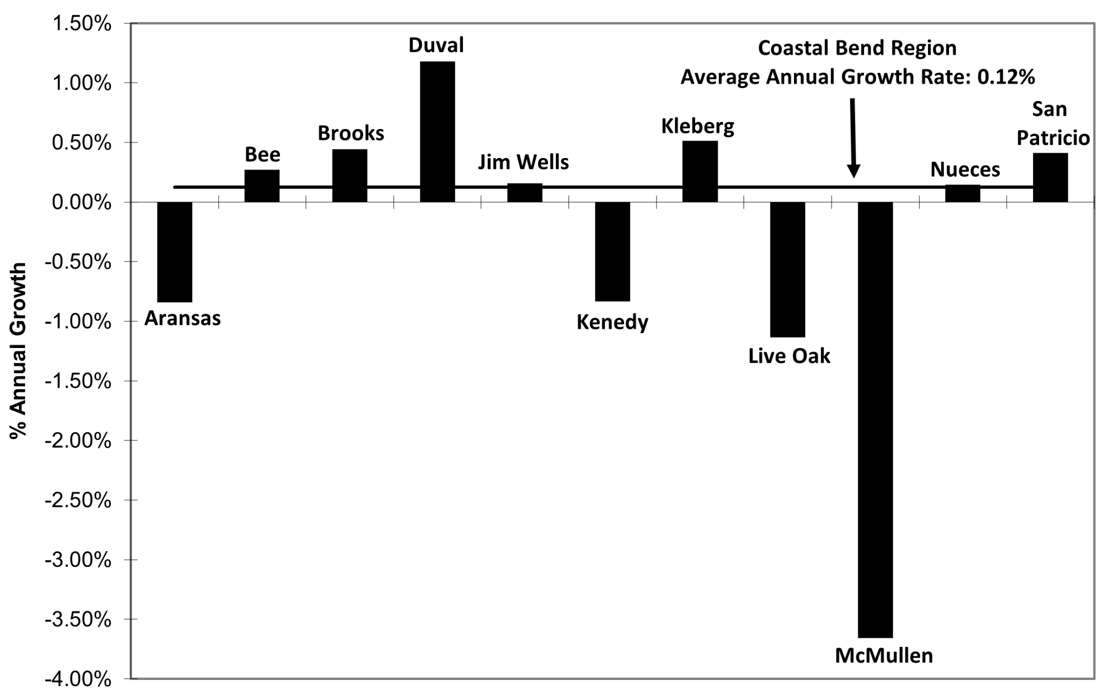


Figure ES.3.
Projected Percent Annual Population Growth Rate for 2020 through 2080 by County

ES.3.2 Water Demand Projections

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

Water User Groups

Each of these consumptive water uses is termed a "water user group." Incorporated cities and County-Other category are water user groups within the Municipal Use category. The County-Other category includes persons residing outside of cities and also outside water utility boundaries. Water demand projections and supplies have been estimated for all water user groups.

Total water use for the region is projected to increase from 163,074 ac-ft in 2020 to 250,809 ac-ft in 2080, a 53.8 percent increase, primarily attributable to projected industrial growth. The six types of water use and associated demands are shown in Figure ES.4. The projected trend in total water use from 2030 to 2080 is shown in Figure ES.5. Municipal, manufacturing, and steam-electric water use are all projected to increase; irrigation and livestock are projected to remain constant from 2030 to 2080; and mining is projected to decline.

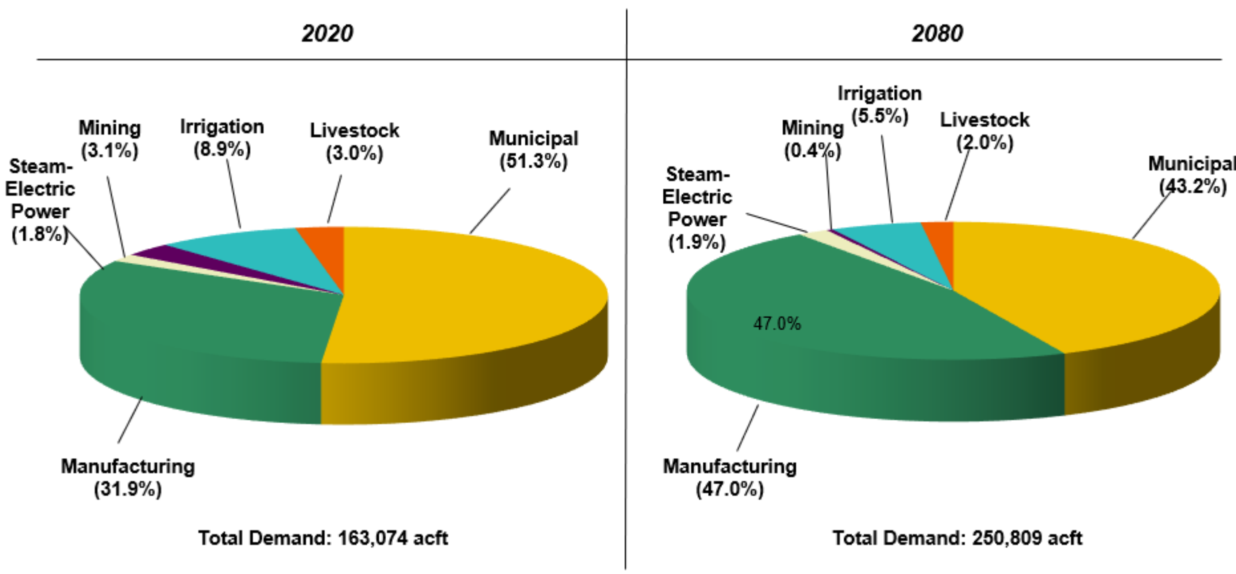


Figure ES.4.
Total Region N Water Demand by Type of Use

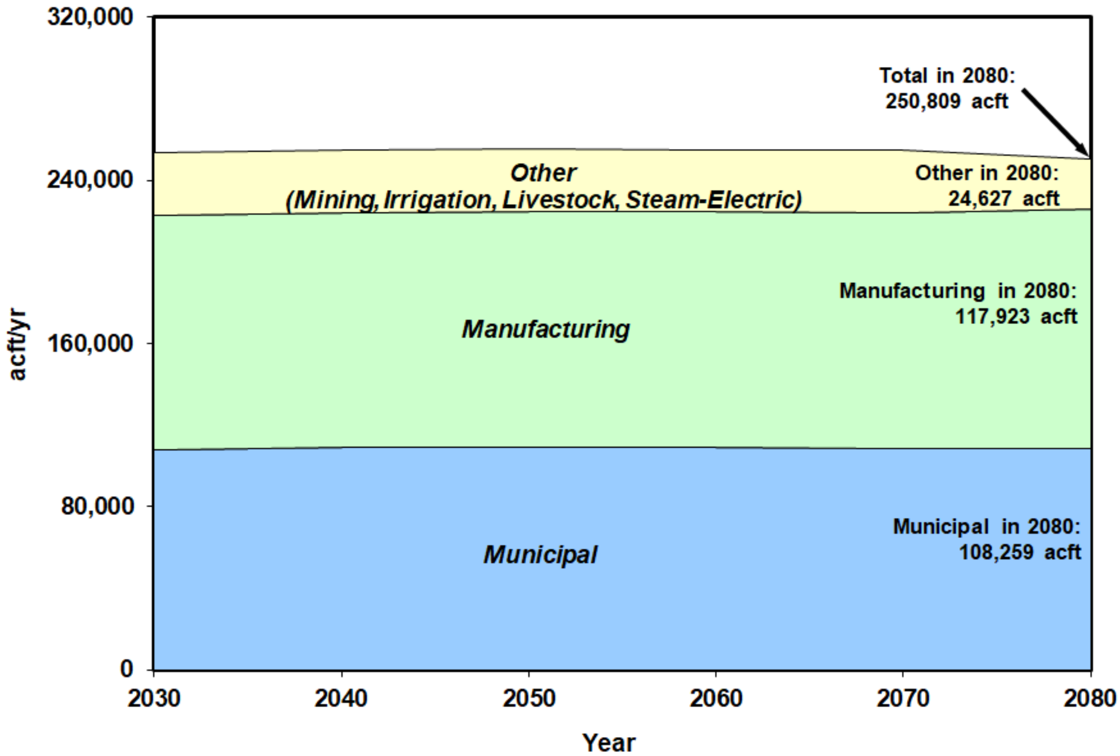


Figure ES.5.
Projected Total Region N Water Demand

ES.4 Water Supply

ES.4.1 Surface Water Supplies

Streamflow in the Nueces River and its tributaries along with reservoirs in the Nueces River Basin and interbasin transfers from Lake Texana and the Colorado River comprise the most significant supplies of surface water in the Coastal Bend Region. The City of Corpus Christi and the Nueces River Authority own water rights associated with major water supply reservoirs. The western and southern parts of the region are heavily dependent on groundwater sources due to limited access to surface water supplies.

Municipal Use and Water Conservation
Average per capita municipal water use from TWDB was 153 gallons per capita per day (gpcd)[3] and is projected to decrease by 5 gpcd to 148 gallons per capita per day by 2080 due to built-in savings for low flow plumbing fixtures.

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 supplies in the Coastal Bend Region with 170,000 acre-feet per year (ac-ft/yr) raw water safe yield available from its CCR/LCC/Texana/MRP Phase II reservoir system (2030 sediment conditions), which declines

[3] Excluding Port Aransas, Corpus Christi Naval Air Station, and Naval Air Station Kingsville, and TDCJ Chase Field which are heavily influenced by transitory, temporary community.

to 157,000 ac-ft/yr by 2080.[4] Run-of-river water rights provide 384 ac-ft/yr of reliable water for Nueces County WCID #3 and 1,500 ac-ft/yr for the City of Three Rivers firmed up with storage. Other surface water supplies are provided by on-farm local sources and reuse.

In addition to raw water supply contracts and/or availability, total surface water supplies are constrained based on existing water treatment plant capacities, as discussed in Chapter 4. As shown in Table ES.3, total surface water from all surface water sources in year 2080 is 151,783 ac-ft/yr, of which 99 percent is provided by the City of Corpus Christi's supplies[5].

Table ES.3.
Surface Water Supply in 2080 (ac-ft)

Municipal	82,101
Manufacturing	62,266
Steam-Electric	4,777
Mining	0
Irrigation	0
Livestock	688
Total	**149,832**

Note: This table considers both treatment plant capacity and raw water constraints.

ES.4.2 Groundwater Supplies

Two major aquifers and three minor aquifers underlie parts of the Coastal Bend Planning Region (Figure ES.1) and have a combined reliable yield of 168,261 ac-ft/yr in 2080, based on the TWDB's MAG estimates for CBRWPG use (Table ES.4). The projected groundwater use in 2070 is 58,455 ac-ft/yr for current water users, or 96,611 ac-ft/yr if recommended water management strategies are implemented.[6] The two major aquifers include the Gulf Coast Aquifer, which supplies 96 percent of the groundwater to the region in 2030, and the Carrizo Aquifer, which supplies water to the northwest portion of the region in parts of McMullen County (Figure ES.1). Groundwater supplies are based on MAG estimates and well capacities. In the northwestern part of the region, the Carrizo-Wilcox Aquifer is prolific but with lesser quality water in most areas. The Yegua-Jackson, Queen City, and Sparta aquifers are minor aquifers relied on for very small amounts of local supply in McMullen County[7].

[4] The City of Corpus Christi holds a contract with the Lavaca-Navidad River Authority for a base amount of 31,440 ac-ft/yr and a maximum of 12,000 ac-ft/yr on an interruptible basis from Lake Texana to the City, and up to 35,000 ac-ft/yr from the City's Garwood water rights. The safe yield estimate includes system operation of CCR/LCC/Texana/MRP Phase II supplies with a 75,000 ac-ft reserve during drought of record conditions.

[5] Note: Total is less than CCR/LCC/Texana/MRP Phase II supplies. SPMWD retains a small surplus based on contracts.

[6] Based on recommended water management strategies, which are constrained by modeled available groundwater (MAG) limits.

[7] No MAG exists for Yegua- Jackson or Sparta, and therefore they are not included in the table, nor relied on in the Plan to provide water supply to meet projected water demands.

ES.4.3 Total Supplies

Total water use from each water source is summarized in Table ES.5. No supplies are over allocated. The total existing water supplies, including both groundwater and surface water supplies, by water user category and decade are summarized in Table ES.6. Pertinent database tables (DB27) required for inclusion by TWDB guidance are included in Appendix A.

ES.4.4 Supply and Demand Comparison

The Coastal Bend Region shows water supply shortages throughout the 50-year planning cycle. Beginning in 2030, a shortage of 32,109 ac-ft exists within the region and increases to a shortage of 44,453 ac-ft by 2080. A small portion of this shortage is associated with treatment plant capacity constraints and is not necessarily a raw water shortage. Current O.N. Stevens water treatment plant (WTP) improvements are in progress to increase treatment plant capacity, which should be sufficient to address water needs with recommended water management strategies for additional supplies.

Nine 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 Bee, Brooks, Duval, Jim Wells, Live Oak, Nueces, and San Patricio counties. Figure ES.6 shows these water user groups with shortages for both 2040 and 2070 timeframes. None of the water user groups in Aransas, Kenedy, Kleberg, or McMullen counties have projected shortages.

Constraints on Water Supply
Water supplies are also affected by contractual arrangements and infrastructure constraints like expiring contracts, insufficient well capacity, and water treatment plant capacity. Each of these supply constraints was taken into account in estimating water supplies available to 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.

Table ES.4.
Groundwater Availability for Aquifers within the Coastal Bend Region

County Name	Basin Name	Aquifer Name	TWDB Provided MAG for 2026 Region N Plan (ac-ft/yr)					
			2030	2040	2050	2060	2070	2080
Aransas	San Antonio-Nueces	Gulf Coast	1,547	1,547	1,547	1,547	1,547	1,547
Bee	Nueces	Carrizo	0	0	0	0	0	0
Bee	San Antonio-Nueces	Gulf Coast	18869	19553	19855	20,042	20,043	20,029
Bee	Nueces	Gulf Coast	1,007	1,069	1,098	1,115	1,115	1,115
Brooks	Nueces-Rio Grande	Gulf Coast	5,123	5,353	5,507	5,738	6,437	6,437
Duval	Nueces	Gulf Coast	351	376	401	428	428	428
Duval	Nueces-Rio Grande	Gulf Coast	21,818	23,388	24,962	26,535	26,535	26,535
Jim Wells	Nueces	Gulf Coast	593	593	593	593	681	681
Jim Wells	Nueces-Rio Grande	Gulf Coast	8,802	9,183	9,582	9,926	11,368	11,368
Kenedy	Nueces-Rio Grande	Gulf Coast	10,104	11,698	12,762	14,358	15,421	15,421
Kleberg	Nueces-Rio Grande	Gulf Coast	9,039	9,989	10,687	11,637	12,142	12,142
Live Oak	San Antonio-Nueces	Gulf Coast	68	62	61	61	61	61

County Name	Basin Name	Aquifer Name	TWDB Provided MAG for 2026 Region N Plan (ac-ft/yr)					
			2030	2040	2050	2060	2070	2080
Live Oak	Nueces	Gulf Coast	11,326	10,382	10,233	10,233	10,233	10,233
Live Oak	Nueces	Carrizo	0	0	0	0	0	0
McMullen	Nueces	Carrizo	7,768	4,867	4,854	4,854	4,854	4,854
McMullen	Nueces	Gulf Coast	510	510	510	510	510	510
McMullen	Nueces	Queen City	3	3	3	3	3	3
McMullen	Nueces	Sparta	0	0	0	0	0	0
McMullen	Nueces	Yegua-Jackson	0	0	0	0	0	0
Nueces	San Antonio-Nueces	Gulf Coast	0	0	0	0	0	0
Nueces	Nueces	Gulf Coast	756	787	816	845	845	845
Nueces	Nueces-Rio Grande	Gulf Coast	6031	6291	6540	6798	6818	6818
San Patricio	San Antonio-Nueces	Gulf Coast	40,514	41,548	42,581	43,615	43,615	43,615
San Patricio	Nueces	Gulf Coast	4,502	4,874	5,247	5,619	5,619	5,619
Total Groundwater Availability (ac-ft/yr)			**148,731**	**152,073**	**157,839**	**164,457**	**168,275**	**168,261**
Gulf Coast Aquifer-MAG (ac-ft/yr)			***140,960***	***147,203***	***152,982***	***159,600***	***163,418***	***163,404***

Table ES.5.
Total Source Water Availability and Supply by Source (ac-ft)

Source	2030	2040	2050	2060	2070	2080
Total Source Water Availability						
CCR/LCC/Texana/MRP2 System	170,000	168,000	166,000	164,000	162,000	157,000
Run-of-River (Firm Yield)	384	384	384	384	384	384
Stock Ponds/On-site	688	689	688	688	688	688
Reuse	5,623	5,623	5,623	5,623	5,623	5,623
Gulf Coast- Groundwater	148,731	152,073	157,839	164,457	168,275	168,261
Carrizo Wilcox- Groundwater	7,768	4,867	4,854	4,854	4,854	4,854
Queen City- Groundwater	3	3	3	3	3	3
Total Source Water Availability (ac-ft)	**333,197**	**331,639**	**335,401**	**340,019**	**341,837**	**336,823**
Existing Water Supply[1]						
CCR/LCC/Texana/MRP Phase II	170,000	168,000	166,000	164,000	162,000	157,000
Run-of-River[2]	384	384	384	384	384	384
Stock Ponds/On-site/Reuse	688	689	688	688	688	688
Reuse	5,623	5,623	5,623	5,623	5,623	5,623
Gulf Coast- Groundwater	41,636	41,665	41,787	42,025	42,222	42,030
Carrizo Wilcox- Groundwater	2,803	2,797	2,795	2,791	2,787	102
Queen City- Groundwater	3	3	3	3	3	3
Total Existing Water Supply (ac-ft)	**221,137**	**219,161**	**217,280**	**215,514**	**213,707**	**205,830**

[1]The existing supply takes into consideration physical, treatment, and legal (contractual) constraints.

[2]Includes run-of-river rights and those with storage rights, other than those associated with the Corpus Christi Regional Water System (CCR/LCC/Texana/MRP Phase II).

Table ES.6.
Summary of Total Existing Water Supplies* by Water User Category (ac-ft)

Water User	2030	2040	2050	2060	2070	2080
Municipal	102,710	104,194	104,736	104,813	104,997	100,177
Manufacturing	79,986	76,536	74,120	72,298	70,370	70,216
Steam-Electric	4,777	4,777	4,777	4,777	4,777	4,777
Mining	6,847	6,878	6,908	6,936	6,938	4,122
Irrigation	13,861	13,861	13,861	13,861	13,861	13,861
Livestock	4,963	4,963	4,963	4,963	4,963	4,963
Total (ac-ft)	**213,144**	**211,209**	**209,365**	**207,648**	**205,906**	**198,037**

*Note: This table considers physical, treatment, and legal (contractual) constraints.

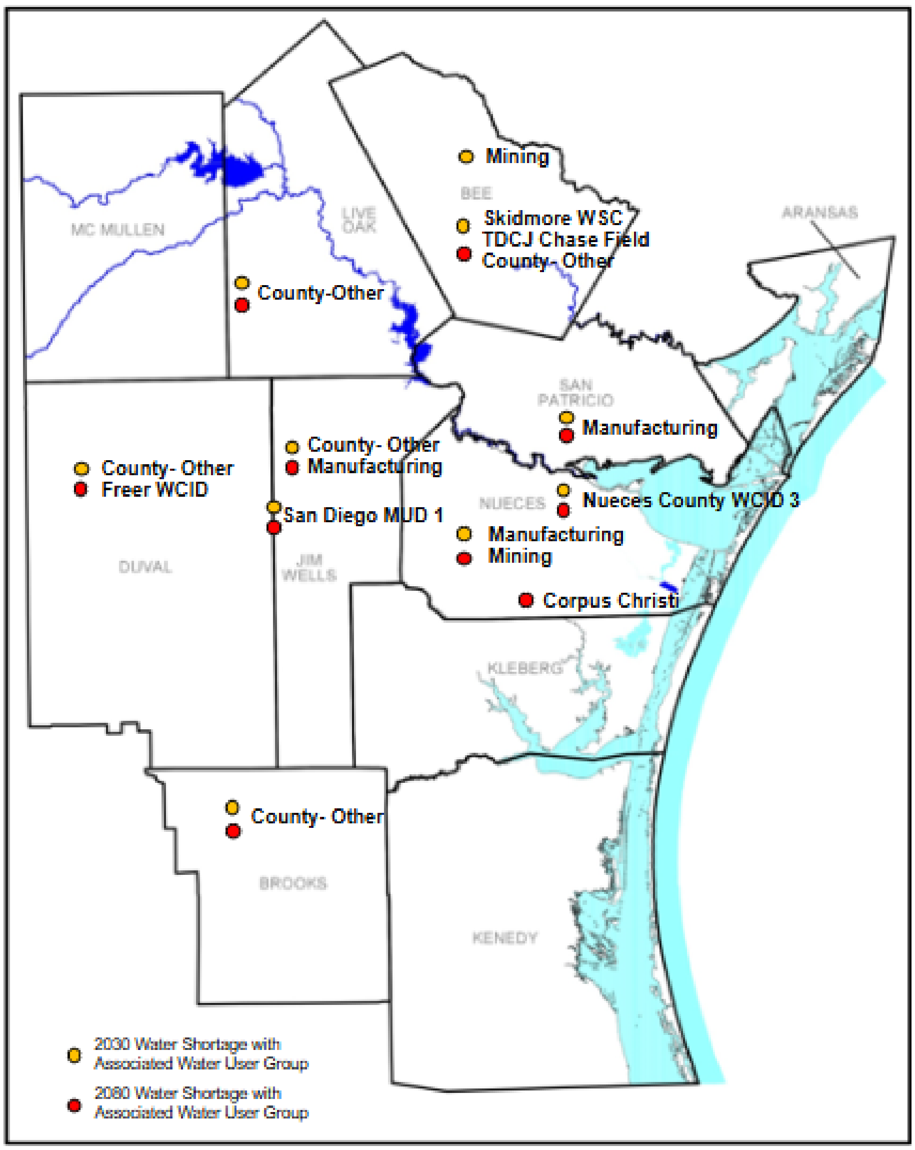


Figure ES.6.
Location and Type of Use for 2030 and 2080 Water Supply Needs

ES.4.5 Additional Plan Information

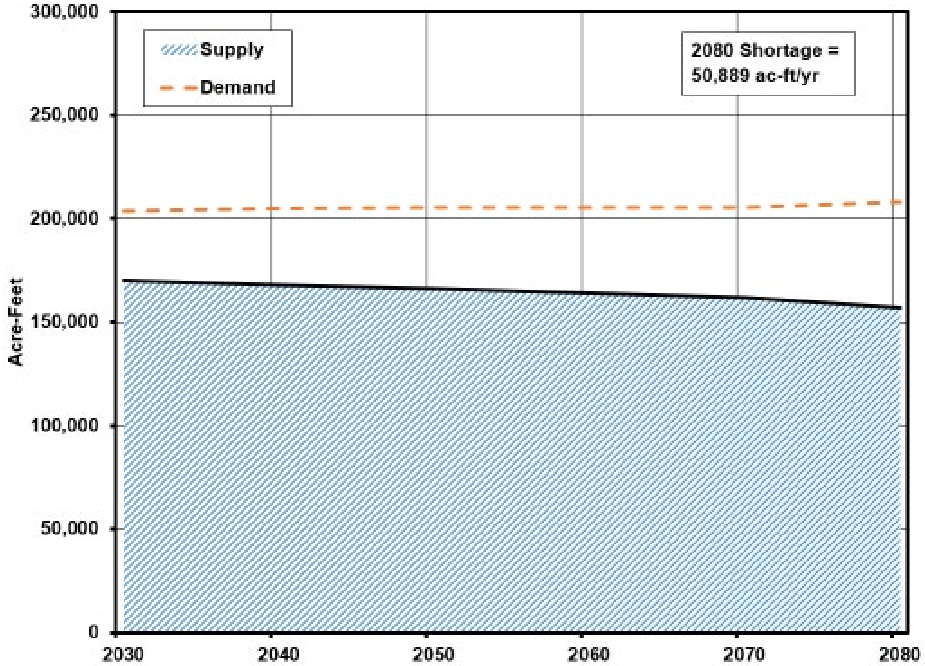
Although most of the plan is focused on assessing supplies (Chapter 3), identifying needs (Chapter 4), and evaluating water management strategies to address projected shortages (Chapter 5), there are additional report sections of interest. Chapter 6 summarizes the impact of water management strategies on key parameters of water quality in the region. Chapter 7 presents drought response information for the region and activities and recommendations to mitigate future drought impacts on water supply. Chapter 8 presents legislative recommendations and unique stream segments/reservoirs from the CBRWPG. Chapter 9 compares this plan to previous plans. Chapter 10 summarizes the public participation process, regional and subcommittee meetings held, and CBRWPG approval of the initially prepared plan.

ES.5 Wholesale Water Providers

The Coastal Bend Region has four current WWPs. These include the City of Corpus Christi, SPMWD, STWA, and Nueces County WCID #3. The City of Corpus Christi supplies about 65 percent of the water demand in the region (not including supplies to SPMWD or STWA). SPMWD and STWA purchase 100 percent of their water from the City of Corpus Christi. The SPMWD subsequently treats and distributes water to numerous entities and supplies about 10 percent of the municipal and industrial water demand in the region. Both STWA and Nueces County WCID #3 provide less than 3 percent of the municipal and industrial water demand in the region. Two potential future WWPs were identified in DB27 for recommended water management strategies: the Nueces River Authority and PCCA. The Nueces River Authority is the project sponsor for the Petronila Creek WWTP Reuse. Both are associated with seawater desalination strategies to primarily serve future San Patricio County and Nueces County manufacturing users.

Figure ES.7 and Figure ES.8 show projected supply and demand for each of the four current WWPs. The City of Corpus Christi, after meeting demands and/or contracts with its customers, has raw water supply shortages from 2030 through 2080, indicating a need for increased source water supplies. In addition, beginning in 2030, the City of Corpus Christi and its treated industrial water customers have shortages associated with treatment plant capacity constraints. The City of Corpus Christi is in the process of O.N. Stevens WTP Improvements to increase system capacity to meet future treated water needs (See Section 5B.10). The City of Corpus Christi's shortages are applied to the City of Corpus Christi and Nueces County manufacturing. SPMWD is authorized to receive 81,560 ac-ft/yr of water through a combination of raw and treated water supply contracts with the City of Corpus Christi, which meets raw water demands of its customers throughout the planning period. However, SPMWD has treatment capacity limitations and therefore shortages are projected throughout the planning period. The City of Corpus Christi meets contracted supplies, with shortage on Nueces County- manufacturing and City of Corpus Christi customers. STWA receives treated water supplies to meet the demands of its customers, consistent with the terms of the present contracts, and has no projected shortages. Nueces County WCID #3 receives supply through run-of-river water rights and is projected to have a shortage in all decades attributed to a lack of sufficient firm yield during drought of record conditions.

City of Corpus Christi Service Area
**Note: Does not include SPMWD and STWA*



San Patricio Municipal Water District Service Area

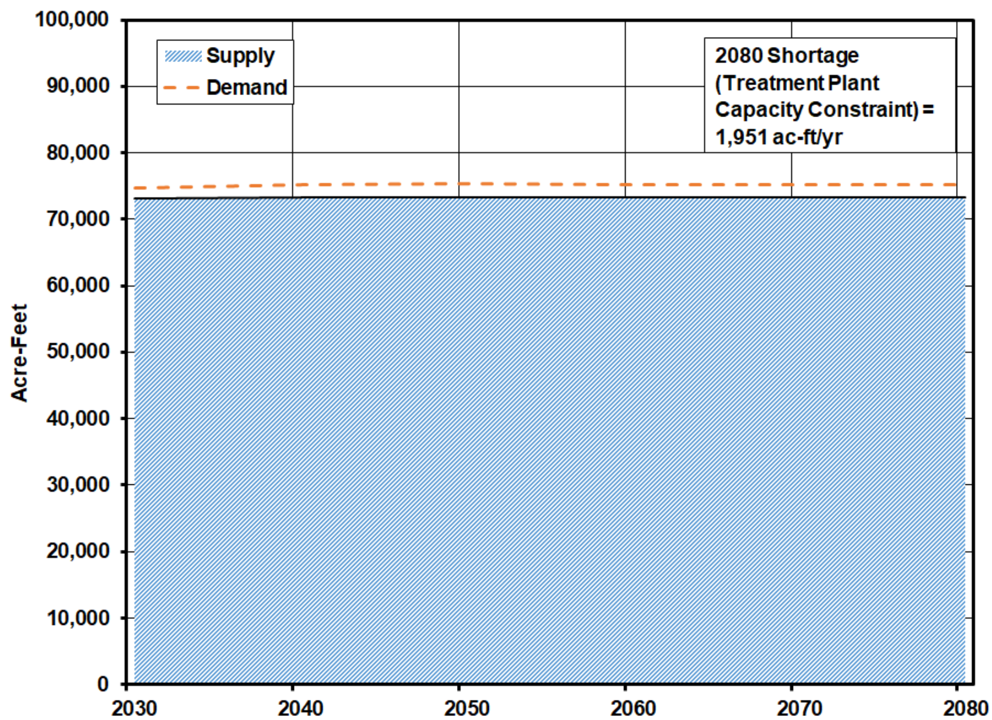
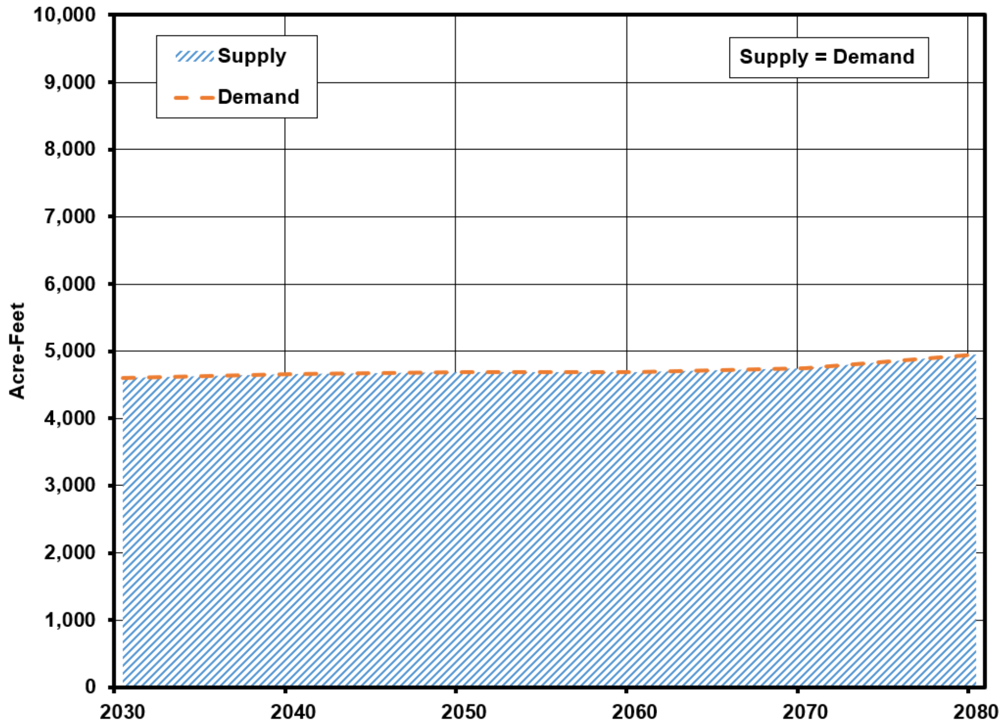


Figure ES.7.
Water Supply vs. Demand for Current Wholesale Water Providers Water Plan
(Page 1 of 2)

South Texas Water Authority Service Area



Nueces County WCID #3 Service Area

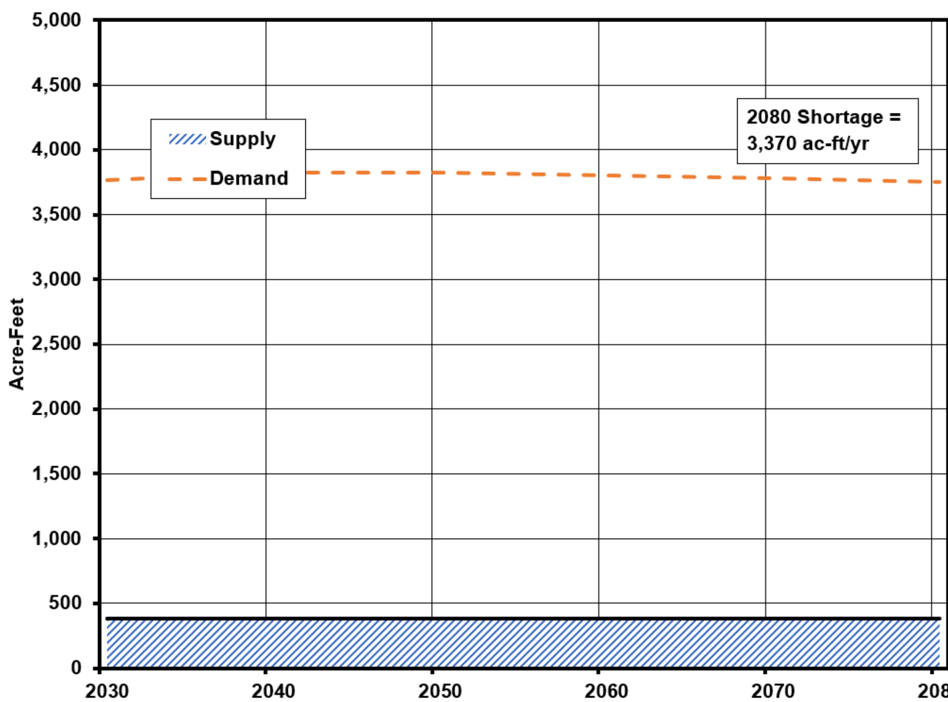


Figure ES.8.
Water Supply vs. Demand for Current Wholesale Water Providers Water Plan (Page 2 of 2).

ES.6 Water Supply Strategies to Meet Needs

The CBRWPG identified several water management strategies as potentially feasible to meet water supply shortages. Each strategy was evaluated and compared to criteria adopted by the CBRWPG. The *2026 Coastal Bend Regional Water Plan* includes recommended water management strategies that emphasize water conservation and reuse; maximizing use of available resources, water rights, and reservoirs; developing drought-tolerant supplies; engaging the efficiency of conjunctive use of surface and groundwater; and limiting depletion of storage in aquifers. The strategies identified as potentially feasible are tabulated in Table ES.7 and Table ES.8 Table ES.7 summarizes potential strategies for current WWPs, while Table ES.8 summarizes strategies for other service areas. Additionally, Figure ES.9 provides a graphical comparison of unit costs and quantities of water provided for selected strategies evaluated. Section 5D discusses each of these possible strategies in detail.

Table ES.9 summarizes findings and recommendations for every water user group, including those with projected water shortages. The table lists each municipality and water user group by county. Water demands are listed for years 2030, 2050, and 2080. Shortages are listed for years 2030, 2050, and 2080, along with recommended actions to meet these shortages.

The recommended water supply plans are presented by county in greater detail in Chapter 5B. Water management strategies recommended in the Coastal Bend Region could produce new supplies in excess of the projected regional need of 44,532 ac-ft in Year 2080. Supplies exceed shortages in case water growth patterns and demands exceed TWDB projections.

Table ES.10 summarizes those strategies that are recommended in the regional water plan. Total estimated project cost (in September 2023 dollars) for the recommended water management strategies for the Coastal Bend Region is $9.36 billion. Capital costs are included for all recommended water management strategies, except manufacturing and mining water conservation due to the high variability and site-specific nature of conservation programs. Five seawater desalination plants are recommended for Nueces County and San Patricio County manufacturing and cumulative water supplies from recommended water management strategies far exceeds identified shortages. No alternative water management strategies are recommended as part of the planning process.

Table ES.7. Potential Water Management Strategies to Meet Long-Term Needs for Current Wholesale Water Providers

WMS ID	Water Management Strategy	Additional Water Supply (ac-ft/yr)	Total Project Cost ($)	Annual Cost ($)	Unit Cost of Additional Treated Water ($ per ac-ft/yr)	Degree of Water Quality Improvement	Environmental Issues/Special Concerns
5B.1	**Municipal Water Conservation**	up to 17,118	Variable, Regional Cost up to $41,349,049	Variable	$577-$583	No change	Possible reduction in return flows to bay and estuary
5B.2	**Manufacturing Water Conservation**	up to 17,689	Highly variable	Highly variable	Variable	Variable. Depends on BMP. Low to significant improvement.	Possible reduction in return flows to bay and estuary
5B.4	**Reuse**						
	Petronila Regional WWTP Reuse	1,120	$13,228,000	$1,554,000	$1,388	Improves quality	Potential reduction of freshwater inflows to bay and estuary; construction and maintenance of pipeline corridors
	Corpus Christi Greenwood WWTP Direct Potable Reuse	5,381	$64,195,000	$11,258,000	$2,092	Improves quality	Reduction of freshwater inflows to intermittent, local streams. Possible reduction in return flows to bay and estuary; construction and maintenance of pipeline corridors
	Oso Regional WWTP Reuse	No information available. Will be evaluated between Initially Prepared and Final Plan.					
5B.5	**City of Corpus Christi Aquifer Storage and Recovery**						
	Non-Potable Phase 1 and 2	20,178	$196,981,000 to $237,314,000	$18,731,000 to $22,280,000	$928 to $1,104	Improves effluent and groundwater quality	Possible reduction in return flows to bay and estuary
	ASR with IPR	8,070	$186,539,000	$22,869,000	$2,834	Improves effluent and groundwater quality	Possible reduction in return flows to bay and estuary
5B.6	**Seawater Desalination**						
	City of Corpus Christi- Inner Harbor (30 MGD)	33,604	$785,000,000	$106,000,000	$3,154	Variable. Low to significant improvement.	Disposal of concentrated brine created from process may impact fish and wildlife habitats or wetlands. NRA Basin Highlights report has identified constituents of concern for Corpus Christi and Nueces Bay to consider during treatment based on end-user goal.
	City of Corpus Christi- La Quinta (40 MGD)	44,806	$1,141,000,000	$155,000,000	$3,460	Variable. Low to significant improvement.	
	City of Corpus Christi Barney Davis Desalination (20 MGD)	33,627	$582,000,000	$83,000,000	$3,705	Variable. Low to significant improvement.	Threatened and endangered species habitat identified near project site.
	Port of Corpus Christi Authority- Harbor Island (100 MGD)	112,014	$3,456,000,000	$405,000,000	$3,616	Variable. Low to significant improvement.	Threatened and endangered species habitat identified near project site.
	Port of Corpus Christi Authority- La Quinta Channel (30 MGD)	33,627	$844,000,000	$116,000,000	$3,452	Variable. Low to significant improvement.	
	Brackish Groundwater Desalination						
	Evangeline Laguna Treated Groundwater	25,637	$486,499,000	$104,738,000	$4,085	Significant improvement	Construction and maintenance of pipeline corridors. Disposal of concentrated brine created from process may impact fish and wildlife habitats or wetlands.
	Driscoll Brackish Groundwater Treatment Project	1,513	$36,289,885	$4,353,679	$2,878	Significant improvement	Construction and maintenance of pipeline corridors. Disposal of concentrated brine created from process may impact fish and wildlife habitats or wetlands.
5B.8	**Local Balancing Storage**	3,827	$26,014,000	$2,035,000	$904	No Change	Construction and maintenance of pipeline corridors and terminal storage
5B.9	**Groundwater Supplies - Rural and Non-Municipal Water Systems**						
	Ricardo Well Project	560	$10,977,100	$1,183,941	$2,114	No to low degradation	Minor Impacts
5B.10	**Regional Water Supply Management and Treatment Facilities**						
	ON Stevens WTP Improvements	32,029	$82,753,000	$7,502,000	$606	No Change	None
	Mary Rhodes Rehabilitation	112,000	$1,236,419,000	$112,506,000	$1,377	No Change	None
	SPMWD Project No. 1 - New WTP (20 MGD) at Plant D	22,418	$69,048,000	$18,349,000	$819	No Change	None
	SPMWD Project No. 2 - New Intake, PS and Raw Transmission on Nueces	69,495	$223,595,000	$44,271,000	$637	No Change	None
	SPMWD Project No. 3 - New PS at MR & Transmission Rehab	33,627	$40,249,000	$16,204,000	$482	No Change	None
5B.11	**Nueces River Diversion to Choke Canyon Reservoir**	2,939	$417,731,000	$35,037,000	$11,923	No to low degradation	Possible reduction in return flows to bay and estuary
5B.12	**Lake Corpus Christi Sediment Removal**	2,000	$2,672,649,000	$228,009,000	$114,005	No to low degradation	Temporary degradation to wildlife habitat and wetlands.

Table ES.8.
Potential Water Management Strategies to Meet Long-Term Needs for Local Service Areas

WMS ID	Water Management Strategy	Water Supply (ac-ft/yr)	Total Project Cost ($)	Annual Cost ($)	Unit Cost of Treated Water ($ per ac-ft/yr)	Degree of Water Quality Improvement	Environmental Issues/Special Concerns
5B.1	**Municipal Water Conservation**	up to 17,118	Variable, Regional Cost up to $26,050,001	Variable	$577-$583	No change	Possible reduction in return flows to bay and estuary
5B.2	**Manufacturing Water Conservation**	up to 17,689	Highly variable	Highly variable	Variable	Variable. Depends on BMP. Low to significant improvement.	Possible reduction in return flows to bay and estuary
5B.3	**Mining Water Conservation**	up to 882	Highly variable	Highly variable	Variable	No change	Possible reduction in return flows to bay and estuary
5B.7	**Brackish Groundwater Desalination**						
	City of Beeville	4,204	$100,904,000	$16,342,000	$3,887	Variable. Low to significant improvement.	Possible reduction in return flows to bay and estuary. Disposal of concentrated brine created from process may impact fish and wildlife habitats or wetlands.
5B.9	**Groundwater Supplies - Rural and Non-Municipal Water Systems**						
	Bee County-Other (Municipal)	1,426	$5,421,000	$567,000	$398	No to low degradation	Minor Impacts
	Bee County-Mining	25	$1,024,000	$80,000	$3,200	No to low degradation	Minor Impacts
	Skidmore WSC	44	$1,067,000	$101,000	$2,295	No to low degradation	Minor Impacts
	TDCJ Chase Field	5	$1,067,000	$100,000	$20,000	No to low degradation	Minor Impacts
	Brooks County-Other (Municipal)	281	$1,089,000	$127,000	$452	No to low degradation	Minor Impacts
	Duval County-Other (Municipal)	253	$1,496,000	$158,000	$625	No to low degradation	Minor Impacts
	San Diego MUD 1	131	$817,000	$92,000	$702	No to low degradation	Minor Impacts
	Jim Wells County- Other (Municipal)	1,621	$8,763,000	$846,000	$522	No to low degradation	Minor Impacts
	Jim Wells County- Manufacturing	25	$747,000	$75,000	$3,000	No to low degradation	Minor Impacts
	Live Oak County- Other (Municipal)	202	$1,317,000	$139,000	$688	No to low degradation	Minor Impacts
	Nueces County-Mining	101	$752,000	$60,000	$594	No to low degradation	Minor Impacts
	City of Mathis	560	$2,177,000	$238,000	$425	No to low degradation	Minor Impacts

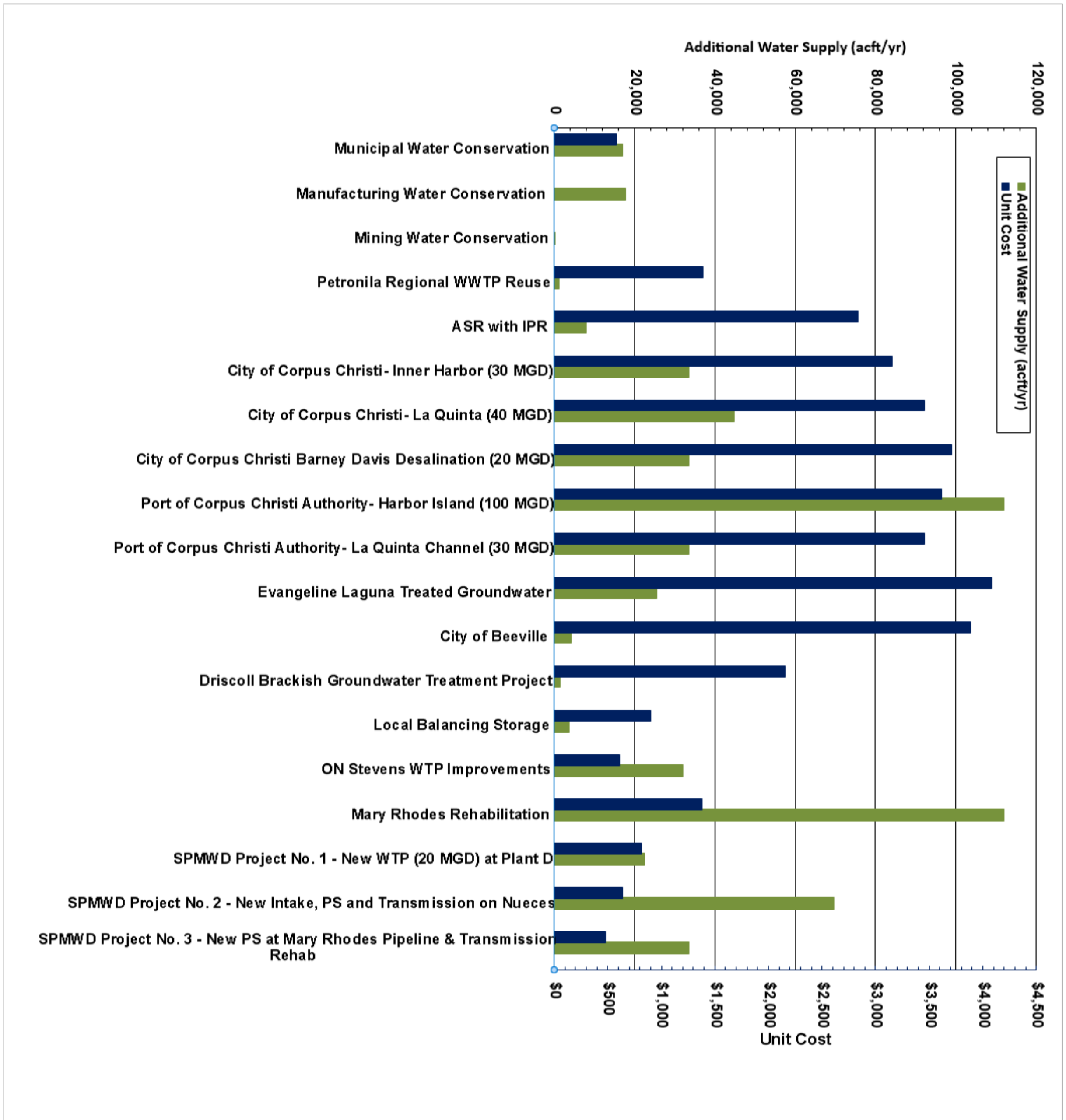


Figure ES.9.
Comparison of Unit Costs and Water Supply Quantities for Potential Water Management Strategies for Coastal Bend

Table ES.9.
Water Plan Summary for Coastal Bend Region

County/Water User Group	Demand (ac-ft)			Need (Shortage) (ac-ft)			Recommended Management Strategies to Meet Need (Shortage)
	2030	2050	2080	2030	2050	2080	
Aransas County	**See Section 4A.3.1**						**See Section 5B.2**
Aransas Pass (P)	116	112	105	none	none	none	-
Rincon WSC (P)	2	2	2	none	none	none	-
Rockport	3266	3162	2962	none	none	none	Municipal Water Conservation
County-Other	530	512	478	none	none	none	-
Manufacturing	0	0	0	none	none	none	-
Steam-Electric	0	0	0	none	none	none	-
Mining	0	0	0	none	none	none	-
Irrigation	0	0	0	none	none	none	-
Livestock	52	52	52	none	none	none	-
Bee County	**See Section 4A.3.2**						**See Section 5B.3**
Beeville	2,805	3,075	3,663	none	none	none	Municipal Water Conservation, Brackish Groundwater Desal
El Oso WSC (P)	94	159	359	none	none	none	Municipal Water Conservation
Pettus MUD	65	73	91	none	none	none	-
Skidmore WSC	103	108	125	(22)	(27)	(44)	Municipal Water Conservation, Groundwater Supplies
TDCJ Chase Field	1,295	1,292	1,292	(5)	(2)	(2)	Municipal Water Conservation, Groundwater Supplies
County-Other	1,645	1,400	737	(1,426)	(1,181)	(518)	Groundwater Supplies
Manufacturing	0	0	0	none	none	none	-
Steam-Electric	0	0	0	none	none	none	-
Mining	239	239	0	(25)	(25)	none	Mining Water Conservation, Groundwater Supplies
Irrigation	2,518	2,518	2,518	none	none	none	-
Livestock	568	568	568	none	none	none	-
Brooks County	**See Section 4A.3.3**						**See Section 5B.4**
Falfurrias	1,162	1,152	1,256	none	none	none	Municipal Water Conservation
County-Other	313	266	133	(281)	(234)	(101)	Groundwater Supplies
Manufacturing	0	0	0	none	none	none	-
Steam-Electric	0	0	0	none	none	none	-
Mining	16	16	16	none	none	none	Mining Water Conservation
Irrigation	597	597	597	none	none	none	-
Livestock	478	478	478	none	none	none	-
Duval County	**See Section 4A.3.4**						**See Section 5B.5**
Duval County CRD	161	143	119	none	none	none	-
Freer WCID	501	444	370	none	none	none	Municipal Water Conservation
San Diego MUD 1 (P)	678	672	716	none	none	none	Municipal Water Conservation
County-Other	253	199	113	(253)	(199)	(113)	Groundwater Supplies
Manufacturing	0	0	0	none	none	none	-
Steam-Electric	0	0	0	none	none	none	-
Mining	6	6	7	none	none	none	Mining Water Conservation
Irrigation	2,016	2,016	2,016	none	none	none	-
Livestock	566	566	566	none	none	none	-
Jim Wells County	**See Section 4A.3.5**						**See Section 5B.6**
Alice	4,009	4,436	5,276	none	none	none	Municipal Water Conservation
Jim Wells County FWSD 1	112	112	117	none	none	none	Municipal Water Conservation
Orange Grove	364	347	336	none	none	none	Municipal Water Conservation
Premont	554	532	522	none	none	none	Municipal Water Conservation, Groundwater Supplies

County/Water User Group	Demand (ac-ft)			Need (Shortage) (ac-ft)			Recommended Management Strategies to Meet Need (Shortage)
	2030	2050	2080	2030	2050	2080	
San Diego MUD 1 (P)	134	143	163	(102)	(111)	(131)	-
County-Other	1,656	1,194	117	(1,621)	(1,159)	(82)	Groundwater Supplies
Manufacturing	87	93	104	(8)	(14)	(25)	Manufacturing Water Conservation, Groundwater Supplies
Steam-Electric	0	0	0	none	none	none	-
Mining	0	0	0	none	none	none	-
Irrigation	1,665	1,665	1,665	none	none	none	-
Livestock	902	902	902	none	none	none	-
Kenedy County	**See Section 4A.3.6**						**See Section 5B.7**
County-Other	175	148	121	none	none	none	Municipal Water Conservation
Manufacturing	0	0	0	none	none	none	-
Steam-Electric	0	0	0	none	none	none	-
Mining	3	3	3	none	none	none	Mining Water Conservation
Irrigation	0	0	0	none	none	none	-
Livestock	631	631	631	none	none	none	-
Kleberg County	**See Section 4A.3.7**						**See Section 5B.8**
Baffin Bay WSC	129	136	156	none	none	none	Municipal Water Conservation
Kingsville	3,907	4,135	4,714	none	none	none	Groundwater Supplies
Naval Air Station Kingsville	264	282	306	none	none	none	Municipal Water Conservation
Ricardo WSC	385	408	467	none	none	none	Groundwater Supplies
Riviera Water System	128	136	155	none	none	none	-
County-Other	208	219	251	none	none	none	Municipal Water Conservation
Manufacturing	1,088	1,170	1,305	none	none	none	Manufacturing Water Conservation
Steam-Electric	0	0	0	none	none	none	-
Mining	10	10	10	none	none	none	Mining Water Conservation
Irrigation	141	141	141	none	none	none	-
Livestock	532	532	532	none	none	none	-
Live Oak County	**See Section 4A.3.8**						**See Section 5B.9**
El Oso WSC (P)	152	165	165	none	none	none	Municipal Water Conservation
George West	304	253	197	none	none	none	Municipal Water Conservation
McCoy WSC	6	4	2	none	none	none	-
Old Marbach School WSC	86	79	75	none	none	none	-
Three Rivers	444	432	426	2,184	1,983	1,639	Municipal Water Conservation
County-Other	639	605	643	(198)	(164)	(202)	Groundwater Supplies
Manufacturing	2,843	3,057	3,409	none	none	none	Manufacturing Water Conservation
Steam-Electric	0	0	0	none	none	none	-
Mining	1,264	1,264	2	none	none	1,262	Mining Water Conservation
Irrigation	844	844	844	none	none	none	-
Livestock	651	651	651	none	none	none	-
McMullen County	**See Section 4A.3.9**						**See Section 5B.10**
County-Other	61	54	42	none	none	none	-
Three Rivers (P)	12	11	9				-
Manufacturing	34	34	34	none	none	none	Manufacturing Water Conservation
Steam-Electric	0	0	0	none	none	none	-
Mining	4,538	4,538	1	none	none	1,856	Mining Water Conservation
Irrigation	24	24	24	none	none	none	-
Livestock	278	278	278	none	none	none	-

County/Water User Group	Demand (ac-ft)			Need (Shortage) (ac-ft)			Recommended Management Strategies to Meet Need (Shortage)
	2030	2050	2080	2030	2050	2080	
Nueces County	**See Section 4A.3.10**						**See Section 5B.11**
Bishop	550	558	547	none	none	none	Municipal Water Conservation, Brackish Groundwater Desal
Corpus Christi	59,084	59,942	58,866	none	none	(5,158)	Municipal Water Conservation, ASR, Seawater Desal, Brackish Groundwater Desal, Regional Water Supply Mgmt and Treatment Facilities
Corpus Christi NAS	2,078	2,112	2,086	none	none	none	Municipal Water Conservation
Driscoll	80	81	80	none	none	none	Brackish Groundwater Desal
Nueces County WCID 3	3,452	3,507	3,441	(3,383)	(3,443)	(3,370)	Municipal Water Conservation, Local Balancing Storage
Nueces County WCID 4	1,370	1,392	1,365	none	none	none	Municipal Water Conservation
Nueces WSC	986	999	992	none	none	none	Municipal Water Conservation, Brackish Groundwater Desal
River Acres WSC	315	320	313	none	none	none	-
Violet WSC	228	230	225	none	none	none	-
County-Other	2,607	2,641	2,593	none	none	none	Brackish Groundwater Desal
Manufacturing	50,363	50,363	52,339	(33,672)	(39,295)	(45,731)	Manufacturing Water Conservation, Reuse, Aquifer Storage and Recovery, Seawater Desal, Brackish Groundwater Desal, Regional Water Supply Mgmt and Treatment Facilities
Steam-Electric	2,201	2,201	2,201	none	none	none	-
Mining	796	858	893	(88)	(93)	(101)	Mining Water Conservation, Groundwater Supplies
Irrigation	559	559	559	none	none	none	-
Livestock	218	218	218	none	none	none	-
San Patricio County	**See Section 4A.3.11**						**See Section 5B.12**
Aransas Pass (P)	1,185	1,183	1,207	none	none	none	-
Gregory	270	257	270	none	none	none	Municipal Water Conservation
Ingleside	986	1,022	1,019	none	none	none	-
Mathis	469	400	451	none	none	none	Groundwater Supplies
Odem	432	421	437	none	none	none	-
Portland	3,555	4,155	5,277	none	none	none	Municipal Water Conservation
Rincon WSC	378	405	396	none	none	none	-
Sinton	1,073	1,045	1,084	none	none	none	Municipal Water Conservation
Taft	337	318	336	none	none	none	-
County-Other	1,664	1,683	493	none	none	none	-
Manufacturing	60,705	60,715	60,732	(1,454)	(2,003)	(1,951)	Manufacturing Water Conservation, Seawater Desal, Brackish Groundwater Desal, Regional Water Supply Mgmt and Treatment Facilities
Steam-Electric	2,576	2,576	2,576	none	none	none	-
Mining	88	92	94	none	none	none	Mining Water Conservation
Irrigation	5,497	5,497	5,497	none	none	none	-
Livestock	278	278	278	none	none	none	-
Total Needs by Water User Type							
Municipal	107,817	109,273	108,259	(5,107)	(4,537)	(8,082)	-
Manufacturing	115,120	115,432	117,923	(35,134)	(41,312)	(47,707)	
Steam-Electric	4,777	4,777	4,777	none	none	none	-
Mining	6,960	7,026	1,026	(113)	(118)	3,017	-
Irrigation	13,861	13,861	13,861	none	none	none	-
Livestock	4,963	4,963	4,963	none	none	none	-
Region N Total	253,498	255,332	250,809	(40,354)	(45,967)	(52,772)	-

Note: (P) = Partial listing – water user group in multiple counties.

Table ES.10. Summary of Recommended Water Management Strategies in the Coastal Bend Region

WMS ID	Recommended WMS	Total Project Cost	First Decade Estimated Unit Cost ($/ac-ft/yr)	Last Decade Estimated Unit Cost ($/ac-ft/yr)	Water Yield (ac-ft/yr)					
					2030	2040	2050	2060	2070	2080
5B.1	**Municipal Water Conservation**	***Variable, Regional Cost up to $41,349,049***	***$577 - $583***	***$577 - $583***	***0***	***7,959***	***14,186***	***15,494***	***16,375***	***17,118***
	Rockport	$931,826	$577	$577	0	300	340	332	325	318
	Beeville	$2,017,740	$577	$577	0	272	552	839	889	945
	El Oso WSC	$127,577	$580	$580	0	12	29	44	58	76
	Skidmore WSC	$1,431	$580	$580	0	0	0	0	1	0
	TDCJ Chase Field	$940,715	$580	$580	0	121	233	334	426	509
	Falfurrias	$872,921	$580	$580	0	107	207	302	395	494
	Freer WCID	$263,124	$580	$580	0	43	79	108	115	108
	San Diego MUD 1	$242,384	$580	$580	0	62	87	88	89	93
	Alice	$2,338,150	$577	$577	0	389	793	900	953	1,017
	Orange Grove	$245,318	$580	$580	0	33	63	88	111	128
	Premont	$365,926	$580	$580	0	50	96	135	171	179
	San Diego MUD 1	$52,907	$580	$580	0	13	19	19	20	21
	County-Other, Kenedy	$99,160	$580	$580	0	16	27	37	43	48
	Baffin Bay WSC	$5,196	$580	$580	0	2	1	2	2	2
	County-Other, Kleberg	$23,739	$580	$580	0	8	8	8	8	9
	Naval Air Station Kingsville	$214,710	$580	$580	0	26	50	75	99	120
	El Oso WSC	$87,182	$580	$580	0	15	29	35	35	35
	George West	$75,275	$580	$580	0	25	29	27	25	23
	Three Rivers	$87,755	$580	$580	0	30	30	31	29	31
	Bishop	$105,523	$580	$580	0	37	36	37	36	36
	Corpus Christi	$26,050,001	$583	$583	0	5,506	9,883	9,823	9,765	9,706
	Corpus Christi Naval Air Station	$1,530,007	$580	$580	0	199	381	545	692	821
	Nueces County WCID 3	$2,510,768	$577	$577	0	326	631	900	1,140	1,354
	Nueces County WCID 4	$1,001,135	$580	$580	0	130	250	358	452	537
	Nueces WSC	$130,498	$580	$580	0	45	45	45	45	45
	Gregory	$30,325	$580	$580	0	10	10	11	11	11
	Portland	$281,225	$577	$577	0	83	89	97	105	113
	Sinton	$716,531	$580	$580	0	99	189	274	335	339

WMS ID	Recommended WMS	Total Project Cost	First Decade Estimated Unit Cost ($/ac-ft/yr)	Last Decade Estimated Unit Cost ($/ac-ft/yr)	Water Yield (ac-ft/yr)					
					2030	2040	2050	2060	2070	2080
5B.2	**Manufacturing Water Conservation**	-	-	-	***2,878***	***5,764***	***8,657***	***11,561***	***14,485***	***17,689***
	Live Oak County	N/A	N/A	N/A	71	147	229	317	411	511
	Nueces County	N/A	N/A	N/A	1,259	2,518	3,777	5,037	6,309	7,851
	San Patricio County	N/A	N/A	N/A	1,518	3,036	4,553	6,073	7,591	9,110
	Jim Wells County	N/A	N/A	N/A	2	5	7	10	13	16
	Kleberg County	N/A	N/A	N/A	27	56	88	121	157	196
	McMullen County	N/A	N/A	N/A	1	2	3	3	4	5
5B.3	**Mining Water Conservation**	-	-	-	***173***	***351***	***526***	***705***	***882***	***153***
	Bee County	N/A	N/A	N/A	6	12	18	24	30	0
	Brooks County	N/A	N/A	N/A	0	1	1	2	2	2
	Duval County	N/A	N/A	N/A	0	0	0	1	1	1
	Kenedy County	N/A	N/A	N/A	0	0	0	0	0	0
	Kleberg County	N/A	N/A	N/A	0	1	1	1	1	2
	Live Oak County	N/A	N/A	N/A	32	63	95	126	158	0
	McMullen County	N/A	N/A	N/A	113	227	340	454	567	0
	Nueces County	N/A	N/A	N/A	20	42	64	88	111	134
5B.4	**Reuse**	-	-	-	-	-	-	-	-	-
	Petronila Regional WWTP Reuse	$13,228,000	$1,388	$557	1,120	1,120	1,120	1,120	1,120	1,120
	Oso Regional WWTP Reuse	-	-	-	-	-	-	-	-	-
5B.5	**Aquifer Storage and Recovery**	-	-	-	-	-	-	-	-	-
	ASR with IPR	$186,539,000	$2,834	$1,209	8,070	8,070	8,070	8,070	8,070	8,070
5B.6	**Seawater Desalination**	-	-	-	-	-	-	-	-	-
	City of Corpus Christi- Inner Harbor (30 MGD)	$785,000,000	$3,154	$1,783	33,604	33,604	33,604	33,604	33,604	33,604
	City of Corpus Christi- La Quinta (40 MGD)	$1,141,000,000	$3,460	$1,677	0	44,806	44,806	44,806	44,806	44,806
	City of Corpus Christi Barney Davis Desalination (20 MGD)	$582,000,000	$3,705	$1,868	0	33,627	33,627	33,627	33,627	33,627
	Port of Corpus Christi Authority- Harbor Island (100 MGD)	$3,456,000,000	$3,616	$1,580	112,014	112,014	112,014	112,014	112,014	112,014
	Port of Corpus Christi Authority- La Quinta Channel (30 MGD)	$844,000,000	$3,452	$1,705	0	33,627	33,627	33,627	33,627	33,627
5B.7	**Brackish Groundwater Desalination**	-	-	-	-	-	-	-	-	-
	Evangeline Laguna Treated Groundwater	$486,499,000	$4,085	$2,747	0	25,637	25,637	25,637	25,637	25,637
	City of Beeville	$100,904,000	$3,887	$2,199	4,204	4,204	4,204	4,204	4,204	4,204
	Driscoll Brackish Groundwater Treatment Project	$36,289,885	$2,878	$1,190	1,513	1,513	1,513	1,513	1,513	1,513
5B.8	**Local Balancing Storage**	$26,014,000	$904	$483	3,827	3,827	3,827	3,827	3,827	3,827

WMS ID	Recommended WMS	Total Project Cost	First Decade Estimated Unit Cost ($/ac-ft/yr)	Last Decade Estimated Unit Cost ($/ac-ft/yr)	Water Yield (ac-ft/yr)					
					2030	2040	2050	2060	2070	2080
5B.9	**Groundwater Supplies - Rural and Non-Municipal Water Systems**	-	-	-	-	-	-	-	-	-
	Bee County-Other (Municipal)	$5,421,000	$398	$130	1,426	1,426	1,426	1,426	1,426	1,426
	Bee County-Mining	$1,024,000	$3,200	$320	25	25	25	25	25	25
	Skidmore WSC	$1,067,000	$2,295	$591	44	44	44	44	44	44
	TDCJ Chase Field	$1,067,000	$20,000	$5,000	5	5	5	5	5	5
	Brooks County-Other (Municipal)	$1,089,000	$452	$178	281	281	281	281	281	281
	Duval County-Other (Municipal)	$1,496,000	$625	$209	253	253	253	253	253	253
	San Diego MUD 1	$817,000	$702	$267	131	131	131	131	131	131
	Jim Wells County- Other (Municipal)	$8,763,000	$522	$141	1,621	1,621	1,621	1,621	1,621	1,621
	Jim Wells County- Manufacturing	$747,000	$3,000	$920	25	25	25	25	25	25
	Live Oak County- Other (Municipal)	$1,317,000	$688	$228	202	202	202	202	202	202
	Nueces County-Mining	$752,000	$594	$69	101	101	101	101	101	101
	City of Mathis	$2,177,000	$425	$152	560	560	560	560	560	560
	Ricardo Well Project	$10,977,100	$2,114	$735	560	560	560	560	560	560
5B.10	**Regional Water Supply Management and Treatment Facilities**	-	-	-	-	-	-	-	-	-
	ON Stevens WTP Improvements	$82,753,000	$606	$424	32,029	32,029	32,029	32,029	32,029	32,029
	Mary Rhodes Rehabilitation	$1,236,419,000	$1,377	$600	112,000	112,000	112,000	112,000	112,000	112,000
	SPMWD Project No. 1 - New WTP (20 MGD) at Plant D	$69,048,000	$819	$600	22,418	22,418	22,418	22,418	22,418	22,418
	SPMWD Project No. 2 - New Intake, PS and Raw Water Transmission on Nueces River	$223,595,000	$637	$411	69,495	69,495	69,495	69,495	69,495	69,495
	SPMWD Project No. 3 - New Pump Station at Mary Rhodes Pipeline & Transmission Rehab	$40,249,000	$482	$398	33,627	33,627	33,627	33,627	33,627	33,627

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

- The CBRWPG 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.
- The TCEQ often considers surface water rights applications for small amounts of water, some are temporary, and some are even non-consumptive. Because most of the surface waters of the Nueces River Basin are appropriated to the City of Corpus Christi and others, any new water rights application for consumptive surface 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 unpredictable. The CBRWPG is of the opinion that each project should be considered by the TWDB and TCEQ on its merits, and that the Legislature provided appropriate language for each agency to address accordingly.

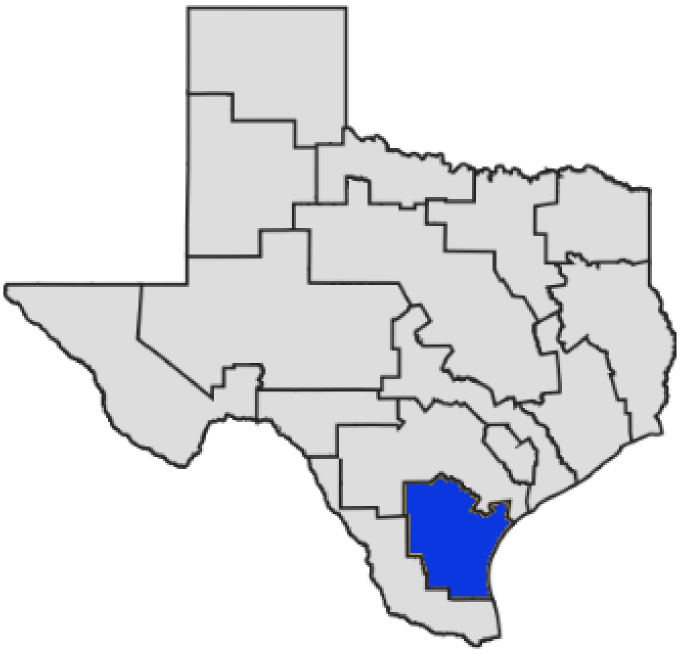
  (Note: The provision related to TCEQ is found in TWC §11.134. It provides that the Commission shall grant an application to appropriate surface water, including amendments, only if the proposed appropriator addresses a water supply need in a manner consistent with an approved regional water plan. TCEQ 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.)

ES.7 Social and Economic Impacts of Not Meeting Projected Water Needs

The TWDB will be conducting a socioeconomic impact analysis of projected water shortages for the Coastal Bend Region area between the Initially Prepared Plan and Final Plan.

ES.8 Unmet Water Needs

There are no identified water needs that remain unmet for the *2026 Coastal Bend Regional Water Plan.*



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Planning Area Description

[31 TAC §357.30]

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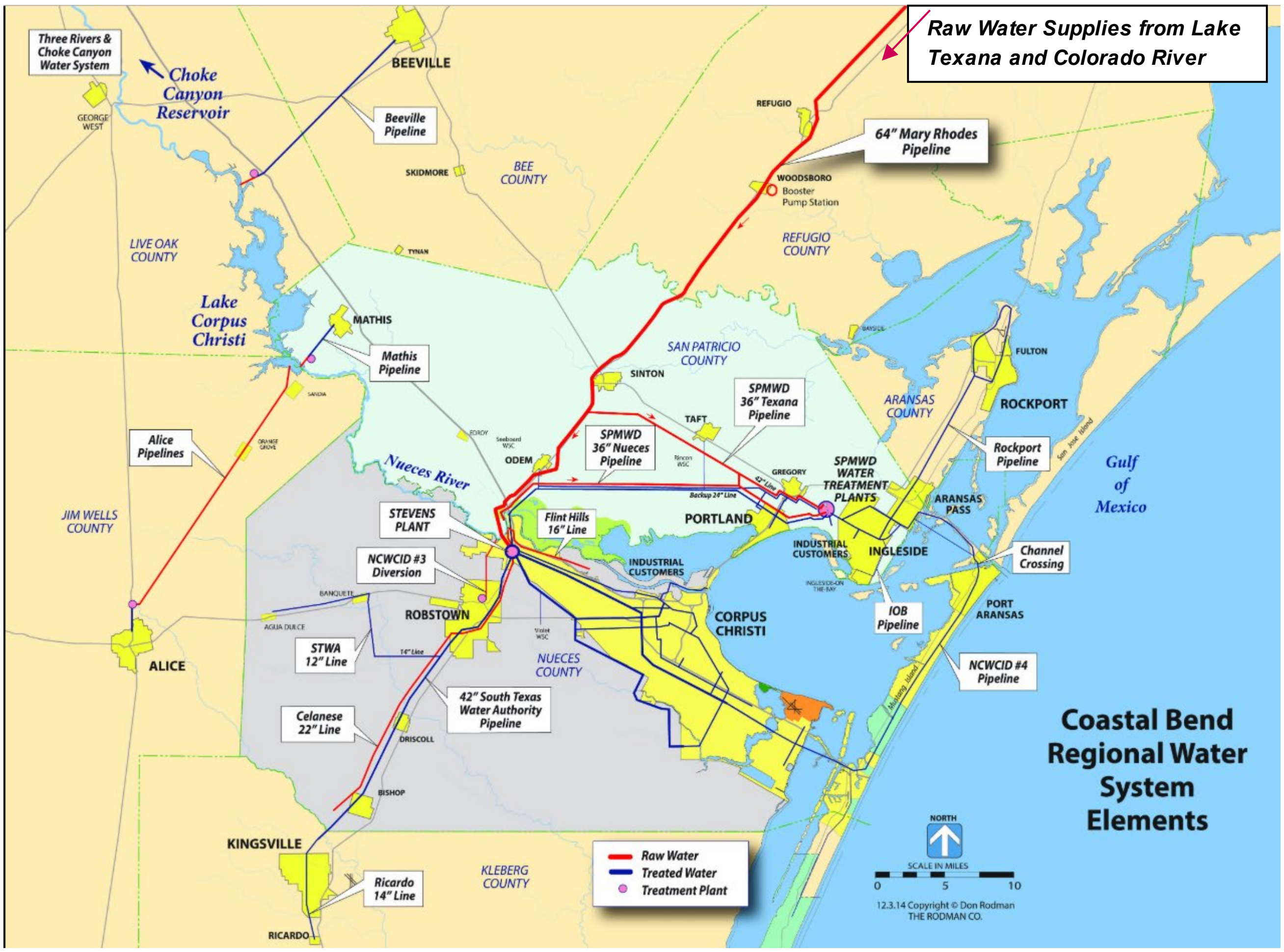
Chapter 1 Planning Area Description

The area represented by the Coastal Bend Regional Water Planning Group (Region N) includes the following 11 counties: Aransas, Bee, Brooks, Duval, Jim Wells, Kenedy, Kleberg, Live Oak, McMullen, Nueces, and San Patricio. Most of the water supplies for the region are provided from surface water from the regional Choke Canyon/Lake Corpus Christi/Lake Texana/Mary Rhodes Pipeline Phase II system through the City of Corpus Christi or customer contracts (Figure 1.1), while others rely on groundwater supplies. Surface water supply relationships are discussed in greater detail in Chapter 3.



Source: City of Corpus Christi, https://www.cctexas.com/sites/default/files/wat-coastal-bend-regional-water-system.jpg

Figure 1.1.
Coastal Bend Regional Water System

1.1 Social and Economic Aspects of the Coastal Bend Region

According to estimates provided by the Texas Water Development Board (TWDB), the historical population of the Coastal Bend Region grew from 529,207 in 2015 to 575,933 in 2020, representing an approximate 1.7 percent annual growth each year. In 2030, the population of the Coastal Bend Region is estimated to be 593,187.

The regional average per capita income in 2022 was $53,796, ranging from $34,707 in Bee County to $118,594 in McMullen County.[1] The Corpus Christi Metropolitan Statistical Area (MSA), consisting of Aransas, Nueces, and San Patricio counties, accounts for 77 percent of the Coastal Bend Region's population and 81 percent of the total personal income. In 2022, the total personal income in the Coastal Bend Region was $30.4 billion (Figure 1.2).

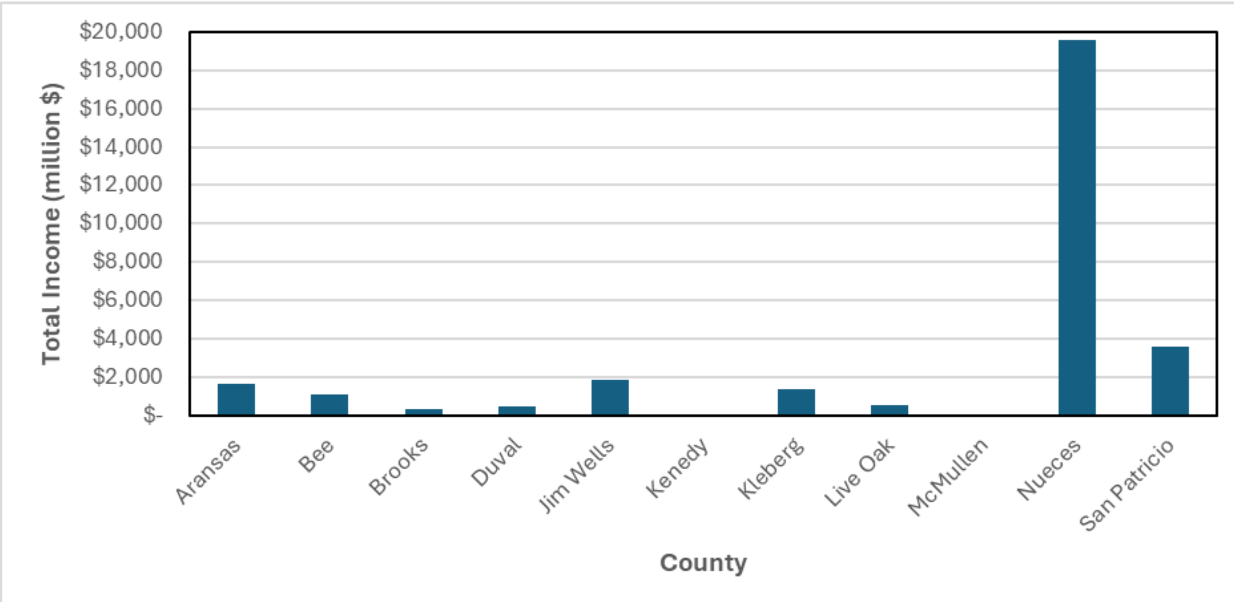


Figure 1.2.
Total Personal Income (Earnings) in 2022 by County

The primary economic activities within the Coastal Bend Region include transportation and warehousing, military-related activities, oil and gas extraction and mining services, manufacturing, agriculture, forestry, fishing and hunting. In 2021, industries employed 180,918 people in the Coastal Bend Region with annual compensation to employees of over $8.2 billion (Figure 1.3 and Figure 1.4).[2] The service industries sector had the biggest economic impact in 2021, with a total compensation to employees of $3.09 billion (Figure 1.3). The service industries sector includes information, public administration, educational, health care, social services businesses, finance and insurance, and real estate. In 2021, 48 percent of the local workforce was employed by this sector (Figure 1.4).

There are two active naval military bases in the Coastal Bend Region: Corpus Christi Naval Air Station and Naval Air Station Kingsville. As of 2023, the Naval Air Station Corpus Christi included 7,159 direct employees of which 2,030 are active-duty.[3] The Comptroller's office estimates the population directly affiliate with NAS Corpus Christi contributed at least $4.6 billion

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[1] U.S. Department of Commerce Bureau of Economic Analysis, Regional Economic Information System (REIS) Database, 2022.

[2] 2021 United States Census Bureau, 2021 Economic Annual Survey County Business Patterns, CB1700CBP, October 2023.

[3] https://comptroller.texas.gov/economy/economic-data/military/2023/nas-corpus.php

to the Texas economy in 2023.[4] As of 2023, NAS Kingsville was home to a total of 1,802 direct employees, of which 549 are active duty.[5] The Comptroller's office estimates the population directly affiliate with NAS Kingsville contributed at least $1 billion to the Texas economy in 2023.[6] Both are listed as water user groups and are reported to include over 8,000 civilian and military personnel.

The oil and gas extraction, manufacturing, and construction and retail/wholesale trade sector is also a large contributor to the local economy. In 2021, 18 percent (32,865 people) of the local workforce was employed by this sector, receiving total compensation of $2.23 billion (Figure 1.3 and Figure 1.4). Retail/wholesale trade employs 33,961 people within the region (19 percent of the local workforce) and has a general annual compensation to employees of $1.31 billion (Figure 1.3 and Figure 1.4).

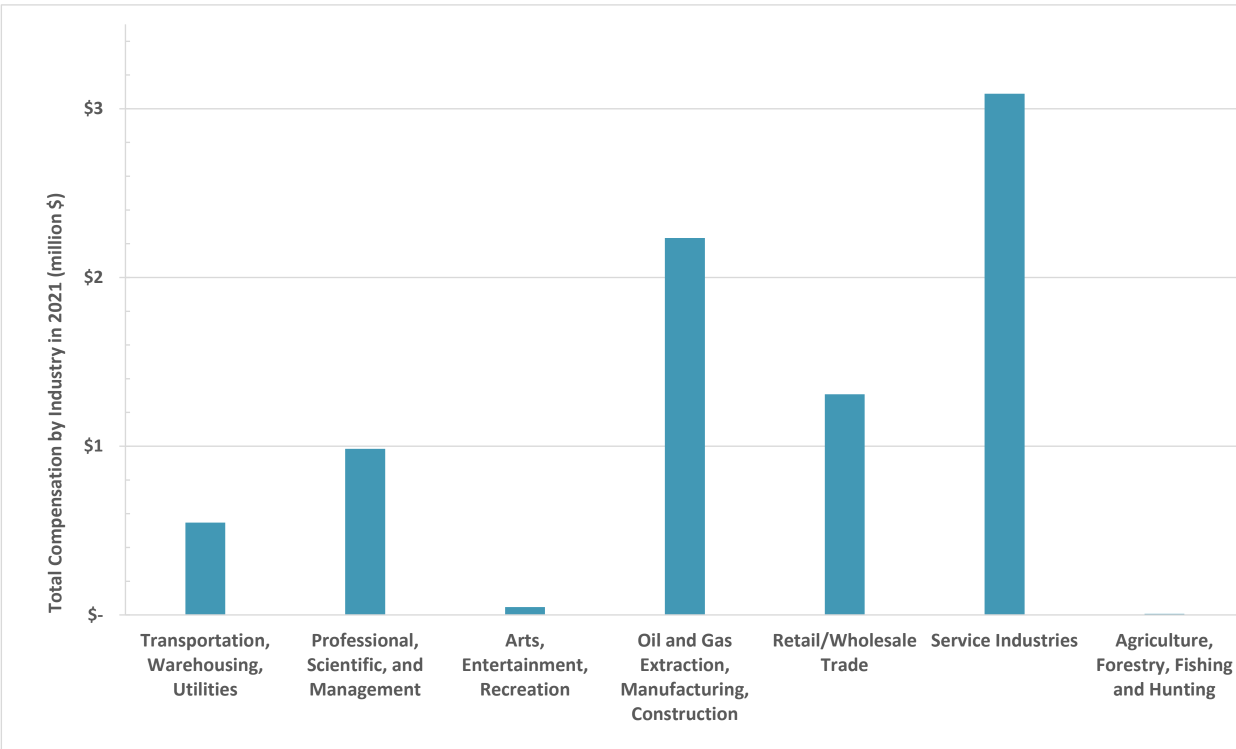

Figure 1.3.
Total Personal Income (Earnings) in 2021 by Industry

[4] This study represents an analysis of the economic impact of the population and employees directly affiliated with the base. This includes active duty, visiting, and other military personnel, dependents, civilian employees and contractors directly affiliated with the base as reported in documents emailed from NAS Corpus Christi to B. Keith Graf, Texas Military Preparedness Commission, March 2024.

[5] https://comptroller.texas.gov/economy/economic-data/military/2023/nas-kingsville.php

[6] This study represents an analysis of the economic impact of the population and employees directly affiliated with the base. This includes active duty, visiting, and other military personnel, dependents, civilian employees and contractors directly affiliated with the base as reported in documents emailed from NAS Kingsville to Jolene Hudson, Texas Military Preparedness Commission, March 2024.

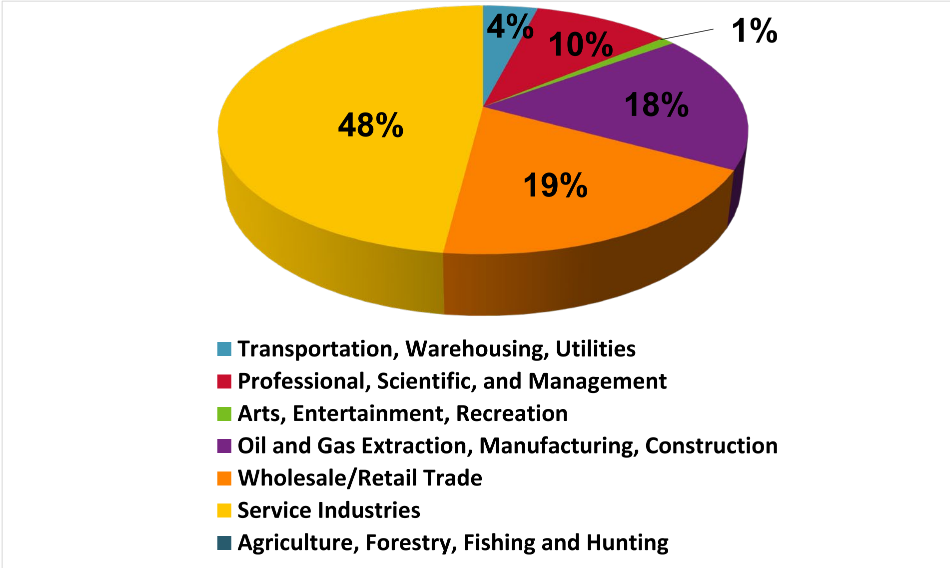

Figure 1.4.
2021 Percentages of Major Employment by Sector in the Coastal Bend Region

1.2 Current Water Use and Major Water Demand Centers

Municipal and industrial water use accounts for the greatest amount of water demand in the Coastal Bend Region, totaling 88 percent of the region's total water use of 163,075 ac-ft in 2020 (Figure 1.5). 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 located along the Corpus Christi and La Quinta Ship Channels in Nueces and San Patricio counties. Agriculture (irrigation and livestock) is the third largest category of water use in the region (Figure 1.5). Based on recent water use records, the City of Corpus Christi provides supplies for about 60 percent of the municipal and industrial water demand in the region (not including supplies to the San Patricio Municipal Water District [SPMWD] or the South Texas Water Authority [STWA and their customers]).

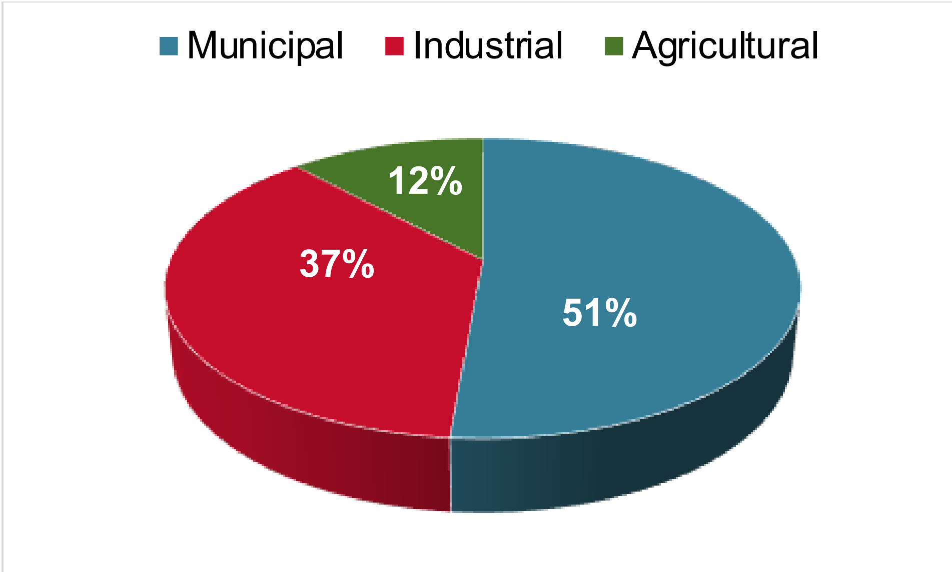

Figure 1.5.
Year 2020 Water Use in the Coastal Bend Regional Water Planning Area = 163,075 ac-ft

1.3 Current Water Supplies and Quality

The Coastal Bend Region depends mostly on surface water sources for municipal and industrial water supply use and groundwater supplies for irrigation and in rural municipal areas that are not served by the Corpus Christi Regional Water Supply System, described below. There are limited reuse supplies in Nueces and San Patricio counties, representing less than 1 percent of the total supply for the region. Figure 1.6 shows the sources of supply for major water users in the Coastal Bend Region.

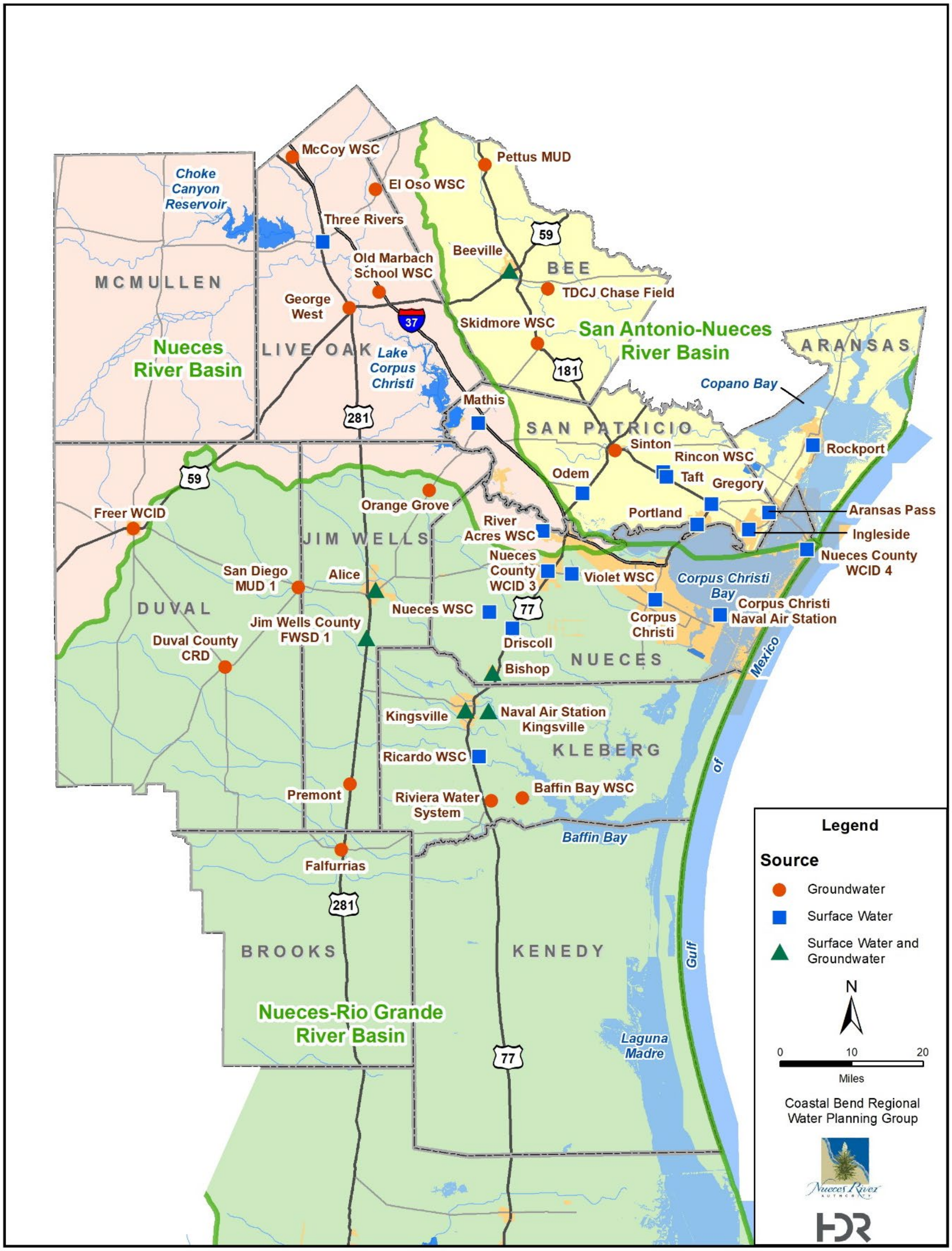

Figure 1.6.
Current Water Sources for Providers in the Planning Region

1.3.1 Surface Water Sources

The three major surface water resources include the Choke Canyon Reservoir/Lake Corpus Christi System (CCR/LCC System) in the Nueces River Basin, Lake Texana on the Navidad River in Jackson County, and water supply from the Garwood water rights located on the Colorado River in Matagorda County. The Colorado River supplies are transported through the Mary Rhodes Pipeline (MRP) Phase II system to Jackson County where Lake Texana supplies are added and delivered together through the Mary Rhodes Pipeline to delivery locations in San Patricio County (SPMWD) and Nueces County (City of Corpus Christi). Collectively, this system is referred to as the CCR/LCC/Texana/MRP Phase II system (or Corpus Christi Regional Water Supply System). Water supply from Lake Texana provides the Coastal Bend Region with 31,440 acre-feet per year (ac-ft/yr) and 12,000 ac-ft/yr on an interruptible basis, according to the contract between the City of Corpus Christi and the Lavaca-Navidad River Authority.[7] The City of Corpus Christi also owns the Garwood water right in the Colorado River Basin for up to 35,000 acre-feet (ac-ft).

On May 18, 2023, the Coastal Bend Regional Water Planning Group (CBRWPG) adopted the use of safe yield as the basis for determining availability for the Corpus Christi Regional Water Supply System. The TWDB approved the hydrologic variance request on January 8, 2024. Based on 2030 sediment conditions, current Phase IV operating policy, including the 2001 Agreed Order governing freshwater pass-throughs to the Nueces Estuary, the CCR/LCC System with supplies from Lake Texana and the Colorado River through Garwood water rights (Corpus Christi Regional Water Supply System) has an annual safe yield of 170,000 ac-ft in 2030, which declines to 157,000 ac-ft in 2080. The annual safe yield assumes 75,000 ac-ft remains in CCR/LCC system storage during the critical month of the drought of record. The CBRWPG adopted the use of safe yield for supply planning, instead of the firm yield of 186,000 ac-ft/yr with zero remaining storage during historical drought of record conditions, due to historical trends showing increasing severity with each successive drought as described in Section 1.10.

The *Nueces River Authority's 2018 Basin Summary Report*[8], and the Texas Commission on Environmental Quality (TCEQ) Texas Integrated Report Index of Water Quality Impairments compiled information on 12 water quality parameters for 48 segments in the San Antonio-Nueces Coastal Basin, the Nueces River Basin, the Nueces-Rio Grande Coastal Basin, and the adjacent bays and estuaries. The report assimilated results from 303(d) List of Impaired Waters and 305(b) Water Quality Inventory and found that the water quality is generally good. However, there are some areas of concern. Choke Canyon Reservoir has nutrient concerns and resulting excessive algal growth. Lake Corpus Christi has an impairment listed for total dissolved solids (TDS) impairment. Calallen Reservoir, where water supply intakes are located, shows chlorophyll-a concerns and TDS impairment. A few stream segments within the region, as well as local bays

[7] The base permit of 41,840 ac-ft/yr is subject to call-back for up to 10,400 ac-ft/yr for Jackson County uses. Since the last round of planning, Lavaca-Navidad River Authority has provided notice of callback for local water users pursuant to contract terms. For this reason, current supplies include full call-back being exercised and thus reducing the base permit to 31,440 acft/yr.

[8] Nueces River Authority, "2018 Basin Summary Report for San Antonio-Nueces Coastal Basin, Nueces River Basin, and Nueces-Rio Grande Coastal Basin," August 2018.

and estuaries, had elevated levels of dissolved solids, nutrients, bacteria, low dissolved oxygen levels, and other parameters for continued monitoring as discussed in greater detail in Section 1.6(Table 1.2).

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 and has less TDS than the Nueces River water. 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. There were high levels of nitrates reported in Lake Texana around 0.37 milligrams per liter (mg/L) pre- Hurricane Harvey and post-Hurricane Harvey nitrate levels were reported around 0.09 mg/L[9].

1.3.2 Groundwater Sources

Some areas in the region are dependent on groundwater. There are two major aquifers that lie beneath the region — the Carrizo-Wilcox and Gulf Coast aquifers. 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 and Live Oak counties and a very small area of Bee County within the Coastal Bend Region. For these three counties, only McMullen County reports a Modeled Available Groundwater (MAG) value for the Carrizo Aquifer. In this downdip portion of the Carrizo-Wilcox Aquifer, the water is softer, hotter (140 degrees Fahrenheit [°F]), 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 five aquifer formations: Catahoula, Jasper, Burkeville, Evangeline, and Chicot. The Evangeline and Chicot aquifers are the uppermost water formations within the Gulf Coast Aquifer System and, consequently, are the formations used most. 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. The Burkeville Aquifer is predominantly clay, and therefore, provides limited water supplies. The TWDB developed a Central Gulf Coast Groundwater Availability Model (CGCGAM) and then revised the portion over the Coastal Bend Region referred to as the Groundwater Management Area 16 (GMA 16) Groundwater Flow Model, which is used to determine groundwater availability. The TWDB GMA 16 Groundwater Flow Model includes six aquifer layers: Layers 1-4 representing the Gulf Coast Aquifer (Jasper, Burkeville, Evangeline, and Chicot), Layer 5 representing the Yegua-Jackson Aquifer System, and Layer 6 aggregating Queen-City, Sparta, and Carrizo-Wilcox Aquifer System.

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

[9] Lavaca-Navidad River Authority, 2019 Lavaca Basin Highlights Report.

of up to 3.71 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. In 1979, the Texas Department of Water Resources developed a Gulf Coast Aquifer Model to evaluate pumpage, water level drawdowns, and subsidence for the 10-year period of 1960 through 1969 for Houston, Jackson-Wharton counties, and Kingsville areas. The objective of the study was to compare modeled results to historical water level declines and subsidence.[10] 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.

Both Queen City and Sparta aquifers are official minor aquifers that cover part of McMullen County. Of these two, the local groundwater district only adopted a MAG for the Queen City.

The Yegua-Jackson is an official minor aquifer and covers parts of McMullen, Live Oak, and Bee counties within the Coastal Bend Region. There is no MAG recognized by the local groundwater conservation district in this aquifer in McMullen County in the Nueces basin; therefore, the aquifer is not used as a water supply by the Coastal Bend Region.

1.3.3 Reuse

There is currently limited reuse occurring within the Coastal Bend Region. According to historical data provided to the TWDB, about 4,821 ac-ft/yr of wastewater is being reused in the 11-county area of the Coastal Bend Region, with 1,128 ac-ft/yr being reused for manufacturing purposes in Nueces County. The City of Corpus Christi also provides reuse to a cemetery, has five reclaimed water customers, including golf courses, parks and recreation areas. The city uses approximately 2.5 percent of the city's overall effluent for reclaimed water. Corpus Christi has supplied reclaimed water to its irrigation customers saving 100 percent of the same amount in potable water[11] . Additional reuse options are recommended to meet future water needs, as described in Chapter 5B.4.

1.3.4 Major Springs

There are no major springs in the Coastal Bend Region. Due to most areas having an underlying impervious clay layer, there has not been much opportunity for springs to form in the Coastal Bend Region. According to *Springs of Texas - Volume I* by Gunnar Brune, there are 18 small springs in the Coastal Bend Region with flow between 0.28 and 2.8 cubic feet per second (cfs) and a number of these springs produce saline, hard, alkaline water. These are the largest documented springs in the Coastal Bend Region.

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[10] "Groundwater Availability in Texas," Texas Department of Water Resources, Report 238, September 1979.

[11] City of Corpus Christi, "Water Conservation Plan 2019", https://wwww.cctexas.com/sites/default/files/WAT-water-conservation-plan.pdf

1.4 Major Water Providers

The Coastal Bend Region has four current regional wholesale water providers (WWPs): the City of Corpus Christi; SPMWD; STWA; and Nueces County Water Control and Improvement District #3 (Nueces County WCID 3). These four entities are considered the major water providers of the region. The CBRWPG did not identify any additional entities as major water providers during development of this plan. The City of Corpus Christi, the largest of the four, sells water to two of the other regional water providers — SPMWD and STWA. The City of Corpus Christi and the SPMWD distribute water to cities, water districts, and water supply corporations, which in turn provide water to residential, commercial, and industrial customers. SPMWD also sells water directly to large industrial facilities located in San Patricio County on the La Quinta Ship Channel. STWA 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. The smallest regional wholesale water provider, Nueces County WCID No. 3, provides water to the City of Robstown and River Acres Water Supply Corporation (WSC) in Nueces County. The Nueces River Authority and Port of Corpus Christi Authority (PCCA) were identified as potential future WWPs to primarily serve future San Patricio County and Nueces County manufacturing users.

On October 17, 2024, the CBRWPG designated four major water providers: City of Corpus Christi, SPMWD, STWA, and the City of Alice. The CBRWPG did not design Nueces River Authority and PCCA as major water providers.

1.5 Agricultural and Natural Resources

Agriculture accounts for a major portion of the land use within the Coastal Bend Region. Of the cultivated land in 2022, over 97 percent was dryland farmed and approximately 22,090 acres of cultivated land was irrigated (Table 1.1). The dominant crops of the region are cotton, corn, and sorghum. Livestock is a major agricultural product of the Coastal Bend Region. In 2022, livestock products made up 33.5 percent of the total market value of agriculture products.[12]

Fishing is another industry that adds to the economic value of the Coastal Bend Region. In 2022, reported bay and Gulf commercial fishing generated about $407 million in sales and value along the Texas coast.[13] The TWDB estimates the overall impact to the state's economy of commercial fishing, sport fishing, and other recreational activities is $597 million per year.

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[12] 2022 Census of Agriculture. https://quickstats.nass.usda.gov/#5B5F4AC2-5BF0-36C2-BC6E-769771DFB0D2

[13] County Business Patterns, 2022. and https://media.fisheries.noaa.gov/2024-01/FEUS-2020-final2-web.pdf

Table 1.1.
Coastal Bend Regional Water Planning Area Agriculture Statistics – 2022

Counties	Region N Total	Aransas	Bee	Brooks	Duval	Jim Wells	Kenedy	Kleberg	Live Oak	McMullen	Nueces	San Patricio
Total Cropland (acres)	973,140	1,767	63,092	11,328	42,027	116,011	N/A	58,989	43,806	8,243	383,446	244,431
Irrigated Cropland (acres)	22,090	N/A	2,647	1,421	1,705	2,453	N/A	18	2,385	6,720	988	3,753
Irrigated Cropland/ Total Cropland	2.3%	N/A	4.2%	12.5%	4.1%	2.1%	N/A	0.0%	5.4%	81.5%	0.3%	1.5%
Total Market Value of Agricultural Product ($1,000)	459,038	2,054	34,899	24,169	14,516	72,499	N/A	51,563	12,439	8,253	137,442	101,204
Market Value of Crop Products Sold ($1,000)	305,488	688	19,930	3,485	1,947	39,927	N/A	16,377	1,553	868	134,256	86,457
Market Value of Livestock Products Sold ($1,000)	153,550	1,366	14,969	20,684	12,569	32,572	N/A	35,186	10,886	7,385	3,186	14,747
Crop Products/ Total Agricultural Products	66.5%	33.5%	57.1%	14.4%	13.4%	55.1%	N/A	31.8%	12.5%	10.5%	97.7%	85.4%
Livestock Products/ Total Agricultural Products	33.5%	66.5%	42.9%	85.6%	86.6%	44.9%	N/A	68.2%	87.5%	89.5%	2.3%	14.6%

Source: 2022 Agricultural Census
N/A = Not available. Withheld in the census to avoid disclosing data for individual operations.

1.6 Identified Water Quality Concerns

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 have 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 Pollutant Discharge Elimination System (NPDES). This program regulates and monitors pollutant discharges into water resources. In the past, the U.S. Environmental Protection Agency (EPA) and the State of Texas each required separate permits to discharge (one under NPDES and one under state law), but recently, the State of Texas has received delegation to administer a joint Texas Pollutant Discharge Elimination System (TPDES) program.

In 1998, the Clean Water Action Plan was initiated to meet the original goals of the Clean Water Act. The main priority of this plan was to identify watersheds and their level of possible concern. The identification of these concerns has been defined within the Texas Unified Watershed 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 TCEQ and the 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 TCEQ. 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 and TCEQ 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. Each year, the Nueces River Authority and the TCEQ coordinate sampling stations and divide stream segment stations between each other in order to eliminate sampling duplication. TCEQ and the Nueces River Authority work together to create the 305(b) Water Quality Inventory Report, which provides an overview of the status of surface waters in the Nueces River Basin and Nueces Coastal Basins. The TCEQ is responsible for administering the Total Maximum Daily Load Program, which addresses the water quality concerns of highest priority as identified in the 305(b) list. Under both the Clean Water Act and the 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, San Antonio- Nueces Coastal, and Nueces-Rio Grande Coastal Basins relevant to the Coastal Bend Region are posing some concerns (Table 1.2).

Table 1.2. Water Quality Concerns

Surface Water Resource (stream segment number)	Water Quality Concerns	Water Quality Impairments
Mission River Tidal *(2001)*	Chlorophyll-a	Bacteria
Mission River Above Tidal *(2002)*	DO	None
Aransas River Tidal *(2003)*	Chlorophyll-a	Bacteria
Aransas River Above Tidal *(2004)*	DO, Nitrates, total phosphorus (P)	Bacteria
Aransas Creek *(2004A)*	None	Bacteria
Poesta Creek *(2004B)*	Bacteria, Nitrate, total P	Bacteria
Nueces River Tidal *(2101)*	Chlorophyll-a, fish kill in water	None
Nueces River Below L. Corpus Christi *(2102)*	Chlorophyll-a	Total dissolved solids (TDS)
Lake Corpus Christi *(2103)*	None	None
Nueces River Above Frio River *(2104)*	Nitrate, total P, Impaired Fish and Macrobenthic Community	None
Nueces River Above Holland Dam *(2105)*	Low DO, Chlorophyll-a	Low DO
Nueces River/Lower Frio River *(2106)*	Chlorophyll-a	Bacteria, TDS
Atascosa River *(2107)*	Chlorophyll-a	Bacteria
San Miguel Creek *(2108)*	None	Bacteria
Choke Canyon Reservoir *(2116)*	Nutrients- excessive algal growth	None
Frio River Above Choke Canyon Reservoir *(2117)*	Low DO, nitrate, Chlorophyll-a	Bacteria, TDS
Arroyo Colorado Tidal *(2201)*	Chlorophyll-a, nitrate, total P	Low DO, bacteria, mercury and polychlorinated biphenyls (PCBs) in edible tissue
Arroyo Colorado Above Tidal *(2202)*	Chlorophyll-a, nitrate, total P	Bacteria, mercury and PCBs in edible tissue
Petronila Creek Tidal *(2203)*	Chlorophyll-a	Bacteria
Petronila Creek Above Tidal *(2204)*	Chlorophyll-a	Bacteria, chloride, sulfate, TDS
San Antonio Bay/Hynes Bay (2462)	Chlorophyll-a	Bacteria in oyster waters
Mesquite Bay (2463)	None	None
Aransas Bay (2471)	None	None
Little Bay (2471A)	Chlorophyll-a	None
Copano Bay/Port Bay (2472)	Chlorophyll-a	Bacteria in oyster waters
St. Charles Bay (2473)	None	None
Corpus Christi Bay (2481)	None	Bacteria at recreational beaches
Nueces Bay (2482)	Chlorophyll-a	Copper, Zinc in edible tissue
Redfish Bay (2483)	None	None
Conn Brown Harbor (2483A)	Copper in water	None
Corpus Christi Inner Harbor (2484)	Ammonia, nitrate	Copper in water
Oso Bay (2485)	Chlorophyll-a, total P, Bacteria	Low DO, bacteria
Oso Creek (2485A)	Chlorophyll-a, nitrate, total P	Bacteria
North Floodway (2491B)	Chlorophyll-a, Nitrate, Bacteria	None
Baffin Bay / Alazan Bay / Cayo del Grullo / Laguna Salada (2492)	Chlorophyll-a	None
San Fernando Creek (2492A)	Chlorophyll-a, nitrate, total P	Bacteria

Surface Water Resource (stream segment number)	Water Quality Concerns	Water Quality Impairments
South Bay (2493)	None	None
Brownsville Ship Channel (2494)	Low dissolved oxygen	None
Port Isabel Fishing Harbor (2494A)	None	Bacteria
Gulf of Mexico (2501)	None	Mercury in edible tissue

Source: Nueces River Authority 2021 Basin Highlights Report: San Antonio-Nueces Coastal Basin, Nueces River Basin, Nueces-Rio Grande Coastal Basin. https://nracleanriversprogram.org/wp-content/uploads/NRA_BHR_2021.pdf Note: Leona River (2109), Lower Sabinal River (2110), Upper Sabinal River (2111), Upper Nueces River (2112), Upper Frio River (2113), Hondo Creek (2114), Arroyo Colorado Tidal (2201) and Arroyo Colorado Above Tidal (2202) are reported in 2019 Basin Highlights Report but not included in table as these segments are outside and not anticipated to impact the Coastal Bend Region.

1.7 Identified Threats to Agricultural and Natural Resources

The Coastal Bend Region's agricultural business relies on groundwater for irrigation and water for livestock. During previous planning efforts, the CBRWPG identified continuing groundwater depletion as a threat to agricultural and natural resources. The Coastal Bend Region also recognizes the following additional potential threats to agricultural and natural resources:

- Shortage of freshwater and economically accessible groundwater attributable to increased irrigation demands.
- Shortage of freshwater and economically accessible groundwater attributable to development of natural gas from the shale in the Eagle Ford Group and water demands associated with hydraulic fracturing of wells.
- Deterioration of surface water quality associated with sand and gravel operations and other activities.
- Deterioration of groundwater quality and increasing concerns of possible arsenic and uranium contamination attributable to uranium mining activities.
- Potential impacts to threatened, endangered, and other species of concern.
- Potential impacts of brush control and other land management practices as currently considered in federal studies.
- Natural disasters or other critical storms.
- Abandoned wells (oil, gas, and water).

These threats are considered for each water management strategy, and when applicable, are specifically addressed in Chapter 5B.

1.8 Summary of Existing Local and Regional Water Plans

1.8.1 2021 Coastal Bend Regional Water Plan

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 TCEQ and the TWDB be consistent with approved regional water plans. Furthermore, Senate Bill 1 specified that regional water planning groups submit a regional water plan by January 2001, and at least as frequently as every 5 years thereafter, for TWDB approval and inclusion in the state water plan.

In October 2020, the Coastal Bend Region submitted a plan for a 50-year planning period from 2020 to 2070 (*2021 Coastal Bend Regional Water Plan*), which consisted of projected population, current water supply, projected needs in the region, and the region's proposed water plans (water management strategies) to meet needs. The total population of the Coastal Bend Region was projected to increase from 614,790 in 2020 to 744,544 by 2070. Similarly, the total water demand was projected to increase from 261,970 ac-ft in 2020 to 343,244 ac-ft by 2070. There were nine individual cities and water user groups (i.e., non-municipal water users, such as industrial and agricultural users) that showed projected needs during the 50-year planning horizon that increased from 10,807 ac-ft in 2020 to 50,950 in 2070. The CBRWPG identified water management strategies to potentially meet water supply shortages. The TWDB evaluated social and economic impacts of not meeting projected water needs, which were included in the *2021 Coastal Bend Regional Water Plan*.

1.8.2 2022 State Water Plan

In *Water for Texas 2022* (State Plan), the TWDB used information and recommendations from the 16 individual 2021 regional water plans developed by the regional water planning groups established under Senate Bill 1. In the State Plan, TWDB acknowledged that each regional water planning group identified many of the same basic recommendations to meet future water demands. These recommendations included: continue regional planning funding, support for groundwater conservation districts, brush control, water reuse, continued support of groundwater availability modeling, conservation education, ongoing funding for groundwater supply projects, and support of alternative water management strategies.

The TWDB included the projects recommended by the CBRWPG, including two proposed off-channel reservoirs (Guadalupe-Blanco River Authority Lower Basin Storage and local balancing storage reservoir to firm up run-of-the-river rights), groundwater development, seawater desalination, water treatment plant improvements, and conservation in *Water for Texas 2022*. Implementing all recommended strategies in the Coastal Bend Plan would result in 282,000 ac-ft of additional water supplies in 2070 at a total capital cost of $3.28 billion. Selected major projects in the plan included:

- Port of Corpus Christi Authority Seawater Desalination- Harbor Island with a total capital cost of $802 million
- Poseidon Regional Seawater Desalination Project at Ingleside with a capital cost of $725 million
- Port of Corpus Christi Authority Seawater Desalination-La Quinta Channel with a capital cost of $458 million
- City of Corpus Christi Seawater Desalination (La Quinta) with a capital cost of $420 million

- City of Corpus Christi Seawater Desalination (Inner Harbor) with a capital cost of $237 million
- Evangeline/Laguna Treated Groundwater Project with a capital cost of $158 million
- Regional Industrial Wastewater Reuse Plan (SPMWD) with a capital cost of $116 million

1.8.3 Local Water Plans

The following is a summary of major planning efforts in the Coastal Bend Planning Region during the past several years.

In 2017, the $154 million MRP Phase II Project was completed to include construction of a 42-mile pipeline, two pump stations, and a sedimentation basin. The pipeline ties City of Corpus Christi Garwood water rights from the Colorado River into the City of Corpus Christi's MRP, which transports water from Lake Texana to the Coastal Bend Region. The water transported via the MRP Phase II pipeline is provided to City of Corpus Christi customers including various municipal and industrial customers.

The City of Corpus Christi is continuing to study the design, construction, and operation of a seawater desalination plant for industrial and drinking water supply purposes. The objectives of this program are to evaluate feasibility and develop cost estimates, test emerging technologies, and identify and assess site options and requirements for a full-scale facility. Desalination of seawater is feasible as a new source for some of the region's water supply needs. The study has included evaluation of desalination technology options, possible source water quality, energy requirements, environmental impacts, possible beneficial uses of by-product brine, and cost estimates for implementing a large-scale facility. In January 2020, the city submitted water rights applications for an Inner Harbor and La Quinta Channel sites that are described in greater detail in the water management strategy discussion. The next step would likely be to pilot, design, construct, and operate one or both plants once the permits have been received.[14]

The Corpus Christi Aquifer Storage and Recovery (ASR) Conservation District was created in 2005. The district is located in Aransas, Kleberg, Nueces, and San Patricio counties. There are currently no ASR facilities in operation within the district. The Corpus Christi Aquifer Storage and Recovery Feasibility Project was performed from August 2016 to May 2019 on behalf of the Corpus Christi ASR Conservation District, with support from the TWDB and City of Corpus Christi through an inter-local agreement with the district. An exploratory test drilling program was completed to evaluate the geology and hydrogeology of the Gulf Coast aquifer system for potential ASR locations. The study also collected and analyzed hydrogeological, geochemical, and water quality data that will be used to model ASR operations and evaluate ASR feasibility. Based on the results of this project, it is estimated that a yield of 13 million gallons per day (mgd) is attainable based on current wastewater treatment plant capacity and up to 18 mgd is possible with Phase II expansion. The next phase will be a pilot well test program to confirm aquifer

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[14] City of Corpus Christi. 2019. Inner Harbor Water Treatment Campus. Accessed at https://sustainablewater.corpuschristitx.gov/

response, operations, prove up geochemical interactions, and identify criteria for appropriate design and operations of a full scale ASR program.

The City of Alice and the City of Beeville are currently developing water supply plans to diversify their water supplies and augment existing surface water supplies from the City of Corpus Christi during times of drought. The City of Alice received funding from the TWDB for the planning, design, and construction of a supplemental water source project, which will include two groundwater wells and a reverse osmosis treatment plant to produce treated supplies of 3,363 ac-ft/yr (approximately 3 mgd). The City of Beeville applied to the TWDB for funding a new Chase well field project to bring on groundwater wells in a supply amount of 1,491 ac-ft/yr.

In 2018, the Lavaca-Navidad River Authority published its 2018 Lavaca Basin Highlights report. This report focuses primarily on water quality issues within the basin. In 2017, the Lavaca-Navidad River Basin received approximately 1.38 inches of rainfall more than total rainfall from the previous year due to Hurricane Harvey. Without this event, 2017 would have been an average rainfall year around 29.45 inches indicative of the February 2020 low reservoir level at around 70 percent of capacity. A rural use attainability analysis was initiated by the TCEQ and the Texas Water Resources Institute for Rocky Creek, as it was placed on the states 303d list for exceeding bacteria levels for contact recreation. A watershed protection plan was developed for Lavaca River Segment (1602_03). There are still issues with trying to control Giant Salvina; however, a biological control method seems to be effective thus far.

The Coastal Bend Bays and Estuaries Program (CBBEP) has published several studies since the *2016 Coastal Bend Regional Water Plan*, which include water quality evaluations of the bay systems and impacts on key biological species of interest[15]. The CBBEP does not possess taxing, federal, state, or local authority. Rather, the CBBEP coordinates the implementation of the CBBEP plan by providing limited amounts of technical and financial assistance towards meeting operating goals.

1.8.4 Groundwater Conservation District Plans

The Texas Legislature authorized in 1947 the creation of groundwater conservation districts to conserve and protect groundwater and later recognized them in 1997 as the “preferred method of determining, controlling, and managing groundwater resources.” According to the Texas Water Code, the purpose of groundwater districts is to provide for the conservation, preservation, protection, and recharge of underground water and prevent waste and control subsidence caused by pumping water.[16] There are ten counties in the 11-county Coastal Bend Region that contain groundwater conservation districts: Bee, Brooks, Duval, Jim Wells, Kleberg, Live Oak, McMullen, Nueces, Kenedy, and San Patricio (Figure 1.7). Information regarding groundwater conservation districts, including contact list, can be found on the TWDB website (http://www.twdb.texas.gov/groundwater/conservation_districts/index.asp).

[15] https://www.cbbep.org/publications2/

[16] Texas Water Code б 36.0015.

1.8.4.1 Bee Groundwater Conservation District

The Bee Groundwater Conservation District (GCD) was created in January 2001 and adopted Management Rules in September 2002. Their most recent management plan was adopted in January 2024. The rules require registration for all existing and future wells in the district. The district imposes spacing and production limitations on new users and limits pumping to 10 gallons per minute (gpm) per acre owned or operated at a maximum annual production of 1 ac-ft per acre.

1.8.4.2 Brush Country Groundwater Conservation District

Brush Country GCD was created by the 81st Texas Legislature in 2009 and includes Brooks and Jim Wells counties within the Coastal Bend Region, as well as Jim Hogg County and a portion of Hidalgo County in Region M. The district's rules were adopted in 2013 and amended in 2017. Their most recent management plan was adopted in December 2022.

1.8.4.3 Corpus Christi Aquifer Storage and Recovery Conservation District

The Corpus Christi ASR Conservation District was created in 2005 by the 79th Texas Legislature. The district is located in Aransas, Kleberg, Nueces, and San Patricio counties. As with other GCDs, the major purposes of the district are to: 1) provide for conservation, preservation, protection, and recharge; 2) prevent waste; and 3) control land surface subsidence. The district's primary objective is to facilitate the operation of ASR operations by the City of Corpus Christi. The district amended its rules in 2016. The district adopted the most recent management plan in July 2019.

1.8.4.4 Duval County Groundwater Conservation District

The Duval County GCD was created in 2005 by the 79th Texas Legislature. The district was approved by voters in 2009. The district initially adopted rules in February 2010, which were most recently amended on February 28, 2018. The most recent management plan was adopted in August 2023.

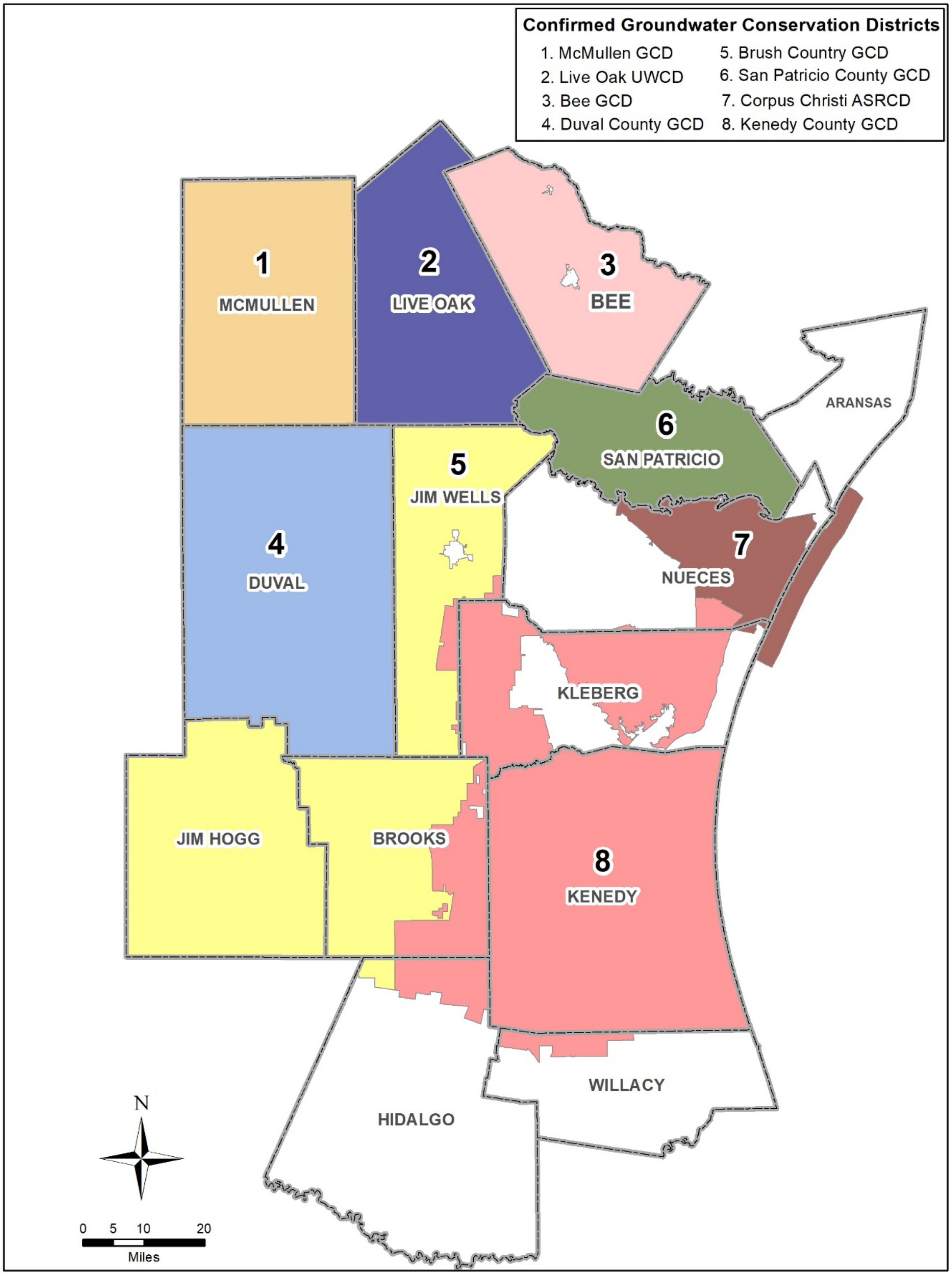

Figure 1.7.
Groundwater Conservation Districts in Region N

1.8.4.5 Live Oak Underground Water Conservation District

The Live Oak Underground Water Conservation District was created June 14, 1989, and confirmed November 7, 1989. The district adopted Management Rules in June 1998 and last amended the rules in November 2011. The rules require registration for all existing and future wells in the district. The district imposes spacing and production limitations on new users and limits pumping to 10 gpm per acre at a maximum annual production of 2 ac-ft per acre. The district does not allow operation of ASR projects. Their most recent management plan was adopted on May 18, 2023.

1.8.4.6 McMullen Groundwater Conservation District

The McMullen GCD was created and published District Rules in November 1999. The rules, last amended in September 2012, require registration for all existing and future wells in the district. The district imposes spacing and production limitations on new users and limits pumping to 10 gpm per acre owned or operated at a maximum annual production of 1 ac-ft per acre. The district does not allow operation of ASR projects. Their most recent management plan was adopted in May 2024.

1.8.4.7 Kenedy County Groundwater Conservation District

The Kenedy County GCD was created in 2003 and includes all of Kenedy County and parts of Brooks, Jim Wells, Kleberg, and Nueces counties. The rules, last amended in July 2012, require registration for all existing and future wells in the district. The district rules include spacing and production limitations on new users and limits annual production to 0.75 acre-inch/acre/year. Their most recent management plan was adopted in February 2023.

1.8.4.8 San Patricio County Groundwater Conservation District

The San Patricio County GCD was created by the 79th Texas Legislature in 2005. The San Patricio County GCD adopted District Rules in April 2012. Permits are required from the San Patricio County GCD prior to drilling or operating wells that can produce in excess of 25,000 gallons per day (17.4 gpm). The district imposes spacing and production limitations on new users and limits annual production to 1.25 ac-ft per acre owned. Their most recent management plan was adopted in June 2023.

1.8.4.9 Aransas County Groundwater Conservation District

The Aransas County GCD was created by the 84th Texas Legislature in 2015. The district was dissolved in September 2019.

1.8.5 Groundwater Management Areas

Groundwater is regulated locally by groundwater conservation districts except in locations that do not have a district. Districts may issue permits that regulate pumping of groundwater and spacing of wells within their jurisdictions. Multiple districts within a single GMA determine the desired future conditions of relevant aquifers within that area.

Three GMAs are represented within the 11-county Coastal Bend Region: GMA 13, GMA 15, and GMA 16. GMA 16 has the greatest coverage extent in the Coastal Bend Region, represented in all 11 counties in the Coastal Bend Planning Area. GMA 13 covers a portion of McMullen County. GMA 15 covers a portion of Bee County. All three of these GMAs adopted new desired future conditions (DFCs) between April 2016 and January 2017, which identify aquifer drawdown constraints for future groundwater production. These DFCs were then used by the TWDB to develop MAGs for use in development of the *2026 Coastal Bend Regional Water Plan*. These MAG projections based on GMA-approved desired future conditions serve as the basis of groundwater availability in the 2026 Coastal Bend Regional Water Plan, as described in greater detail in Chapter 3. The CBRWPG did not perform any independent analyses using groundwater availability models (GAM) to estimate groundwater availability, nor did the CBRWPG use any alternative methods to estimate groundwater availabilities.

Groundwater supplies in the 2026 Coastal Bend Regional Water Plan are based on MAG projections provided by the TWDB, constrained by well capacity as reported in TCEQ Public Water System (PWS) database. For non-municipal groundwater users with groundwater capacities that are not readily obtained from publicly available sources, the groundwater supply was calculated based on TWDB historical water use records. The final step in determining groundwater supplies was to compare the MAG-preserved well capacities to projected demands for each WUG that has historically relied on groundwater. Groundwater supply was set equal to the amount of capacity or water demand, whichever is lower.

The TWDB allows the regional water planning groups to use a MAG peak factor for determining groundwater availability, if needed. The CBRWPG is not requesting use of the MAG peak factor option in the Coastal Bend Region. For the Coastal Bend Region, total anticipated groundwater production in any planning decade does not exceed the MAG volume in any county-aquifer location (total groundwater production includes quantities associated with both existing supplies and any recommended water management strategies). This prevents recommending water management strategies with supply volumes that would result in exceeding (i.e., overdrafting) approved MAG volumes.

1.9 Identified Historic Drought(s) of Record within the Planning Area

In terms of severity and duration, the previous *2016 Coastal Bend Regional Water Plan* considered the drought from 1992-2002 as the drought of record. The most recent drought beginning in 2007 is discussed in the *2016 Coastal Bend Regional Water Plan* as potentially being a new drought of record; however, for several reasons, including that the Corpus Christi Water Supply Model (CCWSM) hydrology period extends from 1934 to 2003, a new drought had not been confirmed at the time of plan submittal in December 2015.

In 2017, the CCWSM was updated to include:

- Recent hydrology through 2015 to include the most recent drought of record for a total model period of 82 years (1934 to 2015), including extensions to net evaporation and ungaged runoff below LCC for recent hydrology using methods consistent with the previous model version (1934 to 2003);
- New TWDB volumetric survey data for Lake Corpus Christi (2016), Choke Canyon Reservoir (2012), and Lake Texana (2010) with updated sediment accumulation rates;
- Recent hydrology for Lake Texana and the Colorado River (for Mary Rhodes Phase II supplies) through 2015; and
- Verification that all enhancements comply with the TCEQ 2001 Agreed Order.

In 2019, additional model updates were made to include:

- Lake Texana callback of 10,400 ac-ft/yr as exercised by Lavaca-Navidad River Authority for local water users in Jackson County pursuant to City of Corpus Christi contract terms; and
- Operational flexibility to exercise water supply calls on the Garwood water right on the Colorado River at a variable rate according to diversion rate and priority date of the rights and based on MRP Phase II system capacities.

With the CCWSM updated for an 82-year hydrology period through 2015 and enhanced to simulate the city's reservoir system operations with the recent MRP Phase II supply, the model was used to evaluate drought conditions to identify any new historic drought of record within the planning area. Average annual inflows to CCR/LCC System continue to trend lower with each successive drought, with the most recent hydrology update[17] for the CCWSM (through 2015) showing a drought of record for the Corpus Christi Regional Water Supply System from 2007 to 2013. The single lowest inflow year to the CCR/LCC System occurred in 2011. The minimum 2-year (24-month) inflow to the CCR/LCC System during this most recent decade occurred from October 2010 to September 2012 at an inflow of 124,000 ac-ft, which is 32 percent less than the minimum 2-year inflow to the CCR/LCC System in the 1990s of 183,000 ac-ft that occurred from August 1994 to July 1996 and was the driver of the previous drought of record. The CBRWPG recognizes the current drought in early 2025 is most likely worse than the drought of record and seeks to address this by over-allocating water management strategies in excess of calculated shortages. See Chapter 7 for more information.

[17] Corpus Christi Water Supply Yield Results from Hydrology Update, June 1, 2017.

1.10 Current Preparations for Drought within the Coastal Bend Region

At the May 18, 2023 CBRWPG meeting, the planning group considered guidance from the TWDB to use firm yield when determining surface water availability. Based on the regional water supply system being prone to severe drought and a new drought of record from 2007 to 2013, the CBRWPG's approved safe yield approach is based on maintaining a 75,000 ac-ft reserve in storage during the worst, historical drought of record. Safe yield is a standard approach that the CBRWPG and the City of Corpus Christi have consistently used in previous planning cycles as a provision for climate and growth uncertainty, such that a *specified reserve amount remains* in storage during the modeled critical drought. Based on a presentation by the City of Corpus Christi and additional information, the CBRWPG approved submittal of a hydrologic variance request to use safe yield for determining surface water supplies available to the City's Regional Water Supply System for 2026 Plan development, which was subsequently granted by the TWDB on January 8, 2024.

The supplies from the City's Regional Water Supply System that are the basis of the needs analysis of this plan are the safe yield supply which includes a provision to prepare for future droughts of greater severity than what has occurred historically (1934-2015).

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 *Drought Contingency Plan*. The city's *Drought Contingency Plan* is implemented when current water supplies are threatened. The *Drought Contingency Plan*, updated in November 2018, is initiated as the percentage of combined storage of the CCR/LCC System decreases and includes water reduction targets based on storage levels. During severe 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. As of February 2025, the City of Corpus Christi was in the process of adopting new drought contingency provisions aiming at enhancing water conservation efforts and addressing the operational needs of local businesses impacted by drought conditions. Specific drought contingency measures for the other three current WWPs (SPMWD, STWA, and Nueces County WCID 3) and other water users in the Coastal Bend Region are included in Chapter 7.

The following entities have provided a TCEQ approved drought contingency plan to the Nueces River Authority for use by the CBRWPG:

- City of Corpus Christi
- San Patricio Municipal Water District;
- South Texas Water Authority;
- Nueces County WCID 3;
- City of Alice;
- City of Aransas Pass;
- City of Beeville;
- El Oso WSC
- City of Falfurrias
- Holiday Beach WSC
- City of Ingleside;
- City of Kingsville;
- McCoy WSC;
- Nueces County WCID 4;
- Nueces WSC;
- City of Odem;
- City of Portland;
- Ricardo WSC
- City of Robstown
- City of Rockport;
- City of Taft;
- City of Three Rivers;
- Aransas County MUD 1
- Blueberry Hills
- El Oso WSC;
- Falfurrias
- Freer WCID
- McCoy WSC;
- Lavaca-Navidad River Authority
- Nueces County WCID #3;
- Nueces WSC;
- Pettus MUD
- Ricardo WSC;
- Rincon WSC;
- River Acres WSC;
- San Patricio MWD; and
- South Texas Water Authority.

Additional drought contingency information for the Coastal Bend Region is included in Chapter 7. A copy of drought contingency plans provided to the Nueces River Authority can be accessed at: https://www.nueces-ra.org/CP/RWPG/dcp.php.

1.11 TWDB Water Loss Audit Data

In accordance with 31 TAC 357.30, this *2021 Coastal Bend Regional Water Plan* includes water loss information compiled by the TWDB from water loss audits provided by retail public utilities of the Coastal Bend Regional Water Planning Area pursuant to Chapter 358.6.

The 2015-2017 Water Loss Data presented in Table 1.3 was submitted to the TWDB by water utilities in Texas, as required by House Bill 3338 of the 78th Texas Legislature. House Bill 3338 requires the TWDB to compile the information included in the water audits by type of retail public utility and by regional water planning area, and provide that information to the regional water planning groups for use in their regional water plan. The methodology used for the Water Loss Audit forms relies upon self-reporting data provided by public utilities, and due to this, the self-reported data may be unreliable and in need of further refinement.

The 2021 regional water planning development used utility-based planning for municipal water user groups, as delineated by water provider service areas, rather than political boundaries. The municipal water user groups included:

- *Retail public utilities* owned by a political subdivision providing more than 100 ac-ft/yr of water for municipal use;
- *Privately-owned utilities* that request inclusion as an individual WUG, provide more than 100 ac-ft/yr for municipal use for each owned water system, and are approved for inclusion as an individual WUG by the regional water planning group;
- *State or federal-owned water systems* that request inclusion as an individual WUG, provide more than 100-AFY for municipal use, and approved for inclusion as an individual WUG by the regional water planning group; and
- *Collective reporting units*, or groups of retail public utilities that have a common association and are requested by the regional water planning group.

The TWDB provided the water loss data for 35 public utilities of the Coastal Bend Regional Water Planning Region that filed a water loss audit report for the 2015-2017 timeframe. Of the 35 public utilities that responded to the water loss survey, 11 reported having delivered less than 100 ac-ft/yr, and 24 reported having delivered more than 100 ac-ft/yr in 2015-2017.

Table 1.3 summarizes a portion of that data for each of the 25 entities. If a municipal water user group filed multiple water loss audit reports for the 3 years, the latest one is reported in the table. This table shows the total retail population served, total water volume input into the system, total water loss, percent loss, the value of water loss in dollars, per capita water loss, and water loss reporting year (2020-2022).The 24 water utilities that responded to the water loss survey reported having served 484,934 people in 2020-2022 (about 84 percent of the 2020 regional population). Total reported water input into the systems was 99,594 ac-ft, with a reported quantity of water loss of 8,247 ac-ft. The quantity of water loss, as a percent of estimated total input water volume is calculated at about 8 percent for the region as a whole.

In addition, in accordance with 31 TAC 357.30, the regional water planning group has considered strategies to reduce water losses as further described in Chapter 5B.1.

Table 1.3.
Summary of Water Loss Survey, 2020-2022

No.	Utility Name	Retail Pop Served	System Input Volume (acft)	Water Loss (acft)	Water Loss (%)	Total Cost of Loss ($)	GPCD Loss	Water Loss Reporting Year
Utilities with Input Volumes of Less Than 100 ac-ft/yr								
1	Aransas County MUD 1	580	39	9	24%	9000	15	2020
2	Copano Cove Subdivision	1170	74	19	26%	4990	15	2020
3	Copano Heights Water	210	12	1	12%	3071	6	2020
4	Copano Ridge Subdivision	580	72	39	55%	50198	61	2020
5	Escondido Creek Water System	129	19	1	3%	787	4	2020
6	Holiday Beach WSC	2469	86	9	11%	3489	3	2022
7	Tynan WSC	250	28	6	23%	3101	23	2021
	Subtotal for Utilities with Less Than 100 acft/yr	**5,388**	**330**	86	**26%**	**74,636**	**-**	**-**
Utilities with Input Volumes of More Than 100 ac-ft/yr								
8	City of Aransas Pass	9547	1623	129	8%	148094	12	2021
9	Baffin Bay WSC	1266	147	12	8%	7419	8	2020
10	City of Bishop	3010	556	284	51%	459368	84	2020
11	City of Corpus Christi	317863	77098	5300	7%	6657187	15	2022
12	City of Ingleside	9678	1033	118	11%	137685	11	2022
13	City of Kingsville	26213	3573	392	11%	224966	13	2021
14	City of Mathis	4150	518	154	30%	289555	33	2022
15	City of Portland	22600	2448	268	11%	270115	11	2022
16	City of Rockport	37314	3040	262	9%	359904	6	2022
17	City of Sinton	5723	1238	339	27%	130979	53	2021
18	City of Taft	2831	373	13	4%	62502	4	2021
19	City of Three Rivers	4389	1673	90	5%	90430	18	2021
20	Freer WCID	2689	568	210	37%	393756	70	2020
21	Nueces County WCID 3	19000	1792	129	7%	175149	6	2022
22	Nueces County WCID 4	4494	2292	187	8%	176824	37	2020
23	Nueces WSC	3102	593	60	10%	59350	17	2020
24	Ricardo WSC	3177	338	48	14%	48012	14	2020
25	River Acres WSC	2500	359	163	45%	160827	58	2022
	Subtotal for Utilities with More Than 100 acft/yr	**479,546**	**99,264**	**8,161**	**12.1%**	**9,852,122**	**-**	**-**
	TOTAL for all 25 entities	**484,934**	**99,594**	**8,247**	**8%**	**9,926,758**	**-**	**-**

*Note: The water losses in this table include real and apparent losses.

1.12 Identification of Threats to Agricultural and Natural Resources, Endangered, and Rare Species of the Coastal Bend Region Affected by Water Management Strategies

While the Coastal Bend Region is known for its valuable mineral resources, especially oil and gas, this area also supports a rich diversity of living natural resources. Three distinct natural regions occur in the Coastal Bend Region: the South Texas Brush Country, which characterizes the inland portion of the region; the Coastal Sand Plains along the southern coastline; and the Gulf Coast Prairies and Marshes along the northern coastline (Figure 1.8).

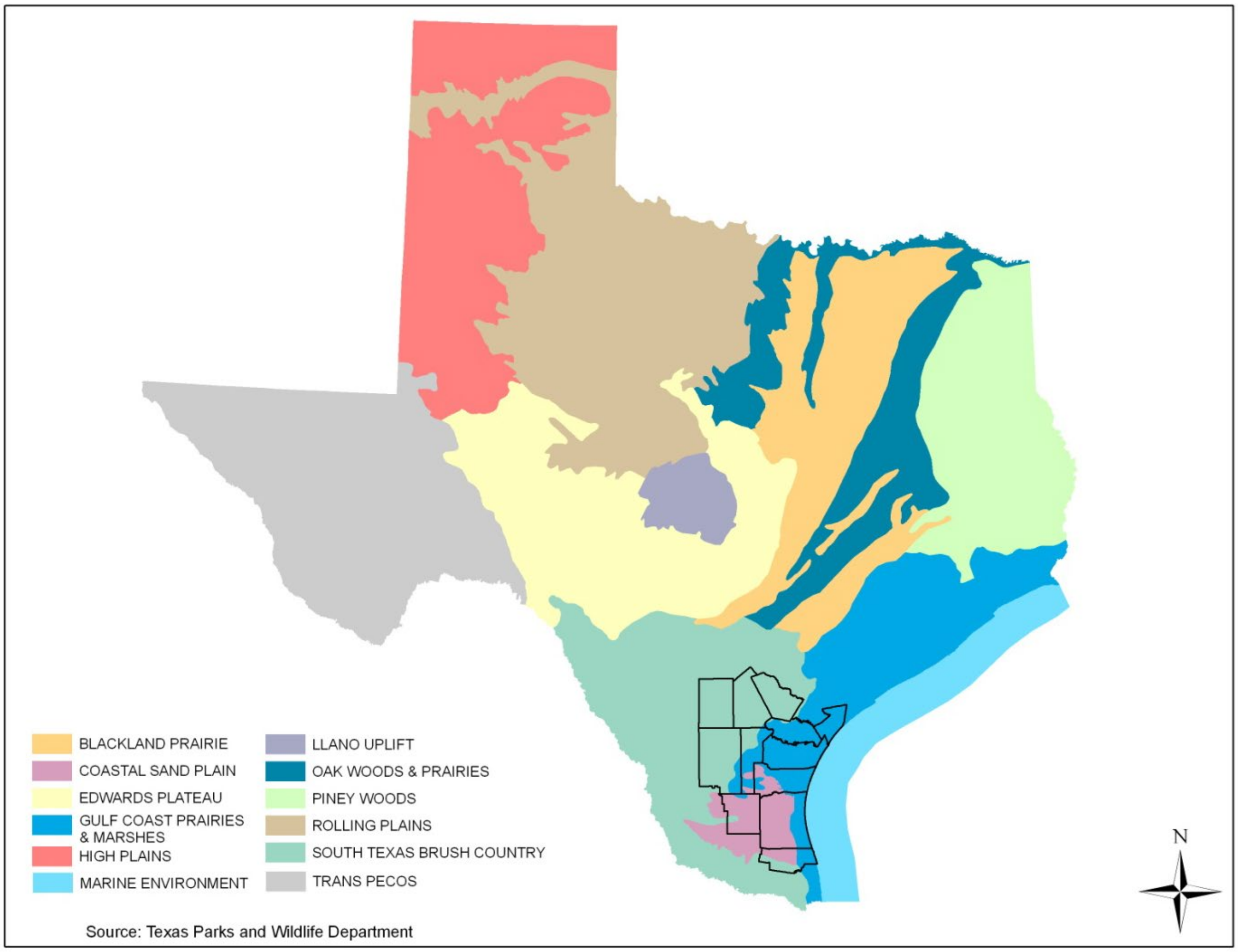

Figure 1.8.
Natural Regions of Texas

Regional water plan guidelines require identification of threats to agricultural and natural resources and discussions of how they will be addressed or affected by water management strategies evaluated in the plan. These environmental impacts include possible effects on agriculture, natural resources, wildlife habitat, cultural resources, environmental water needs, and inflows to bays and estuaries. Each water management strategy summary (Chapter 5B) includes a discussion of these environmental considerations and potential impacts associated with project implementation. The summary at the end of each Chapter 5B water management strategy summary also includes water quality concerns and impairments for stream and bay segments (Table 1.2) anticipated to be affected by or to affect the water management strategy. Water quality parameters considered in the water management strategy evaluations include total dissolved solids, salinity, bacteria, chlorides, bromide, sulfate, uranium, arsenic, and others.

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 well as nutrients that are important to the productivity of estuarine systems. In addition, 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 TCEQ in 1995, and the subsequent 2001 Agreed Order, Choke Canyon Reservoir and Lake Corpus Christi are operated in such a way as to "pass-through" inflows up to a certain target amount of water each month to the Nueces Bay and Estuary. This water provides the important freshwater inflows needed by the Nueces Estuary based on maximum harvest studies and inflow recommendations.

Because the Coastal Bend Region is located along many migratory flyways, birds comprise a major portion of the wildlife population found within the area. The area provides many birds with unique nesting and forage resources within its coastal prairies, wetlands, and riverine ecosystems. The brown pelican, which was delisted as a federally endangered species in 2009, uses the Coastal Bend's natural resources year-round while the endangered whooping crane is only found seasonally.

The Coastal Bend Region provides habitat for numerous state- and federally-listed endangered and threatened species. These listed species include birds, amphibians, reptiles, fish, mammals, and vascular plants (Table 1.4). Texas Parks and Wildlife Department (TPWD) and U.S. Fish and Wildlife Service (USFWS) - Southwest Region Ecological Service maintain maps identifying potential habitats (by county) of each endangered or threatened species. These potential habitats are considered for each water management strategy and when possibly impacted, are noted in the appropriate water management strategy summary (Chapter 5B).

Table 1.4. Endangered and Threatened Species of the Coastal Bend Region

Common Name	Scientific Name	County for which Species is Listed	Federal Status[1]	State Status[2]
Atlantic hawksbill sea turtle	*Eretmochelys imbricata*	Aransas, Kenedy, Kleberg, Nueces, San Patricio	Endangered	Endangered
Black lace cactus	*Echinocereus reichenbachii var. albertii*	Duval, Jim Wells, Kleberg, Nueces	Endangered	Endangered
Eastern Black Rail	*Laterallus jamaicensis ssp. jamaicensis*	Aransas, Bee, Kenedy, Kleberg, Nueces, San Patricio	Threatened	Threatened
Black-spotted newt	*Notophthalmus meridionalis*	Aransas, Bee, Brooks, Jim Wells, Kenedy, Kleberg, Live Oak, McMullen, Nueces, San Patricio	—	Threatened
Black-striped snake	*Coniophanes imperialis*	Kenedy	—	Threatened
Blue whale	*Balaenoptera musculus*	Aransas, Kenedy, Kleberg, Nueces, San Patricio	--	Endangered
Cactus Ferruginous Pygmy-Owl	*Glaucidium brasilianum cactorum*	Brooks, Kenedy	Threatened	Threatened
Coues' rice rat	*Oryzomys couesi aquaticus*	Brooks, Kenedy, Kleberg	—	Threatened
Gray Hawk	*Buteo plagiatus*	Kenedy, Kleberg	--	Threatened
Green sea turtle	*Chelonia mydas*	Aransas, Kenedy, Kleberg, Nueces, San Patricio	Threatened	Threatened
Gulf Coast Jaguarundi	*Puma yagouaroundi cacomitli*	-	Endangered	-
Gulf of Mexico Bryde's whale	*Balaenoptera ricei*	Aransas, Kenedy, Kleberg, Nueces, San Patricio	--	Endangered
Kemp's Ridley sea turtle	*Lepidochelys kempii*	Aransas, Kenedy, Kleberg, Nueces	Endangered	Endangered
Leatherback sea turtle	*Dermochelys coriacea*	Aransas, Kenedy, Nueces	Endangered	Endangered
Loggerhead sea turtle	*Caretta caretta*	Aransas, Kenedy, Kleberg, Nueces	Threatened	Threatened
Monarch butterfly	*Danaus plexippus*	Aransas, Bee, Brooks, Duval, Jim Wells, Kenedy, Kleberg, Live Oak, McMullen, Nueces, San Patricio	Candidate	-
North Atlantic right whale	*Eubalaena glacialis*	Aransas, Kenedy, Kleberg, Nueces, San Patricio	--	Endangered
Northern Aplomado Falcon	*Falco femoralis septentrionalis*	Aransas, Duval, Kenedy, Kleberg, Nueces	Endangered	Endangered
Northern Beardless-Tyrannulet	*Camptostoma imberbe*	Brooks, Kenedy	—	Threatened
Northern cat-eyed snake	*Leptodeira septentrionalis septentrionalis*	Brooks, Kenedy, Kleberg	—	Threatened
Oceanic whitetip shark	*Carcharhinus longimanus*	Aransas, Kenedy, Kleberg, Nueces, San Patricio	--	Threatened
Ocelot	*Leopardus pardalis*	Aransas, Bee, Brooks, Duval, Jim Wells, Kenedy, Kleberg, Live Oak, McMullen, Nueces, San Patricio	Endangered	Endangered

Common Name	Scientific Name	County for which Species is Listed	Federal Status[1]	State Status[2]
Piping Plover	*Charadrius melodus*	Aransas, Bee, Brooks, Duval, Jim Wells, Kenedy, Kleberg, Live Oak, McMullen, Nueces, San Patricio	Threatened	Threatened
Reddish Egret	*Egretta rufescens*	Aransas, Kenedy, Kleberg, Nueces, San Patricio	—	Threatened
Rufa Red Knot	*Calidris canutus rufa*	Aransas, Bee, Kenedy, Kleberg, Nueces, San Patricio	Threatened	Threatened
Sei whale	*Balaenoptera borealis*	Aransas, Kenedy, Kleberg, Nueces, San Patricio	--	Endangered
Sheep frog	*Hypopachus variolosus*	Aransas, Bee, Brooks, Duval, Jim Wells, Kenedy, Kleberg, Live Oak, McMullen, Nueces, San Patricio	—	Threatened
Shortfin Mako shark	*Isurus oxyrinchus*	Aransas, Kenedy, Kleberg, Nueces, San Patricio	--	Threatened
Slender rushpea	*Hoffmannseggia tenella*	Kleberg, Nueces	Endangered	Endangered
Sooty Tern	*Onychoprion fuscatus*	Kenedy, Kleberg, Nueces	—	Threatened
South Texas ambrosia	*Ambrosia cheiranthifolia*	Jim Wells, Kleberg, Nueces	Endangered	Endangered
South Texas siren (large form)	*Siren sp.1*	Bee, Brooks, Duval, Jim Wells, Kenedy, Kleberg, Live Oak, McMullen, Nueces, San Patricio	—	Threatened
Speckled racer	*Drymobius margaritiferus*	Kleberg	--	Threatened
Sperm whale	*Physeter macrocephalus*	Aransas, Kenedy, Kleberg, Nueces, San Patricio	--	Endangered
Swallow-tailed Kite	*Elanoides forficatus*	Aransas, Bee, Brooks, Jim Wells, Kenedy, Kleberg, Live Oak, Nueces, San Patricio	--	Threatened
Texas Botteri's Sparrow	*Peucaea botterii texana*	Brooks, Duval, Jim Wells, Kenedy, Kleberg, Nueces, San Patricio	—	Threatened
Texas horned lizard	*Phrynosoma cornutum*	Aransas, Bee, Brooks, Duval, Jim Wells, Kenedy, Kleberg, Live Oak, McMullen, Nueces, San Patricio	—	Threatened
Texas scarlet snake	*Cemophora lineri*	Aransas, Brooks, Duval, Jim Wells, Kenedy, Kleberg, Nueces, San Patricio	—	Threatened
Texas tortoise	*Gopherus berlandieri*	Aransas, Bee, Brooks, Duval, Jim Wells, Kenedy, Kleberg, Live Oak, McMullen, Nueces, San Patricio	—	Threatened
Tricolored bat	*Perimyotis subflavus*	Aransas, Bee, Brooks, Duval, Jim Wells, Kenedy, Kleberg, Live Oak, McMullen, Nueces, San Patricio	Proposed Endangered	--
Tropical Parula	*Setophaga pitiayumi*	Brooks, Kenedy, Kleberg, Nueces	—	Threatened
Walkers's manioc	*Manihot walkerae*	Duval	Endangered	Endangered
West Indian manatee	*Trichechus manatus*	Aransas, Kenedy, Kleberg, Nueces, San Patricio	Threatened	Threatened

Common Name	Scientific Name	County for which Species is Listed	Federal Status[1]	State Status[2]
White-faced Ibis	*Plegadis chihi*	Aransas, Bee, Brooks, Duval, Jim Wells, Kenedy, Kleberg, Live Oak, McMullen, Nueces, San Patricio	—	Threatened
White-nosed coati	*Nasua narica*	Aransas, Bee, Brooks, Duval, Jim Wells, Kenedy, Kleberg, Live Oak, McMullen, Nueces, San Patricio	—	Threatened
White-tailed hawk	*Buteo albicaudatus*	Aransas, Bee, Brooks, Duval, Jim Wells, Kenedy, Kleberg, Live Oak, McMullen, Nueces, San Patricio	—	Threatened
Whooping Crane	*Grus americana*	Aransas, Bee, Jim Wells, Kenedy, Kleberg, McMullen, Live Oak, Nueces, San Patricio	Endangered	Endangered
Wood Stork	*Mycteria americana*	Aransas, Bee, Brooks, Duval, Jim Wells, Kenedy, Kleberg, Live Oak, McMullen, Nueces, San Patricio	—	Threatened
Zone-tailed Hawk	*Buteo albonotatus*	Brooks, Kenedy	—	Threatened

Source: [1] USFWS, 2024. Information for Planning and Consultation. Dated March 2024.

[2]TPWD, Annotated County List of Rare Species, Aransas, Bee, Brooks, Duval, Jim Wells, Kleberg, Kenedy, Live Oak, McMullen, Nueces, and San Patricio Counties (updated September 2023).

— Not Listed as Endangered or Threatened

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Population and Water Demand Projections [31 TAC §357.31]

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Chapter 2: Population and Water Demand Projections

2.1 Introduction

For the 2026 regional water planning cycle, 2020 census data was made available. A Coastal Bend Region municipal subcommittee was formed on January 20, 2022, at a regular public meeting to review population and municipal water projections. The subcommittee consists of Mark Scott, Esteban Ramos, Gene Camargo, and Carl Crull. On January 23, 2023, the Texas Water Development Board (TWDB) released draft population and municipal water demand projections for the Coastal Bend Regional Water Planning Group's (CBRWPG) review for a 1.0 migration scenario (at water user group level) and 0.5 migration scenario (at county-level). At the Coastal Bend Region's request, the TWDB prepared 0.5 migration scenario projections at the water user group level and sent them for CBRWPG consideration on March 3, 2023. The Coastal Bend Region municipal subcommittee met on April 10, 2023, to discuss projections and prepare a recommendation for Coastal Bend Region at the May 19, 2023 meeting. The TWDB provided revised municipal water demand projections on May 5, 2023, that were included in this analysis. On November 9, 2023, the TWDB adopted population and water demand projections for use in the 2026 regional water plan.

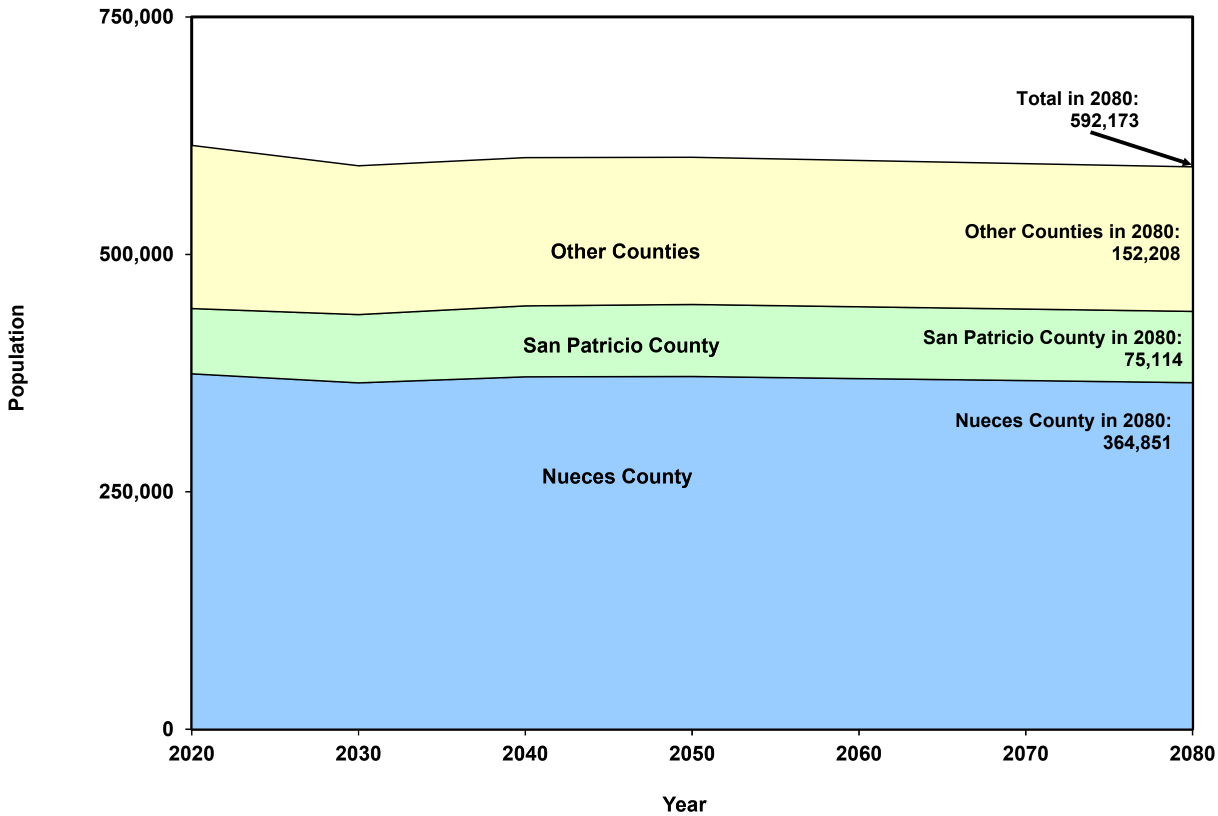
A Coastal Bend Region non-municipal subcommittee was formed on January 20, 2022, at a regular public meeting to review non-municipal water projections. The subcommittee consists of Charles Ring, Teresa Carrillo, Esteban Ramos, Andy Garza, Lonnie Stewart, and Mark Sugarek. On September 8 2022, the Coastal Bend Region non-municipal subcommittee met to review the TWDB water demand projections for manufacturing, irrigation, mining, steam electric, and livestock users through Year 2080. During the virtual meeting, draft TWDB projections were discussed along with TWDB methodology that was used to estimate the future water demands. The Coastal Bend Region non-municipal subcommittee had additional meetings to further review projections for each water use, which resulted in submission of alternative non-municipal water demands for TWDB consideration and is further discussed in respective sections.

This chapter contains TWDB- adopted population and water demand projections for each municipal, manufacturing, mining, irrigation, and livestock water demand projections by county and river basin for the 11-county Coastal Bend Regional Water Planning Area. These counties are located within three river basins: the Nueces River Basin, the San Antonio-Nueces Coastal Basin, and the Nueces-Rio Grande Coastal Basin (Figure 2.1).

2.2 Population Projections

From 1990 to 2020, the population in the 11-county region grew by 57,129 (from 492,807 to 549,936), an increase of 11.6 percent (0.04 percent compound annual growth), as shown in Table 2.1. This compares with a statewide increase in population of 75 percent (1.8 percent annually). Most of the growth occurred in Nueces and San Patricio counties, the two largest counties in the region by population. Combined, they accounted for 75.6 percent of the total increase, and in 2020 their populations totaled 71.5 percent of the region. In 2020, 60.8 percent of the region's total population lived in Nueces County, 10.7 percent in San Patricio County, 5.7 percent in Jim Wells County, 5.5 percent in Kleberg County, 4.7 percent in Bee County, and 12.6 percent in the remaining six counties combined.

The population in the 11-county region is projected to increase by 42,237 from 2020 to 2080, an increase of 7.7 percent (0.04 percent annually), as shown in Table 2.1. This compares to a statewide projected population growth in the same period of 76.2 percent (0.95 percent annually). The total population for the region in 2020 was 1.9 percent of the 29.7 million population statewide. It declines by 2080, to 1.1 percent of the projected 52.3 million statewide totals. In 2080, it is projected that 61.6 percent of the region's population will live in Nueces County, 12.7 percent in San Patricio County, 6.9 percent in Kleberg County, 5.8 percent in Jim Wells County, and 13 percent in each of the remaining seven counties.



Duval and Kleberg counties are the fastest growing counties in the region, based on percent growth since 2020, with future projections growing at an annual rate higher than the regional average of 0.12 percent (Figure 2.3). These growth numbers are predominantly from 2030 to 2060. The growth rate for Aransas, Kenedy, Live Oak, and McMullen counties is expected to be negative over the next 60 years and Bee, Brooks, Duval, Jim Wells, Kleberg, Nueces, and San Patricio are expected to have an overall positive growth rate from 2020 to 2080.

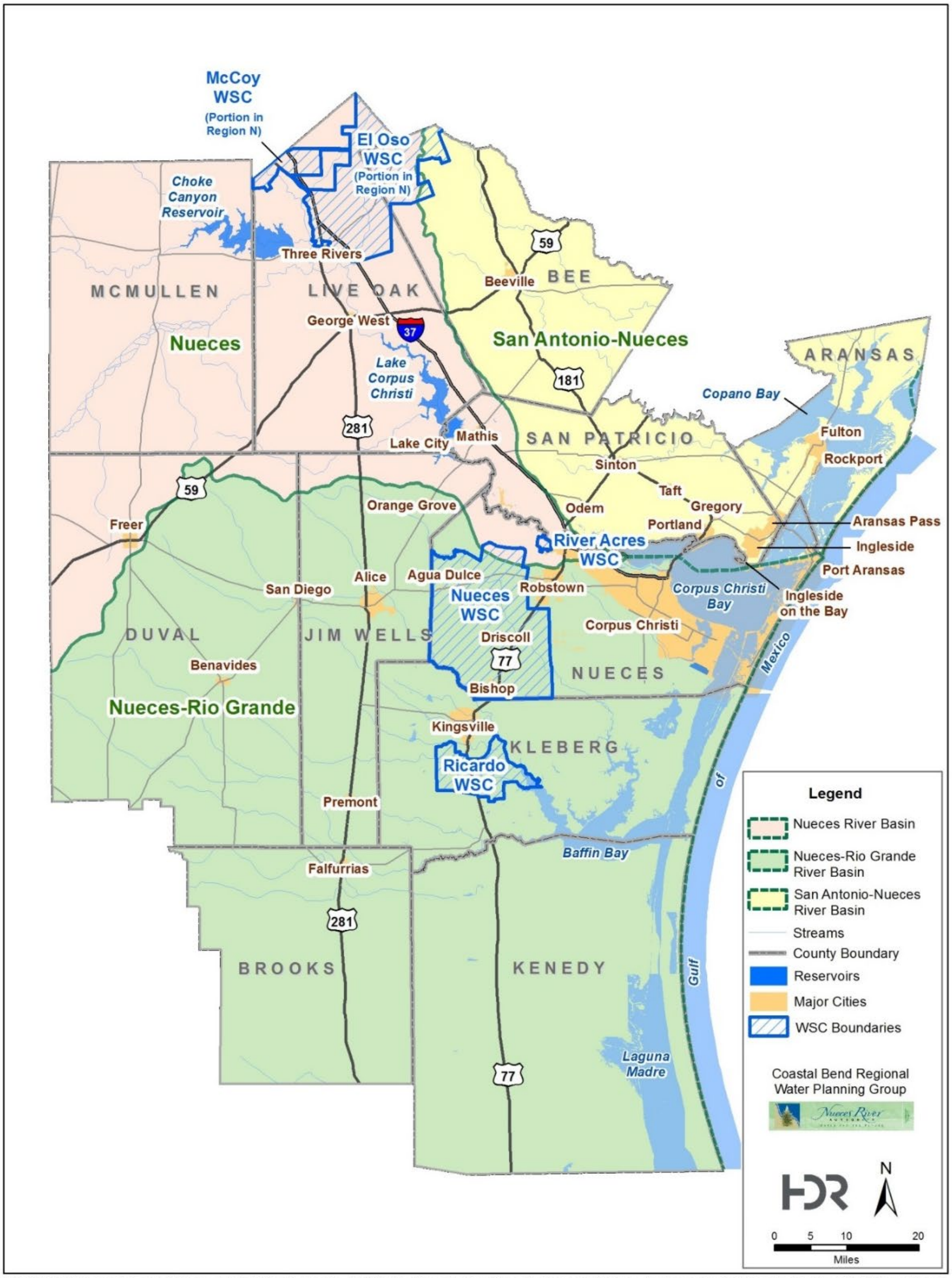


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Figure 2.1.
Coastal Bend Region River Basin Boundaries

Table 2.1.
Coastal Bend Region Population (by City/County)

County/River Basin	Historical[1]				Projections[1]						Percent Growth[2]	Percent Growth[2]
	1990	2000	2010	2020	2030	2040	2050	2060	2070	2080	1990-2020	2020-80
Aransas County	17,892	22,497	23,146	23,818	24,415	24,299	23,708	23,195	22,691	22,196	2.44%	-0.84%
Bee County	25,135	32,359	33,679	33,670	31,363	31,563	31,337	31,030	30,725	30,422	0.10%	0.27%
Brooks County	8,204	7,976	7,223	7,076	6,895	6,702	6,493	6,256	6,020	5,785	-2.02%	0.44%
Duval County	12,918	13,120	11,650	9,643	9,261	8,828	8,436	8,108	7,782	7,458	-4.09%	1.18%
Jim Wells County	37,679	39,326	40,970	39,079	38,692	38,400	37,573	36,430	35,294	34,164	-0.63%	0.16%
Kenedy County	460	414	416	350	336	306	283	266	249	232	-0.61%	-0.83%
Kleberg County	30,274	31,549	32,061	31,040	33,923	34,901	36,068	37,772	39,466	41,151	0.00%	0.51%
Live Oak County	9,556	12,309	20,244	21,451	11,093	10,740	10,499	10,473	10,447	10,421	2.61%	-1.14%
McMullen County	817	851	1,681	1,548	546	511	493	455	417	379	5.01%	-3.66%
Nueces County	291,123	313,575	340,223	353,178	364,690	371,130	371,485	369,261	367,050	364,851	0.46%	0.15%
San Patricio County	58,749	67,138	64,816	68,767	71,973	74,569	75,816	75,578	75,344	75,114	0.00%	0.41%
Total for Region	**492,807**	**541,114**	**576,109**	**589,620**	**593,187**	**601,949**	**602,191**	**598,824**	**595,485**	**592,173**	**0.37%**	**0.12%**
Nueces River Basin	49,281	54,111	69,235	71,263	58,251	57,980	56,968	55,559	54,096	52,565	0.37%	-0.08%
Nueces-Rio Grande River Basin	349,893	384,191	395,152	402,556	415,125	421,497	422,087	420,696	419,389	418,192	0.37%	0.11%
San Antonio-Nueces River Basin	93,633	102,812	111,723	115,801	119,811	122,472	123,136	122,569	122,000	121,416	0.37%	0.25%
Total for Region	**492,807**	**541,114**	**576,109**	**589,620**	**593,187**	**601,949**	**602,191**	**598,824**	**595,485**	**592,173**	**0.37%**	**0.12%**
Total for Texas	**16,986,510**	**20,851,790**	**25,145,561**	**29,695,345**	**33,913,233**	**38,063,056**	**42,294,281**	**46,763,473**	**51,486,113**	**52,319,248**	**1.88%**	**0.95%**

[1] Historical data and projections from Texas Water Development Board.

[2] Compound annual growth rate.

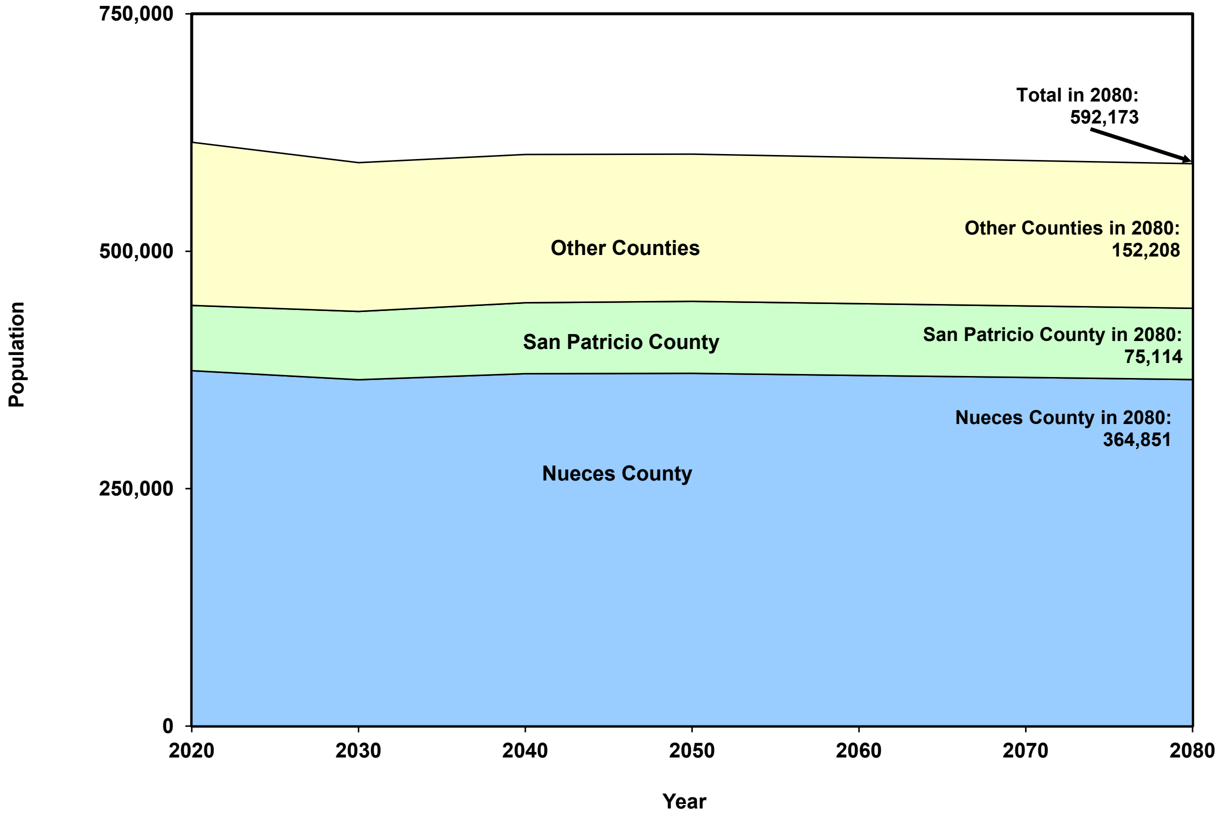

Figure 2.2.
Coastal Bend Region Population

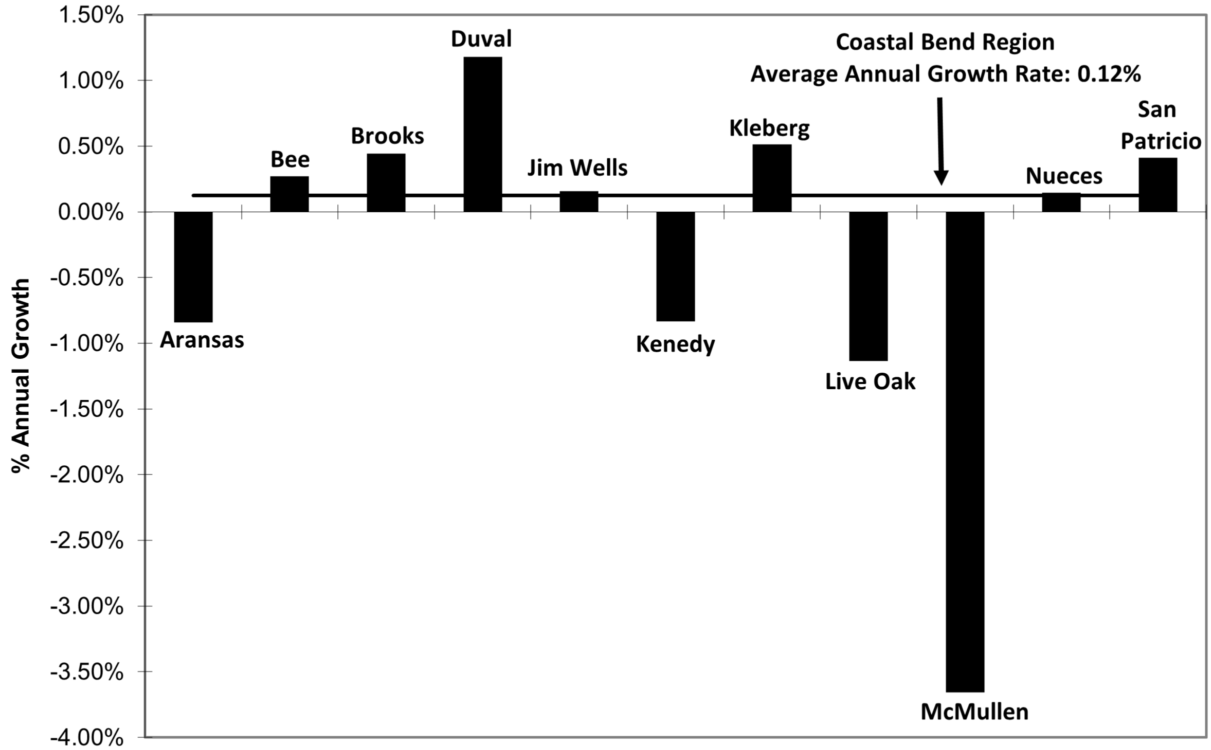

Figure 2.3.
Percent Annual Population Growth Rate for 2020 through 2080 by County

Corpus Christi and Kingsville are the two largest cities in the region, accounting for 58.7 percent of the total population in 2010, decreasing to 58.6 percent of the total in 2080. Population projections for the 46 cities, water supply corporations, and "County-Other" users in the region are shown in Table 2.2. County-Other category includes persons residing outside of cities and also outside water utility boundaries. Population for water user groups by county and river basin are included in Appendix A.

Table 2.2.
Coastal Bend Region Population (by City/County)

City/County	Historical[1]				Projections[1]						Percent Growth[2]	Percent Growth[2]
	1990	2000	2010	2020	2030	2040	2050	2060	2070	2080	1990-10	2020-80
ARANSAS PASS (P)	912	867	846	832	842	837	816	798	780	763	-1.15%	-4.10%
RINCON WSC	--	--	--	--	23	23	22	23	22	21	N/A	-8%
ROCKPORT	5,355	7,385	17,259	18,088	18,530	18,443	17,997	17,611	17,232	16,859	2.49%	-0.12%
COUNTY-OTHER, ARANSAS	10,862	12,692	5,041	4,898	5,020	4,996	4,873	4,763	4,657	4,553	1.16%	-0.37%
Aransas County	***17,892***	***22,497***	***23,146***	***23,818***	***24,415***	***24,299***	***23,708***	***23,195***	***22,691***	***22,196***	***1.30%***	***-0.84%***
BEEVILLE	13,547	13,129	13,538	13,086	13,233	13,852	14,552	15,394	16,317	17,333	-0.26%	0.47%
EL OSO WSC (P)	271	320	2,060	2,999	472	612	796	1,043	1,370	1,803	1.53%	-2.22%
COUNTY-OTHER, BEE	11,317	18,910	14,348	12,094	12,196	11,590	10,428	8,962	7,330	5,490	2.52%	4.57%
PETTUS MUD	--	--	562	496	451	480	512	551	593	640	N/A	0
SKIDMORE WSC	--	--	637	632	649	667	687	718	753	794	N/A	0
TDCJ CHASE FIELD	--	--	2,534	4,363	4,362	4,362	4,362	4,362	4,362	4,362	N/A	0
Bee County	***25,135***	***32,359***	**33,679**	**33,670**	***31,363***	***31,563***	***31,337***	***31,030***	***30,725***	***30,422***	***1.19%***	***0.27%***
FALFURRIAS	5,788	5,297	4,795	4,443	4,331	4,285	4,305	4,361	4,481	4,693	-0.75%	0.09%
COUNTY-OTHER, BROOKS	2,416	2,679	2,428	2,633	2,564	2,417	2,188	1,895	1,539	1,092	-0.37%	N/A
Brooks County	***8,204***	***7,976***	***7,223***	***7,076***	***6,895***	***6,702***	***6,493***	***6,256***	***6,020***	***5,785***	***-0.63%***	***0.44%***
FREER WCID	3,271	3,241	2,844	2,417	2,254	2,125	2,007	1,901	1,790	1,671	-0.74%	-0.61%
SAN DIEGO (P)	4,109	3,928	4,057	3,733	3,748	3,746	3,732	3,733	3,803	3,974	-0.68%	N/A
COUNTY-OTHER, DUVAL	5,538	5,951	3,120	2,222	2,074	1,838	1,642	1,474	1,248	934	-0.15%	N/A
DUVAL COUNTY CRD	--	--	1,629	1,271	1,185	1,119	1,055	1,000	941	879	N/A	-1%
Duval County	***12,918***	***13,120***	***11,650***	***9,643***	***9,261***	***8,828***	***8,436***	***8,108***	***7,782***	***7,458***	***-0.46%***	***1.18%***
ALICE	19,788	19,010	22,191	20,651	20,549	21,799	22,830	24,021	25,441	27,158	-0.18%	0.46%
ORANGE GROVE	1,175	1,288	1,560	1,443	1,434	1,399	1,369	1,345	1,331	1,327	0.58%	-0.14%
PREMONT	2,914	2,772	2,510	2,330	2,318	2,272	2,231	2,201	2,186	2,189	-0.47%	-0.10%
SAN DIEGO MUD 1	874	825	1,018	936	743	767	792	824	861	907	0.15%	-2.69%

City/County	Historical[1]				Projections[1]						Percent Growth[2]	Percent Growth[2]
	1990	2000	2010	2020	2030	2040	2050	2060	2070	2080	1990-10	2020-80
COUNTY-OTHER, JIM WELLS	12,928	15,431	11,917	12,041	11,979	10,496	8,683	6,361	3,776	849	1.34%	1.44%
JIM WELLS COUNTY FWSD 1	--	--	1,774	1,678	1,669	1,667	1,668	1,678	1,699	1,734	N/A	0%
Jim Wells County	***37,679***	***39,326***	***40,970***	***39,079***	***38,692***	***38,400***	***37,573***	***36,430***	***35,294***	***34,164***	***0.40%***	***0.16%***
COUNTY-OTHER, KENEDY	460	414	416	350	336	306	283	266	249	232	-0.50%	-0.83%
Kenedy County	***460***	***414***	***416***	***350***	***336***	***306***	***283***	***266***	***249***	***232***	***-0.50%***	***-0.83%***
KINGSVILLE	25,276	25,575	26,189	25,307	27,641	28,437	29,380	30,760	32,131	33,494	0.18%	0.47%
RICARDO WSC	1,503	2,301	3,156	3,030	3,321	3,417	3,537	3,710	3,880	4,052	2.84%	0.49%
BAFFIN BAY WSC	--	--	689	735	806	830	859	900	943	983	N/A	0.49%
NAVAL AIR STATION KINGSVILLE	--	--	57	52	55	57	59	61	63	64	N/A	0.35%
COUNTY-OTHER, KLEBERG	3,495	3,673	1,152	1,158	1,269	1,304	1,347	1,413	1,477	1,544	-0.41%	2.27%
RIVIERA WATER SYSTEM	--	--	818	758	831	856	886	928	972	1,014	N/A	0.49%
Kleberg County	***30,274***	***31,549***	***32,061***	***31,040***	***33,923***	***34,901***	***36,068***	***37,772***	***39,466***	***41,151***	***0.29%***	***0.51%***
EL OSO WSC (P)	*812*	*1,000*	2,694	3,923	758	827	827	827	827	827	-1.09%	-3.48%
GEORGE WEST	2,586	2,524	2,148	1,888	1,707	1,550	1,426	1,311	1,206	1,111	-0.28%	-0.88%
MCCOY WSC (P)	185	443	7,522	7,803	53	42	33	26	20	16	-0.45%	-9.80%
OLD MARBACH SCHOOL WSC	--	--	642	607	587	560	539	531	522	513	N/A	-0.28%
THREE RIVERS	1,889	1,878	1,848	1,735	2,624	2,577	2,565	2,550	2,537	2,527	-0.11%	-0.15%
COUNTY-OTHER, LIVE OAK	4,084	6,464	5,390	5,495	5,364	5,184	5,109	5,228	5,335	5,427	2.29%	3.49%
Live Oak County	***9,556***	***12,309***	***20,244***	***21,451***	***11,093***	***10,740***	***10,499***	***10,473***	***10,447***	***10,421***	***0.94%***	***-1.14%***
THREE RIVERS	--	--	1,093	1,026	*72*	*73*	*67*	*61*	*56*	*51*	*N/A*	*-6.44%*
COUNTY-OTHER, MCMULLEN	817	851	588	522	474	438	426	394	361	328	-0.72%	-1.43%
McMullen County	***817***	***851***	***1,681***	***1,548***	***546***	***511***	***493***	***455***	***417***	***379***	***-0.72%***	***-3.66%***
BISHOP	3,337	3,305	3,332	3,160	3,265	3,323	3,326	3,305	3,282	3,261	-0.31%	0.05%
CORPUS CHRISTI	257,453	277,450	294,154	303,472	313,373	318,911	319,214	317,292	315,382	313,482	0.85%	0.05%
CORPUS CHRISTI NAVAL AIR STATION	--	--	1,289	1,320	1,360	1,384	1,385	1,380	1,374	1,368	N/A	0.06%

City/County	Historical[1]				Projections[1]						Percent Growth[2]	Percent Growth[2]
	1990	2000	2010	2020	2030	2040	2050	2060	2070	2080	1990-10	2020-80
DRISCOLL	688	825	682	621	641	652	654	649	645	640	0.36%	0.05%
NUECES WSC	--	--	2,064	5,805	5,977	6,071	6,081	6,068	6,054	6,041	N/A	0.07%
RIVER ACRES WSC	2,130	2,750	1,829	1,952	2,017	2,052	2,054	2,042	2,028	2,014	0.64%	0.05%
COUNTY-OTHER, NUECES	27,515	29,245	16,406	20,080	20,738	21,107	21,126	20,992	20,865	20,737	-0.21%	4.85%
NUECES COUNTY WCID 3	--	--	14,082	11,486	11,864	12,076	12,086	12,009	11,933	11,857	N/A	0.05%
NUECES COUNTY WCID 4	--	--	3,597	2,631	2,717	2,766	2,769	2,752	2,733	2,715	N/A	0.05%
VIOLET WSC	--	--	2,788	2,651	2,738	2,788	2,790	2,772	2,754	2,736	N/A	0.05%
Nueces County	***291,123***	***313,575***	***340,223***	***353,178***	***364,690***	***371,130***	***371,485***	***369,261***	***367,050***	***364,851***	***0.78%***	***0.15%***
ARANSAS PASS (P)	6,246	7,201	8,721	8,584	8,585	8,591	8,611	8,671	8,729	8,787	0.90%	-0.12%
GREGORY	2,458	2,318	1,800	1,714	1,644	1,593	1,575	1,602	1,628	1,654	-1.26%	-0.06%
INGLESIDE	5,696	9,388	8,956	9,402	9,741	10,019	10,156	10,146	10,135	10,125	2.53%	0.12%
MATHIS	5,423	5,034	4,958	4,333	3,819	3,431	3,274	3,414	3,553	3,690	-0.46%	-0.27%
ODEM	2,366	2,499	3,132	3,055	2,984	2,934	2,919	2,955	2,990	3,026	0.05%	-0.02%
PORTLAND	12,224	14,827	15,099	17,910	22,106	23,940	25,926	28,076	30,405	32,927	1.06%	1.02%
RINCON WSC	--	--	3,333	3,698	3,939	4,149	4,246	4,213	4,180	4,149	N/A	0.19%
SINTON	5,549	5,676	4,998	4,812	4,689	4,602	4,575	4,634	4,692	4,749	0.10%	-0.02%
TAFT	3,222	3,396	2,742	2,549	2,422	2,327	2,293	2,338	2,382	2,425	-0.28%	-0.08%
COUNTY-OTHER, SAN PATRICIO	15,565	16,799	11,077	12,710	12,044	12,983	12,241	9,529	6,650	3,582	-1.43%	1.12%
San Patricio County	***58,749***	***67,138***	***64,816***	***68,767***	***71,973***	***74,569***	***75,816***	***75,578***	***75,344***	***75,114***	***0.49%***	***0.41%***
Total For Region	**492,807**	**541,114**	**576,109**	**589,620**	**593,187**	**601,949**	**602,191**	**598,824**	**595,485**	**592,173**	**0.68%**	**0.12%**

Notes: (P) Partial

1 Historical Data and Projections from Texas Water Development Board

2 Compound annual growth rate

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, 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 decrease by 2,689 acre-feet per year (ac-ft/yr) between 2030 and 2080, from 253,498 ac-ft/yr to 250,809 ac-ft/yr, a 1.06 percent drop. Municipal and mining are projected to increase until 2050 and 2060, respectively, and then decline. Manufacturing is projected to increase, while steam-electric, irrigation, and livestock water use are all projected to remain constant from 2030 to 2080. The trend in projected total water use for the region is shown in Figure 2.4. In 2020, 51.3 percent of the total water use was for municipal purposes, 31.9 percent for manufacturing, 1.8 percent for steam-electric water, 3.1 percent for mining, 8.9 percent for irrigation, and 3.0 percent for livestock. In 2080, municipal use as a percentage of the total is projected to decrease to 43.2 percent, manufacturing use to increase to 47 percent, steam-electric water use to increase to 1.9 percent, mining use to decrease to 0.4 percent, irrigation water use to decrease to 5.5 percent, and livestock use to decrease to 2 percent. Municipal water demand projections include water conservation attributed to updated plumbing code savings. These components of total water use for 2020 and 2080 are shown in Figure 2.5.

Table 2.3.
Coastal Bend Region Total Water Demand by Type of Use and River Basin (ac-ft/yr)

Water Use	Historical[1]			Projections[2]					
	2000	2010	2020	2030	2040	2050	2060	2070	2080
Municipal	98,573	90,620	83,775	107,817	109,080	109,273	108,888	108,541	108,259
Manufacturing	54,481	44,820	52,056	115,120	115,273	115,432	115,596	115,877	117,923
Steam-Electric	8,799	388	2,865	4,777	4,777	4,777	4,777	4,777	4,777
Mining	12,397	5,255	5,045	6,960	7,001	7,026	7,045	7,058	1,026
Irrigation	21,971	18,398	14,501	13,861	13,861	13,861	13,861	13,861	13,861
Livestock	8,838	7,073	4,832	4,963	4,963	4,963	4,963	4,963	4,963
Total for Region	**205,059**	**166,554**	**163,074**	**253,498**	**254,955**	**255,332**	**255,130**	**255,077**	**250,809**
Nueces River Basin	38,217	36,642	35,876	58,538	58,639	58,637	58,563	58,483	52,389
Nueces-Rio Grande River Basin	136,744	94,936	92,952	136,638	137,638	137,843	137,675	137,645	139,316
San Antonio-Nueces River Basin	30,098	34,976	34,246	58,322	58,678	58,852	58,892	58,949	59,104
Total for Region	**205,059**	**166,554**	**163,074**	**253,498**	**254,955**	**255,332**	**255,130**	**255,077**	**250,809**

[1] Historical Data from Texas Water Development Board Water Use Survey Historical Summary Estimates

[2] Projections from Texas Water Development Board

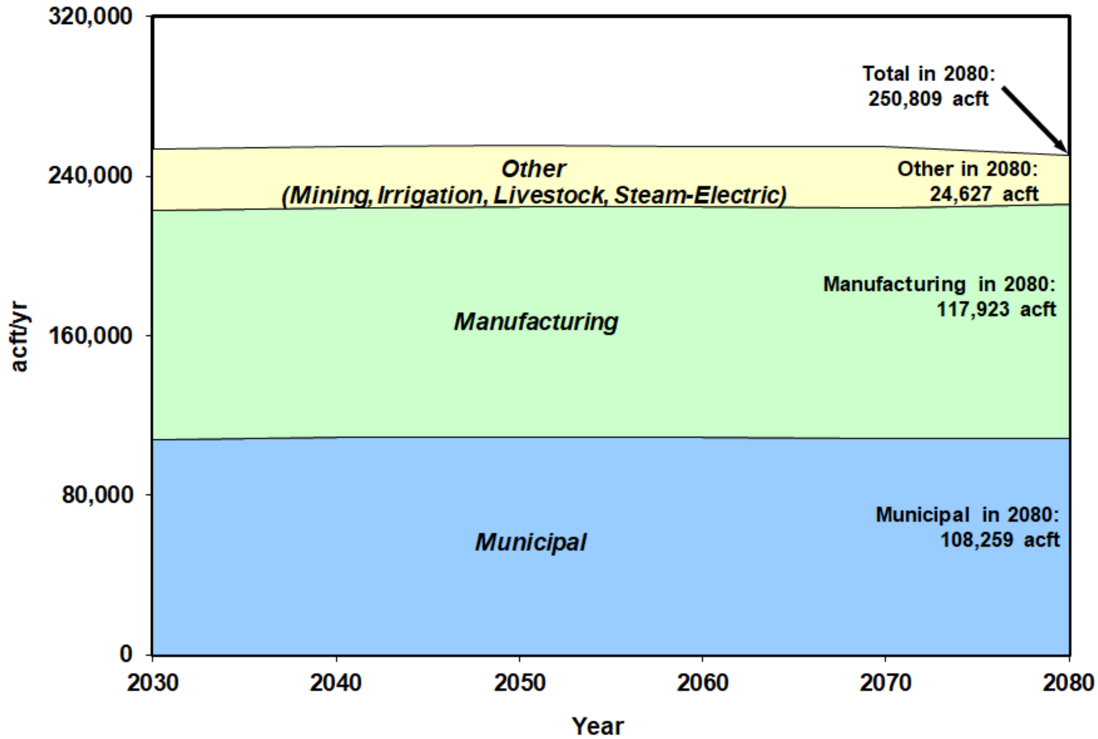

Figure 2.4.
Coastal Bend Region Water Demand

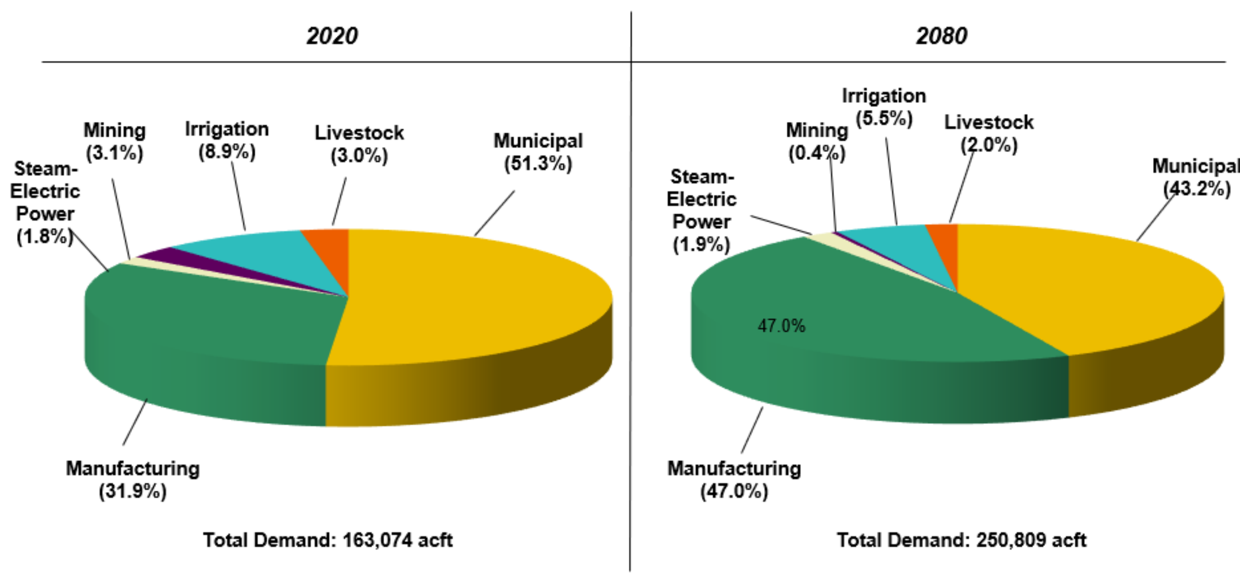

Figure 2.5.
Total Water Demand by Type of Use

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 accounts for current plumbing fixtures as well as water savings due to plumbing fixture requirements identified in the Texas Health and Safety Code, Chapter 372. Any additional changes in plumbing fixtures to promote more aggressive water savings beyond those realized in the Texas Health and Safety Code, would be expected to reduce projected water demands. The projected per capita water use is an "expected" scenario of water conservation, including installation of water-efficient plumbing fixtures as defined by the 1991 State Water-Efficient Plumbing Act. In all cases, applying this conservation scenario to the per capita use results in a declining per capita water use over time.

In 2020, total reported municipal use in the Coastal Bend Region was 83,775 ac-ft/yr[1]. Nueces and San Patricio counties accounted for 68.1 percent of the total. Municipal use is projected to increase 29.2 percent to 108,259 ac-ft by year 2080 (Table 2.4). Bee, Jim Wells, Kenedy, Kleberg, and Nueces counties see increases, at 3.6, 0.2, 39.1, 42.2, and 68.9 percent, respectively. Aransas, Brooks, Duval, Live Oak, McMullen, and San Patricio counties see decreases of 7.2, 8.9, 28.6, 38.1, 72.1, and 28.4 percent, respectively. By 2080, Nueces and San Patricio counties will account for 75.3 percent of the total municipal water use in the region (Figure 2.6).

Generally, the increase in water use for the entities in the region is less than their respective increases in population (i.e., low flow plumbing fixtures). This is attributable to a declining per capita water use, which includes conservation built-in the TWDB demand projections. Per capita water use in Corpus Christi is projected to decline 8.5 percent, from 201 gallons per capita daily (gpcd) in 2019 to 167.5 gpcd in 2080. The average per capita water use of all municipal water user groups in the Coastal Bend Region was 159 gpcd in 2019, which is projected to decline to 156.3 gpcd in 2080 with conservation built-in the TWDB demand projections. Additional water conservation recommended by the CBRWPG for select municipal water user group entities is described in Section 5B.1. Municipal water use projections for the 57 entities in the region, including County- Other, are presented in Table 2.5.

[1] TWDB Water Use Survey, 2020.

Table 2.4.
Coastal Bend Region Municipal Water Demand by County (ac-ft/yr)

County	Historical			Projections[1]					
	2000	2010	2020	2030	2040	2050	2060	2070	2080
Aransas	3,314	4,182	3,824	3,914	3,882	3,788	3,706	3,625	3,547
Bee	4,220	6,062	6,047	6,007	6,070	6,107	6,148	6,201	6,267
Brooks	1,970	1,842	1,525	1,475	1,441	1,418	1,397	1,386	1,389
Duval	2,323	1,947	1,837	1,593	1,520	1,458	1,408	1,359	1,318
Jim Wells	8,562	7,257	6,516	6,829	6,824	6,764	6,668	6,589	6,531
Kenedy	46	109	87	175	160	148	139	130	121
Kleberg	5,415	4,033	4,255	5,021	5,144	5,316	5,564	5,809	6,049
Live Oak	1,990	1,649	2,437	1,631	1,575	1,538	1,528	1,516	1,508
McMullen	135	156	183	73	68	65	60	55	51
Nueces	61,725	53,581	41,746	70,750	71,714	71,782	71,359	70,933	70,508
San Patricio	8,873	9,802	15,318	10,349	10,682	10,889	10,911	10,938	10,970
Total for Region	**98,573**	**90,620**	**83,775**	**107,817**	**109,080**	**109,273**	**108,888**	**108,541**	**108,259**

[1] Projections from Texas Water Development Board

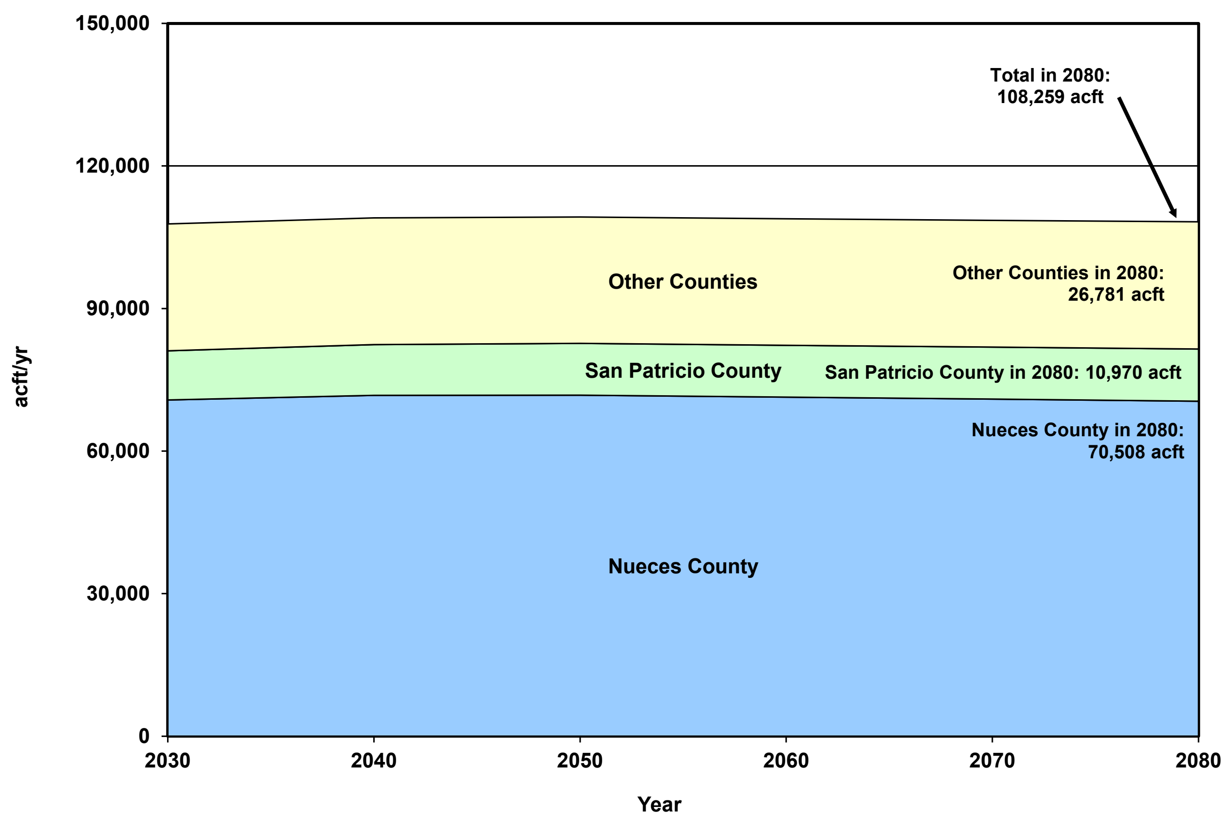

Figure 2.6.
Coastal Bend Region Municipal Water Demand

Table 2.5.
Coastal Bend Region Municipal Water Demand by City/County (ac-ft/yr)

City/County	Historical			Projections[1]					
	2000	2010	2020	2030	2040	2050	2060	2070	2080
Aransas Pass (P)	146	413	377	116	115	112	110	107	105
Rincon WSC	--		--	2	2	2	2	2	2
Rockport	1,357	3,178	2,906	3,266	3,240	3,162	3,094	3,027	2,962
County-Other	1,811	591	541	530	525	512	500	489	478
Aransas County	**3,314**	**4,182**	**3,824**	**3,914**	**3,882**	**3,788**	**3,706**	**3,625**	**3,547**
Beeville	2,529	3,457	3,448	2,805	2,927	3,075	3,253	3,448	3,663
El Oso (P)	60	85	85	94	122	159	208	273	359
County-Other	1,631	1,426	1,422	1,645	1,556	1,400	1,203	984	737
Pettus Mud	--	98	98	65	68	73	79	85	91
Skidmore WSC	--	95	95	103	105	108	113	119	125
TDCJ Chase Field	--	901	899	1,295	1,292	1,292	1,292	1,292	1,292
Bee County	**4,220**	**6,062**	**6,047**	**6,007**	**6,070**	**6,107**	**6,148**	**6,201**	**6,267**
Falfurrias	1,661	1,464	1,212	1,162	1,147	1,152	1,167	1,199	1,256
County-Other	309	378	313	313	294	266	230	187	133
Brooks County	**1,970**	**1,842**	**1,525**	**1,475**	**1,441**	**1,418**	**1,397**	**1,386**	**1,389**
Freer WCID	624	572	540	501	470	444	421	396	370
San Diego MUD 1	471	770	727	678	675	672	673	685	716
County-Other	1,228	393	371	253	223	199	179	151	113
Duval County CRD	--	211	199	161	152	143	135	127	119
Duval County	**2,323**	**1,947**	**1,837**	**1,593**	**1,520**	**1,458**	**1,408**	**1,359**	**1,318**
Alice	5,281	4,209	3,779	4,009	4,235	4,436	4,667	4,943	5,276
Orange Grove	353	331	297	364	354	347	341	337	336
Premont	807	512	460	554	541	532	524	521	522
San Diego (P)	99	242	217	134	138	143	148	155	163
Jim Wells County FWSD1	--	277	249	112	112	112	113	114	117
County-Other	2,022	1,686	1,514	1,656	1,444	1,194	875	519	117
Jim Wells County	**8,562**	**7,257**	**6,516**	**6,829**	**6,824**	**6,764**	**6,668**	**6,589**	**6,531**
County-Other	46	109	87	175	160	148	139	130	121
Kenedy County	**46**	**109**	**87**	**175**	**160**	**148**	**139**	**130**	**121**
Kingsville	4,440	3,033	3,200	3,907	4,002	4,135	4,329	4,522	4,714
Ricardo WSC	296	319	337	385	394	408	428	447	467
County-Other	679	436	460	208	212	219	230	240	251
Baffin Bay WSC	--	138	146	129	132	136	143	150	156
Naval Air Station Kingsville	--	106	112	264	273	282	292	301	306
Riviera Water System	--	0	0	128	131	136	142	149	155
Kleberg County	**5,415**	**4,033**	**4,255**	**5,021**	**5,144**	**5,316**	**5,564**	**5,809**	**6,049**
El Oso WSC (P)	189	93	137	152	165	165	165	165	165
George West	642	365	540	304	275	253	233	214	197
McCoy WSC	50	48	71	6	5	4	3	2	2
Old Marbach School WSC	--	62	91	86	82	79	78	76	75
Three Rivers	425	316	325	444	434	432	430	427	426

City/County	Historical			Projections[1]					
	2000	2010	2020	2030	2040	2050	2060	2070	2080
County-Other	684	765	1,273	639	614	605	619	632	643
Live Oak County	**1,990**	**1,649**	**2,437**	**1,631**	**1,575**	**1,538**	**1,528**	**1,516**	**1,508**
Three Rivers	--	--	--	12	12	11	10	9	9
County-Other	135	156	183	61	56	54	50	46	42
McMullen County	**135**	**156**	**183**	**73**	**68**	**65**	**60**	**55**	**51**
Bishop	459	467	364	550	558	558	555	551	547
Corpus Christi	55,629	40,514	31,565	59,084	59,885	59,942	59,581	59,223	58,866
Driscoll	97	96	75	80	81	81	81	80	80
Nueces WSC		685	534	986	997	999	997	994	992
River Acres WSC [2]	314	442	344	315	319	320	318	316	313
County-Other	5,214	3,347	2,608	2,607	2,639	2,641	2,625	2,609	2,593
Corpus Christi Naval Air Station	--	675	526	2,078	2,111	2,112	2,105	2,096	2,086
Nueces County WCID 3[2]	--	4,460	3,475	3,452	3,504	3,507	3,485	3,463	3,441
Nueces County WCID 4	--	2,648	2,063	1,370	1,391	1,392	1,384	1,374	1,365
Violet WSC	--	246	192	228	229	230	228	227	225
Nueces County	**61,725**	**53,581**	**41,746**	**70,750**	**71,714**	**71,782**	**71,359**	**70,933**	**70,508**
Aransas Pass (P)	1,210	724	1,132	1,185	1,180	1,183	1,191	1,199	1,207
Gregory	249	176	275	270	260	257	262	266	270
Ingleside	873	582	910	986	1,008	1,022	1,021	1,020	1,019
Mathis	671	534	835	469	419	400	417	434	451
Odem	319	276	431	432	423	421	426	431	437
Portland	1,976	1,503	2,349	3,555	3,837	4,155	4,500	4,873	5,277
Rincon WSC	--	351	549	378	396	405	402	399	396
Sinton	1,036	825	1,289	1,073	1,051	1,045	1,058	1,071	1,084
Taft	559	317	495	337	323	318	324	330	336
County-Other	1,980	4,513	7,053	1,664	1,785	1,683	1,310	915	493
San Patricio County	**8,873**	**9,802**	**15,318**	**10,349**	**10,682**	**10,889**	**10,911**	**10,938**	**10,970**
Total for Region	**98,573**	**90,620**	**83,775**	**107,817**	**109,080**	**109,273**	**108,888**	**108,541**	**108,259**

Note: (P) Partial

[1] Projections from Texas Water Development Board

[2] These entities rely on supplies delivered by Nueces County WCID 3. Nueces County WCID 3 diverts water from the Lower Nueces River and conveys supplies through an unlined canal. By lining the canals, the amount of water necessary for diversion by Nueces County WCID 3 to meet customer needs could be reduced.

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. According to TWDB studies, over the past two decades, industrial water use in Texas has declined by 60 percent at the same time that output product has nearly doubled. 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.

Petroleum refining is one of the largest industries in the region, accounting for about 60 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 improvement programs. These refineries use between 35 and 46 gallons of water per barrel of crude petroleum refined, compared to the State average of 100 gallons per barrel refined.[2]

The TWDB provided draft manufacturing water demand projections to the Coastal Bend Region in January 2022. The TWDB projected manufacturing water demand for years 2030 through 2080 is based on the highest region-county manufacturing water use in 5 years of aggregated data (2015 to 2019) for manufacturing water users from the annual water use survey. In 2020, total manufacturing water use for Coastal Bend Region was 52,056 acre-feet (ac-ft). Nueces and San Patricio counties accounted for 93.7 percent of this total (Table 2.6).

The Coastal Bend Region non-municipal subcommittee met to review TWDB water demand projections for manufacturing, irrigation, mining, steam electric, and livestock users through Year 2080 and prepared a recommendation for the Coastal Bend Region's consideration at the January 26, 2023 meeting. At that meeting, the Coastal Bend Region requested additional information from water providers and local stakeholders for consideration at the May 18, 2023, meeting.

At the January 26, 2023, meeting, the CBRWPG adopted the Coastal Bend Region non-municipal subcommittee input to reduce McMullen County manufacturing to 2018 use for Year 2030 and remain constant through Year 2080. The CBRWPG also considered proposed increases for Nueces County. Given that about 95 percent of the Coastal Bend Region manufacturing demand occurs in Nueces and San Patricio counties, and both counties anticipate substantial growth in the future, the CBRWPG requested additional outreach, thereby deferring action on Nueces and San Patricio county manufacturing water demand projections to the May 18, 2023 meeting.

Manufacturing water users in Nueces and San Patricio counties are predominantly served by the City of Corpus Christi and San Patricio Municipal Water SPMWD (SPMWD). Although not a current water provider, the Port of Corpus Christi is tracking industrial growth in the area.

HDR received feedback from the City of Corpus Christi and SPMWD on February 27, 2023, and the Port of Corpus Christi on April 26, 2023, on manufacturing projections. HDR met with City of Corpus Christi and SPMWD representatives on February 27, 2023, to discuss TWDB draft manufacturing water demand projections. The City of Corpus Christi provided information that showed Nueces County's manufacturing water use was 35,290 ac-ft in 2022. Based on information provided by the SPMWD, San Patricio County's manufacturing water use was

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

25,902 ac-ft in 2022, which corresponds to an annual increase of about 16 percent since 2019. The following input was provided:

- Nueces County Manufacturing – The City of Corpus Christi recommended increasing Nueces County projections to match those from the 2021 Plan for Years 2030-2060 and no changes to TWDB draft projections for 2070-2080.
- San Patricio County Manufacturing – The SPMWD recommended alternative San Patricio County manufacturing projections of 56,986 ac-ft/yr in 2030, equal to SPMWD's contracted supplies with manufacturers in 2022. For subsequent decades, a 0.5 percent annual increase was projected which resulted in an estimate of 59,835 ac-ft/yr in 2040 increasing to 72,730 ac-ft/yr in 2080.
- The Port of Corpus Christi projected significantly higher water demands for Nueces County – manufacturing and provided a demand range from 8,775 to 12,872 ac-ft/yr in 2030 and to remain constant through 2050.
- The Port of Corpus Christi projected demands for San Patricio County – manufacturing, to range from 35,394 to 41,559 ac-ft/yr in 2030 increasing to range from 61,290 to 136,084 ac-ft/yr by 2040.

On May 18, 2023, the CBRWPG considered the above alternate manufacturing water demand projections and adopted the alternative projections from the City of Corpus Christi and SPMWD with an understanding that recommended water management strategies would be assigned to show an over-allocation of calculated needs to account for the Port of Corpus Christi projections and the range of possibilities in future manufacturing water demands as driven by market forces and technology improvements that make industrial growth in the Coastal Bend Region difficult to predict. The Coastal Bend Region provided the official revision request to the TWDB on July 12, 2023.

The TWDB considered the CBRWPG's alternate projections and issued a recommendation for the TWDB Board consideration on October 20, 2023, of manufacturing demands that were different than those adopted by the Coastal Bend Region. While it was noted that the TWDB manufacturing demands for San Patricio County were higher for 2030-2040 than the Coastal Bend Region's alternate projections but lower for 2050-2080, the TWDB Board ultimately adopted their staff recommendations on November 9, 2023, which were 11,998 ac-ft lower than the Coastal Bend Region requested revision for San Patricio County's 2080 projection. Manufacturing use was 52,056 ac-ft in 2020 and is projected to be 117,923 ac-ft in 2080, a 126.5 percent increase. In 2080, Nueces and San Patricio counties are projected to account for 96 percent of the total manufacturing water use in the region (Figure 2.7).

Table 2.6.
Coastal Bend Region Manufacturing Water Demand by County and River Basin (ac-ft/yr)

County	Historical*			Projections[1]					
	2000	2010	2020	2030	2040	2050	2060	2070	2080
Aransas	235	0	0	0	0	0	0	0	0
Bee	1	0	0	0	0	0	0	0	0
Brooks	0	0	0	0	0	0	0	0	0
Duval	0	0	0	0	0	0	0	0	0
Jim Wells	0	79	1	87	90	93	96	100	104
Kenedy	0	0	0	0	0	0	0	0	0
Kleberg	0	1,275	1,045	1,088	1,128	1,170	1,213	1,258	1,305
Live Oak	1,767	2,124	2,198	2,843	2,948	3,057	3,170	3,287	3,409
McMullen	0	219	5	34	34	34	34	34	34
Nueces	39,763	33,517	36,590	50,363	50,363	50,363	50,363	50,472	52,339
San Patricio	12,715	7,606	12,217	60,705	60,710	60,715	60,720	60,726	60,732
Total for Region	**54,481**	**44,820**	**52,056**	**115,120**	**115,273**	**115,432**	**115,596**	**115,877**	**117,923**

Note: *Self-reported use
[1] Projections from Texas Water Development Board

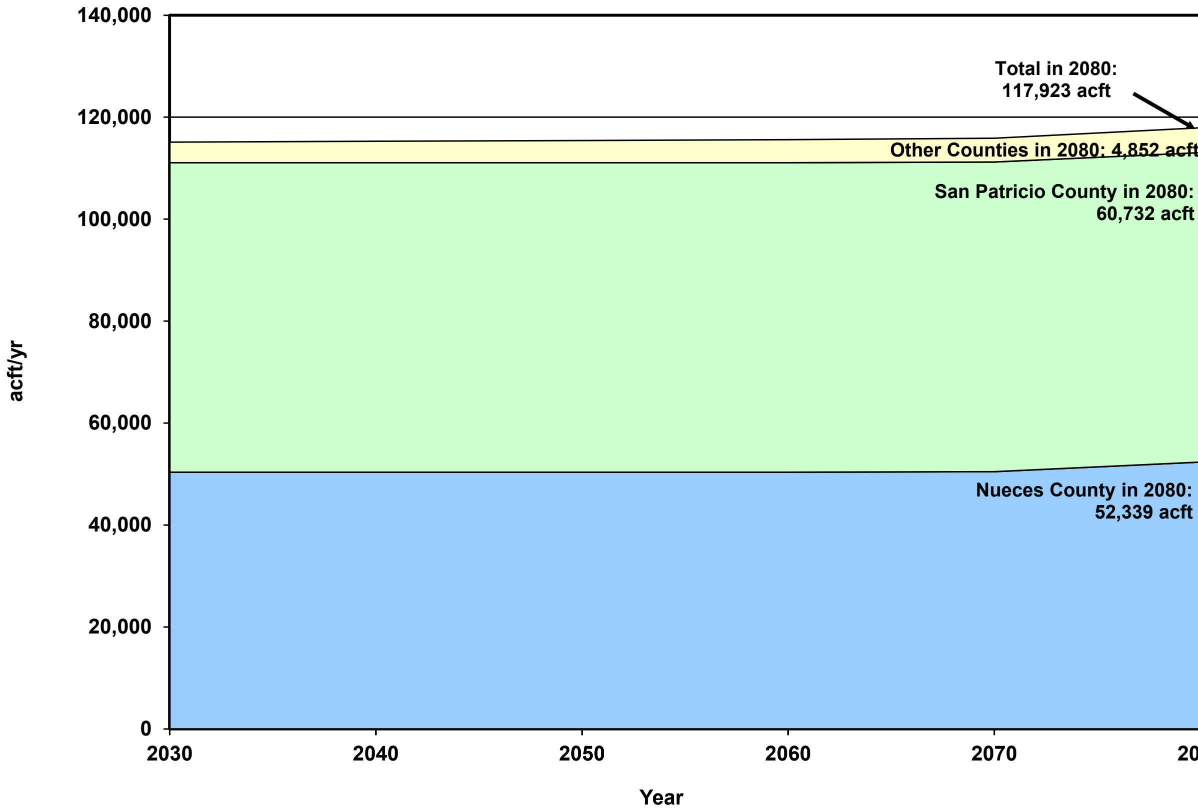

Figure 2.7.
Coastal Bend Region Manufacturing Water Demand

2.3.3 Steam-Electric Water Demand

The TWDB provided draft steam-electric water demand projections to the Coastal Bend Region in January 2022. The draft steam-electric power water demand projections for each region-county were developed based upon:

1. The highest single-year county water use from within the most recent 5 years of data for steam-electric power water users from the annual water use survey (WUS),
2. Near-term additions and retirements of generating facilities, and
3. Holding the projected water demand volume constant through 2080.

Only two Coastal Bend Region counties report steam-electric water demands, Nueces and San Patricio counties. Projections for steam-electric power water demand are based on power generation projections—determined by population and manufacturing growth—and on generating capacity and 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 Nueces Bay Power Station is not currently operating. The use of saltwater for cooling at Topaz (formerly AEP-CPL's) Barney Davis Power Station saves approximately 6,300 ac-ft/yr in freshwater (1999 figures). At the third plant, Lon C. Hill, fresh water is used for the boiler feed and cooling. Table 2.7 shows that in 2020, 2,865 ac-ft/yr of water was used.

At the January 26, 2023, meeting, the CBRWPG considered subcommittee input and requested additional outreach and deferring action on steam-electric water demand projections to the May 18 meeting. HDR received feedback from the City of Corpus Christi and SPMWD on February 27, 2023, on steam-electric projections. With projected steam electric growth, the SPMWD recommended a revised 2030 water demand projection to 6,161 ac-ft, equal to current contracts as of 2022. The SPMWD suggested the water demand remain constant at 6,161 ac-ft for 2040 through 2080. No changes were recommended for Nueces County.

On May 18, 2023, the CBRWPG considered the alternate steam-electric water demand projection and approved. After discussion with the TWDB, it was determined that some of this demand was more appropriately categorized as manufacturing in alignment with TWDB methods. The TWDB considered the CBRWPG's alternate projections and issued a recommendation for TWDB Board consideration on October 20, 2023, of steam-electric demands. The TWDB Board adopted their staff recommendations at the end of 2023.

The TWDB adopted steam-electric water demands for the 2026 regional water plan are provided in Table 2.7, which shows a constant demand of 2,201 ac-ft/yr and 2,576 ac-ft/yr from 2030 to 2080 for Nueces and San Patricio counties, respectively. In 2080, steam-electric demands for freshwater are projected to be 4,777 ac-ft/yr (Figure 2.8).

Table 2.7.
Coastal Bend Region Steam-Electric Water Demand by County and River Basin (ac-ft/yr)

County	Historical*			Projections[1]					
	2000	2010	2020	2030	2040	2050	2060	2070	2080
Aransas	0	0	0	0	0	0	0	0	0
Bee	0	0	0	0	0	0	0	0	0
Brooks	0	0	0	0	0	0	0	0	0
Duval	0	0	0	0	0	0	0	0	0
Jim Wells	0	0	0	0	0	0	0	0	0
Kenedy	0	0	0	0	0	0	0	0	0
Kleberg	0	0	0	0	0	0	0	0	0
Live Oak	0	0	0	0	0	0	0	0	0
McMullen	0	0	0	0	0	0	0	0	0
Nueces	8,799	388	2,213	2,201	2,201	2,201	2,201	2,201	2,201
San Patricio	0	0	652	2,576	2,576	2,576	2,576	2,576	2,576
Total for Region	**8,799**	**388**	**2865**	**4,777**	**4,777**	**4,777**	**4,777**	**4,777**	**4,777**

Note: * Self-reported use.
[1] Projections from Texas Water Development Board.

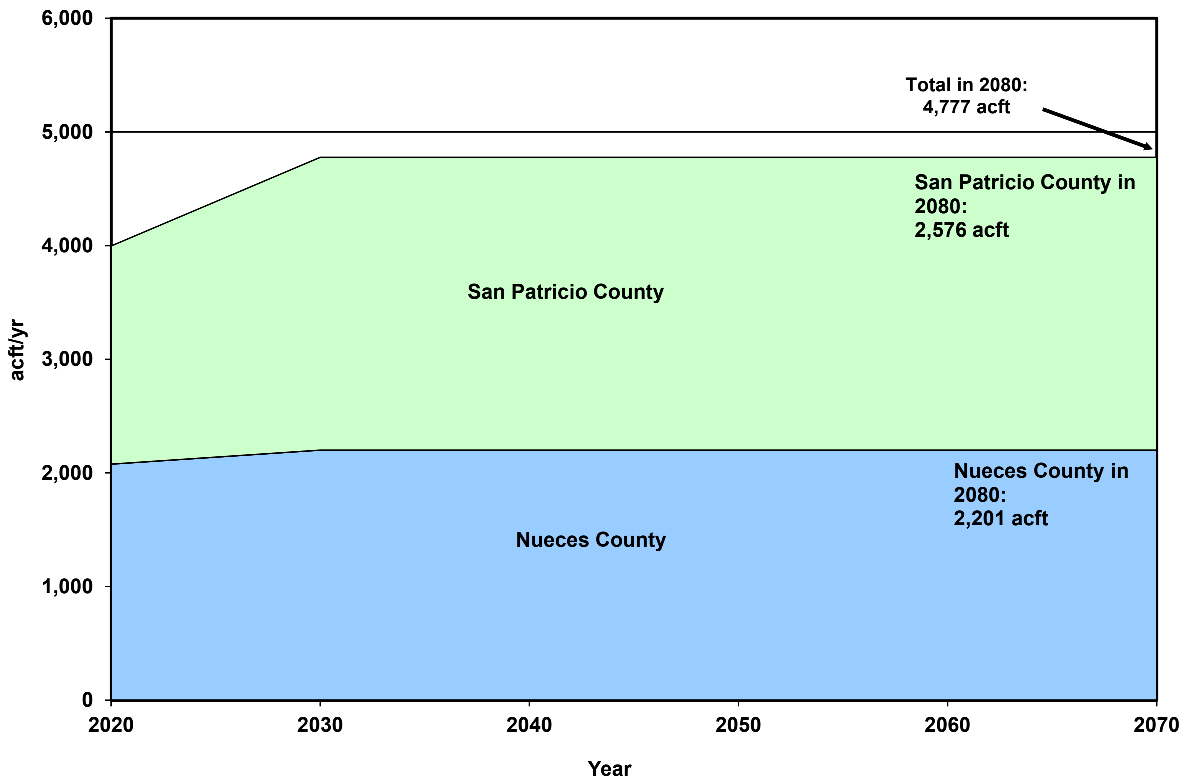

Figure 2.8.
Coastal Bend Region Steam-Electric Water Demand

2.3.4 Mining Water Demand

The TWDB provided draft mining water demand projections to the Coastal Bend Region in August 2022. On September 8, 2023, the Coastal Bend Region non-municipal subcommittee met to review TWDB water demand projections for mining users through Year 2080. During the virtual meeting, draft TWDB projections were discussed along with TWDB methodology that was used to estimate the future water demands. At the January 26, 2023, meeting, the CBRWPG considered subcommittee input and approved adoption of the TWDB's draft mining projections. The TWDB Board adopted their staff recommendations at the end of 2023.

The TWDB used 2010-2019 historical WUS data to inform the development of their draft mining projections. Additionally, 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.

The development of natural gas from the shale in the Eagleford Group is active in several counties in the Coastal Bend Region, especially Live Oak and McMullen counties. Water demands associated with these mining activities impact local groundwater use. The impacts of developing gas wells in the Eagleford shale and uranium mining activities on groundwater supplies in the Coastal Bend Region should continue to be considered in future planning efforts.

Table 2.8.
Coastal Bend Region Mining Water Demand by County and River Basin (ac-ft/yr)

County	Historical*			Projections[1]					
	2000	2010	2020	2030	2040	2050	2060	2070	2080
Aransas	81	19	0	0	0	0	0	0	0
Bee	29	384	3	239	239	239	239	239	0
Brooks	127	334	0	16	16	16	16	16	16
Duval	4,544	1,594	78	6	6	6	6	7	7
Jim Wells	347	49	0	0	0	0	0	0	0
Kenedy	1	82	12	3	3	3	3	3	3
Kleberg	2,627	558	12	10	10	10	10	10	10
Live Oak	3,105	118	618	1,264	1,264	1,264	1,264	1,264	2
McMullen	176	440	3,607	4,538	4,538	4,538	4,538	4,538	1
Nueces	1,275	1,369	715	796	835	858	876	887	893
San Patricio	85	308	0	88	90	92	93	94	94
Total for Region	**12,397**	**5,255**	**5,045**	**6,960**	**7,001**	**7,026**	**7,045**	**7,058**	**1,026**

Note: * Self-reported use.
[1] Projections from Texas Water Development Board

In 2010, for the 11 counties of the Coastal Bend Planning Area, 5,255 ac-ft was used in the mining of sand, gravel, production of crude oil, and possibly mineral/uranium exploration. 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, McMullen and Nueces counties accounted for 87.2 percent of the 2020 total use (Table 2.8). Mining water use in 2020 was 5,045 ac-ft and is projected to increase 40 percent to 7,058 ac-ft in 2070 before decreasing to 1,026 ac-ft in 2080. Nueces and San Patricio counties will account for 96 percent of the 2080 total use (Figure 2.9). The drop in projected demands is attributable to estimates of Eagleford activities slowing down after 2040; however, future trends are difficult to predict considering technology enhancements and energy market.

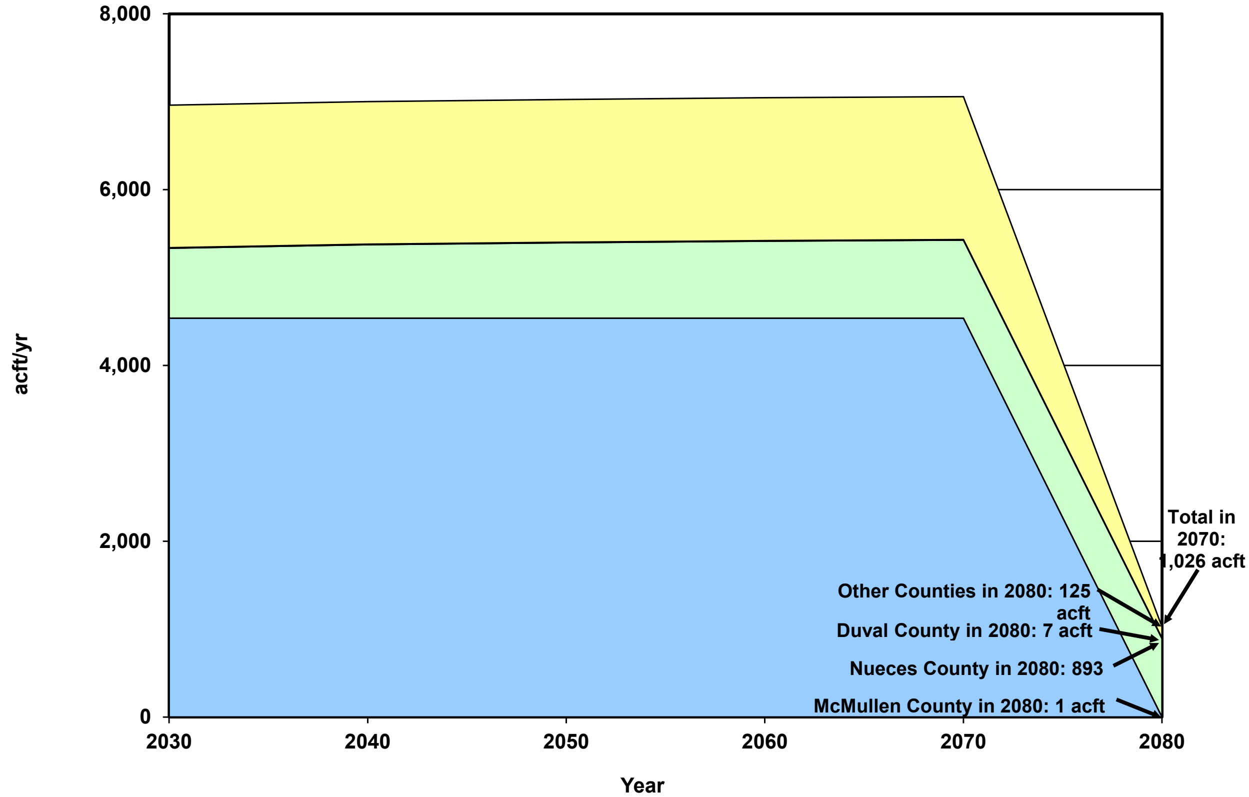

Figure 2.9.
Coastal Bend Region Mining Water Demand

2.3.5 Irrigation Water Demand

The TWDB provided draft irrigation water demand projections to the Coastal Bend Region in August 2022. The draft irrigation water demand projections are based upon the average of the most recent 5 years of water use estimates (2015 through 2019) for each region-county. The projections either held constant between 2030 and 2080 or, in counties where the total groundwater availability over the planning period is projected to be less than the groundwater-portion of the baseline water demand projections, the irrigation water demand projections are held constant for 10 years beyond the point that the groundwater availability falls below the baseline demand. In most cases, this is in 2030 to 2040, after projected demands will begin to decline, depending on and commensurate with the groundwater availability.

On September 8, 2023, a Coastal Bend Region non-municipal subcommittee met to review TWDB water demand projections for irrigation users through Year 2080. During the virtual meeting, draft TWDB projections were discussed along with TWDB methodology that was used to estimate the future water demands. At the January 26, 2023, meeting, the CBRWPG considered subcommittee input and approved adoption of the TWDB's draft irrigation projections. The TWDB Board adopted their staff recommendations at the end of 2023.

Irrigated crop production in Coastal Bend Region is projected in 9 of the 11 counties. Irrigation survey data provided by the TWDB reported 27,336 acres of irrigated farmland in 2010 for the

Coastal Bend Region, with over 99 percent irrigated with groundwater. In 2017, about 14,780 ac-ft of water was used to irrigate 26,210 acres in the region. Major crops include corn, cotton, sorghum, hay and vegetables.

The irrigation water demand projections are based on specific assumptions regarding crop prices, crop yields, agricultural policy, and technological advances in irrigation systems. The TWDB estimated 2020 total irrigated water use in the Coastal Bend Region at 14,501 ac-ft based on self-reported irrigation water use surveys (Table 2.9). Bee, Duval and San Patricio counties accounted for 68 percent of that total. Irrigated water use is projected to remain constant from 2030 to 2080 at 13,861 ac-ft (Figure 2.10). In Bee and Live Oak counties, most irrigation occurs in the southern portion of those counties in the more productive Evangeline layers of the Gulf Coast Aquifer.

Table 2.9.
Coastal Bend Region Irrigation Water Demand by County and River Basin (ac-ft/yr)

County	Historical*			Projections[1]					
	2000	2010	2020	2030	2040	2050	2060	2070	2080
Aransas	0	0	0	0	0	0	0	0	0
Bee	2,798	4,425	2,391	2,518	2,518	2,518	2,518	2,518	2,518
Brooks	25	803	807	597	597	597	597	597	597
Duval	4,524	1,642	2,638	2,016	2,016	2,016	2,016	2,016	2,016
Jim Wells	3,731	1,574	1,967	1,665	1,665	1,665	1,665	1,665	1,665
Kenedy	107	0	0	0	0	0	0	0	0
Kleberg	1,002	576	220	141	141	141	141	141	141
Live Oak	3,539	700	717	844	844	844	844	844	844
McMullen	0	0	120	24	24	24	24	24	24
Nueces	1,680	1,503	753	559	559	559	559	559	559
San Patricio	4,565	7,175	4,888	5,497	5,497	5,497	5,497	5,497	5,497
Total for Region	**21,971**	**18,398**	**14,501**	**13,861**	**13,861**	**13,861**	**13,861**	**13,861**	**13,861**

Note: * Self–reported use.
[1] Projections from Texas Water Development Board

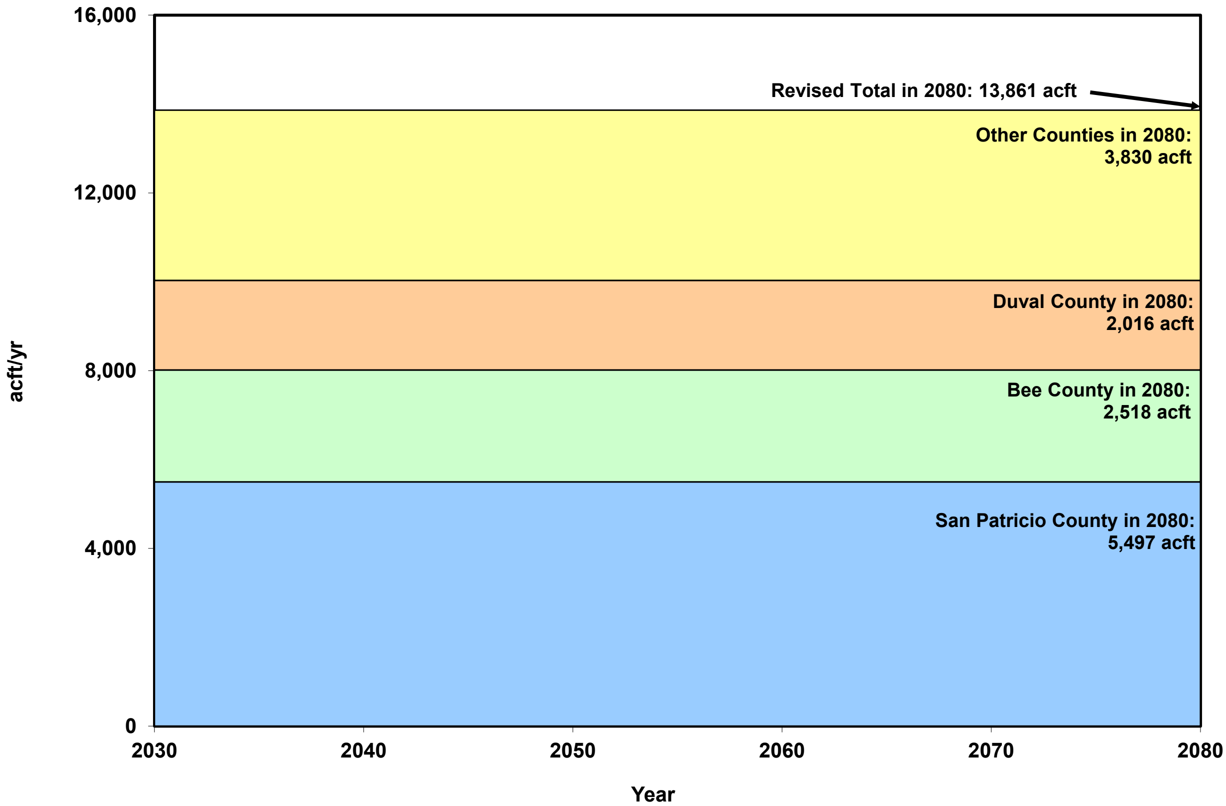

Figure 2.10.
Coastal Bend Region Irrigation Water Demand

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.

The TWDB provided draft livestock water demand projections to the Coastal Bend Region in January 2022. On September 8, 2023, the Coastal Bend Region non-municipal subcommittee met to review TWDB water demand projections for livestock users through Year 2080. During the virtual meeting, draft TWDB projections were discussed along with TWDB methodology that was used to estimate the future water demands. At the January 26, 2023, meeting, the CBRWPG considered subcommittee input and approved adoption of the TWDB's draft livestock projections. The TWDB Board adopted their staff recommendations at the end of 2023.

The livestock water demand projections are based on 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 2020, livestock water use for the Coastal Bend Region was reported as 4,832 ac-ft: 10.2 percent in Kleberg County, 13.3 percent in Kenedy County, 14.0 percent in Jim Wells County, 11.6 percent in Bee County, and 50.9 percent in the remaining counties. From 2030 to 2080, the TWDB projects water use for livestock to remain constant at 4,963 ac-ft (Table 2.10 and Figure 2.11).

Table 2.10.
Coastal Bend Region Livestock Water Demand by County and River Basin (ac-ft/yr)

County	Historical*			Projections[1]					
	2000	2010	2020	2030	2040	2050	2060	2070	2080
Aransas	23	63	52	52	52	52	52	52	52
Bee	995	1,147	560	568	568	568	568	568	568
Brooks	747	449	452	478	478	478	478	478	478
Duval	873	710	556	566	566	566	566	566	566
Jim Wells	1,064	1,122	675	711	711	711	711	711	711
Kenedy	901	840	643	631	631	631	631	631	631
Kleberg	1,900	726	494	532	532	532	532	532	532
Live Oak	833	779	633	651	651	651	651	651	651
McMullen	659	464	281	278	278	278	278	278	278
Nueces	279	324	196	218	218	218	218	218	218
San Patricio	564	449	290	278	278	278	278	278	278
Total for Region	**8,838**	**7,073**	**4,832**	**4,963**	**4,963**	**4,963**	**4,963**	**4,963**	**4,963**

Note: * Self-reported use.
[1] Projections from Texas Water Development Board

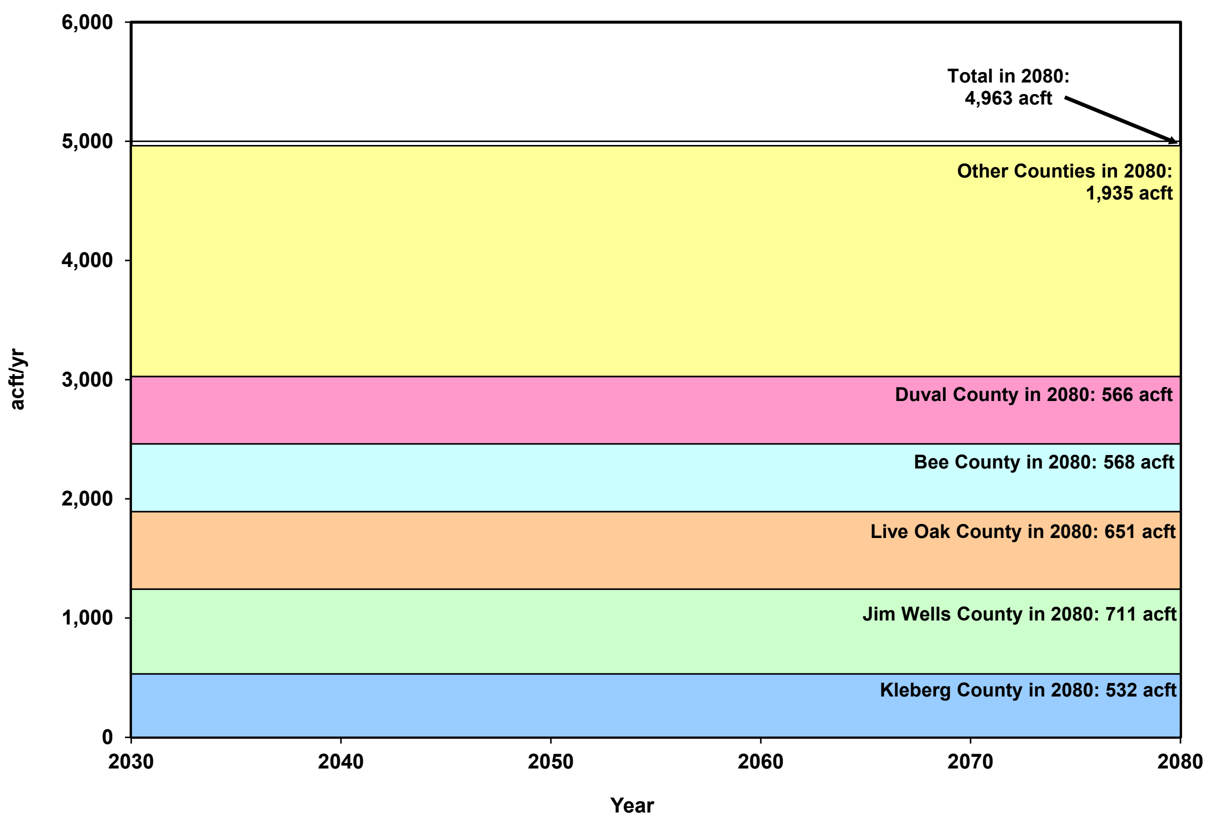

Figure 2.11.
Coastal Bend Region Livestock Water Demand

2.4 Water Demand Projections for Major Water Providers

There are four current regional wholesale water providers (WWPs) in the Coastal Bend Region: the City of Corpus Christi, SPMWD, South Texas Water Authority (STWA), and Nueces County Water Control and Improvement District #3 (WCID 3). The CBRWPG designated these four WWPs as major water providers (MWPs) on November 9, 2017. The City of Corpus Christi provides water to SPMWD and STWA, as shown in Table 2.11. The City of Corpus Christi is contracted to provide up to 83,800 ac-ft/yr to SPMWD (46,800 ac-ft/yr of raw water and 37,000 ac-ft/yr of treated water supplies after Year 2020) and meet demands of STWA and their customers. For the 2026 regional water plan, water supply constraints are considered based on system yield (raw water) or water treatment plant capacity (treated water), whichever is the most constraining. Accordingly, the water demands for each WWP and their customers are shown in Table 2.11 and are categorized according to raw or treated water demands for ease of comparison to supplies discussed in Chapters 3 and 4. The City of Corpus Christi and SPMWD provide both raw and treated water supplies to their customers. STWA solely provides treated water supplies to its customers. Nueces County WCID 3 provides treated water supplies to its customers. Two potential future WWP were identified for recommended water management strategies: the Port of Corpus Christi Authority (PCCA) and Poseidon Water. However, because they are not current MWPs, they are not included in the table.

Table 2.11.
Coastal Bend Region Water Demand Projections for Current Major Water Providers

Major Water Provider (Water User/County)	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
CITY OF CORPUS CHRISTI						
Raw Water Demand						
Municipal						
Jim Wells County						
City of Alice[1]	2,254	2,480	2,681	2,912	3,188	3,521
Bee County						
City of Beeville	1,550	1,672	1,820	1,998	2,193	2,408
San Patricio County						
City of Mathis	469	419	400	417	434	451
San Patricio MWD *(based on water supply contract)*	46,800	46,800	46,800	46,800	46,800	46,800
Live Oak County						
City of Three Rivers	3,363	3,363	3,363	3,363	3,363	3,363
Non-Municipal						
Nueces County						
Manufacturing	9,199	9,199	9,199	9,199	9,221	9,594
Steam Electric	2,201	2,201	2,201	2,201	2,201	2,201
Total Raw Water Demand	**65,836**	**66,134**	**66,464**	**66,890**	**67,400**	**68,338**
Treated Water Demand						
Municipal						
Nueces County						
Nueces County WCID 4	630	640	640	637	632	628

Major Water Provider (Water User/County)	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
City of Corpus Christi	58,748	59,549	59,606	59,245	58,887	58,530
Corpus Christi Naval Air Station	2,078	2,111	2,112	2,105	2,096	2,086
Violet WSC	228	229	230	228	227	225
San Patricio County						
San Patricio MWD	34,760	34,760	34,760	34,760	34,760	34,760
Kleberg County						
South Texas Water Authority *(based on water supply contract)*	4,596	4,660	4,687	4,696	4,750	4,945
Non-Municipal						
Manufacturing (Nueces County)	36,796	36,796	36,796	36,796	36,883	38,377
Total Treated Water Demand	**137,836**	**138,745**	**138,831**	**138,467**	**138,235**	**139,551**
Total Water Demand	**203,672**	**204,879**	**205,295**	**205,357**	**205,635**	**207,889**
River Basin						
Nueces	18,164	18,234	18,224	18,187	18,163	18,350
Nueces- Rio Grande	100,158	101,173	101,451	101,372	101,479	103,331
San Antonio- Nueces	85,350	85,472	85,620	85,798	85,993	86,208
Total Water Demand	**203,672**	**204,879**	**205,295**	**205,357**	**205,635**	**207,889**
SAN PATRICIO MUNICIPAL WATER DISTRICT						
Raw Water Demand						
Non-Municipal						
San Patricio County						
Manufacturing (*San Patricio County*)	12,119	12,120	12,121	12,122	12,123	12,124
Steam-Electric (*San Patricio County*)	2,576	2,576	2,576	2,576	2,576	2,576
Total Raw Water Demand	**14,695**	**14,696**	**14,697**	**14,698**	**14,699**	**14,700**
Treated Water Demand						
Municipal						
Nueces County						
City of Aransas Pass	0	0	0	0	0	0
Nueces County WCID 4	740	751	752	747	742	737
County-Other[1]	0	0	0	0	0	0
San Patricio County						
City of Aransas Pass	452	447	450	458	466	474
City of Gregory	270	260	257	262	266	270
City of Ingleside	986	1,008	1,022	1,021	1,020	1,019
City of Odem	432	423	421	426	431	437
City of Portland	3,555	3,837	4,155	4,500	4,873	5,277
Rincon WSC	378	396	405	402	399	396
City of Taft	337	323	318	324	330	336
County-Other[1,2]	1,158	1,279	1,177	804	409	152
Aransas County						
City of Aransas Pass	116	115	112	110	107	105
City of Rockport	3,172	3,146	3,068	3,000	2,933	2,868
Rincon	2	2	2	2	2	2
County-Other[1]	0	0	0	0	0	0
Municipal Treated Water Demand	**11,598**	**11,987**	**12,139**	**12,056**	**11,978**	**12,073**

Major Water Provider (Water User/County)	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Non-Municipal						
Manufacturing (*San Patricio County*)	48,476	48,480	48,484	48,488	48,493	48,498
Industrial Treated Water Demand	**48,476**	**48,480**	**48,484**	**48,488**	**48,493**	**48,498**
Total Water Demand	**74,769**	**75,163**	**75,320**	**75,242**	**75,170**	**75,271**
River Basin						
Nueces	–	–	–	–	–	–
Nueces- Rio Grande	–	–	–	–	–	–
San Antonio- Nueces	74,769	75,163	75,320	75,242	75,170	75,271
Total Water Demand	**74,769**	**75,163**	**75,320**	**75,242**	**75,170**	**75,271**
SOUTH TEXAS WATER AUTHORITY						
Municipal						
Nueces County						
Driscoll	80	81	81	81	80	80
Bishop[1]	268	276	276	273	269	265
Nueces WSC	986	997	999	997	994	992
County-Other, Nueces[3]	2,607	2,639	2,641	2,625	2,609	2,593
Kleberg County						
Kingsville + County-Other[1]	6	0	0	0	50	242
Naval Air Station Kingsville	264	273	282	292	301	306
Ricardo WSC	385	394	408	428	447	467
Total Water Demand (All Treated)	**4,596**	**4,660**	**4,687**	**4,696**	**4,750**	**4,945**
River Basin						
Nueces	98	99	99	99	99	99
Nueces- Rio Grande	4,498	4,561	4,588	4,597	4,651	4,846
San Antonio- Nueces	-	-	-	-	-	-
Total Water Demand	**4,596**	**4,660**	**4,687**	**4,696**	**4,750**	**4,945**
NUECES COUNTY WCID #3						
Nueces County						
Nueces County WCID 3	3,452	3,504	3,507	3,485	3,463	3,441
River Acres WSC	315	319	320	318	316	313
Total Water Demand (All Treated)	**3,767**	**3,823**	**3,827**	**3,803**	**3,779**	**3,754**
River Basin						
Nueces	315	319	320	318	316	313
Nueces- Rio Grande	3,452	3,504	3,507	3,485	3,463	3,441
San Antonio- Nueces	-	-	-	-	-	-
Total Water Demand	**3,767**	**3,823**	**3,827**	**3,803**	**3,779**	**3,754**

[1] Wholesale water provider does not meet full demand (i.e., additional supply from groundwater)
[2] Includes Taft Southwest, and Seaboard WSC.
[3] Includes Coastal Bend Youth City, KB Foundation, Geo Center, and Nueces County WCID #5.

3

Water Supply Analysis

[31 TAC §357.32]

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Chapter 3: Water Supply Analysis

3.1 Surface Water Supplies

The Coastal Bend Region is located within 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 large quantities of water except during high rainfall conditions. 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 used 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 their source. Supply associated with a given 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 (e.g., 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 "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 Commission on Environmental Quality (TCEQ) 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 a system that was very difficult to manage. 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.

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 applications to the TCEQ. The TCEQ determines if the water right will be issued and under what conditions. The water right grants a certain quantity of water to be diverted and/or stored, a priority date, and often comes with some restrictions on when and how the right may be used. Restrictions may include a maximum diversion rate and/or an instream flow restriction to protect existing water rights and provide environmental protection.

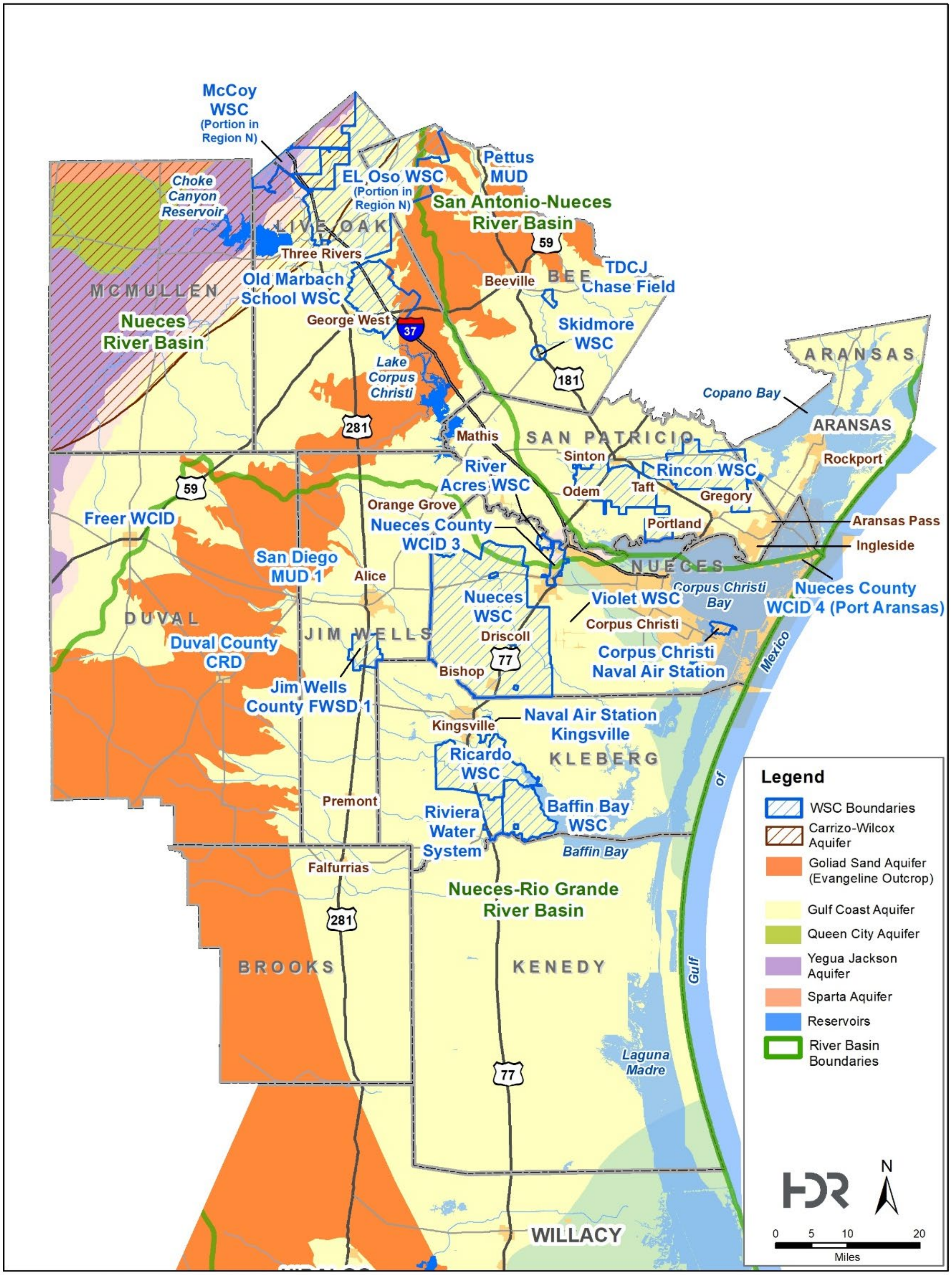

Figure 3.1.
Watershed Boundaries and Aquifer Location Map

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 of first capture, or the appropriation date. The established priority system must be adhered to by all water right holders when diverting or storing water for use. A right holder must pass all water to downstream senior water rights when conditions are such that the senior water rights would not be satisfied otherwise. 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 promulgated by Senate Bill 3, although most water rights issued prior to 1985 do not include such conditions. An important exception to the rule is Certificate of Adjudication Number (CA#) 21-3214 for Choke Canyon Reservoir, which represents approximately 75 percent of the Nueces River Basin water rights and requires instream flows and freshwater flows for the Nueces Estuary. 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 ac-ft 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 TCEQ 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]

The 1992 Interim Order established a monthly schedule of desired freshwater inflows to Nueces Bay 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.

[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.

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 TCEQ 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 — monthly releases (pass-throughs) to the estuary were limited to CCR/LCC System inflows and stored water is not required to meet estuary freshwater flow needs.

On April 17, 2001, the TCEQ issued an amendment to the 1995 Agreed Order to revise operational procedures in accordance with revisions requested by the City of Corpus Christi. Changes included: 1) passage of inflows to Nueces Bay and Estuary at 40 percent and 30 percent reservoir system capacity upon institution of mandatory outdoor watering restrictions; 2) calculating reservoir system storage capacity based on most recently completed bathymetric surveys; and 3) provisions for operating Rincon Bayou diversions and conveyance facility from Calallen Pool to enhance the amount of freshwater to the Nueces Bay and Delta.

All CCR/LCC/Texana/Mary Rhodes Pipeline (MRP) Phase II System (or Corpus Christi Regional Water Supply System) yield analyses and water availability results used in this plan were evaluated based on the current operation conditions in accordance with 2001 Agreed Order provisions.

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 were issued in perpetuity for approved claims during the adjudication process. This type of water right was 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 for some streams.

The TCEQ issues new permits only where drought 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. Term permits may be issued by the TCEQ 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, other water right holders are still not fully utilizing the water in the basin. Temporary permits are issued for up to 3 years. Temporary

[2] Texas Commission on Environmental Quality (TCEQ), 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.

permits are issued mainly for road construction projects, where water is used to suppress dust, to compact soils, and to start the growth of new vegetation. As term and temporary permits are not permanent water rights, they are not considered in the process of determining available water supplies.

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 actual streamflow availability, priority date, pumping rate, or diversion location.

Water rights, which 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.

While most water rights are diverted and used within the river basin of origin, water rights that divert from one river basin to another basin require an interbasin transfer permit. Several types of transfers that receive special consideration and simplified process include emergency transfers, transfers 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), diversions of less than 3,000 acre-feet per year (ac-ft/yr), and diversions within any city or county that has any portion in the basin of origin.

The annual availability of a water right is typically considered in terms of firm yield or safe yield supply. The Texas Water Development Board (TWDB) guidelines[3] state that surface water availability for regional water planning must use firm yield evaluated using TCEQ's Water Availability Model (WAM)[4] *unless a hydrologic variance approval is granted by the TWDB Executive Administrator for variations in modeling requirements*. Firm yield (for a reservoir) is defined as the maximum water volume a reservoir can provide each year under a repeat of a drought of record, using anticipated sedimentation rates and assuming all senior rights are used and no return flows are included such that the reservoir storage draws down to zero or some other defined dead pool storage with no shortages. The firm yield of a run-of-the-river diversion is defined in two ways by the TWDB for use in regional planning. For municipal sole-source water users, the firm yield of a run-of-the-river diversion is defined as "the minimum monthly diversion amount that is available 100 percent of the time during a repeat of the drought of record." For all other water users, the firm diversion is defined as "the minimum annual diversion, which is the lowest annual summation of monthly diversions reported by the WAM over the simulation period representing the calendar year within the simulation that represents the lowest diversion available." The water rights of Nueces County Water Control and Improvement District #3 (WCID 3) are based on firm yield analyses for municipal sole-source water users.

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[3] First Amended General Guidelines for Fifth Cycle of Regional Water Plan Development, April 2017.

[4] Specifically, unmodified WAM Run 3 which includes all water rights at full authorization, all applicable permit conditions, such as flow requirements and no return flows.

Safe yield supply represents a more conservative approach to determining minimum annual availability in areas where the severity of droughts is uncertain. Safe yield supply is the amount of water that can be withdrawn from a reservoir such that a given volume remains in reservoir storage during the critical month of the drought of record. The surface water availabilities for the largest water rights in the Nueces Basin (i.e., City of Corpus Christi and their customers) are based on safe yield analyses and assume a reserve of 75,000 acre-feet (ac-ft) for future drought conditions.[5]

3.1.3 Water Rights in the Nueces River Basin

A total of 412 water rights exist in the Nueces River Basin (336 having permitted diversions) with a total authorized diversion and consumptive use of 573,233 ac-ft/yr.[6] A small percentage of the water rights make up a large percentage of the authorized diversion volume. In the Nueces River Basin, five water rights (1.2 percent) make up 495,444 ac-ft/yr (86.4 percent) of the authorized diversion volume. One of these five large water rights is a recharge permit for the Edwards Aquifer Authority; the other four are shown in Figure 3.2. Of these, three water rights account for 455,444 ac-ft/yr of the 467,172 ac-ft/yr total in the Nueces River Basin of the Coastal Bend Region. The remaining water rights primarily consist of small municipal, industrial, irrigation, and recharge rights distributed throughout the river basin. Municipal and industrial diversion rights represent 82 percent of all authorized diversion rights in the Nueces River Basin by volume of permitted diversion. Based in large part on water stored in the 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 94 percent of these municipal and industrial rights in the basin by volume of permitted diversion.[7] With the inclusion of the municipal water rights held by the Nueces County WCID 3, diverted from the Nueces River upstream of the Calallen Dam, the Coastal Bend Region includes over 97 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.

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[5] On May 18, 2023, the CBRWPG adopted a 75,000 ac-ft safe yield reserve in storage during the worst, historical drought of record as the basis for determining availability for the Corpus Christi Water Supply System. On January 8, 2024, the TWDB approved safe yield use for planning purposes in the 2026 Plan.

[6] The number of water rights and corresponding authorized diversion amounts are based on the Texas Commission on Environmental Quality's Water Rights Database, February 2025.

[7] The Nueces River Authority's water right is for 20% of Choke Canyon Reservoir.

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
3082/95	Zavala-Dimmit Co. WCID #1	28,000	28,000	5,361	
2466	Nueces County WCID #3	11,546	11,546	0	

Major Water Rights*

*Authorized Annual Diversions > 10,000 acft. Major water rights information obtained from the TCEQ.

Figure 3.2.
Location of Major Water Rights in the Nueces River Basin

Table 3.1. Nueces River Basin Water Rights in the Coastal Bend Region

Water Right No.	Name	Annual Diversion Volume (ac-ft/yr)	Reservoir Storage Capacity (ac-ft)	Priority Date	Type of Use	Facility	County
2464	City of Corpus Christi	304,898	301,175	12/1913[1]	Municipal (51%) Industrial (49%) Irrigation (minimal) Mining (minimal)	Lake Corpus Christi (300,000 ac-ft) and Calallen Dam (1,175 ac-ft)	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 #3	11,546	0	2/1909[1]	Municipal	-	Nueces
2467	Garnett T. & Patsy A. Brooks; Coastal Bend Bays & Estuaries Program, Inc.	221	0	2/1964	Irrigation	-	San Patricio
2468	Coastal Bend Bays & Estuaries Program, Inc.	27	0	2/1964	Irrigation	-	Nueces
2469	Ila M. Noakes Lindgreen	101	0	2/1964	Irrigation	-	Nueces
3141	LONESOME COYOTE RANCH, L.L.C.	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	Harold W. Nix, et ux.	0	285	2/1969	Recreation	-	McMullen
3204	Oscar Leo Quintanilla	233	0	12/1963	Irrigation	-	McMullen
3205	Oscar Leo Quintanilla Wende Lynne Quintanilla	103	122	12/1963	Irrigation	-	McMullen
3206	James L. House Trust; Bradley K. Aery, Randi G. Aery	123	0	12/1966	Irrigation	-	McMullen
3214	Nueces River Authority, City of Corpus Christi, and City of Three Rivers[2]	139,000	700,000	7/1976	Municipal (43%) Industrial (57%) Irrigation (minimal)	Choke Canyon Reservoir	Nueces/ Live Oak
3215	City of Three Rivers[2]	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[3]	0	0	6/1986	Irrigation	-	Live Oak
5145	San Miguel Electric Co-Op, Inc.	300	335	12/1990	Industrial	-	McMullen
5736	City of Corpus Christi	8,000	0	9/2001	Wetlands	-	San Patricio
	TOTAL	**467,172**					

[1] Water right with multiple priority dates. Earliest date shown in table. In 2001, the District amended the water right so that it could be used for municipal purposes. Previously 37% was for municipal use and 63% for irrigation use.

[2] According to Special Condition 5B Certificate of Adjudication No. 21-3214 (April 26, 1995) and amendment to the 1984 deed and water contract between the City of Three Rivers and the City of Corpus Christi (April 29, 2005), the City of Three Rivers was added to No. 21-3214 with transfer of ownership of 2% of designed storage and firm yield in Choke Canyon in an average amount of 3 MGD. Through this instrument, the City of Three Rivers can directly divert from Choke Canyon Reservoir. In exchange, the City of Three Rivers permanently transferred management, control and coordination responsibility over Water Right No. 21-3215

to the City of Corpus Christi for use in the Frio and Atascosa watersheds. The City of Three Rivers retains water storage rights (No. 21-3215) associated with the current channel dam.

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

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 132 water rights (105 permitted for diversion) in these two coastal basins authorizing diversions of about 2,359,403 ac-ft/yr.[8] Approximately 2,149,584 ac-ft (91 percent) of the combined authorized diversions are from within the Coastal Bend Region Planning Area, and of these rights, 1,892,601 ac-ft (88 percent) are for steam-electric and manufacturing processes from the bays and saline water bodies along the coast most of which are returned back after cooling processes. 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, there are few of these freshwater rights that are sustainable throughout an extended drought. For this reason, no firm yield supplies were available from the San Antonio-Nueces Coastal Basin or Nueces-Rio Grande Basin to meet water supply needs for water users in the Coastal Bend Region.

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[9] and a contract with the Lavaca-Navidad River Authority (LNRA) to divert 31,440 ac-ft/yr on a firm basis and up to 12,000 ac-ft/yr on an interruptible basis from Lake Texana in the Lavaca-Navidad River Basin to the City's O.N. Stevens Water Treatment Plant.[10] This water is delivered to the City via the MRP, which became operational in 1998. In addition, the pipeline delivers MRP Phase II supplies from the Colorado River to the City through a second interbasin transfer permit owned by the City of Corpus Christi.

[8] The number of water rights and corresponding authorized diversion amounts are based on the Texas Commission on Environmental Quality's Water Rights Database, February 2025.

[9] TCEQ, Certificate of Adjudication No. 16-2095C, held by Lavaca-Navidad River Authority and Texas Water Development Board (TWDB), October 21, 1996.

[10] A call-back of 10,400 ac-ft/yr has been exercised by the Lavaca-Navidad River Authority for water needs in Jackson County.

This permit[11] allows the diversion of up to 35,000 ac-ft/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 the 35,000 ac-ft/yr is available from this run-of-river right during the Nueces Basin drought of record when integrated as part of the Corpus Christi Regional Water Supply System. Table 3.2 summarizes the major inter-basin transfer permits in the 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 (ac-ft/yr)	Priority Date
Lavaca-Navidad	LNRA	Transfer from Lake Texana to adjacent river basins including the Nueces River Basin.	43,440[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 31,440 ac ft/yr after Lavaca-Navidad River Authority (LNRA) call-back and a maximum of 12,000 ac-ft/yr on an interruptible basis from Lake Texana to the City.

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, Lake Texana via the MRP, and from the Colorado River via MRP Phase II to two major wholesale customers: San Patricio Municipal Water District (SPMWD) and South Texas Water Authority (STWA). 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 and treated surface water to industrial customers.

The City of Corpus Christi has contractual obligations to provide consumptive water use plus up to 10 percent growth each year to City of Alice, City of Beeville, City of Mathis, Port Aransas, Violet Water Supply Corporation (WSC), and STWA. The City of Corpus Christi is contracted to provide up to 3,363 ac-ft/yr to City of Three Rivers[12] and up to 83,800 ac-ft/yr to SPMWD[13] (up to 46,800 ac-ft/yr of raw water and 37,000 ac-ft/yr of treated water). Furthermore, the City of Corpus Christi provides raw and treated water supplies to meet needs of manufacturing, mining, and steam and electric water users in Nueces County. SPMWD and STWA meet water needs of their

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[11] TCEQ, Certificate of Adjudication No. 14-5434B, held by the City of Corpus Christi (via the Garwood Irrigation Company), October 13, 1998.

[12] Through an amendment to the 1984 deed and water contract between the City of Three Rivers and the City of Corpus Christi (April 29, 2005), the City of Three Rivers was added to No. 21-3214 with transfer of ownership of 2% of designed storage and firm yield in Choke Canyon in an average amount of 3 MGD.

[13] An amendment to the water contract was approved by Corpus Christi City Council on August 20, 2019. The amendment increases the SPMWD treated water contract to 27,000 acft after Year 2020, with an additional 10,000 acft/yr reserve with advance notice. This plan assumes total contracted supplies of 73,800 acft/yr after Year 2020.

customers (Figure 3.3). Within the Coastal Bend Region, Nueces County WCID 3 provides treated water to City of Robstown and River Acres WSC through run-of-the-river rights on the Nueces River.

Figure 3.3 summarizes the major contract relationships in the Coastal Bend Region.

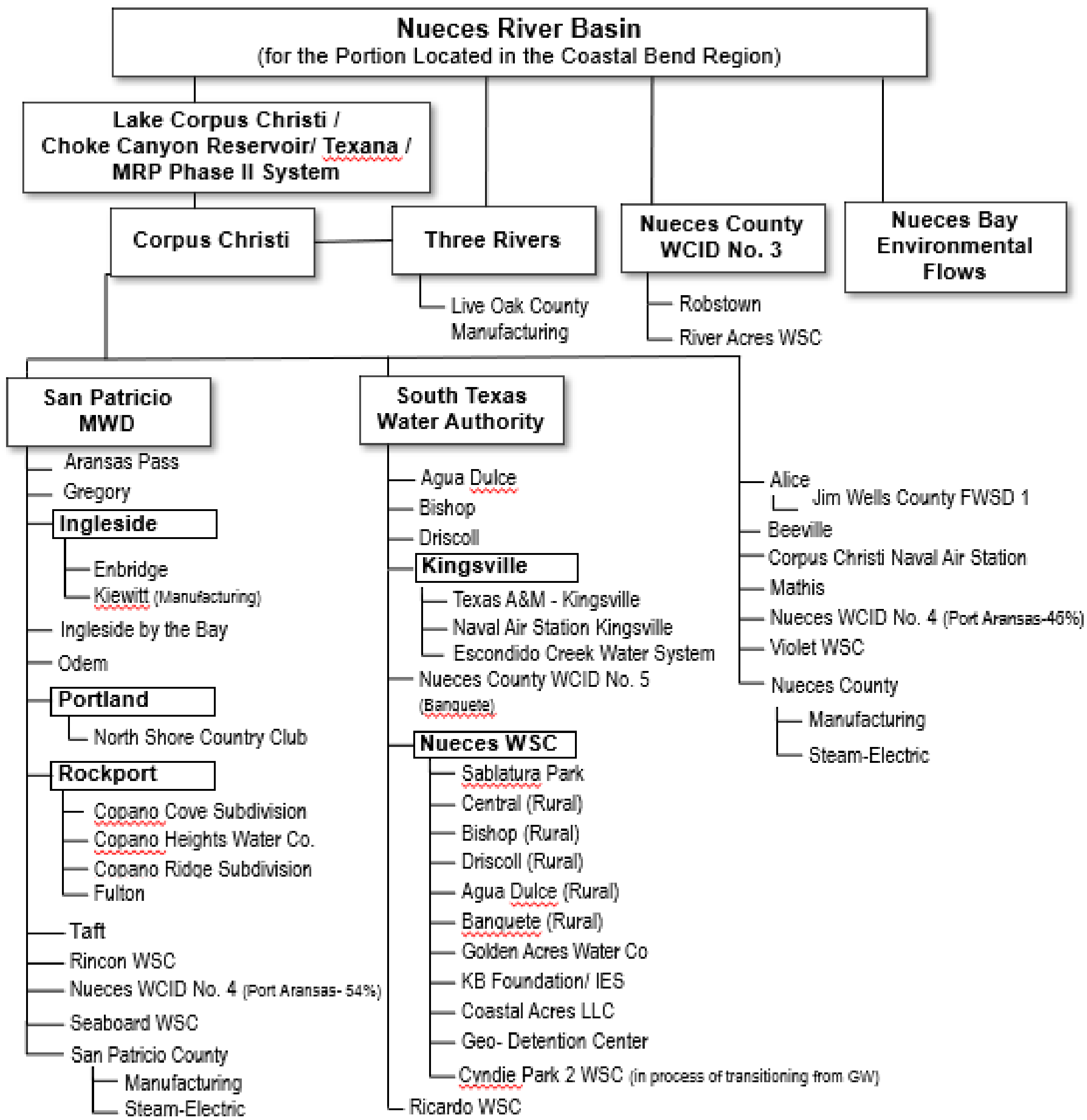

Figure 3.3.
Major Surface Water Supply Contract Relationships in the Coastal Bend Region

Figure 3.4 presents water supply systems in the Coastal Bend Region. These relationships will be revisited in Chapter 4A, when comparisons of supplies and demands in the region are presented.

Note: Two transmission lines exist from Lake Corpus Christi to the City of Alice. One is not in service but may be used in emergency depending on pipeline condition.

Figure 3.4.
Coastal Bend Water Supply System

3.1.7 Wholesale Water Providers

The Coastal Bend Region has four wholesale water providers (WWPs) who currently provide water supplies to the region. These include the City of Corpus Christi, SPMWD, STWA, and Nueces County WCID 3. The City of Corpus Christi supplies about 65 percent of the water demand in the region (not including supplies to SPMWD or STWA). SPMWD and STWA purchase 100 percent of their water from the City of Corpus Christi. The SPMWD subsequently treats and distributes water to numerous entities and supplies about 10 percent of the municipal and industrial water demand in the region. Both STWA and Nueces County WCID 3 provide about 3 percent of the municipal and industrial water demand in the region.

The TWDB defines WWPs as "any entity that delivers or sells water wholesale (treated or raw) to water user groups (WUGs) or other WWPs or that the regional water planning group expects or recommends to deliver or sell water wholesale to WUGs or other WWPs during the period covered by the plan." Two potential future wholesale water providers were identified[14] and serve as project sponsors for recommended water management strategies, based on TWDB DB27 requirements: the Nueces River Authority and Port of Corpus Christi Authority (PCCA). The Nueces River Authority is the project sponsor for the Petronila Creek wastewater treatment plant (WWTP) reuse. Both are associated with seawater desalination strategies to primarily serve future San Patricio County and Nueces County manufacturing users.

As for water supply planning, each WUG 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 Coastal Bend Regional Water Planning Group (CBRWPG) deems it necessary, the CBRWPG reserves the right to revisit wholesale water provider designations during subsequent planning efforts.

3.1.8 Major Water Providers

Four WWPs (City of Corpus Christi, SPMWD, STWA and Nueces County WCID 3) currently provide about 79 percent of the total water for the Coastal Bend Region.

The TWDB includes provisions in the regional water planning guidance for planning groups to consider identifying major water providers. The TWDB defines major water providers (MWPs) as "a water user group or wholesale water provider of particular significance to the region's water supply as determined by the regional water planning group, including public or private entities that provide water for any water use category." The CBRWPG considered this provision at the October 17, 2024, meeting and designated the City of Alice, the City of Corpus Christi, STWA, and SPMWD as MWPs.

Existing supplies for the four MWPs and current WWPs (to include Nueces County WCID 3) by decade and category of use is provided in Table 4A.25.

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[14] The CBRWPG identified the Nueces River Authority as a Wholesale Water Provider on May 16, 2024. The CBRWPG re-designated the Port of Corpus Christi Authority as a Wholesale Water Provider on January 30, 2025.

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. Recurring droughts are common in the region with significant drought periods occurring in the 1950s, 1960s, 1980s, 1990s, and current. As discussed in Chapter 1, average annual inflows to Lake Corpus Christi and Choke Canyon System continue to trend lower with each successive drought, with the most recent hydrology update[15] for the Corpus Christi Water Supply Model (through 2015) showing a drought of record in the Nueces Basin from 2007 to 2013. Currently, the basin may be experiencing even worse conditions than the 2013 drought, which is not included in the yield analyses due to the necessity of a model update. Additional details regarding droughts in the region are discussed in Chapter 7.

Municipal and industrial water suppliers typically require a very high degree of reliability for their water sources. In most cases, interruptions to water supply are 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; however, safe yield analyses are becoming commonly used in anticipation of future droughts greater in severity than the worst drought of record.

Based on the regional water supply system being prone to severe drought and a drought of record defined from 2007 to 2013, on May 18, 2023, the CBRWPG approved use of safe yield for users relying on supplies from the Corpus Christi Regional Water System. The safe yield maintains a 75,000 ac-ft reserve in storage during the worst, historical drought of record (DOR) as a provision for climate and growth uncertainty, such that a *specified reserve amount remains* in storage during the modeled critical drought. On January 8, 2024, the TWDB granted approval for use of safe yield for the *2026 Coastal Bend Regional Water Plan*.

The CBRWPG recognizes the current drought in early 2025 is most likely worse than the DOR. In future planning cycles, it is important to maintain and update model hydrology (beyond 2015) to account for new DOR conditions on surface water supply reliability. In the meantime, this *2026 Coastal Bend Regional Water Plan* seeks to address current drought conditions by over-allocating water management strategies in excess of calculated shortages. This not only identifies additional potential supply to mitigate droughts worse than the DOR but also includes protection for additional growth beyond TWDB projections and flexibility for water utilities to advance implementation of water management strategies, as needed, to address regional water demands. The drought response discussion (Chapter 7.2) provides additional information related to drought impacts.

For reservoirs, the safe yield may decrease over time as a result of sedimentation. When a reservoir is constructed on a stream channel, the sediment carried by the stream accumulates 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

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[15] Corpus Christi Water Supply Yield Results from Hydrology Update, June 1, 2017.

the CCR/LCC System were recently updated with new volumetric surveys.[16] The volumetric surveys for Choke Canyon Reservoir and Lake Corpus Christi reported sedimentation rates of 1,693 ac-ft/yr and 717 ac-ft/yr, respectively. Although this sedimentation rate is high, the Corpus Christi Water Supply System includes water supplies from Lake Texana and the Colorado River (MRP Phase II) that mitigate the effect of sedimentation accumulation in these two reservoirs on yield. Future reservoir capacity in 2080 was calculated based on sedimentation rates from the TWDB volumetric survey and extrapolating to 2080 conditions. It is estimated that the CCR/LCC/Texana/MRP Phase II system safe yield will be reduced by 13,000 ac-ft due to sediment accumulations between 2030 and 2080. The CCR/LCC/Texana/MRP Phase II system, during drought of record conditions, results in a safe yield supply of 170,000 ac-ft/yr in 2030, which reduces to 157,000 ac-ft/yr by 2080 due to reservoir sedimentation.

For Nueces County WCID 3 and smaller run-of-river water rights in the Nueces River Basin, firm yield supplies were based on the minimum annual supply that could be diverted over a historical period of record limited by minimum month conditions in accordance with TWDB guidelines. Run-of-river availabilities were simulated for these water users using an unmodified Nueces WAM Run 3, which determined monthly availability subject to water right priority and hydrologic conditions. Minimum month conditions were assessed within the context of use-appropriate monthly percentage of the annual firm diversion. When the full amount sought was not available for a given month, storage was identified as a water management strategy to bridge potential seasonal water shortages to avoid overestimating the reliability of run-of-river water during drought.

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 TCEQ as part of its WAM Program.[17] 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 City of Corpus Christi Water Supply Model [formerly known as the Lower Nueces River Basin and Estuary Model (NUBAY)[18]]. The City of Corpus Christi Water Supply Model (CCWSM) focuses on the

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[16] Volumetric and Sedimentation Survey of Choke Canyon Reservoir June 2012 Survey. Texas Water Development Board, August 2013. (http://www.twdb.texas.gov/surfacewater/surveys/completed/files/ChokeCanyon/2012-06/ChokeCanyon2012_FinalReport.pdf), Volumetric and Sedimentation Survey of Lake Texana January – March 2010 Survey. Texas Water Development Board, August 2011. (http://www.twdb.texas.gov/surfacewater/surveys/completed/files/Texana/2010-03/Texana2010_FinalReport.pdf), *draft* Volumetric Survey and Sedimentation Survey of Lake Corpus Christi. Texas Water Development Board, 2016.

[17] HDR, "Water Availability in the Nueces River Basin," TCEQ, October 1999.

[18] In 1990, the City of Corpus Christi developed the Lower Nueces River Basin and Estuary Model (NUBAY) to evaluate its multi-basin regional water supply system subject to environmental flow provisions and reservoir operating

operations of the CCR/LCC/Lake Texana/MRP Phase II System and is capable of simulating this system subject to the City of Corpus Christi's Phased Operations Plan and the 2001 Agreed Order governing freshwater inflow passage to the Nueces Estuary.

In 2017, the CCWSM was updated to include:

- Hydrology through 2015 to include a total model period of 82 years (1934 to 2015), including extensions to net evaporation and ungaged runoff below LCC for recent hydrology using methods consistent with previous model version (1934 to 2003);
- New TWDB volumetric survey data for Lake Corpus Christi (2016), Choke Canyon Reservoir (2012), and Lake Texana (2010) for sedimentation rates;
- Hydrology for Lake Texana and the Colorado River (for MRP Phase II supplies) through 2015; and
- Verification that all enhancements maintain the provisions of the TCEQ 2001 Agreed Order.

In 2019, additional model updates were made to include:

- Lake Texana callback of 10,400 ac-ft/yr as exercised by Lavaca-Navidad River Authority for local water users in Jackson County pursuant to City of Corpus Christi contract terms; and
- Operational flexibility to exercise water supply calls on the Garwood water right on the Colorado River at a variable rate according to diversion rate and priority date of the rights and based on MRP Phase II system capacities.

At the CBRWPG meeting on May 18, 2023, the planning group discussed TCEQ WAMs relevant to surface water supplies in the region and the CCWSM. The CBRWPG does not consider the TCEQ Nueces Basin WAM Run 3 to be the best model to simulate the Corpus Christi Regional Water Supply System operation policy subject to permits nor does it reflect all aspects of the TCEQ 2001 Agreed Order. Furthermore, the hydrology ends in 1996 and does not cover the recent drought of record.

Furthermore, at the Coastal Bend Region's May 18, 2023, meeting, the CBRWPG considered TWDB's guidance to use firm yield when determining surface water availability. The City of Corpus Christi's regional water supply system is prone to severe drought. Average annual inflows to the Lake Corpus Christi and Choke Canyon System are lower with each successive drought, with the most recent hydrology update to the CCWSM (through 2015) showing a *new* drought of record for the Corpus Christi Regional Water Supply System. Safe yield is a standard approach that the Coastal Bend Region and the City of Corpus Christi have consistently used in

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policies. Since then, the City and other public agencies have supported enhancements and updates to the NUBAY model, which has been renamed the City of Corpus Christi Water Supply Model. The previous Region N Plans (2006, 2011, and 2016) used the Corpus Christi Water Supply Model to evaluate water availability, with safe yield as a basis for developing water planning and needs analysis for the City of Corpus Christi and its customers.

previous planning cycles as a provision for climate and growth uncertainty, such that a *specified reserve amount remains* in storage during the modeled critical drought.

At the Coastal Bend Region meeting on May 18, 2023, the CBRWPG approved submittal of a hydrologic variance request to the TWDB Executive Administrator to (1) use the CCWSM to evaluate water availability for the Corpus Christi Regional Water Supply System and (2) use of safe yield with 75,000 ac-ft reserve and the City of Corpus Christi's reservoir operating policies to calculate water availability from the Corpus Christi Regional Water Supply System for the *2026 Coastal Bend Regional Water Plan*.

The CBRWPG received variance approval from the TWDB on January 8, 2024, to use the CCWSM for determining surface water availability for the Corpus Christi Regional Water Supply System, to report water availability for the multi-basin regional supply as a system rather than individual reservoirs, and use of safe yield to calculated water availability for the *2026 Coastal Bend Regional Water Plan*. As discussed previously, the region is likely in a new drought of record and therefore the modeled safe yield may not be sufficient to appropriately address surface water availability. The model should be updated through current hydrology, in future planning cycles, in addition to revisiting safe yield assumptions.

The CCWSM was used to estimate the safe yield of the CCR/LCC/Lake Texana/MRP Phase II System and the TCEQ WAM WRAP model was used to determine the firm yield 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 yield availability is presented in Table 3.3. The surface water supplies are based on water rights and supply availability during the drought of record as discussed previously in Section 3.2.

Local supplies[19] are used in the plan to meet livestock needs only. The volume of local supply available to livestock users is based on the percent of surface water used to meet demands after considering 2010 groundwater use reported by the TWDB, discussed later in Section 4.2. Table 3.4 shows the amount of local supplies by decade for each livestock-county user, which totals 1,860 ac-ft/yr for the region. The livestock local surface water supplies presented in the table were identified based on 2010 use and considered firm supplies under drought conditions.

The Coastal Bend Region adopted use of safe yield supply for the City of Corpus Christi's regional water supply system which affects three largest current WWPs: City of Corpus Christi, SPMWD, and STWA and their customers. The safe yield supplies assume a reserve of 75,000 ac-ft as a drought management strategy to plan for future droughts greater than the drought of record. Table 3.5 shows the safe yield water supply for each MWP and current WWP.

The surface water supplies described above serve as a basis for the supply and demand comparisons in Chapter 4A.

[19] The TWDB defines local supplies in Exhibit C- First Amended General Guidelines for Regional Water Plan Development (October 2012) as "limited, unnamed individual surface water supplies that, separately, are available only to particular non-municipal WUGs".

3.4 Reuse Availability

Eight of eleven counties in the Coastal Bend Region are reusing and are projected to reuse in 2030[20]. Reuse in the Coastal Bend Region is used for a variety of purposes, including irrigation, manufacturing, mining, and municipal works. The projected amount of reuse by the Coastal Bend Region is 5,622 ac-ft/yr in decades from 2030 to 2070. The projected reuse in 2080 decreases to 5,543 ac-ft/yr due to the TWDB's projections for Bee County mining water demand reducing to zero in 2080. Therefore, it is assumed reuse water of 79 acft/yr in Bee County for mining purposes would not be used.

[20] TWDB. 2025. Historical Water Use Summary and Data Dashboard https://www.twdb.texas.gov/waterplanning/waterusesurvey/dashboard/index.asp

Table 3.3.
Surface Water Rights Availability
Nueces River Basin Water Rights in the Coastal Bend Region

Water Right Owner	Annual Permitted Diversion Volume (ac-ft/yr)	Yield[1] (ac-ft)	Type Of Use	Priority Date	County
City of Corpus Christi and Nueces River Authority	487,338[2]	157,000[3]	Municipal & Industrial	12/1913[4]	Nueces
			Irrigation	12/1913	Nueces
			Mining	12/1913	Nueces
			Irrigation	12/1913	Live Oak
Reality Traders & Exchange, Inc.	20	0	Irrigation	10/1952	San Patricio
Wayne Shambo	140	0	Irrigation	10/1952	San Patricio
Nueces Co. WCID #3	4,246 7,300 11,546	384	Municipal Irrigation	2/1909[4]	Nueces
Garnett T. & Patsy A. Brooks; Coastal Bend Bays & Estuaries Program, Inc.	221	0	Irrigation	2/1964	San Patricio
Coastal Bend Bays & Estuaries Program, Inc.	27	0	Irrigation	2/1964	Nueces
Ila M. Noakes Lindgreen	101	0	Irrigation	2/1964	Nueces
LONESOME COYOTE RANCH, L.L.C.	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
Oscar Leo Quintanilla	0	0	Recreation	2/1969	McMullen
Oscar Leo Quintanilla Wende Lynne Quintanilla	336	0	Irrigation	12/1963	McMullen
James L. House Trust; Bradley K. Aery, Randi G. Aery	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[5]	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
City of Mathis	50	0	Irrigation	11/1996	San Patricio
City of Corpus Christi	8,000	0	Wetlands	9/2001	San Patricio
TOTAL	**513,126**	**168,884**			

[1] Yield computed assuming 2080 sediment accumulation. City of Corpus Christi and Nueces River Authority is based on safe yield of approximate 98,000 ac-ft/yr Nueces Basin (Choke Canyon/Lake Corpus Christi) with remaining amount from Lake Texana/MRP Phase II. Through system optimization with supplies from the east, safe yield is calculated. The City of Three Rivers owns 2% storage in Choke Canyon (see Table 3.1 for additional details), the yield of which is included in table calculations.

[2] Corpus Christi annual permitted diversion includes CCR/LCC System (443,898 ac-ft/yr) and Lavaca-Navidad River Authority contracts with Corpus Christi (31,440 ac-ft/yr) and a maximum 12,000 ac-ft/yr from Lake Texana on an interruptible basis.

[3] Corpus Christi minimum annual supply equals computed 2080 safe yield of the CCR/LCC/Lake Texana/MRP Phase II System per HDR water availability analysis for the City of Corpus Christi.

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

[5] Diamond Shamrock irrigation right is for irrigation from on-site process water return flows. In effect, this permit is for a reuse project.

Table 3.4. Livestock Local Surface Water Supplies (ac-ft/yr)

County	2030	2040	2050	2060	2070	2080
Aransas	52	52	52	52	52	52
Bee	568	568	568	568	568	568
Brooks	478	478	478	478	478	478
Duval	566	566	566	566	566	566
Jim Wells	711	711	711	711	711	711
Kenedy	631	631	631	631	631	631
Kleberg	532	532	532	532	532	532
Live Oak	651	651	651	651	651	651
McMullen	278	278	278	278	278	278
Nueces	218	218	218	218	218	218
San Patricio	278	278	278	278	278	278
Total	**4,963**	**4,963**	**4,963**	**4,963**	**4,963**	**4,963**

Note: Supplies provided by stock ponds.

Table 3.5.
Major Water Provider and Current Wholesale Water Provider Available Surface Water Supply

Major Water Provider (Water User/County)	2030	2040	2050	2060	2070	2080
City of Corpus Christi						
Safe Yield Supply	**170,000**	**168,000**	**166,000**	**164,000**	**162,000**	**157,000**
Current Treatment Capacity	128,114	128,114	128,114	128,114	128,114	128,114
Raw Water Available for Sales[1]	41,886	39,886	37,886	35,886	33,886	28,886
San Patricio Municipal Water District						
Contracted Purchases from the City of Corpus Christi[2]	**81,560**	**81,560**	**81,560**	**81,560**	**81,560**	**81,560**
Actual Amount that Can Be Provided based on Current Supply (acft/yr)	**81,560**	**81,560**	**81,560**	**81,560**	**81,560**	**81,560**
Amount the City Provides to Meet SPMWD Water Demands, within Contract Terms (*SPMWD surpluses on manufacturing*)	**74,769**	**75,163**	**75,320**	**75,242**	**75,170**	**75,271**
Average Day SPMWD Maximum Industrial Treatment Available[3]	12,098	12,098	12,098	12,098	12,098	12,098
Average Day SPMWD Maximum Potable-Municipal Treatment Available[3]	11,762	11,762	11,762	11,762	11,762	11,762
Average Day SPMWD Total Treatment Available[3]	23,860	23,860	23,860	23,860	23,860	23,860
Purchased Treated Water from City of Corpus Christi[2]	34,760	34,760	34,760	34,760	34,760	34,760
Total Treated Water Supply[2]	**58,620**	**58,620**	**58,620**	**58,620**	**58,620**	**58,620**
Raw Water Available for Sales (remaining after SPMWD treated demands)[2]	**21,486**	**21,093**	**20,937**	**21,016**	**21,089**	**20,989**
Potable-Municipal Treated Water Supply[2,4]	11,598	11,987	12,139	12,056	11,978	12,073
Industrial- Treated Water Supply[2,4]	48,476	48,480	48,484	48,488	48,493	48,498
Total Water Supply Available Based on Current Supply (acft/yr)	**81,560**	**81,560**	**81,560**	**81,560**	**81,560**	**81,560**
South Texas Water Authority						
Total Surface Water Right	**0**	**0**	**0**	**0**	**0**	**0**
Contract Purchases	**4,596**	**4,660**	**4,687**	**4,696**	**4,750**	**4,945**
City of Alice						
Contract Purchases (from the City of Corpus Christi)	2,254	2,480	2,681	2,912	3,188	3,521
Nueces County WCID 3						
Total Surface Water Right (firm yield)	**384**	**384**	**384**	**384**	**384**	**384**

1. Raw water available for sales is safe yield less contracted supplies with customers and treated water demands or treatment plant capacity, whichever is the lesser of the two.

2. An amendment to the raw water contract was approved by Corpus Christi City Council on August 20, 2019, to total 46,800 acft/yr raw water to SPMWD. An amendment between the City of Corpus Christi and SPMWD increases the treated water contract to 27,000 acft, with an additional provision for 10,000 acft/yr reserve with advance notice (up to 37,000 acft/yr treated water). A contract amendment executed on July 15, 2024, reduced treated water contracts to maximum of 34,760 acft/yr. Total contracts with City of Corpus Christi for raw and treated water is up to 81,560 acft/yr.

3. SPMWD has a potable (municipal) water treatment plant with 9 MGD design capacity (plant a), an industrial water treatment plant with 8 MGD design capacity (plant b), and a third water treatment plant with 21.4 MGD design capacity that can be used to produce treated water for either municipal or industrial use (plant c). From information provided by SPMWD on Feb 10, 2025, average day industrial treatment capacity is 10.8 MGD (or 12,098 acft/yr) and average day municipal treatment capacity is 10.5 MGD (or 11,762 acft/yr), which amounts to an estimated 1.8: 1 peak to average day capacity ratio. The total WTP capacity for SPMWD's system is 38.4 MGD. With SPMWD average annual WTP capacity of 23,860 acft/yr and 34,760 acft/yr treated water contracts with the City, SPMWD's treated water capacity is 58,620 acft/yr.

as providing 46% to meet water demands and San Patricio MWD as providing 54% to meet water demands through 2080.

4. Assumes raw water delivered to District treatment plants equal to demands, or District treatment capacity whichever is the lesser of the two. Treated water from City of Corpus Christi contract to augment treated water demands, beyond existing SPMWD treatment plant constraints.

3.5 Groundwater Availability

The Coastal Bend Region includes parts of five aquifers—two major (Gulf Coast and Carrizo-Wilcox aquifers) and three minor (Yegua-Jackson, Queen City and Sparta aquifers). Figure 3.1 shows the locations of the major and minor aquifers. According to TWDB guidelines, RWPGs are to use Modeled Available Groundwater (MAG) values developed by the Groundwater Management Areas (GMAs) and TWDB as groundwater supply availability estimates for the 2026 regional water plan. All Coastal Bend Region counties are located within three GMAs as follows:

- GMA 13- McMullen County (portion),
- GMA 15- Aransas and Bee County (portion); and
- GMA 16- Remaining Region N counties.

All three of these GMAs adopted new desired future conditions (DFCs) between October and November of 2021, as summarized in Table 3.6. The TWDB then used these to develop MAG estimates for use in development of this *2026 Coastal Bend Regional Water Plan*. A summary of the MAGs is included in Table 3.7. At their meeting on January 26, 2024, the CBRWPG discussed these MAG projections based on GMA-approved desired future conditions and confirmed their use to serve as the basis of groundwater availability in this *2026 Coastal Bend Regional Water Plan*. The CBRWPG did not perform any independent analyses using groundwater availability models (GAMs) to estimate groundwater availability, nor were any alternative methods used to estimate groundwater availabilities.

Table 3.6.
Desired Future Conditions Adopted by GMAs in Region N

Aquifer	GMA	Desired Future Conditions (DFC)	Date DFC was Adopted
Carrizo-Wilcox, Queen City, and Sparta Aquifer	13	Average drawdown of 48 feet for all of GMA 13 calculated from the end of 2012 conditions to the year 2080	Nov 2021
Aransas Gulf Coast Aquifer	15	0 feet of drawdown of the Gulf Coast Aquifer System	Oct 2021
Bee Gulf Coast Aquifer	15	7 feet of drawdown of the Gulf Coast Aquifer System	Oct 2021
Bee GCD Gulf Coast Aquifer	16	93 feet of drawdown of the Gulf Coast Aquifer System	Nov 2021
Live Oak UWCD Gulf Coast Aquifer	16	45 feet of drawdown of the Gulf Coast Aquifer System	Nov 2021
McMullen GCD Gulf Coast Aquifer	16	12 feet of drawdown of the Gulf Coast Aquifer System	Nov 2021
Kenedy County GCD Gulf Coast Aquifer	16	27 feet of drawdown of the Gulf Coast Aquifer System	Nov 2021
Brush Country GCD Gulf Coast Aquifer	16	89 feet of drawdown of the Gulf Coast Aquifer System	Nov 2021
Duval County GCD Gulf Coast Aquifer	16	137 feet of drawdown of Gulf Coast Aquifer System	Nov 2021
San Patricio County GCD Gulf Coast Aquifer	16	69 feet of drawdown of the Gulf Coast Aquifer System	Nov 2021
Non-District Kleberg Gulf Coast Aquifer	16	21 feet of drawdown of the Gulf Coast Aquifer System	Nov 2021
Non-District Nueces Gulf Coast Aquifer	16	26 feet of drawdown of the Gulf Coast Aquifer System	Nov 2021

Of the five aquifers, the Gulf Coast Aquifer underlies all 11 counties in the Coastal Bend Region, is the primary groundwater resource in the region, and is estimated to constitute 97 percent of the region's groundwater availability according to MAG. The Carrizo Wilcox Aquifer underlies three counties and is estimated to constitute about 2 percent of the groundwater availability. The Queen City, Sparta, and Yegua-Jackson aquifers in McMullen County constitute approximately 0.1 percent of the MAG.

3.5.1 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 five water-bearing formations: Catahoula, Jasper, Burkeville Confining System, Evangeline, and Chicot. The Evangeline and Chicot aquifers are the uppermost water-bearing formations, are the most productive and, consequently, are the formations used 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. The Burkeville Confining System is a limited water-bearing formation and characterized as containing substantial amounts of clay.

The TWDB developed the Central Gulf Coast Groundwater Availability Model (CGCGAM) 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; however, the model had limitations and was not considered to satisfactorily represent the Gulf Coast Aquifer in GMA 16, which covers the majority of the Coastal Bend Area. For this reason, the TWDB issued a GMA 16 Groundwater Flow Model for the Coastal Bend Region. This model was used to evaluate DFCs and set MAGs for the region, summarized in Table 3.7.

3.5.2 Carrizo-Wilcox Aquifer

Three counties within the Coastal Bend Region have 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 milligrams per liter (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. Only McMullen County identified a MAG for the Carrizo Aquifer. Long-term groundwater available from the Carrizo-Wilcox Aquifer in the region is summarized in Table 3.7.

3.5.3 Queen City and Sparta Aquifers

The TWDB classifies the Queen City and Sparta aquifers that underlie McMullen County as minor aquifers. 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.

3.5.4 Yegua- Jackson

The TWDB classifies the Yegua-Jackson Aquifer, which underlies McMullen County, as minor aquifer. The Yegua- Jackson geologic unit consists of interbedded sand, silt, and clay layers. Most water is produced from the sand units, which water is either fresh or slightly saline. A MAG was not identified through the Groundwater Conservation District (GCD)/GMA process for the Yegua-Jackson Aquifer.

3.6 Assigning Current Supplies to Water User Groups

Current water supplies were assigned to be consistent with TWDB and Texas Administrative Code guidance. Source water availability was limited according to minimum month drought of record conditions for surface water supplies and MAG estimates for groundwater supplies. Additionally, legal and physical constraints were used to determine the amount available to water user groups and wholesale water providers. WUGs that receive water from WWPs or another water user group were limited according by contract, if applicable. Details of the water supply allocation methodology are included in Chapter 4A.2.

Current reuse information was obtained from the TWDB. Delineation of direct and indirect reuse was not provided.

Table 3.7.
Groundwater Availability for Aquifers within the Coastal Bend Region

County Name	Basin Name	Aquifer Name	TWDB Provided MAG for 2026 Region N Plan (ac-ft/yr)					
			2030	2040	2050	2060	2070	2080
Aransas	San Antonio-Nueces	Gulf Coast	1,547	1,547	1,547	1,547	1,547	1,547
Bee	Nueces	Carrizo	0	0	0	0	0	0
Bee	San Antonio-Nueces	Gulf Coast	18869	19553	19855	20,042	20,043	20,029
Bee	Nueces	Gulf Coast	1,007	1,069	1,098	1,115	1,115	1,115
Brooks	Nueces-Rio Grande	Gulf Coast	5,123	5,353	5,507	5,738	6,437	6,437
Duval	Nueces	Gulf Coast	351	376	401	428	428	428
Duval	Nueces-Rio Grande	Gulf Coast	21,818	23,388	24,962	26,535	26,535	26,535
Jim Wells	Nueces	Gulf Coast	593	593	593	593	681	681
Jim Wells	Nueces-Rio Grande	Gulf Coast	8,802	9,183	9,582	9,926	11,368	11,368
Kenedy	Nueces-Rio Grande	Gulf Coast	10,104	11,698	12,762	14,358	15,421	15,421
Kleberg	Nueces-Rio Grande	Gulf Coast	9,039	9,989	10,687	11,637	12,142	12,142
Live Oak	San Antonio-Nueces	Gulf Coast	68	62	61	61	61	61
Live Oak	Nueces	Gulf Coast	11,326	10,382	10,233	10,233	10,233	10,233
Live Oak	Nueces	Carrizo	0	0	0	0	0	0
McMullen	Nueces	Carrizo	7,768	4,867	4,854	4,854	4,854	4,854
McMullen	Nueces	Gulf Coast	510	510	510	510	510	510
McMullen	Nueces	Queen City	3	3	3	3	3	3
McMullen	Nueces	Sparta	0	0	0	0	0	0
McMullen	Nueces	Yegua-Jackson	0	0	0	0	0	0
Nueces	San Antonio-Nueces	Gulf Coast	0	0	0	0	0	0
Nueces	Nueces	Gulf Coast	756	787	816	845	845	845
Nueces	Nueces-Rio Grande	Gulf Coast	6031	6291	6540	6798	6818	6818
San Patricio	San Antonio-Nueces	Gulf Coast	40,514	41,548	42,581	43,615	43,615	43,615
San Patricio	Nueces	Gulf Coast	4,502	4,874	5,247	5,619	5,619	5,619
Total Groundwater Availability (ac-ft/yr)			**148,731**	**152,073**	**157,839**	**164,457**	**168,275**	**168,261**
Gulf Coast Aquifer- MAG (ac-ft/yr)			***140,960***	***147,203***	***152,982***	***159,600***	***163,418***	***163,404***

Table 3.8.
Municipal Supply by City/County (ac-ft)

City/County	2030	2040	2050	2060	2070	2080
Aransas County						
ARANSAS PASS						
Supply	116	115	112	110	107	105
Groundwater	-	-	-	-	-	-
Surface water	116	115	112	110	107	105
Reuse	-	-	-	-	-	-
RINCON WSC						
Supply	2	2	2	2	2	2
Groundwater	-	-	-	-	-	-
Surface water	2	2	2	2	2	2
Reuse	-	-	-	-	-	-
ROCKPORT						
Supply	3266	3240	3162	3094	3027	2962
Groundwater	-	-	-	-	-	-
Surface water	3172	3146	3068	3000	2933	2868
Reuse	94	94	94	94	94	94
COUNTY-OTHER, ARANSAS						
Supply	530	525	512	500	489	478
Groundwater	482	477	464	452	441	430
Surface water	-	-	-	-	-	-
Reuse	48	48	48	48	48	48
Bee County						
BEEVILLE						
Supply	2,805	2,927	3,075	3,253	3,448	3,663
Groundwater	1,255	1,255	1,255	1,255	1,255	1,255
Surface water	1,550	1,672	1,820	1,998	2,193	2,408
Reuse	-	-	-	-	-	-
EL OSO WSC						
Supply	94	122	159	208	273	359
Groundwater	94	122	159	208	273	359
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
PETTUS MUD						
Supply	65	68	73	79	85	91
Groundwater	65	68	73	79	85	91
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
SKIDMORE WSC						
Supply	81	81	81	81	81	81
Groundwater	81	81	81	81	81	81
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
TDCJ CHASE FIELD						
Supply	1,290	1,290	1,290	1,290	1,290	1,290
Groundwater	1,290	1,290	1,290	1,290	1,290	1,290
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
COUNTY-OTHER, BEE						
Supply	219	219	219	219	219	219
Groundwater	219	219	219	219	219	219
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-

City/County	*2030*	*2040*	*2050*	*2060*	*2070*	*2080*
Bee County						
FALFURRIAS						
Supply	1,162	1,147	1,152	1,167	1,199	1,256
Groundwater	1,162	1,147	1,152	1,167	1,199	1,256
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
COUNTY-OTHER, BROOKS						
Supply	32	32	32	32	32	32
Groundwater	32	32	32	32	32	32
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Duval County						
DUVAL COUNTY CRD						
Supply	161	152	143	135	127	119
Groundwater	161	152	143	135	127	119
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
FREER WCID						
Supply	5	5	4	4	4	4
Groundwater	5	5	4	4	4	4
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
SAN DIEGO MUD 1						
Supply	678	675	672	673	685	716
Groundwater	678	675	672	673	685	716
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
COUNTY-OTHER, DUVAL						
Supply	-	-	-	-	-	-
Groundwater	-	-	-	-	-	-
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Jim Wells County						
ALICE						
Supply	4,009	4,235	4,436	4,667	4,943	5,276
Groundwater	1,568	1,568	1,568	1,568	1,568	1,568
Surface water	2,254	2,480	2,681	2,912	3,188	3,521
Reuse	187	187	187	187	187	187
JIM WELLS COUNTY FWSD 1						
Supply	112	112	112	113	114	117
Groundwater	112	112	112	113	114	117
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
ORANGE GROVE						
Supply	364	354	347	341	337	336
Groundwater	364	354	347	341	337	336
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
PREMONT						
Supply	554	541	532	524	521	522
Groundwater	554	541	532	524	521	522
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
SAN DIEGO MUD 1						
Supply	32	32	32	32	32	32
Groundwater	32	32	32	32	32	32
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-

City/County	2030	2040	2050	2060	2070	2080
COUNTY-OTHER, JIM WELLS						
Supply	35	35	35	35	35	35
Groundwater	35	35	35	35	35	35
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Kenedy County						
COUNTY-OTHER, KENEDY						
Supply	175	160	148	139	130	121
Groundwater	175	160	148	139	130	121
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Kleberg County						
BAFFIN BAY WSC						
Supply	129	132	136	143	150	156
Groundwater	129	132	136	143	150	156
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
KINGSVILLE						
Supply	3,907	4,002	4,135	4,329	4,522	4,714
Groundwater	3,901	4,002	4,135	4,329	4,472	4,472
Surface water	6	-	-	-	50	242
Reuse	-	-	-	-	-	-
NAVAL AIR STATION KINGSVILLE						
Supply	264	273	282	292	301	306
Groundwater	-	-	-	-	-	-
Surface water	264	273	282	292	301	306
Reuse	-	-	-	-	-	-
RICARDO WSC						
Supply	385	394	408	428	447	467
Groundwater	-	-	-	-	-	-
Surface water	385	394	408	428	447	467
Reuse	-	-	-	-	-	-
RIVIERA WATER SYSTEM						
Supply	128	131	136	142	149	155
Groundwater	128	131	136	142	149	155
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
COUNTY-OTHER, KLEBERG						
Supply	208	212	219	230	240	251
Groundwater	208	212	219	230	240	251
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Live Oak County						
EL OSO WSC						
Supply	152	165	165	165	165	165
Groundwater	152	165	165	165	165	165
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
GEORGE WEST						
Supply	304	275	253	233	214	197
Groundwater	304	275	253	233	214	197
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
MCCOY WSC						
Supply	6	5	4	3	2	2
Groundwater	6	5	4	3	2	2
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-

City/County	2030	2040	2050	2060	2070	2080
OLD MARBACH SCHOOL WSC						
Supply	86	82	79	78	76	75
Groundwater	86	82	79	78	76	75
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
McMullen County						
THREE RIVERS						
Supply	2,628	2,523	2,415	2,303	2,187	2,065
Groundwater	-	-	-	-	-	-
Surface water	2,562	2,457	2,349	2,237	2,121	1,999
Reuse	66	66	66	66	66	66
COUNTY-OTHER, LIVE OAK						
Supply	441	441	441	441	441	441
Groundwater	441	441	441	441	441	441
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
THREE RIVERS						
Supply	12	12	11	10	9	9
Groundwater	-	-	-	-	-	-
Surface water	12	12	11	10	9	9
Reuse	-	-	-	-	-	-
COUNTY-OTHER, MCMULLEN						
Supply	61	56	54	50	46	42
Groundwater	60	55	53	49	45	41
Surface water	-	-	-	-	-	-
Reuse	1	1	1	1	1	1
Nueces County						
BISHOP						
Supply	550	558	558	555	551	547
Groundwater	282	282	282	282	282	282
Surface water	268	276	276	273	269	265
Reuse	-	-	-	-	-	-
CORPUS CHRISTI						
Supply	59,084	59,885	59,942	59,581	59,223	53,708
Groundwater	-	-	-	-	-	-
Surface water	58,748	59,549	59,606	59,245	58,887	53,372
Reuse	336	336	336	336	336	336
CORPUS CHRISTI NAVAL AIR STATION						
Supply	2,078	2,111	2,112	2,105	2,096	2,086
Groundwater	-	-	-	-	-	-
Surface water	2,078	2,111	2,112	2,105	2,096	2,086
Reuse	-	-	-	-	-	-
DRISCOLL						
Supply	80	81	81	81	80	80
Groundwater	-	-	-	-	-	-
Surface water	80	81	81	81	80	80
Reuse	-	-	-	-	-	-
NUECES COUNTY WCID 3						
Supply	69	65	64	66	68	71
Groundwater	-	-	-	-	-	-
Surface water	69	65	64	66	68	71
Reuse	-	-	-	-	-	-
NUECES COUNTY WCID 4						
Supply	1,370	1,391	1,392	1,384	1,374	1,365
Groundwater	-	-	-	-	-	-
Surface water	1,370	1,391	1,392	1,384	1,374	1,365
Reuse	-	-	-	-	-	-

City/County	2030	2040	2050	2060	2070	2080
NUECES WSC						
Supply	986	997	999	997	994	992
Groundwater	-	-	-	-	-	-
Surface water	986	997	999	997	994	992
Reuse	-	-	-	-	-	-
RIVER ACRES WSC						
Supply	315	319	320	318	316	313
Groundwater	-	-	-	-	-	-
Surface water	315	319	320	318	316	313
Reuse	-	-	-	-	-	-
VIOLET WSC						
Supply	228	229	230	228	227	225
Groundwater	-	-	-	-	-	-
Surface water	228	229	230	228	227	225
Reuse	-	-	-	-	-	-
COUNTY-OTHER, NUECES						
Supply	2,607	2,639	2,641	2,625	2,609	2,593
Groundwater	-	-	-	-	-	-
Surface water	2,607	2,639	2,641	2,625	2,609	2,593
Reuse	-	-	-	-	-	-
San Patricio County						
ARANSAS PASS						
Supply	1,185	1,180	1,183	1,191	1,199	1,207
Groundwater	-	-	-	-	-	-
Surface water	452	447	450	458	466	474
Reuse	733	733	733	733	733	733
GREGORY						
Supply	270	260	257	262	266	270
Groundwater	-	-	-	-	-	-
Surface water	270	260	257	262	266	270
Reuse	-	-	-	-	-	-
INGLESIDE						
Supply	986	1,008	1,022	1,021	1,020	1,019
Groundwater	-	-	-	-	-	-
Surface water	986	1,008	1,022	1,021	1,020	1,019
Reuse	-	-	-	-	-	-
MATHIS						
Supply	469	419	400	417	434	451
Groundwater	-	-	-	-	-	-
Surface water	469	419	400	417	434	451
Reuse	-	-	-	-	-	-
ODEM						
Supply	432	423	421	426	431	437
Groundwater	-	-	-	-	-	-
Surface water	432	423	421	426	431	437
Reuse	-	-	-	-	-	-
PORTLAND						
Supply	3,555	3,837	4,155	4,500	4,873	5,277
Groundwater	-	-	-	-	-	-
Surface water	3,555	3,837	4,155	4,500	4,873	5,277
Reuse	-	-	-	-	-	-
RINCON WSC						
Supply	378	396	405	402	399	396
Groundwater	-	-	-	-	-	-
Surface water	378	396	405	402	399	396
Reuse	-	-	-	-	-	-

City/County	2030	2040	2050	2060	2070	2080
SINTON						
Supply	1,073	1,051	1,045	1,058	1,071	1,084
Groundwater	1,073	1,051	1,045	1,058	1,071	1,084
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
TAFT						
Supply	337	323	318	324	330	336
Groundwater	-	-	-	-	-	-
Surface water	337	323	318	324	330	336
Reuse	-	-	-	-	-	-
COUNTY-OTHER, SAN PATRICIO						
Supply	1,664	1,785	1,683	1,310	915	493
Groundwater	506	506	506	506	506	341
Surface water	1,158	1,279	1,177	804	409	152
Reuse	-	-	-	-	-	-

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4A

Identification of Water Needs

[31 TAC §357.33]

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Section 4A: Identification of Water Needs

4A.1 Introduction

In this chapter, the demand projections from Chapter 2 and the supply projections from Chapter 3 are brought together to estimate projected water needs in the Coastal Bend Region for the next 50 years. Chapter 2 presented demand projections for six types of use: municipal, manufacturing, steam-electric, mining, irrigation, and livestock. Municipal water demand projections are shown for each utility as delineated by water provider service areas, rather than political boundaries. The municipal water user groups (WUGs) represent retail public utilities, privately-owned utilities, and state/federal owned water systems that provide more than 100 acre-feet per year (ac-ft/yr) of water for municipal use. Smaller municipal systems are combined and reported for County-Other. Non-municipal water demand projections are shown on a county-wide basis for each county. Chapter 3 presented surface water availability by water right and groundwater availability and projected use by aquifer.

Chapter 4A.3 includes a summary page for each of the 11 counties in the Coastal Bend Region that highlights specific supply and demand information, followed by two tables. The first table presents supply and demand comparisons for the six types of water use; the second table presents supply and demand comparisons for the municipal WUGs in the county. Water supply and demand information aggregated for major water providers is summarized in Chapter 4A.4.

Chapter 4A.5 summarizes the secondary needs analysis, which estimates the water needs that would remain assuming full implementation of water conservation or direct reuse recommended water management strategies.

Chapter 4A.6 summarizes the water supply and demand picture for the entire region, focusing on those WUGs that have immediate and/or long-term needs.

In accordance with House Bill 807 from 86th legislative session, "if a RWPG has significant identified water needs, the RWP shall provide a specific assessment of the potential for aquifer storage and recovery projects to meet those needs." The Coastal Bend Regional Water Planning Group (CBRWPG) considered this statutory requirement and considers significant water needs to be equal or greater than 20,000 ac-ft/yr. The Initially Prepared Coastal Bend Region Plan includes aquifer storage and recovery (ASR) as an evaluated strategy (Section 5B.5) and recommended water management strategy to meet future manufacturing needs in the Nueces County area as sponsored by the City of Corpus Christi.

4A.2 Allocation Methodology

Existing water supply was determined as the maximum amount of water available from existing sources during drought of record conditions, subject to physical transmission and/or treatment plant constraints and contract limits. Surface water, groundwater, and reuse availability was allocated among the six user groups using the methods explained below.

4A.2.1 Surface Water Allocation

Surface water in the region that is available to meet projected demands consists of the safe yield of the regional reservoir system, 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 according to their stated type of use: municipal, industrial (manufacturing, steam-electric, and mining), and irrigation. Municipal supply was further allocated among cities and other municipal water supply entities by obtaining water seller information (i.e., which water wholesale providers [WWPs] resell water to other water supply entities) and water purchase contract limits between buyers and sellers, provided by the Texas Water Development Board (TWDB) and current WWPs. In most cases, for those cities purchasing water on a wholesale basis, the contract amount remains constant through 2080. It was also assumed that water associated with a wholesaler that is not resold remains as an available supply to the wholesaler. In the case where a supply to a wholesaler is deficient to meet its own demands and contract requirements, a shortage would be expected for their non-municipal customers. Also, in the case of surface water, the available supplies were compared to the water treatment plant (WTP) capacities shown in Table 4A.1.

Table 4A.1.
Water Treatment Plant Capacities for Region N Water User Groups

Entity	WTP Capacity (mgd)	Average Day WTP Capacity (mgd)	Average Day WTP Capacity (ac-ft/yr)
City of Beeville	6.4	5.2	5,833
City of Alice	8.7	6.7	7,560
City of Mathis	2.2	1.7	1,877
City of Three Rivers	3.0	2.1	2,399
Nueces County WCID #3	6.6	5.0	5,605
City of Corpus Christi	160	114.3	128,114
San Patricio Municipal Water District*	38.4	21.3	23,860

*Note: San Patricio Municipal Water District has three water treatment plants (a- municipal; b- industrial; c- municipal or industrial. Municipal (potable) average day capacity of 10.5 mgd (11,762 ac-ft/yr) and industrial treatment plant average day capacity of 10.8 mgd (12,098 ac-ft/yr) per SPMWD email on February 11, 2025.

If the total available surface water supplies were greater than treatment plant capacity, the supplies were constrained by the treatment plant capacity. A detailed explanation of water demand and supplies for current WWPs [1] is described in Section 4A.4. Figure 4A.1 shows how surface water in the Coastal Bend Region is distributed.

[1] The Port of Corpus Christi Authority (PCCA) and Poseidon Water are potential future WWPs for recommended water management based on TWDB DB22 requirements. However, water supply plans are not included for them since they are not current WWPs and were not identified as WWPs by the CBRWPG.

Two situations deserve special attention regarding raw water supplies for the region. The City of Corpus Christi has 170,000 ac-ft/yr in available safe yield supply[2] in 2030 through its own water right in the Nueces Basin from the Choke Canyon Reservoir/Lake Corpus Christi System (CCR/LCC System), a contract with the Lavaca-Navidad River Authority for a base amount of 31,440 ac-ft/yr[3] and up to 12,000 ac-ft on an interruptible basis from Lake Texana, and up to 35,000 ac-ft/yr from the City of Corpus Christi's Garwood water rights. These supplies are referred to collectively as supplies from the CCR/LCC/Texana/ Mary Rhodes Pipeline (MRP) Phase II System (or Corpus Christi Regional Water Supply System).

From this supply, the City of Corpus Christi provides water to its municipal customers throughout the Coastal Bend Region and manufacturing and steam-electric customers in Nueces County (Figure 3.3). The San Patricio Municipal Water District (SPMWD) has a contract to buy up to 81,560 acre-feet (ac-ft) of raw and treated water from the City of Corpus Christi and provides water to municipal customers in Aransas, Nueces and San Patricio counties, as well as manufacturing customers in San Patricio County. South Texas Water Authority (STWA) supplies municipal and rural customers in Nueces and Kleberg counties. Nueces County Water Control and Improvement District #3 (WCID 3) supplies the City of Robstown and River Acres Water Supply Corporation (WSC) in Nueces County.

[2] At the CBRWPG meeting on May 18, 2023, the CBRWPG approved submittal of a hydrologic variance request to the TWDB Executive Administrator to use the Corpus Christi Regional Water Supply Model for regional water supply availability and adoption of safe yield for evaluating regional supplies for the 2026 Region N Plan. The TWDB approved the hydrologic variance request on January 8, 2024.

[3] The LNRA exercised a call-back of 10,400 ac-ft/yr for Jackson County uses per contract, and therefore is not included in the safe yield calculation.

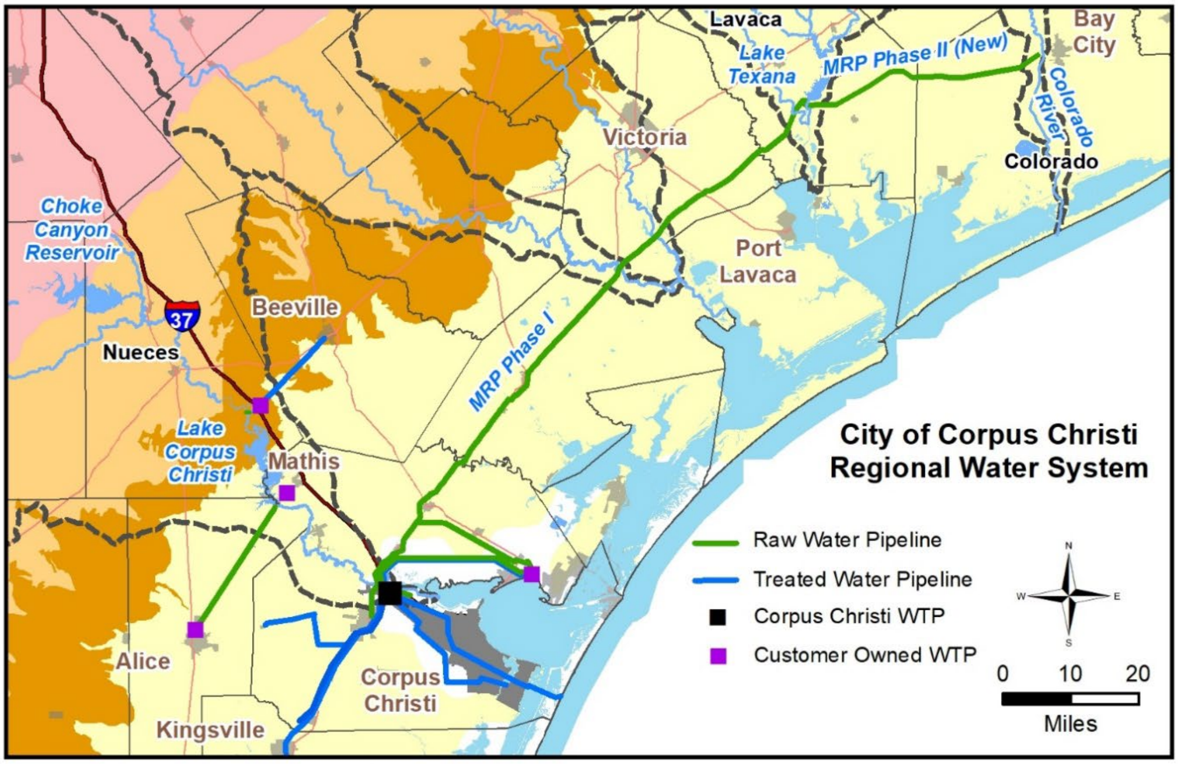

Figure 4A.1.
Distribution of Surface Water from the Corpus Christi Regional Water System in the Coastal Bend Region

The final process in the allocation of surface water supplies was to examine the available WTP capacity for each entity with a WTP and compare that capacity to existing raw water supplies. The WTP capacity was calculated based on average day production using a peaking factor based on recent water use records and feedback from the utility. If the WTP capacity was insufficient to treat the existing raw water supplies, then surface water supplies to that entity were limited to the current WTP treatment capacity. Current WTP capacities are shown in Table 4A.1.

Local surface water supply from stock ponds is available to meet livestock needs when groundwater supplies are insufficient to meet those demands. Generally, these ponds (less than 200 ac-ft of storage) are not large enough to require a water rights permit.

4A.2.2 Groundwater Allocation

Groundwater is regulated locally by groundwater conservation districts except in locations that do not have a district. Districts may issue permits that regulate pumping of groundwater and spacing of wells within their jurisdictions. Multiple districts within a single Groundwater Management Area (GMA) determine the desired future conditions of relevant aquifers within that area. Three GMAs are represented within the Coastal Bend Region’s 11-county area: GMA 13, GMA 15, and GMA 16. All three of these GMAs adopted new desired future conditions (DFCs) between October and November 2021, as described in Chapter 3. These DFCs were then used by the TWDB to develop Modeled Available Groundwater (MAGs) volumes. A MAG volume is the amount of groundwater production, on an average annual basis, that will achieve a DFC. The DFC at a specific location may not be achieved if groundwater production exceeds the MAG volume over the long term. These MAG projections, based on GMA-approved[4] desired future conditions, were adopted on October 12, 2023 by the CBRWPG as the basis of groundwater availability in this *2026 Coastal Bend Regional Water Plan*.

Current groundwater supplies in the 2026 *Coastal Bend Regional Water Plan* are based on MAG projections provided by the TWDB, constrained by well capacity as reported in the Texas Commission on Environmental Quality (TCEQ) Public Water System (PWS) database. The well capacity was assumed to include peaking; therefore, for municipal water users, the average annual capacity was set equal to half of the rated or tested capacity from the PWS database, whichever was lower. For non-municipal groundwater users with groundwater capacities that are not readily obtained from publicly available sources, the groundwater supply was calculated based on TWDB historical water use records from 2010-current. The final step in determining groundwater supplies was to compare the MAG-preserved well capacities to projected demands for each WUG that has historically relied on groundwater. Groundwater supply was set equal to the amount of capacity or water demand, whichever is lower.

For WUGs that use both groundwater and surface water supplies, it was generally assumed that the WUG would use groundwater up to its well capacity (limited by MAG) and then use available surface water per rights or contracts to total the projected water demand through combination of groundwater and surface water supplies. It is assumed that groundwater beyond demands would not be pumped, and therefore, would be available as a collective resource for future water management strategy development subject to adopted MAGs.

Total anticipated groundwater production in any planning decade may not exceed the MAG volume in any county-aquifer location (total groundwater production includes quantities associated with both existing supplies and any recommended water management strategies). This prevents regional water planning groups from recommending water management strategies with supply volumes that would result in exceeding (i.e., overdrafting) approved MAG volumes. Groundwater supply was generally allocated in the following manner:

Municipal Use

- For cities, groundwater supply was based upon half of the rated or tested well capacity listed in the TCEQ PWS database.
- For rural areas, a list of PWS included in county-other provided by the TWDB was used to identify well capacities.

Irrigation Use

- Irrigation supply was estimated as either the projected demand in each decade or well capacity, whichever is less. The well capacity was generally estimated as the maximum

[4] The MAGs calculated by the TWDB were approved by GMA 13 on July 25, 2022; GMA 15 on August 16, 2022; and GMA 16 on October 31, 2022.

amount of water used by irrigators in 2010 to 2020 according to self-reported survey to the TWDB. Data from the local groundwater conservation district manager superseded the TWDB data for McMullen County-Irrigation. Actual well capacity pumping constraints may be different than those estimated based on previous maximum annual irrigation water use. Most irrigation water in the Coastal Bend Region is applied during growing seasons, and therefore wells may be capable of providing additional supplies for peak use conditions.

Manufacturing Use

- The manufacturing well capacity was generally estimated as the highest groundwater usage from 2010-2020. Groundwater supply was based on projected water use or estimated well capacities, whichever is less.

Mining Use

- The mining supply was estimated as either the projected demand in each decade or well capacity, whichever is less. Well capacity was generally estimated as the highest groundwater usage from 2010-2020. An exception was made for Bee County-Mining, which had maximum groundwater use in 2022.

Livestock Use

- The groundwater supply for livestock was calculated based on maximum historic groundwater use reported by TWDB from 2010 to 2020. Any remaining demand is met with local surface water supplies.

4A.2.3 Reuse Water Allocation

The reuse supply was estimated from the maximum historical reuse during the 2018-2022 period based on data from the TWDB's data dashboard.

4A.3 County Summaries – Comparison of Demand to Supply

4A.3.1 Comparison of Demand to Supply – Aransas County

A summary of population, water demands, water supply, and shortages are shown by decade for the 2030 through 2080 period in Table 4A.2 for all categories of water use. Table 4A.3 includes a summary of municipal demands.

Demands

- For the period 2020 to 2080, municipal demand decreases from 3,914 ac-ft in 2030 to 3,547 ac-ft in 2080.
- There are no manufacturing, stream-electric, mining, or irrigation demands projected across the 2030 to 2080 period.
- Livestock demand is constant at 52 ac-ft/yr.

Supplies

- Surface water from the CCR/LCC/Texana/MRP Phase II System is supplied to municipalities via the SPMWD.
- Groundwater supplies are from the Gulf Coast Aquifer. There is sufficient MAG available.
- Surface water for livestock needs is provided from on-farm and local sources.
- Reuse water supply from Aransas County Municipal Utility District (MUD)/Rockport based on the maximum historical reuse from 2018-2022 reported in the TWDB data dashboard.

Comparison of Demand to Supply

- There are adequate supplies available to meet all projected demands through the planning period.

Table 4A.2. Aransas County Population, Water Supply, and Water Demand Projections

	Population Projection	2030	2040	2050	2060	2070	2080
		24,415	24,299	23,708	23,195	22,691	22,196
	Supply and Demand by Type of Use	Year					
		2030 (ac-ft)	2040 (ac-ft)	2050 (ac-ft)	2060 (ac-ft)	2070 (ac-ft)	2080 (ac-ft)
Municipal	Municipal Demand (See Table 4A.3)	3,914	3,882	3,788	3,706	3,625	3,547
	Municipal Existing Supply						
	Groundwater	482	477	464	452	441	430
	Surface water	3,290	3,263	3,182	3,112	3,042	2,975
	Reuse	142	142	142	142	142	142
	Total Existing Municipal Supply	3,914	3,882	3,788	3,706	3,625	3,547
	Municipal Balance	0	0	0	0	0	0
Industrial	Manufacturing Demand	0	0	0	0	0	0
	Manufacturing Existing 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 Balance	0	0	0	0	0	0
	Steam-Electric Demand	0	0	0	0	0	0
	Steam-Electric Existing 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 Balance	0	0	0	0	0	0
	Mining Demand	0	0	0	0	0	0
	Mining Existing Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	0	0	0	0	0	0
	Total Mining Supply	0	0	0	0	0	0
	Mining Balance	0	0	0	0	0	0
Agriculture	Irrigation Demand	0	0	0	0	0	0
	Irrigation Existing 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 Balance	0	0	0	0	0	0
	Livestock Demand	52	52	52	52	52	52
	Livestock Existing Supply						
	Groundwater	23	23	23	23	23	23
	Surface water	29	29	29	29	29	29
	Total Livestock Supply	52	52	52	52	52	52
	Livestock Balance	0	0	0	0	0	0
Total	Municipal and Industrial Demand	3,914	3,882	3,788	3,706	3,625	3,547
	Existing Municipal and Industrial Supply						
	Groundwater	482	477	464	452	441	430
	Surface water	3,290	3,263	3,182	3,112	3,042	2,975
	Reuse	142	142	142	142	142	142
	Total Municipal and Industrial Supply	3,914	3,882	3,788	3,706	3,625	3,547
	Municipal and Industrial Balance	0	0	0	0	0	0
	Agriculture Demand	52	52	52	52	52	52
	Existing Agricultural Supply						
	Groundwater	23	23	23	23	23	23
	Surface water	29	29	29	29	29	29
	Total Agriculture Supply	52	52	52	52	52	52
	Agriculture Balance	0	0	0	0	0	0
	Total Demand	3,966	3,934	3,840	3,758	3,677	3,599
	Total Supply						
	Groundwater	505	500	487	475	464	453
	Surface water	3,319	3,292	3,211	3,141	3,071	3,004
	Reuse	142	142	142	142	142	142
	Total Supply	3,966	3,934	3,840	3,758	3,677	3,599
	Total Balance	0	0	0	0	0	0

Table 4A.3.
Aransas County Municipal Water Demand and Supply by City/County (ac-ft)

City/County	2030	2040	2050	2060	2070	2080
ARANSAS PASS						
Demand	116	115	112	110	107	105
Supply	116	115	112	110	107	105
Groundwater	-	-	-	-	-	-
Surface water	116	115	112	110	107	105
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
RINCON WSC						
Demand	2	2	2	2	2	2
Supply	2	2	2	2	2	2
Groundwater	-	-	-	-	-	-
Surface water	2	2	2	2	2	2
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
ROCKPORT						
Demand	3266	3240	3162	3094	3027	2962
Supply	3266	3240	3162	3094	3027	2962
Groundwater	-	-	-	-	-	-
Surface water	3172	3146	3068	3000	2933	2868
Reuse	94	94	94	94	94	94
Balance	-	-	-	-	-	-
COUNTY-OTHER, ARANSAS						
Demand	530	525	512	500	489	478
Supply	530	525	512	500	489	478
Groundwater	482	477	464	452	441	430
Surface water	-	-	-	-	-	-
Reuse	48	48	48	48	48	48
Balance	-	-	-	-	-	-
County Total						
Demand	3914	3882	3788	3706	3625	3547
Supply	3914	3882	3788	3706	3625	3547
Groundwater	482	477	464	452	441	430
Surface water	3290	3263	3182	3112	3042	2975
Reuse	142	142	142	142	142	142
Balance	-	-	-	-	-	-

4A.3.2 Comparison of Demand to Supply – Bee County

A summary of population, water demands, water supply, and shortages are shown by decade for the 2030 through 2080 period in Table 4A.4 for all categories of water use. Table 4A.5 includes a summary of municipal demands.

Demands

- For the period 2030 to 2080, municipal demand increases from 6,007 ac-ft in 2030 to 6,267 ac-ft in 2080.
- There are no manufacturing or stream-electric demands from 2030 to 2080.
- Mining demand is constant at 239 ac-ft from 2030 through 2070 until it decreases to 0 ac-ft in 2080.
- For the period 2030 to 2080, irrigation demand is constant at 2,518 ac-ft and livestock demand is constant at 568 ac-ft.

Supplies

- Surface water is provided to the City of Beeville from Lake Corpus Christi associated with the CCR/LCC/Texana/MRP Phase II System. The City of Beeville has groundwater supplies that they use in conjunction with surface water.
- Surface water for livestock needs is provided from on-farm/local sources.
- Groundwater supplies are from the Gulf Coast Aquifer aquifers for all WUGs except El Oso WSC, which pumps groundwater from the Carrizo Aquifer. The groundwater supply is limited by water well capacity which was estimated based on TWDB historical water use records from 2010-2020. There is sufficient MAG available.
- Groundwater supply for irrigation was set equal to the maximum historical pumpage (i.e., estimated well capacity) during 2010-2020.
- Reuse water supply from Beeville is available for mining based on the maximum historical reuse from 2018-2022 reported in the TWDB data dashboard. When mining demands are zero in 2080, reuse is not expected to be used.

Comparison of Demand to Supply

- There are insufficient supplies available to meet projected demands. In 2030, Bee County has a projected water shortage of 1,478 ac-ft and decreases to a shortage of 564 ac-ft in 2080. The shortage falls on mining and municipal WUGs due to water well capacity limitations.

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

	Population Projection	2030	2040	2050	2060	2070	2080
		31,363	31,563	31,337	31,030	30,725	30,422
	Supply and Demand by Type of Use	Year					
		2030 (ac-ft)	2040 (ac-ft)	2050 (ac-ft)	2060 (ac-ft)	2070 (ac-ft)	2080 (ac-ft)
Municipal	Municipal Demand (See Table 4A.5)	6,007	6,070	6,107	6,148	6,201	6,267
	Municipal Existing Supply						
	Groundwater	3,004	3,035	3,077	3,132	3,203	3,295
	Surface water	1,550	1,672	1,820	1,998	2,193	2,408
	Total Existing Municipal Supply	4,554	4,707	4,897	5,130	5,396	5,703
	Municipal Balance	(1,453)	(1,363)	(1,210)	(1,018)	(805)	(564)
Industrial	Manufacturing Demand	0	0	0	0	0	0
	Manufacturing Existing 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 Balance	0	0	0	0	0	0
	Steam-Electric Demand	0	0	0	0	0	0
	Steam-Electric Existing 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 Balance	0	0	0	0	0	0
	Mining Demand	239	239	239	239	239	0
	Mining Existing Supply						
	Groundwater	135	135	135	135	135	0
	Surface water	0	0	0	0	0	0
	Reuse	79	79	79	79	79	0
	Total Mining Supply	214	214	214	214	214	0
	Mining Balance	(25)	(25)	(25)	(25)	(25)	0
Agriculture	Irrigation Demand	2,518	2,518	2,518	2,518	2,518	2,518
	Irrigation Existing Supply						
	Groundwater	2,518	2,518	2,518	2,518	2,518	2,518
	Surface water	0	0	0	0	0	0
	Total Irrigation Supply	2,518	2,518	2,518	2,518	2,518	2,518
	Irrigation Balance	0	0	0	0	0	0
	Livestock Demand	568	568	568	568	568	568
	Livestock Existing Supply						
	Groundwater	558	558	558	558	558	558
	Surface water	10	10	10	10	10	10
	Total Livestock Supply	568	568	568	568	568	568
	Livestock Balance	0	0	0	0	0	0
Total	Municipal and Industrial Demand	6,246	6,309	6,346	6,387	6,440	6,267
	Existing Municipal and Industrial Supply						
	Groundwater	3,139	3,170	3,212	3,267	3,338	3,295
	Surface water	1,550	1,672	1,820	1,998	2,193	2,408
	Reuse	79	79	79	79	79	79
	Total Municipal and Industrial Supply	4,768	4,921	5,111	5,344	5,610	5,782
	Municipal and Industrial Balance	(1,478)	(1,388)	(1,235)	(1,043)	(830)	(485)
	Agriculture Demand	3,086	3,086	3,086	3,086	3,086	3,086
	Existing Agricultural Supply						
	Groundwater	3,076	3,076	3,076	3,076	3,076	3,076
	Surface water	10	10	10	10	10	10
	Total Agriculture Supply	3,086	3,086	3,086	3,086	3,086	3,086
	Agriculture Balance	0	0	0	0	0	0
	Total Demand	9,332	9,395	9,432	9,473	9,526	9,353
	Total Supply						
	Groundwater	6,215	6,246	6,288	6,343	6,414	6,371
	Surface water	1,560	1,682	1,830	2,008	2,203	2,418
		79	79	79	79	79	0
	Total Supply	7,854	8,007	8,197	8,430	8,696	8,789
	Total Balance	(1,478)	(1,388)	(1,235)	(1,043)	(830)	(564)

Table 4A.5.
Bee County Municipal Water Demand and Supply by City/County (ac-ft)

City/County	2030	2040	2050	2060	2070	2080
BEEVILLE						
Demand	2,805	2,927	3,075	3,253	3,448	3,663
Supply	2,805	2,927	3,075	3,253	3,448	3,663
Groundwater	1,255	1,255	1,255	1,255	1,255	1,255
Surface water	1,550	1,672	1,820	1,998	2,193	2,408
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
EL OSO WSC						
Demand	94	122	159	208	273	359
Supply	94	122	159	208	273	359
Groundwater	94	122	159	208	273	359
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
PETTUS MUD						
Demand	65	68	73	79	85	91
Supply	65	68	73	79	85	91
Groundwater	65	68	73	79	85	91
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
SKIDMORE WSC						
Demand	103	105	108	113	119	125
Supply	81	81	81	81	81	81
Groundwater	81	81	81	81	81	81
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	(22)	(24)	(27)	(32)	(38)	(44)
TDCJ CHASE FIELD						
Demand	1,295	1,292	1,292	1,292	1,292	1,292
Supply	1,290	1,290	1,290	1,290	1,290	1,290
Groundwater	1,290	1,290	1,290	1,290	1,290	1,290
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	(5)	(2)	(2)	(2)	(2)	(2)
COUNTY-OTHER, BEE						
Demand	1,645	1,556	1,400	1,203	984	737
Supply	219	219	219	219	219	219
Groundwater	219	219	219	219	219	219
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	(1,426)	(1,337)	(1,181)	(984)	(765)	(518)
County Total						
Demand	6,007	6,070	6,107	6,148	6,201	6,267
Supply	4,554	4,707	4,897	5,130	5,396	5,703
Groundwater	3,004	3,035	3,077	3,132	3,203	3,295
Surface water	1,550	1,672	1,820	1,998	2,193	2,408
Reuse	-	-	-	-	-	-
Balance	(1,453)	(1,363)	(1,210)	(1,018)	(805)	(564)

4A.3.3 Comparison of Demand to Supply – Brooks County

A summary of population, water demands, water supply, and shortages are shown by decade for the 2030 through 2080 period in Table 4A.6 for all categories of water use. Table 4A.7 includes a summary of municipal demands.

Demands

- For the period 2030 to 2080, municipal demand decreases from 1,475 ac-ft in 2030 to 1,397 ac-ft in 2060 and to 1,389 ac-ft in 2080.
- Mining demand is constant at 16 ac-ft across the 2030 to 2080 planning period.
- For the period 2030 to 2080, irrigation demand is constant at 597 ac-ft; livestock demand is constant at 478 ac-ft.
- There is no manufacturing or steam-electric demand projected for 2030 to 2080.

Supplies

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

Comparison of Demand to Supply

- There are insufficient supplies to meet municipal and industrial demands across the entire 2030-2080 planning period due to water well capacity limitations. In 2030, Brooks County has a projected water shortage of 281 ac-ft and decreases to a shortage of 101 ac-ft in 2080. The shortage falls on municipal county-other due to water well capacity limitations.

Table 4A.6.
Brooks County Population, Water Supply, and Water Demand Projections

	Population Projection	2030	2040	2050	2060	2070	2080
		6,895	6,702	6,493	6,256	6,020	5,785
	Supply and Demand by Type of Use	Year					
		2030 (ac-ft)	2040 (ac-ft)	2050 (ac-ft)	2060 (ac-ft)	2070 (ac-ft)	2080 (ac-ft)
Municipal	Municipal Demand (See Table 4A.7)	1,475	1,441	1,418	1,397	1,386	1,389
	Municipal Existing Supply						
	Groundwater	1,194	1,179	1,184	1,199	1,231	1,288
	Surface water	0	0	0	0	0	0
	Total Existing Municipal Supply	1,194	1,179	1,184	1,199	1,231	1,288
	Municipal Balance	(281)	(262)	(234)	(198)	(155)	(101)
Industrial	Manufacturing Demand	0	0	0	0	0	0
	Manufacturing Existing 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 Balance	0	0	0	0	0	0
	Steam-Electric Demand	0	0	0	0	0	0
	Steam-Electric Existing 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 Balance	0	0	0	0	0	0
	Mining Demand	16	16	16	16	16	16
	Mining Existing Supply						
	Groundwater	16	16	16	16	16	16
	Surface water	0	0	0	0	0	0
	Total Mining Supply	16	16	16	16	16	16
	Mining Balance	0	0	0	0	0	0
Agriculture	Irrigation Demand	597	597	597	597	597	597
	Irrigation Existing Supply						
	Groundwater	597	597	597	597	597	597
	Surface water	0	0	0	0	0	0
	Total Irrigation Supply	597	597	597	597	597	597
	Irrigation Balance	0	0	0	0	0	0
	Livestock Demand	478	478	478	478	478	478
	Livestock Existing Supply						
	Groundwater	343	343	343	343	343	343
	Surface water	135	135	135	135	135	135
	Total Livestock Supply	478	478	478	478	478	478
	Livestock Balance	0	0	0	0	0	0
Total	Municipal and Industrial Demand	1,491	1,457	1,434	1,413	1,402	1,405
	Existing Municipal and Industrial Supply						
	Groundwater	1,210	1,195	1,200	1,215	1,247	1,304
	Surface water	0	0	0	0	0	0
	Total Municipal and Industrial Supply	1,210	1,195	1,200	1,215	1,247	1,304
	Municipal and Industrial Balance	(281)	(262)	(234)	(198)	(155)	(101)
	Agriculture Demand	1,075	1,075	1,075	1,075	1,075	1,075
	Existing Agricultural Supply						
	Groundwater	940	940	940	940	940	940
	Surface water	135	135	135	135	135	135
	Total Agriculture Supply	1,075	1,075	1,075	1,075	1,075	1,075
	Agriculture Balance	0	0	0	0	0	0
	Total Demand	2,566	2,532	2,509	2,488	2,477	2,480
	Total Supply						
	Groundwater	2,150	2,135	2,140	2,155	2,187	2,244
	Surface water	135	135	135	135	135	135
	Total Supply	2,285	2,270	2,275	2,290	2,322	2,379
	Total Balance	(281)	(262)	(234)	(198)	(155)	(101)

Table 4A.7. Brooks County Municipal Water Demand and Supply by City/County (ac-ft)

City/County	2030	2040	2050	2060	2070	2080
FALFURRIAS						
Demand	1,162	1,147	1,152	1,167	1,199	1,256
Supply	1,162	1,147	1,152	1,167	1,199	1,256
Groundwater	1,162	1,147	1,152	1,167	1,199	1,256
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
COUNTY-OTHER, BROOKS						
Demand	313	294	266	230	187	133
Supply	32	32	32	32	32	32
Groundwater	32	32	32	32	32	32
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	(281)	(262)	(234)	(198)	(155)	(101)
County Total						
Demand	1,475	1,441	1,418	1,397	1,386	1,389
Supply	1,194	1,179	1,184	1,199	1,231	1,288
Groundwater	1,194	1,179	1,184	1,199	1,231	1,288
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	(281)	(262)	(234)	(198)	(155)	(101)

4A.3.4 Comparison of Demand to Supply – Duval County

A summary of population, water demands, water supply, and shortages are shown by decade for the 2030 through 2080 period in Table 4A.8 for all categories of water use. Table 4A.9 includes a summary of municipal demands.

Demands

- For the period 2030 to 2080, municipal demand decreases from 1,593 ac-ft in 2030 to 1,408 ac-ft in 2060 then to 1,318 ac-ft in 2080.
- Mining demand is constant at from 6 ac-ft from 2030 through 2060 until it increases to 7 ac-ft for 2070 and 2080.
- For the period 2030 to 2080, irrigation demand remains constant at 2,016 ac-ft; livestock demand is constant at 566 ac-ft.
- There is no manufacturing or steam-electric demand projected for 2030 to 2080.

Supplies

- Groundwater supplies are from the Gulf Coast Aquifer. There is sufficient MAG available.

Comparison of Demand to Supply

- Due to water well capacity limitations, there is a total projected water shortage of 253 ac-ft/yr in 2030, which decreases to 113 ac-ft/yr in 2080. County-other is projected to have a shortage of 253 ac-ft/yr in 2030 that decreases to 113 ac-ft/yr in 2080.

Table 4A.8. Duval County Population, Water Supply, and Water Demand Projections

	Population Projection	2030	2040	2050	2060	2070	2080
		9,261	8,828	8,436	8,108	7,782	7,458
	Supply and Demand by Type of Use	Year					
		2030 (ac-ft)	2040 (ac-ft)	2050 (ac-ft)	2060 (ac-ft)	2070 (ac-ft)	2080 (ac-ft)
Municipal	Municipal Demand (See Table 4A.9)	1,593	1,520	1,458	1,408	1,359	1,318
	Municipal Existing Supply						
	Groundwater	1,340	1,297	1,259	1,229	1,208	1,205
	Surface water	0	0	0	0	0	0
	Total Existing Municipal Supply	1,340	1,297	1,259	1,229	1,208	1,205
	Municipal Balance	(253)	(223)	(199)	(179)	(151)	(113)
Industrial	Manufacturing Demand	0	0	0	0	0	0
	Manufacturing Existing 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 Balance	0	0	0	0	0	0
	Steam-Electric Demand	0	0	0	0	0	0
	Steam-Electric Existing 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 Balance	0	0	0	0	0	0
	Mining Demand	6	6	6	6	7	7
	Mining Existing Supply						
	Groundwater	6	6	6	6	7	7
	Surface water	0	0	0	0	0	0
	Total Mining Supply	6	6	6	6	7	7
	Mining Balance	0	0	0	0	0	0
Agriculture	Irrigation Demand	2,016	2,016	2,016	2,016	2,016	2,016
	Irrigation Existing Supply						
	Groundwater	2,016	2,016	2,016	2,016	2,016	2,016
	Surface water	0	0	0	0	0	0
	Total Irrigation Supply	2,016	2,016	2,016	2,016	2,016	2,016
	Irrigation Balance	0	0	0	0	0	0
	Livestock Demand	566	566	566	566	566	566
	Livestock Existing Supply						
	Groundwater	566	566	566	566	566	566
	Surface water	0	0	0	0	0	0
	Total Livestock Supply	566	566	566	566	566	566
	Livestock Balance	0	0	0	0	0	0
Total	Municipal and Industrial Demand	1,599	1,526	1,464	1,414	1,366	1,325
	Existing Municipal and Industrial Supply						
	Groundwater	1,346	1,303	1,265	1,235	1,215	1,212
	Surface water	0	0	0	0	0	0
	Total Municipal and Industrial Supply	1,346	1,303	1,265	1,235	1,215	1,212
	Municipal and Industrial Balance	(253)	(223)	(199)	(179)	(151)	(113)
	Agriculture Demand	2,582	2,582	2,582	2,582	2,582	2,582
	Existing Agricultural Supply						
	Groundwater	2,582	2,582	2,582	2,582	2,582	2,582
	Surface water	0	0	0	0	0	0
	Total Agriculture Supply	2,582	2,582	2,582	2,582	2,582	2,582
	Agriculture Balance	0	0	0	0	0	0
	Total Demand	4,181	4,108	4,046	3,996	3,948	3,907
	Total Supply						
	Groundwater	3,928	3,885	3,847	3,817	3,797	3,794
	Surface water	0	0	0	0	0	0
	Total Supply	3,928	3,885	3,847	3,817	3,797	3,794
	Total Balance	(253)	(223)	(199)	(179)	(151)	(113)

Table 4A.9.
Duval County Municipal Water Demand and Supply by City/County (ac-ft)

City/County	2030	2040	2050	2060	2070	2080
DUVAL COUNTY CRD						
Demand	161	152	143	135	127	119
Supply	161	152	143	135	127	119
Groundwater	161	152	143	135	127	119
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
FREER WCID						
Demand	501	470	444	421	396	370
Supply	5	5	4	4	4	4
Groundwater	5	5	4	4	4	4
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	(496)	(465)	(440)	(417)	(392)	(366)
SAN DIEGO MUD 1						
Demand	678	675	672	673	685	716
Supply	678	675	672	673	685	716
Groundwater	678	675	672	673	685	716
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
COUNTY-OTHER, DUVAL						
Demand	253	223	199	179	151	113
Supply	-	-	-	-	-	-
Groundwater	-	-	-	-	-	-
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	(253)	(223)	(199)	(179)	(151)	(113)
County Total						
Demand	1,593	1,520	1,458	1,408	1,359	1,318
Supply	844	832	819	812	816	839
Groundwater	844	832	819	812	816	839
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	(749)	(688)	(639)	(596)	(543)	(479)

Table 4A.10.
Duval County Municipal Water Demand and Supply by City/County (ac-ft)

City/County	2030	2040	2050	2060	2070	2080
DUVAL COUNTY CRD						
Demand	161	152	143	135	127	119
Supply	161	152	143	135	127	119
Groundwater	161	152	143	135	127	119
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
FREER WCID						
Demand	501	470	444	421	396	370
Supply	501	470	444	421	396	370
Groundwater	501	470	444	421	396	370
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
SAN DIEGO MUD 1						
Demand	678	675	672	673	685	716
Supply	678	675	672	673	685	716
Groundwater	678	675	672	673	685	716
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
COUNTY-OTHER, DUVAL						
Demand	253	223	199	179	151	113
Supply	-	-	-	-	-	-
Groundwater	-	-	-	-	-	-
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	(253)	(223)	(199)	(179)	(151)	(113)
County Total						
Demand	1,593	1,520	1,458	1,408	1,359	1,318
Supply	1,340	1,297	1,259	1,229	1,208	1,205
Groundwater	1,340	1,297	1,259	1,229	1,208	1,205
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	(253)	(223)	(199)	(179)	(151)	(113)

4A.3.5 Comparison of Demand to Supply – Jim Wells County

A summary of population, water demands, water supply, and shortages are shown by decade for the 2030 through 2080 period in Table 4A.11 for all categories of water use. Table 4A.12 includes a summary of municipal demands.

Demands

- For the period 2030 to 2080, municipal demand decreases from 6,829 ac-ft in 2030 to 6,668 ac-ft in 2060, then to 6,531 ac-ft in 2080.
- Manufacturing demand increases from 87 ac-ft in 2030 to 104 ac-ft in 2080.
- For the period 2030 to 2080, irrigation demand remains constant at 1,665 ac-ft; livestock demand is constant at 711 ac-ft.
- There is no steam-electric or mining demand projected for the 2030-2080 planning period.

Supplies

- Surface water is provided to the City of Alice from the CCR/LCC/Texana/MRP Phase II System; livestock needs are met with on-farm/local sources.
- Groundwater supplies are from the Gulf Coast Aquifer. San Diego groundwater supply is obtained from Duval County Conservation and Reclamation District (CRD). There is sufficient MAG available.
- Reuse water supply from Alice based on the maximum historical reuse from 2018-2022 reported in the TWDB data dashboard.

Comparison of Demand to Supply

- There are sufficient municipal supplies available through 2080 for Alice, Jim Wells County Fresh Water Supply District #1 (FWSD 1), Orange Grove, and Premont.
- Due to water well capacity limitations, there is a total municipal shortage of 1,723 ac-ft/yr in 2030, decreasing to 213 ac-ft/yr in 2080; San Diego MUD 1 is projected to have a water shortage of 102 ac-ft, increasing to 131 ac-ft in 2080. The county-other user group is projected to have a water shortage of 1,621 ac-ft/yr in 2030, decreasing to 82 ac-ft/yr in 2080.
- Manufacturing has a projected water shortage of 8 ac-ft/yr in 2030, increasing to 25 ac-ft in 2080.
- There are sufficient agricultural supplies to meet irrigation and livestock demand through 2080.

Table 4A.11. Jim Wells County Population, Water Supply, and Water Demand Projections

	Population Projection	2030	2040	2050	2060	2070	2080
		38,692	38,400	37,573	36,430	35,294	34,164
	Supply and Demand by Type of Use	Year					
		2030 (ac-ft)	2040 (ac-ft)	2050 (ac-ft)	2060 (ac-ft)	2070 (ac-ft)	2080 (ac-ft)
Municipal	Municipal Demand (See Table 4A.11)	6,829	6,824	6,764	6,668	6,589	6,531
	Municipal Existing Supply						
	Groundwater	2,665	2,642	2,626	2,613	2,607	2,610
	Surface water	2,254	2,480	2,681	2,912	3,188	3,521
	Reuse	187	187	187	187	187	187
	Total Existing Municipal Supply	5,106	5,309	5,494	5,712	5,982	6,318
	Municipal Balance	(1,723)	(1,515)	(1,270)	(956)	(607)	(213)
Industrial	Manufacturing Demand	87	90	93	96	100	104
	Manufacturing Existing Supply						
	Groundwater	79	79	79	79	79	79
	Surface water	0	0	0	0	0	0
	Total Manufacturing Supply	79	79	79	79	79	79
	Manufacturing Balance	(8)	(11)	(14)	(17)	(21)	(25)
	Steam-Electric Demand	0	0	0	0	0	0
	Steam-Electric Existing 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 Balance	0	0	0	0	0	0
	Mining Demand	0	0	0	0	0	0
	Mining Existing Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	0	0	0	0	0	0
	Total Mining Supply	0	0	0	0	0	0
	Mining Balance	0	0	0	0	0	0
Agriculture	Irrigation Demand	1,665	1,665	1,665	1,665	1,665	1,665
	Irrigation Existing Supply						
	Groundwater	1,665	1,665	1,665	1,665	1,665	1,665
	Surface water	0	0	0	0	0	0
	Total Irrigation Supply	1,665	1,665	1,665	1,665	1,665	1,665
	Irrigation Balance	0	0	0	0	0	0
	Livestock Demand	711	711	711	711	711	711
	Livestock Existing Supply						
	Groundwater	661	661	661	661	661	661
	Surface water	50	50	50	50	50	50
	Total Livestock Supply	711	711	711	711	711	711
	Livestock Balance	0	0	0	0	0	0
Total	Municipal and Industrial Demand	6,916	6,914	6,857	6,764	6,689	6,635
	Existing Municipal and Industrial Supply						
	Groundwater	2,744	2,721	2,705	2,692	2,686	2,689
	Surface water	2,254	2,480	2,681	2,912	3,188	3,521
	Reuse	187	187	187	187	187	187
	Total Municipal and Industrial Supply	5,185	5,388	5,573	5,791	6,061	6,397
	Municipal and Industrial Balance	(1,731)	(1,526)	(1,284)	(973)	(628)	(238)
	Agriculture Demand	2,376	2,376	2,376	2,376	2,376	2,376
	Existing Agricultural Supply						
	Groundwater	2,326	2,326	2,326	2,326	2,326	2,326
	Surface water	50	50	50	50	50	50
	Total Agriculture Supply	2,376	2,376	2,376	2,376	2,376	2,376
	Agriculture Balance	0	0	0	0	0	0
	Total Demand	9,292	9,290	9,233	9,140	9,065	9,011
	Total Supply						
	Groundwater	5,070	5,047	5,031	5,018	5,012	5,015
	Surface water	2,304	2,530	2,731	2,962	3,238	3,571
	Reuse	187	187	187	187	187	187
	Total Supply	7,561	7,764	7,949	8,167	8,437	8,773
	Total Balance	(1,731)	(1,526)	(1,284)	(973)	(628)	(238)

Table 4A.12.
Jim Wells County Municipal Water Demand and Supply by City/County (ac-ft)

City/County	2030	2040	2050	2060	2070	2080
ALICE						
Demand	4,009	4,235	4,436	4,667	4,943	5,276
Supply	4,009	4,235	4,436	4,667	4,943	5,276
Groundwater	1,568	1,568	1,568	1,568	1,568	1,568
Surface water	2,254	2,480	2,681	2,912	3,188	3,521
Reuse	187	187	187	187	187	187
Balance	-	-	-	-	-	-
JIM WELLS COUNTY FWSD 1						
Demand	112	112	112	113	114	117
Supply	112	112	112	113	114	117
Groundwater	112	112	112	113	114	117
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
ORANGE GROVE						
Demand	364	354	347	341	337	336
Supply	364	354	347	341	337	336
Groundwater	364	354	347	341	337	336
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
PREMONT						
Demand	554	541	532	524	521	522
Supply	554	541	532	524	521	522
Groundwater	554	541	532	524	521	522
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
SAN DIEGO MUD 1						
Demand	134	138	143	148	155	163
Supply	32	32	32	32	32	32
Groundwater	32	32	32	32	32	32
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	(102)	(106)	(111)	(116)	(123)	(131)
COUNTY-OTHER, JIM WELLS						
Demand	1,656	1,444	1,194	875	519	117
Supply	35	35	35	35	35	35
Groundwater	35	35	35	35	35	35
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	(1,621)	(1,409)	(1,159)	(840)	(484)	(82)
County Total						
Demand	6,829	6,824	6,764	6,668	6,589	6,531
Supply	5,106	5,309	5,494	5,712	5,982	6,318
Groundwater	2,665	2,642	2,626	2,613	2,607	2,610
Surface water	2,254	2,480	2,681	2,912	3,188	3,521
Reuse	187	187	187	187	187	187
Balance	(1,723)	(1,515)	(1,270)	(956)	(607)	(213)

4A.3.6 Comparison of Demand to Supply – Kenedy County

A summary of population, water demands, water supply, and shortages are shown by decade for the 2030 through 2080 period in Table 4A.13 for all categories of water use. Table 4A.14 includes a summary of municipal demands.

Demands

- For the period 2030 to 2080, municipal demand decreases from 175 ac-ft in 2030 to 121 ac-ft in 2080.
- Mining demand is constant at 3 ac-ft across the 2030-2080 planning period.
- Livestock demand is constant at 631 ac-ft across the 2030-2080 planning period.
- There is no demand projected for manufacturing, steam-electric, or irrigation across the 2030-2080 planning period.

Supplies

- Groundwater supplies are from the Gulf Coast Aquifer. There is sufficient MAG.
- Reuse water supply from mining in Kenedy County based on the maximum historical reuse from 2018-2022 reported in the TWDB data dashboard.

Comparison of Demand to Supply

- There are adequate supplies available to meet all projected demands through the planning period.

Table 4A.13. Kenedy County Population, Water Supply, and Water Demand Projections

Population Projection		2030	2040	2050	2060	2070	2080
		336	306	283	266	249	232
Supply and Demand by Type of Use		Year					
		2030 (ac-ft)	2040 (ac-ft)	2050 (ac-ft)	2060 (ac-ft)	2070 (ac-ft)	2080 (ac-ft)
Municipal	Municipal Demand (See Table 4A.13)	175	160	148	139	130	121
	Municipal Existing Supply						
	Groundwater	175	160	148	139	130	121
	Surface water	0	0	0	0	0	0
	Total Existing Municipal Supply	175	160	148	139	130	121
	Municipal Balance	0	0	0	0	0	0
Industrial	Manufacturing Demand	0	0	0	0	0	0
	Manufacturing Existing 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 Balance	0	0	0	0	0	0
	Steam-Electric Demand	0	0	0	0	0	0
	Steam-Electric Existing 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 Balance	0	0	0	0	0	0
	Mining Demand	3	3	3	3	3	3
	Mining Existing Supply						
	Groundwater	2	2	2	2	2	2
	Surface water	0	0	0	0	0	0
	Reuse	1	1	1	1	1	1
	Total Mining Supply	3	3	3	3	3	3
	Mining Balance	0	0	0	0	0	0
Agriculture	Irrigation Demand	0	0	0	0	0	0
	Irrigation Existing 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 Balance	0	0	0	0	0	0
	Livestock Demand	631	631	631	631	631	631
	Livestock Existing Supply						
	Groundwater	631	631	631	631	631	631
	Surface water	0	0	0	0	0	0
	Total Livestock Supply	631	631	631	631	631	631
	Livestock Balance	0	0	0	0	0	0
Total	Municipal and Industrial Demand	178	163	151	142	133	124
	Existing Municipal and Industrial Supply						
	Groundwater	177	162	150	141	132	123
	Surface water	0	0	0	0	0	0
	Reuse	1	1	1	1	1	1
	Total Municipal and Industrial Supply	178	163	151	142	133	124
	Municipal and Industrial Balance	0	0	0	0	0	0
	Agriculture Demand	631	631	631	631	631	631
	Existing Agricultural Supply						
	Groundwater	631	631	631	631	631	631
	Surface water	0	0	0	0	0	0
	Total Agriculture Supply	631	631	631	631	631	631
	Agriculture Balance	0	0	0	0	0	0
	Total Demand	809	794	782	773	764	755
	Total Supply						
	Groundwater	808	793	781	772	763	754
	Surface water	0	0	0	0	0	0
	Reuse	1	1	1	1	1	1
	Total Supply	809	794	782	773	764	755
	Total Balance	0	0	0	0	0	0

Table 4A.14.
Kenedy County Municipal Water Demand and Supply by City/County (ac-ft)

City/County	2030	2040	2050	2060	2070	2080
COUNTY-OTHER, KENEDY						
Demand	175	160	148	139	130	121
Supply	175	160	148	139	130	121
Groundwater	175	160	148	139	130	121
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
County Total						
Demand	175	160	148	139	130	121
Supply	175	160	148	139	130	121
Groundwater	175	160	148	139	130	121
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-

4A.3.7 Comparison of Demand to Supply – Kleberg County

A summary of population, water demands, water supply, and shortages are shown by decade for the 2030 through 2080 period in Table 4A.15 for all categories of water use. Table 4A.16 includes a summary of municipal demands.

Demands

- For the period 2030 to 2080, municipal demand increases from 5,021 ac-ft in 2030 to 6,049 ac-ft in 2080.
- Manufacturing demand increases from 1,088 ac-ft/yr in 2030 to 1,305 ac-ft/yr in 2080.
- Mining demand remains constant at 10 ac-ft across the planning period.
- For the period 2030 to 2080, irrigation demand is constant at 141 ac-ft; livestock demand is constant at 532 ac-ft.

Supplies

- Surface water is supplied to municipal users from the CCR/LCC/Texana/MRP Phase II System via the STWA.
- Groundwater supplies are from the Gulf Coast Aquifer and are reduced to not exceed the MAG in 2030 and 2040. There is sufficient MAG available for 2050 to 2080.

Comparison of Demand to Supply

- There are adequate supplies available to meet all projected demands through the planning period.

Table 4A.15. Kleberg County Population, Water Supply, and Water Demand Projections

	Population Projection	2030	2040	2050	2060	2070	2080
		33,923	34,901	36,068	37,772	39,466	41,151
	Supply and Demand by Type of Use	**Year**					
		2030 (ac-ft)	**2040 (ac-ft)**	**2050 (ac-ft)**	**2060 (ac-ft)**	**2070 (ac-ft)**	**2080 (ac-ft)**
Municipal	Municipal Demand (See Table 4A.15)	5,021	5,144	5,316	5,564	5,809	6,049
	Municipal Existing Supply						
	Groundwater	4,366	4,477	4,626	4,844	5,011	5,034
	Surface water	655	667	690	720	798	1,015
	Total Existing Municipal Supply	5,021	5,144	5,316	5,564	5,809	6,049
	Municipal Balance	0	0	0	0	0	0
Industrial	Manufacturing Demand	1,088	1,128	1,170	1,213	1,258	1,305
	Manufacturing Existing Supply						
	Groundwater	1,088	1,128	1,170	1,213	1,258	1,305
	Surface water	0	0	0	0	0	0
	Total Manufacturing Supply	1,088	1,128	1,170	1,213	1,258	1,305
	Manufacturing Balance	0	0	0	0	0	0
	Steam-Electric Demand	0	0	0	0	0	0
	Steam-Electric Existing 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 Balance	0	0	0	0	0	0
	Mining Demand	10	10	10	10	10	10
	Mining Existing Supply						
	Groundwater	10	10	10	10	10	10
	Surface water	0	0	0	0	0	0
	Total Mining Supply	10	10	10	10	10	10
	Mining Balance	0	0	0	0	0	0
Agriculture	Irrigation Demand	141	141	141	141	141	141
	Irrigation Existing Supply						
	Groundwater	141	141	141	141	141	141
	Surface water	0	0	0	0	0	0
	Total Irrigation Supply	141	141	141	141	141	141
	Irrigation Balance	0	0	0	0	0	0
	Livestock Demand	532	532	532	532	532	532
	Livestock Existing Supply						
	Groundwater	532	532	532	532	532	532
	Surface water	0	0	0	0	0	0
	Total Livestock Supply	532	532	532	532	532	532
	Livestock Balance	0	0	0	0	0	0
Total	Municipal and Industrial Demand	6,119	6,282	6,496	6,787	7,077	7,364
	Existing Municipal and Industrial Supply						
	Groundwater	5,464	5,615	5,806	6,067	6,279	6,349
	Surface water	655	667	690	720	798	1,015
	Total Municipal and Industrial Supply	6,119	6,282	6,496	6,787	7,077	7,364
	Municipal and Industrial Balance	0	0	0	0	0	0
	Agriculture Demand	673	673	673	673	673	673
	Existing Agricultural Supply						
	Groundwater	673	673	673	673	673	673
	Surface water	0	0	0	0	0	0
	Total Agriculture Supply	673	673	673	673	673	673
	Agriculture Balance	0	0	0	0	0	0
	Total Demand	6,792	6,955	7,169	7,460	7,750	8,037
	Total Supply						
	Groundwater	6,137	6,288	6,479	6,740	6,952	7,022
	Surface water	655	667	690	720	798	1,015
	Total Supply	6,792	6,955	7,169	7,460	7,750	8,037
	Total Balance						0

Table 4A.16. Kleberg County Municipal Water Demand and Supply by City/County (ac-ft)

City/County	2030	2040	2050	2060	2070	2080
BAFFIN BAY WSC						
Demand	129	132	136	143	150	156
Supply	129	132	136	143	150	156
Groundwater	129	132	136	143	150	156
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
KINGSVILLE						
Demand	3,907	4,002	4,135	4,329	4,522	4,714
Supply	3,907	4,002	4,135	4,329	4,522	4,714
Groundwater	3,901	4,002	4,135	4,329	4,472	4,472
Surface water	6	-	-	-	50	242
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
NAVAL AIR STATION KINGSVILLE						
Demand	264	273	282	292	301	306
Supply	264	273	282	292	301	306
Groundwater	-	-	-	-	-	-
Surface water	264	273	282	292	301	306
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
RICARDO WSC						
Demand	385	394	408	428	447	467
Supply	385	394	408	428	447	467
Groundwater	-	-	-	-	-	-
Surface water	385	394	408	428	447	467
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
RIVIERA WATER SYSTEM						
Demand	128	131	136	142	149	155
Supply	128	131	136	142	149	155
Groundwater	128	131	136	142	149	155
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
COUNTY-OTHER, KLEBERG						
Demand	208	212	219	230	240	251
Supply	208	212	219	230	240	251
Groundwater	208	212	219	230	240	251
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
County Total						
Demand	5,021	5,144	5,316	5,564	5,809	6,049
Supply	5,021	5,144	5,316	5,564	5,809	6,049
Groundwater	4,366	4,477	4,626	4,844	5,011	5,034
Surface water	655	667	690	720	798	1,015
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-

4A.3.8 Comparison of Demand to Supply – Live Oak County

A summary of population, water demands, water supply, and shortages are shown by decade for the 2030 through 2080 period in Table 4A.17 for all categories of water use. Table 4A.18 includes a summary of municipal demands.

Demands

- For the period 2030 to 2080, municipal demand decreases from 1,631 ac-ft in 2030 to 1,508 ac-ft in 2080.
- Manufacturing demands increase from 2,843 ac-ft in 2030 to 3,409 ac-ft in 2080.
- Mining demand is constant at 1,264 ac-ft from 2030 to 2070 until it decreases to 2 ac-ft in 2080.
- For the period 2020 to 2080, irrigation demand remains constant at 844 ac-ft; livestock demand is constant at 651 ac-ft.
- No steam-electric demand is projected across the planning period.

Supplies

- Surface water is supplied from the CCR/LCC reservoirs for the City of Three Rivers and manufacturing customers according to contract. Some livestock needs are met with on-farm/local sources.
- Groundwater supplies are from the Gulf Coast, Carrizo, and Queen City Aquifers. There is enough MAG[5].
- Reuse water supply from Three Rivers based on the maximum historical reuse from 2018-2022 reported in the TWDB data dashboard.

Comparison of Demand to Supply

- There is a projected municipal shortage on County-Other of 198 ac-ft in 2030 due to well capacity constraints, increasing to 202 ac-ft in 2080.There are no other projected municipal water shortages projected in the county through the planning period.
- There is no projected water shortage for manufacturing, steam-electric, mining, irrigation, or livestock in the county through the planning period.

[5] Note that El Oso WSC and McCoy WSC in both Region N and Region L. The groundwater supply for these WUGs do not count against the MAG associated with Region N and are instead taken from the MAG associated with Region L as these WUGs are predominantly located in Region L.

Table 4A.17.
Live Oak County Population, Water Supply, and Water Demand Projections

	Population Projection	2030	2040	2050	2060	2070	2080
		11,093	10,740	10,499	10,473	10,447	10,421
	Supply and Demand by Type of Use	Year					
		2030 (ac-ft)	2040 (ac-ft)	2050 (ac-ft)	2060 (ac-ft)	2070 (ac-ft)	2080 (ac-ft)
Municipal	Municipal Demand (See Table 4A.17)	1,631	1,575	1,538	1,528	1,516	1,508
	Municipal Existing Supply						
	Groundwater	989	968	942	920	898	880
	Surface water	2,562	2,457	2,349	2,237	2,121	1,999
	Reuse	66	66	66	66	66	66
	Total Existing Municipal Supply	3,617	3,491	3,357	3,223	3,085	2,945
	Municipal Balance	1,986	1,916	1,819	1,695	1,569	1,437
Industrial	Manufacturing Demand	2,843	2,948	3,057	3,170	3,287	3,409
	Manufacturing Existing Supply						
	Groundwater	2,054	2,054	2,054	2,054	2,054	2,054
	Surface water	789	894	1,003	1,116	1,233	1,355
	Total Manufacturing Supply	2,843	2,948	3,057	3,170	3,287	3,409
	Manufacturing Balance	0	0	0	0	0	0
	Steam-Electric Demand	0	0	0	0	0	0
	Steam-Electric Existing 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 Balance	0	0	0	0	0	0
	Mining Demand	1,264	1,264	1,264	1,264	1,264	2
	Mining Existing Supply						
	Groundwater	472	472	472	472	472	472
	Surface water	0	0	0	0	0	0
	Reuse	792	792	792	792	792	792
	Total Mining Supply	1,264	1,264	1,264	1,264	1,264	1,264
	Mining Balance	0	0	0	0	0	1,262
Agriculture	Irrigation Demand	844	844	844	844	844	844
	Irrigation Existing Supply						
	Groundwater	844	844	844	844	844	844
	Surface water	0	0	0	0	0	0
	Total Irrigation Supply	844	844	844	844	844	844
	Irrigation Balance	0	0	0	0	0	0
	Livestock Demand	651	651	651	651	651	651
	Livestock Existing Supply						
	Groundwater	529	529	529	529	529	529
	Surface water	122	122	122	122	122	122
	Total Livestock Supply	651	651	651	651	651	651
	Livestock Balance	0	0	0	0	0	0
Total	Municipal and Industrial Demand	5,738	5,787	5,859	5,962	6,067	4,919
	Existing Municipal and Industrial Supply						
	Groundwater	3,515	3,494	3,468	3,446	3,424	3,406
	Surface water	3,351	3,351	3,352	3,353	3,354	3,354
	Reuse	858	858	858	858	858	858
	Total Municipal and Industrial Supply	7,724	7,703	7,678	7,657	7,636	7,618
	Municipal and Industrial Balance	1,986	1,916	1,819	1,695	1,569	2,699
	Agriculture Demand	1,495	1,495	1,495	1,495	1,495	1,495
	Existing Agricultural Supply						
	Groundwater	1,373	1,373	1,373	1,373	1,373	1,373
	Surface water	122	122	122	122	122	122
	Total Agriculture Supply	1,495	1,495	1,495	1,495	1,495	1,495
	Agriculture Balance	0	0	0	0	0	0
	Total Demand	7,233	7,282	7,354	7,457	7,562	6,414
	Total Supply						
	Groundwater	4,888	4,867	4,841	4,819	4,797	4,779
	Surface water	3,473	3,473	3,474	3,475	3,476	3,476
	Reuse	858	858	858	858	858	858
	Total Supply	9,219	9,198	9,173	9,152	9,131	9,113
	Total Balance	1,986	1,916	1,819	1,695	1,569	2,699

Table 4A.18. Live Oak County Municipal Water Demand and Supply by City/County (ac-ft)

City/County	2030	2040	2050	2060	2070	2080
EL OSO WSC						
Demand	152	165	165	165	165	165
Supply	152	165	165	165	165	165
Groundwater	152	165	165	165	165	165
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
GEORGE WEST						
Demand	304	275	253	233	214	197
Supply	304	275	253	233	214	197
Groundwater	304	275	253	233	214	197
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
MCCOY WSC						
Demand	6	5	4	3	2	2
Supply	6	5	4	3	2	2
Groundwater	6	5	4	3	2	2
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
OLD MARBACH SCHOOL WSC						
Demand	86	82	79	78	76	75
Supply	86	82	79	78	76	75
Groundwater	86	82	79	78	76	75
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
THREE RIVERS						
Demand	444	434	432	430	427	426
Supply	2,628	2,523	2,415	2,303	2,187	2,065
Groundwater	-	-	-	-	-	-
Surface water	2,562	2,457	2,349	2,237	2,121	1,999
Reuse	66	66	66	66	66	66
Balance	2,184	2,089	1,983	1,873	1,760	1,639
COUNTY-OTHER, LIVE OAK						
Demand	639	614	605	619	632	643
Supply	441	441	441	441	441	441
Groundwater	441	441	441	441	441	441
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	(198)	(173)	(164)	(178)	(191)	(202)
County Total						
Demand	1,630	1,574	1,537	1,527	1,516	1,508
Supply	3,616	3,490	3,356	3,222	3,085	2,945
Groundwater	988	967	941	919	898	880
Surface water	2,562	2,457	2,349	2,237	2,121	1,999
Reuse	66	66	66	66	66	66
Balance	1,986	1,916	1,819	1,695	1,569	1,437

4A.3.9 Comparison of Demand to Supply – McMullen County

A summary of population, water demands, water supply, and shortages are shown by decade for the 2030 through 2080 period in Table 4A.19 for all categories of water use. Table 4A.20 includes a summary of municipal demands.

Demands

- For the period 2030 to 2080, municipal demand decreases from 73 ac-ft in 2030 to 51 ac-ft in 2080.
- Manufacturing demand is constant across the planning period at 34 ac-ft.
- Mining demand is constant at 4,538 ac-ft through 2070 until decreasing to 1 ac-ft in 2080.
- Irrigation demand is constant at 24 ac-ft across the planning period.
- Livestock demand is constant at 278 ac-ft across the planning period.

Supplies

- Groundwater supplies are from the Gulf Coast, Carrizo, and Queen City aquifers. Gulf Coast Aquifer supply is reduced to not exceed the MAG across the planning period. There is sufficient MAG for the Carrizo and Queen City aquifers.
- Surface water for livestock needs is met by on-farm/local sources.
- Reuse water supply from McMullen County-Other based on the maximum historical reuse from 2018-2022 reported in the TWDB data dashboard.

Comparison of Demand to Supply

- There are adequate supplies available to meet all projected demands through the planning period.

Table 4A.19. McMullen County Population, Water Supply, and Water Demand Projections

Population Projection		2030	2040	2050	2060	2070	2080
		546	511	493	455	417	379
Supply and Demand by Type of Use		Year					
		2030 (ac-ft)	2040 (ac-ft)	2050 (ac-ft)	2060 (ac-ft)	2070 (ac-ft)	2080 (ac-ft)
Municipal	Municipal Demand (See Table 4A.19)	73	68	65	60	55	51
	Municipal Existing Supply						
	Groundwater	60	55	53	49	45	41
	Surface water	12	12	11	10	9	9
	Reuse	1	1	1	1	1	1
	Total Existing Municipal Supply	73	68	65	60	55	51
	Municipal Balance	0	0	0	0	0	0
Industrial	Manufacturing Demand	34	34	34	34	34	34
	Manufacturing Existing Supply						
	Groundwater	34	34	34	34	34	34
	Surface water	0	0	0	0	0	0
	Total Manufacturing Supply	34	34	34	34	34	34
	Manufacturing Balance	0	0	0	0	0	0
	Steam-Electric Demand	0	0	0	0	0	0
	Steam-Electric Existing 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 Balance	0	0	0	0	0	0
	Mining Demand	4538	4538	4538	4538	4538	1
	Mining Existing Supply						
	Groundwater	2681	2681	2681	2681	2681	0
	Surface water	0	0	0	0	0	0
	Reuse	1857	1857	1857	1857	1857	1857
	Total Mining Supply	4538	4538	4538	4538	4538	1857
	Mining Balance	0	0	0	0	0	1856
Agriculture	Irrigation Demand	24	24	24	24	24	24
	Irrigation Existing Supply						
	Groundwater	24	24	24	24	24	24
	Surface water	0	0	0	0	0	0
	Total Irrigation Supply	24	24	24	24	24	24
	Irrigation Balance	0	0	0	0	0	0
	Livestock Demand	278	278	278	278	278	278
	Livestock Existing Supply						
	Groundwater	11	10	10	10	10	10
	Surface water	267	268	268	268	268	268
	Total Livestock Supply	278	278	278	278	278	278
	Livestock Balance	0	0	0	0	0	0
Total	Municipal and Industrial Demand	4,645	4,640	4,637	4,632	4,627	86
	Existing Municipal and Industrial Supply						
	Groundwater	2,775	2,770	2,768	2,764	2,760	75
	Surface water	12	12	11	10	9	9
	Reuse	1858	1858	1858	1858	1858	1858
	Total Municipal and Industrial Supply	4645	4640	4637	4632	4627	1942
	Municipal and Industrial Balance	0	0	0	0	0	1856
	Agriculture Demand	302	302	302	302	302	302
	Existing Agricultural Supply						
	Groundwater	35	34	34	34	34	34
	Surface water	267	268	268	268	268	268
	Total Agriculture Supply	302	302	302	302	302	302
	Agriculture Balance	0	0	0	0	0	0
	Total Demand	4947	4942	4939	4934	4929	388
	Total Supply						
	Groundwater	2810	2804	2802	2798	2794	109
	Surface water	279	280	279	278	277	277
	Reuse	1,858	1,858	1,858	1,858	1,858	1,858
	Total Supply	4,947	4,942	4,939	4,934	4,929	2,244
	Total Balance	0	0	0	0	0	1,856

Table 4A.20. McMullen County Municipal Water Demand and Supply by City/County (ac-ft)

City/County	2030	2040	2050	2060	2070	2080
THREE RIVERS						
Demand	12	12	11	10	9	9
Supply	12	12	11	10	9	9
Groundwater	-	-	-	-	-	-
Surface water	12	12	11	10	9	9
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
COUNTY-OTHER, MCMULLEN						
Demand	61	56	54	50	46	42
Supply	61	56	54	50	46	42
Groundwater	60	55	53	49	45	41
Surface water	-	-	-	-	-	-
Reuse	1	1	1	1	1	1
Balance	-	-	-	-	-	-
County Total						
Demand	73	68	65	60	55	51
Supply	73	68	65	60	55	51
Groundwater	60	55	53	49	45	41
Surface water	12	12	11	10	9	9
Reuse	1	1	1	1	1	1
Balance	-	-	-	-	-	-

4A.3.10 Comparison of Demand to Supply – Nueces County

A summary of population, water demands, water supply, and shortages are shown by decade for the 2030 through 2080 period in Table 4A.21 for all categories of water use. Table 4A.22 includes a summary of municipal demands.

Demands

- Municipal demand increases from 70,750 in 2030 to 71,782 in 2050 before decreasing to 70,508 in 2080.
- Manufacturing demand is constant at 50,363 ac-ft from 2030 to 2070 before increasing to 52,339 ac-ft in 2080.
- Mining demand increases from 796 ac-ft in 2030 to 893 ac-ft in 2080.
- Steam-electric demand is constant at 2,201 ac-ft across the planning period.
- For the period 2030 to 2080, irrigation demand is constant at 559 ac-ft; livestock demand is constant at 218 ac-ft.

Supplies

- Surface water is supplied from the CCR/LCC/Texana/MRP Phase II System, SPMWD, STWA, and Nueces County WCID 3; some livestock needs are met with on-farm/local sources.
- Groundwater supplies are from the Gulf Coast Aquifer and are reduced to not exceed the MAG across the planning period
- Reuse water supply from Corpus Christi based on the maximum historical reuse from 2018-2022 reported in the TWDB data dashboard.

Comparison of Demand to Supply

- Nueces County WCID 3 is contractual obligated to provide enough water to meet all demands to River Acres WSC across the planning period. However, to meet their contractual demands, Nueces County WCID 3 has a water shortage of 3,383 in 2030, which increases to 3,439 in 2040 before decreasing to 3,370 in 2080. Shortages are attributed to water supply limits during drought of record conditions. A small, local balancing storage reservoir is recommended for Nueces County WCID 3 use during drought events to firm up water to meet customers' needs in full through 2080. Corpus Christi has a water supply shortage of 5,158 ac-ft/yr. No other municipal WUGs in Nueces County are projected to have shortages across the planning period.
- County-Other receives water supplies from STWA that were distributed based on TWDB information provided for County-Other entities and existing contracts in place. County-Other is not projected to have water shortages across the planning period.

- Manufacturing has a shortage of 33,672 ac-ft in 2030, which increases to 45,731 in 2080. The shortages are attributable to both raw water and water treatment plant constraints.
- Steam-Electric is not projected to have a shortage during the planning period.
- Across the planning period, mining has shortages ranging from a minimum of 84 ac-ft/yr in 2060 to a maximum of 101 ac-ft/yr in 2080. The shortages are attributable to both raw water and treatment plant constraints.
- Irrigation has sufficient supply across the planning period.
- There are sufficient livestock supplies through 2080.

Table 4A.21.
Nueces County Population, Water Supply, and Water Demand Projections

		2030	2040	2050	2060	2070	2080
Population Projection		364,690	371,130	371,485	369,261	367,050	364,851
Supply and Demand by Type of Use		**Year**					
		2030 (ac-ft)	**2040 (ac-ft)**	**2050 (ac-ft)**	**2060 (ac-ft)**	**2070 (ac-ft)**	**2080 (ac-ft)**
Municipal	Municipal Demand (See Table 4A.21)	70,750	71,714	71,782	71,359	70,933	70,508
	Municipal Existing Supply						
	Groundwater	282	282	282	282	282	282
	Surface water	66,749	67,657	67,721	67,322	66,920	61,362
	Reuse	336	336	336	336	336	336
	Total Existing Municipal Supply	67,367	68,275	68,339	67,940	67,538	61,980
	Municipal Balance	(3,383)	(3,439)	(3,443)	(3,419)	(3,395)	(8,528)
Industrial	Manufacturing Demand	50,363	50,363	50,363	50,363	50,472	52,339
	Manufacturing Existing Supply						
	Groundwater	3,240	3,240	3,240	3,240	3,240	3,240
	Surface water	12,323	9,116	6,700	4,638	2,469	2,240
	Reuse	1,128	1,128	1,128	1,128	1,128	1,128
	Total Manufacturing Supply	16,691	13,484	11,068	9,006	6,837	6,608
	Manufacturing Balance	(33,672)	(36,879)	(39,295)	(41,357)	(43,635)	(45,731)
	Steam-Electric Demand	2,201	2,201	2,201	2,201	2,201	2,201
	Steam-Electric Existing Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	2,201	2,201	2,201	2,201	2,201	2,201
	Total Steam-Electric Supply	2,201	2,201	2,201	2,201	2,201	2,201
	Steam-Electric Balance	0	0	0	0	0	0
	Mining Demand	796	835	858	876	887	893
	Mining Existing Supply						
	Groundwater	708	737	765	792	792	792
	Surface water	0	0	0	0	0	0
	Total Mining Supply	708	737	765	792	792	792
	Mining Balance	(88)	(98)	(93)	(84)	(95)	(101)
Agriculture	Irrigation Demand	559	559	559	559	559	559
	Irrigation Existing Supply						
	Groundwater	258	258	258	258	258	258
	Surface water	0	0	0	0	0	0
	Reuse	301	301	301	301	301	301
	Total Irrigation Supply	559	559	559	559	559	559
	Irrigation Balance	0	0	0	0	0	0
	Livestock Demand	218	218	218	218	218	218
	Livestock Existing Supply						
	Groundwater	188	188	189	189	189	189
	Surface water	30	30	29	29	29	29
	Total Livestock Supply	218	218	218	218	218	218
	Livestock Balance	0	0	0	0	0	0

Population Projection		2030	2040	2050	2060	2070	2080
		364,690	371,130	371,485	369,261	367,050	364,851
Supply and Demand by Type of Use		Year					
		2030 (ac-ft)	2040 (ac-ft)	2050 (ac-ft)	2060 (ac-ft)	2070 (ac-ft)	2080 (ac-ft)
Total	Municipal and Industrial Demand	124,110	125,113	125,204	124,799	124,493	125,941
	Existing Municipal and Industrial Supply						
	Groundwater	4,230	4,259	4,287	4,314	4,314	4,314
	Surface water	81,273	78,974	76,622	74,161	71,590	65,803
	Reuse	1,464	1,464	1,464	1,464	1,464	1,464
	Total Municipal and Industrial Supply	86,967	84,697	82,373	79,939	77,368	71,581
	Municipal and Industrial Balance	(37,143)	(40,416)	(42,831)	(44,860)	(47,125)	(54,360)
	Agriculture Demand	777	777	777	777	777	777
	Existing Agricultural Supply						
	Groundwater	446	446	447	447	447	447
	Surface water	30	30	29	29	29	29
	Reuse	301	301	301	301	301	301
	Total Agriculture Supply	777	777	777	777	777	777
	Agriculture Balance	0	0	0	0	0	0
	Total Demand	124,887	125,890	125,981	125,576	125,270	126,718
	Total Supply						
	Groundwater	4,676	4,705	4,734	4,761	4,761	4,761
	Surface water	81,303	79,004	76,651	74,190	71,619	65,832
		1,765	1,765	1,765	1,765	1,765	1,765
	Total Supply	87,744	85,474	83,150	80,716	78,145	72,358
	Total Balance	(37,143)	(40,416)	(42,831)	(44,860)	(47,125)	(54,360)

Table 4A.22. Nueces County Municipal Water Demand and Supply by City/County (ac-ft)

City/County	2030	2040	2050	2060	2070	2080
BISHOP						
Demand	550	558	558	555	551	547
Supply	550	558	558	555	551	547
Groundwater	282	282	282	282	282	282
Surface water	268	276	276	273	269	265
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
CORPUS CHRISTI						
Demand	59,084	59,885	59,942	59,581	59,223	58,866
Supply	59,084	59,885	59,942	59,581	59,223	53,708
Groundwater	-	-	-	-	-	-
Surface water	58,748	59,549	59,606	59,245	58,887	53,372
Reuse	336	336	336	336	336	336
Balance	-	-	-	-	-	(5,158)
CORPUS CHRISTI NAVAL AIR STATION						
Demand	2,078	2,111	2,112	2,105	2,096	2,086
Supply	2,078	2,111	2,112	2,105	2,096	2,086
Groundwater	-	-	-	-	-	-
Surface water	2,078	2,111	2,112	2,105	2,096	2,086
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
DRISCOLL						
Demand	80	81	81	81	80	80
Supply	80	81	81	81	80	80
Groundwater	-	-	-	-	-	-
Surface water	80	81	81	81	80	80
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
NUECES COUNTY WCID 3						
Demand	3,452	3,504	3,507	3,485	3,463	3,441
Supply	69	65	64	66	68	71
Groundwater	-	-	-	-	-	-
Surface water	69	65	64	66	68	71
Reuse	-	-	-	-	-	-
Balance	(3,383)	(3,439)	(3,443)	(3,419)	(3,395)	(3,370)
NUECES COUNTY WCID 4						
Demand	1,370	1,391	1,392	1,384	1,374	1,365
Supply	1,370	1,391	1,392	1,384	1,374	1,365
Groundwater	-	-	-	-	-	-
Surface water	1,370	1,391	1,392	1,384	1,374	1,365
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
NUECES WSC						
Demand	986	997	999	997	994	992
Supply	986	997	999	997	994	992
Groundwater	-	-	-	-	-	-
Surface water	986	997	999	997	994	992
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-

City/County	*2030*	*2040*	*2050*	*2060*	*2070*	*2080*
RIVER ACRES WSC						
Demand	315	319	320	318	316	313
Supply	315	319	320	318	316	313
Groundwater	-	-	-	-	-	-
Surface water	315	319	320	318	316	313
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
VIOLET WSC						
Demand	228	229	230	228	227	225
Supply	228	229	230	228	227	225
Groundwater	-	-	-	-	-	-
Surface water	228	229	230	228	227	225
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
COUNTY-OTHER, NUECES						
Demand	2,607	2,639	2,641	2,625	2,609	2,593
Supply	2,607	2,639	2,641	2,625	2,609	2,593
Groundwater	-	-	-	-	-	-
Surface water	2,607	2,639	2,641	2,625	2,609	2,593
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
County Total						
Demand	70,750	71,714	71,782	71,359	70,933	70,508
Supply	67,367	68,275	68,339	67,940	67,538	61,980
Groundwater	282	282	282	282	282	282
Surface water	66,749	67,657	67,721	67,322	66,920	61,362
Reuse	336	336	336	336	336	336
Balance	(3,383)	(3,439)	(3,443)	(3,419)	(3,395)	(8,528)

4A.3.11 Comparison of Demand to Supply – San Patricio County

A summary of population, water demands, water supply, and shortages are shown by decade for the 2030 through 2080 period in Table 4A.23 for all categories of water use. Table 4A.24 includes a summary of municipal demands.

Demands

- For the period 2030 to 2080, municipal demand increases from 10,349 ac-ft in 2030 to 10,970 ac-ft in 2080.
- Manufacturing demand increases from 60,705 ac-ft in 2030 to 60,732 ac-ft in 2080.
- Steam-electric demand is constant at 2,576 ac-ft across the planning period.
- Mining increases from 88 ac-ft in 2030 to 94 ac-ft in 2080.
- For the period 2030 to 2080, irrigation demand is constant at 5,497 ac-ft; livestock demand is constant at 278 ac-ft.

Supplies

- Surface water is supplied from the CCR/LCC/Texana/MRP Phase II System; the SPMWD has a contract with the City of Corpus Christi to purchase up to 46,800 ac-ft/yr raw and 34,760 ac-ft/yr treated water, resulting in an 81,560 ac-ft/yr contracted supply. Municipal water supplies are prioritized according to water demands and contracts. Some livestock demands are met with on-farm/local sources. SPMWD surface water supply is further constrained by water treatment plant capacity. The total treated water supplies available from SPMWD water treatment plants (34,760 ac-ft/yr) and purchased treated water from the City of Corpus Christi is 58,620 ac-ft/yr across the planning period (Table 4A.25). Treated water supplies are allocated to fulfill contracts followed by municipal then manufacturing demands.
- Groundwater supplies are from the Gulf Coast Aquifer. There is sufficient MAG.
- Groundwater supply for irrigation was set equal to the maximum historical pumping (i.e. estimated well capacity).
- Reuse water supply from Aransas Pass based on the maximum historical reuse from 2018-2022 reported in the TWDB data dashboard.

Comparison of Demand to Supply

- There are adequate supplies available to meet all projected demands through the planning period and a surplus of manufacturing supply.
- SPMWD provides the majority of supplies to San Patricio County municipal and manufacturing water users, through contracts with the City of Corpus Christi. Based on contracted supply, a raw water surplus ranging from 6,791 to 6,289 ac-ft/yr during the 2030-2080 period is shown on San Patricio County- manufacturing. Based on conversations with SPMWD, the water has already been contracted out with manufacturing users due to local demands anticipated to exceed TWDB-adopted water

demand projections. However, based on treatment plant constraints assuming 80 percent of SPMWD supplies to industries are treated, there is a treatment shortage of 1,454 ac-ft/yr to 2,003 ac-ft/yr during the planning period.

Table 4A.23.
San Patricio County Population, Water Supply, and Water Demand Projections

Population Projection		2030	2040	2050	2060	2070	2080
		71,973	74,569	75,816	75,578	75,344	75,114
Supply and Demand by Type of Use		Year					
		2030 (ac-ft)	2040 (ac-ft)	2050 (ac-ft)	2060 (ac-ft)	2070 (ac-ft)	2080 (ac-ft)
Municipal	Municipal Demand (See Table 4A.23)	10,349	10,682	10,889	10,911	10,938	10,970
	Municipal Existing Supply						
	Groundwater	1,579	1,557	1,551	1,564	1,577	1,425
	Surface water	8,037	8,392	8,605	8,614	8,628	8,812
	Reuse	733	733	733	733	733	733
	Total Existing Municipal Supply	10,349	10,682	10,889	10,911	10,938	10,970
	Municipal Balance	0	0	0	0	0	0
Industrial	Manufacturing Demand	60,705	60,715	60,732	60,705	60,715	60,732
	Manufacturing Existing Supply						
	Groundwater	110	110	110	110	110	110
	Surface water	59,141	58,753	58,602	58,686	58,765	58,671
	Total Manufacturing Supply	59,251	58,863	58,712	58,796	58,875	58,781
	Manufacturing Balance	(1,454)	(1,847)	(2,003)	(1,924)	(1,851)	(1,951)
	Steam-Electric Demand	2,576	2,576	2,576	2,576	2,576	2,576
	Steam-Electric Existing Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	2,576	2,576	2,576	2,576	2,576	2,576
	Total Steam-Electric Supply	2,576	2,576	2,576	2,576	2,576	2,576
	Steam-Electric Balance	0	0	0	0	0	0
	Mining Demand	88	90	92	93	94	94
	Mining Existing Supply						
	Groundwater	88	90	92	93	94	94
	Surface water	0	0	0	0	0	0
	Total Mining Supply	88	90	92	93	94	94
	Mining Balance	0	0	0	0	0	0
Agriculture	Irrigation Demand	5,497	5,497	5,497	5,497	5,497	5,497
	Irrigation Existing Supply						
	Groundwater	5,497	5,497	5,497	5,497	5,497	5,497
	Surface water	0	0	0	0	0	0
	Total Irrigation Supply	5,497	5,497	5,497	5,497	5,497	5,497
	Irrigation Balance	0	0	0	0	0	0
	Livestock Demand	278	278	278	278	278	278
	Livestock Existing Supply						
	Groundwater	233	233	233	233	233	233
	Surface water	45	45	45	45	45	45
	Total Livestock Supply	278	278	278	278	278	278
	Livestock Balance	0	0	0	0	0	0
Total	Municipal and Industrial Demand	73,718	74,272	74,372	73,718	74,272	74,372
	Existing Municipal and Industrial Supply						
	Groundwater	1,777	1,753	1,629	1,777	1,753	1,629
	Surface water	69,754	69,721	69,783	69,876	69,969	70,059
	Reuse	733	733	733	733	733	733
	Total Municipal and Industrial Supply	72,264	72,211	72,269	72,376	72,483	72,421
	Municipal and Industrial Balance	(1,454)	(1,847)	(2,003)	(1,924)	(1,851)	(1,951)
	Agriculture Demand	5,775	5,775	5,775	5,775	5,775	5,775
	Existing Agricultural Supply						
	Groundwater	5,730	5,730	5,730	5,730	5,730	5,730
	Surface water	45	45	45	45	45	45
	Total Agriculture Supply	5,775	5,775	5,775	5,775	5,775	5,775
	Agriculture Balance	0	0	0	0	0	0
	Total Demand	79,493	80,047	80,147	79,493	80,047	80,147
	Total Supply						

Population Projection	2030	2040	2050	2060	2070	2080
	71,973	74,569	75,816	75,578	75,344	75,114
Supply and Demand by Type of Use	**Year**					
	2030 (ac-ft)	**2040 (ac-ft)**	**2050 (ac-ft)**	**2060 (ac-ft)**	**2070 (ac-ft)**	**2080 (ac-ft)**
Groundwater	7,507	7,483	7,359	7,507	7,483	7,359
Surface water	69,799	69,766	69,828	69,921	70,014	70,104
Reuse	733	733	733	733	733	733
Total Supply	78,039	77,986	78,044	78,151	78,258	78,196
Total Balance	(1,454)	(1,847)	(2,003)	(1,924)	(1,851)	(1,951)

Table 4A.24. San Patricio County Municipal Water Demand and Supply by City/County (ac-ft)

City/County	2030	2040	2050	2060	2070	2080
ARANSAS PASS						
Demand	1,185	1,180	1,183	1,191	1,199	1,207
Supply	1,185	1,180	1,183	1,191	1,199	1,207
Groundwater	-	-	-	-	-	-
Surface water	452	447	450	458	466	474
Reuse	733	733	733	733	733	733
Balance	-	-	-	-	-	-
GREGORY						
Demand	270	260	257	262	266	270
Supply	270	260	257	262	266	270
Groundwater	-	-	-	-	-	-
Surface water	270	260	257	262	266	270
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
INGLESIDE						
Demand	986	1,008	1,022	1,021	1,020	1,019
Supply	986	1,008	1,022	1,021	1,020	1,019
Groundwater	-	-	-	-	-	-
Surface water	986	1,008	1,022	1,021	1,020	1,019
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
MATHIS						
Demand	469	419	400	417	434	451
Supply	469	419	400	417	434	451
Groundwater	-	-	-	-	-	-
Surface water	469	419	400	417	434	451
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
ODEM						
Demand	432	423	421	426	431	437
Supply	432	423	421	426	431	437
Groundwater	-	-	-	-	-	-
Surface water	432	423	421	426	431	437
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
PORTLAND						
Demand	3,555	3,837	4,155	4,500	4,873	5,277
Supply	3,555	3,837	4,155	4,500	4,873	5,277
Groundwater	-	-	-	-	-	-
Surface water	3,555	3,837	4,155	4,500	4,873	5,277
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
RINCON WSC						
Demand	378	396	405	402	399	396
Supply	378	396	405	402	399	396
Groundwater	-	-	-	-	-	-
Surface water	378	396	405	402	399	396
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-

City/County	2030	2040	2050	2060	2070	2080
SINTON						
Demand	1,073	1,051	1,045	1,058	1,071	1,084
Supply	1,073	1,051	1,045	1,058	1,071	1,084
Groundwater	1,073	1,051	1,045	1,058	1,071	1,084
Surface water	-	-	-	-	-	-
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
TAFT						
Demand	337	323	318	324	330	336
Supply	337	323	318	324	330	336
Groundwater	-	-	-	-	-	-
Surface water	337	323	318	324	330	336
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
COUNTY-OTHER, SAN PATRICIO						
Demand	1,664	1,785	1,683	1,310	915	493
Supply	1,664	1,785	1,683	1,310	915	493
Groundwater	506	506	506	506	506	341
Surface water	1,158	1,279	1,177	804	409	152
Reuse	-	-	-	-	-	-
Balance	-	-	-	-	-	-
County Total						
Demand	10,349	10,682	10,889	10,911	10,938	10,970
Supply	10,349	10,682	10,889	10,911	10,938	10,970
Groundwater	1,579	1,557	1,551	1,564	1,577	1,425
Surface water	8,037	8,392	8,605	8,614	8,628	8,812
Reuse	733	733	733	733	733	733
Balance	-	-	-	-	-	-

4A.4 Major Water Providers – Comparison of Demand and Supply

The Coastal Bend Region has four current WWPs: the City of Corpus Christi, SPMWD, STWA, and Nueces County WCID 3. Additionally, the Nueces River Authority and Port of Corpus Christi Authority were designated WWPs for the 2026 Plan at the May 16, 2024 and January 30, 2025 CBRWPG meetings, respectively. However, water supply plans are not included for them since they are not current WWPs. At the October 17, 2024, meeting, CBRWPG designated four major water providers (MWPs): the City of Alice, the City of Corpus Christi, STWA, and SPMWD.

The City of Corpus Christi provides water to SPMWD and STWA, who then supply water to their customers, as shown previously in Figure 3.3. SPMWD is contracted to receive up to 81,560 ac-ft/yr from the City of Corpus Christi. Current supplies are not adequate for the City of Corpus Christi to fulfill this contract and meet all of its own municipal needs in 2080 or all manufacturing needs in 2030 through 2080. The City of Corpus Christi and SPMWD are working together to develop future water management strategies. The most typical contract between the City of Corpus Christi and its other non-SPMWD customers includes providing water at the greater amount supplied in previous years plus 10 percent. When projecting customer supplies (2030 to 2080), it was assumed that either: 1) supply increased each year by 10 percent; or 2) supply was equal to demand, whichever is less.

4A.4.1 Safe Yield Supply to Demands

The Coastal Bend Region adopted use of safe yield supply for the three largest current WWPs: City of Corpus Christi, SPMWD, and STWA and their customers. The safe yield supplies assume a reserve of 75,000 ac-ft as a drought management strategy to plan for future droughts greater than the drought of record. Table 4A.25 shows the safe yield water supply for each MWP and current WWP, the amount of water supplied to each customer, and resulting water surplus or shortage after meeting customer needs. The City of Alice receives water from the City of Corpus Christi, with a new brackish groundwater desalination supply of 1,568 ac-ft/yr (or 1.4 million gallons per day [MGD]) This analysis is shown for both the raw water and treated water components of the City of Corpus Christi and SPMWD customer systems. However, treated and raw water shortages are not additive, but are instead shown in the table only to differentiate raw water source shortages. As discussed earlier, the larger of the raw water or treated water plant capacity shortages by decade are used for planning purposes. STWA and their customers receive only treated water supplies. The City of Corpus Christi safe yield water supply for 2030 is 170,000 ac-ft, which includes supplies from the CCR/LCC System, a base amount of 31,440 ac-ft/yr and interruptible supplies from Lake Texana during the drought of record, and up to 35,000 ac-ft/yr from the City-owned Garwood water right based on availability. The System supply reduces to 157,000 ac-ft by 2080 due to reservoir sedimentation.

Table 4A.25. Major Water Provider and Current Wholesale Water Provider Surface Water Allocation

Major Water Provider (Water User/County)	2030	2040	2050	2060	2070	2080
City of Corpus Christi						
Safe Yield Supply	**170,000**	**168,000**	**166,000**	**164,000**	**162,000**	**157,000**
Current Treatment Capacity	128,114	128,114	128,114	128,114	128,114	128,114
Raw Water Available for Sales[1]	41,886	39,886	37,886	35,886	33,886	28,886
Raw Water Supply/Needs Analysis						
Raw Water Demand						
Municipal						
Jim Wells County						
Alice	2,254	2,480	2,681	2,912	3,188	3,521
Bee County						
Beeville	1,550	1,672	1,820	1,998	2,193	2,408
San Patricio County						
Mathis	469	419	400	417	434	451
San Patricio MWD[2]	46,800	46,800	46,800	46,800	46,800	46,800
Live Oak County						
Three Rivers	3,363	3,363	3,363	3,363	3,363	3,363
Non-Municipal						
Manufacturing (Nueces County)[3]	9,199	9,199	9,199	9,199	9,221	9,594
Steam-Electric Power (Nueces County)	2,201	2,201	2,201	2,201	2,201	2,201
Total Raw Water Demand	**65,836**	**66,134**	**66,464**	**66,890**	**67,400**	**68,338**
Raw Water Surplus/Shortage (*Contracts* based)	**(23,950)**	**(26,248)**	**(28,578)**	**(31,004)**	**(33,514)**	**(39,452)**
Raw Water Surplus/Shortage (*Needs* based)[4]	**(17,159)**	**(19,851)**	**(22,338)**	**(24,686)**	**(27,124)**	**(33,163)**
Treated Water Supply/Needs Analysis						
O.N. Stevens WTP Capacity[5]	**128,114**	**128,114**	**128,114**	**128,114**	**128,114**	**128,114**
Treated Water Demand						
Municipal						
City of Corpus Christi	58,748	59,549	59,606	59,245	58,887	58,530
Kleberg County						
South Texas Water Authority	4,596	4,660	4,687	4,696	4,750	4,945
Nueces County						
Nueces County WCID 4[6]	630	640	640	637	632	628
Corpus Christi Naval Air Station	2,078	2,111	2,112	2,105	2,096	2,086
Violet WSC	228	229	230	228	227	225
San Patricio County						
San Patricio MWD[2]	34,760	34,760	34,760	34,760	34,760	34,760
Non-Municipal						
Manufacturing- Nueces[3,7]	36,796	36,796	36,796	36,796	36,883	38,377
Total Treated Water Demand	**137,836**	**138,745**	**138,831**	**138,467**	**138,235**	**139,551**
Treated Water Surplus/Shortage (*Contracts* based)[8]	**(9,722)**	**(10,631)**	**(10,717)**	**(10,353)**	**(10,121)**	**(11,437)**
Treated Water Surplus/Shortage (*Needs* based)						
Total Water Supply/Needs Analysis						
Safe Yield Supply						
Total Raw and Treated Water Demands (*Contracts* Based)	**170,000**	**168,000**	**166,000**	**164,000**	**162,000**	**157,000**
Total Water Surplus/Shortage (*Contracts* based)	**203,672**	**204,879**	**205,295**	**205,357**	**205,635**	**207,889**
Total Water Surplus/Shortage (*Needs* based, includes SPMWD needs on following page)	**(33,672)**	**(36,879)**	**(39,295)**	**(41,357)**	**(43,635)**	**(50,889)**
San Patricio Municipal Water District						
Contracted Purchases from the City of Corpus Christi[7]	**81,560**	**81,560**	**81,560**	**81,560**	**81,560**	**81,560**
Actual Amount that Can Be Provided based on Current Supply (acft/yr)	**81,560**	**81,560**	**81,560**	**81,560**	**81,560**	**81,560**
Amount the City Provides to Meet SPMWD Water Demands, within Contract Terms (*SPMWD surpluses on manufacturing*)	**74,769**	**75,163**	**75,320**	**75,242**	**75,170**	**75,271**
Average Day SPMWD Maximum Industrial Treatment Available[8]	12,098	12,098	12,098	12,098	12,098	12,098

Major Water Provider (Water User/County)	2030	2040	2050	2060	2070	2080
Average Day SPMWD Maximum Potable-Municipal Treatment Available[8]	11,762	11,762	11,762	11,762	11,762	11,762
Average Day SPMWD Total Treatment Available[8]	23,860	23,860	23,860	23,860	23,860	23,860
Purchased Treated Water from City of Corpus Christi[7]	34,760	34,760	34,760	34,760	34,760	34,760
Total Treated Water Supply[7]	**58,620**	**58,620**	**58,620**	**58,620**	**58,620**	**58,620**
Raw Water Available for Sales (remaining after SPMWD treated demands)[7]	**21,486**	**21,093**	**20,937**	**21,016**	**21,089**	**20,989**
Raw Water Needed	14,695	14,696	14,697	14,698	14,699	14,700
Raw Water Supply/Needs Analysis						
Raw Water Demand						
Non-Municipal						
Manufacturing- San Patricio[9]	12,119	12,120	12,121	12,122	12,123	12,124
Steam-Electric- San Patricio	2,576	2,576	2,576	2,576	2,576	2,576
Total Raw Water Demand	**14,695**	**14,696**	**14,697**	**14,698**	**14,699**	**14,700**
Raw Water Surplus (Shortages shown in red)	6,791	6,397	6,240	6,318	6,390	6,289
Treated Water Supply/Needs Analysis						
Potable-Municipal Treated Water Demands[7,11]	11,598	11,987	12,139	12,056	11,978	12,073
Industrial- Treated Water Demands[7,11]	48,476	48,480	48,484	48,488	48,493	48,498
Treated Water Demand						
Municipal						
Aransas County						
Aransas Pass-Aransas	116	115	112	110	107	105
Rincon WSC	2	2	2	2	2	2
Rockport	3,172	3,146	3,068	3,000	2,933	2,868
County-Other, Aransas	0	0	0	0	0	0
Nueces County						
Aransas Pass-Nueces	0	0	0	0	0	0
Nueces County WCID 4[10]	740	751	752	747	742	737
San Patricio County						
Aransas Pass- San Patricio	452	447	450	458	466	474
Gregory	270	260	257	262	266	270
Ingleside	986	1,008	1,022	1,021	1,020	1,019
Odem	432	423	421	426	431	437
Portland	3,555	3,837	4,155	4,500	4,873	5,277
Rincon WSC	378	396	405	402	399	396
Taft	337	323	318	324	330	336
County-Other, San Patricio	1,158	1,279	1,177	804	409	152
Municipal Treated Water Demand	**11,598**	**11,987**	**12,139**	**12,056**	**11,978**	**12,073**
Non-Municipal						
Manufacturing (San Patricio County)[9]	48,476	48,480	48,484	48,488	48,493	48,498
Industrial Treated Water Demand	**48,476**	**48,480**	**48,484**	**48,488**	**48,493**	**48,498**
Total Water Supply/Needs Analysis						
Total Water Supply Available Based on Current Supply (acft/yr)	**81,560**	**81,560**	**81,560**	**81,560**	**81,560**	**81,560**
Total Raw Water and Treated Water Demands	**74,769**	**75,163**	**75,320**	**75,242**	**75,170**	**75,271**
Total Water Surplus/Shortage (*Needs* Based)	**0**	**0**	**0**	**0**	**0**	**0**
Total Water Surplus/Shortage (*Contracts* Based)[12]	**6,791**	**6,397**	**6,240**	**6,318**	**6,390**	**6,289**
Total Treated Surplus/Shortage (WTP Capacity Constrained)[7,8,12]	**(1,454)**	**(1,847)**	**(2,003)**	**(1,924)**	**(1,851)**	**(1,951)**
South Texas Water Authority						
Total Surface Water Right	**0**	**0**	**0**	**0**	**0**	**0**
Contract Purchases	**4,596**	**4,660**	**4,687**	**4,696**	**4,750**	**4,945**
Contract Sales						
Municipal						
Nueces County						
Driscoll	80	81	81	81	80	80
Bishop	268	276	276	273	269	265
Nueces WSC	986	997	999	997	994	992

Major Water Provider (Water User/County)	2030	2040	2050	2060	2070	2080
County-Other, Nueces	2,607	2,639	2,641	2,625	2,609	2,593
Kleberg County						
Kingsville	6	0	0	0	50	242
Naval Air Station Kingsville	264	273	282	292	301	306
Ricardo WSC	385	394	408	428	447	467
Total Contract Sales	4,596	4,660	4,687	4,696	4,750	4,945
Surplus/Shortage	—	—	—	—	—	—
City of Alice						
Contract Purchases (from the City of Corpus Christi)	2,254	2,480	2,681	2,912	3,188	3,521
Brackish Groundwater Desalination Supply	1,568	1,568	1,568	1,568	1,568	1,568
Reuse	187	187	187	187	187	187
Municipal						
Alice	4,009	4,235	4,436	4,667	4,943	5,276
Surplus/Shortage	—	—	—	—	—	—
Nueces County WCID 3						
Total Surface Water Right (firm yield)	**384**	**384**	**384**	**384**	**384**	**384**
Contract Sales						
Municipal						
Nueces County						
Wholesale Water Provider (Water User/County)						
NUECES COUNTY WCID 3	69	65	64	66	68	71
River Acres WSC	315	319	320	318	316	313
Total Contract Sales	**3,767**	**3,823**	**3,827**	**3,803**	**3,779**	**3,754**
Surplus/Shortage	(3,383)	(3,439)	(3,443)	(3,419)	(3,395)	(3,370)

1. Raw water available for sales is safe yield less contracted supplies with customers and treated water demands or treatment plant capacity, whichever is the lesser of the two.

2. The City of Corpus Christi's contract with San Patricio MWD specifies up to 34,760 acft/yr treated water and 46,800 acft/yr of raw water. Per TWDB requirements, shortages are based on contracts, however this table also shows shortages based on fulfilling customer water demands which are less than contracted supplies (see footnote #4).

3. Assumed 20% of the Nueces County Manufacturing demand is supplied by raw water.

4. Needs based analysis assumes City of Corpus Christi contracts are fulfilled for STWA and wholesale water customers (Alice, Beeville, Mathis, etc.). For SPMWD, however, supplies are provided to meet projected water demands for their San Patricio County customers within contracted supply limits.

5. The City's ON Stevens Water Treatment Plant has a treatment plant capacity of 160 MGD. Average day treatment capacity is calculated at 113.6 MGD, or 128,114 acft/yr, after considering a peaking capacity of 1.4:1. Peak to average day ratio is based on historical data, provided by City staff and used in the 2021 Region N Plan.

6. Of the total water demand for NCWCID 4 (Port Aransas), the City is shown as providing 46% to meet water demands and San Patricio MWD as providing 54% to meet water demands through 2080.

7. An amendment to the raw water contract was approved by Corpus Christi City Council on August 20, 2019, to total 46,800 acft/yr raw water to SPMWD. An amendment between the City of Corpus Christi and SPMWD increases the treated water contract to 27,000 acft, with an additional provision for 10,000 acft/yr reserve with advance notice (up to 37,000 acft/yr treated water). A contract amendment executed on July 15, 2024, reduced treated water contracts to maximum of 34,760 acft/yr. Total contracts with City of Corpus Christi for raw and treated water is up to 81,560 acft/yr.

8. SPMWD has a potable (municipal) water treatment plant with 9 MGD design capacity (plant a), an industrial water treatment plant with 8 MGD design capacity (plant b), and a third water treatment plant with 21.4 MGD design capacity that can be used to produce treated water for either municipal or industrial use (plant c). From information provided by SPMWD on Feb 10, 2025, average day industrial treatment capacity is 10.8 MGD (or 12,098 acft/yr) and average day municipal treatment capacity is 10.5 MGD (or 11,762 acft/yr), which amounts to an estimated 1.8: 1 peak to average day capacity ratio. The total WTP capacity for SPMWD's system is 38.4 MGD. With SPMWD average annual WTP capacity of 23,860 acft/yr and 34,760 acft/yr treated water contracts with the City, SPMWD's treated water capacity is 58,620 acft/yr.

9. Assumes 20% of the San Patricio County Manufacturing demand is supplied by raw water and 80% from treated water.

10. Of the total water demand for NCWCID 4 (Port Aransas), the City is shown as providing 46% to meet water demands and San Patricio MWD as providing 54% to meet water demands through 2080.

11. Assumes raw water delivered to District treatment plants equal to demands, or District treatment capacity whichever is the lesser of the two. Treated water from City of Corpus Christi contract to augment treated water demands, beyond existing SPMWD treatment plant constraints.

12. SPWMD shows raw water surplus ranging from 6,791 to 6,289 acft/yr during the 2030-2080 period based on TWDB approved water demands. However, based on treatment plant constraints assuming 80% of SPMWD supplies to industries are treated, there is a treatment shortage of 1,454 acft/yr to 2,003 acft/yr during the planning period. Based on conversations with SPMWD, this water has already been contracted out with manufacturing users based on local demands which exceed TWDB-adopted water demand projections.

After meeting demands and/or contracts with its customers, the City of Corpus Christi has raw water supply shortages across the entire 50-year planning period, showing a need for increased source water supplies. The City of Corpus Christi has shortages associated with the treated water customers, indicating that the current treatment plant capacity is not sufficient to meet future treated water needs. Shortages are shown for municipal, and industrial, users in Nueces County, as seen in Table 4A.21. SPMWD is authorized to receive 81,560 ac-ft/yr, which meets the demands of its customers and have a raw water surplus throughout the planning period. However, the treated water needs exceeds treatment capacity with contracted treated water from the City of Corpus Christi, therefore SPMWD is showing a shortage across the entire 50-year planning period. SPMWD raw water shortage ranges from 6,240 to 6,791 ac-ft/yr during the entire 2030-2080 planning period, however, based on conversations with SPMWD, this water has already been contracted out with manufacturing users based on local demands expected to exceed TWDB-adopted water demand projections. STWA receives treated water supplies to meet the demands of its customers, consistent with the terms of the present contracts, and has no projected shortages. Nueces County WCID 3 receives supply through run-of-river water rights and is projected to have a shortage in all decades attributed to a lack of sufficient firm yield during drought of record conditions.

4A.5 Secondary Needs Analysis

A secondary water needs analysis was performed for all WUGs and MWPs, representing the water needs that would remain assuming full implementation of water conservation or direct reuse recommended water management strategies. Secondary needs (i.e., second-tier needs) were calculated by TWDB for WUGs based on State Water Planning Database (DB27) entries and is included in Appendix A. Using this information, a secondary needs analysis was summarized for MWPs as shown in Table 4A.26.

Table 4A.26.
Coastal Bend Region Major Water Provider (MWP) Secondary Water Needs

Major Water Provider	Second Tier Needs (ac-ft/yr)					
	2030	2040	2050	2060	2070	2080
City of Alice	—	—	—	—	—	—
City of Corpus Christi	(32,431)	(28,362)	(24,642)	(25,022)	(25,865)	(31,434)
South Texas Water Authority	—	—	—	—	—	—
San Patricio Municipal Water District	**(1,454)**	**(1,847)**	**(2,003)**	**(1,924)**	**(1,851)**	**(1,951)**
Nueces County WCID 3	(3,383)	(3,113)	(2,812)	(2,519)	(2,255)	(2,016)

Note: Dashes shown when no water needs are identified. The secondary needs for San Patricio Municipal Water District remain unchanged, because the shortage is due to treatment constraints, rather than raw water.

4A.6 Region Summary

When comparing total available supplies to total demands, the region shows a shortage throughout the 50-year planning cycle. Beginning in 2030, a shortage of 40,354 ac-ft exists within the Coastal Bend Region and increases to a shortage of 52,772 ac-ft by 2080 (Table 4A.27 and Figure 4A.2). A small portion of this shortage is associated with treatment plant capacity constraints and is not necessarily a raw water shortage (for example, see Table 4A.25). Current O.N. Stevens WTP improvements are in progress to increase treatment plant capacity, which should be sufficient to address long term water needs with recommended water management strategies for additional supplies.

4A.6.1 Municipal and Industrial Summary

On a regional basis, municipal and industrial entities (manufacturing, steam-electric, and mining) show a shortage increasing from 40,354 ac-ft in 2030 to 52,772 ac-ft in 2080, due primarily to decreasing manufacturing surface water availability accompanied by increasing manufacturing demand beginning in 2030. Shortages in supplies provided by the CCR/LCC/Texana/MRP Phase II System were placed on industrial (mining and/or manufacturing) demands in San Patricio and Nueces counties consistent with the approach used for all previous water planning cycles. Shortage in supplies based on SPMWD treatment capacity were placed on San Patricio County manufacturing.

Municipal demands account for approximately 43 percent of total demands in the region in 2080. Surface water accounts for approximately 82 percent of 2080 municipal supplies, with groundwater accounting for 17 percent and reuse accounting for 1 percent. Overall, the Coastal Bend Region is experiencing a municipal water supply shortage throughout the 50-year planning cycle. The specific municipal entities experiencing shortages are summarized in Table 4A.28.

Manufacturing demands account for 47 percent of total demands in 2080. Most of these demands, 96 percent, are in Nueces and San Patricio counties. Jim Wells, Kleberg, McMullen, and Live Oak counties make up the remaining 4 percent. Surface water supplies provide 89 percent of total manufacturing supplies in 2080; groundwater 10 percent and reuse 2 percent. Region-wide there is a manufacturing supply deficit of 35,134 ac-ft in 2030 increasing to 47,707 ac-ft by 2080.

Jim Wells, Nueces, and San Patricio counties show manufacturing shortages across the entire 50-year planning period. Manufacturing shortages are summarized in Table 4A.29.

As for the remaining industrial demands, there are sufficient surface water supplies to meet all Coastal Bend Region projected steam-electric water demands of 4,777 ac-ft through 2080.

The regional mining demand, 1,026 ac-ft, accounts for less than 1 percent of total demand in 2080. Multiple counties show immediate and long-term shortages from 2030 to 2080, summarized in Table 4A.30.

Table 4A.27.
Coastal Bend Region Summary Population, Water Supply, and Water Demand Projections

	Population Projection	2030	2040	2050	2060	2070	2080
		593,187	601,949	602,191	598,824	595,485	592,173
	Supply and Demand by Type of Use	Year					
		2030 (ac-ft)	2040 (ac-ft)	2050 (ac-ft)	2060 (ac-ft)	2070 (ac-ft)	2080 (ac-ft)
Municipal	Municipal Demand	107,817	109,080	109,273	108,888	108,541	108,259
	Municipal Existing Supply						
	Groundwater	16,136	16,129	16,212	16,423	16,633	16,611
	Surface water	85,109	86,600	87,059	86,925	86,899	82,101
	Reuse	1,465	1,465	1,465	1,465	1,465	1,465
	Total Existing Municipal Supply	102,710	104,194	104,736	104,813	104,997	100,177
	Municipal Balance	(5,107)	(4,886)	(4,537)	(4,075)	(3,544)	(8,082)
Industrial	Manufacturing Demand	115,120	115,273	115,432	115,596	115,877	117,923
	Manufacturing Existing Supply						
	Groundwater	6,605	6,645	6,687	6,730	6,775	6,822
	Surface water	72,253	68,763	66,305	64,440	62,468	62,267
	Reuse	1,128	1,128	1,128	1,128	1,128	1,128
	Total Manufacturing Supply	79,986	76,536	74,120	72,298	70,371	70,217
	Manufacturing Balance	(35,134)	(38,737)	(41,312)	(43,298)	(45,506)	(47,707)
	Steam-Electric Demand	4,777	4,777	4,777	4,777	4,777	4,777
	Steam-Electric Existing Supply						
	Groundwater	0	0	0	0	0	0
	Surface water	4,777	4,777	4,777	4,777	4,777	4,777
	Reuse	0	0	0	0	0	0
	Total Steam-Electric Supply	4,777	4,777	4,777	4,777	4,777	4,777
	Steam-Electric Balance	0	0	0	0	0	0
	Mining Demand	6,960	7,001	7,026	7,045	7,058	1,026
	Mining Existing Supply						
	Groundwater	4,118	4,149	4,179	4,207	4,209	1,393
	Surface water	0	0	0	0	0	0
	Reuse	2,729	2,729	2,729	2,729	2,729	2,650
	Total Mining Supply	6,847	6,878	6,908	6,936	6,938	4,043
	Mining Balance	(113)	(123)	(118)	(109)	(120)	3,017
Agriculture	Irrigation Demand	13,861	13,861	13,861	13,861	13,861	13,861
	Irrigation Existing Supply						
	Groundwater	13,560	13,560	13,560	13,560	13,560	13,560
	Surface water	0	0	0	0	0	0
	Reuse	301	301	301	301	301	301
	Total Irrigation Supply	13,861	13,861	13,861	13,861	13,861	13,861
	Irrigation Balance	0	0	0	0	0	0
	Livestock Demand	4,963	4,963	4,963	4,963	4,963	4,963
	Livestock Existing Supply						
	Groundwater	4,275	4,274	4,275	4,275	4,275	4,275
	Surface water	688	689	688	688	688	688
	Reuse	0	0	0	0	0	0
	Total Livestock Supply	4,963	4,963	4,963	4,963	4,963	4,963
	Livestock Balance	0	0	0	0	0	0
Total	Municipal and Industrial Demand	234,674	236,131	236,508	236,306	236,253	231,985
	Existing Municipal and Industrial Supply						
	Groundwater	26,859	26,923	27,078	27,360	27,617	24,826
	Surface water	162,139	160,140	158,141	156,142	154,144	149,145
	Reuse	5,322	5,322	5,322	5,322	5,322	5,243
	Total Municipal and Industrial Supply	194,320	192,385	190,541	188,824	187,083	179,214
	Municipal and Industrial Balance	(40,354)	(43,746)	(45,967)	(47,482)	(49,170)	(52,772)
	Agriculture Demand	18,824	18,824	18,824	18,824	18,824	18,824
	Existing Agricultural Supply						
	Groundwater	17,835	17,834	17,835	17,835	17,835	17,835
	Surface water	688	689	688	688	688	688
	Reuse	301	301	301	301	301	301

Population Projection	2030	2040	2050	2060	2070	2080
	593,187	601,949	602,191	598,824	595,485	592,173
Supply and Demand by Type of Use	**Year**					
	2030 (ac-ft)	**2040 (ac-ft)**	**2050 (ac-ft)**	**2060 (ac-ft)**	**2070 (ac-ft)**	**2080 (ac-ft)**
Total Agriculture Supply	18,824	18,824	18,824	18,824	18,824	18,824
Agriculture Balance	0	0	0	0	0	0
Total Demand	253,498	254,955	255,332	255,130	255,077	250,809
Total Supply						
Groundwater	44,694	44,757	44,913	45,195	45,452	42,661
Surface water	162,827	160,829	158,829	156,830	154,832	149,833
Reuse	5,623	5,623	5,623	5,623	5,623	5,544
Total Supply	213,144	211,209	209,365	207,648	205,907	198,038
Total Balance	(40,354)	(43,746)	(45,967)	(47,482)	((49,170)	(52,772)

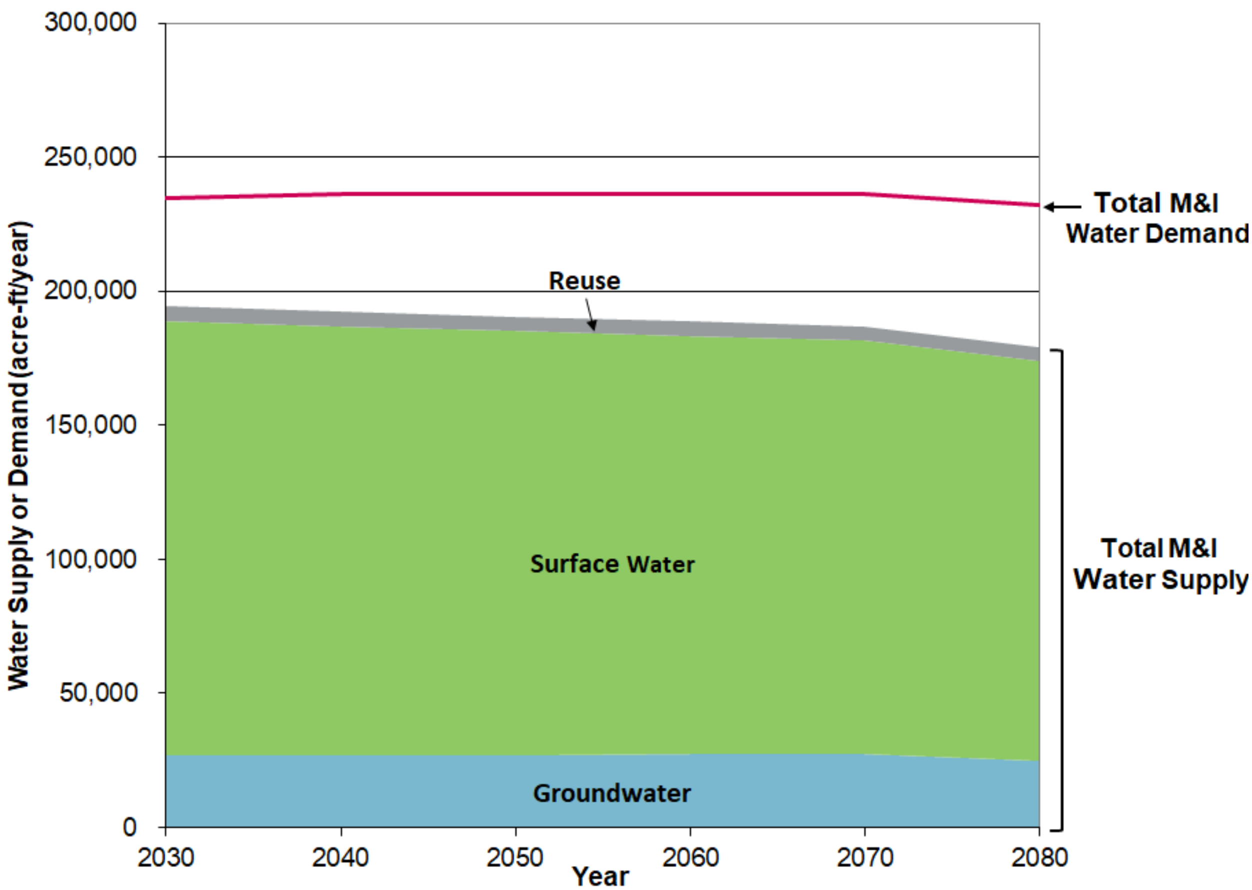

Figure 4A.2.
Municipal and Industrial Supply and Demand

Table 4A.28.
Municipal Entities with Projected Water Shortages

County/City	Projected Shortages (ac-ft)		
	2030	2050	2080
Bee County			
Skidmore WSC	(22)	(27)	(44)
TDCJ Chase Field	(5)	(2)	(2)
County-Other	(1,426)	(1,181)	(518)
Brooks County			
County-Other	(281)	(234)	(101)
Duval County			
County-Other	(253)	(199)	(113)
Jim Wells County			
San Diego MUD 1	(102)	(111)	(131)
County-Other	(1,621)	(1,159)	(82)
Live Oak County			
County-Other	(198)	(164)	(202)
Nueces County			
Nueces County WCID 3	(3,383)	(3,443)	(3,370)

Table 4A.29.
Manufacturing with Projected Water Shortages

County	Projected Shortages (ac-ft)		
	2030	2050	2080
Jim Wells County	(8)	(14)	(25)
Nueces County	(33,672)	(39,295)	(45,731)
San Patricio County	(1,454)	(2,003)	(1,951)

Table 4A.30.
Mining with Projected Water Shortages

County	Projected Shortages (ac-ft)		
	2030	2050	2080
Bee County	(25)	(25)	79
Nueces County	(88)	(93)	(101)

4A.6.2 Agriculture Summary

Irrigation demand remains constant at 13,861 ac-ft over the 50-year planning period and in 2080 represents 6 percent of total demand. Groundwater accounts for 98 percent of the total projected irrigation water supply and reuse accounts for the other 2 percent. No irrigation shortages are projected for the 50-year planning cycle.

Livestock demand remains constant at 4,963 ac-ft over the 50-year planning period and in 2080 represents 2 percent of total demand. For each county, groundwater was allocated based on maximum historic use from 2010 to 2020. Surface water supplies were assumed to consist of local, on-farm sources and used to meet demands.

4A.6.3 Summary

Overall, the Coastal Bend Region has insufficient supplies to meet the demands of all six WUG categories through 2080. Water groups with shortages are presented in Figure 4A.3.

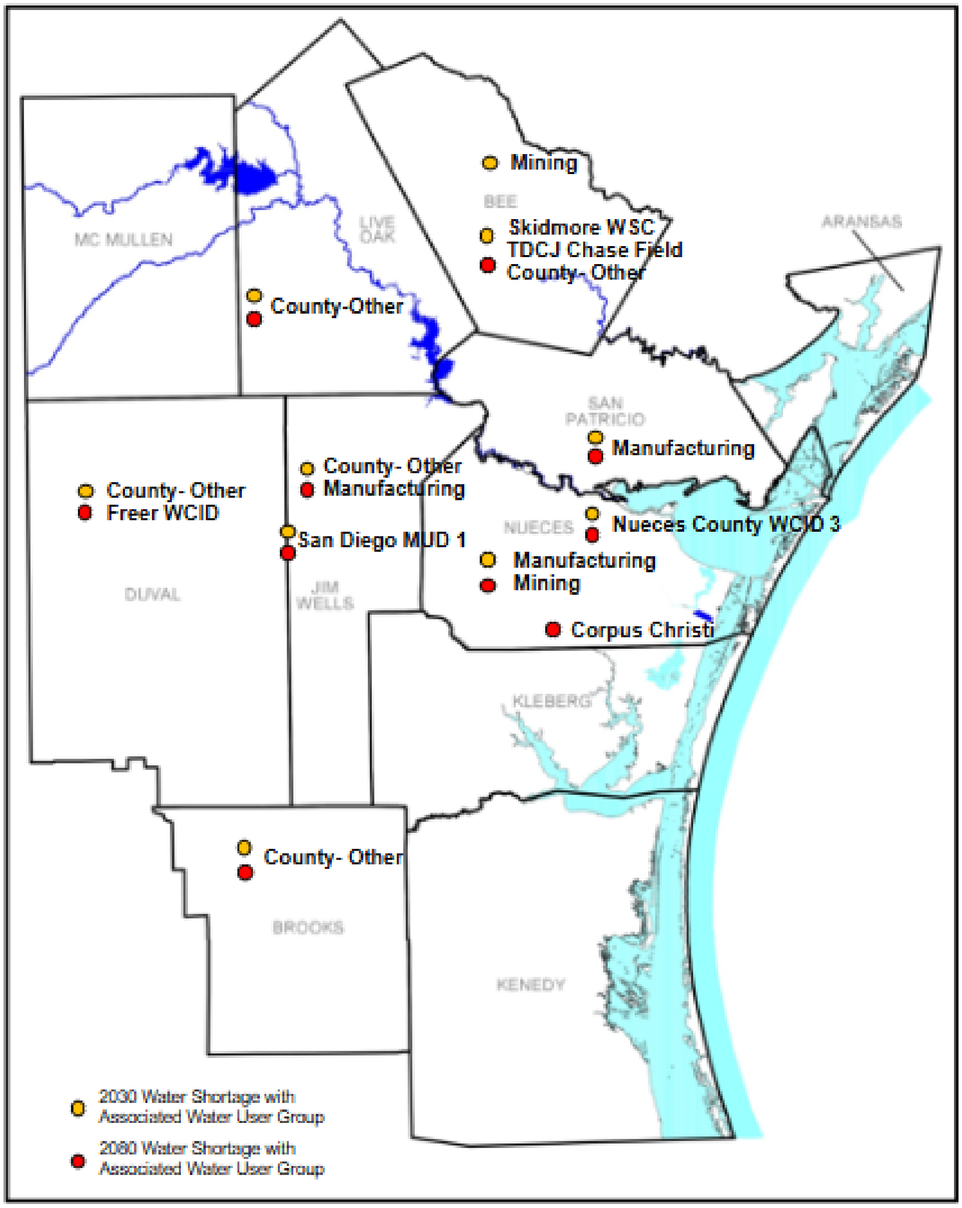

Figure 4A.3.
Location and Type of Use for 2030 and 2080 Water Supply Shortages

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4B

Identification of Infeasible Water Management Strategies in the Previously Adopted 2021 Plan

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Section 4B: Identification of Infeasible Water Management Strategies in the Previously Adopted 2021 Plan

A new requirement for this cycle of regional planning is to identify newly infeasible water management strategies and projects that were feasible and recommended in the 2021 regional water plans but have since become infeasible, in accordance with Senate Bill 1511 85th Texas Legislature directive. According to Texas Water Development Board (TWDB) guidance, "At minimum, RWPGs must review the status of recommended strategies and projects with an online decade of 2020 in the 2021 RWPs." A list of these recommended strategies and projects were provided to the Coastal Bend Region in January 2023 in supporting data spreadsheets. Regional water planning groups are also encouraged to review additional near-term strategies or projects with lengthy permitting or construction processes. Regional water planning groups must document the region's process for determining infeasible water management strategies.

In accordance with the Texas Water Code (§16.053(h)(10)), a strategy or project is considered infeasible if:

> *"…the proposed sponsor of the water management strategy or project has not taken an affirmative vote or other action to make expenditures necessary to construct or file applications for permits required in connection with the implementation of the water management strategy or project under federal or state law on a schedule that is consistent with the completion of the implementation of the water management strategy or project by the time the water management strategy or project is projected by the regional water plan or the state water plan to be needed."*

An infeasibility review is not required for strategies or projects that do not require a permit or involve construction (i.e., water conservation). The TWDB recognizes that information may be difficult to obtain for some categories of water users, such as those projects associated with county-wide water user groups (WUGs). Therefore, a region may not be able to determine infeasibility for some strategies or projects. If responses are not received from a WUG or sponsor regarding status of a water management strategy, it may still be considered feasible.

In accordance with contract guidance for the 2021 regional water plans, recommended strategies and projects with an online decade of 2020 were required to be online and delivering water by January 5, 2023. If any such strategies and projects are not currently implemented by this date and the project sponsor has not taken any affirmative steps towards implementation, the 2021 regional water plan must be amended to remove or revise the strategy or project to make them feasible. Affirmative steps by the sponsor may include but are not limited to 1) spending money on the strategy or project, 2) voting to spend money on the strategy or project, or 3) applying for a federal or state permit for the strategy or project.

The following WUGs and recommended water management strategies were shown in the *2021 Coastal Bend Regional Water Plan* for the 2020 decade. Sponsors with water management strategies shown as being implemented by the 2020 decade were contacted and status update is included below.

Note: County-wide strategies were not targeted for outreach.

- City of Alice- Brackish Groundwater Desalination
  - This is a feasible strategy and should remain in the 2021 regional water plan. Active steps have been taken and project is anticipated to be delivering finished water by end of 2024.
- El Oso Water Supply Corporation (WSC)-Additional groundwater well
  - Sponsor was contacted. El Oso refurbished an existing well. Awaiting additional information on capacity.
- San Diego Municipal Utility District (MUD) 1- Additional groundwater well
  - Sponsor was contacted. No additional info available.
- TDCJ Chase Field-Additional groundwater well
  - Sponsor was contacted. No additional info available.
- Nueces County Water Control and Improvement District #3 (WCID 3)-Local Balancing Storage Reservoir
  - On February 20, the sponsor identified a 100-acre tract that will be developed for flood protection and water supply storage benefits.
- Corpus Christi- O.N. Stevens Water Treatment Plant (WTP) Improvements
  - This is a feasible strategy and should remain in the 2021 Plan. Active steps have been taken and project is anticipated to be completed in 2024.

The Coastal Bend Regional Water Planning Group (CBRWPG) discussed 2021 Coastal Bend regional water plan strategies with an online decade of Year 2020 at the January 26, 2023, Coastal Bend Region meeting and TWDB supporting data spreadsheets for consideration of infeasible strategies at the October 12, 2023, meeting.

The CBRWPG adopted the following process on October 12, 2023, for determining infeasible water management strategies for the Coastal Bend regional water plan.

- Consider TWDB guidance regarding identifying infeasible water management strategies recommended in the 2021 Coastal Bend Regional Water Plan.
- Review supporting data[1] provided by TWDB on water management strategies and associated projects from the 2021 regional water plan.

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[1] Sent by TWDB to Region N on January 10, 2013. Includes the following data sheets that were reviewed: '2022SWPWMS&ProjectFeasibilityAnalysis_WMSWorkbook+RegN.xlxs,

- Conduct outreach to project sponsors to determine project status and assess infeasibility.
- Present the results of outreach, and analysis where applicable, at a CBRWPG meeting. This must occur at the same meeting where the regional water planning group presents its process for identifying potentially feasible water management strategies in the current plan under Task 5A.
- If responses are not received from a WUG or sponsor regarding status of a water management strategy, it will remain feasible (i.e., no action will be taken to warrant amendment to the 2021 regional water plan). Water management strategies previously identified for County-Other WUGs will remain feasible.
- The CBRWPG will include in the technical memorandum a list of regional water planning group-identified infeasible strategies for projects from the 2021 regional water plans, or a statement that no infeasible strategies or projects were identified. If infeasible strategies are identified, the regional water planning group will prepare an amendment to the 2021 regional water plan to revise/remove infeasible strategies and submit to the TWDB by the June 5, 2024, deadline.

The CBRWPG included the above information in the mid-cycle technical memorandum. Based on the results of sponsor outreach and discussion by the CBRWPG for projects that were unable to be confirmed, no infeasible strategies or projects were identified.

2022SWPWMS&ProjectFeasibilityAnalysis_WMSProjectWorkbook+RegN.xlxs, and
2022SWPWMS&ProjectFeasibilityAnalysis_WMSDetails&ProjectRelationships.xlxs

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5

Water Management Strategies

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Chapter 5: Water Management Strategies

Section 5A Identification of Potentially Feasible Water Management Strategies

The Coastal Bend Regional Water Planning Group (CBRWPG) identified and evaluated potentially feasible water management strategies for each water user group (WUG) and wholesale water provider (WWP) in the region, particularly for those WUGs with shortages projected during the planning period. As required by Texas Water Code, the CBRWPG considered the following potential feasible water management strategies for inclusion in the *2026 Coastal Bend Regional Water Plan*:

- Conservation
- Aquifer Storage and Recovery
- Desalination
- Reuse
- Management of Existing Supplies
- Conjunctive Use
- Acquisition of Available Existing Water Supplies
- Development of New Water Supplies
- Development of Regional Water Supply Projects or Facilities
- Voluntary Transfer of Water Within the Region
- Emergency Transfers of Water

The CBRWPG considered a complete list of potentially feasible water management strategies based on previous plans, local on-going studies, and feedback from local sponsors. These potentially feasible strategies included all water management strategy types referenced in the Texas Water Code as presented above. On January 26, 2023, the CBRWPG reviewed the status of recommended strategies and projects with an online decade of 2030 from the 2021 regional water plan to determine relevance for the 2026 regional water plan. At their regular public meeting on October 12, 2023, the CBRWPG approved their process for identifying and evaluating potentially feasible water management strategies for the Coastal Bend Region, which is provided in Figure 5A.1. Additionally, at the same meeting, the CBRWPG determined infeasible water management strategies from the previous 2021 regional water plan. A CBRWPG subcommittee[1] was formed at the same October 12 CBRWPG meeting to consider potentially feasible water management strategies for evaluation in the 2026 regional water plan. Emails were sent to WUGs and WWPs in November 2023, January 2024, and February 2024 with follow-up phone calls to gather information on potentially feasible water management strategies to evaluate for the 2026 regional water plan. On January 25, 2024, the CBRWPG identified potentially feasible water management strategies. Additional input on potentially feasible water management strategies was received at a WWP and WUG workshop on January 26, 2024. A CBRWPG subcommittee met on April 9, 2024, to review the list of potentially

[11] The subcommittee consisted of Joe Almaraz, Carl Crull, Andy Garza, John Marez, Lonnie Stewart, and Esteban Ramos.

feasible water management strategies and prioritized those to evaluate in the 2026 regional water plan. On May 16, 2024, the CBRWPG adopted the water management strategies for evaluation in the 2026 regional water plan.as summarized in Table 5A.1. Water management strategies from previous plans considered no longer relevant for active evaluation in the 2026 regional water plan were summarized and are included in Chapter 11.3. Subsequent to adoption of a list of water management strategies at the May 16, 2024, CBRWPG meeting, HDR Engineering, Inc. (HDR) received requests from the City of Corpus Christi, Port of Corpus Christi Authority (PCCA), and City of Mathis on new water management strategies that they would like considered in the Coastal Bend regional water plan. In response to this, the CBRWPG agreed on an approach at the December 12, 2024, meeting that placeholders for new water management strategies in the early stages of development would be included in the Initially Prepared Plan if full evaluations could not be completed in time. In January and February 2025, additional request of four new water management strategies were received, which included one new water management strategy for the City of Corpus Christi, one new strategy by the City of Beeville, and two new water management strategies for the South Texas Water Authority (STWA).

A total of 12 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. These strategies are summarized in Table 5A.1.

All potentially feasible water management strategy evaluations in the 2026 regional water plan included in Section 5B were evaluated in accordance with 31 Texas Administrative Code (TAC) 357.34 requirements and the Texas Water Development Board (TWDB) guidelines. Water management strategies from previous plans that were identified as relevant by the CBRWPG for the 2026 regional water plan were updated to reflect new costs, redeveloped to meet current rule requirements, revised for changed physical or socioeconomic conditions, and/or updated to reflect current project configuration information based on the level of detail requested by project sponsors or CBRWPG members. Water losses associated with recommended water management strategies are anticipated to be negligible with routine, standard maintenance performed to extend project life. In accordance with TWDB guidance, water plans should not include project costs associated with maintenance of replacing existing infrastructure.

Proposed Process to Identify Potentially Feasible Water Management Strategies for the 2026 Coastal Bend (Region N) Regional Water Plan

Adopted by CBRWPG, Oct 12, 2023

The process of identifying potentially feasible water management strategies outlined below is proposed for development of the 2026 Region N Regional Water Plan (2026 Plan)[1]:

1) The Coastal Bend Regional Water Planning Group (RWPG) recognizes that regional water planning is an evolving process and draws upon results obtained from previous planning efforts. A summary of water management strategies (WMSs) from the five previous planning cycles (2001, 2006, 2011, 2016, 2021 Plans) will be discussed at a Region N meeting for consideration for the 2026 Plan. The Texas Water Code list of WMSs eligible for consideration in the Plan will be discussed, including TWDB Water Loss Audit Report, conservation best management practices, and drought management as required by TWDB guidance.
2) The Nueces River Authority will host a workshop for water utilities located within the 11-county Region N area to discuss local plans and assess potential regional collaboration opportunities. Current local, on-going studies and future water plans, including specific WMSs of interest, will be solicited from Water User Groups (WUGs) and Wholesale Water Providers (WWPs).
3) Considering information compiled from outreach, a draft list of potentially feasible WMSs will be discussed at a Coastal Bend RWPG meeting for public comment.
4) HDR, technical consultant, will follow-up with WUGs and WWPs to confirm the list of water management strategies for development of the 2026 Plan.
5) The Coastal Bend RWPG will consider forming a subcommittee to review potentially feasible strategies and prepare a draft scope of work for strategies to evaluate for the 2026 Plan. The scope of work subcommittee will review a preliminary list of potentially feasible WMSs and prepare a recommendation for Coastal Bend RWPG consideration given TWDB funding allocations.
6) A scope of work for strategies to be evaluated will be considered and adopted at a RWPG meeting after receiving public comment. Subsequently, the Nueces River Authority will submit a letter request for TWDB consideration and approval.
7) Based on the adopted list of potentially feasible water management strategies, potential water management strategies will be identified to meet needs for all WUGs and WWPs with identified needs. If no potentially feasible strategy can be identified for a WUG or WWP with a need, the reason for this will be documented in the Technical Memorandum, IPP and Final Plan.
8) The list of potentially feasible water management strategies will be included in the Technical Memorandum, IPP, and Final Plan.
9) After TWDB approval of the scope of work for water management strategy evaluations, additional water management strategies may be considered and approved for inclusion in the 2026 Plan at WUG sponsor request and expense. These strategies will be brought to the Coastal Bend RWPG for consideration as potentially feasible WMSs and if approved will be included in the Initially Prepared Plan and Final Plan.

[1] Pursuant to Texas Administrative Code Title 31 Part 10 Chapter 357.5(e)(4) of the Regional Water Planning Guidelines which states: "Before a regional water planning group begins the process of identifying potentially feasible water management strategies, it shall document the process by which it will list all possible water management strategies and identify the water management strategies that are potentially feasible for meeting a need in the region."

Figure 5A.1.
Region N-Adopted Process for Identification of Potentially Feasible Water Management Strategies for Development of the 2026 Coastal Bend Regional Water Plan

Table 5A.1. Potentially Feasible Water Management Strategies Selected by the CBRWPG for Evaluation in the 2026 Plan

5B.1	Municipal Water Conservation
5B.2	Manufacturing Water Conservation
5B.3	Mining Water Conservation
5B.4	Reuse
5B.5	Aquifer Storage and Recovery
5B.6	Seawater Desalination
5B.7	Brackish Groundwater Desalination
5B.8	Local Balancing Storage Reservoir
5B.9	Groundwater Supplies- Rural and Non-Municipal Water Systems
5B.10	Regional Water Supply Management and Treatment Facilities
5B.11	Nueces River Diversion to Choke Canyon Reservoir
5B.12	Lake Corpus Christi Sediment Removal

Section 5B Water Management Strategy Evaluations and Recommended Water Management Strategies

Table 5B.1 summarizes strategies that were selected for inclusion as recommended or alternative strategies in the plan for WWPs in the Coastal Bend Region and Table 5B.2 shows potential strategies for other local service areas. Each water management strategy category identified in Table 5A.1 has included projects evaluated in accordance with regional water planning guidance and included in Sections 5B.1 through 5B.12. The regional water plan does not include any retail distribution-level infrastructure or associated costs, except those associated with municipal water conservation-related strategies such as pipeline and meter replacement programs (Section 5B.1). Strategies related to water treatment plant improvements (Section 5B.10) rely on development of new raw water supplies to fully deliver at treated capacity. Without new raw water supplies, the treated water available with these strategies declines as existing raw water supplies become utilized by industrial customers to meet growing water demands. There are no Coastal Bend Region strategies that mutually exclude another recommended strategy.

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Table 5B.1.
Potential Water Management Strategies to Meet Long-Term Needs for Wholesale Water Providers

WMS ID	Water Management Strategy	Additional Water Supply (ac-ft/yr)	Total Project Cost ($)	Annual Cost ($)	Unit Cost of Additional Treated Water ($ per ac-ft/yr)	Degree of Water Quality Improvement	Environmental Issues/Special Concerns
5B.1	**Municipal Water Conservation**	up to 17,118	Variable, Regional Cost up to $41,349,049	Variable	$577-$583	No change	Possible reduction in return flows to bay and estuary
5B.2	**Manufacturing Water Conservation**	up to 17,689	Highly variable	Highly variable	Variable	Variable. Depends on BMP. Low to significant improvement.	Possible reduction in return flows to bay and estuary
5B.4	**Reuse**						
	Petronila Regional WWTP Reuse	1,120	$13,228,000	$1,554,000	$1,388	Improves quality	Potential reduction of freshwater inflows to bay and estuary; construction and maintenance of pipeline corridors
	Corpus Christi Greenwood WWTP Direct Potable Reuse	5,381	$64,195,000	$11,258,000	$2,092		Reduction of freshwater inflows to intermittent, local streams. Possible reduction in return flows to bay and estuary; construction and maintenance of pipeline corridors
	Oso Regional WWTP Reuse	No information available. Will be evaluated between Initially Prepared and Final Plan.					
5B.5	**City of Corpus Christi Aquifer Storage and Recovery**						
	Non-Potable Phase 1 and 2	20,178	$196,981,000 to $237,314,000	$18,731,000 to $22,280,000	$928 to $1,104	Improves effluent and groundwater quality	Possible reduction in return flows to bay and estuary
	ASR with IPR	8,070	$186,539,000	$22,869,000	$2,834	Improves effluent and groundwater quality	Possible reduction in return flows to bay and estuary
5B.6	**Seawater Desalination**						
	City of Corpus Christi- Inner Harbor (30 MGD)	33,604	$785,000,000	$106,000,000	$3,154	Variable. Low to significant improvement.	Disposal of concentrated brine created from process may impact fish and wildlife habitats or wetlands. NRA Basin Highlights report has identified constituents of concern for Corpus Christi and Nueces Bay to consider during treatment based on end-user goal.
	City of Corpus Christi- La Quinta (40 MGD)	44,806	$1,141,000,000	$155,000,000	$3,460	Variable. Low to significant improvement.	
	City of Corpus Christi Barney Davis Desalination (20 MGD)	33,627	$582,000,000	$83,000,000	$3,705	Variable. Low to significant improvement.	Threatened and endangered species habitat identified near project site.
	Port of Corpus Christi Authority- Harbor Island (100 MGD)	112,014	$3,456,000,000	$405,000,000	$3,616	Variable. Low to significant improvement.	Threatened and endangered species habitat identified near project site.
	Port of Corpus Christi Authority- La Quinta Channel (30 MGD)	33,627	$844,000,000	$116,000,000	$3,452	Variable. Low to significant improvement.	
	Brackish Groundwater Desalination						
	Evangeline Laguna Treated Groundwater	25,637	$486,499,000	$104,738,000	$4,085	Significant improvement	Construction and maintenance of pipeline corridors. Disposal of concentrated brine created from process may impact fish and wildlife habitats or wetlands.
	Driscoll Brackish Groundwater Treatment Project	2,016	$36,289,885	$4,353,679	$2,160	Significant improvement	Construction and maintenance of pipeline corridors. Disposal of concentrated brine created from process may impact fish and wildlife habitats or wetlands.
5B.8	**Local Balancing Storage**	3,827	$54,093,000	$4,607,000	$1,204	No Change	Construction and maintenance of pipeline corridors and terminal storage
5B.9	**Groundwater Supplies - Rural and Non-Municipal Water Systems**						
	Ricardo Well Project	560	$10,977,100	$1,183,941	$2,114	No to low degradation	Minor Impacts
5B.10	**Regional Water Supply Management and Treatment Facilities**						
	ON Stevens WTP Improvements	32,029	$82,753,000	$7,502,000	$606	No Change	None
	Mary Rhodes Rehabilitation	112,000	$1,236,419,000	$112,506,000	$1,377	No Change	None
	SPMWD Project No. 1 - New WTP (20 MGD) at Plant D	22,418	$69,048,000	$18,349,000	$819	No Change	None
	SPMWD Project No. 2 - New Intake, PS and Raw Transmission on Nueces	69,495	$223,595,000	$44,271,000	$637	No Change	None
	SPMWD Project No. 3 - New PS at MR & Transmission Rehab	33,627	$40,249,000	$16,204,000	$482	No Change	None
5B.11	**Nueces River Diversion to Choke Canyon Reservoir**	2,939	$417,731,000	$35,037,000	$11,923	No to low degradation	Possible reduction in return flows to bay and estuary
5B.12	**Lake Corpus Christi Sediment Removal**	2,000	$2,672,649,000	$228,009,000	$114,005	No to low degradation	Temporary degradation to wildlife habitat and wetlands.

Table 5B.2.
Potential Water Management Strategies to Meet Long-Term Needs for Local Service Areas

WMS ID	Water Management Strategy	Water Supply (ac-ft/yr)	Total Project Cost ($)	Annual Cost ($)	Unit Cost of Treated Water ($ per ac-ft/yr)	Degree of Water Quality Improvement	Environmental Issues/Special Concerns
5B.1	**Municipal Water Conservation**	up to 17,118	Variable, Regional Cost up to $26,050,001	Variable	$577-$583	No change	Possible reduction in return flows to bay and estuary
5B.2	**Manufacturing Water Conservation**	up to 17,689	Highly variable	Highly variable	Variable	Variable. Depends on BMP. Low to significant improvement.	Possible reduction in return flows to bay and estuary
5B.3	**Mining Water Conservation**	up to 882	Highly variable	Highly variable	Variable	No change	Possible reduction in return flows to bay and estuary
5B.7	**Brackish Groundwater Desalination**						
	City of Beeville	4,204	$100,904,000	$16,342,000	$3,887	Variable. Low to significant improvement.	Possible reduction in return flows to bay and estuary. Disposal of concentrated brine created from process may impact fish and wildlife habitats or wetlands.
5B.9	**Groundwater Supplies - Rural and Non-Municipal Water Systems**						
	Bee County-Other (Municipal)	1,426	$5,421,000	$567,000	$398	No to low degradation	Minor Impacts
	Bee County-Mining	25	$1,024,000	$80,000	$3,200	No to low degradation	Minor Impacts
	Skidmore WSC	44	$1,067,000	$101,000	$2,295	No to low degradation	Minor Impacts
	TDCJ Chase Field	5	$1,067,000	$100,000	$20,000	No to low degradation	Minor Impacts
	Brooks County-Other (Municipal)	281	$1,089,000	$127,000	$452	No to low degradation	Minor Impacts
	Duval County-Other (Municipal)	253	$1,496,000	$158,000	$625	No to low degradation	Minor Impacts
	San Diego MUD 1	131	$817,000	$92,000	$702	No to low degradation	Minor Impacts
	Jim Wells County- Other (Municipal)	1,621	$8,763,000	$846,000	$522	No to low degradation	Minor Impacts
	Jim Wells County- Manufacturing	25	$747,000	$75,000	$3,000	No to low degradation	Minor Impacts
	Live Oak County- Other (Municipal)	202	$1,317,000	$139,000	$688	No to low degradation	Minor Impacts
	Nueces County-Mining	101	$752,000	$60,000	$594	No to low degradation	Minor Impacts
	City of Mathis	560	$2,177,000	$238,000	$425	No to low degradation	Minor Impacts

All strategies are compared with respect to four areas of interest: 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 5B.1. A detailed analysis of each strategy is included in Section 5B (refer to Sections 5B.1 through 5B.12). In these detailed descriptions, each strategy was evaluated with respect to 11 impact categories, as required by TWDB rules. These categories are shown in Table 5B.3. An evaluation summary is included at the end of each water management strategy description, which summarizes how each strategy relates to the 10 impact categories.

Each strategy includes a separate environmental issues discussion, which describes environmental factors, including impacts to agricultural resources. In the evaluation summaries, some impacts are qualitatively discussed. According to TAC Chapter 357.34(e)(3), quantitative reporting is required for quantity (yield), cost, environmental factors, and impacts to agricultural resources. Table 5B.4 and Table 5B.5 include the keys to the environmental issues and impacts to agricultural resources descriptors, respectively, presented in the evaluation summaries.

Recommended plans to meet the specific needs of the cities and other WUGs during the planning period (2040 through 2080) are presented in the following sections. The plans are organized by county and WUG in the following sections (Sections 5B.2 to 5B.13). Annual and unit costs are shown for each water management strategy and decline after debt service is paid, which generally occurs after 20 years. A new balance is shown in each water supply plan calculated after recommended water management strategy yields have been applied to shortages. Water supply plans for WUGs and major water providers (MWPs) frequently include multiple recommended water management strategies that when totaled, sum up to more than the volume needed to meet a water supply shortage. This additional supply accounts for uncertainties in population projections, future demands, climate variability, yield of recommended water management strategies, permitting challenges, and other uncertainties. The TWDB-provided table that shows the calculated management supply factors for each decade by WUG is included in Appendix A. Using this information, management supply factors were summarized for MWP and is presented in Table 5B.6.

According to the TWDB, regional planning is a reconnaissance-level effort and a detailed investigation of project impacts is beyond the scope and mandate of this effort. The impacts, costs, and benefit of large-scale projects such as reservoirs or major diversions would, if implemented, undergo additional and extensive evaluation during permitting under Section 404 of the Clean Water Act, the National Environmental Policy Act, and any other applicable federal, state, or local regulations.

Water conservation is recommended based on per capita rates, described below in Section 5C. Drought management is not a recommended water management strategy to meet projected water needs in the Coastal Bend Region, in part because it cannot be demonstrated to be an economically feasible strategy. However, a safe yield reserve of 75,000 acre-feet (ac-ft) is included as a drought management measure when evaluating regional surface water supplies from the Choke Canyon Reservoir/Lake Corpus Christi System/Texana/Mary Rhodes Pipeline (CCR/LCC/Texana/MRP Phase II) System, as discussed in Chapter 7.

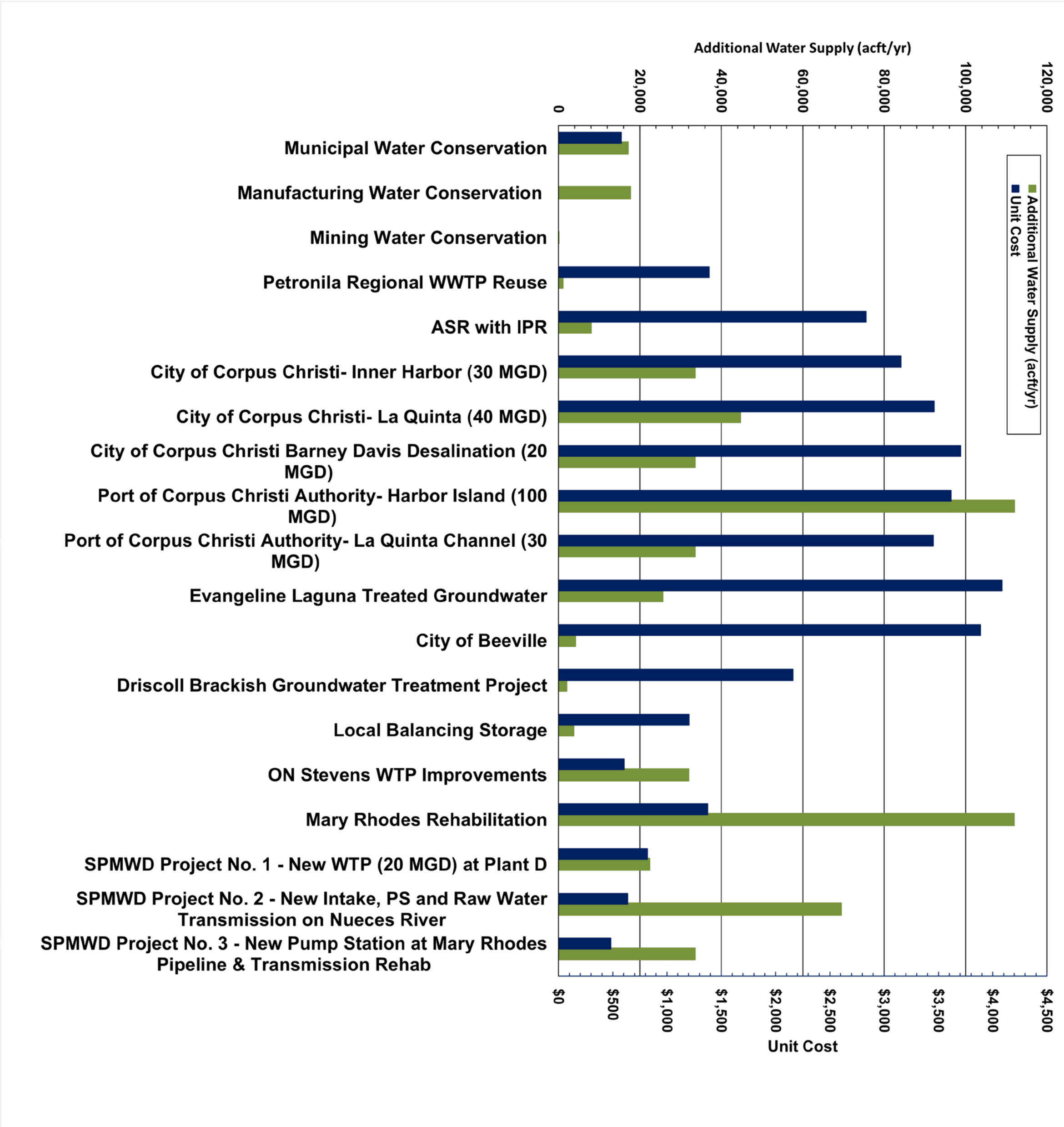

Figure 5B.1.
Unit Cost and Water Supply Comparison for Selected Water Management Strategies

Table 5B.3.
Summary of Impact Categories for Evaluation of Water Management Strategies

a.	Water Supply	
	1.	Quantity
	2.	Reliability
	3.	Cost of Treated Water
b.	Environmental factors	
	1.	Instream flows
	2.	Bay and Estuary Inflows and arms of the Gulf of Mexico
	3.	Wildlife Habitat
	4.	Wetlands
	5.	Threatened and Endangered Species
	6.	Cultural Resources
	7.	Water Quality (Key Parameters Identified by Region N) a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents
c.	Impacts to agricultural resources and State water resources	
d.	Threats to agriculture and natural resources in region	
e.	Recreational impacts	
f.	Equitable comparison of strategies	
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	
k.	Impacts on water pipelines and other facilities currently used for water conveyance	

Table 5B.4.
Impacts to Environmental Factors Key

Impacts to Environmental Factors Key	Criteria
None or Low; Negligible	Reduction in environmental flows with implementation of the strategy is indiscernible (less than 1%) using the approved surface water availability model, as compared to instream, Bay and Estuary flows and arms of the Gulf of Mexico flows without the project. Wildlife habitat is not expected to be altered by the project. Wetlands are not expected to be altered (less than 1% alteration) with project implementation. Threatened and endangered species habitat are not expected to be altered (less than 1% alteration) with project implementation. Cultural resources are not expected to be altered with project implementation. .
Moderate; Some	Reduction in environmental flows with implementation of the strategy is expected to range from 1% to 10% using the approved surface water availability model, as compared to instream and Bay and Estuary flows and arms of the Gulf of Mexico flows without the project. Due to the nature of the strategy, localized impacts to small creeks or on-site tanks may be noticed (up to 10%). Wildlife habitat may be temporarily impacted during project construction (less than 10% area), but long-term impacts to wildlife habitat are not expected. Wetlands may be temporarily impacted during construction (less than 10% area) but long-term impacts with project implementation are not expected. Threatened and endangered species habitat may be temporarily impacted during construction (less than 10% area) but long-term impacts with project implementation are not expected. Cultural resources are not expected to be altered with project implementation.
High	Reduction in environmental flows with implementation of the strategy is expected to exceed 10% using the approved surface water availability model, as compared to instream and Bay and Estuary flows and arms of the Gulf of Mexico flows without the project. Long-term wildlife habitat alteration (of 10% or greater) is highly likely with project. Permanent wetlands (of 20% or more current wetland area) is highly likely with project implementation. Threatened and endangered species habitat is highly likely (20% or more of habitat area) with project implementation. Cultural resources are highly likely to be altered with project implementation. .

Table 5B.5.
Impacts to Agricultural Resources Key

Impacts to Agricultural Resources Key	Criteria
None or Low; Negligible	Temporary impacts to agricultural land during project construction. Occasion disturbances due to maintenance on right of way for pipelines. Less than 5 irrigated acres permanently affected due to repurposing of land to support the project.
Moderate; Some	Loss of up to 50 irrigated acres permanently due to repurposing of land to support the project (i.e. impoundment).
High	Loss of more than 50 irrigated acres permanently due to repurposing of land to support the project (i.e. impoundment).

Table 5B.6.
Region N Major Water Providers Management Supply Factor

Major Water Provider	MWP Management Supply Factor					
	2030	2040	2050	2060	2070	2080
City of Corpus Christi	1.1	1.6	1.7	1.7	1.7	1.7
San Patricio Municipal Water District	1.3	3.9	3.8	3.8	3.8	3.8
South Texas Water Authority	1.0	1.0	1.0	1.0	1.0	1.0
Nueces County WCID 3	1.0	1.1	1.2	1.2	1.3	1.3

The TWDB socioeconomic impact analysis of water needs in Coastal Bend Region will be conducted by the TWDB between the Initially Prepared Plan and Final Plan. .

Future projects involving authorization from either the TCEQ and/or TWDB that 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 regional water planning group 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. TCEQ 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 regional water planning group is of the opinion that each project should be considered by the TWDB and Texas Commission on Environmental Quality (TCEQ) 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 TCEQ 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 appropriator addresses a water supply need in a manner consistent with an approved regional water plan. TCEQ 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.)

5B.1

Municipal Water Conservation

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Section 5B.1 Municipal Water Conservation

5B.1.1 Description of Strategy

Water conservation is typically a low-capital intensive alternative that water supply entities can pursue to extend the life of current water supplies and can even defer development of new water supplies. Water conservation refers to those methods and practices that either reduce the demand for water supply or increase the efficiency of the supply or use facilities so that existing supply is conserved and made available for future use. Water supply entities and major water right holders are required by Senate Bill 1 regulations to submit a Water Conservation Plan to the Texas Commission on Environmental Quality (TCEQ) for approval. These plans must be updated every 5 years and detail the water supply entities' plans to reduce water demand, including 5-year and 10-year goals. Reference Chapter 5C.1 – Conservation Recommendations for additional information regarding the current list of water utilities/entities in the Coastal Bend Region that have submitted their Water Conservation Plans to TCEQ and provided copies to the Texas Water Development Board (TWDB).

For regional water planning purposes, municipal water use is defined as residential and commercial water use. Municipal water is primarily used for drinking, sanitation, cleaning, cooling, fire protection, and landscape watering for residential, commercial, and institutional establishments. A key parameter of municipal water use within a typical city or water service area is the number of gallons used per person per day (per capita water use). The primary objective of water conservation is to decrease the amount of water, which is measured in gallons per person per day (gpcd), a typical person uses on a daily basis.

Regional water planning groups have been required to consider water conservation and drought management measures for each water user group with a need (projected water shortage) since the Texas Legislature amended the Texas Water Code in 2001. Subsequently, the Water Conservation Implementation Task Force (Task Force) was created by Senate Bill 1094 to identify and describe Water Conservation Best Management Practices (BMPs) and provide a BMP Guide[1] that has been used by regional water planning groups for development of the regional water plans from 2006 to present. The Task Force recommended that a standardized methodology be used for determining municipal water use based on gpcd to allow consistent evaluations of effectiveness of water conservation measures adopted among Texas cities located in the various climates and regions of Texas.

Municipal water user groups (WUGs) with per capita rates exceeding 140 gpcd are recommended to voluntarily reduce per capita consumption by 1 percent annually through 2080 until a 140 gpcd rate is attained. This recommendation from the Coastal Bend Regional Water Planning Group (CBRWPG) applies to all municipal WUGs with and without projected water supply needs (or shortage). Although the CBRWPG considered the recommendations of the

[1] Texas Water Development Board, Water Conservation Implementation Task Force, Water Conservation Best Management Practices Guide, November 2004. http://www.twdb.texas.gov/publications/reports/numbered_reports/doc/R362_BMPGuide.pdf?d=1581280795628

Water Conservation Advisory Council (WCAC) report to the 88th Texas Legislature[2]; however, the WCAC methodology of calculating the estimated dry-year planning gpcd resulted in a projected gpcd reduction in the later planning decades that might not be realistic for some of the municipal WUGs.

Since the last planning cycle, TWDB has continued the work of the Task Force and WCAC by updating the previous resources for municipal water users to assist water utilities with water conservation, including:

- Water Conservation Best Management Practice Guides
    - Municipal Users, February 2020
    - Wholesale Water Providers, October 2017
- Water Conservation Plan Guidance for Utilities, developed in September 2020
    - Water Conservation Plan Checklist
    - What is a Water Conservation Plan
    - Identifying Water Conservation Targets and Goals

TWDB provided additional tools for regional water planning groups to consider during the development of the municipal water conservation recommendations for the 2026 regional water plans. The following TWDB resources were considered during the development of the *2026 Coastal Bend Region Regional Water Plan*:

- Conservation Resource Guide for the Development of the 2026 Regional Water Plan
- Uniform Costing Model and Drought Management Costing Tool
- *Hidden Reservoirs: Addressing Water Loss in Texas*, National Wildlife Federation Report, 2022.
    - Report provides an in-depth analysis of water loss in Texas and concludes that utilities are losing approximately 572,000 acre-feet (ac-ft) of water per year.
- Interregional Planning Council Report (2024) to TWDB.
    - Report recommends decreasing water loss for utilities through improving infrastructure and water resources management.
- Municipal Water Conservation Planning Tool
    - The Municipal Water Conservation Planning Tool was developed by the TWDB to assist individual water utilities with planning conservation programs. The tool allows the user to include a mix of BMPs and produces the expected annual conservation savings and associated capital and annual costs.

[2] Progress Made in Water Conservation in Texas: Report and Recommendations to the 88th Texas Legislature, Water Conservation Advisory Council, December 2022.

Per capita water use for 2026 regional water planning purposes was based on population and water demand projections provided and approved by the TWDB for each municipal WUG in the Coastal Bend Region; the water demand projections incorporated water efficiency savings for each decade from 2030 to 2080). The TWDB provided this information for WUGs based on county, so in some instances one WUG is represented multiple times (i.e., Aransas Pass has two entries for portions located in Aransas and San Patricio counties). For consistency, Section 5B.1 presents information in this way for each WUG and county combination for a total of 55 municipal WUG entries rather than the 52 WUGs reported for the Coastal Bend Region, including 41 discrete WUGs (i.e., Aransas Pass located in multiple counties counted as one) and 11 County-Other.

The base year per capita water use[3] (primarily from 2020) was used as a basis for projected per capita water use in decades from 2030 to 2080 that might be expected with implementation of low flow plumbing fixtures. For WUGs with per capita rates lower than 60 gpcd, the TWDB applied a minimum of 60 gpcd in the draft water demand projections and no water efficiency savings were applied to them both in the *2022 State Water Plan* and the 2026 draft demand projections. Per capita water use is shown for 55 municipal entities located in the Coastal Bend Region in Table 5B.1.1.

[3] Based on water user surveys provided voluntarily by water provider to the TWDB.

Table 5B.1.1.
Municipal Water User Groups Projected Per Capita Water Use
(Based on approved Region N—TWDB Population & Water Demand Projections)

No.	County	Water User	Base Year 2020 gpcd	2030	2040	2050	2060	2070	2080
1	Jim Wells	Jim Wells FWSD 1	60	60	60	60	60	60	60
2	Jim Wells	Premont	218	213	213	213	213	213	213
3	San Patricio	Ingleside	95	90	90	90	90	90	90
4	Bee	Pettus MUD	132	129	127	127	128	128	127
5	Nueces	Bishop	155	150	150	150	150	150	150
6	Nueces	Violet WSC	79	74	73	74	73	74	73
7	San Patricio	Portland	148	144	143	143	143	143	143
8	Nueces	Driscoll	116	111	111	111	111	111	112
9	San Patricio	Rincon WSC	90	86	85	85	85	85	85
10	Nueces	River Acres WSC	144	139	139	139	139	139	139
11	Kleberg	Kingsville	131	126	126	126	126	126	126
12	Kleberg	Ricardo WSC	108	104	103	103	103	103	103
13	Aransas	County-Other	100	94	94	94	94	94	94
14	Aransas	Aransas Pass	128	123	123	123	123	123	123
15	Duval	Duval County CRD	126	121	121	121	121	121	121
16	Live Oak	County-Other	111	106	106	106	106	106	106
17	San Patricio	Gregory	151	147	146	146	146	146	146
18	Live Oak	McCoy WSC	111	101	106	108	103	89	112
19	Duval	County-Other	114	109	108	108	108	108	108
20	Brooks	County-Other	114	109	109	109	108	109	109
21	McMullen	County-Other	119	115	114	113	113	114	114
22	Nueces	County-Other	118	112	112	112	112	112	112
23	Duval	San Diego MUD 1	166	162	161	161	161	161	161
24	San Patricio	Mathis	114	110	109	109	109	109	109
25	Aransas	Rockport	162	157	157	157	157	157	157
26	Bee	County-Other	125	120	120	120	120	120	120
27	Jim Wells	San Diego MUD 1	166	161	161	161	160	161	160
28	Jim Wells	County-Other	128	123	123	123	123	123	123
29	San Patricio	County-Other	128	123	123	123	123	123	123
30	San Patricio	Odem	134	129	129	129	129	129	129
31	Kleberg	Baffin Bay WSC	147	143	142	141	142	142	142
32	Duval	Freer WCID	203	198	198	198	198	198	198
33	Nueces	Corpus Christi	173	168	168	168	168	168	168
34	Live Oak	Old Marbach School WSC[1]	136	131	131	131	131	130	131
35	Bee	Skidmore WSC[1]	146	142	141	140	141	141	141
36	Bee	Beeville	194	189	189	189	189	189	189
37	Jim Wells	Alice	179	174	173	174	174	174	174
38	Kleberg	County-Other	151	146	145	145	145	145	145
39	Nueces	Nueces WSC	151	147	147	147	147	147	147

No.	County	Water User	Base Year 2020 gpcd	2030	2040	2050	2060	2070	2080
40	Live Oak	George West	164	159	158	158	159	158	158
41	San Patricio	Aransas Pass	128	123	123	123	123	123	123
42	San Patricio	Taft	129	124	124	124	124	124	124
43	San Patricio	Sinton	209	204	204	204	204	204	204
44	Jim Wells	Orange Grove	232	227	226	226	226	226	226
45	Kleberg	Riviera Water System	142	138	137	137	137	137	137
46	Nueces	Nueces Co. WCID 3	264	260	259	259	259	259	259
47	Live Oak	El Oso WSC	183	178	178	178	178	178	178
48	Brooks	Falfurrias	244	240	239	239	239	239	239
49	Live Oak	Three Rivers	156	151	150	150	150	150	151
50	Bee	El Oso WSC	183	178	178	178	178	178	178
51	Bee	TDCJ Chase Field	268	265	264	264	264	264	264
52	Nueces	Nueces Co. WCID 4	455	450	449	449	449	449	449
53	Kenedy	County-Other	471	465	467	467	467	466	466
54	Nueces	Corpus Christi Naval Air Station	1371	1364	1362	1361	1362	1362	1361
55	Kleberg	Naval Air Station Kingsville	4306	4285	4276	4267	4274	4265	4268

[1] Base year per capita water use is from 2018.

The purpose of a municipal water conservation water management strategy is to evaluate the potential of additional municipal water conservation beyond low flow plumbing code for inclusion in the regional water plan to meet a part of the projected water needs (shortages) as required by 31 Texas Administrative Code (TAC) Chapter 357.22.

The City of Corpus Christi, the largest water user in the Coastal Bend Region, has demonstrated significant water savings attributable to conservation efforts over the past decades. The City of Corpus Christi's municipal water use was nearly 220 gpcd in 1990[4] and was reduced to 177 gpcd by 2000 and 150 gpcd by 2016, a decrease of about 23 and 32 percent from 1990. According to TWDB water use projections, the City of Corpus Christi water use solely attributable to plumbing code savings is anticipated to be 168 gpcd in 2030 (Table 5B.1.1).

[4] City of Corpus Christi Water Conservation Plan, 1999.

During development of this plan, the CBRWPG gathered and reviewed water conservation plans submitted to the Nueces River Authority and TCEQ by municipal WUGs (and some smaller utilities included in County-Other) in the 11-county Coastal Bend Region. The water conservation plans for the Coastal Bend Region municipal WUGs are summarized in Table 5B.1.1 and includes 4 wholesale water providers (City of Corpus Christi, San Patricio Municipal Water District (SPMWD), South Texas Water Authority (STWA), Nueces County Water Control and Improvement District #3 (WCID 3), and 20 municipal WUGs. The purpose of reviewing these plans was to gather information regarding preferred voluntary water conservation BMPs in the Coastal Bend Region and success of the ongoing programs originally identified by the CBRWPG in 2009.[5] Additionally, information on goals that WUGs in the region have in the next 5 and 10 years was gathered from the water conservation plans. Based on the most current plans on record from 2011 to 2024, local water conservation programs in the Coastal Bend Region have used leak detection, water conservation pricing measures, reuse, meter replacement programs, retrofit programs, public education, xeriscaping and other BMPs as shown in Table 5B.1.4 to reduce water use.

The 5-year and 10-year goals identified in the water conservation plans for the Coastal Bend Region municipal WUGS are shown in Table 5B.1.2. Some user groups want to maintain their current per capita use, some have identified 1, 2.5, 3 or 5 percent reductions over various time periods, and one WUG plans to have a gpcd 10 percent below the state average. This information was used by the CBRWPG to develop municipal water conservation goals and prepare a list of most-practical BMPs for voluntary implementation in the region. Additional details on the impact of municipal water conservation BMPs that were implemented based on information provided to the TWDB by the cities of Alice, Aransas Pass, Beeville, Corpus Christi, Kingsville, Portland, Rockport, Three Rivers, Nueces County WCID 3, Nueces County WCID 4, and River Acres Water Supply Corporation (WSC) are included in Chapter 5C discussion summarizing Coastal Bend Region conservation recommendations (Table 5C.1.4. through 5C.1.6).

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[5] Coastal Bend Regional Water Planning Group, 2011 Regional Water Plan, Study 1 – Region-Specific Water Conservation Best Management Practices (BMPs), April 2009.

Table 5B.1.2. Summary of 5- and 10-Year Water Conservation Goals in the Coastal Bend Region

Wholesale Water Provider	5-Year Goal		10-Year Goal	
	GPCD Target	General	GPCD Target	General
City of Corpus Christi[1,2,3]	195[2]	1% annual reduction over next decade & reduce summertime peak demand	184[2]	1% annual reduction over next decade & reduce summertime peak demand
San Patricio Municipal Water District[1]	141	1% annual reduction over next decade	134	1% annual reduction over next decade
South Texas Water Authority[1]	140-145	Not Available	140-145	Not Available
Nueces County WCID 3[1,2]	103	Not Available	108	Not Available
Water User Group				
Alice[1]	145	Reduce per capita use by 3%	141	Reduce per capita use by 3%
Aransas Pass[2]	225	2.5% per capita	260	5% per capita
Beeville[1]	161	1% annual reduction over next decade	160	1% annual reduction over next decade
Corpus Christi[1,2,3]	195	1% annual reduction over next decade	184	1% annual reduction over next decade
El Oso WSC	N/A	Reduce water loss	N/A	Reduce water loss
Falfurrias[1]	N/A	Not Available	N/A	Not Available
Holiday Beach WSC[1]	58	Reduce water loss	56	Reduce water loss
Ingleside[1]	106	1% reduction in water loss and usage within the next 5 years	105	2% within the next 10 years
Kingsville[1,2]	130	1% annual reduction	125	1% annual reduction
Lamar Improvement District[1]	150	Reduce water loss	145	Reduce water loss
McCoy WSC[1]	115	Maintain current per capita usage; Reduce water loss to 4% of water pumped, line flushing/fire fighting	110	Reduce usage by 4.5%; Reduce water loss to 2% of water pumped, not including line flushing/fire fighting
Nueces County WCID 4[1,2]	396	1% annual reduction over next decade	376	1% annual reduction over next decade
Nueces WSC[1]	118	Maintain current per capita usage	118	Maintain current per capita usage
Odem[1]	149	5% over the next 10 years	146	7% reduction in unaccounted-for water over the next 10 years
Portland[1]	88	5% reduction	84	10% reduction
Ricardo WSC[1]	95	Maintain current per capita usage	95	Maintain current per capita usage
River Acres WSC[1]	100	1% annual reduction	99	1% annual reduction
Robstown[2]	N/A	Not Available	N/A	Not Available
Rockport	107	Maintain unaccounted water in the system below 12% annually in 2016 and subsequent years and reduce other water demands	107	Maintain unaccounted water in the system below 12% annually in 2016 and subsequent years and reduce other water demands
Taft[1]	147	Reduce per capita use by 3%	140	Reduce per capita use by 3%
Three Rivers[3]	386	0.5% annual reduction	377	0.5% annual reduction

1 Water Conservation Plan on-file with the Nueces River Authority.
2 Information is from the 2019/2020 Water Conservation Plans, Target and Goal Table, provided by the TWDB.

3 Calculated by taking volume of treated water, excluding water sold to wholesale customers, and dividing by permanent population, divided by 365. Because industrial use is close to 40% of treated water, the per capita rate is higher.

Public information and education can work to conserve water by informing water users of ways to manage and operate existing and new fixtures and appliances so that less water is used. This includes ideas and practices such as washing full loads of clothes and dishes; using a bucket of water instead of a flowing hose to wash automobiles; turning the water off while brushing one's teeth, washing one's hands, or shaving; and watering lawns, gardens, and shrubs during the evening hours as opposed to daytime.

The CBRWPG recommends that WUGs, with and without shortages, above 140 gpcd reduce consumption by one percent each year until a target per capita rate of 140 gpcd is met and then hold the 140 gpcd rate constant through the remaining planning period. For entities with projected water use equal or less than 140 gpcd in 2030, the TWDB projections are recommended. All water user groups in the region are encouraged to voluntarily conserve water.

In 2030, 27 municipal water users in the Coastal Bend Water Planning Region have per capita water use of less than or equal to 140 gpcd. Water users with 140 gpcd or less represent 25 percent of the population of the region in 2030 and use approximately 17 percent of the total municipal water in the region (reference Table 5B.1.3). In 2030, 28 municipal water users have per capita water use greater than 140 gpcd. This group represents 75 percent of the region's population in 2030 and accounts for approximately 83 percent of the municipal water used in the region (reference Table 5B.1.3.

Table 5B.1.3.
Municipal Water User Groups Number, Population, and Water Use by Per Capita Water Use Levels Coastal Bend Water Planning Region

Per Capita Water Use in 2030 (gpcd)	Number of WUGs	Percent of WUGs	Population		Water Use	
			Year 2030	Percent of Total	2030 (ac-ft)	Percent of Total
140 and less	27	49.1%	145,942	24.6%	18,746	17.4%
Greater than 140	28	50.9%	447,245	75.4%	89,071	82.6%
Total	55	100.0%	593,187	100.0%	107,817	100%

5B.1.2 Available Yield

All municipal entities in the Coastal Bend Region are encouraged to conserve water, regardless of per capita consumption. Of the 55 municipal entities in the Coastal Bend Region, 28 had per capita water use rates equal to or higher than 140 gpcd, the goal established by the CBRWPG. The CBRWPG recommends a 1 percent reduction per year in water use for those municipal entities with per capita use greater than 140 gpcd until a target goal of 140 gpcd is reached. This conservation goal was approved by the CBRWPG during their Coastal Bend Region meeting on January 30, 2025, and can be achieved in a variety of ways, including using these BMPs identified by the TWDB[6]:

1. Utility Water Audit and Water Loss (updated 2020),
2. Water Conservation Pricing,
3. Prohibition on Wasting Water,
4. Conservation Ordinance Planning and Development,
5. Showerhead, Aerator, and Toilet Flapper Retrofit,
6. Residential Toilet Replacement Programs with Ultra-Low-Flow toilets,
7. Residential Clothes Washer Incentive Program,
8. School Education,
9. Water Survey for Single-Family and Multi-Family Customers,
10. Landscape Irrigation Conservation and Incentives,
11. Water-Wise Landscape Design and Conversion Programs,
12. Athletic Field Conservation,
13. Golf Course Conservation,
14. Metering of all New Connections and Retrofitting of Existing Connections,
15. Wholesale Agency Assistance Programs,
16. Conservation Coordinator (updated 2019),
17. Water Reuse[7],
18. Public Information,
19. Rainwater Harvesting and Condensate Reuse[8],
20. New Construction Greywater,
21. Park Conservation,
22. Conservation Programs for Industrial, Commercial, and Institutional Accounts,
23. Residential Landscape Irrigation Evaluation,
24. Outdoor Watering Schedule (adopted 2019),
25. Custom Characterization (adopted 2019),
26. Public Outreach and Education (adopted 2019),
27. Partnerships with Nonprofit Organizations,
28. Custom Conservation Rebates (adopted 2019),
29. Plumbing Assistance for Economically Disadvantaged Customers (adopted 2019)
30. Cost Effectiveness Analysis,
31. Enforcement of Irrigation Standards (adopted 2020)

For the BMPs listed above, water savings (yield) and costs to implement these strategies reported in TWDB guidance documents are summarized in Table 5B.1.4. Also, the TWDB BMP categories adopted by the Coastal Bend Region municipalities in 2022 are presented in Figure

[6] https://www.twdb.texas.gov/conservation/BMPs/Mun/index.asp

[7] Water Reuse to read “It is assumed that any savings associated with reuse is a small contribution to the savings identified on Table 5B.1.6 and does not duplicate reuse projects identified in Section 5B.4.

[8] While the municipal conservation best practices guide includes rainwater harvesting and reuse, for regional water planning purposes these practices are considered separate sources and not classified as ‘conservation’.

5B.1.1; landscaping and public education/awareness are the two most popular categories implemented and comprise approximately 56 percent of the total.

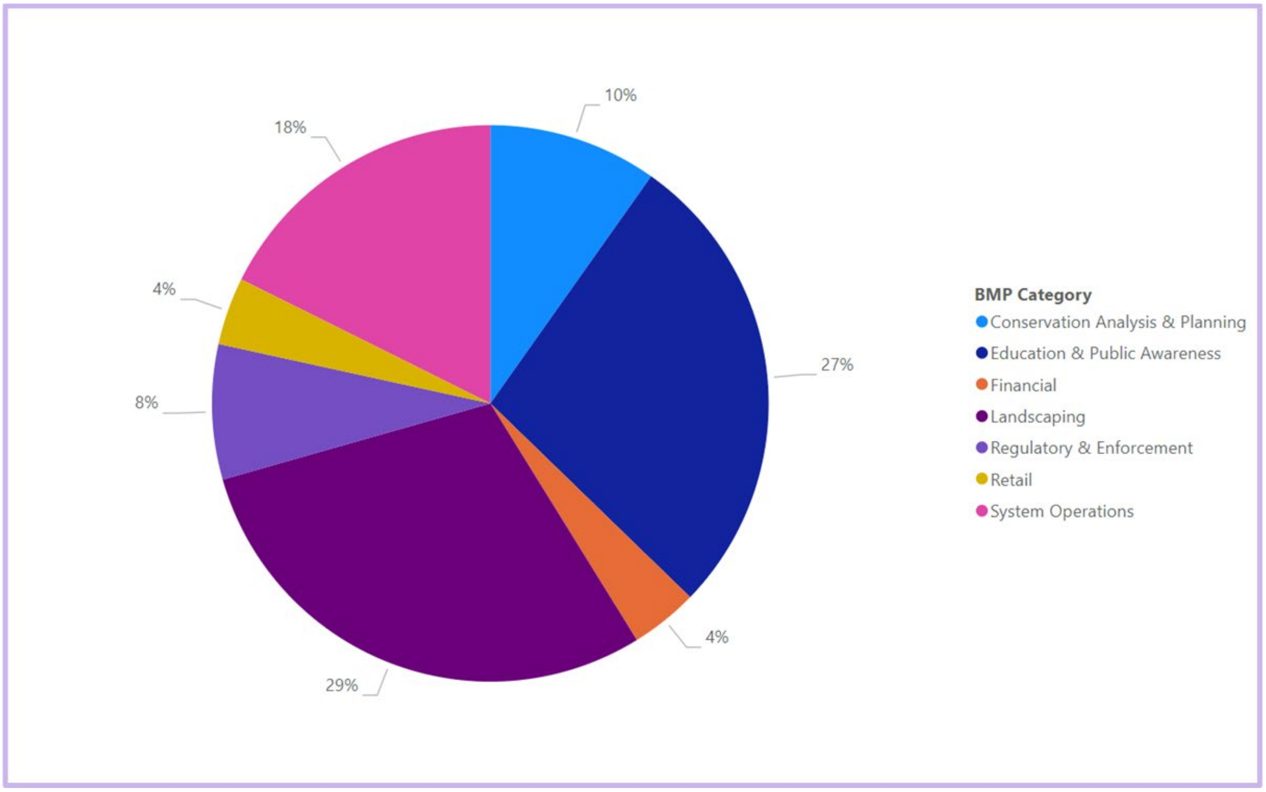

Figure 5B.1.1.
TWDB BMP Category Summary (2022) – Region N Municipalities

Costs and savings presented are general and often sparse, based on a range of variables affecting implementation and level of success. For this reason and others, specific municipal water conservation BMPs are not assigned to municipal entities to provide flexibility for entities to identify practical conservation strategies that fit their individual situation the best.

A description of indoor, landscape irrigation, and water loss reduction and meter replacement methods are discussed below to assist municipal entities achieve water conservation savings.

Table 5B.1.4.
Costs and Savings of Possible Municipal Water Conservation Techniques (BMPs)

Best Management Practices		Water Savings Estimates				Cost Estimates				Assumptions/ Notes
		Min	Max	Avg	Savings Metric	Min	Max	Avg	Cost Metric	
1	Water Conservation Pricing/Seasonal or Inverted Block Rates	1	3	2	%	-	-	10	%	Average reduction in water use of 1 to 3% for every 10% increase in the average monthly water bill
2	Metering of All New Connections and Retrofit of Existing Connections	-	-	-	-	-	-	-	-	
3	System Water Audit and Water Loss Control	-	-	-	-	-	-	-	-	
4	Landscape Irrigation Conservation and Incentives	-	-	15	%	-	-	-	-	
5	Athletic Field Conservation	-	-	-	-	-	-	-	-	
6	Golf Course Conservation	15	100	57.5	%	-	-	-	-	Savings and costs highly variable based measures taken - from implementing a CCIS to switching from potable to non-potable water
7	School Education	-	-	-	-	$1	$35	$18	per student	
8	Public Information	-	-	-	-	$0.50	$3.00	$1.75	per customer	
9	Water Reuse	-	100	-	%	-	-	-	-	
10	Prohibitions on Wasting Water	-	-	-	-	-	-	-	-	
11	Residential Toilet Replacement Programs	-	-	10.5	gpcd	$70	$100	$85	per toilet	
12	Showerhead, Aerator, and Toilet Flapper Retrofit	5.5	12.8	9.15	gpd per device	10	50	$30.00	per customer	5.5 gpd of permanent savings for showerheads and faucet aerators; 12.8 gpd for toilet flapper for 5 years (device life span)
13	Water Wise Landscape Design and Conversion Programs	-	-	-	-	0.05	1	$0.53	per sq ft	Costs reflect customer rebates - does not include staff labor cost, which ranges between $50 to $100 per conversion
14	Custom Conservation Rebates	-	-	-	-	-	-	-	-	

Best Management Practices		Water Savings Estimates				Cost Estimates				Assumptions/ Notes
		Min	Max	Avg	Savings Metric	Min	Max	Avg	Cost Metric	
15	Plumbing Assistance for Economically Disadvantaged Customers	300	262,080	131,190	gal/yr	-	-	-	-	
16	Rainwater Harvesting and Condensate Reuse	-	-	-	-	-	-	-	-	

Source TWDB: https://www.twdb.texas.gov/conservation/BMPs/Mun/index.asp

5B.1.2.1 Indoor Water Conservation

During the 2009 Texas Legislature, House Bill (2667 was enacted to establish new minimum standards for plumbing fixtures sold in Texas beginning in 2014. House Bill 2667 also outlines the national standards of the American Society of Mechanical Engineers and American National Standards Institute by which plumbing fixtures are to be produced and tested. Since January 2014, TCEQ has promulgated rules to reflect this change in law that requires all toilets to use no more than 1.28 gallons per flush (20 percent savings from the 1991 1.6 gallons per flush standard), as shown in Table 5B.1.5.

Table 5B.1.5.
Standards for Plumbing Fixtures

Fixture	Standard
Toilets*	1.28 gallons per flush
Shower Heads	2.75 gallons per minute at 80 psi
Urinals	0.5 gallon per flush
Faucet Aerators	2.20 gallons per minute at 60 psi
Drinking Water Fountains	Shall be self-closing

* House Bill 2667 of the 81st Texas Legislature, 2009

Based upon an average frequency of per-person toilet use of 5.1 and a per-use savings of 0.32 gallons per use, the supplementary savings of adopting high-efficiency toilets is 1.63 gpcd. The water savings potential with the plumbing efficiency program is shown in Table 5B.1.6.

Table 5B.1.6.
Water Conservation Potentials of Low Flow Plumbing Fixtures

Plumbing Fixture	Water Savings (gpcd)
Toilets and Showerheads	16.0
Additional Savings (High Efficiency Toilet)*	1.63
Faucet Aerators – 2.2 gallons per minute	2.0
Urinals – 1.0 gallon per minute	0.3
Drinking Fountains (self-closing)	0.1
Total	20.03 (~20 gpcd)

* TWDB, 2013

The TWDB water demand and per capita projections for the *2026 Coastal Bend Region Water Plan* already includes water savings through mandated plumbing fixture replacement programs, and much of the savings reported in Table 5B.1.6 have likely been realized. The target water conservation goals recommended by the Coastal Bend Region for WUGs exceeding 140 gpcd are to be achieved with additional BMPs for the desired water savings above the amount already included in TWDB projections.

5B.1.2.2 Outdoor Water Conservation

In addition to the indoor water conservation measures described above, the water conservation water management strategies for municipal entities for the Coastal Bend Region include landscape irrigation and lawn watering. Unlike indoor water conservation, no limit was assumed for the savings potentials associated with outdoor conservation. Instead, outdoor water conservation can be used to meet the projected water savings needed to meet the Coastal Bend Region municipal water goals.

5B.1.2.3 Water Loss Reduction and Meter Replacement

A municipality can determine unaccounted for water losses by performing a water audit, which includes collecting information that can then be used to calculate unaccounted for water loss using the following equation:

Unaccounted for water = Water production/purchased (gallons) – Water sales (gallons)

To maximize the benefits of this conservation strategy, the utility uses this audit information to revise meter testing and repairs, reduce unmetered use, improve accuracy of the utility's metering system, and implement effective water loss management strategies. Factors that affect the amount of unaccounted for water include density of the system, age of the system, construction quality of the system, and accuracy of the water metering.

In December 2004, the TWDB adopted rules to require retail public utilities, as defined by Texas Water Code §13.002, to perform a water loss audit and submit water loss audit forms to the

TWDB every 5 years.[9] Pursuant to TWDB Rules[10] for regional water planning, regional water planning groups are required to include information compiled by the TWDB from water loss audits performed by retail public utilities and consider strategies to address any issues identified in the water loss audit information compiled by the TWDB. The CBRWPG presented this information in Chapter 1.

The TCEQ reports that unaccounted for water losses of 15 percent or less are acceptable for communities greater than 5,000 people. Losses above 15 percent may be an area of concern and provide conservation potentials. Of the 33 entities in the Coastal Bend Region that primarily responded to the 2020-2022 Water Loss Audit (17 from individual municipal entities and 16 from County-Other entities), 13 reported water losses exceeding 15 percent. Based on this information, these utilities may want to consider pipeline replacement programs.[11] Pipeline replacement programs are intended to address real losses, that is, those losses primarily associated with breaks, leaks, and unreported losses. Estimated costs for a 10-year pipeline replacement program were prepared for these 13 entities as shown in Table 5B.1.7. Pipeline costs were based on the Unified Costing Model (UCM) and the following assumptions:

- Entities with less than 32 connections: pipeline costs based on 12" rural, soil environment of $214 per ft ($1,129,920 per mile)
- Entities with greater than 32 connections: pipeline costs based on 16" urban, soil environment of $393 per ft ($2,075,040 per mile)
- Pipeline replacement of 10 percent each year. Full replacement after 10 years.

For the 2026 Region Water Plan, TWDB uses the American Water Works Association Water Loss Control Committee Report (2020) as an indicator of a utility's performance by evaluating their service connection density (SCD). Service connection density is calculated by dividing the number of active/inactive retail customer connections by the total length of main lines located within a utility's distribution system. Based on this American Water Works Association report, retail public utilities are categorized by the following criteria:

- Less dense communities (utilities having less than 32 connections per mile in distribution system) = 57 gallons per connection per day
- More dense communities (utilities having 32 or more connections per mile in distribution system) = 30 gallons per connection per day

Table 5B.1.8summarizes 10 entities/utilities in Coastal Bend Region that exceed the water loss threshold according to their current water loss audit on file with TWDB. Water loss threshold data has been primarily evaluated by TWDB since July 1, 2023, when a retail public utility requests TWDB funding for a water supply project and may need to mitigate their water loss.

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[9] In accordance with Texas Administrative Code §358.6.

[10] In accordance with Texas Administrative Code §357.7(a)(1)(M) and Texas Administrative Code §357.7(a)(7)(a)(iv)

[11] Meter retrofits can also achieve water savings, but due to high cost variability based on individual systems this best practice was not explored in detail.

In addition to unaccounted for water losses, public information programs can be an important and key element to having water users save water inside homes and commercial structures, in landscaping and lawn watering, and in recreation uses. Public information and education can work in two ways to accomplish water conservation. One way is to inform and convince water users to obtain and use water-efficient plumbing fixtures and appliances, to adopt low water use landscaping plans and plants, to find and repair plumbing leaks, to use gray water for permissible uses (e.g., lawn and shrubbery watering where regulations allow), and to take advantage of water conservation incentives where available.

The accurate metering of consumed water encourages personal accountability, water conservation and equity in billing rates. Meter replacement programs can be an effective measure for reducing apparent loss, or water that has been consumed but not properly measured or billed. The 2020-2022 Water Loss Audits (those primarily completed) reported an overall customer meter accuracy of 96.6 percent and apparent loss in the Coastal Bend Region of 3.4 percent based on responses from 33 entities. Four of the 33 entities in the Coastal Bend Region that responded to the survey reported apparent losses greater than 5 percent. Based on this information, these utilities may want to consider meter replacement programs. Most meters used in residential systems are between 5/8 and 1 inch with ± 1.5 percent accuracy, and the cost averages about $235 per meter (cost of material only, does not include automatic meter reading)[12]. Estimated costs for meter replacement program for entities reporting apparent losses greater than 5 percent are shown in Table 5B.1.9. After considering demand reductions already incorporated into the TWDB demand projections, a 1 percent reduction in per capita water use per year for those cities and county-others using greater than 140 gpcd in 2030 results in a water savings (yield) — less water used — of 7,957 ac-ft in 2040 and 17,116 ac-ft in 2080, as seen in Table 5B.1.10. Note: Water savings are only included for 28 of the 55 municipal entities, since 27 of the entities had a water use equal or less than 140 gpcd in 2030.

[12] Seametrics MJN Pulse Water Meter ¾" $235/each, internet February 2025.

Table 5B.1.7.
Summary of Estimated Pipeline Replacement Costs for Entities Reporting Losses Greater than 15%

Utility Name & Year of Recent Audit	Retail Pop Served	Main Line Miles	Real Loss/In-put Volume*	Total 10 year water savings needed to achieve 5% Real Loss (gallons)	Annual Water Savings Needed to Achieve 5% Real Loss in 10 years (gallons)	Amt of Pipe (miles) replaced annually to achieve 100% in 10 years	Annual Cost	Cost of 10- year Program	Amortized Annual Cost of 10-year Program	Unit Cost ($ per ac-ft saved)
Aransas Bay Utilities (2015)	600	10	29%	4,880,129	488,013	1	$2,075,040	$20,750,400	$2,752,909	$1,838,144
Aransas County MUD 1 (2020)	580	15	20%	1,926,434	192,643	2	$3,112,560	$31,125,600	$4,129,364	$6,984,704
City of Alice (2018)	18,949	100	21%	173,376,449	17,337,645	10	$20,750,400	$207,504,000	$27,529,093	$517,393
City of Bishop (2020)	3,010	31	43%	67,884,334	6,788,433	3	$6,432,624	$64,326,240	$8,534,019	$409,641
City of Mathis (2022)	4,150	36	27%	36,328,618	3,632,862	4	$7,470,144	$74,701,440	$9,910,473	$888,924
City of Sinton (2022)	5,723	60	50%	246,966,279	24,696,628	6	$12,450,240	$124,502,400	$16,517,456	$217,934
Copano Cove Subdivision (2020)	1,170	20	24%	4,583,552	458,355	2	$4,150,080	$41,500,800	$5,505,819	$3,914,162
Copano Ridge Subdivision (2020)	580	13	54%	11,491,428	1,149,143	1	$2,593,800	$25,938,000	$3,441,137	$975,769
Duval County CRD (2015)	2,525	20	17%	7,492,115	749,212	2	$4,150,080	$41,500,800	$5,505,819	$2,394,620
Freer WCID (2020)	2,689	51	34%	52,797,473	5,279,747	5	$10,582,704	$105,827,040	$14,039,837	$866,499
Holiday Beach WSC (2019)	2,190	23	23%	4,104,596	410,460	2	$4,772,592	$47,725,920	$6,331,691	$5,026,532
River Acres WSC (2021)	2,000	18	34%	31,355,848	3,135,585	2	$3,735,072	$37,350,720	$4,955,237	$514,950
Tynan WSC (2021)	250	8	23%	1,597,923	159,792	1	$1,660,032	$16,600,320	$2,202,327	$4,491,021

*Note: The percentage shown is attributable to real losses, which can be addressed with pipeline replacement programs. These percentages will differ from water loss audit information, which reports total water loss (apparent and real loss).

Table 5B.1.8.
Summary of Entities Exceeding Water Loss Thresholds Based on Water Loss Audits

Utility Name	Audit Year*	Main Line Miles	Retail Population Served	Retail Connections Served	Real Loss (gallons)	Entity's Service Conn. Density (SCD)	Real Loss Threshold Limit (gal/conn/ day) based on Entity's SCD	Entity's Current Real Loss Threshold (gal/conn/day)
Aransas Bay Utilities	2015	10	600	270	5,898,105	27	57	60
City of Bishop	2020	31	3,010	1,232	76,935,042	40	30	171
City of Alice	2018	100	18,949	8,512	227,972,988	86	30	73
City of Corpus Christi	2022	1,810	317,863	97,923	1,135,067,698	55	30	32
City of Mathis	2022	36	4,150	1,670	44,775,468	47	30	73
City of Sinton	2022	60	5,723	2,293	274,628,269	39	30	328
Copano Ridge Subdivision	2020	13	580	232	12,658,697	19	57	149
Duval County CRD	2015	20	2,525	776	10,594,950	41	30	37
Freer WCID	2020	51	2,689	1,212	62,058,526	24	57	140
River Acres WSC	2021	18	2,000	800	36,793,506	45	30	126

*Water loss audit currently on file with TWDB.

Table 5B.1.9.
Summary of Estimated Meter Replacement Costs for Entities Reporting Apparent Losses Greater than 5%

Utility Name & Year of Recent Survey	No. of Retail Service Connections	System Input Volume (gallons)	Total Apparent Loss (gallons)	Apparent Loss (%)	Number of Meters to be Replaced Annually to Achieve 100% replacement in 10 years	Annual Cost ($235 per meter; 10-year program)	Total 10 Year Program Meter Replacement Cost	Amortized Annual Cost of 10-Year Program
Aransas Bay Utilities (2015)	270	20,359,523	3,940,134	19%	27	$6,345	$63,450	$8,418
City of Alice (2018)	8,512	1,091,930,787	84,663,749	8%	851	$200,032	$2,000,320	$265,378
City of Bishop (2020)	1,232	181,014,167	15,654,122	9%	123	$28,952	$289,520	$38,410
Copano Heights Water (2020)	108	4,050,452	255,363	6%	11	$2,538	$25,380	$3,367

Table 5B.1.10.
Potential Additional Water Conservation Savings for Water User Groups Having 2030 per Capita Water Use Greater than 140 gpcd

WUG Name	County	Housing Area	2040		2050		2060		2070		2080	
			gpcd	ac-ft/yr	gpcd	ac-ft/yr	gpcd	ac-ft/yr	gpcd	ac-ft/yr	gpcd	ac-ft/yr
Rockport	Aransas	Suburban	15	300	17	340	17	332	17	325	17	318
Beeville	Bee	Suburban	18	272	34	552	49	839	49	889	49	945
El Oso WSC	Bee	Rural	17	12	33	29	38	44	38	58	38	76
Skidmore WSC	Bee	Rural	1	0	0	0	1	0	1	1	1	0
TDCJ Chase Field	Bee	Rural	25	121	48	233	68	334	87	426	104	509
Falfurrias	Brooks	Rural	22	107	43	207	62	302	79	395	94	494
Freer WCID	Duval	Rural	18	43	35	79	51	108	58	115	58	108
San Diego MUD 1	Duval	Rural	15	62	21	87	21	88	21	89	21	93
Alice	Jim Wells	Suburban	16	389	31	793	33	900	33	953	33	1,017
Orange Grove	Jim Wells	Rural	21	33	41	63	59	88	74	111	86	128
Premont	Jim Wells	Rural	20	50	38	96	55	135	70	171	73	179
San Diego MUD 1	Jim Wells	Rural	15	13	21	19	20	19	21	20	20	21
County-Other, Kenedy	Kenedy	Rural	46	16	87	27	123	37	155	43	184	48
Baffin Bay WSC	Kleberg	Rural	2	2	1	1	2	2	2	2	2	2
County-Other, Kleberg	Kleberg	Rural	5	8	5	8	5	8	5	8	5	9
Naval Air Station Kingsville	Kleberg	Rural	400	26	762	50	1,104	75	1,399	99	1,676	120
El Oso WSC	Live Oak	Rural	16	15	32	29	38	35	38	35	38	35
George West	Live Oak	Rural	15	25	18	29	19	27	18	25	18	23
Three Rivers	Live Oak	Rural	10	30	10	30	10	31	10	29	11	31
Bishop	Nueces	Rural	10	37	10	36	10	37	10	36	10	36
Corpus Christi	Nueces	Urban	15	5,506	28	9,883	28	9,823	28	9,765	28	9,706
Corpus Christi Naval Air Station	Nueces	Rural	128	199	246	381	353	545	449	692	536	821
Nueces County WCID 3	Nueces	Suburban	24	326	47	631	67	900	85	1,140	102	1,354
Nueces County WCID 4	Nueces	Rural	42	130	81	250	116	358	148	452	176	537
Nueces WSC	Nueces	Rural	7	45	7	45	7	45	7	45	7	45
Gregory	San Patricio	Rural	6	10	6	10	6	11	6	11	6	11
Portland	San Patricio	Suburban	3	83	3	89	3	97	3	105	3	113

WUG Name	County	Housing Area	2040		2050		2060		2070		2080	
			gpcd	ac-ft/yr	gpcd	ac-ft/yr	gpcd	ac-ft/yr	gpcd	ac-ft/yr	gpcd	ac-ft/yr
Sinton	San Patricio	Rural	19	99	37	189	53	274	64	335	64	339
Total				**7,957**		**14,188**		**15,496**		**16,375**		**17,116**

5B.1.3 Environmental Issues

Environmental impacts from water conservation measures in the Coastal Bend Region are not associated with direct physical impacts to the natural environment. Some of the indoor conservation measures recommended could reduce the amount of treated wastewater available to send to the Nueces Bay and Estuary during low flow times, which could be offset by possible positive impact resulting from higher reservoir levels.

Under a 2001 Agreed Order from the TCEQ[13], the City of Corpus Christi is required to pass specified volumes of inflows to the reservoirs in accordance with a monthly schedule to mitigate the impacts of Choke Canyon Reservoir and maintain the health of the Nueces Estuary. In any month when the System storage is less than 40 percent but greater than 30 percent, the target Nueces Bay inflow requirement may be reduced to 1,200 ac-ft per month when the City of Corpus Christi and its customers implement Condition II of the city's Water Conservation and Drought Contingency Plan (DCP). If system storage drops below 30 percent, bay and estuary releases (except for return flows) may be suspended when the city and its customers implement Condition III of the DCP. The City of Corpus Christi's water conservation and DCP is summarized in Chapters 5C and 7.

[13] Texas Commission on Environmental Quality (TCEQ), Agreed Order Establishing Operational Procedures Pertaining to Special Condition B, Certificate of Adjudication No. 21-3214, Held by City of Corpus Christ, et al., April 28, 1995.

5B.1.4 Engineering and Costing

Municipal water conservation costs were based on the TWDB Municipal Water Conservation Planning Tool developed to assist individual water utilities with planning conservation programs. The tool allows the user to select a mix of BMPs, and it then shows the expected annual conservation savings and associated capital and annual costs. The tool comes with population and water demand projections (and other data such as number of connections) for municipal WUGs. The tool includes user-based functionality to load baseline demand projections, select conservation measures (plan or single-year savings) based on implementation activity, manage scenarios (to evaluate various BMP combinations) and use this information to calculate water savings and costs. The tool includes the following pre-defined BMPs:

- Bathroom Retrofit
- Showerhead and Aerator Kit
- Clothes Washer Rebate
- Home Water Reports
- Irrigation Audits- High Users
- HE Toilet Rebate
- High Efficiency Sprinkler Nozzle Rebate
- Smart Irrigation Controller Rebate
- WaterWise Landscape Rebate
- Rainwater Harvesting Rebate, and
- Rain Barrel

The costs to implement these BMPs ranges from $243 to $1,409 per ac-ft saved, with the showerhead kit being the most economical ($243 per ac-ft saved) and clothes washer rebates and rain barrels being the most expensive at $1,220 and $1,409 per ac-ft, respectively. Three Coastal Bend Region water user groups were selected to represent a range of Small, Medium, and Large utilities for costing purposes.

The City of Taft records in the TWDB tool was considered representative of “Small” Coastal Bend Region municipal water users; the City of Alice was considered representative of “Medium” Coastal Bend Region municipal water users (populations less than 20,000); and the City of Corpus Christi information was obtained from the TWDB tool. As shown in Table 5B.1.11, 22 of the 28 entities with per capita rates exceeding 140 gpcd for which additional conservation is recommended are categorized as “Small”; five entities categorized as “Medium”; and one entity categorized as “Large”. Although the TWDB tool did not present costs for the most common water conservation BMPs from local water conservation plans in the Coastal Bend Region (reference Table 5B.1.4), the following BMPs from the TWDB tool were selected during the *2021 Coastal Bend Regional Water Plan* to estimate a unit cost for municipal water conservation: HE Toilet Rebate, Bathroom Retrofit, Showerhead and Aerator Kit, Home Water Reports, and WaterWise Landscape Rebate. The costs to implement these BMPs according to the program rates, as well as accounting for inflation this planning cycle, ranged from $577 to $583 per ac-ft water saved.

The total program costs for municipal entities having per capita use greater than 140 gpcd in 2030 are presented in Table 5B.1.11. Total conservation potential costs for Coastal Bend Region are estimated at $4,627,450 in 2040 and increasing to $9,945,379 by 2080. The CBRWPG recommends the BMPs listed in Section 5B.1.2 to encourage conservation while maintaining flexibility for municipal users to adopt strategies that suit them the best.

These annual costs have been capitalized over a 20-year period at 3.5 percent interest rate by assuming that 70 percent of the annual costs for a municipal water conservation program are associated with repayment of debt issued to fund the initial capital expenditures. Capital costs are also shown in Table 5B.1.11.

5B.1.5 Implementation Issues

There are several issues that may slow down the efforts of water conservation activities. However, the most crucial item is to get water customers to change their water use habits. Effective public outreach and education can go a long way towards reducing water use, but in the end the effectiveness of any program is dependent upon the individual. A key element to the DCP that each entity has been required to submit to the TCEQ is the curtailment of water use during drought. Enforcement of these restrictions — typically those that limit lawn watering — is often difficult. Lastly, capital costs for retrofit programs can be expensive depending on the system and may be difficult for cities or rural entities to initially finance.

5B.1.6 Evaluation Summary

An evaluation summary of this water management option is provided in Table 5B.1.12.

Table 5B.1.11. Cost of Water Conservation for Selected Water Conservation Techniques for Water User Groups Having 2030 per Capita Water Use Greater than 140 gpcd

WUG Name	County	Housing Area	Cost per ac-ft	2040	2050	2060	2070	2080
Rockport	Aransas	Suburban	$577	$173,190	$196,011	$191,703	$187,338	$183,584
Beeville	Bee	Suburban	$577	$156,681	$318,558	$484,281	$513,049	$545,171
El Oso WSC	Bee	Rural	$580	$6,828	$17,018	$25,773	$33,731	$44,227
Skidmore WSC	Bee	Rural	$580	$233	$153	$234	$530	$281
TDCJ Chase Field	Bee	Rural	$580	$70,079	$135,030	$193,771	$246,895	$294,940
Falfurrias	Brooks	Rural	$580	$62,216	$120,233	$174,878	$228,945	$286,649
Freer WCID	Duval	Rural	$580	$24,845	$45,897	$62,900	$66,869	$62,613
San Diego MUD 1	Duval	Rural	$580	$36,051	$50,313	$50,802	$51,396	$53,822
Alice	Jim Wells	Suburban	$577	$224,327	$457,580	$519,313	$550,076	$586,854
Orange Grove	Jim Wells	Rural	$580	$19,047	$36,411	$51,307	$64,371	$74,182
Premont	Jim Wells	Rural	$580	$28,951	$55,614	$78,236	$99,467	$103,658
San Diego MUD 1	Jim Wells	Rural	$580	$7,481	$10,903	$10,893	$11,587	$12,043
County-Other, Kenedy	Kenedy	Rural	$580	$9,201	$15,917	$21,182	$25,081	$27,779
Baffin Bay WSC	Kleberg	Rural	$580	$1,067	$749	$1,080	$1,229	$1,071
County-Other, Kleberg	Kleberg	Rural	$580	$4,354	$4,503	$4,880	$4,858	$5,144
Naval Air Station Kingsville	Kleberg	Rural	$580	$14,825	$29,214	$43,741	$57,248	$69,682
El Oso WSC	Live Oak	Rural	$580	$8,712	$17,030	$20,480	$20,480	$20,480
George West	Live Oak	Rural	$580	$14,706	$17,037	$15,897	$14,427	$13,208
Three Rivers	Live Oak	Rural	$580	$17,647	$17,545	$17,715	$17,032	$17,816
Bishop	Nueces	Rural	$580	$21,394	$21,121	$21,291	$21,063	$20,654
Corpus Christi	Nueces	Urban	$583	$3,210,104	$5,761,681	$5,726,939	$5,692,849	$5,658,428
Corpus Christi Naval Air Station	Nueces	Rural	$580	$115,147	$221,065	$316,273	$401,109	$476,413
Nueces County WCID 3	Nueces	Suburban	$577	$188,267	$363,945	$519,500	$657,941	$781,115
Nueces County WCID 4	Nueces	Rural	$580	$75,198	$145,013	$207,383	$262,225	$311,316
Nueces WSC	Nueces	Rural	$580	$26,068	$26,318	$26,341	$25,874	$25,897
Gregory	San Patricio	Rural	$580	$5,908	$5,805	$6,249	$6,204	$6,159
Portland	San Patricio	Suburban	$577	$47,733	$51,515	$56,037	$60,518	$65,422
Sinton	San Patricio	Rural	$580	$57,190	$109,459	$158,695	$194,416	$196,771

WUG Name	County	Housing Area	Cost per ac-ft	2040	2050	2060	2070	2080
Total Region N Cost of Water Conservation Programs to Achieve Savings Goals ($)				$4,627,450	$8,251,639	$9,007,773	$9,516,808	$9,945,379

Table 5B.1.12. Evaluation Summary of Municipal Water Conservation

Impact Category	Comment(s)
a. Water Supply	
1. Quantity 2. Reliability 3. Cost of Treated Water 4. Estimated Water Losses	1. Firm Yield: 7,957 ac-ft/yr in 2040 to 17,116 ac-ft/yr in Year 2080. 2. Highly reliable. 3. Unit Cost ranges from $577 to $583 per ac-ft water saved 4. Varies based on information reported in TWDB Water Loss Audit (includes apparent and real loss)
b. Environmental factors	
1. Effects on Instream flows	1. Some impact due to decreased return flows, which could be offset by possible positive impact resulting from higher reservoir levels.
2. Effects on Bay and Estuary Inflows and arms of the Gulf of Mexico	2. Some impact due to decreased return flows, which could be offset by possible positive impact resulting from higher reservoir levels.
3. Wildlife Habitat	3. Some impact due to decreased return flows, which could be offset by possible positive impact resulting from higher reservoir levels.
4. Wetlands	4. Some impact due to decreased return flows, which could be offset by possible positive impact resulting from higher reservoir levels.
5. Threatened and Endangered Species	5. None.
6. Cultural Resources	6. No cultural resources affected.
7. Water Quality	7. None or low impact.
a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	-
c. Impacts to Agricultural Resources and State water resources	• No apparent negative impacts on water resources
d. Threats to agriculture and natural resources	• None
e. Recreational impacts	• None
f. Equitable Comparison of Strategies	• Standard analyses and methods used
g. Interbasin transfers	• None
h. Third party social and economic impacts from voluntary redistribution of water	• None
i. Efficient use of existing water supplies and regional opportunities	• Improvement over current conditions
j. Effect on navigation	• None
k. Impacts on water pipelines and other facilities used for water conveyance	• May be some impact to disinfectant chlorine residuals.

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5B.2

Manufacturing Water Conservation

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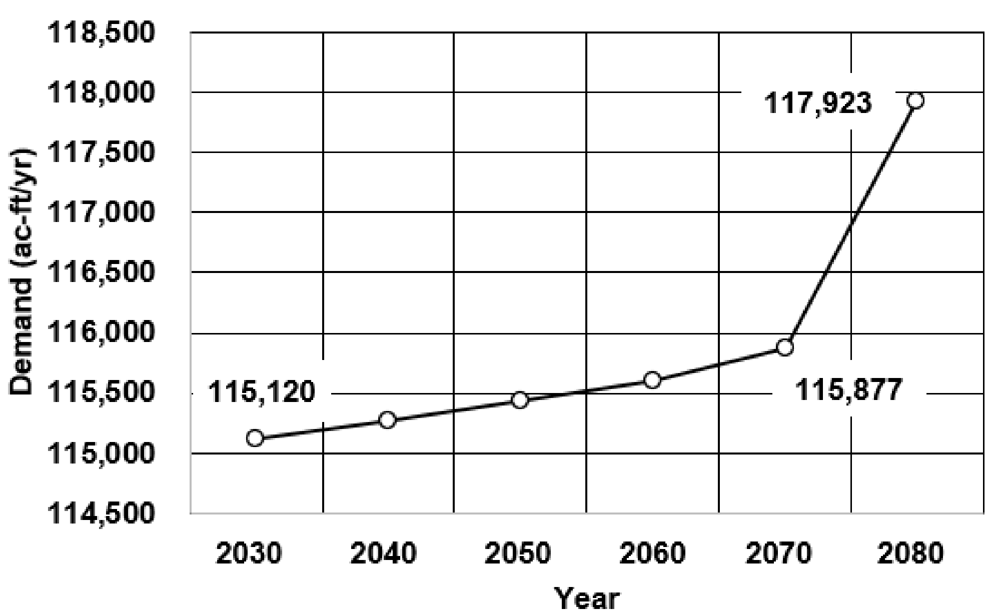
Section 5B.2 Manufacturing Water Conservation

5B.2.1 Description of Strategy

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. Over the past two decades, Texas refiners have reduced water usage by as much as 30 percent while output revenue has increased steadily.[1]

The manufacturing water demand projections used in this plan for the Coastal Bend Region were provided by the Texas Water Development Board (TWDB) and differed from those presented in the 2021 regional water plan. Manufacturing water use for the Coastal Bend Region is projected to be 15 percent greater this planning cycle at 115,120 ac-ft in 2030 compared to 98,480 acre-feet (ac-ft) in 2030 in the 2021 regional water plan. Although the manufacturing industry is projected to grow after 2030, long-term planning assumes continued efficiency from 2030 to 2070, as shown in Figure 5B.2-1. Most of the Coastal Bend Region manufacturing demand occurs in Nueces and San Patricio counties. Between 2030 and 2080, these two counties account for 96 percent of the total projected manufacturing water use in the region (Figure 5B.2-2). Six of the 11 counties in Coastal Bend Region show manufacturing demands. Manufacturing demands are not projected in Aransas, Bee, Brooks, Duval, or Kenedy counties.



[1] Progress Made in Water Conservation in Texas: Report and Recommendations to the 88th Texas Legislature, Water Conservation Advisory Council, December 1, 2022.

Figure 5B.2-1.
Coastal Bend Region Manufacturing Water Demand Projections

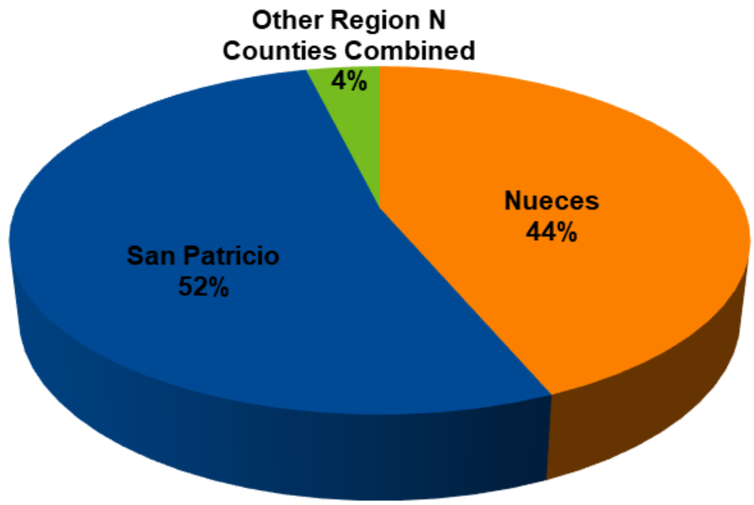


Figure 5B.2-2.
2030-2080 Percentages of Manufacturing Water Demand by County in Coastal Bend

In the Coastal Bend Region, manufacturing supply is obtained from both surface and groundwater sources, as well as reuse or recycling of water. Three of the six counties with manufacturing demands rely solely on groundwater sources for their water supply. San Patricio County manufacturing receives nearly all of their water supplies from surface water. Nueces County manufacturing receives over 60 percent of their supply from surface water, and a combination of groundwater and reuse supplies make up the remaining difference. Nueces County's total manufacturing water supply is comprised of less than 1 percent from water reuse. Live Oak manufacturing receives approximately 30 to 40 percent of its surface water through contract with the City of Three Rivers; the county's remaining manufacturing demand is supplied by groundwater.

Six of the 11 counties in the Coastal Bend Region have projected manufacturing needs beginning in 2030: Jim Wells, Kleberg, Live Oak, McMullen, Nueces, and San Patricio counties, as shown in

Table 5B.2.1. A modest shortage is shown for Jim Wells; however, the primary shortage in the region, which steadily increase through 2080, is in Nueces County. The greatest manufacturing shortage (47,971 ac-ft/yr) occurs in 2080 for Nueces County.

TWDB rules for regional water planning require regional water planning groups to consider water conservation and drought management measures for each WUG with a need (projected water shortage). The TWDB has provided information on industrial water conservation best management practices (BMPs), for consideration in the development of the water conservation water management strategies, including a Best Management Practice Guides for Industrial Water Users.

Table 5B.2.1.
Projected Water Demands, Supplies, and Water Needs (Shortages) for Manufacturing Users in Jim Wells, Kleberg, Live Oak, McMullen, Nueces, and San Patricio Counties

County	Manufacturing Projections (ac-ft/yr)					
	2030 (ac-ft)	2040 (ac-ft)	2050 (ac-ft)	2060 (ac-ft)	2070 (ac-ft)	2080 (ac-ft)
Jim Wells County						
Manufacturing Demand	87	90	93	96	100	104
Manufacturing Existing Supply						
Groundwater	79	79	79	79	79	79
Surface water	0	0	0	0	0	0
Reuse	0	0	0	0	0	0
Total Manufacturing Supply	79	79	79	79	79	79
Surplus (Shortage)	(8)	(11)	(14)	(17)	(21)	(25)
Kleberg County						
Manufacturing Demand	1,088	1,128	1,170	1,213	1,258	1,305
Manufacturing Existing Supply						
Groundwater	1,088	1,128	1,170	1,213	1,258	1,305
Surface water	0	0	0	0	0	0
Reuse	0	0	0	0	0	0
Total Manufacturing Supply	1,088	1,128	1,170	1,213	1,258	1,305
Surplus (Shortage)	0	0	0	0	0	0
Live Oak County						
Manufacturing Demand	2,843	2,948	3,057	3,170	3,287	3,409
Manufacturing Existing Supply						
Groundwater	2,054	2,054	2,054	2,054	2,054	2,054
Surface water	789	894	1,003	1,116	1,233	1,355
Reuse	0	0	0	0	0	0
Total Manufacturing Supply	2,843	2,948	3,057	3,170	3,287	3,409
Surplus (Shortage)	0	0	0	0	0	0
McMullen County						
Manufacturing Demand	34	34	34	34	34	34
Manufacturing Existing Supply						
Groundwater	34	34	34	34	34	34
Surface water	0	0	0	0	0	0
Reuse	0	0	0	0	0	0
Total Manufacturing Supply	34	34	34	34	34	34
Surplus (Shortage)	0	0	0	0	0	0
Nueces County						
Manufacturing Demand	50,363	50,363	50,363	50,363	50,472	52,339
Manufacturing Existing Supply						
Groundwater	3,240	3,240	3,240	3,240	3,240	3,240
Surface water	10,230	7,023	4,607	2,545	376	0
Reuse	1,128	1,128	1,128	1,128	1,128	1,128
Total Manufacturing Supply	14,598	11,391	8,975	6,913	4,744	4,368
Surplus (Shortage)	(35,765)	(38,972)	(41,388)	(43,450)	(45,728)	(47,971)

County	Manufacturing Projections (ac-ft/yr)					
	2030 (ac-ft)	2040 (ac-ft)	2050 (ac-ft)	2060 (ac-ft)	2070 (ac-ft)	2080 (ac-ft)
San Patricio County						
Manufacturing Demand	60,705	60,710	60,715	60,720	60,726	60,732
Manufacturing Existing Supply						
Groundwater	110	110	110	110	110	110
Surface water	69,583	69,194	69,042	69,125	69,203	69,108
Reuse	0	0	0	0	0	0
Total Manufacturing Supply	69,693	69,304	69,152	69,235	69,313	69,218
Surplus (Shortage)	8,988	8,594	8,437	8,515	8,587	8,486

5B.2.2 Available Yield

All manufacturing entities in the Coastal Bend Region are encouraged to conserve water.

Of the six counties in Coastal Bend Region with manufacturing water demands, two counties show shortages (

Table 5B.2.1). The Coastal Bend Regional Water Planning Group (CBRWPG) recommends that all counties with projected manufacturing water demands (regardless of need or shortage) to target reducing their manufacturing water demands by 15 percent by 2080.

The TWDB lists the following 14 industrial BMPs that may be used to achieve water savings[2]:

1. Industrial Water Audit
2. Industrial Water Waste Reduction
3. Industrial Submetering
4. Cooling Towers
5. Cooling Systems (other than Cooling Towers)
6. Industrial Alternative Sources and Reuse and Recirculation of Process Water
7. Rinsing/Cleaning
8. Water Treatment
9. Boiler and Steam Systems
10. Refrigeration (including Chilled Water)
11. Once-Through Cooling
12. Management and Employee Programs
13. Industrial Facility Landscaping
14. Industrial Site-Specific Conservation

An additional BMP, stormwater runoff, has been added to the list during this planning cycle based on feedback received during a virtual meeting held on September 18, 2024, with manufacturing representatives on the CBRWPG. This additional BMP was presented and approved at the Coastal Bend Region meeting on October 17, 2024.

[2] TWDB website: https://www.twdb.texas.gov/conservation/BMPs/Ind/index.asp

Also, a Coastal Bend Region Survey for Industrial Water Users was conducted during December 2024 and January 2025 to gain additional feedback on effective and voluntary water supply BMPs used. Of the four responses received, four different types of industry were represented: construction, chemical manufacturing, crude terminal, and refining. All four industries highlighted eliminating non-essential water use as the primary BMP implemented to reduce water use during a drought, which resulted in approximately 10 percent water savings. Additional voluntary water supply BMPs considered by the industries to reduce water use include:

- Management and employee education programs
- Industrial facility landscaping
- Industrial water audit
- Stormwater runoff (capture onsite)
- Alternative cooling water technologies
- Industrial Alternative Sources, Reuse, and Recirculation of Process Water
- Retrofits and process improvements

Fifty percent of the industries who participated in the survey have developed their own drought contingency plans and target implementing future projects (on-site and/or process related) within the next 5 years to achieve further water savings and water demand reductions. These future projects include treatment of water supply (such as reverse osmosis) to improve the efficiency of boiler and cooling tower operations while reducing water consumption.

Based on the CBRWPG's recommendation, a 15 percent voluntary reduction in manufacturing water demand by 2080 results in a total savings of 17,689 ac-ft/yr for the region, as shown in Table 5B.2.2. If manufacturing water conservation savings are attained as recommended, shortages would be reduced for all manufacturing counties with needs. New needs after conservation are re-calculated, as shown in Table 5B.2.2. The CBRWPG-recommended water conservation goal alone is insufficient to fully address manufacturing shortages in Coastal Bend Region, and additional strategies are considered to address this projected supply deficit (see Chapter 5B).

For the BMPs listed above, water savings (yield) and costs to implement these strategies reported in TWDB guidance documents are summarized in Table 5B.2.3. TWDB describes how the BMPs reduce water use; however, information regarding specific water savings and costs to implement conservation programs is generally unavailable. Conservation savings and costs are facility and process specific. Since manufacturing entities are presented on a county basis and are not individually identified, identification and quantifying savings of specific water management strategies are not a reasonable expectation.

Table 5B.2.2. Projected Water Demands Considering a 15 Percent Reduction by 2080 for All Manufacturing Users; Additional Needs (Shortages) Shown for Jim Wells & Nueces Counties

County	Projections (ac-ft/yr)					
	2030	2040	2050	2060	2070	2080
Jim Wells County						
New Demand (after conservation)	85	85	86	86	87	88
Expected Savings	2	5	7	10	13	16
New Manufacturing Shortage (after recommended conservation)	(6)	(6)	(7)	(7)	(8)	(9)
Shortage Reduction (ac-ft/yr)	25%	45%	50%	59%	62%	64%
Kleberg County						
New Demand (after conservation)	1,061	1,072	1,082	1,092	1,101	1,109
Expected Savings	27	56	88	121	157	196
Balance After Conservation (ac-ft/yr)	27	56	88	121	157	196
Shortage Reduction (ac-ft/yr)	N/A	N/A	N/A	N/A	N/A	N/A
Live Oak County						
New Demand (after conservation)	2,772	2,801	2,828	2,853	2,876	2,898
Expected Savings	71	147	229	317	411	511
Balance After Conservation (ac-ft/yr)	71	147	229	317	411	511
Shortage Reduction (ac-ft/yr)	N/A	N/A	N/A	N/A	N/A	N/A
McMullen County						
New Demand (after conservation)	33	32	31	31	30	29
Expected Savings	1	2	3	3	4	5
Balance After Conservation (ac-ft/yr)	1	2	3	3	4	5
Shortage Reduction (ac-ft/yr)	N/A	N/A	N/A	N/A	N/A	N/A
Nueces County						
New Demand (after conservation)	49,104	47,845	46,586	45,326	44,163	44,488
Expected Savings	1,259	2,518	3,777	5,037	6,309	7,851
New Manufacturing Shortage (after recommended conservation)	(34,506)	(36,454)	(37,611)	(38,413)	(39,419)	(40,120)
Shortage Reduction (ac-ft/yr)	4%	6%	9%	12%	14%	16%
San Patricio County						
New Demand (after conservation)	59,187	57,674	56,162	54,647	53,135	51,622
Expected Savings	1,518	3,036	4,553	6,073	7,591	9,110
Balance After Conservation (ac-ft/yr)	10,506	11,630	12,990	14,588	16,178	17,596
Shortage Reduction (ac-ft/yr)	N/A	N/A	N/A	N/A	N/A	N/A
Total Manufacturing Savings (Region N)	**2,878**	**5,764**	**8,657**	**11,561**	**14,485**	**17,689**

Table 5B.2.3.
Costs and Savings of Possible Manufacturing Water Conservation Techniques (BMPs)

Best Management Practices		Water Savings Estimates				Cost Estimates				Assumptions/Notes
		Min	Max	Avg	Savings Metric	Min	Max	Avg	Cost Metric	
1	Industrial Water Audit	10	35	22.5	%	-	-	-	-	-
2	Industrial Water Waste Reduction	-	-	-	-	-	-	-	-	-
3	Industrial Submetering	-	-	-	-	-	-	-	-	-
4	Cooling Towers	-	-	-	-	-	-	-	-	Highly variable. Savings due to increased concentration ratio and implemented changes in operating procedures. TWDB guidance available for calculating water savings.
5	Cooling Systems (other than Cooling Towers)	-	90	-	%	-	-	-	-	Estimated that retrofitting of single-pass cooling equipment such as x-rays to recirculating water systems can cut water use by up to 90%.
6	Industrial Alternative Sources and Reuse and Recirculation of Process Water	-	-	-	-	-	-	-	-	-
7	Rinsing/Cleaning	-	-	-	-	-	-	-	-	-
8	Water Treatment	10	85	47.5	%	-	-	-	-	Water savings range widely based on specific updates - from process adjustments to reclaim systems.
9	Boiler and Steam Systems	-	-	-	-	-	-	-	-	Highly variable. Savings due to increased condensate return and increased concentration ratios. TWDB guidance available for calculating water savings.
10	Refrigeration (including Chilled Water)	-	-	-	-	-	-	-	-	-
11	Once-Through Cooling	-	-	-	-	-	-	-	-	-
12	Management and Employee Programs	-	-	-	-	-	-	-	-	-
13	Industrial Facility Landscaping	-	-	15	%	-	-	-	-	-
14	Industrial Site Specific Conservation	10	95	52.5	%	-	-	-	-	Savings vary widely based on specific measure - from water audits to changing from potable to recycled water.

Best Management Practices		Water Savings Estimates				Cost Estimates				Assumptions/Notes
		Min	Max	Avg	Savings Metric	Min	Max	Avg	Cost Metric	
15	Stormwater Runoff*	-	-	-	%	-	-	-	-	Savings vary depending on size of impervious area, drainage features, and capture ratio of runoff water onsite.

Source: TWDB website: https://www.twdb.texas.gov/conservation/BMPs/Ind/index.asp; *BMP No. 15 added to list for 2026 Region Plan based on feedback received from Manufacturing Representatives on the CBRWPG.

5B.2.3 Alternative Cooling Water Technologies

Cooling towers can be among the largest water using systems in the industrial and commercial sector. The most significant opportunity for water savings in cooling tower operation is by reducing the amount of highly concentrated water removed from the system as blowdown.[3] The Alliance for Water Efficiency (AWE) developed a tool to assist users to identify water savings opportunities based on source water quality data and to provide potential solutions to improve the cycles of concentration to reduce the amount of blowdown lost from system.[4] AWE also followed up with a pilot study in 2022 to assess several alternative technologies and their effectiveness of meeting a user's cooling demand while providing water savings. Three alternative cooling water technologies recommended from the AWE study include the following: Thermosyphon Cooler Hybrid System, Hygroscopic Cooling Tower, and Thermal Membrane Distillation.

Also, the AWE guide provides information on how to increase water efficiency in cooling towers, including design and operations of cooling towers to achieve additional water savings. Although AWE's pilot study did not include rigorous economic evaluations of the capital cost of the improvements versus the reoccurring operating expenses; however, the tool can be used to help inform industries regarding the life cycle cost analysis and payback period during their evaluation process.

5B.2.3.1 Thermosyphon Cooler Hybrid System

A thermosyphon cooler hybrid system (TCHS) integrates the control of a dry heat rejection device, the thermosyphon cooler (TSC), with an open cooling tower. The TCHS, developed by Johnson Controls, involves placing a dry cooling device, a TSC, upstream and in series with a wet cooling tower. This system uses evaporative cooling when it is most advantageous and then uses dry cooling as system operations and ambient weather conditions permit to save water. In 2016, Johnson Controls partnered with the National Renewable Energy Laboratory (NREL) and Sandia National Laboratories to conduct and model test scenarios using the TCHS. The results

[3] *Cooling Systems Management, Report 362*, Texas Water Development Board, 2004.

[4] *Taking Inventory: A Guide for Identifying Cooling Towers and Estimating Water Use*, Alliance for Water Efficiency, February 2021.

of the pilot study of the hybrid cooling system demonstrated a reduction of annual utility costs by 40 percent in addition to achieving a significant 56 percent annualized water savings.[5]

5B.2.3.2 Hygroscopic Cooling Tower

A hygroscopic cooling tower is similar to a conventional wet evaporative cooling system and uses a hygroscopic working fluid as a direct-contact heat-transfer medium between a cooling water loop and the ambient air. The hygroscopic liquid desiccant, a mixture of calcium chloride (CaCl2) and water, restricts the free evaporation of moisture and results in more heat transfer to the air compared to water. CaCl2 is the preferred desiccant material since it is widely available, low cost, and has few environmental concerns compared to other desiccants or salts.

In a conventional wet cooling tower, approximately 90 percent of the energy transfer occurs through evaporation, which is independent on outdoor temperature conditions. With the hygroscopic tower, the amount of heat transfer can be varied to maximize the water savings depending on the air/weather conditions. In 2018, the University of North Dakota conducted a pilot study with grant assistance from the U.S. Department of Defense to test a conventional cooling tower using hygroscopic working fluid to vary the amount of dry versus wet evaporative heat transfer relative to ambient weather conditions.[6] The results of this study demonstrated the following using hygroscopic cooling towers:

- Allows a full range of wet-to-dry performance using a single air–liquid interface instead of separate wet and dry stages;
- Evaporates all makeup water to provide cooling, which eliminates the need for a wasteful blowdown stream; and,
- Possible annual water savings in the range of 30 to 50 percent.

5B.2.3.3 Thermal Membrane Distillation

Treating and reusing cooling tower blowdown water (CTBD) can achieve additional water efficiency and reduce water demands for manufacturing and industrial users. Thermal membrane distillation (MD) is a thermally driven membrane separation process that creates a vapor pressure generated by a temperature difference between the liquids on both sides of the membrane. The vapor is transported through the membrane from the hot feed liquid side to the condensate side under the effect of the pressure difference.

The School of Energy, Power and Mechanical Engineering at the North China Electric Power University conducted a pilot study and developed a computational model to study the treatment of CTBD by reverse osmosis (RO) and MD to address the issue of cooling tower blowdown

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[5] *Thermosyphon Cooler Hybrid System for Water Savings in an Energy-Efficient HPC Data Center Report: Results of 24 Months and Impact on Water Usage Effectiveness*, National Renewable Energy Laboratory, September 2018.

[6] *Hygroscopic Cooling Tower for Reduced Water Consumption (ESTCP Project EW-201723)*, University of North Dakota and U.S. Department of Defense, September 2018.

treatment.[7] During the study, the effects of the main operating parameters on the RO and MD (with/without waste heat use) were explored, as well as water-savings and energy consumption. The results showed that MD achieved a water-saving rate of 18.4 percent, and energy consumption was slightly lower than RO. Also, waste heat utilization demonstrated an improvement in the economy of MD.

5B.2.4 Environmental Issues

The TWDB BMPs have been developed and tested through public and private sector research and have been applied within the region. Such programs have been implemented and are not expected to have significant environmental issues associated when in operation. For example, most BMPs improve water use efficiency without making changes to wildlife habitat. Therefore, the proposed conservation practices do not have anticipated potential adverse effects, and in fact have potentially beneficial environmental effects.

5B.2.5 Engineering and Costing

The CBRWPG recommends implementing voluntary water conservation for all manufacturing users regardless of need to reduce their water demand by 15 percent by 2080. The Coastal Bend Region can save up to 17,689 ac-ft/yr in 2080 with this approach. Costs to implement BMPs vary from site to site and the region recognizes that manufacturing industries will pursue conservation strategies that are economically feasible with water savings benefits. For this reason, it is impractical to evaluate the costs of implementing manufacturing water conservation strategies.

5B.2.6 Implementation Issues

Demand reduction through water conservation is being implemented throughout the Coastal Bend Region. The rate of adoption of efficient water-using practices is dependent upon public knowledge of the benefits, information about how to implement water conservation measures, and financing.

There is public support for manufacturing water conservation, and it is being implemented at a steady pace. As water markets for conserved water expand and the Coastal Bend industrial sector continues to expand, conservation practices will likely reach a greater potential. The TWDB has industrial water conservation programs including presentations and workshops for utilities who wish to train staff to develop local programs including water use site surveys, publications on industrial water reuse potential, and information on tax incentives for industries that conserve or reuse water. Future planning efforts should consider the use of detailed studies to fully determine the maximum potential benefits of manufacturing conservation.

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[7] *Performance and Economic Analysis of the Cooling Tower Blowdown Water Treatment System in a Coal-Fired Power Plant*, Institution of Chemical Engineers, Vol. 201, 2023.

5B.2.7 Evaluation Summary

An evaluation summary of this water management option is provided in Table 5B.2.4.

Table 5B.2.4.
Evaluation Summary of Manufacturing Water Conservation

Impact Category	Comment(s)
a. Water Supply	
1 Quantity	1. Firm Yield: Variable; Max of 17,689 ac-ft/yr (2080)
2. Reliability 3. Cost of Treated Water 4. Estimated Water Losses	2. Reliable quantity with proven BMPs 3. Cost: Highly variable based on BMP selected and facility specifics. 4. Data unavailable; facility specific.
b. Environmental factors	
1. Effects on Instream flows	1. None or low impact.
2. Effects on Bay and Estuary Inflows and arms of the Gulf of Mexico	2. None or low impact.
3. Wildlife Habitat	3. None or low impact.
4. Wetlands	4. None or low impact.
5. Threatened and Endangered Species	5. None.
6. Cultural Resources	6. No cultural resources affected.
7. Water Quality	7. None or low impact.
a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	-
c. Impacts to Agricultural Resources and State water resources	• No apparent negative impacts on water resources
d. Threats to agriculture and natural resources in region	• None
e. Recreational impacts	• None
f. Equitable Comparison of Strategies	• Standard analyses and methods used
g. Interbasin transfers	• None
h. Third party social and economic impacts from voluntary redistribution of water	• None
i. Efficient use of existing water supplies and regional opportunities	• Improvement over current conditions by reducing the rate of decline of local groundwater levels.
j. Effect on navigation	• None
k. Impacts on water pipelines and other facilities used for water conveyance	• None

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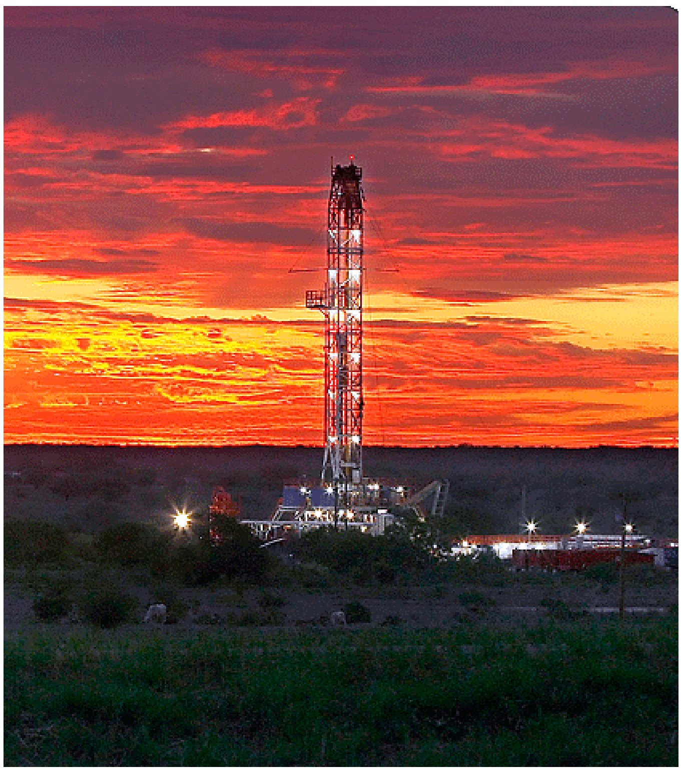

5B.3

Mining Water Conservation

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Section 5B.3 Mining Water Conservation

5B.3.1 Description of Strategy

Water for mining uses is primarily associated with oil and gas extraction, coal mining, metal mining, and nonmetallic mineral operations. Gross state domestic product data released from the U.S. Department of Commerce showed mining economic outputs of $152.5 billion for 2018 and $203.4 billion for 2023.[1] Individual county data for both 2018 and 2023 is presented in Table 5B.3.1 for comparison purposes.

Table 5B.3.1
U.S. Department of Commerce Data – Gross State Domestic Product (GDP): Mining, Quarrying, and Oil and Gas Extraction

Counties in Region N	Gross State Domestic Product	
	2018 (thousands of dollars)	2023 (thousands of dollars)
Aransas	46,896	29,336
Bee	75,234	71,613
Brooks	108,260	*
Duval	132,631	131,116
Jim Wells	785,949	562,049
Kenedy	123,249	*
Kleberg	51,330	38,795
Live Oak	824,939	1,535,180
McMullen	1,736,373	1,823,713
Nueces	762,589	588,191
San Patricio	119,211	166,553

* Data not provided by BEA due to confidentiality; estimates are included in higher-level totals for the state.

The Texas Water Development Board (TWDB) water demand projections for mining users are generally based on projected economic output, assuming past and current water use trends remain constant over time. The mining water demand projections used in this plan for the Coastal Bend Region were provided by the TWDB and differed from those presented in the *2021 Coastal Bend Regional Water Plan*. For 2030, the projected demands in this planning cycle are approximately 30 percent less than those shown in the 2021 regional water plan (9,821 acre-feet per year [ac-ft/yr] decreased to 6,960 ac-ft/yr in 2030). In the Coastal Bend Region, the trends for mining water demands are projected to increase during 2030 to 2070 with a maximum demand of 7,058 acre-feet (ac-ft) and then decrease after 2070 to a minimum of 1,026 ac-ft/yr in 2080 as shown in Figure 5B.3.1. The decrease in water demand is due to the anticipated slowdown of Eagle Ford Shale mining activities in the Coastal Bend Region. Also, McMullen County has the largest projected mining water demands by TWDB, constituting over half of the regional mining water demand during 2030 Figure 5B.3.2), as well as the highest gross domestic product (GDP) in the Coastal Bend Region, as shown in Table 5B.3.1.

[1] Bureau of Economic Analysis, U.S. Department of Commerce.

In the Coastal Bend Region, all counties receive their full mining supply from groundwater sources. Based on a virtual meeting held on September 24, 2024, with Lonnie Stewart (General Manager, Live Oak Underground Water Conservation District), mining companies also construct and operate non-commercial recycling ponds to provide additional water supply; recycled water use from these ponds varies from 15 to 70 percent. Mining activities along with their use of non-commercial recycling ponds are regulated by the Texas Railroad Commission. Existing groundwater supplies were based on Texas Commission on Environmental Quality (TCEQ) reported well capacity, when available. In most cases, however, mining well capacity information was not publicly available. For this reason, mining groundwater supplies were calculated based on highest use from recent TWDB historical water use records (2010-2020) subject to Modeled Available Groundwater estimates (MAG) (i.e., groundwater availability).

For the *2026 Coastal Bend Regional Water Plan*, nine of the eleven counties in the Coastal Bend Region have projected mining needs: Bee, Brooks, Duval, Kenedy, Kleberg, Live Oak, McMullen, Nueces, and San Patricio counties, as shown in Table 5B.3.2. Overall, shortages in the region peak in 2040 and show a surplus by 2080 due to the reduction in mining water demands expected with reductions in Eagleford shale activities. However, the greatest mining shortage (2,809 ac-ft/yr) is shown for McMullen County during 2030-2070.

TWDB rules for regional water planning require regional water planning groups to consider water conservation and drought management measures for each water user group with a need (projected water shortage). The TWDB has provided information on industrial water conservation best management practices (BMPs), for consideration in the development of the water conservation water management strategies, including a Best Management Practice Guides for Industrial Water Users.

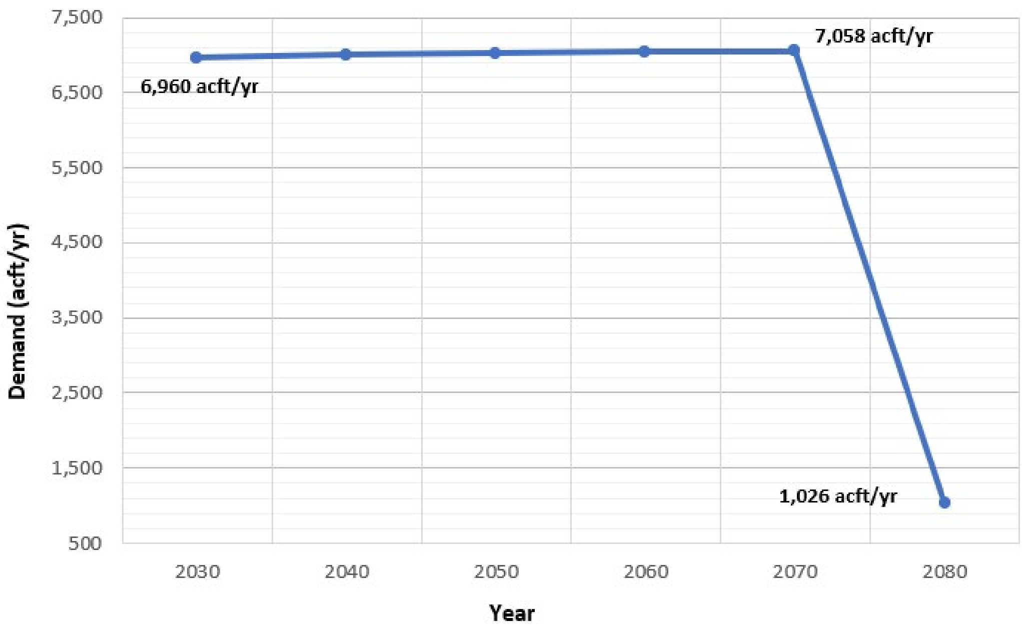

Figure 5B.3.1.
Coastal Bend Region Mining Water Demand Projections

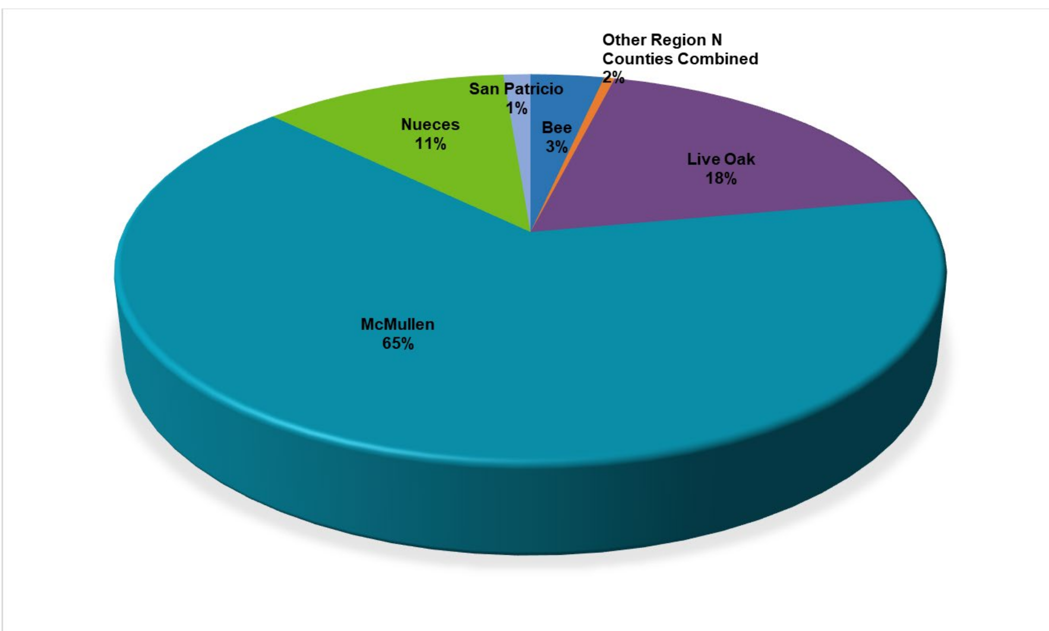

Figure 5B.3.2.
2030 Percentages of Mining Water Demand by County
Total Demand for Coastal Bend Region – 6,960 ac-ft

Table 5B.3.2
Projected Water Demands, Supplies, and Water Needs (Shortages) for Mining Users in Bee, Brooks, Duval, Kenedy, Kleberg, Live Oak, McMullen, Nueces, and San Patricio Counties

County	Mining Projections (ac-ft/yr)					
	2030 (ac-ft)	2040 (ac-ft)	2050 (ac-ft)	2060 (ac-ft)	2070 (ac-ft)	2080 (ac-ft)
Bee County						
Mining Demand	239	239	239	239	239	0
Mining Existing Supply						
Groundwater	74	74	74	74	74	0
Surface Water	0	0	0	0	0	0
Reuse	7	7	7	7	7	0
Total Mining Supply	81	81	81	81	81	0
Surplus (Shortage)	(158)	(158)	(158)	(158)	(158)	0
Brooks County						
Mining Demand	16	16	16	16	16	16
Mining Existing Supply						
Groundwater	16	16	16	16	16	16
Surface Water	0	0	0	0	0	0
Reuse	0	0	0	0	0	0
Total Mining Supply	16	16	16	16	16	16
Surplus (Shortage)	0	0	0	0	0	0
Duval County						
Mining Demand	6	6	6	6	7	7
Mining Existing Supply						
Groundwater	6	6	6	6	7	7
Surface Water	0	0	0	0	0	0
Reuse	0	0	0	0	0	0
Total Mining Supply	6	6	6	6	7	7
Surplus (Shortage)	0	0	0	0	0	0
Kenedy County						
Mining Demand	3	3	3	3	3	3
Mining Existing Supply						
Groundwater	2	2	2	2	2	2
Surface Water	0	0	0	0	0	0
Reuse	1	1	1	1	1	1
Total Mining Supply	3	3	3	3	3	3
Surplus (Shortage)	0	0	0	0	0	0

County	Mining Projections (ac-ft/yr)					
	2030 (ac-ft)	2040 (ac-ft)	2050 (ac-ft)	2060 (ac-ft)	2070 (ac-ft)	2080 (ac-ft)
Kleberg County						
Mining Demand	10	10	10	10	10	10
Mining Existing Supply						
Groundwater	9	9	9	9	9	9
Surface Water	0	0	0	0	0	0
Reuse	1	1	1	1	1	1
Total Mining Supply	10	10	10	10	10	10
Surplus (Shortage)	0	0	0	0	0	0
Live Oak County						
Mining Demand	1,264	1,264	1,264	1,264	1,264	2
Mining Existing Supply						
Groundwater	674	674	674	674	674	674
Surface Water	0	0	0	0	0	0
Reuse	590	590	590	590	590	590
Total Mining Supply	1,264	1,264	1,264	1,264	1,264	1,264
Surplus (Shortage)	0	0	0	0	0	1,262
McMullen County						
Mining Demand	4,538	4,538	4,538	4,538	4,538	1
Mining Existing Supply						
Groundwater	506	506	506	506	506	506
Surface Water	0	0	0	0	0	0
Reuse	1,223	1,223	1,223	1,223	1,223	1,223
Total Mining Supply	1,729	1,729	1,729	1,729	1,729	1,729
Surplus (Shortage)	(2,809)	(2,809)	(2,809)	(2,809)	(2,809)	1,728
Nueces County						
Mining Demand	796	835	858	876	887	893
Mining Existing Supply						
Groundwater	708	737	765	792	792	792
Surface Water	0	0	0	0	0	0
Reuse	0	0	0	0	0	0
Total Mining Supply	708	737	765	792	792	792
Surplus (Shortage)	(88)	(98)	(93)	(84)	(95)	(101)
San Patricio County						
Mining Demand	88	90	92	93	94	94
Mining Existing Supply						
Groundwater	88	90	92	93	94	94
Surface Water	0	0	0	0	0	0
Reuse	0	0	0	0	0	0
Total Mining Supply	88	90	92	93	94	94
Surplus (Shortage)	0	0	0	0	0	0

5B.3.2 Available Yield

All mining entities in the Coastal Bend Region are encouraged to conserve water.

Of the nine counties in the Coastal Bend Region with mining water demands, only three counties show shortages (Table 5B.3.3) this planning cycle compared to nine counties showing shortages in the 2021 regional water plan. The Coastal Bend Regional Water Planning Group (CBRWPG) recommends that all counties with projected mining water demands (regardless of need or shortage) to target reducing their mining water demands by 15 percent by 2080. Based on this approach, the region achieves a max savings of 882 ac-ft by 2070, which then declines to 153 ac-ft by 2080, as shown in Table 5B.3.3. The CBRWPG-recommended water conservation goal alone is insufficient to fully address mining shortages in the Coastal Bend Region during 2030-2080, and additional strategies are considered to address this projected supply deficit (see Chapter 5B).

Table 5B.3.3
Projected Water Demands Considering a 15 Percent Reduction by 2080 for All Mining Users; Additional Needs (Shortages) Shown for Bee, McMullen, and Nueces Counties

County	Projections (ac-ft/yr)					
	2030	2040	2050	2060	2070	2080
Bee County						
New Demand (after conservation)	233	227	221	215	209	0
Expected Savings	6	12	18	24	30	0
New Mining Shortage (after recommended conservation)	(152)	(146)	(140)	(134)	(128)	0
Shortage Reduction (ac-ft/yr)	4%	8%	11%	15%	19%	N/A
Brooks County						
New Demand (after conservation)	16	15	15	14	14	14
Expected Savings	0	1	1	2	2	2
Balance After Conservation (ac-ft/yr)	0	1	1	2	2	2
Shortage Reduction (ac-ft/yr)	N/A	N/A	N/A	N/A	N/A	N/A
Duval County						
New Demand (after conservation)	6	6	6	5	6	6
Expected Savings	0	0	0	1	1	1
Balance After Conservation (ac-ft/yr)	0	0	0	1	1	1
Shortage Reduction (ac-ft/yr)	N/A	N/A	N/A	N/A	N/A	N/A
Kenedy County						
New Demand (after conservation)	3	3	3	3	3	3
Expected Savings	0	0	0	0	0	0
Balance After Conservation (ac-ft/yr)	0	0	0	0	0	0
Shortage Reduction (ac-ft/yr)	N/A	N/A	N/A	N/A	N/A	N/A
Kleberg County						
New Demand (after conservation)	10	9	9	9	9	8
Expected Savings	0	1	1	1	1	2
Balance After Conservation (ac-ft/yr)	0	1	1	1	1	2
Shortage Reduction (ac-ft/yr)	N/A	N/A	N/A	N/A	N/A	N/A
Live Oak County						
New Demand (after conservation)	1,232	1,201	1,169	1,138	1,106	2
Expected Savings	32	63	95	126	158	0
Balance After Conservation (ac-ft/yr)	32	63	95	126	158	1,262
Shortage Reduction (ac-ft/yr)	N/A	N/A	N/A	N/A	N/A	N/A
McMullen County						
New Demand (after conservation)	4,425	4,311	4,198	4,084	3,971	1
Expected Savings	113	227	340	454	567	0
New Mining Shortage (after recommended conservation)	(2,696)	(2,582)	(2,469)	(2,355)	(2,242)	0
Shortage Reduction (ac-ft/yr)	4%	8%	12%	16%	20%	N/A
Nueces County						
New Demand (after conservation)	776	793	794	788	776	759
Expected Savings	20	42	64	88	111	134
New Mining Shortage (after recommended conservation)	(68)	(56)	(29)	4	16	33

County	Projections (ac-ft/yr)					
	2030	**2040**	**2050**	**2060**	**2070**	**2080**
Shortage Reduction (ac-ft/yr)	23%	43%	69%	N/A	N/A	N/A
San Patricio County						
New Demand (after conservation)	86	85	85	84	82	80
Expected Savings	2	5	7	9	12	14
Balance After Conservation (ac-ft/yr)	2	5	7	9	12	14
Shortage Reduction (ac-ft/yr)	N/A	N/A	N/A	N/A	N/A	N/A
Total Mining Savings (Region N)	**173**	**351**	**526**	**705**	**882**	**153**

The TWDB lists the following industrial BMPs that may be used to achieve the recommended water savings[2]:

1. Industrial Water Audit
2. Industrial Water Waste Reduction
3. Industrial Submetering
4. Cooling Towers
5. Cooling Systems (other than Cooling Towers)
6. Industrial Alternative Sources and Reuse and Recirculation of Process Water
7. Rinsing/Cleaning
8. Water Treatment
9. Boiler and Steam Systems
10. Refrigeration (including Chilled Water)
11. Once-Through Cooling
12. Management and Employee Programs
13. Industrial Facility Landscaping
14. Industrial Site Specific Conservation

For the BMPs listed above, water savings (yield) and costs to implement these strategies reported in TWDB guidance documents are summarized in Table 5B.3.4. TWDB describes how the BMPs reduce water use; however, information regarding specific water savings and costs to implement conservation programs is generally unavailable. Conservation savings and costs are facility and process specific. Since mining entities are presented on a county basis and are not individually identified, identification and quantifying savings of specific water management strategies are not a reasonable expectation.

[2] TWDB website: https://www.twdb.texas.gov/conservation/BMPs/Ind/index.asp

Table 5B.3.4
Costs and Savings of Possible Mining Water Conservation Techniques (BMPs)

Best Management Practices		Water Savings Estimates				Cost Estimates				Assumptions/Notes
		Min	Max	Avg	Savings Metric	Min	Max	Avg	Cost Metric	
1	Industrial Water Audit	10	35	22.5	%	-	-	-	-	-
2	Industrial Water Waste Reduction	-	-	-	-	-	-	-	-	-
3	Industrial Sub-metering	-	-	-	-	-	-	-	-	-
4	Cooling Towers	-	-	-	-	-	-	-	-	Highly variable. Savings due to increased concentration ratio and implemented changes in operating procedures. TWDB guidance available for calculating water savings.
5	Cooling Systems (other than Cooling Towers)	-	90	-	%	-	-	-	-	Estimated that retrofitting of single-pass cooling equipment such as x-rays to recirculating water systems can cut water use by up to 90%.
6	Industrial Alternative Sources and Reuse and Recirculation of Process Water	-	-	-	-	-	-	-	-	-
7	Rinsing/Cleaning	-	-	-	-	-	-	-	-	-
8	Water Treatment	10	85	47.5	%	-	-	-	-	Water savings range widely based on specific updates - from process adjustments to reclaim systems.
9	Boiler and Steam Systems	-	-	-	-	-	-	-	-	Highly variable. Savings due to increased condensate return and increased concentration ratios. TWDB guidance available for calculating water savings.
10	Refrigeration (including Chilled Water)	-	-	-	-	-	-	-	-	-
11	Once-Through Cooling	-	-	-	-	-	-	-	-	-
12	Management and Employee Programs	-	-	-	-	-	-	-	-	-
13	Industrial Facility Landscaping	-	-	15	%	-	-	-	-	-
14	Industrial Site Specific Conservation	10	95	52.5	%	-	-	-	-	Savings vary widely - from water audits to changing from potable to recycled water.

5B.3.3 Environmental Issues

The TWDB BMPs have been developed and tested through public and private sector research and have been applied within the region. Such programs have been installed, and are in operation today, and are not expected to have significant environmental issues associated with implementation. For example, most BMPs improve water use efficiency without making changes to wildlife habitat. Thus, the proposed conservation practices do not have anticipated potential adverse effects, and in fact have potentially beneficial environmental effects.

5B.3.4 Engineering and Costing

The CBRWPG recommends implementing voluntary water conservation for all mining users regardless of need to reduce their water demand by 15 percent by 2080. The Coastal Bend Region achieves a maximum savings of 882 ac-ft/yr in 2070 with this approach. Costs to implement BMPs vary from site to site, and the region recognizes that mining industries will pursue conservation strategies that are economically feasible with water savings benefits. For this reason, it is impractical to evaluate the costs of implementing mining water conservation strategies.

5B.3.5 Implementation Issues

Demand reduction through water conservation is being implemented throughout the Coastal Bend Region. The rate of adoption of efficient water-using practices is dependent upon public knowledge of the benefits, information about how to implement water conservation measures, and financing.

There is public support for mining water conservation, and it is being implemented at a steady pace. As water markets for conserved water expand, this practice will likely reach a greater potential. The TWDB has industrial water conservation programs including presentations and workshops for utilities who wish to train staff to develop local programs including water use site surveys, publications on industrial water reuse potential, and information on tax incentives for industries that conserve or reuse water. Future planning efforts should consider the use of detailed studies to fully determine the maximum potential benefits of mining conservation.

5B.3.6 Evaluation Summary

An evaluation summary of this water management option is provided in Table 5B.3.5.

Table 5B.3.5
Evaluation Summary of Mining Water Conservation

Impact Category	Comment(s)
a. Water Supply	
1 Quantity	1. Firm Yield: Variable; Max of 882 ac-ft/yr (2070)
2. Reliability	2. Reliable quantity with proven BMPs
3. Cost of Treated Water	3. Cost: Highly variable based on BMP selected and facility specifics.
4. Estimated Water Losses	4. Data unavailable; facility specific
b. Environmental factors	
1. Effects on Instream flows	1. None or low impact.
2. Effects on Bay and Estuary Inflows and arms of the Gulf of Mexico	2. None or low impact.
3. Wildlife Habitat	3. None or low impact.
4. Wetlands	4. None or low impact.
5. Threatened and Endangered Species	5. None.
6. Cultural Resources	6. No cultural resources affected.
7. Water Quality	7. None or low impact.
a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	-
c. Impacts to Agricultural Resources and State water resources	• No apparent negative impacts on water resources
d. Threats to agriculture and natural resources in region	• None
e. Recreational impacts	• None
f. Equitable Comparison of Strategies	• Standard analyses and methods used
g. Interbasin transfers	• None
h. Third party social and economic impacts from voluntary redistribution of water	• None
i. Efficient use of existing water supplies and regional opportunities	• Improvement over current conditions by reducing the rate of decline of local groundwater levels.
j. Effect on navigation	• None
k. Impacts on water pipelines and other facilities used for water conveyance	• None

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5B.4

Reuse

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Section 5B.4 Reuse

5B.4.1 Nueces River Authority Petronila Regional Wastewater Treatment Plant Reuse

5B.4.1.1 Description of Strategy

Water reuse is a strategy that treats wastewater to a safe and suitable extent based on the reuse application, such as potable or non-potable applications. The Nueces River Authority is consolidating local wastewater flows into a regional wastewater treatment plant (WWTP), Petronila Regional WWTP, to replace failing WWTPs and septic systems in Bishop, Driscoll, Banquete, and Robstown.

The Bishop WWTP is permitted to discharge through Texas Pollutant Discharge Elimination System (TPDES) Permit No. WQ0011541002, an average of 0.32 million gallons per day (mgd) directly to Carreta Creek, which drains to San Fernando Creek, then the Cayo del Grullo portion of Baffin Bay/Alazan Bay/Cayo del Grullo/Laguna Salada in Segment No. 2492 of the Bays and Estuaries. The Driscoll WWTP is permitted to discharge (TPDES Permit No. WQ0010427001) an average of 0.10 mgd directly to Petronila Creek Above Tidal in Segment No. 2204 of the Nueces-Rio Grande Coastal Basin. The Banquete WWTP is permitted to discharge (TPDES Permit No. WQ0011583002) an average of 0.10 million mgd directly to Banquete Creek, thence to Petronila Creek Above Tidal in Segment No. 2204 of the Nueces-Rio Grande Coastal Basin. The Robstown WWTP is permitted (TPDES Permit No. WQ0010261001) to not exceed an annual average flow of 2.4 mgd. The discharge flows through an unnamed ditch, to Oso Creek, then Oso Bay in Segment No. 2485 of the Bays and Estuaries.

The Nueces River Authority is considering developing up to 1 mgd from Petronila Creek Regional WWTP as a non-potable Type 1 reuse supply to serve Nueces County industries. The project layout is shown in Figure 5B.4.1. It is assumed that the source water for the reuse project would originate from Robstown WWTP and a 2.4-mile pipeline would be needed to convey wastewater flow to the proposed Petronila Regional WTP. For this supply option, only the 1 mgd Type 1 reuse plant is costed. The construction and costing of the total Petronila Regional WWTP and conveyance to associated wetlands are not included in this strategy.

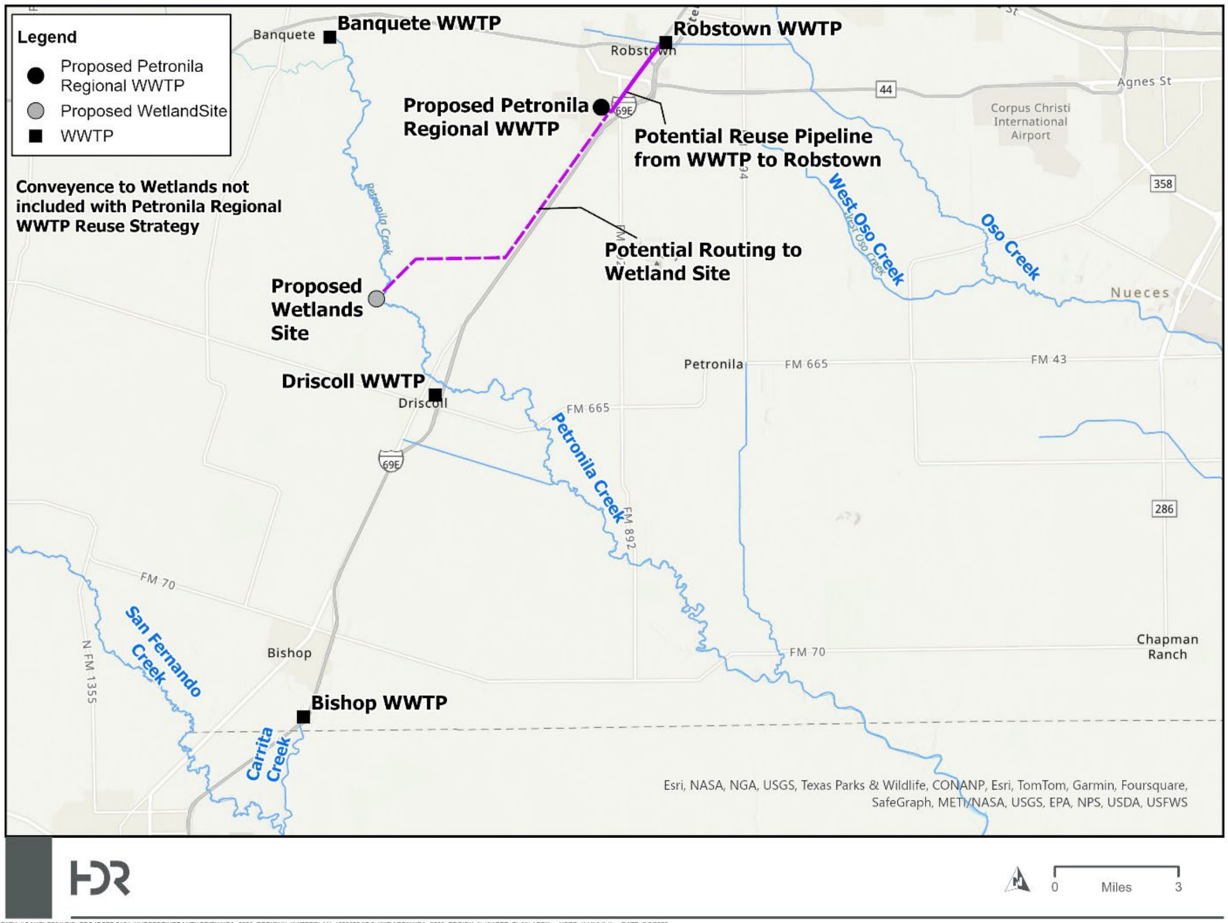

Figure 5B.4.1.
Project Layout of the Petronila Regional Wastewater Reuse Project

5B.4.1.2 Texas Administrative Code, Chapter 210 – Use of Reclaimed Water

There are two general qualities of treated wastewater allowed for reclaimed water use under Texas Commission on Environmental Quality (TCEQ) rules, Chapter 210. These are grouped and defined as Type I and Type II uses.

Broadly defined, Type I reclaimed water quality is required where contact between humans and the reclaimed water is likely. The type of water uses for which Type I reclaimed water could be generally used are:

- Residential irrigation;
- Urban irrigation for public parks, golf courses with unrestricted public access, school yards or athletic fields;
- Fire protection;

- Irrigation of food crops where the reclaimed water may have direct contact with the edible part of the crop;
- Irrigation of pastures for milking animals;
- Maintenance of water bodies where recreation may occur;
- Toilet or urinal flushing; and
- Other similar activities where unintentional human exposure may occur.

Type I water can also be used for all Type II uses listed below.

Type II water quality is where such human contact is unlikely. The type of water uses that would generally be considered as eligible for Type II reclaimed water are:

- Irrigation of sod farms, silviculture, limited access highway rights-of-way, and other areas where human access is restricted (restricted access can include remote sites, fenced or walled borders with controlled access, or the site not being used by the public when normal irrigation operations are in process);
- Irrigation of food crops where the reclaimed water is not likely to have direct contact with the edible part of the crop;
- Irrigation of animal feed crops, other than pasture for milking animals;
- Maintenance of water bodies where direct human contact is unlikely;
- Certain soil compaction or dust control uses;
- Cooling tower makeup water;
- Hydraulic fracking;
- Irrigation or other non-potable uses of reclaimed water at a wastewater treatment facility; and
- Any eligible Type I water uses.

At a minimum, the TCEQ requires that the reclaimed water will be of the quality specified in the rules (Table 5B.4.1).

Table 5B.4.1.
Quality Standards for Using Reclaimed Water (30-day Average)

Constituent	Standard
Type I	
BOD_5 or $CBOD_5$	5 mg/L
Turbidity	3 NTU
Fecal Coliform	20 CFU/100 mL (geometric mean)
Fecal Coliform (not to exceed)	75 CFU/100 mL (single grab sample)
Enterococci	4 CFU/100 mL (geometric mean)
Enterococci (not to exceed)	9 CFU/100 mL (single grab sample)
Type II Other than Pond Systems	
BOD_5	20 mg/L
or $CBOD_5$	15 mg/L
Fecal Coliform	200 CFU/100 mL (geometric mean)
Fecal Coliform (not to exceed)	800 CFU/100 mL (single grab sample)
Enterococci	35 CFU/100 mL (geometric mean)
Enterococci (not to exceed)	89 CFU/100 mL (single grab sample)
Type II Pond Systems	
BOD_5	30 mg/L
Fecal Coliform	200 CFU/100 mL (geometric mean)
Fecal Coliform (not to exceed)	800 CFU/100 mL (single grab sample)
Enterococci	35 CFU/100 mL (geometric mean)
Enterococci (not to exceed)	89 CFU/100 mL (single grab sample)

Source: TAC §210.33 - accessed January 2025
mg/L = milligrams per liter
BOD_5 = Biochemical Oxygen Demand (5-day)
C/BOD_5 = Carbonaceous Biochemical Oxygen Demand (5-day)
CFU/100 ml = Colony Forming Units per 100 milliliter

5B.4.1.3 Available Yield

Nueces River Authority is considering project to generate 1 mgd (1,120 acre-feet per year [ac-ft/yr]) reuse supply from Petronila Regional WWTP for Nueces County-Manufacturing. The reuse water will be non-potable, Type I.

5B.4.1.4 Environmental Issues

The proposed Petronila project would combine four failing WWTPs into one regional facility and would be designed to meet TCEQ reclaimed water regulations along with applicable effluent discharge permit limits. Approximately 1 mgd of the WWTP effluent would be reused for non-potable purposes by Nueces County industries. The remaining approximately 3 mgd would be returned to wetlands that will flow down Petronila Creek into Baffin Bay. Water from the proposed WWTP would discharge to Petronila Creek (TCEQ Segment 2204) and would flow downstream Petronila Creek Tidal (TCEQ Segment 2203). These segments are both listed as impaired on the TCEQ 2024 Draft 303(d) List[1] for bacteria in water (recreation use). A study conducted by the Harte Research Institute for Gulf of Mexico Studies at Texas A&M University Corpus Christi indicated that 60 percent of pollutants flowing through Petronila Creek and into Baffin Bay are the direct result of failing municipal WWTPs and failing residential septic systems[2]. Water from Petronila Creek enters Baffin Bay/Alazan Bay/Cayo del Grullo/Laguan Salada (TCEQ Segment 2492) which was not currently listed as impaired[3]. The proposed project would be expected to improve the water quality in Petronila Creek and downstream by closing failing municipal WWTPs and providing riparian treatment for agricultural and wildlife nutrient loading.

Additional studies including a delineation of waters of the United States, a habitat assessment for threatened and endangered species, and cultural resources investigations should be completed early in the design phase to assist with proper siting of WWTP and associated structures and pipelines. Proper siting can avoid and minimize impacts to sensitive resources. Using sites that have previously been disturbed can minimize impacts to wildlife habitat.

Studies should be conducted to ensure that adequate water would reach Baffin Bay and water quality would be compatible with maintaining biological processes since estuaries are important as migratory bird use areas, wetlands, and marine fish and invertebrate nursery areas. Impacts to downstream threatened and endangered species should be considered.

5B.4.1.5 Engineering and Costing

The effluent wastewater needs to be treated to reach standards shown in Table 5B.4.1. To estimate the treatment required to reach non-potable Type I reclaimed water, a Level 2 treatment level was utilized in the Uniform Costing Model (UCM). The level 2 treatment process includes alum and polymer addition, rapid mix, flocculation, filtration, and disinfection.

5B.4.1.6 Non-potable Reuse, Type I Cost Estimate

The planning-level cost estimate includes:

- Level 2 (Simple Filtration) Treatment
  - Alum and polymer addition
  - Rapid mix
  - Flocculation
  - Filtration
  - Disinfection

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[1] TCEQ, 2024. 2024 Texas Integrated Report – Texas 303(d) List. Accessed online 2024 Texas IR 303(d) List February 5, 2025.

[2] Partnership for Petronila, 2025. Partnership for Petronila Building a Sustainable Wastewater Treatment Facility . . . Together Brochure.

[3] TCEQ, 2024. 2024 Texas Integrated Report – Texas 303(d) List. Accessed online 2024 Texas IR 303(d) List February 5, 2025.

- Yield of 1 MGD
- 12,735-foot pipeline and associated pump station to deliver water from Petrolina Regional WWTP to Robstown WWTP

A cost estimate is shown in Table 5B.4.2. The total project cost is approximately $13,228,000. The annual cost is $1,554,000. The unit cost of water is estimated to be $1,388 per acre-foot (ac-ft).

Table 5B.4.2.
Cost Estimate Summary, Petronila WWTP Reuse (Sept 2023 Prices)

Item	Estimated Costs
Booster Pump Station (1 MGD)	$896,000
Transmission Pipeline (10 in. dia., 2.4 miles)	$2,411,000
Water Treatment Plant (1 MGD)	$5,599,000
Integration, Relocations, Backup Generator & Other	$12,000
Total Cost of Facilities	**$8,918,000**
Engineering:	
- Planning (3%)	$268,000
- Design (7%)	$624,000
- Construction Engineering (1%)	$89,000
Legal Assistance (2%)	$178,000
Fiscal Services (2%)	$178,000
Pipeline Contingency (15%)	$362,000
All Other Facilities Contingency (20%)	$1,301,000
Environmental & Archaeology Studies and Mitigation	$72,000
Land Acquisition and Surveying (20 acres)	$63,000
Interest During Construction (3.5% for 3 years with a 0.5% ROI)	$1,175,000
Total Cost of Project	**$13,228,000**
Debt Service (3.5 percent, 20 years)	$930,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$24,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$22,000
Water Treatment Plant	$560,000
Pumping Energy Costs (198025 kW-hr @ 0.09 $/kW-hr)	$18,000
Total Annual Cost	**$1,554,000**
Available Project Yield (acft/yr)	1,120
Annual Cost of Water ($ per acft)	$1,388
Annual Cost of Water After Debt Service ($ per acft)	$557
Annual Cost of Water ($ per 1,000 gallons)	$4.26
Annual Cost of Water After Debt Service ($ per 1,000 gallons)	$1.71

5B.4.1.7 Implementation Issues

No major implementation issues have been identified for the Petronila Regional WWTP Reuse project. TCEQ water quality criteria for reclaimed water will need to be met according to rules). Project implementation will need to be done to meet with public health standards and protection.

Cultural resources will need to be investigated along the pipeline routes and proposed sites and avoided where possible. Implementation of this alternative should be considered in conjunction with local stakeholders.

5B.4.1.8 Evaluation Summary

An evaluation summary of this water management option is provided in Table 5B.4.3

Table 5B.4.3.
Evaluation Summary of Petronila Regional WWTP Project

Impact Category	Comment(s)
a. Water Supply	
1 Quantity	1. Yield: 1,120 ac-ft/yr
2. Reliability 3. Cost of Treated Water	2. Reliable, based on system operations 3. Non-Potable Type I: $831- $1,021 per ac-ft
b. Environmental factors	
1. Instream flows	1. Reduced flow in Oso Creek. Potential for environmental impacts to streams currently receiving wastewater effluent.
2. Bay and Estuary Inflows and arms of the Gulf of Mexico	2. Environmental impact to estuary in potential reduction of freshwater inflows.
3. Wildlife Habitat	3. None or low impact.
4. Wetlands	4. None or low impact.
5. Threatened and Endangered Species	5. None or low impact.
6. Cultural Resources	6. Cultural resources investigations will be required for all pipeline routes.
7. Water Quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. a. Dissolved solids are estimated to be around 2,000 mg/L for non-potable use. If water use needed is potable, additional treatment will be required. b. Salinity are addressed for non-potable use. If water use needed is potable, additional treatment will be required. c. Bacteria is addressed with treatment process. d. Chlorides are estimated to be around 750 mg/L for non-potable use. If water use needed is potable, additional treatment will be required. e-h. None or low impact i. Nitrate, TSS, TOC, and Mn addressed with treatment processes.
c. Impacts to agricultural resources and State water resources	• No negative impacts on other water resources
d. Threats to agriculture and natural resources in region	• Temporary damage due to construction of pipeline(s)
e. Recreational impacts	• None
f. Equitable Comparison of Strategies	• Standard analyses and methods used for portions
g. Interbasin transfers	• None
h. Third party social and economic impacts from voluntary redistribution of water	• Not applicable
i. Efficient use of existing water supplies and regional opportunities	• Provides reuse opportunities of water supplies
j. Effect on navigation	• None
k. Impacts on water pipelines and other facilities used for water conveyance	• Additional care should be exercised in construction of pipeline in dense industrial area.

5B.4.2 City of Corpus Christi Greenwood WWTP Direct Potable Reuse

5B.4.2.1 Description of Strategy

In December 2022, City staff initiated a technical study to develop an alternative treatment strategy to treat WWTP effluent for an indirect potable reuse (IPR) system using aquifer storage recovery (ASR) along with a limited direct potable reuse (DPR) system, included in Section 5B.5 – Aquifer Storage and Recovery. A DPR-only treatment option was also explored to compare the two advanced water supply solutions at the Greenwood WWTP. DPR refers to using treated municipal wastewater and providing additional advanced treatment so that potential chemical and biological contaminants are removed to meet drinking water standards. This alternative was evaluated by (1) developing a layout for a DPR-only system and estimating construction costs, (2) evaluating brine disposal that is generated from reverse osmosis treatment and permitting issues, and (3) preparing a high-level project schedule.

The IPR and DPR-only alternatives differ from the previous 2019 ASR feasibility study in that the reuse goal for this evaluation is to treat the water to potable standards. The City of Corpus Christi continues to face issues with droughts and is evaluating new water supply strategies to address future water demand. The *2021 Coastal Bend Regional Water Plan*[4] found that the City of Corpus Christi will need to augment their existing water supplies with new water by 2030 to avoid customer shortages. The shortages indicate a need to secure alternative water sources and explore new storage methods such as DPR. Both IPR and DPR are viable options as water supply sources. Environmental permitting is still needed for disposal of waste generated during advanced treatment and will be an important step in implementing either of these strategies.

5B.4.2.2 Available Yield

DPR of Greenwood WWTP effluent has a yield of 4.8 MGD (5,381 ac-ft/yr). The Greenwood WWTP effluent must undergo additional treatment as shown in Figure 5B.4.2. to reach potable standards.

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[4] HDR and Coastal Bend (Region N) Regional Water Planning Group. 2020. 2021 Coastal Bend (Region N) Regional Water Plan, October 2020. Available online: [2021 Regional Water Plans | Texas Water Development Board]

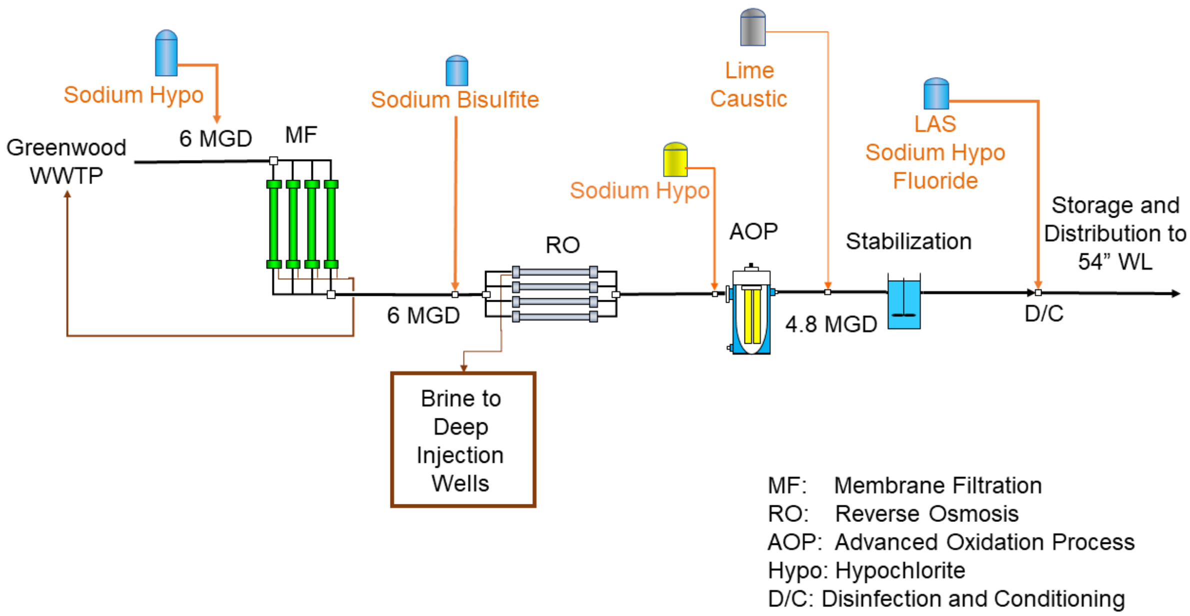

Figure 5B.4.2.
Process flow diagram of aquifer storage and recharge with direct potable reuse treatment

5B.4.2.3 Environmental Issues

The most significant environmental issue associated with the DPR project is repurposing Greenwood WWTP effluent that would otherwise be discharged to Oso Creek. Oso Creek receives treated domestic wastewater from a number of facilities, one industrial facility, three municipal storm sewer systems, four concrete production facilities, and three pesticide plants authorized to discharge. Based on a 3-year average from January 2015 to December 2017, the discharge from Greenwood WWTP was about 5.5 mgd. This represents about 50 percent of discharge to Oso Creek upstream of Davis Power Station. Oso Creek (Segment 2485A), is listed[5] to have bacteria impairment and water quality concerns of Chlorophyll-a, nitrates, and total P, as shown in Chapter 1, Planning Area Description, Table 1.2. Within the Oso Creek watershed, the most probable sources of bacteria is regulated stormwater, industrial sources, and nonpoint sources.[6] The Texas A&M University at Corpus Christi Center for Coastal Studies and local stakeholders have formed a group to study Oso Creek and in response, the TCEQ adopted a total maximum daily load[7] (TMDL) for Oso Creek on July 31, 2019 to monitor and reduce bacterial loads in Oso Creek. The U.S. Environmental Protection Agency (EPA)-approved the TMDL on October 25, 2019, and is now part of the state's Water Quality Management Plan. The Texas State Soil and Water Conservation Board is working to decrease bacterial loads from agriculture by assisting landowners in developing and implementing water quality management plans.

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[5] Nueces River Authority 2019 Basin Highlights Report: San Antonio-Nueces Coastal Basin, Nueces River Basin, Nueces-Rio Grande Coastal Basin. https://www.nueces-ra.org/CP/CRP/pdfs/2019_BHR.pdf

[6] TCEQ, One Total Maximum Daily Load for Indicator Bacteria in Oso Creek, Adopted July 2019.

[7] https://www.tceq.texas.gov/assets/public/waterquality/tmdl/67osocreekbacteria/67-osocreekbacteria.pdf

Additional studies are needed to evaluate the environmental impact of reducing Greenwood WWTP discharge to use as a supply for DPR.

In addition to diverting flow from Greenwood WWTP, treating the effluent to potable standards requires advanced treatment using reverse osmosis (RO) membranes. RO membranes effectively remove trace contaminants typically found in wastewater effluent as RO separates most dissolved salts, pathogens, and chemicals from the filtered water. Contaminants that may pose risks to aquatic ecosystems or downstream drinking water sources become highly concentrated in the RO brine. The concentration of contaminants increases relative to the amount of water recovered by RO. The estimated composition of the brine exiting the RO membranes for DPR is summarized in Table 5B.4.4. The brine composition was estimated using WWTP effluent data provided by the City and assumed an 80 percent recovery rate in the RO system, resulting in a concentration factor of 5.

Table 5B.4.4.
Estimated Brine Discharge and Total Dissolved Solids (TDS)

Treatment Process	DPR
Brine Flow from Aquifer (MGD)	0
Brine Flow from Direct Reuse (MGD)	1.2
Total (MGD)	1.2
Estimated Total Dissolved Solids (mg/L)	8,555

MGD=million gallons per day; DPR=direct potable reuse

To avoid impacting sensitive ecosystems or nearby drinking water sources, the brine is disposed of in deep injection wells, as shown in Figure 5B.4.3, which requires the City of Corpus Christi to acquire a Class I injection well permit. Disposal of waste by Class I well injection is regulated by TCEQ, and the City of Corpus Christi must obtain the permit, pursuant to the Texas Water Code (TWC), Chapter 27, and the Texas Health and Safety Code (THSC), Chapter 361. As part of construction of the injection well, completion of a well data report also is required.

A potential option could include permitting the injection wells under the Class I Underground Injection Code (UIC) General Permit WDWG010000 that provides authorization for use of a Class I injection well to inject nonhazardous brine from a desalination operation or nonhazardous drinking water treatment residuals. To obtain authorization to construct and operate a Class I well under the General Permit, a Notice of Intent (NOI) is submitted to TCEQ. As part of the general permitting process, TCEQ will review the City of Corpus Christi's compliance history.

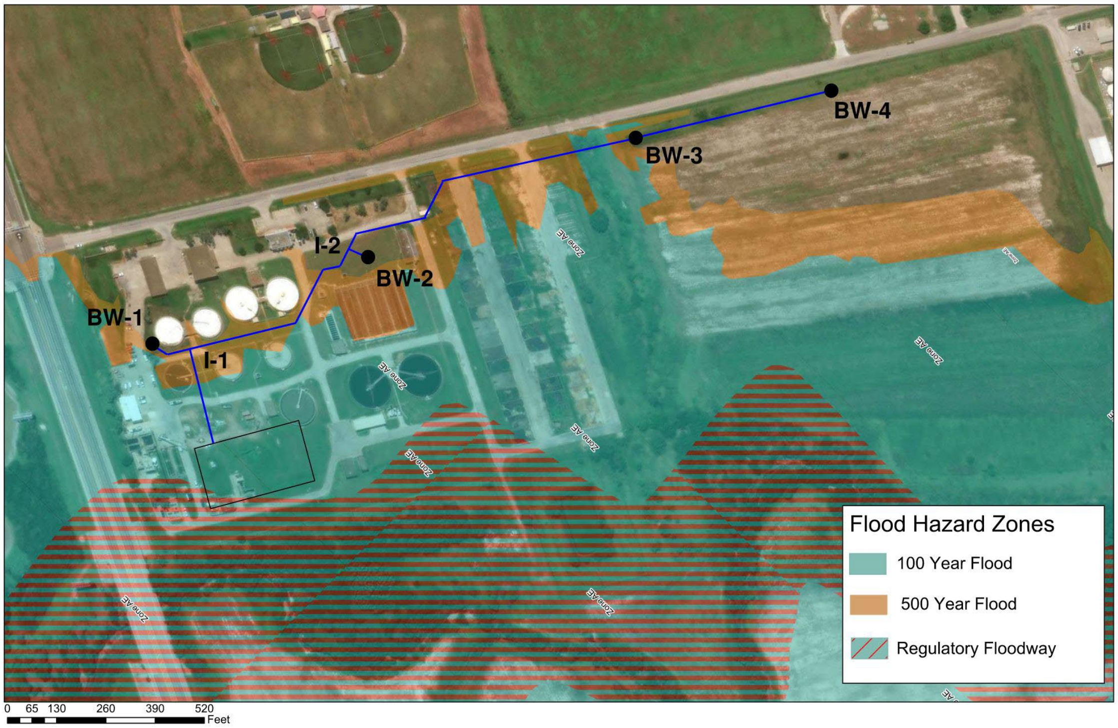

Figure 5B.4.3.
Proposed Reverse Osmosis Brine Well and Piping

If the NOI is administratively complete, TCEQ sends a letter to the City of Corpus Christi acknowledging authorization under the General Permit. The letter would include a unique identification number that has been assigned for each well at the facility that is authorized under the UIC General Permit. If TCEQ denies the City's NOI or authorization to inject waste under the General Permit, TCEQ provides written notice, including a statement of the basis for this decision.

To determine if a general permit or a site-specific permit is most applicable to this project, HDR will communicate further with the City of Corpus Christi regarding items that could affect general permit eligibility, including compliance history.

5B.4.2.4 Engineering and Costing

The effluent wastewater needs to be treated to reach requirements of the Safe Drinking Water Act and TCEQ. The DPR treatment system considers MF, RO, and ultraviolet (UV)/Chlorine advanced oxidation process (AOP). Cost estimates for the advanced treatment technologies (MF, RO, AOP) were provided by Newman Regency Group on March 20, 2023 and April 13, 2023. The cost estimates were evaluated using the Association for the Advancement of Cost Engineering (AACE) Class IV Opinion of Probable Cost level with an expected accuracy of -30 to +50 percent and the Texas Water Development Board's (TWDB) Uniform Costing Model (UCM), using a cost basis for September, 2023. Cost estimates are for review only and is not to be used for any other purpose. Considering recent material shortages and cost volatility, HDR

Engineering, Inc. (HDR) cannot guarantee that proposals, bids, or actual construction cost will not vary.

Reverse Osmosis

Reverse osmosis treatment uses high pressure to drive flow through a semipermeable membrane to remove dissolved constituents, like salts and pathogens. RO membranes have a pore size much smaller than MF, at approximately 0.0001 micrometers (µm). As the feed water overcomes the osmotic pressure within the membrane, it produces a filtered flow stream at a recovery rate of 70 to 97 percent depending on operating parameters and the total dissolved solids (TDS) concentration in the feed water. For the analysis in this study a conservative recovery of 80 percent was assumed. The filtered flow stream is nearly devoid of contaminants of concern, making RO membranes highly effective at removing bacteria, viruses, and inorganic contaminants. RO systems have a TDS removal rate of 94 to 98 percent, typically, and produce a concentrated brine stream that can be disposed of through deep injection wells or surface water systems with permit. RO systems are energy intensive systems to operate.

Advanced Oxidation Processes

The AOP system following the RO system uses a high intensity UV light in combination with free chlorine as a chemical oxidant. The oxidant degrades organic compounds and inorganic compounds in the wastewater effluent using highly reactive free radicals produced in the process thus rendering them inactive and incapable of harm.

5B.4.2.5 DPR Cost Estimate

The DPR only configuration planning-level cost estimate includes:

- DPR treatment (6 mgd)
  - MF + RO + UV/Chlorine AOP
- 4.8 MGD pump station at WWTP for potable water distribution
- 1.2 MGD pump station at WWTP for deep well injection
- 4 deep injection wells for reverse osmosis brine
  - 300 gallons per minute (gpm) each injecting to a depth of 3,400 feet
- 18-inch transmission pipeline from potable water pumpstation at WWTP to existing potable water line
- Land acquisition of 10 acres at cost of $10,000 per acre
- Survey and geotechnical costs estimated at $55,000 per mile
- Well supervisory control and data acquisition (SCADA) system estimated at 6 percent construction costs

The cost estimate for building treatment facilities, wells, and transmission pipelines to treat 6 mgd of WWTP effluent for DPR is presented in Table 5B.4.5.

The total project cost and annual cost are estimated to be $64,195,000 and $11,258,000, respectively. The unit cost of water is estimated to be $2,092 per ac-ft.

Table 5B.4.5.
Cost Estimate Summary,
City of Corpus Christi – DPR Only Configuration (Sept 2023 Prices)

Item	Estimated Costs
Capital Cost	
Deep Injection Piping (0.5 mi, 8 IN - 12 IN dia.)	$756,000
Deep Injection Wells (4 wells, 300 gpm, 3400 ft depth)	$11,205,000
Potable Water Piping (0.9 mi, 18 IN dia.)	$2,443,000
DPR Treatment (6 MGD, MF + RO + UV/Chlorine AOP)	$27,996,000
SCADA	$785,000
Total Cost of Facilities	**$43,185,000**
Engineering:	
- Planning (3%)	$1,296,000
- Design (7%)	$3,023,000
- Construction Engineering (1%)	$432,000
Legal Assistance (2%)	$864,000
Fiscal Services (2%)	$864,000
Pipeline Contingency (15%)	$366,000
All Other Facilities Contingency (20%)	$8,148,000
Environmental & Archaeology Studies and Mitigation	$143,000
Land Acquisition and Surveying (18 acres)	$177,000
Interest During Construction (3.5% for 3 years with a 0.5% ROI)	$5,697,000
Total Cost of Project	**$64,195,000**
Annual Cost	
Debt Service (3.5 percent, 20 years)	$4,512,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$152,000
Advanced Water Treatment Facility	$6,455,000
Pumping Energy Costs (1542424 kW-hr @ 0.09 $/kW-hr)	$139,000
Total Annual Cost	**$11,258,000**
Available Project Yield (acft/yr)	5,381
Annual Cost of Water ($ per acft)	$2,092
Annual Cost of Water After Debt Service ($ per acft)	$1,254
Annual Cost of Water ($ per 1,000 gallons)	$6.42
Annual Cost of Water After Debt Service ($ per 1,000 gallons)	$3.85

5B.4.2.6 Implementation Issues

The deep injection wells required for RO brine disposal will require a Class I injection well permit. Upon receipt of the application for an injection well permit, TCEQ staff date stamp the application and review the application for administrative completeness. The applicant may be contacted by way of an administrative deficiency letter for clarification or additional information at any time during the administrative review.

Within 30 days of the date that the application is determined to be administratively complete, the Chief Clerk mails the Notice of Receipt of Application and Intent to Obtain Permit to the applicant, to potentially affected persons, and to others. The applicant is responsible for newspaper publication of notice of the application in accordance with 30 Texas Administrative Code (TAC) §39.418(b)(1) and §39.651(c). The applicant must also place a copy of the administratively complete application in a public place in accordance with 30 TAC §39.405(g).

TCEQ begins a technical review of the application as soon as the application is administratively complete. As part of the technical review, staff evaluate the applicant's compliance history for the previous 5 years, including the company and facility compliance classification and rating. The applicant may be contacted by way of a technical notice of deficiency letter for clarification or additional information at any time during the technical review. TCEQ will issue no more than two notice of deficiency letters.

After the technical review, TCEQ makes a preliminary decision to issue a permit or recommend denial of the permit. TCEQ delivers the preliminary decision concurrently with the Notice of Application and Preliminary Decision to the applicant, to potentially affected persons, and to others. The applicant is responsible for newspaper publication of the Notice of Application and Preliminary Decision in accordance with 30 TAC §39.419(b) and §39.651(d).

Public comments must be filed with TCEQ within the time period specified in the notice. The public comment period ends 30 days (nonhazardous waste permits) or 45 days (hazardous waste permits) after the last publication of the Notice of Application and Preliminary Decision, except as provided in 30 TAC §55.152. If comments are received, TCEQ prepares a response to comments and files the response to comments with the TCEQ Chief Clerk within 60 days following the close of the comment period in accordance with 30 TAC §55.156. The TCEQ Chief Clerk mails the Executive Director's decision, the Executive Director's response to public comments, instructions for requesting that the Commission reconsider the Executive Director's decision, and instructions for requesting a contested case hearing.

The Executive Director may act on an uncontested application if public notice requirements have been satisfied and the application meets all relevant statutory and administrative criteria in accordance with 30 TAC §50.133. The TCEQ Chief Clerk mails notice of the action and an explanation of the opportunity to file a motion to overturn the Executive Director's action on the application. A motion to overturn must be filed no later than 20 days after the signed permit is mailed to the applicant in accordance with §50.139.

5B.4.2.7 Evaluation Summary

An evaluation summary of this water management option is provided in Table 5B.4.6.

Table 5B.4.6.
Evaluation Summary of City of Corpus Christi DPR Project

Impact Category	Comment(s)
a. Water Supply	
1 Quantity	1. Yield: 5,381 ac-ft/yr
2. Reliability 3. Cost of Treated Water	2. Reliable, based on system operations 3. $2,092 per ac-ft
b. Environmental factors	
1. Instream flows	1. Low impact. Reduced flow in Oso Creek.
2. Bay and Estuary Inflows and arms of the Gulf of Mexico	2. None or low impact.
3. Wildlife Habitat	3. None or low impact.
4. Wetlands	4. None or low impact.
5. Threatened and Endangered Species	5. None.
6. Cultural Resources	6. No cultural resources affected.
7. Water Quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. a. Dissolved solids are estimated to be around 2,000 mg/L for non-potable use. If water use needed is potable, additional treatment will be required. b. Salinity are addressed for non-potable use. If water use needed is potable, additional treatment will be required. c. Bacteria is addressed with treatment process. d. Chlorides are estimated to be around 750 mg/L for non-potable use. If water use needed is potable, additional treatment will be required. e-h. None or low impact i. Nitrate, TSS, TOC, and Mn addressed with treatment processes.
c. Impacts to agricultural resources and State water resources	• Reduce discharge to Oso Creek.
d. Threats to agriculture and natural resources in region	• None
e. Recreational impacts	• None
f. Equitable Comparison of Strategies	• Standard analyses and methods used
g. Interbasin transfers	• None
h. Third party social and economic impacts from voluntary redistribution of water	• Reduce discharge to Oso Creek.
i. Efficient use of existing water supplies and regional opportunities	• Reuses water supply and compatible with regional development.
j. Effect on navigation	• None
k. Impacts on water pipelines and other facilities used for water conveyance	• None

5B.4.3 Oso Regional WWTP Reuse

5B.4.3.1 Description of Strategy

The City of Corpus Christi is evaluating alternative water reclamation and reuse applications. DPR could potentially partially satisfy potable water demand increase, especially for manufacturing water use applications, thus minimizing the size and cost of other alternative water supplies that the City of Corpus Christi could add to its portfolio. After evaluating four WWTP sites owned and maintained by the City of Corpus Christi, the City of Corpus Christi determined that Oso WWTP is the most viable location for a DPR plant, as it has the largest volume of effluent available for reuse. The project layout is included in Figure 5B.4.4.

The City of Corpus Christi is in the process of developing a source water characterization report, preparing pilot plant planning and design documents, and summarizing reuse alternatives. At the time of preparation of the Initially Prepared regional water plan, information was not readily available to evaluate this strategy nor was this strategy included in the scope of work approved by the CBRWPG on May 16, 2024. Information is anticipated to be available between the Initially Prepared Regional Water Plan and the Final Plan. Pursuant to CBRWPG directives at the December 12, 2025, meeting, this placeholder is included in the Initially Prepared regional water plan with the understanding that the City of Corpus Christi will fund the evaluation of this strategy for inclusion in the *2026 Coastal Bend Regional Water Plan*.

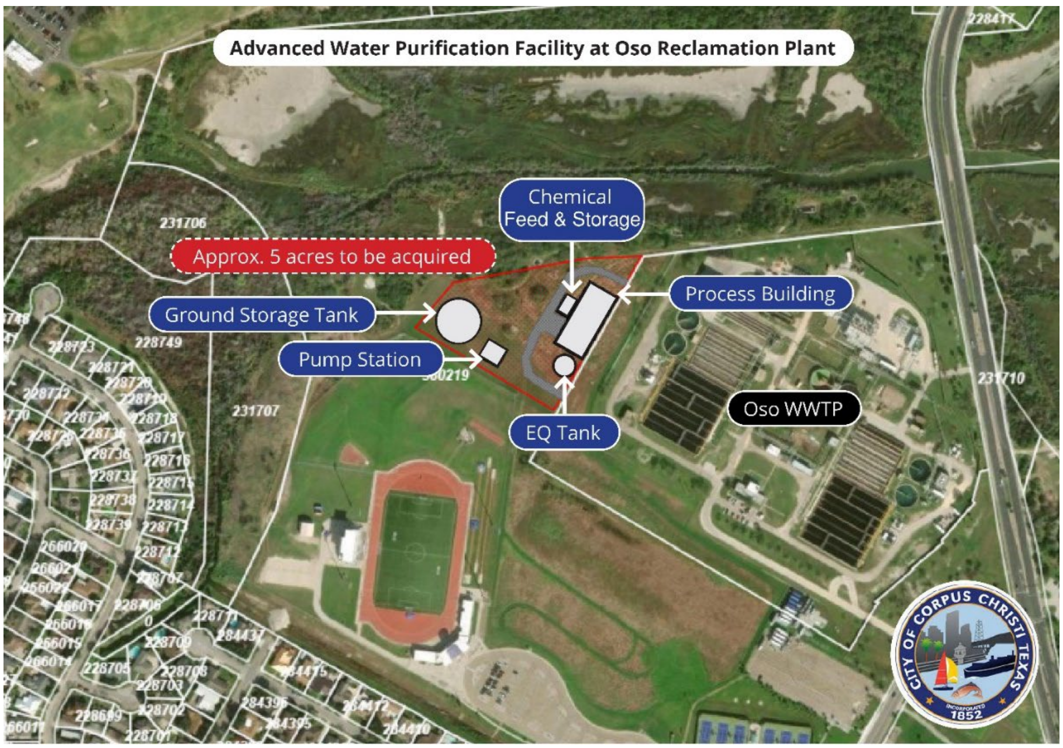

Figure 5B.4.4.
Project layout at Oso WWTP

5B.4.3.2 Available Yield

No information is available at this time of preparation of the Initially Prepared regional water plan. See note above in Section 5B.4.3.1.

5B.4.3.3 Environmental Issues

No information is available at this time of preparation of the Initially Prepared regional water plan. See note above in Section 5B.4.3.1.

5B.4.3.4 Engineering and Costing

No information is available at this time of preparation of the Initially Prepared regional water plan. See note above in Section 5B.4.3.1.

5B.4.3.5 Cost Estimate

No information is available at this time of preparation of the Initially Prepared regional water plan. See note above in Section 5B.4.3.1.

5B.4.3.6 Implementation Issues

No information is available at this time of preparation of the Initially Prepared regional water plan. See note above in Section 5B.4.3.1.

5B.4.3.7 Evaluation Summary

No information is available at this time of preparation of the Initially Prepared regional water plan. See note above in Section 5B.4.3.1. An evaluation summary of this water management option consistent with other water management strategies will be included in the *2026 Coastal Bend Regional Water Plan*.

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5B.5

Aquifer Storage and Recovery

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Section 5B.5 Aquifer Storage and Recovery

5B.5.1 Description of Strategy

Aquifer storage and recovery (ASR) is a process whereby water is placed into an aquifer for storage to be recovered for beneficial use during a later time when needed. In Texas, treated water is normally recharged into the aquifer through well(s)[1]. During recharge and recovery cycles, well screens placed in productive zones for storage allow water to flow through porous areas of the aquifer. The stored water is then recovered and used when water supplies are constrained, such as during drought, periods of high seasonal demands, or water service interruptions. Monitoring wells are used to help maintain a buffer zone within the aquifer between stored and native groundwater and manage storage for supply system operations. ASR can be readily adapted to current infrastructure, delay costly system improvements, and provide supply system redundancy for reliability.

The City of Corpus Christi, in conjunction with the Corpus Christi Aquifer Storage and Recovery Conservation District (District), completed a Corpus Christi ASR Feasibility Project in August 2019. The project was partially funded by a grant from the Texas Water Development Board (TWDB) to study innovative water solutions to promote long term, cost-effective, reliable water supplies for future growth. The work included (1) developing a field-testing plan (2) conducting an exploratory test drilling and sampling program (3) performing a geochemical analysis for source and groundwater compatibility (4) developing a groundwater model and simulating potential ASR operations for long-term drought and supply augmentation during peaking and (5) evaluating ASR operating policies toward project implementation. The final report is accessible on the TWDB website[2]. During the study, both O.N. Stevens water treatment plant (WTP) and Greenwood wastewater treatment plant (WWTP) effluent were evaluated as potential supplies. Based on City of Corpus Christi staff directives, it was determined that Greenwood WWTP effluent was the preferred recharge source due to less competing needs for its use, native groundwater quality considerations, and more frequent availability for recharge than O.N. Stevens WTP water. A conceptual ASR schematic is shown in Figure 5B.5.1.

The first Corpus Christi ASR alternative, also included previously in the *2021 Coastal Bend Regional Water Plan*, upcycles treated effluent from the Greenwood WWTP for beneficial non-potable, industrial water supply during droughts and/or high seasonal demands. Greenwood WWTP effluent is treated and conditioned prior to recharge for storage in the brackish Gulf Coast Aquifer System. After multiple cycles, water quality improves and stored water takes on the characteristics of the recharge water separated by a buffer zone from native groundwater. Based on exploratory testing results, the most favorable ASR storage zones are located between 350 and 800 feet below ground surface. The recovered water quality is estimated to

[1]For most previous ASR applications, TCEQ has required treatment to drinking water standards prior to recharge but newer rules passed in 2015 and described in Section 5 of Exhibit G may give some flexibility since both the quality of the effluent relative to drinking water is considered along with the potential to degrade the native groundwater.

[2]https://www.twdb.texas.gov/publications/reports/contracted_reports/doc/1600011956_Corpus_Christi_ASR.pdf?d=1581391239865

have total dissolved solids (TDS) and chloride levels around 2,000 and 750 milligrams per liter (mg/L), respectively. Reverse osmosis (RO) treatment can be added to reduce TDS and chloride levels.

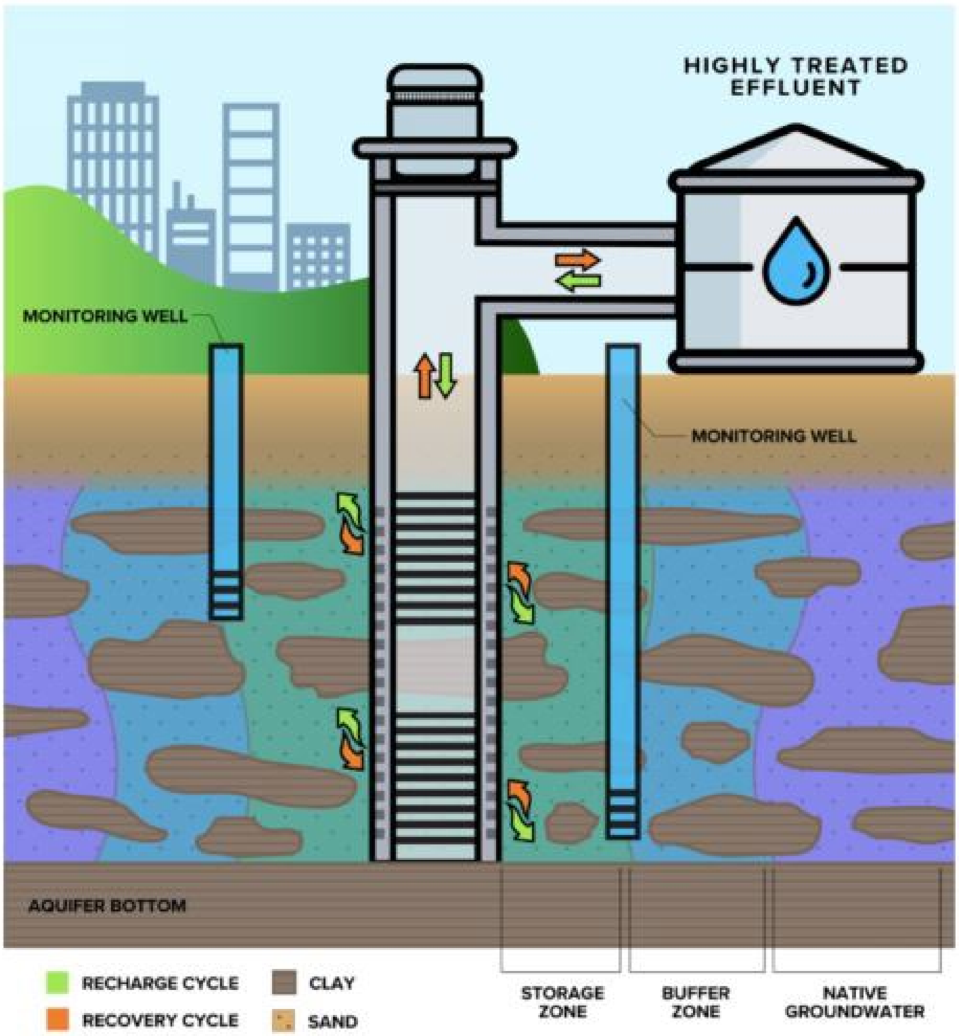

Figure 5B.5.1.
Conceptual ASR Process

For ASR projects, it is important to evaluate source water compatibility with native groundwater and aquifer minerology to avoid adverse mechanical and chemical processes with project implementation. The geochemical analysis did not identify any fatal flaws; however, pilot testing of tertiary treatment of WWTP effluent is needed prior to aquifer recharge and monitoring during pilot testing will be critical in proving up geochemical desk-top analyses prior to full scale project implementation and remove suspended materials to avoid clogging the fine sand in aquifer formation for storage. Prior to implementation, a piloting program is needed to verify field tests and confirm water treatment processes necessary to obtain a Texas Commission on Environmental Quality (TCEQ) permit for ASR production, which requires that the source water for recharge to be treated to a sufficient quality so as to not impact or impair the aquifer formation or groundwater. The Greenwood WWTP effluent will need to be improved with additional treatment upgrades to reduce the following constituents in the existing effluent that could affect operations:

- Total Suspended Solids (TSS)
- Nitrate (NO_3)
- Total Organic Carbon (TOC)
- Manganese (Mn)
- Bacteria

A field-scale groundwater model was constructed using site-specific data collected during the exploratory testing program. The model was then used to simulate most likely ASR operational scenarios[3] based on source water availability and future water demands in the vicinity of the project site to determine yield. During scenario development, it was determined that industrial water users in the vicinity of the ASR wellfield would be the most likely customers for recovered water. This determination is based on projected future growth and non-potable needs that could be met with ASR supplies with minimal to no treatment anticipated after recovery.

In December 2022, City of Corpus Christi staff initiated a technical study to develop an alternative treatment strategy to treat WWTP effluent for an indirect potable reuse (IPR) system using ASR along with a limited direct potable reuse (DPR) system. A DPR-only treatment option was also explored, which is included in Chapter 5B.4 - Reuse. IPR is the process of discharging treated municipal wastewater into an environmental buffer, like the Gulf Coast Aquifer, where the treated wastewater will be diluted and undergo additional natural treatment processes before being withdrawn and treated to drinking water standards. DPR refers to using treated municipal wastewater and providing additional advanced treatment so that potential chemical and biological contaminants are removed to meet drinking water standards. The alternative was evaluated by (1) developing layouts for an IPR system using ASR and a limited DPR treatment system and estimating construction costs, (2) evaluating brine disposal that is generated from reverse osmosis treatment and permitting issues, and (3) preparing a high-level project schedule.

The IPR and DPR-only alternatives differ from the previous 2019 ASR feasibility study in that the reuse goal for this evaluation is to treat the water to potable standards. The shortages indicate a need to secure alternative water sources and explore new storage methods such as ASR which can be used along with an IPR treatment strategy for reuse. Both IPR and DPR are viable options as water supply sources. Environmental permitting is still needed for disposal of waste generated during advanced treatment and will be an important step in implementing either of these strategies.

This strategy considers two conceptual alternatives: Option 1- Non-Potable ASR phased for up to 18 million gallons per day (mgd) and Option 2- Potable ASR/IPR with limited DPR.

[3] Based on conversations with City Staff and stakeholders

5B.5.2 Available Yield

The Corpus Christi Non-Potable Aquifer Storage and Recovery Project (Option 1) is a phased project, with the initial size based on current Greenwood WWTP capacity and capable of expansion to address industrial growth by providing up to 18 mgd of new water supply.

The non-potable ASR Phase I is focused on 10 wells at the Corpus Christi International Airport site and Phase II adds 5 wells to the east of Phase I. A schematic showing transmission pipelines, Phase I and II wells and associated well field pipeline, and delivery location is shown in Figure 5B.5.2. Phase I and II operated conjunctively would be capable of providing about 10 mgd from ASR well operation, and up to 18 mgd with Greenwood WWTP expansion[4].

The Phase I and II findings from the Corpus Christi ASR Feasibility Project are as follows:

Phase I

- Phase I limits recharge to 5 mgd, which is based on current available Greenwood WWTP capacity after considering existing contracts to provide treated effluent to golf courses and would be capable of providing up to 8 mgd through recovery at ASR wells.
- If tertiary treated Greenwood WWTP effluent by-passes ASR and is delivered concurrent with ASR recovery, then the combined water supply would be 13 mgd for Phase I.

Phase II

- Based on City of Corpus Christi staff input, Greenwood WWTP will likely be expanded to 10 mgd by 2030 to 2035. With tertiary treatment expansion to 10 mgd, it is assumed that up to 8 mgd would be available for ASR project and/or delivery to industrial customers.
- Phase I and II operated conjunctively would provide about 10 mgd from ASR well operation, and up to 18 mgd total by-passed water from Greenwood WWTP expansion[5].

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[4] Based on City staff feedback, Greenwood WWTP expansion to 12 MGD by Year 2025-2030 would result in about 8 MGD treated effluent available for potential ASR use.

[5] Based on City staff feedback, Greenwood WWTP expansion to 12 MGD by Year 2025-2030 would result in about 8 MGD treated effluent available for potential ASR use.

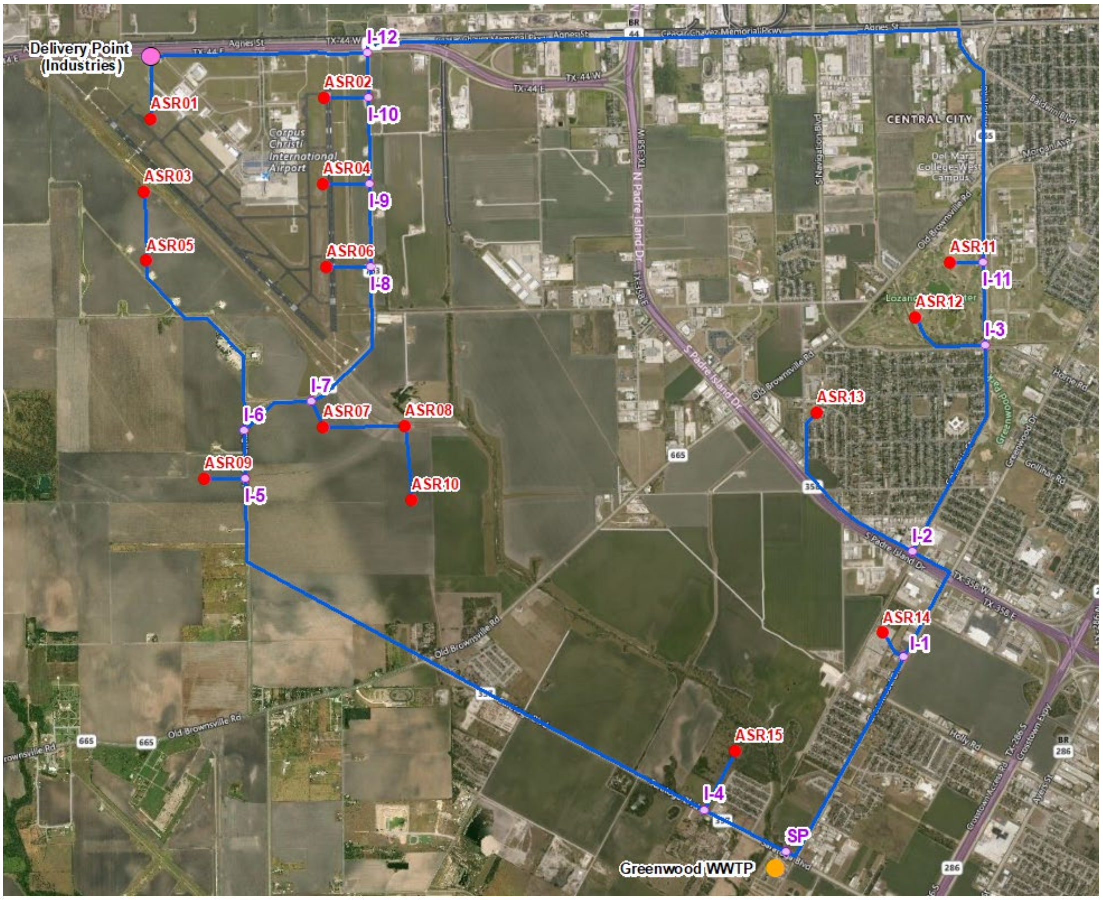

Figure 5B.5.2.
Project Layout of the Corpus Christi ASR Feasibility Project (Phase I and II)

The ASR/IPR with limited DPR reuse strategy (Option 2) treats 6 mgd of Greenwood WWTP effluent with microfiltration (MF), diverting 5 mgd for ASR during seasonal periods of low water demand and further treating 1 mgd with advanced RO processes to meet DPR standards. During periods of high-water demand, 8 mgd of water can be withdrawn from the aquifer, treated through MF/RO, and blended with the DPR water. ASR provides a long-term strategy for the storage of water supply and helps recharge the local aquifer system to improve groundwater quality. The use of ASR requires the installation of nearly 13.4 miles of piping, 10 ASR wells, and a booster pump station at the Corpus Christi International Airport.

5B.5.3 Environmental Issues

The 2001 Agreed Order includes provisions for 151,000 acre-feet per year (ac-ft/yr) of freshwater inflows to the Nueces Bay and Estuary System, made up with a combination of 54,000 acre-feet (ac-ft) return flow credit and remaining 97,000 ac-ft from pass-throughs and controlled releases from the Choke Canyon Reservoir/Lake Corpus Christi System (CCR/LCC System) according to inflow and stored water levels. The actual wastewater discharges in 2017 and 2018 amounted to 84,663 and 92,327 ac-ft, respectively. It is unlikely that use of Greenwood WWTP effluent as a source water for ASR will have a meaningful impact on achieving freshwater inflow requirements associated with the 2001 Agreed Order.

The most significant environmental issue associated with the ASR project is repurposing Greenwood WWTP effluent that would otherwise be discharged to Oso Creek. Oso Creek receives treated domestic wastewater from a number of facilities, one industrial facility, three municipal storm sewer systems, four concrete production facilities, and three pesticide plants authorized to discharge. Based on a 3-year average from January 2015-December 2017, the discharge from Greenwood WWTP was about 5.5 mgd. This represents about 50 percent of discharge to Oso Creek upstream of Davis Power Station. Oso Creek (Segment 2485A) is listed[6] to have bacteria impairment and water quality concerns of Chlorophyll-a, nitrates, and total phosphorus, as shown in Chapter 1-Planning Area Description, Table 1.2. Within the Oso Creek watershed, the most probable sources of bacteria are regulated stormwater, industrial sources, and nonpoint sources.[7] The Texas A&M University at Corpus Christi Center for Coastal Studies and local stakeholders have formed a group to study Oso Creek and in response, the TCEQ adopted a total maximum daily load[8] (TMDL) for Oso Creek on July 31, 2019, to monitor and reduce bacterial loads in Oso Creek. The U.S. Environmental Protection Agency (EPA)-approved the TMDL on October 25, 2019, and is now part of the state's Water Quality Management Plan. The Texas State Soil and Water Conservation Board is working to decrease bacterial loads from agriculture by assisting landowners in developing and implementing water quality management plans. Additional studies are needed to evaluate the environmental impact of reducing Greenwood WWTP discharge to use as a supply for ASR.

In addition to diverting flow from Greenwood WWTP, treating the effluent to potable standards requires advanced treatment using RO membranes. RO membranes effectively remove trace contaminants typically found in wastewater effluent as RO separates most dissolved salts, pathogens, and chemicals from the filtered water. Contaminants that may pose risks to aquatic ecosystems or downstream drinking water sources become highly concentrated in the RO brine. The concentration of contaminants increases relative to the amount of water recovered by RO. The estimated composition of the brine exiting the RO membranes for DPR is summarized in Table 5B.5.1. The brine composition was estimated using WWTP effluent data provided by the City of Corpus Christi and assumed an 80 percent recovery rate in the RO system, resulting in a concentration factor of 5.

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[6] Nueces River Authority 2019 Basin Highlights Report: San Antonio-Nueces Coastal Basin, Nueces River Basin, Nueces-Rio Grande Coastal Basin. https://www.nueces-ra.org/CP/CRP/pdfs/2019_BHR.pdf

[7] TCEQ, One Total Maximum Daily Load for Indicator Bacteria in Oso Creek, Adopted July 2019.

[8] https://www.tceq.texas.gov/assets/public/waterquality/tmdl/67osocreekbacteria/67-osocreekbacteria.pdf

Table 5B.5.1.
Estimated Brine Discharge and Total Dissolved Solids (TDS)

Treatment Process	IPR and limited DPR
Brine Flow from Aquifer (MGD)	1.6
Brine Flow from Direct Reuse (MGD)	0.2
Total (MGD)	1.8
Estimated Total Dissolved Solids (mg/L)	9,839

MGD=million gallons per day; DPR=direct potable reuse; IPR=indirect potable reuse

To avoid impacting sensitive ecosystems or nearby drinking water sources, the brine is disposed of in deep injection wells, as shown in Figure 5B.5.3, which requires the City of Corpus Christi to acquire a Class I injection well permit. Disposal of waste by Class I well injection is regulated by TCEQ, and the City of Corpus Christi must obtain the permit, pursuant to the Texas Water Code (TWC), Chapter 27, and the Texas Health and Safety Code (THSC), Chapter 361. As part of construction of the injection well, completion of a well data report also is required.

A potential option could include permitting the injection wells under the Class I Underground Injection Code (UIC) General Permit WDWG010000 that provides authorization for use of a Class I injection well to inject nonhazardous brine from a desalination operation or nonhazardous drinking water treatment residuals. To obtain authorization to construct and operate a Class I well under the General Permit, a Notice of Intent (NOI) is submitted to TCEQ. As part of the general permitting process, TCEQ will review the City of Corpus Christi’s compliance history.

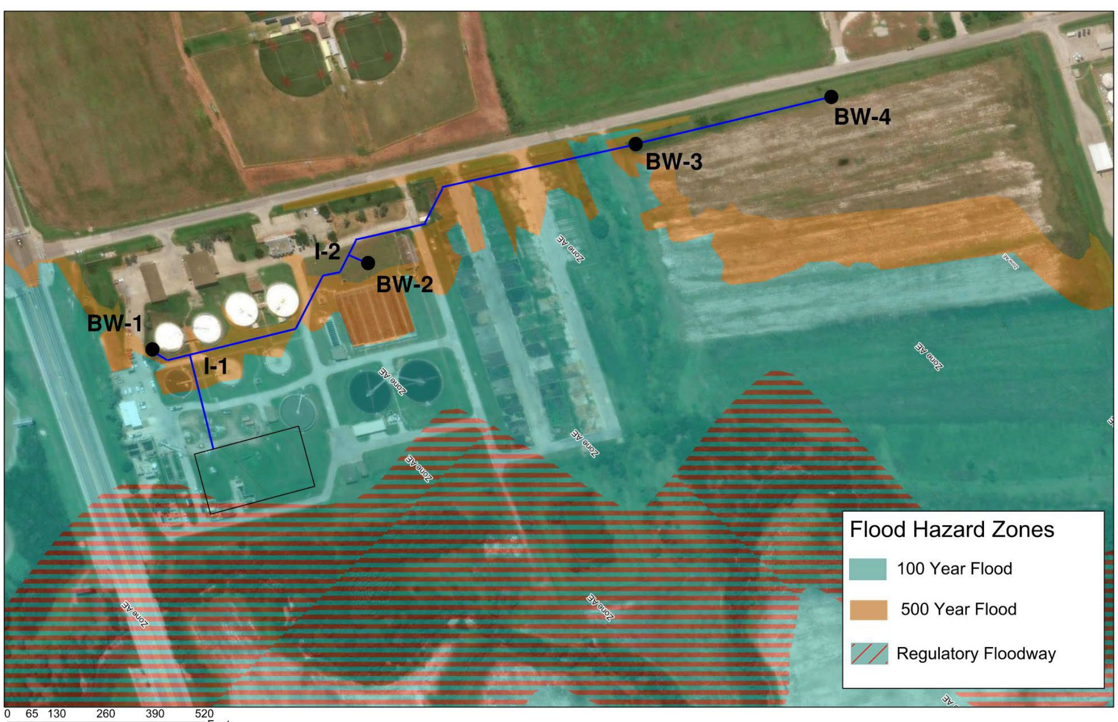

Figure 5B.5.3.
Proposed Reverse Osmosis Brine Well and Piping

If the NOI is administratively complete, TCEQ sends a letter to the City of Corpus Christi acknowledging authorization under the General Permit. The letter would include a unique identification number that has been assigned for each well at the facility that is authorized under the UIC General Permit. If TCEQ denies the City of Corpus Christi's NOI or authorization to inject waste under the General Permit, TCEQ provides written notice, including a statement of the basis for this decision.

To determine if a general permit or a site-specific permit is most applicable to this project, HDR Engineering, Inc. (HDR) will communicate further with the City of Corpus Christi regarding items that could affect general permit eligibility, including compliance history.

5B.5.4 Engineering and Costing

The non-potable ASR project (Option 1) includes two phases (Phase I and II) based on current WWTP treatment capacity and phased according to industrial growth needs. If tertiary treated Greenwood WWTP effluent by-passes ASR and is delivered concurrent with ASR recovery, then the combined water supply would be 13 mgd for Phase I. Phase I and II operated conjunctively would be capable of providing about 10 mgd from ASR well operation, and up to 18 mgd with Greenwood WWTP expansion[9].

The current secondary treatment process at the Greenwood WWTP consists of a conventional, activated sludge treatment system. The system effectively reduces the biochemical oxygen demand (BOD) and nitrifies the influent ammonia. However, augmentations to the secondary treatment system are required to reduce the effluent nitrate (NO_3). This process will reduce NO_3 to less than 10 mg/L, the maximum contaminant level (MCL). A Modified Ludzack-Ettinger (MLE) process is proposed to complete this treatment. To fully treat the wastewater effluent after the MLE process to sufficient quality to be able to inject it into the aquifer, additional unit processes will likely be required. The main parameters to be reduced or removed in the tertiary system are manganese, TSS, TOC, and bacteria. Three treatment trains are recommended to be compared during the pilot system, which will inform and direct the Phase I and II project construction and later expansion of the treatment plant. The proposed pilot plant arrangement is shown in Figure 5B.5.4.

In the absence of pilot system results, the cost analysis considers secondary treatment improvements and the additional tertiary system considers the following processes:

- Tertiary Membrane Filtration (Microfiltration)
- Ozone and Biologically Active Filter (BAF)
- Ozone and BAF with Microfiltration polishing

5B.5.4.1 Microfiltration

The standard method for removing suspended particles is typically through a membrane filter. Microfiltration, or tertiary membrane filtration (TMF), through hollow fiber membranes is an

[9] Based on City staff feedback, Greenwood WWTP expansion to 12 MGD by Year 2025-2030 would result in about 8 MGD treated effluent available for potential ASR use.

efficient system to effectively remove particles larger than 1 micrometer (μm), which includes most bacteria. The system will use a submerged membrane configuration and be maintained with an air scouring system with periodic cleaning using acid based cleaners. The physical filtration mechanism should efficiently remove TSS and bacteria once the MLE system removes NO_3. Microfiltration treatment will likely not sufficiently remove TOC or dissolved manganese.

5B.5.4.2 Ozone and Biologically Active Filters

Biologically active filters operate in a similar way as a traditional slow sand filter. However, a biologically active layer is allowed to develop at the surface of the filter to further treat organic constituents. Ozone is used as an oxidizer before the filter to breakdown recalcitrant TOC that was not available to be processed in the secondary treatment. The biological layer for the BAF will then consume the now biodegradable TOC. An additional benefit of the configuration is that any remaining Mn is expected to be oxidized and removed.

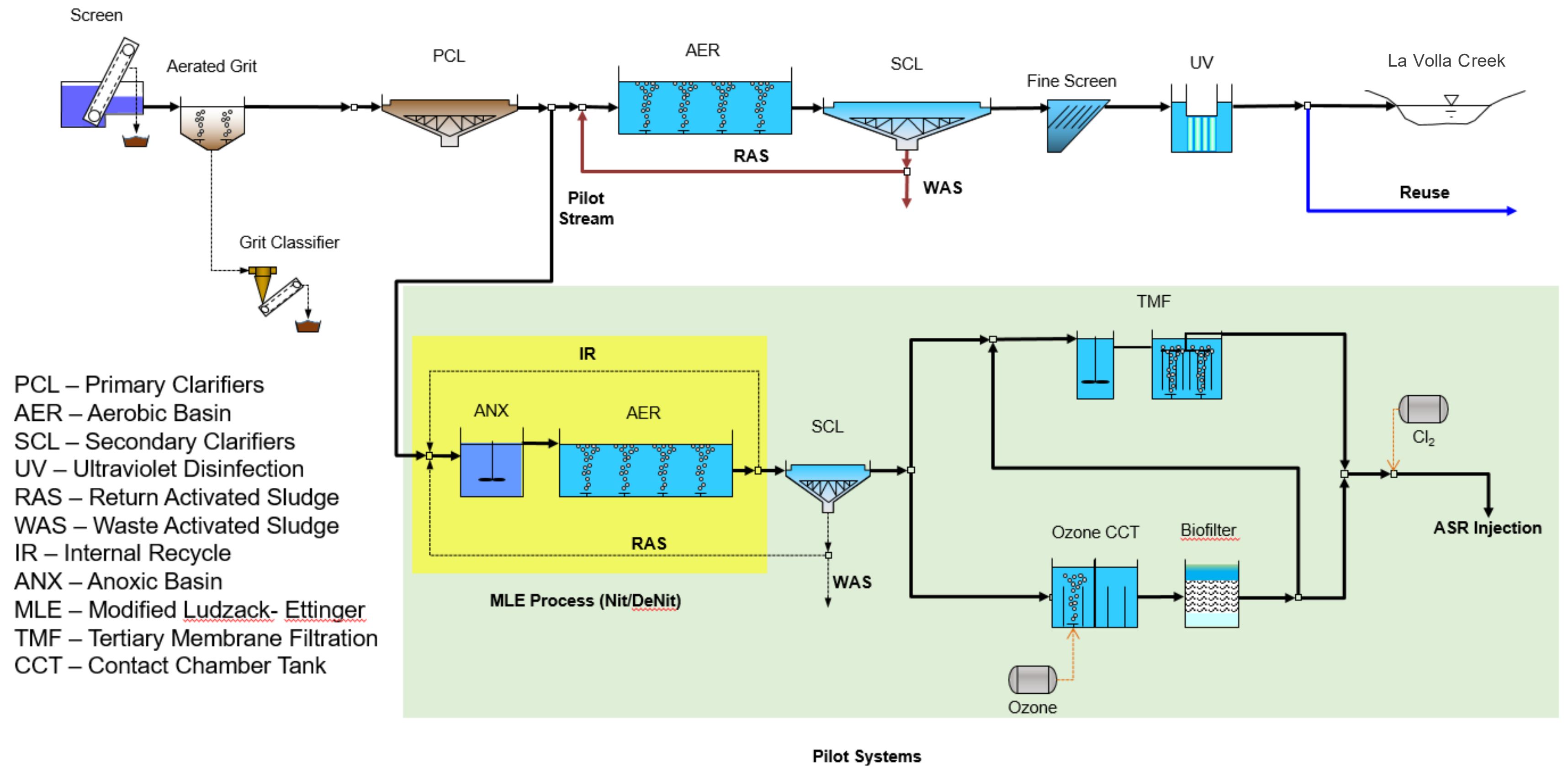

Figure 5B.5.4.
Proposed Pilot System Configuration Process Flow Diagram

Potential inefficiencies of the treatment systems is that the bacteria from the biologically active area may be carried into the effluent and TSS will likely not be sufficiently reduced.

5B.5.4.3 Ozone and BAF with Microfiltration polishing

The combination of the two treatment systems should effectively treat the effluent to a level that will not significantly impact the aquifer environment. All constituents of concern should be removed to meet water quality requirements for ASR injection as detailed previously. This option effectively eliminates individual limitations for the TMF and Ozone/BAF systems.

The IPR and limited DPR project includes 1 mgd for DPR treatment, 5 mgd for recharge, and 8 mgd for recovery. HDR developed cost estimates for the improvements for the additional treatment technologies, ASR wells and piping, brine disposal wells, and transmission line for potable water from the WWTP to an existing water line. Cost estimates for the advanced treatment technologies (MF, RO, advanced oxidative process (AOP)) were provided by Newman Regency Group on March 20, 2023, and April 13, 2023. The cost estimates for both options were evaluated using the Association for the Advancement of Cost Engineering (AACE) Class IV Opinion of Probable Cost level with an expected accuracy of -30 to +50 percent and the TWDB's Uniform Costing Model (UCM), using a cost basis for September 2023. Cost estimates are for review only and is not to be used for any other purpose. Considering recent material shortages and cost volatility, HDR cannot guarantee that proposals, bids, or actual construction cost will not vary.

In the absence of pilot system results, the cost analysis for Potable ASR/IPR and Limited DPR Reuse (Option 2) includes treatment of membrane filtration for recharge and membrane filtration and RO for recovery. The proposed treatment process flow diagram for potable ASR/IPR with limited DPR reuse alternative (Option 2) is shown in Figure 5B.5.5.

5B.5.4.4 Membrane Filtration

Membrane filtration refers to both microfiltration and ultrafiltration, which are low-pressure driven separation processes using a semipermeable membrane. Membrane filtration systems have a pore size ranging from 0.01-10 µm and are effective at removing turbidity, bacteria, fats, oils, colloids, and microparticles. MF is often used as a pretreatment to RO and improves RO performance by increasing flux and reducing membrane fouling.

5B.5.4.5 Reverse Osmosis

RO treatment uses high pressure to drive flow through a semipermeable membrane to remove dissolved constituents, like salts and pathogens. RO membranes have a pore size much smaller than membrane filtration, at approximately 0.0001 µm. As the feed water overcomes the osmotic pressure within the membrane, it produces a filtered flow stream at a recovery rate of 70 to 97 percent depending on operating parameters and the TDS concentration in the feed water. For the analysis in this study a conservative recovery of 80 percent was assumed. The filtered flow stream is nearly devoid of contaminants of concern, making RO membranes highly effective at removing bacteria, viruses, and inorganic contaminants. RO systems have a TDS removal rate of 94 to 98 percent, typically, and produce a concentrated brine stream that can be disposed of through deep injection wells or surface water systems with permit. RO systems are energy intensive systems to operate.

5B.5.4.6 Ultraviolet Advanced Oxidation Processes (AOP)

The AOP system following the RO system uses a high intensity ultraviolet (UV) light in combination with free chlorine as a chemical oxidant. The oxidant degrades organic compounds and inorganic compounds in the wastewater effluent using highly reactive free radicals produced in the process thus rendering them inactive and incapable of harm.

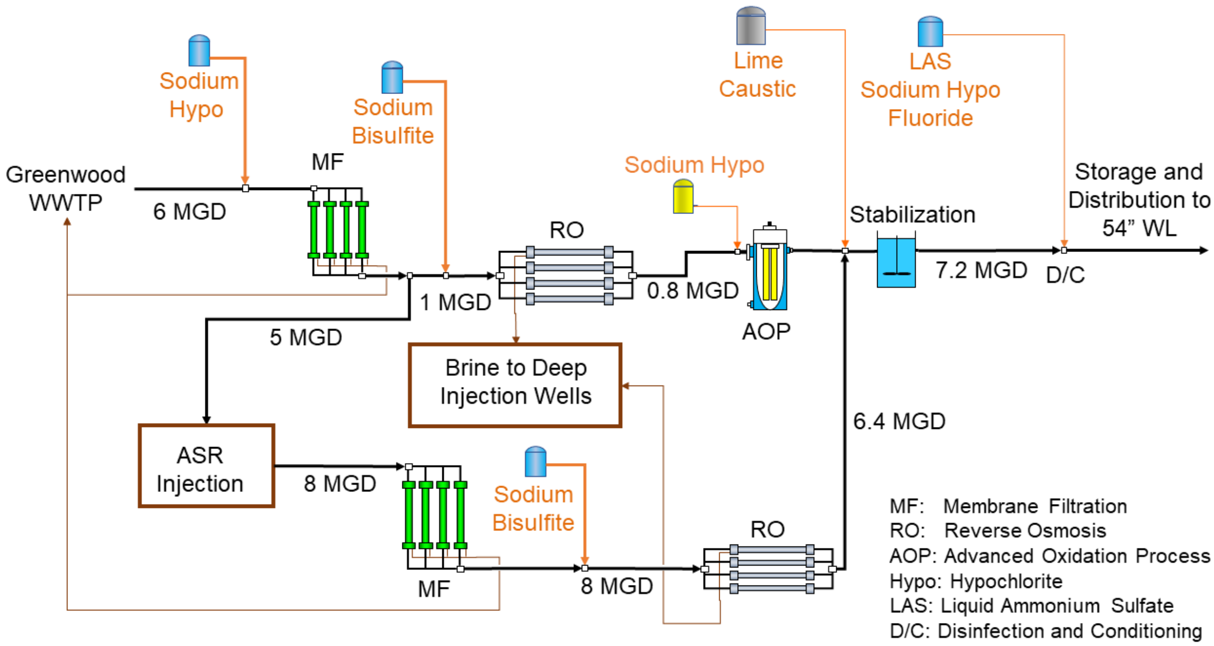

Figure 5B.5.5.
Process Flow Diagram of Aquifer Storage and Recovery with Indirect and Direct Potable Reuse Treatment

5B.5.4.7 ASR with Non-potable Reuse, Phase I Cost Estimate

The Phase I planning-level cost estimate includes:

- 10 wells constructed and equipped to:
  - Recharge up to 415 gallons per minute (gpm) each (total 5.976 mgd, or about 20 percent extra to account for well downtime and/or maintenance)
  - Recover up to 685 gpm each (total 9.8 mgd, or about 23 percent to account for well downtime and/or maintenance)
- 5 mgd pump station at Greenwood WWTP (for recharge)
- 10.9 mgd booster pump station near Phase I wellfield (for recovery)
- 24-inch transmission pipeline from tertiary treatment facilities at Greenwood WWTP to Phase I well field and 8-inch to 30-inch well field piping

- 30-inch diameter pipe to deliver total Phase I supply produced by 10 wells to a delivery point located to the north west of the Corpus Christi International Airport on Agnes Road, south of the intersection of Bronco Road and Interstate Hwy 44
- 2-million-gallon (MG) terminal storage tank
- Supervisory control and data acquisition system (SCADA) estimated at 3 percent of construction costs
- Easement acquisition of 96 acres at cost of $10,000 per acre
- Survey and geotechnical costs estimated at $55,000 per mile
- Tertiary treatment (5 mgd)
  - MLE treatment
  - Additional tertiary treatment (low to high)
    - Alternative 2: Ozone + BAF (low)
    - Alternative 3: Ozone + BAF + Microfiltration (high)
- Yields up to 13 mgd during recovery
  - 8 mgd through ASR wellfield operation plus
  - 5 mgd through bypass from tertiary treatment facilities at Greenwood WWTP.

A cost estimate for Phase I wells and transmission pipelines needed for recharge, recovery, and conveyance is shown in Table 5B.5.2. The costs shown represent a range of treatment processes that will be identified during piloting for subsequent refinement of Phase I costs, accordingly.

The total project cost is expected to range from $130,002,000 to $159,141,000 depending on treatment process. The annual cost ranges from $12,112,000 to $14,584,000. The unit cost of water is estimated to be $824 to $993 per ac-ft during recovery, which is the firm yield expected during drought conditions. After adding recharge operations to replenish storage for later recovery, the energy costs increase by approximately $100,000. The unit cost increases to $831 to $1,001 per ac-ft.

Table 5B.5.2.
Cost Estimate Summary ASR with Non-Potable Reuse (Option 1)- Phase I Low to High Range Based on Treatment (Sept 2023 Prices)

Item	Estimated Costs with Ozone + BAF (Low)	Estimated Costs with Ozone + BAF + Microfiltration (High)
Capital Cost		
Greenwood WWTP Pump Station (5 MGD,617 HP)	$5,824,000	$5,824,000
Booster Pump Station(s) & Storage Tank(s) (10.9 MGD, 390 HP)	$5,184,000	$5,184,000
Wellfield Piping (13.4 mi, 8 IN - 30 IN dia.)	$37,784,000	$37,784,000
ASR Wells (10 wells, 685 gpm, 800 ft depth)	$15,150,000	$15,150,000
Terminal Storage Tank (2 MG)	$2,545,000	$2,545,000
Tertiary Treatment and MLE Upgrade (5MGD)	$14,772,000	$33,326,000
SCADA	$4,428,000	$5,542,000
Total Cost of Facilities	**$85,687,000**	**$105,355,000**
Engineering:	$2,571,000	$3,161,000
- Planning (3%)	$5,998,000	$7,375,000
- Design (7%)	$857,000	$1,054,000
- Construction Engineering (1%)	$1,714,000	$2,107,000
Legal Assistance (2%)	$1,714,000	$2,107,000
Fiscal Services (2%)	$319,000	$319,000
Pipeline Contingency (15%)	$16,712,000	$20,645,000
All Other Facilities Contingency (20%)	$2,571,000	$3,161,000
Environmental & Archaeology Studies and Mitigation	$658,000	$658,000
Land Acquisition and Surveying (213 acres)	$2,241,000	$2,241,000
Interest During Construction (3.5% for 3 years with a 0.5% ROI)	$11,531,000	$14,119,000
Total Cost of Project	**$130,002,000**	**$159,141,000**
Annual Cost		
Debt Service (3.5 percent, 20 years)	$9,132,000	$11,182,000
Operation and Maintenance	x-	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$620,000	$631,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$224,000	$224,000
Tertiary Treatment (Ozone + BAF)	$1,244,000	$1,655,000
Pumping Energy Costs (@ 0.08 $/kW-hr)	$892,000	$892,000
Total Annual Cost	**$12,112,000**	**$14,584,000**
Available Project Yield (acft/yr)	14,573	14,573
Annual Cost of Water ($ per acft)	$831	$1,001
Annual Cost of Water After Debt Service ($ per acft)	$204	$233
Annual Cost of Water ($ per 1,000 gallons)	$2.55	$3.07
Annual Cost of Water After Debt Service ($ per 1,000 gallons)	$0.63	$0.72

5B.5.4.8 ASR with Non-potable Reuse, Phase II Cost Estimate

The Phase II planning-level cost estimate includes:

- 15 wells constructed and equipped to:
  - Recharge up to 415 gpm each for Phase I wells and 500 gpm for Phase II wells (total 9.6 mgd, or about 30 percent for well downtime and/or maintenance)
  - Recover up to 685 gpm each for Phase I wells and 750 gpm for Phase II wells (total 15.3 mgd to account for well downtime and/or maintenance)
- 10 mgd pump station at Greenwood WWTP (for recharge)
- 17 mgd booster pump station(s) total
- Phase I pipelines + 12-inch transmission pipeline from tertiary treatment facilities at Greenwood WWTP to Phase II well field and well field piping
- 30-inch diameter pipe to deliver total Phase II supply to a delivery point located to the north west of the Corpus Christi International Airport on Agnes Road, south of the intersection of Bronco Road and Interstate Highway 44
- Two 2-MG terminal storage tanks (4 MG total)
- SCADA estimated at 3 percent of construction costs
- Land acquisition of 155 acres at cost of $10,000 per acre
- Survey and geotechnical costs estimated at $55,000 per mile
- Tertiary treatment (10 mgd, total)
  - MLE treatment
  - Additional tertiary treatment (low to high)
    - Alternative 2: Ozone + BAF (low)
    - Alternative 3: Ozone + BAF + Microfiltration (high)
- Yields up to 18 mgd during recovery
  - 10 mgd through ASR wellfield operation plus
  - 8 mgd through bypass from tertiary treatment facilities at Greenwood WWTP after expansion.

A cost estimate for Phase II wells and transmission pipelines needed for recharge, recovery, and conveyance of water to the delivery point for industrial customer use is shown in Table 5B.5.3. Similar to Phase I, the costs shown represent a range of treatment processes that will be identified during piloting for subsequent refinement of Phase I costs, accordingly.

The total project cost is expected to range from $196,981,000 to $237,314,000 depending on treatment process. The annual cost ranges from $18,731,000 to $22,280,000. The unit cost of water is estimated to be $923 to $1,098 per ac-ft during recovery, which is the firm yield expected during drought conditions. After adding recharge operations to replenish storage for later recovery, the energy costs increase by approximately $100,000. The unit cost increases to $928 to $1,104 per ac-ft.

Table 5B.5.3.
Cost Estimate Summary ASR with Non-Potable Reuse (Option 1)- Phase II
Low to High Range Based on Treatment (Sept 2023 Prices)

Item	Estimated Costs with Ozone + BAF (Low)	Estimated Costs with Ozone + BAF + Microfiltration (High)
Capital Cost		
Greenwood WWTP Pump Station (10 MGD,907 HP)	$8,306,000	$8,306,000
Booster Pump Station(s) & Storage Tank(s) (16.9 MGD, 500 HP)	$7,108,000	$7,108,000
Wellfield Piping (24.5mi, 8 IN - 30 IN dia.)	$60,987,000	$60,987,000
ASR Wells (15 wells, 685-750 gpm, 800 ft depth)	$21,453,000	$21,453,000
Terminal Storage Tank (2 MG)	$5,091,000	$5,091,000
Tertiary Treatment (Microfiltration + BAF+Ozone) and MLE Upgrade (10 MGD)	$20,449,000	$46,131,000
SCADA	$6,692,000	$8,233,000
Total Cost of Facilities	**$130,086,000**	**$157,309,000**
Engineering:		
- Planning (3%)	$3,903,000	$4,719,000
- Design (7%)	$9,106,000	$11,012,000
- Construction Engineering (1%)	$1,301,000	$1,573,000
Legal Assistance (2%)	$2,602,000	$3,146,000
Fiscal Services (2%)	$2,602,000	$3,146,000
Pipeline Contingency (15%)	$1,144,000	$1,144,000
All Other Facilities Contingency (20%)	$24,492,000	$29,937,000
Environmental & Archaeology Studies and Mitigation	$950,000	$950,000
Land Acquisition and Surveying (213 acres)	$3,314,000	$3,314,000
Interest During Construction (3.5% for 3 years with a 0.5% ROI)	$17,481,000	$21,064,000
Total Cost of Project	**$196,981,000**	**$237,314,000**
Annual Cost		
Debt Service (3.5 percent, 20 years)	$13,845,000	$16,683,000
Operation and Maintenance	-	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$965,000	$981,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$327,000	$327,000
Advanced Water Treatment Facility	$2,486,000	$3,181,000
Pumping Energy Costs (12308008 kW-hr @ 0.09 $/kW-hr)	$1,108,000	$1,108,000
Total Annual Cost	**$18,731,000**	**$22,280,000**
Available Project Yield (acft/yr)	20,178	20,178
Annual Cost of Water ($ per acft)	$928	$1,104
Annual Cost of Water After Debt Service ($ per acft)	$242	$277
Annual Cost of Water ($ per 1,000 gallons)	$2.85	$3.39
Annual Cost of Water After Debt Service ($ per 1,000 gallons)	$0.74	$0.85

5B.5.4.9 Potable ASR/IPR and Limited DPR Reuse Cost Estimate

The IPR and Limited DPR configuration planning-level cost estimate includes:

- DPR treatment (1 mgd)
  - MF + RO + UV/Chlorine AOP
- IPR treatment
  - 5 mgd for recharge
    - MF
  - 8 mgd for recovery
    - MF + RO
- 5 mgd pump station at WWTP (for recharge)
- 8 mgd booster pump station near wellfield (for recovery)
- 7.2 mgd pump station at WWTP for potable water distribution
- 1.8 mgd pump station at WWTP for deep well injection
- 10 ASR wells constructed and equipped to:
  - Recharge up to 415 gpm each (total 5.976 mgd, or approximately 25 percent to account for well downtime and/or maintenance)
  - Recover up to 685 gpm each (total 9.8 mgd, or approximately 25 percent to account for well downtime and/or maintenance)
- 5 deep injection wells for RO brine
  - 300 gpm each injecting to a depth of 3,400 feet
- 24-inch transmission pipeline from DPR treatment facilities at WWTP to well field and 8-inch to 30-inch well field piping.
- 24-inch transmission pipeline from potable water pumpstation at WWTP to existing potable water line.
- 2-MG terminal storage tank at wellfield
- Well SCADA estimated at 6 percent construction costs
- Easement acquisition of 113 acres at cost of $10,000 per acre
- Survey and geotechnical costs estimated at $55,000 per mile

The cost estimate for building treatment facilities, wells, and transmission pipelines to treat 6 mgd of WWTP effluent for IPR and Limited DPR is presented in Table 5B.5.4.

The total project cost and annual cost are estimated to be $186,539,000 and $22,869,000, respectively. The unit cost of water is estimated to be $2,821 per ac-ft during recovery, which is the firm yield expected during drought conditions. After adding recharge operations to replenish storage for later recovery, the energy costs increase by approximately $100,000. The unit cost increases to $2,834 per ac-ft.

Table 5B.5.4
Cost Estimate Summary
Potable ASR/IPR with Limited DPR (Option 2)
(Sept 2023 Prices)

Item	Estimated Costs
Capital Cost	
Booster Pump Station for ASR Recovery (8 MGD)	$9,833,000
ASR Wellfield Piping (13.4 mi, 8 IN - 30 IN dia.)	$36,088,000
ASR Wells (10 wells, 685 gpm, 700 ft depth)	$13,972,000
Deep Injection Piping (0.5 mi, 8 IN - 12 In dia)	$926,000
Deep Injection Wells (5 wells, 300 gpm, 2700 ft depth)	$13,750,000
Potable Water Piping (0.9 mi, 24 IN dia.)	$3,093,000
Terminal Storage Tank (2 MG)	$2,545,000
ASR + DPR Treatment	$39,002,000
ASR Treatment (MF + RO, 8 MGD)	
DPR Treatment (MF + RO, UV/Chlorine AOP, 1 MGD)	
SCADA for Wells	$4,340,000
Total Cost of Facilities	**$123,549,000**
Engineering:	
- Planning (3%)	$3,700,000
- Design (7%)	$8,634,000
- Construction Engineering (1%)	$1,233,000
Legal Assistance (2%)	$2,467,000
Fiscal Services (2%)	$2,467,000
Pipeline Contingency (15%)	$768,000
All Other Facilities Contingency (20%)	$23,644,000
Environmental & Archaeology Studies and Mitigation	$1,559,000
Land Acquisition and Surveying (113 acres)	$1,964,000
Interest During Construction (3.5% for 3 years with a 0.5% ROI)	$16,554,000
Total Cost of Project	**$186,539,000**
Annual Cost	
Debt Service (3.5 percent, 20 years)	$13,110,000
Operation and Maintenance	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$745,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$246,000
Advanced Water Treatment Facility	$8,050,000
Pumping Energy Costs (7973120 kW-hr @ 0.09 $/kW-hr)	$718,000
Total Annual Cost	**$22,869,000**
Available Project Yield (acft/yr)	8,070
Annual Cost of Water ($ per acft)	$2,834
Annual Cost of Water After Debt Service ($ per acft)	$1,209
Annual Cost of Water ($ per 1,000 gallons)	$8.70
Annual Cost of Water After Debt Service ($ per 1,000 gallons)	$3.71

5B.5.5 Implementation Issues

The TCEQ administers state rules governing most facets of ASR project implementation in Texas, which are prescribed in Title 30 of the Texas Administrative Code (TAC), Chapter 331, Underground Injection Control (UIC). The TCEQ has primacy from the EPA to regulate most injection wells through the Texas UIC Program. Since the proposed ASR project does not currently contemplate recovery of water directly to a public water system, rules related to public supply wells and groundwater sources and development, as contained in 30 TAC §290.41 (c), do not apply. Of particular relevance to the proposed ASR project are the requirements in 30 TAC§331.186 (a), which outlines the criteria to be consider by TCEQ in authorizing ASR operations. The effluent from the Greenwood WWTP does not currently meet drinking water standards for chloride, TDS, manganese, and nitrate concentration, or pathogen removal. While it is anticipated that nitrate and manganese will likely be below the drinking water maximum contaminant limit after tertiary treatment, the other parameters will not be significantly altered prior to recharge. As such, the City of Corpus Christi will need to demonstrate to the TCEQ that proposed ASR well operations will not: 1) render the groundwater produced from the receiving formation harmful or detrimental to people, animals, vegetation, or property, or 2) require an unreasonably higher level of treatment of the groundwater produced from the receiving geologic formation than is necessary for the native groundwater in order to render the groundwater suitable for beneficial use.

For most previous ASR applications, TCEQ has required treatment to drinking water standards prior to recharge but newer rules passed in 2015, and described in Section 5 of Exhibit G, may give some flexibility since both the quality of the effluent relative to drinking water is considered along with the potential to degrade the native groundwater. This project would improve the native groundwater for constituents more relevant to Safe Drinking Water Act as a result of the tertiary treatment prior to injection that address the constituents above MCL. Although the storage aquifer is considered brackish it would still be classified as an underground source of drinking water (USDW) per Title 40, Code of Federal Regulations (40 CFR) Section 144.3. It is likely that TCEQ may require additional treatment at the WWTP to meet MCLs and that treatment could be necessary to maintain ASR operations and water compatibility. Treatment may include modifications to the WWTP's treatment process to promote de-nitrification, reduce turbidity, and improve the disinfection system to further inactivate bacteria.

There are several existing wells identified within the ASR study area that will likely be impacted by ASR implementation. Additional efforts to survey unregistered wells in the vicinity of the proposed ASR well field area would be helpful to identify wells to monitor and/or mitigate in advance of commencing ASR operations. Supply protection is within the jurisdictional authority of the District as detailed in the District's 2019 *Groundwater Management Plan*[10].

5B.5.5.1 Underground Injection Code Permitting Timeframe

The deep injection wells required for RO brine disposal will require a Class I injection well permit. Upon receipt of the application for an injection well permit, TCEQ staff date stamp the

[10] http://www.twdb.texas.gov/groundwater/docs/GCD/ccasrcd/CCASRCDMgmtPlan2019.pdf?d=1581392749650

application and review the application for administrative completeness. The applicant may be contacted by way of an administrative deficiency letter for clarification or additional information at any time during the administrative review.

Within 30 days of the date that the application is determined to be administratively complete, the Chief Clerk mails the Notice of Receipt of Application and Intent to Obtain Permit to the applicant, to potentially affected persons, and to others. The applicant is responsible for newspaper publication of notice of the application in accordance with 30 TAC §39.418(b)(1) and §39.651(c). The applicant must also place a copy of the administratively complete application in a public place in accordance with 30 TAC §39.405(g).

TCEQ begins a technical review of the application as soon as the application is administratively complete. As part of the technical review, staff evaluate the applicant's compliance history for the previous 5 years, including the company and facility compliance classification and rating. The applicant may be contacted by way of a technical notice of deficiency letter for clarification or additional information at any time during the technical review. TCEQ will issue no more than two notice of deficiency letters.

After the technical review, TCEQ makes a preliminary decision to issue a permit or recommend denial of the permit. TCEQ delivers the preliminary decision concurrently with the Notice of Application and Preliminary Decision to the applicant, to potentially affected persons, and to others. The applicant is responsible for newspaper publication of the Notice of Application and Preliminary Decision in accordance with 30 TAC §39.419(b) and §39.651(d).

Public comments must be filed with TCEQ within the time period specified in the notice. The public comment period ends 30 days (nonhazardous waste permits) or 45 days (hazardous waste permits) after the last publication of the Notice of Application and Preliminary Decision, except as provided in 30 TAC §55.152. If comments are received, TCEQ prepares a response to comments and files the response to comments with the TCEQ Chief Clerk within 60 days following the close of the comment period in accordance with 30 TAC §55.156. The TCEQ Chief Clerk mails the Executive Director's decision, the Executive Director's response to public comments, instructions for requesting that the Commission reconsider the Executive Director's decision, and instructions for requesting a contested case hearing.

The Executive Director may act on an uncontested application if public notice requirements have been satisfied and the application meets all relevant statutory and administrative criteria in accordance with 30 TAC §50.133. The TCEQ Chief Clerk mails notice of the action and an explanation of the opportunity to file a motion to overturn the Executive Director's action on the application. A motion to overturn must be filed no later than 20 days after the signed permit is mailed to the applicant in accordance with §50.139.

5B.5.6 Evaluation Summary

An evaluation summary of this water management option is provided in Table 5B.5.5.

Table 5B.5.5. Evaluation Summary of City of Corpus Christi ASR Projects

Impact Category	Comment(s)
a. Water Supply	
1 Quantity	1. Firm Yield: 14,573 ac-ft/yr (Non-potable Phase I); 20,178 ac-ft/yr (Non-potable Phase II); 8,071 ac-ft/yr (ASR with IPR and DPR)
2. Reliability 3. Cost of Treated Water	2. Reliable, based on system operations 3. Non-Potable ASR: $831- $1,001 per ac-ft (Phase I) and $928- $1,104 per ac-ft (Phase II) ASR with IPR and DPR: $2,834 per ac-ft
b. Environmental factors	
1. Instream flows	1. Low impact. Reduced flow in Oso Creek.
2. Bay and Estuary Inflows and arms of the Gulf of Mexico	2. None or low impact.
3. Wildlife Habitat	3. None or low impact.
4. Wetlands	4. None or low impact.
5. Threatened and Endangered Species	5. None.
6. Cultural Resources	6. No cultural resources affected.
7. Water Quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. a. Dissolved solids are estimated to be around 2,000 mg/L for non-potable use. If water use needed is potable, additional treatment will be required. b. Salinity are addressed for non-potable use. If water use needed is potable, additional treatment will be required. c. Bacteria is addressed with treatment process. d. Chlorides are estimated to be around 750 mg/L for non-potable use. If water use needed is potable, additional treatment will be required. e-h. None or low impact i. Nitrate, TSS, TOC, and Mn addressed with treatment processes.
c. Impacts to agricultural resources and State water resources	• Reduce discharge to Oso Creek.
d. Threats to agriculture and natural resources in region	• None
e. Recreational impacts	• None
f. Equitable Comparison of Strategies	• Standard analyses and methods used
g. Interbasin transfers	• None
h. Third party social and economic impacts from voluntary redistribution of water	• Reduce discharge to Oso Creek.
i. Efficient use of existing water supplies and regional opportunities	• Reuses water supply and compatible with regional development.
j. Effect on navigation	• None
k. Impacts on water pipelines and other facilities used for water conveyance	• None

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5B.6

Seawater Desalination

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Secton 5B.6 Seawater Desalination

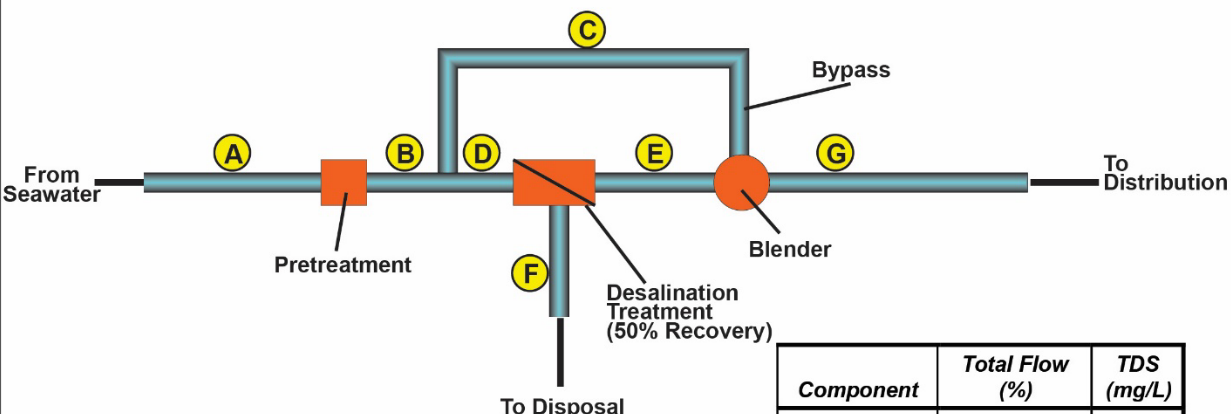
5B.6.1 Seawater Desalination Background

Seawater desalination is a process whereby seawater is treated to reduce total dissolved solids, salts, and minerals to make suitable for human consumption and/or high quality industrial/manufacturing purposes. Seawater near Corpus Christi Bay and the Gulf of Mexico, where plants are being considered, is estimated to have total dissolved solids (TDS) content of between 30,000 and 50,000 parts per million.

Commercially available processes that are commonly used to desalt seawater to produce potable water are:

- Distillation (thermal) Processes; and
- Membrane (non-thermal) Processes.

Figure 5B.6.1 shows a process diagram for a typical seawater desalination treatment plant, the percent of water flowing through each component of the system, and the concentration of the TDS. This diagram is intended to serve as an example, recognizing that details and recovery percentages for specific seawater desalination plants may vary.



Component	*Total Flow (%)*	*TDS (mg/L)*
A	100	30,000
B	100	30,000
C	1	30,000
D	99	30,000
E	50	600
F	49	60,000
G	51	~1.000

Figure 5B.6.1.
Flow Diagram for a Typical Seawater Desalination Water Treatment Plant

The following section describes distillation and membrane processes and discusses a number of issues that should be considered before selecting a process for desalination of seawater. Coastal seawater desalination projects are either in operation or under construction in Florida and California, but there are no seawater desalination plants operating in Texas.[1]

5B.6.1.1 Distillation (Thermal) Processes

Distillation processes produce purified water by vaporizing a portion of the saline feedstock to form steam. Since the salts dissolved in the feedstock are nonvolatile, they remain unvaporized and the steam formed is captured as a pure condensate. Distillation processes are normally very energy-intensive, expensive, and are generally used for large-scale desalination of seawater. Heat is usually supplied by steam produced by boilers or from a turbine power cycle used for electric power generation. Distillation plants are commonly dual-purpose facilities that produce purified water and electricity. According to a recent study by the City of Corpus Christi, geothermal energy is better suited to thermal desalination rather than reverse osmosis membrane processes.[2]

In general, for a specific plant capacity, the equipment in distillation plants tends to be much larger than membrane desalination equipment. However, distillation plants do not have the stringent feedwater quality requirements of membrane plants. Due to the relatively high temperatures required to evaporate water, distillation plants have high energy requirements, making energy a large factor in their overall water cost. Their high operating temperatures can result in scaling (precipitation of minerals from the feedwater), which reduces the efficiency of the evaporator processes. Once an evaporator system is constructed, the size of the exchange area and the operating profile are fixed, leaving energy transfer as a function of only the heat transfer coefficient. Therefore, any scale that forms on heat exchanger surfaces reduces heat transfer coefficients. Under normal circumstances, scale can be controlled by chemical inhibitors, which inhibit but do not eliminate scale, and by operating at temperatures of less than 200 degrees Fahrenheit.

Distillation product water recoveries normally range from 15 to 45 percent, depending on the process. The product water from these processes is nearly mineral-free, with very low TDS (less than 25 milligrams per liter [mg/L]). However, this product water is extremely aggressive and is too corrosive to meet the Safe Drinking Water Act corrosivity standards without post-treatment. Product water can be stabilized by chemical treatment or by blending with other potable water.

The three main distillation processes in use today are Multistage Flash Evaporation (MSF), Multiple Effect Distillation (MED), and Vapor Compression (VC). All three of these processes utilize an evaporator vessel that vaporizes and condenses the feedstock. The three processes differ in the design of the heat exchangers in the vessels and in the method of heat introduction into the process. Since there are no distillation processes in Texas that can be shown as

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[1] City of Corpus Christi website, “Corpus Christi Desalination Demonstration Project”, June 2014. http://www.cctexas.com/Assets/Departments/Water/Files/DesalFactSheet.pdf

[2] City of Corpus Christi, Variable Salinity Desalination Demonstration Project “Technical Memorandum No. 1- Desalination Technology Research Project No. E13063”, September 2014.

comparable installations, distillation will not be considered here. However, there are membrane desalination operations in Texas, so the following discussion and analyses are based upon information from the use of membrane technology for desalination.

5B.6.1.2 Membrane (Non-Thermal) Processes

The two types of membrane processes use either pressure — as in reverse osmosis (RO) — or electrical charge — as in electrodialysis reversal (EDR) — to reduce the mineral content of water. Both processes use semi-permeable membranes that allow selected ions to pass-through while other ions are blocked. EDR uses direct electrical current applied across a vessel to attract the dissolved salt ions to their opposite electrical charges. EDR can desalinate brackish water with TDS up to several thousand milligrams per liter, but energy requirements make it economically uncompetitive for seawater, which contains approximately 35,000 mg/L TDS. As a result, only RO is used for seawater desalination.

RO uses a semi-permeable membrane that limits the passage of salts from the saltwater side to the freshwater side of the membrane. Electric motor-driven pumps or steam turbines (in dual-purpose installations) provide the 800 to 1,200 pounds per square inch (psi) pressure to overcome the osmotic pressure and drive the freshwater through the membrane, leaving a waste stream of brine/concentrate. The basic components of an RO plant include pre-treatment, high-pressure pumps, membrane assemblies, and post-treatment. Pretreatment is essential because feedwater must pass through very narrow membrane passages during the process and suspended materials, biological growth, and some minerals can foul the membrane. As a result, virtually all suspended solids must be removed and the feedwater must be pre-treated so precipitation of minerals or growth of microorganisms does not occur on the membranes. This is normally accomplished by using various levels of filtration and the addition of various chemical additives and inhibitors. Post-treatment of product water is usually required prior to distribution to reduce its corrosivity and to improve its aesthetic qualities. Specific treatment is dependent on product water composition.

A "single-pass/stage" seawater RO plant will produce water with a TDS of 300 to 500 mg/L, most of which is sodium and chloride. The product water will be corrosive, but this may be acceptable, if a source of blending water is available. If not, and if post-treatment is required, the various post-treatment additives may cause the product water to exceed the desired TDS levels. In such cases, or when better water quality is desired, a "two-pass/stage" RO system is used to produce water typically in the 200 mg/L TDS range. In a two-pass RO system, the concentrate water from the first RO pass/stage is further desalted in a second RO pass/stage, and the product water from the second pass is blended with product water from the first pass.

Recovery rates up to 45 percent are common for a two-pass/stage seawater RO facility. RO plants, which comprise about 47 percent of the world's desalting capacity, range from a few gallons per day to 35 mgd. The largest RO seawater plant in the United States is the 25 mgd plant in Tampa Bay, Florida. The current domestic and worldwide trend seems to be for the adoption of RO when a single purpose seawater desalting plant is to be constructed. RO membranes have been improved significantly over the past two decades (i.e., the membranes have been improved with respect to efficiency, longer life, and lower prices). Municipal use desalination plants in Texas that use lake water, river, or groundwater are shown in Table 5B.6.1. As of 2020, The Texas Water Development Desalination Plant database reported 53 public water supply desalination plants currently operating in Texas, greater than 25,000 gallons per day. The plant capacities range from 0.1 mgd (Homestead MUD-El Paso) to 10 mgd (Lake Granbury).

Table 5B.6.1.
Municipal Use Desalt Plants in Texas (greater than 25,000 gpd)

Location	County	Source	Raw Water TDS (mg/L), estimate	Target TDS for Finished Water (mg/L)	Total Capacity (MGD)	Desalt Capacity (MGD)	Membrane Type[1]	Membrane Recovery (%)
Abilene, City of	Taylor	Surface Water	1500	<500	7.95	3	RO	0.7
Ballinger, City of	Runnels	Surface Water	-	40	-	-	-	0.92
Bardwell, City of	Ellis	Groundwater	-	400	0.252	0.036	RO	0.6
Bayside, City of	Refugio	Groundwater	2500	350	0.045	-	RO	-
Beckville, City of	Panola	Groundwater	1200	100	0.216	0.216	RO	0.75
Benjamin, City of	Knox	Groundwater	-	-	0.072	-	-	0.71
Big Bend Motor Inn	Brewster	Groundwater	1694	300	0.057	0.057	RO	0.75
Bob Elder Water Treatment Plant	Parker	Surface Water	1255	-	-	1	RO	0.68
Brady, City of	McCulloch	Surface Water	1,200 - 1,600	-	3	1.5	RO	0.75
Brazoria County MUD 21	Brazoria	Groundwater	-	-	2.572	2.572	-	-
Clarksville City, City of	Gregg	Groundwater	2600	200	0.288	0.288	RO	0.75
Cypress WTP	Wichita	Surface Water	3500	<100	12	12	RO	0.75
Dell City	Hudspeth	Groundwater	1466	435	0.1	0.1	EDR	0.75
DS Waters of America, LP	Waller	Groundwater	470	36	0.09	-	RO	0.75
Esperanza Fresh Water Supply	Hudspeth	Groundwater	-	-	0.023	-	RO	-
Evant, City of	Coryell	Groundwater	1100	800	0.1	0.08	RO	0.8
Fort Hancock RO Plant 1	Hudspeth	Groundwater	-	-	0.43	0.43	RO	0.78
Ft. Stockton, City of	Pecos	Groundwater	1500	150	7	3	RO	0.8
Granbury, City of (IDLE)	Hood	Surface Water	-	-	0.462	0.35	RO	0.75
H2OAKS Center	Bexar	Groundwater	1160 - 1460	30-50	12	10	RO	0.9
Holiday Beach WSC	Aransas	Groundwater	2000	450	0.15	-	RO	0.7
Horizon Regional MUD RO Plant	El Paso	Groundwater	-	80	6	3.3	RO	0.80
Hubbard, City of	Hill	Groundwater	2793	-	0.648	0.432	RO	0.62
Kay Bailey Hutchison Desalination Plant	El Paso	Groundwater	2500 - 3500	750	27.5	15	RO	0.825
Kenedy, City of	Karnes	Groundwater	1500	-	2.86	0.72	RO	0.67
Brazos Regional Public Utility Agency	Hood	Surface Water	850	150	15	7.5	RO	0.85
Klondike ISD	Dawson	Groundwater	-	-	0.043	-	RO	-
Midland Country Club	Midland	Groundwater	3840	200	0.023	0.11	RO	0.8

Location	County	Source	Raw Water TDS (mg/L), estimate	Target TDS for Finished Water (mg/L)	Total Capacity (MGD)	Desalt Capacity (MGD)	Membrane Type[1]	Membrane Recovery (%)
Military Hwy WSC- Las Rusias	Cameron	Surface Water	-	-	2.1	2.1	RO	-
Military Hwy WSC-Progreso	Cameron	Groundwater	-	-	1	1	RO	-
Millersview-Doole WSC	Concho	Surface Water	800	100	1.53	0.748	RO	0.75
Mitchell County Desal Plant (Idle)	Mitchell	Groundwater	-	-	0.25	-	RO	-
North Alamo WSC (Doolittle)	Hidalgo	Groundwater	2500	500	3.5	3	RO	-
North Alamo WSC (Lasara)	Willacy	Groundwater	-	500	1.2	1	RO	-
North Alamo WSC (Owassa)	Hidalgo	Groundwater	2000	500	2	1.5	RO	-
North Cameron/Hidalgo WA	Cameron	Groundwater	3500	400 uS/cm	2.304	1.152	RO	0.75
Oak Trail Shores	Hood	Surface Water	-	-	1.584	-	RO	-
Possum Kingdom WSC	Palo Pinto	Surface Water	2400	50-100	1	-	RO	0.75
Raw Water Production Facility Big Spring Plant	Howard	Groundwater	2500-3000	<750	2.5	2.5	RO	0.825
River Oaks Ranch	Hays	Groundwater	1500	300	0.1152	0.1152	RO	0.7
Robinson, City of	McLennan	Surface Water	500-900	100-600	2.3	1.6	RO	0.75
Rule, City of	Haskell	Groundwater	-	-	0.864	0.0864	RO	0.68
Seadrift, City of	Calhoun	Groundwater	2200	400	0.61	0.524	RO	0.7
Seymour, City of	Baylor	Groundwater	800	400	3	3	RO	0.81
Sherman, City of	Grayson	Surface Water	-	400-500	10	5	RO	0.80
Southmost Regional Water Authority	Cameron	Groundwater	3500	550	10	8.8	RO	0.75
Sportsmans World MUD	Palo Pinto	Surface Water	-	300	0.083	0.083	RO	0.5
Study Butte Terlingua Water System	Brewster	Groundwater	1425	200	0.144	0.144	RO	0.75
Tatum, City of	Rusk	Groundwater	1200	320	0.324	0.288	RO	0.75
The Cliffs	Palo Pinto	Surface Water	-	400	0.381	0.381	RO	0.8
TPWD Caprock Canyon State Park	Briscoe	Groundwater	-	-	0.54	0.54	RO	-
Valley MUD #2	Cameron	Groundwater	3500	400	1	0.5	RO	0.75
Veolia WTP (Idle)	Jefferson	Surface Water	-	-	0.245	0.066	RO	0.8
Victoria Road Plant	Hidalgo	Groundwater	4000	150	2.25	2	RO	0.75

Source: TWDB Desalination Plant Database, 2020

[1] RO = Reverse Osmosis EDR = Electrodialysis Reversal

5B.6.1.3 Examples of Relevant Existing Desalt Projects

Seadrift, TX: In 1996, Seadrift (retail population 1,890) was dependent on the Gulf Coast Aquifer for its water supply. TDS and chlorides had reached unacceptable levels of 1,592 mg/L and 844 mg/L, respectively. These values exceeded the primary drinking water standard for TDS

(1,000 mg/L) and the secondary drinking water standard for chlorides (300 mg/L). Since the community was not located near an adequate quantity of freshwater or a wholesaler of drinking water, the decision was made to install RO to treat this slightly brackish groundwater. The city installed pressure filters, two RO units, anti-scalant chemical feed equipment, and a chlorinator. The capital cost for the system was $1.2 million and the annual operation and maintenance (O&M) cost is $56,000, resulting in a total debt service plus O&M cost of about $0.88 per 1,000 gallons treated by RO. The capital cost included the cost of facilities in addition to the RO units and their appurtenant equipment. Product water from the RO units is blended with groundwater to meet an acceptable quality level. About 60 percent of the total is from the desalt units.

Tampa, FL: The water utility, Tampa Bay Water, selected a 30-year design, build, operate, and own (DBOO) proposal to construct a nominal 25 mgd seawater desalt plant. The plant uses RO as the desalt process. The proposal included total capitalization and operations costs for producing high quality drinking water (chlorides less than 100 mg/L). The total cost to Tampa Bay Water in the original proposal was to be $2.08 per 1,000 gallons on a 30-year average, with first year cost being $1.71 per 1,000 gallons. However, subsequent issues with the original design, including significant problems in obtaining adequate pretreatment have increased the projected total cost to Tampa Bay Water by $0.72 per 1,000 gallons for a total projected cost of $2.80 per 1,000 gallons on a 30-year average.[3] The results of Tampa Bay's competition has attracted international interest in the current cost profile of desalting seawater for drinking water supply, since these costs are only about one-half the levels experienced in previous desalination projects.

Tampa Bay Water selected the winning proposal from four DBOO proposals submitted, which ranged from $2.08 to $2.53 per 1,000 gallons. The factors listed below may be all or partially responsible for these seemingly low costs:

- Salinity at the Tampa Bay sites ranges from 25,000 to 30,000 mg/L, lower than the more common 35,000 mg/L for seawater. RO cost is sensitive to salinity.
- The power cost, which is interruptible, is below $0.04 per kilowatt-hour (kWh).
- Construction cost savings through using existing power plant canals for intake and concentrate discharge.
- Economy of scale at 25 mgd.
- Amortizing over 30 years.
- Use of tax-exempt bonds for financing.

The Tampa Bay Seawater Desalination Plant went on-line in 2007. Information on this project can be found on Tampa Bay Water's website: https://www.tampabaywater.org/tampa-bay-seawater-desalination.

The Tampa bids contrast with another current large-scale desalination project in which distillation is proposed. The current desalt project of the Singapore Public Utility Board, which proposes a

[3] Associated Press, "Tampa Bay Water to Hire Group to Fix Desalination Plant," September 21, 2004.

36 mgd multi-stage flash distillation plant, will cost an estimated $5.76 per 1,000 gallons for the first year operation.[4]

Carlsbad Desalination Facility: This 54 mgd desalination plant is located in California and designed by Poseidon with 10 miles of 54-inch pipeline serving San Diego County. It is the largest desalination plan in the Americas. The main technology used for desalination is reverse osmosis. The main delivery method is Design-Build-Finance-Own-Operate-Maintain and Transfer. The total capital cost for the project was around $922 million, with financing closed in 2012. The project became operational in December 2015 and was delivered on time and on budget. The total water produced to date is greater than 51 billion gallons. The estimated cost is around $7.82 per thousand gallons, which includes the cost to pump water through the 10-mile pipeline, including a 1,000-foot elevation increase.

5B.6.2 Environmental Issues

House Bill (HB) 2031, passed by the 84th Legislature, requires consultation with Texas Water Development Board (TWDB) and the General Land Office (GLO) regarding siting of marine seawater desalination intakes and discharges to minimize ecological impacts. This legislation created new Texas Water Code (TWC) Chapter 18 addressing marine seawater desalination projects. TWC §18.003 establishes the requirements for obtaining a permit to divert the state's seawater and to discharge brine effluent from desalination projects into the Gulf of Mexico. This legislation applies to desalination plants sited outside the Texas coastal barrier islands.

In the Coastal Bend Region, five proposed desalination plant options are being considered by different entities, including the City of Corpus Christi, the Port of Corpus Christi Authority, and Poseidon/City of Ingleside, as shown in Figure 5B.6.2. Site-specific environmental issues are discussed in the following sections (Sections 5B.6 through 5D.12). This section discusses more general environmental issues associated with seawater desalination plants in the Coastal Bend area.

[4] Desalination & Water Reuse Quarterly, vol. 7/4, Feb/Mar 1998.

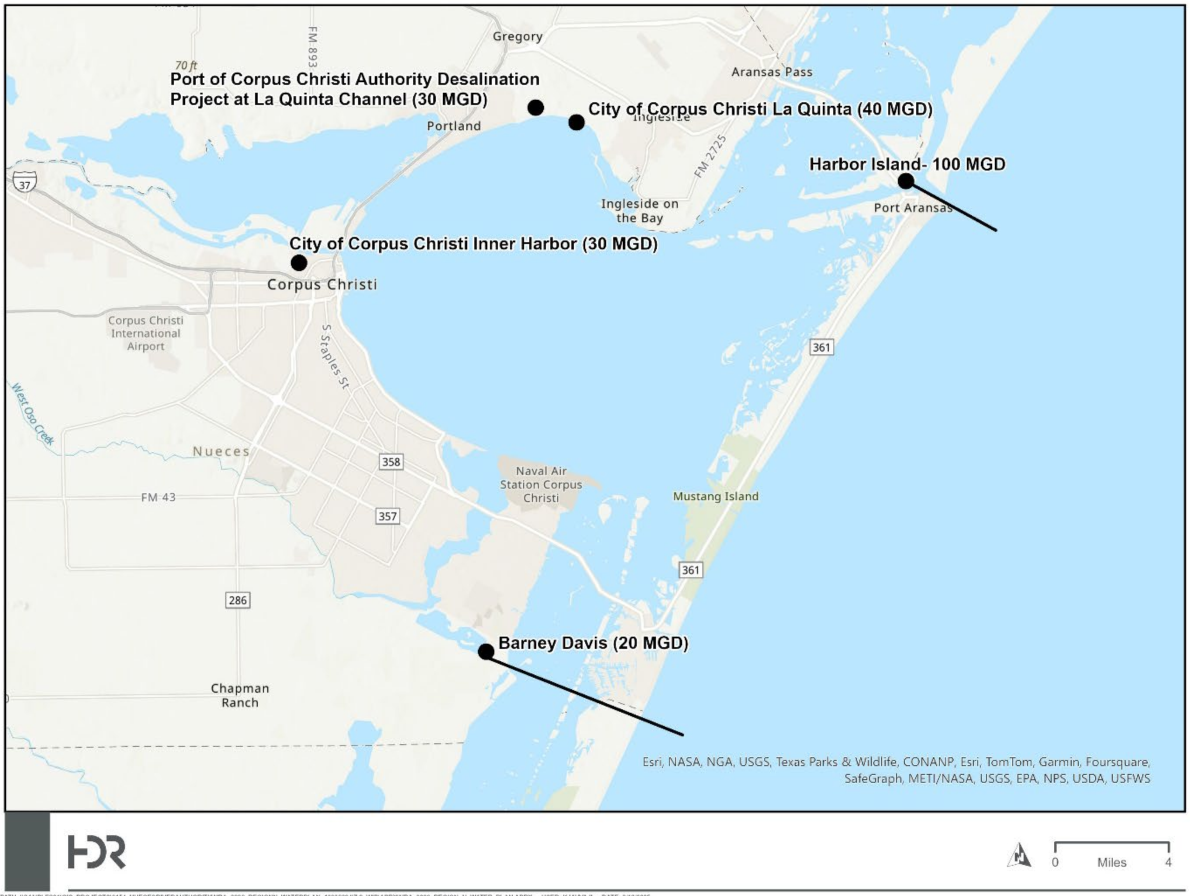

Figure 5B.6.2.
Locations for Proposed Seawater Desalination Plants in Region N

Estuaries and bays serve as critical habitat and spawning grounds for many marine species and migratory birds. Estuaries are marine environments maintained in a brackish state by the inflow of freshwater from rivers and streams. The high productivity characteristic of estuaries arises from the abundance of terrigenous nutrient input, shallow water, and the ability of a few marine species to exploit environments continually stressed by low, variable salinities, temperature extremes, and, on occasion, low dissolved oxygen concentrations. The potential environmental effects resulting from the construction of a desalination plant in the vicinity of Nueces Bay and/or Corpus Christi Bay will be sensitive to the siting of the plant and its appurtenances. Environmental analyses including impingement and entrainment will need to be considered as part of the intake evaluation.

The Texas Parks and Wildlife Department (TPWD) and the GLO conducted a joint agency study[5], required by House Bill 2031, on marine seawater desalination plants. The study included general recommendations for diversion intake systems to reduce environmental impacts to

[5] Texas Parks and Wildlife Department and Texas General Land Office, 2018. Marine Seawater Desalination Diversion and Discharge Zones Study. Accessed online https://tpwd.texas.gov/publications/pwdpubs/media/hb2031dz.pdf?d=462414.3799 December 26, 2019.

marine organisms. While the projects proposed in the following sections are located bayside of the coastal barrier islands and are considered seawater desalination plants, some of the recommendations from the study may be applicable. The recommendations in the study for intake structures included:

- Keeping the flow-through velocity of seawater at the intake structure below 0.5 feet per second;
- Do not co-locate diversions such that combined impacts in the surrounding approach area exceeds 0.5 feet per second;
- Design intake structures to adjust or adaptively manage with varying flows and water quality;
- Design intake structures and reduce velocity so marine organisms can escape the intake;
- Use exclusion devices, such as screens or booms, to exclude organisms from the intake; and
- Conduct a site-specific study of conditions at proposed intake locations to identify marine organisms at risk from intake operations during the design planning process.
- If possible and feasible, the study suggested drawing water down through a sandy bottom to below ground piping which would prevent impingement of marine organisms and entrainment of other organisms on the intake screen.

Concentrated brine effluent is produced during the desalination process. Releasing brine concentrate could potentially affect organisms that are dependent upon a specific range of temperature and salinity. Changes to the ratio and type of salt discharges can cause osmotic imbalances and toxicity. The joint TPWD/GLO study on marine seawater desalination also summarized recommendations on siting discharge locations, from their study and published literature. Site specific studies on the receiving waters and brine discharges should be conducted during project planning and include salinity, types of salts, circulation at the discharge site, other contaminants from the process, maintenance, and pipes that may be discharged to the receiving water. These studies should be conducted to find ways to minimize any potential toxicity and impacts to receiving water chemistry and biota.[6] Salinity can affect the density of seawater with higher salinity correlating to denser water thereby potentially affecting water movement in the area. The City of Corpus Christi and Port of Corpus Christi Authority (PCCA) have suggested the use of diffusers at the discharge point, or another mechanism, to mix brine discharge effluent with the seawater to reduce these types of impacts[6]. The Gulf of Mexico coastal seawater typically has a concentration of approximately 35 parts sea salt per thousand parts water by weight, where freshwater is near zero. Salinity variations in estuary and

[6] City of Corpus Christi Seawater Desalination Project (https://www.cctexas.com/desal) Accessed December 27, 2019.

bay areas are typically in response to river inflow, evaporation, and mixing by wind and ocean tides.[7]

The proposed projects are located within the Gulf Coast Prairies and Marshes physiographic region of Texas and within the Tamaulipan biotic province.[8] According to general vegetation data for the state of Texas, several vegetation types occur within the vicinity of the proposed projects, including urban, crops, live oak woods/parks, and marsh barrier island.[9] Vegetation impacts include clearing areas for the desalination plants and installation of pipelines.

According to Information for Planning and Consultation (IPaC), downloaded from the U.S. Fish and Wildlife Service (USFWS) on January 29, 2025, 15 federally listed threatened or endangered species have the possibility of being in the project area (see Table 5B.6.2). Critical habitat for the threatened piping plover (*Charadrius melodus*) is located on San Jose Island and Mustang Island, and proposed critical habitat for the threatened rufa red knot (*Calidris canutus rufa*) is located on Mustang Island, within the 2 miles of Harbor Island and the proposed PCCA Harbor Island desalination site.[10]

Table 5B.6.2 lists federally listed endangered or threatened species occur in the vicinity of the proposed desalination plants. Inclusion in this table does not mean that a species will occur within the project area but only acknowledges the potential for its occurrence in the project area. Because the project will use seawater, no impacts to existing stream flows or stream habitats would be anticipated. Positive impacts to river and stream segments may occur as utilizing treated seawater may reduce or eliminate the water needs from freshwater surface sources. Potential impacts to listed species within the project area could occur due to disturbance associated with intake and discharge structures during operation of the facility. However, proper siting and studies conducted prior to implementation will minimize these impacts.

Impacts to existing habitat resulting from the construction of the desalination plants and their associated pipelines, pump stations and water treatment facilities is a function of facility location and design. Impacts to potential habitat can be avoided by utilizing previously disturbed areas. Site-specific habitat surveys should be conducted prior to project construction to determine whether populations of potential habitats used by listed species occur in the area to be affected. Coordination with TPWD and USFWS regarding threatened and endangered species with potential to occur in the project area should be initiated early in project planning.

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[7] Amec Foster Wheeler, 2017. Process Design Basis and Narrative Port of Corpus Christi Authority Industrial Seawater Desalination Harbor Island. December 2017.

[8] Blair, W.F., “The Biotic Provinces of Texas, “Tex. J. Sci. 2:93-117, 1950.

[9] McMahan, C.A., R.G. Frye, and K.L. Brown, 1984. The Vegetation Types of Texas. Accessed online https://tpwd.texas.gov/publications/pwdpubs/pwd_bn_w7000_0120/ March 22, 2019.

[10] USFWS, 2019. Information for Planning and Consultation (IPaC) resource list. December 18, 2019.

Table 5B.6.2. Federally-Listed Threatened or Endangered Species in the Vicinity of Proposed Desalination Projects in the Coastal Bend Region

Common Name	Scientific Name	Federal Status	Habitat Requirements
Tricolored bat	*Perimyotis subflavus*	PE	Forest, woodland and riparian areas are important. Caves are very important to this species.
West Indian manatee	*Trichechus manatus*	T	Marine, brackish, and freshwater systems in coastal and riverine areas.
Eastern Black Rail	*Laterallus jamaicensis jamaicensis*	T	Salt, brackish, and freshwater marshes, and borders, wet meadows, and grassy swamps.
Northern Aplomado Falcon	*Falco femoralis septentrionalis*	E	Open country, especially savanna and open woodland, and sometimes in very barren areas.
Piping Plover	*Charadrius melodus*	T	Beaches, sandflats, and dunes along Gulf Coast beaches and adjacent offshore islands. Also spoil islands in the Intracoastal Waterway.
Rufa Red Knot	*Calidris canutus rufa*	T	Primarily seacoasts on tidal flats and beaches, herbaceous wetland, and tidal flat/shore.
Whooping Crane	*Grus americana*	E	Small ponds, marshes and flooded grain fields for both roosting and foraging.
Green sea turtle	*Chelonia mydas*	T	Gulf and bay system; shallow water seagrass beds, open water between feeding and nesting areas, barrier island beaches.
Hawksbill sea turtle	*Eretmochelys imbricata*	E	Gulf and bay system, warm shallow waters especially in rocky marine environments such as coral reefs and jetties. Juveniles found in floating mats of sea plants.
Kemp's Ridley sea turtle	*Lepidochelys kempii*	E	Gulf and bay system, adults stay within the shallow waters of the Gulf of Mexico.
Leatherback sea turtle	*Dermochelys coriacea*	E	Gulf and bay systems, and widest ranging open water reptile.
Loggerhead sea turtle	*Caretta caretta*	T	Gulf and bay system primarily for juveniles, adults are most pelagic of sea turtles.
Monarch butterfly	*Danaus plexippus*	PT	Fields, roadsides, wetlands, with milkweed and flowering plants.
Slender rush-pea	*Hoffmannseggia tenella*	E	Coastal prairie grasslands on level uplands and on gentle slopes along drainages.
South Texas ambrosia	*Ambrosia cheiranthifolia*	E	Grasslands and mesquite-dominated shrublands on various soils. Mostly over the Beaumont Formation on the Coastal Plain.

Source: USFWS, 2025. Information for Planning and Consultation Resource List. Downloaded January 29, 2025.
E=Endangered, T=Threatened, PE=Proposed Endangered, PT=Proposed Threatened

Energy is the largest operational cost of a desalination facility, and energy use is directly proportional to salinity of the source water. Potential indirect environmental effects include air and greenhouse gas emissions associated with energy usage. These effects could be minimized by incorporating the use of renewable energy sources.

Cultural resource surveys of the plant sites and pipeline routes will need to be performed consistent with requirements of the Texas Antiquities Code. Because of the relatively small areas involved, construction and maintenance of surface facilities are not expected to result in substantial environmental impacts. Where environmental resources (e.g., endangered species habitat and cultural resource sites) could be impacted by surface infrastructure, changes in facility siting and pipeline alignment would generally be sufficient to avoid or minimize adverse effects.

5B.6.3 Implementation Issues

Permitting of this seawater desalination facilities will require extensive coordination with applicable regulatory entities, including the Texas Commission on Environmental Quality (TCEQ), GLO, and others listed above. Permitting and construction of the intake and concentrate pipeline will be major project components.

The installation and operation of a seawater desalination water treatment plant will likely have to address the following issues.

- Disposal of concentrated brine from desalination water treatment plant;
- Permitting and constructing concentrate pipeline through seagrass beds and barrier island;
- Impact on the bays from removing water for consumptive use and altering existing power plant water rights permits;
- Confirming that blending desalted seawater with other water sources in the municipal demand distribution system can be successfully accomplished;
- High power requirements for desalination process dependent on large, reliable power source;
- Skilled operators of desalination water treatment plants;
- Permitting of a pipeline across rivers, highways, and private rural and urban property; and
- Possibility of using a design, build, operate contract for a desalination water treatment plant.

5B.6.4 City of Corpus Christi Seawater Desalination- Inner Harbor and La Quinta Channel Projects

5B.6.4.1 Description of Strategy

Desalting seawater from the Gulf of Mexico is a potential source of freshwater supplies for municipal and industrial uses. In August 2004, the City of Corpus Christi conducted a feasibility study[11] funded by the TWDB of a large-scale seawater desalination facility in the Region N area. For the 2006 and 2011 regional water plans, a large-scale 25 to 100 mgd seawater desalination facility co-sited with the Barney M. Davis Power Station in Corpus Christi near Laguna Madre, Oso Bay, and Corpus Christi Bay was considered. Favorable factors for the Barney Davis power station location include use of cooling plant effluent for diluting concentrate, ability to use the existing seawater intake infrastructure at the power plant, and close proximity to the water distribution system. The desalination concentrate was considered to be piped out to the open Gulf of Mexico to be discharged in waters over 30 feet deep. The 2011 regional water plan estimated the cost of a 25 mgd seawater desalination facility at Barney M. Davis Power Station with 5-mile pipeline delivery to proposed distribution center on the south side of town at $1,696 per ac-ft (or $5.21 per 1,000 gallons) based on September 2008 dollars. Blending with brackish groundwater, previously evaluated in the 2006 regional water plan, was eliminated from further consideration based on the lack of availability of groundwater at suitable quality (summarized in Chapter 9). The seawater desalination facility co-sited with Barney M. Davis Power Station was included as an alternate strategy in the 2011 regional water plan at the 25 mgd size, which was subsequently updated through amendment in August 2014 to be listed as a recommended strategy for the 2011 regional water plan to meet needs beginning in 2020.

The City of Corpus Christi, as a wholesale water provider (WWP), continues to evaluate seawater desalination options, including variable desalination programs and combinations with brackish groundwater resources to address future industrial development and anticipated population growth associated with new industry and Eagle Ford Shale production. In April 2014, the Corpus Christi City Council voted to accept a federal, U.S. Bureau of Reclamation grant and transfer funds from the City's Raw Water Supply Development Fund for a City of Corpus Christi Desalination Program Pilot Study. In July 2014, Corpus Christi City Council considered and subsequently adopted a resolution to the 84th Texas Legislature to appropriate funding for FY 16-17 biennium and partnering with local sponsors to implement desalination projects.

The City of Corpus Christi conducted a $3 million demonstration program with support from the U.S. Bureau of Reclamation to design, construct, and operate a demonstration desalination plant for industrial and drinking water purposes. The objectives of the program are to evaluate the feasibility of seawater desalination and develop cost estimates, to test emerging technologies, and to identify and assess site options and requirements for a full-scale facility.[12] With the results of the study, the City of Corpus Christi will consider moving forward with a full-scale desalination project. As of November 2019, the City of Corpus Christi is considering two potential sites to provide additional supplies of 30 mgd for Nueces County industries and municipal customers and 40 mgd for San Patricio County: Inner Harbor and La Quinta Channel. These locations are shown in Figure 5B.6.3, with the aerial photograph showing the most current location.

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[11] City of Corpus Christi, Draft Report "Large Scale Demonstration Desalination Feasibility Study," August 2004.

[12] City of Corpus Christi website, "Corpus Christi Desalination Demonstration Project", June 2014. http://www.cctexas.com/Assets/Departments/Water/Files/DesalFactSheet.pdf

Figure 5B.6.3.
Proposed Location for Inner Harbor and La Quinta Seawater Desalination Programs

The Inner Harbor Desalination site in Nueces County would be constructed to treat 30 mgd and La Quinta Channel Desalination site in San Patricio County would treat 40 mgd. The treatment efficiency of the desalination plant is estimated to be 45 percent. The finished water quality is targeted to be approximately 500 mg/L. The Inner Harbor Plant will treat all of its product water to potable standards and send it through the City of Corpus Christi distribution system. The La Quinta Channel Plant will treat the product water to potable water standards and deliver it to San Patricio Municipal Water District (SPMWD). The SPMWD will deliver this water to industrial customers, but they may adjust water quality to meet the needs of different customers.

The Inner Harbor water use permit was granted on October 10, 2022, for diversions not to exceed 93, 148 ac-ft/yr with a maximum diversion of 129 cubic feet per second (57,708 gallons per minute). The discharge and the U.S. Army Corps of Engineers (USACE) permits are in progress. The La Quinta water use permit was granted on April 17, 2024, for diversions not to exceed 186,295 ac-ft/yr with a maximum diversion of 257 cubic feet per second (115,349 gallons per minute). The discharge and USACE permits are in progress.

An industrial wastewater permit application was filed by the City of Corpus Christi on January 22, 2020. TCEQ Executive Director decided on December 19, 2024, that the permit application meets the requirements of applicable law for discharge permit, TPDES Permit No. WQ0005289000, for effluent discharged directly to Corpus Christi Inner Harbor in Segment No. 2484 of the Bays and Estuaries. The designated uses for Segment No. 2484 are non-contact recreation and intermediate aquatic life use. TCEQ commissioners have set a public meeting on March 13, 2025, to consider the permit and request for hearing.

5B.6.4.2 Available Yield- Inner Harbor

Seawater from the Gulf of Mexico is assumed to be available in an unlimited quantity within the context of a supply for the Coastal Bend Region. Also, it is assumed that the cost of Gulf water is zero prior to extraction from the source. The City of Corpus Christi and port industries are currently considering a finished desalination supply of 30 mgd (33,604 ac-ft/yr) at the Inner Harbor facility. A map is shown in Figure 5B.6.4.

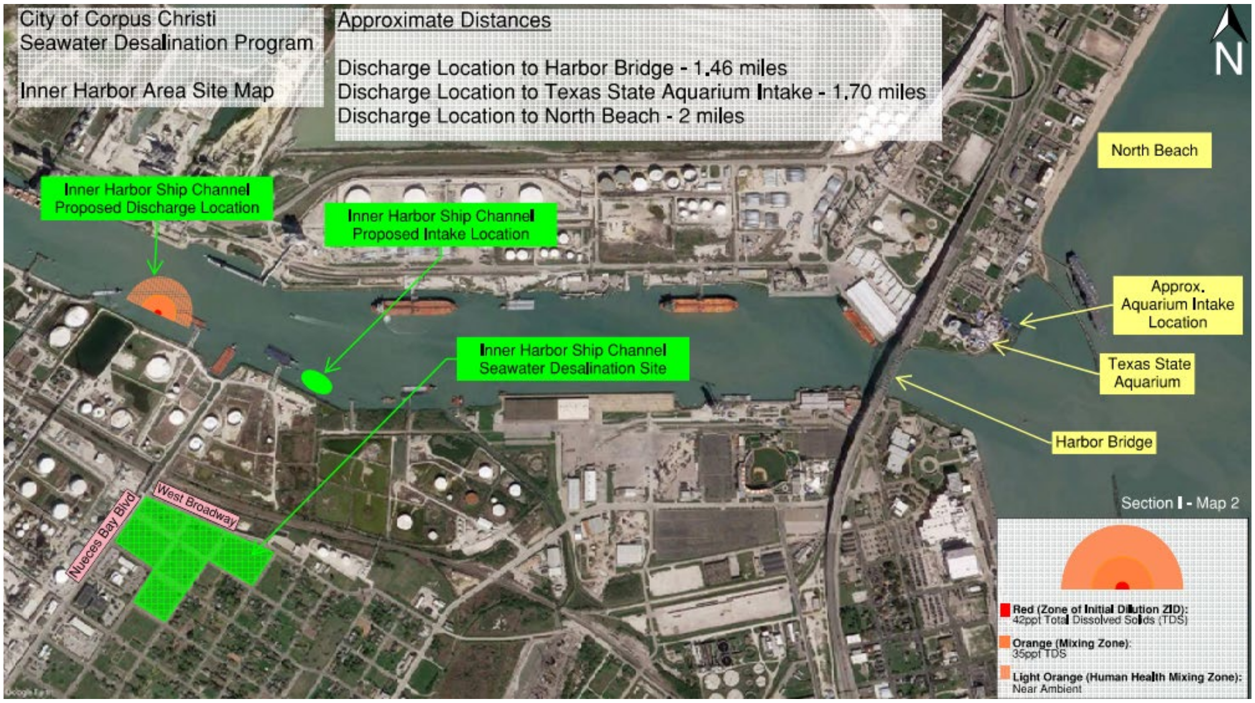

Figure 5B.6.4.
Proposed Location for Inner Harbor Seawater Desalination Programs

5B.6.4.3 Engineering and Costing- Inner Harbor

Based on information provided by City of Corpus Christi staff and its consultant, the following costs were identified for the Inner Harbor seawater desalination project as shown in Table 5B.6.3:

- Total estimated construction costs for a 30 mgd Inner Harbor facility $785 million.
- Lifecycle water production costs, at the fence, are estimated to be $9.68 per 1,000 gallons with debt service for a plant located at the 30 mgd Inner Harbor facility.

Details regarding desalination process and site-specific environmental impacts for transmission and delivery are unavailable at this time. A 3,500-foot raw water pipeline, 2,300-foot concentrate discharge pipeline, and 500-foot product water delivery line are included in the cost estimate, based on information provided by Freese and Nichols.

Energy is the largest operational cost of a desalination facility, and energy use is directly proportional to salinity of the source water. Using the Unified Costing Model (UCM) tool for regional water planning according to TWDB guidelines, which includes a higher cost for operations and maintenance than is expected by the City of Corpus Christi and their consultant results in an annual cost around $106,000,000 for the 30 mgd plant. This results in a unit cost of water of $3,154 per ac-ft with debt service for the Inner Harbor site. Private industry partnerships and funding structures may be considered to help reduce costs and minimize treatment plant operation and maintenance risks assumed by City of Corpus Christi operators, which may account for costing differences as compared to information shown in Table 5B.6.3. The information was developed based on capital costs, project costs, and annual water productions costs provided by Freese and Nichols, updated using the UCM and is relevant for desalination distribution near the facility. Delivery costs to specific industries or municipal distribution system are not included.

Table 5B.6.3. Cost Estimate Summary, City of Corpus Christi- Inner Harbor 30 mgd Desalination Project (Sept 2023 Prices)

Item	Estimated Costs for Facilities
Water Treatment Plant (30 MGD, includes pretreatment)	$211,739,000
Intake Structure and Pipelines	$32,561,000
Product Storage and Delivery	$106,603,000
Brine Discharge Pipeline and Diffuser	$67,281,000
Sitework, Electrical, Solids Handling, Auxiliary Utilities, Buildings, and Startup	$126,720,723
Total Cost of Facilities[a]	**$544,904,723**
- Planning (3%)	$16,000,000
- Design (7%)	$38,000,000
- Construction Engineering (1%)	$5,000,000
Legal Assistance (2%)	$11,000,000
Fiscal Services (2%)	$11,000,000
Pipeline Contingency (15%)	$26,000,000
All Other Facilities Contingency (20%)	$74,000,000
Environmental & Archaeology Studies and Mitigation	$32,000
Land Acquisition and Surveying (27 acres)	$111,000
Interest During Construction (3.5% for 3 years with a 0.5% ROI)	$59,000,000
Total Cost of Project	**$785,000,000**
Annual Cost	
Debt Service (3.5 percent, 20 years)	$46,000,000
Operation and Maintenance	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$3,006,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$1,000,000
Water Treatment Plant[b]	$55,000,000
Pumping Energy Costs (10079868 kW-hr @ 0.09 $/kW-hr)[c]	$900,000
Total Annual Cost	**$106,000,000**
Available Project Yield (acft/yr)	33,604
Annual Cost of Water ($ per acft)	$3,154
Annual Cost of Water After Debt Service ($ per acft)	$1,783
Annual Cost of Water ($ per 1,000 gallons)	$9.68
Annual Cost of Water After Debt Service ($ per 1,000 gallons)	$5.47

[a] Cost of Facilities provided by the City of Corpus Christi. Cost estimates originated in a Freese and Nichols report.

[b] The water treatment plant annual costs from the TWDB uniform costing model include energy costs associated with use of reverse osmosis membrane treatment to desalinate seawater and produce finished water with TDS levels below the TCEQ regulatory limit.

[c] The pumping energy cost is calculated by the uniform costing model based on pipeline diameter and length, flowrate, and elevation data. This cost accounts for pumping raw water from the intake, brine discharge to the outfall, and treated water to the delivery point.

5B.6.4.4 Available Yield- La Quinta

Seawater from the Gulf of Mexico is assumed to be available in an unlimited quantity within the context of a supply for the Coastal Bend Region. Also, it is assumed that the cost of Gulf water is zero prior to extraction from the source. The City of Corpus Christi and port industries are currently considering a finished desalination supply of 40 mgd (44,806 ac-ft/yr).

5B.6.4.5 Engineering and Costing- La Quinta

Based on information provided by City of Corpus Christi staff and its consultant, the following costs were identified for the La Quinta Channel seawater desalination project as shown in Table 5B.6.4:

- Total estimated construction costs for a 40 mgd La Quinta facility $1,141,000,000.
- Lifecycle water production costs, at the fence, are estimated to be $10.62 per 1,000 gallons with debt service for a plant located at the 40 mgd La Quinta facility.

Details regarding desalination process and site-specific environmental impacts for transmission and delivery are unavailable at this time. A 11,800-foot raw water pipeline, 14,500-foot concentrate discharge pipeline, and 2,000-foot product water delivery line are included in the cost estimate, based on information provided by Freese and Nichols. The brine discharge outfall structure was assumed to cost the same as an intake structure for the designated flow rate based on 45 percent RO recovery.

Energy is the largest operational cost of a desalination facility, and energy use is directly proportional to salinity of the source water. Using the UCM tool for regional water planning according to TWDB guidelines, which includes a higher cost for operations and maintenance is expected to result in an annual cost around $155,000,000. This results in a unit cost of water of $3,460 per ac-ft with debt service for the La Quinta site with plant size of 40 mgd. Private industry partnerships and funding structures may be considered to help reduce costs and minimize treatment plant operation and maintenance risks assumed by City of Corpus Christi operators, which may account for costing differences as compared to information shown in Table 5B.6.4. The information presented in the tables was developed based on capital costs, project costs, and annual water productions costs provided by Freese and Nichols, updated using the UCM and is relevant for desalination distribution near the facility. Delivery costs to specific industries or municipal distribution system are not included.

Table 5B.6.4.
Cost Estimate Summary,
City of Corpus Christi- La Quinta 40 mgd Desalination Project (Sept 2023 Prices)

Item	Estimated Costs for Facilities
Intake Structure and Pump Station (89 MGD)	$60,000,000
Water Treatment Plant (40 MGD)	$614,000,000
Transmission Pipeline (48" - 2,000 ft)	$3,000,000
Raw Water Pipeline (72" - 11,800 ft)	$31,000,000
Brine Pipeline (54" - 14,500 ft)	$28,000,000
Brine Discharge Outfall and Pump Station	$23,000,000
Treated Water Booster Pump Station	$7,000,000
Substation and Transmission lines[a]	$8,000,000
Total Cost of Facilities	**$774,000,000**
- Planning (3%)	$23,000,000
- Design (7%)	$54,000,000
- Construction Engineering (1%)	$8,000,000
Legal Assistance (2%)	$15,000,000
Fiscal Services (2%)	$15,000,000
Pipeline Contingency (15%)	$9,000,000
All Other Facilities Contingency (20%)	$142,000,000
Environmental & Archaeology Studies and Mitigation	$161,000
Land Acquisition and Surveying (39 acres)	$240,000
Interest During Construction (3.5% for 3 years with a 0.5% ROI)	$101,000,000
Total Cost of Project	**$1,141,000,000**
Annual Cost	
Debt Service (3.5 percent, 20 years)	$80,000,000
Operation and Maintenance	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$706,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$2,000,000
Water Treatment Plant[b]	$71,000,000
Pumping Energy Costs (12816026 kW-hr @ 0.09 $/kW-hr)[c]	$1,450,000
Total Annual Cost	**$155,000,000**
Available Project Yield (acft/yr)	44,804
Annual Cost of Water ($ per acft)	$3,460
Annual Cost of Water After Debt Service ($ per acft)	$1,677
Annual Cost of Water ($ per 1,000 gallons)	$10.62
Annual Cost of Water After Debt Service ($ per 1,000 gallons)	$5.15

[a] Cost estimated by HDR, externally from the UCM.
[b] The water treatment plant annual costs from the TWDB uniform costing model includes energy costs associated with use of reverse osmosis membrane treatment to desalinate seawater and produce finished water with TDS levels below the TCEQ regulatory limit.
[c] The pumping energy cost is calculated by the uniform costing model based on pipeline diameter and length, flowrate, and elevation data. This cost accounts for pumping raw water from the intake, brine discharge to the outfall, and treated water to the delivery point.

5B.6.4.6 Environmental Issues

The two project areas being considered by the City of Corpus Christi for the proposed desalination plant are the Inner Harbor and La Quinta sites. The La Quinta option is located on Corpus Christi Bay, east of the inlet to Nueces Bay; the Inner Ship Channel option is located along the Main Turning Basin, near the outlet to Corpus Christi Bay. The specific siting information is still to be determined, but each proposed desalination plant site would be approximately 10 acres in size. Key factors considered in the selection of these two locations are the availability of power, proximity to the water transmission system, the character of the source water, location of a suitable concentrate discharge location, among other environmental considerations.[13]

Specific siting information for the discharge of desalination concentrate will be determined during project design. Since the desalination concentrate will be saltier than the receiving waters, the City of Corpus Christi has stated that a diffusing system would be desirable to remix the concentrate with the source water. Additional chemicals, which may be used during the filtering/treating process, may be present in the concentrate. The outfall for brine concentrate will need to consider impacts to the estuary and bay system. Prior to construction, site specific environmental studies will need to be conducted to evaluate all potential impacts to the environment and identify best management practices to eliminate or reduce adverse impacts.[14] As of 2024, the City of Corpus Christi has received the TCEQ water rights permit and has submitted the discharge permit application.

Inner Harbor Desalination Site

The TPWD maintains the Texas Natural Diversity Database (TXNDD), which documents the occurrence of endangered, threatened and rare species, natural communities, and animal aggregations. The TXNDD data was reviewed for recorded occurrences of listed or rare species or natural communities, near the proposed project. The plains spotted skunk (*Spilogale putorius interrupta*), a rare species has been documented at the project site. The West Indian manatee (*Trichechus manatus*), a federally-listed threatened species, and a marine mammal with protections under the Marine Mammal Protection Act has been documented within two miles of the proposed project site. Three rare species, the Texas diamondback terrapin (*Malaclemys terrapin littoralis*), Texas stonecrop (*Lenophyllum texanum*), and Texas windmill grass (*Chloris texensis*) have also been documented within two miles of the proposed project. The TXNDD data identified a colonial wading bird colony (rookery) on the northeast side of the causeway (US 181) across Nueces Bay.

The intake and discharge locations for Inner Harbor have been studied[15]. This study noted that the habitat quality in the intake area has already been impacted by industrialization and it is unlikely that mortality from entrainment would be enough to substantially impact any local

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[13] City of Corpus Christi Desalination Project Frequently Asked Questions (https://www.cctexas.com/sites/default/files/water-desal-faq-022819.pdf)

[14] City of Corpus Christi Desalination Project Frequently Asked Questions (https://www.cctexas.com/sites/default/files/water-desal-faq-022819.pdf)

[15] Stunz, Greg and Paul Montagna, 2015. Identification and Characterization of Potential Environmental Impacts Mitigation Measures Related to Intake and Discharge Facilities of Seawater Desalination Plants.

populations. The Inner Harbor intake area is also unlikely to have any type of sensitive habitat types (i.e., seagrasses) which would impact benthic communities. Additionally, the area is highly industrialized and any surface housings would be unlikely to impact aesthetics of the area. For potential discharge, the study recommended further studies on the salinity and water chemistry to determine potential impacts, and bringing brine discharge to ambient bay temperatures prior to discharging.

National Wetland Inventory (NWI) maps were reviewed and the proposed Inner Harbor Desalination site may be in close proximity to estuarine and marine deepwater habitat, freshwater ponds, and freshwater emergent wetlands. Coordination with USACE has been initiated for impacts to waters of the United States, and a permit is expected in first quarter of 2025.

The proposed desalination plant would be located on the Inner Harbor. The Corpus Christi Inner Harbor (TCEQ Segment 2484) is listed as impaired on TCEQ's 2024 Draft 303(d) List[16] for copper in the water. Within approximately 5 miles, one Corpus Christi Bay Recreational Beach (TCEQ Segment 2481CB_06) and the Corpus Christi Bay (Oyster Water) (TCEQ Segment 2481OW_01) are listed as impaired for bacteria in water. Additionally, the inlet to Nueces Bay (TCEQ Segment 2482) is likely within 5 miles of the proposed desalination plant and is listed as impaired for copper in water.

Cultural resources protection on public lands in Texas is afforded by the Antiquities Code of Texas (Title 9, Chapter 191, Texas Natural Resource Code of 1977), the National Historic Preservation Act (Pl96-515), and the Archeological and Historic Preservation Act (PL93-291). Based on the review of publicly available Geographic Information System (GIS) records obtained from the Texas Historical Commission, there are no State Historic Sites, National Register Properties or Districts, cemeteries or Historical Markers within the project area. Two cemeteries, New Bayview and Old Bayview, as well as five sites listed on the National Register of Historic Places, the Nueces County Courthouse, Simon Gugenheim House, Charlotte Sidbury House, S. Julius Lichtenstein House, and the U.S.S. Lexington were located within approximately one mile from the project area. A review of archaeological resources in the proposed project area should be conducted during the project planning phase. Because the owner or controller of the proposed project, the City of Corpus Christi, is a political subdivision of the State of Texas they will be required to coordinate with the Texas Historical Commission prior to project construction.

La Quinta Desalination Site

The TXNDD data was reviewed for documented occurrences of listed or rare species or natural communities near the project area. The federally-listed endangered jaguarundi (*Felis yagouaroundi cacomitli*), as well as several rare species or species of greatest conservation need, the keeled earless lizard (*Holbrookia propinqua*), coastal gay-feather (*Liatris bracteata*), threeflower broomweed (*Thurovia triflora*), Indianola beakrush (*Rynchospora indianolensis*), and

[16] TCEQ, 2024. 2024 Texas Integrated Repot – Texas 303(d) List (Category 5). Accessed online https://www.tceq.texas.gov/downloads/water-quality/assessment/integrated-report-2024/2024-303d December 4, 2024.

Wright's trichocoronis (*Trichocoronis wrightii var wrightii*) have been documented within two miles of the proposed La Quinta site. Additionally, a rookery was documented on the spoil banks in Corpus Christi Bay, located southeast of the project area.

The intake and discharge locations for the La Quinta site have been studied[17]. This study noted that mortality of benthic organisms could occur due to disturbance to bottom sediments. This area is known to have some sensitive seagrass habitats and is located adjacent to other sensitive habitats including fish nursery habitat, rookeries, migratory bird feeding and resting areas, and feeding areas for sea turtles. Due to its location near sensitive habitats, there would be potential for more severe environmental impacts due to brine discharge.

National Wetland Inventory (NWI) maps were reviewed and the proposed La Quinta Desalination site may be in close proximity to estuarine and marine deepwater habitat, estuarine and marine wetlands, freshwater ponds, and lakes. A jurisdictional determination of waters should be completed for the proposed project site, during project planning. Coordination with the USACE would be required for impacts to waters of the United States.

The proposed desalination plant would be located on the Corpus Christi Bay (TCEQ Segment 2481OW).[18] This Segment is listed as impaired on the 2024 Draft 303(d) List for bacteria in oyster waters. The Corpus Christi Bay (TCEQ Segment 2481CB_06) is a recreational beach likely located within 5 miles of the proposed project site and listed as impaired for bacteria in water.

Based on the review of publicly available geographic information system (GIS) records obtained from the Texas Historical Commission, there are no State Historic Sites, National Register Properties or Districts, cemeteries or Historical Markers within the project area, or within one mile of the proposed project area. A review of archaeological resources in the proposed project area should be conducted during the project planning phase. Because the owner or controller of the proposed project, the City of Corpus Christi, is a political subdivision of the State of Texas (i.e., river authority, municipality, county, etc.), they will be required to coordinate with the Texas Historical Commission prior to project construction.

5B.6.4.7 Implementation Issues

The installation and operation of a seawater desalination water treatment plant may have to address the following issues.

- Disposal of concentrated brine from desalination water treatment plant;
- Permitting and constructing concentrate pipeline through seagrass beds and barrier island, including conforming with applicable laws and regulations including:
    - USACE permitting (including Section 404 Clean Waters Act and Section 10 Rivers & Harbors Act)

[17] Stunz, Greg and Paul Montagna, 2015. Identification and Characterization of Potential Environmental Impacts Mitigation Measures Related to Intake and Discharge Facilities of Seawater Desalination Plants.

[18] TCEQ, 2020. Surface Water Quality Viewer. Accessed online tceq.maps.arcgis.com January 13, 2020.

- Endangered Species Act compliance and TPWD coordination, if required
- Compliance with the Antiquities Code of Texas, the National Historic Preservation Act, and the Archeological and Historic Preservation.
- TPDES, stormwater, and associated construction permits
- Associated TCEQ registrations
- Local land use and construction permits
- GLO permitting requirements

- Impact on the bays from removing water for consumptive use and altering existing water rights permits;
- Confirming that blending desalted seawater with other water sources in the municipal demand distribution system can be successfully accomplished;
- High power requirements for desalination process dependent on large, reliable power source;
- Skilled operators of desalination water treatment plants;
- Permitting of a pipeline across rivers, highways, and private rural and urban property; and
- Possibility of using design, build, operate contract for a desalination water treatment plant.

5B.6.4.8 Evaluation Summary

An evaluation summary of this regional water management strategy is provided in Table 5B.6.5.

Table 5B.6.5.
Evaluation Summary of the City of Corpus Christi's Inner Harbor (30 mgd) and La Quinta (40 mgd) Seawater Desalination Projects

Impact Category	Comment(s)
a. Water supply:	
1. Quantity	1. Project size: Inner Harbor: 33,604 ac-ft/yr and La Quinta: 44,804 ac-ft/yr
2. Reliability	2. Highly reliable quantity.
3. Cost of treated water	3. Cost for Inner Harbor: $3,154 and La Quinta $3,460 per ac-ft.
b. Environmental factors:	
1. Instream flows	1. None or low impact.
2. Bay and estuary inflows and arms of the Gulf of Mexico	2. Some environmental impact to estuary.
3. Wildlife habitat	3. Some. Disposal of concentrated brine created from process may impact fish and wildlife habitats or wetlands.
4. Wetlands	4. Some. Disposal of concentrated brine created from process may impact fish and wildlife habitats or wetlands.
5. Threatened and endangered species	5. None identified. Endangered species survey will be needed to identify impacts.
6. Cultural resources	6. Cultural resources survey will be needed to identify any significant sites.
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. 7a-b. Total dissolved solids and salinity of water is removed with reverse osmosis treatment. Brine concentrate disposal issues will need to be evaluated. 7c-i. Bacteria, chlorides, nitrate, alkalinity, ammonia, and copper were all identified as constituents of concern for the Nueces Bay in the TCEQ and NRA Basin Highlights Report. Additional studies regarding impacts on or as a result of project are needed.
c. Impacts to agricultural resources and State water resources	• None or low impacts on other water resources • Negligible impacts to agricultural resources
d. Threats to agriculture and natural resources in region	• Some. Temporary damage due to construction of pipeline
e. Recreational impacts	• None
f. Equitable comparison of strategies	• Standard analyses and methods used for portions • Seawater desalination cost modeled after bid and manufacturers' budgets, but not constructed, comparable project
g. Interbasin transfers	• Not applicable
h. Third party social and economic impacts	• Not applicable
i. Efficient use of existing water supplies and regional opportunities	• Provides regional opportunities
j. Effect on navigation	• None
k. Impacts to water pipelines and other facilities used for water conveyance	• Construction and maintenance of transmission pipeline corridor (in future). Possible impact to wildlife habitat along pipeline route and right-of-way.

5B.6.5 City of Corpus Christi Barney Davis Desalination

5B.6.5.1 Description of Strategy

The Barney Davis power facility (owned by Talen Energy) uses seawater originating from the Laguna Madre for cooling. The concept of co-locating a seawater desalination facility at Barney Davis power facility was first developed over 20 years ago[19] and was considered in the *2001 Coastal Bend Regional Water Plan*[20] as a water management strategy to meet long-term manufacturing water demands in Nueces and San Patricio counties. The Barney Davis site was identified as technically feasible in a seawater desalination feasibility study[21] and potential implementation challenges were identified. For the 2006 and 2011 regional water plans, a large-scale 25 to 100 mgd seawater desalination facility co-sited with the Barney M. Davis Power Station in Corpus Christi near Laguna Madre, Oso Bay, and Corpus Christi Bay was considered. Favorable factors for the Barney Davis power station location include use of cooling plant effluent for diluting concentrate, ability to use the existing seawater intake infrastructure at the power plant, and close proximity to the water distribution system. The desalination concentrate was considered to be off-shore in the open Gulf of Mexico to be discharged in waters over 30 feet deep. The 2011 regional water plan estimated the cost of a 25 mgd seawater desalination facility at Barney M. Davis Power Station with 5-mile pipeline delivery to proposed distribution center on the south side of town at $1,696 per ac-ft (or $5.21 per 1,000 gallons) based on September 2008 dollars. Blending with brackish groundwater, previously evaluated in the 2006 regional water plan, was eliminated from further consideration based on the lack of availability of groundwater at suitable quality (summarized in Chapter 11). The seawater desalination facility co-sited with Barney M. Davis Power Station was included as an alternate strategy in the 2011 regional water plan at the 25 mgd size, which was subsequently updated through amendment in August 2014 to be listed as a recommended strategy in the 2011 regional water plan to meet needs beginning in 2020.

The concept evaluated in the 2026 regional water plan is to have the desalination facility draw raw water from the power facility cooling pond and discharge brine generated by the RO treatment process through a 7.5-mile pipeline to the Gulf of Mexico. The concept of co-locating a desalination facility at the Barney Davis power facility site is of interest since it would potentially allow a desalination facility to benefit from the existing open water intake permit thereby simplifying the permitting and approval process, as well as reducing power costs for treatment by co-locating the desalination facility at the site of a power facility.

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[19] HDR Engineering, Inc (HDR), "Desalination for Texas Water Supply," Texas Water Development Board, Nueces River Authority, August 2000.

[20] HDR Engineering, Inc (HDR), "Coastal Bend Regional Water Plan," Texas Water Development Board, January 2001

[21] City of Corpus Christi and Turner Collie Braden, Large Scale Demonstration Desalination Feasibility Study, November 2004. https://www.twdb.texas.gov/publications/reports/contracted_reports/doc/2004483508_Corpus_Desal.pdf?d=9668.39999999851

The GLO and TPWD prepared a report[22] in response to House Bill 2031 directed by the 84th Texas Legislature that identified zones in the Gulf of Mexico appropriate for diversion of marine seawater and discharge of brine concentrate while accounting for protection of marine organisms. The 7.5-discharge pipeline provides the advantage of not impacting environmentally sensitive nearby receiving bodies (Oso Creek and Laguna Madre). The desalination facility is conceptualized, such that it does not impact Talen Energy's existing power facility operations. There appears to be sufficient space at the Barney Davis site for addition of a 20 mgd desalination facility. The proposed desalination site is shown in Figure 5B.6.5.

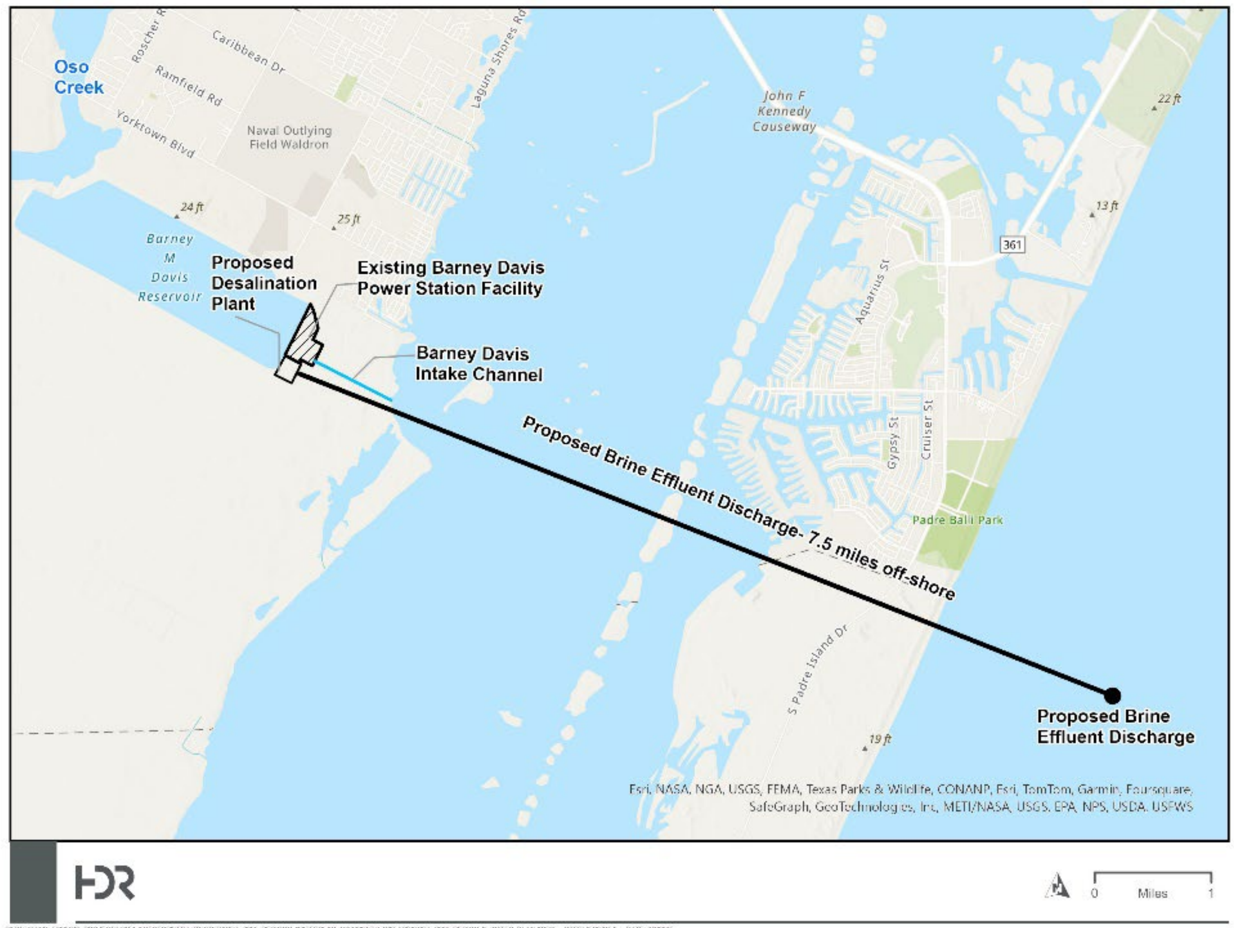

Figure 5B.6.5.
Proposed Location for Seawater Desalination Facility at Barney Davis

5B.6.5.2 Available Yield- Barney Davis

The current Intake Permit at Barney Davis allows for 725,000 acre-feet per year (ac-ft/yr) to be diverted through the intake, or the equivalent of 645 mgd. The current Intake Permit also allows for up to 6,650 ac-ft/yr of consumptive use, or the equivalent of 6 mgd. The consumptive use

[22] Texas Parks and Wildlife and Texas General Land Office, 2018, Marine Seawater Desalination Diversion and Discharge Zones Study.

would need to be increased to allow for the operation of a 20 mgd desalination facility. An amendment to the intake permit authorizing a change of use from industrial purposes to public water supply would also be required. The anticipated supply is 33,627 ac-ft/yr (20 mgd).

5B.6.5.3 Environmental Issues- Barney Davis

The USFWS Information for Planning and Consultation (IPaC) Report lists a total of 15 threatened, endangered, and proposed listed species that may be present in the project area (Table 5B.6.6). Coordination with the USFWS and National Marine Fisheries Service (NMFS) is required when there is a federal nexus with the project, with formal consultation required if impacts to listed species are anticipated.

Table 5B.6.6
USFWS listed species with potential to occur within the study area

Species Name	Status	Probability of presence in the Project Area
Tricolored Bat ***Perimyotis subflavus***	Proposed Endangered	The project area may provide habitat for the species. A habitat assessment is recommended.
West Indian Manatee ***Trichechus manatus***	Threatened	The project area may provide habitat for the species. The facility has a controlled access system that prevents the passage of marine species from the Laguna Madre and monitoring protocols in place for aquatic species in the intake channel.
Eastern Black Rail ***Laterallus jamaicensis ssp. jamaicensis***	Threatened	The project area may provide habitat for the species. A habitat assessment is recommended.
Northern Aplomado Falcon ***Falco femoralis septentrionalis***	Endangered	The project area may provide habitat for the species. A habitat assessment is recommended.
Piping Plover ***Charadrius melodus***	Threatened	The project area may provide habitat for the species. A habitat assessment is recommended. Critical habitat for this species is along Mustang Island, potentially within the Study Area.
Rufa Red Knot ***Calidris canutus rufa***	Threatened	The project area may provide habitat for the species. A habitat assessment is recommended. Critical habitat for this species is along Mustang Island, potentially within the Study Area.
Whooping Crane ***Grus americana***	Endangered	The project area may provide habitat for the species. A habitat assessment is recommended. No critical habitat for this species is within the Study Area.
Green Sea Turtle ***Chelonia mydas***	Threatened	The project area may provide habitat for the species. The facility has a controlled access system that prevents the passage of marine species from the Laguna Madre and monitoring protocols in place for aquatic species in the intake channel.
Hawksbill Sea Turtle ***Eretmochelys imbricata***	Endangered	The project area may provide habitat for the species. The facility has a controlled access system that prevents the passage of marine species from the Laguna Madre and monitoring protocols in place for aquatic species in the intake channel.
Kemp's Ridley Sea Turtle ***Lepidochelys kempii***	Endangered	The project area may provide habitat for the species. The facility has a controlled access system that prevents the passage of marine species from the Laguna Madre and monitoring protocols in place for aquatic species in the intake channel.

Species Name	Status	Probability of presence in the Project Area
Leatherback Sea Turtle ***Dermochelys coriacea***	Endangered	Gulf and bay system, adults stay within the shallow waters of the Gulf of Mexico. The project would be expected to discharge into the Gulf of Mexico using diffusers, studies should be conducted to ensure discharged water chemistry is consistent with the surrounding area.
Loggerhead Sea Turtle ***Caretta caretta***	Threatened	Gulf and bay system primarily for juveniles, adults are most pelagic of sea turtles. The project would be expected to discharge into the Gulf of Mexico using diffusers, studies should be conducted to ensure discharged water chemistry is consistent with the surrounding area.
Monarch Butterfly ***Danaus plexippus***	Proposed Threatened	The project area may provide habitat for the species. A habitat assessment is recommended.
Slender Rush-pea ***Hoffmannseggia tenella***	Endangered	The project area may provide habitat for the species. A habitat assessment is recommended.
South Texas Ambrosia ***Ambrosia cheiranthifolia***	Endangered	The project area may provide habitat for the species. A habitat assessment is recommended.

Generally, habitat may be present for species within the project area, particularly along the coastline and at the point of intake to the power facility in the Laguna Madre and at the discharge point within the Gulf of Mexico. A habitat assessment will be necessary to delineate areas of potential habitat for threatened and endangered species so that siting of the proposed desalination facility can avoid sensitive habitat to the extent practicable.

Barney Davis, LLC received a permit for incidental take for threatened and endangered species on August 3, 2020, under Section 10(a)(1)(B) of the Endangered Species Act. The primary threat to threatened and endangered species from the existing intake, and by extension the proposed desalination facility, is to cold-stunned green and Kemp's ridley sea turtles, which have been documented in the intake canal in recent years. Sea turtles may float into the intake canal and become impinged on the automatic rake before entering the cooling water facility. The facility follows a monitoring and removal plan for cold-stunned sea turtles during the winter months to minimize the number of incidental takes of sea turtles and submits annual reports on the total annual actual take. The permit, which expires August 31, 2030, allows for capture of 206 green sea turtles and 4 Kemp's ridley sea turtles, with mortality and injury take limited to 24 total green sea turtles and 0 Kemp's ridley sea turtles within the 10-year permit period[23]. Permitting for the desalination facility will likely require new coordination with NMFS and/or USFWS.

HDR Engineering, Inc. (HDR) conducted a desktop analysis of known and potential cultural resources within and in proximity to the project area in 2023. Staff consulted the Texas Historical Commission Atlas (Atlas), the National Register of Historic Places (NRHP), and the Texas Freedom Colonies Atlas to determine if previously identified archaeological sites, historic architectural resources, and previous cultural resource investigations are located within a one-mile (1.6 kilometer) radius of the project area. Additionally, historical U.S. Geological Survey (USGS) topographic maps and aerial imagery were viewed to identify potential historic-age

[23] National Marine Fisheries Service (NMFS). 2020. Permit to Incidentally Take Endangered/Threatened Species. Issued to Barney Davis, LLC. NOAA, NMFS.

structures within the project area. This section describes known cultural resources and the potential for unidentified cultural resources within the project area and summarizes potential issues that may arise during the proposed project.

HDR's desktop analysis indicated that nine previous cultural resources surveys, nine archaeological sites, and one National Register District (King Ranch) were recorded within 1 mile (1.6 kilometers) of the project area. Of these cultural resources, two archaeological surveys, two archaeological sites, and one National Register District (King Ranch) overlap with the project area. A review of historical aerials and topographic maps indicated that the project area was historically undeveloped and agricultural land until the development of the coastal residential area in the 1950s and onward (Oso Creek 1925, Oso Creek 1951, Pita Island 1969). The Barney Davis electrical facility and associated cooling pond first appears on the 1975 Pita Island map[24, 25, 26, 27]. In 2024, a 7.5-mile pipeline was proposed to discharge water from the facility into the Gulf of Mexico. The exact location of the pipeline is unknown and a desktop analysis of cultural resources has not been completed.

A review of the Texas Department of Transportation's (TxDOT) Potential Archaeological Liabilities Map data revealed that the project area primarily consists of areas of negligible potential for buried cultural deposits in the area of the cooling pond. The areas surrounding the cooling pond contain moderate to high potential for buried deposits, with high potential primarily in the eastern portion of the project area near the coast[28]. The area for the proposed 7.5-mile discharge pipeline has not been determined and the potential for buried cultural deposits along its length is unknown. The presence of archaeological sites within the project area, as well as large areas of high potential for buried deposits along both stream terraces and near the coastline, indicates that an archaeological survey will likely be necessary for the proposed project. As a political subdivision of the state of Texas, the City of Corpus Christi is required to coordinate with the Texas Historical Commission (THC) under the Antiquities Code of Texas (ACT) (13 TAC 26) regarding this project. The THC will determine whether additional cultural resources work may be required. Should federal funds, property, and/or permits be required to complete the proposed project, further coordination may be required by the State Historic Preservation Office (SHPO) under Section 106 of the National Historic Preservation Act (NHPA), as amended (16 United States Code [USC] § 470).

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[24] National Register of Historic Places (NRHP). 2023.. Available online: https://www.nps.gov/maps/full.html?mapId=7ad17cc9-b808-4ff8-a2f9-a99909164466, accessed January 2023

[25] Historic Aerials. 2023. Historic Aerials: Viewer, Texas. Available online at https://www.historicaerials.com/viewer, accessed January 2023

[26] Texas Historical Commission. 2023.Texas Archeological Sites Atlas. Available online at https://atlas.thc.texas.gov/, accessed January 2023.

[27] United States Geological Survey (USGS). 2023. USGS Historical Topographic Map Explorer. Available online: https://livingatlas.arcgis.com/topoexplorer/index.html, accessed January 2023

[28] Texas Department of Transportation (TxDOT). 2023. Potential Archeological Liability Maps. Available online at https://www.txdot.gov/inside-txdot/division/environmental/compliance-toolkits/toolkit/archeological-map.html, accessed January 2023.

NWI-mapped wetlands and National Hydrography Dataset (NHD)-mapped resources in the project vicinity were reviewed for the Barney Davis facility. Preliminary plans estimate the location of a desalination facility generally south of the intake channel and southwest of the existing power plant. A 20-mgd facility would take approximately 12 acres of land. Discharge piping from the facility would extend approximately 7.5 miles into the Gulf of Mexico. There is the likely potential to encounter freshwater emergent wetlands as well as estuarine and marine wetlands along the proposed pipeline route as well as impacts to the bay and gulf. The cooling pond would also be potentially jurisdictional due to the hydrologic connection to Oso Creek. A site delineation of waters of the United States, including wetlands, in accordance with USACE methods and guidelines would be necessary to map and characterize potentially jurisdictional waters in the project area. Further refinement of the site plan would be required to determine impacts to regulated resources and the actual Section 404/10 permitting requirements, but siting of the desalination facility and discharge piping could seek to minimize impacts to existing wetlands and waters of the United States.

If project activities impact jurisdictional waters, a Section 404/10 permit would be required from the USACE. A Nationwide Permit 7 for Outfall Structures and Associated Intake Structures may be used to authorize impacts to waters resulting from construction of the outfall. A Nationwide Permit 39 may be used for the desalination facility as long as the loss of non-tidal waters of the U.S. does not exceed 0.5 acre, and there is no loss of tidal waters or non-tidal wetlands adjacent to tidal waters. A pre-construction notification is required for all activities authorized under Nationwide Permits 7 and 39. If the project will not qualify for a Nationwide Permit, then an Individual Permit would be required. The proposed desalination plant would be located at the Barney Davis power facility. The facility is located on the Laguna Madre (TCEQ Segment 2491). The Laguna Madre is listed as impaired on TCEQ's 2024 303(d) List[29] for bacteria in water and depressed dissolved oxygen in water. Within approximately 5 miles, the Oso Bay Oyster Waters and Oso Creek (TCEQ Segments 2485OW and 2485A) are listed as impaired for bacteria in water. The Gulf of Mexico (TCEQ Segment 2501) would be the receiving water for brine discharge and is listed as impaired for mercury in edible tissue.

5B.6.5.4 Engineering and Costing- Barney Davis

Some of the cost associated with the project are summarized below:

- Total estimated costs for a 20 mgd facility located at Barney Davis power facility at $582,000,000.
- Assumed 0.5-mile 54-inch pipeline for raw water delivery, 3,500-foot 36-inch pipeline for treated water delivery, and 7.5-mile 42-inch brine discharge tunnel system.

Details regarding desalination process, site-specific environmental impacts, and storage needs are unavailable at this time and are not included in the cost estimate other than the 3-mile

[29] TCEQ, 2024. 2024 Texas Integrated Report – Texas 303(d) List (Category 5). Accessed online https://www.tceq.texas.gov/downloads/water-quality/assessment/integrated-report-2024/2024-303d January 17, 2025.

product delivery pipeline mentioned above. Facility cost estimates were taken from the HDR 2023 Barney Davis Desalination Site Assessment.

Energy is the largest operational cost of a desalination facility. Energy use is directly proportional to salinity of the source water. Using the UCM tool for regional water planning according to TWDB guidelines, which includes a higher cost for operations and maintenance is expected to result in an annual cost around $83,000,000. This results in a unit cost of water of $3,705 per ac-ft with debt service. The capital costs shown presented in Table 5B.6.7 were developed in a 2023 HDR report. The TWDB UCM tool was used to calculate the total cost and annual cost.

Table 5B.6.7. Cost Estimate Summary 20 mgd Desalination Project at Barney Davis Power Facility (Sept 2023 Prices)

Item	Estimated Costs for Facilities
Intake Improvements on Laguna Madre[a]	$20,000,000
Cooling Pond Intake and Raw Water Pumping[a]	$20,000,000
Water Treatment Plant (20 MGD) [a]	$240,000,000
Finished Water Line[a]	$2,500,000
Brine Discharge Outfall and Tunnel System (7.5 miles, 42")	$114,090,000
Total Cost of Facilities	**$396,590,000**
- Planning (3%)	$11,903,000
- Design (7%)	$27,773,000
- Construction Engineering (1%)	$3,968,000
Legal Assistance (2%)	$7,935,000
Fiscal Services (2%)	$7,935,000
Pipeline Contingency (15%)	$15,811,000
All Other Facilities Contingency (20%)	$58,269,000
Environmental & Archaeology Studies and Mitigation	$260,000
Land Acquisition and Surveying (12 acres)	$50,000
Interest During Construction (3.5% for 3 years with a 0.5% ROI)	$52,000,000
Total Cost of Project	**$582,000,000**
Annual Cost	
Debt Service (3.5 percent, 20 years)	$41,000,000
Operation and Maintenance	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$1,054,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$1,000,000
Water Treatment Plant[b]	$39,000,000
Pumping Energy Costs (8807756 kW-hr @ 0.09 $/kW-hr)[c]	$790,000
Total Annual Cost	**$83,000,000**
Available Project Yield (acft/yr)	22,402
Annual Cost of Water ($ per acft),	$3,705
Annual Cost of Water After Debt Service ($ per acft),	$1,868
Annual Cost of Water ($ per 1,000 gallons),	$11.37
Annual Cost of Water After Debt Service ($ per 1,000 gallons),	$5.73

[a] Capital costs estimated in Site Assessment Report (HDR, 2023).

[b] The water treatment plant annual costs from the TWDB uniform costing model include energy costs associated with use of reverse osmosis membrane treatment to desalinate seawater and produce finished water with TDS levels below the TCEQ regulatory limit.

[c] The pumping energy cost is calculated by the uniform costing model based on pipeline diameter and length, flowrate, and elevation data. This cost accounts for pumping raw water from the intake, brine discharge to the outfall, and treated water to the delivery point.

5B.6.5.5 Implementation Issues- Barney Davis

Permitting of this facility will require extensive coordination with all applicable regulatory entities.

The proposed brine discharge outfall for the Barney Davis Desalination plant is 7.5 miles off-shore in the Marine Seawater Discharge Zone, and eligible for an alternative expedited permitting process[30]. On November 6, 2019, TCEQ commissioners adopted the TPWD and GLO's diversion and discharge zones study and codified Section 318.9 of 30 TAC Chapter 318 to expedite permitting for projects within the discharge zone. This is anticipated to save time in permitting the Barney Davis Desalination Project.

The installation and operation of a seawater desalination water treatment plant may have to address the following issues to implementation:

- Disposal of concentrated brine from desalination water treatment plant;
- Permitting and construction, which may include:
  - USACE permitting (including Section 404 Clean Waters Act and Section 10 Rivers & Harbors Act)
  - Endangered Species Act compliance and TPWD coordination, if required
  - Compliance with the Antiquities Code of Texas, the National Historic Preservation Act, and the Archeological and Historic Preservation.
  - TCEQ Water Right, TPDES, stormwater, and associated construction permits
  - Associated TCEQ registrations
  - Local land use and construction permits
  - Expedited GLO permitting requirements
- Hydrodynamic Modeling to verify project feasibility;
- Impact on the bays from removing water for consumptive use and altering existing power plant water rights permit;
- High power requirements for desalination process dependent on large, reliable power source;
- Skilled operators of desalination water treatment plants;
- Permitting of a pipeline across rivers, highways, and private rural and urban property; and
- Possibility of using a design, build, operate contract for a desalination water treatment plant.

[30] Texas Parks and Wildlife and Texas General Land Office, 2018, Marine Seawater Desalination Diversion and Discharge Zones Study.

5B.6.5.6 Evaluation Summary

An evaluation summary of this regional water management strategy is provided in Table 5B.6.8.

Table 5B.6.8.
Evaluation Summary of the 20 mgd Barney Davis Desalination Project

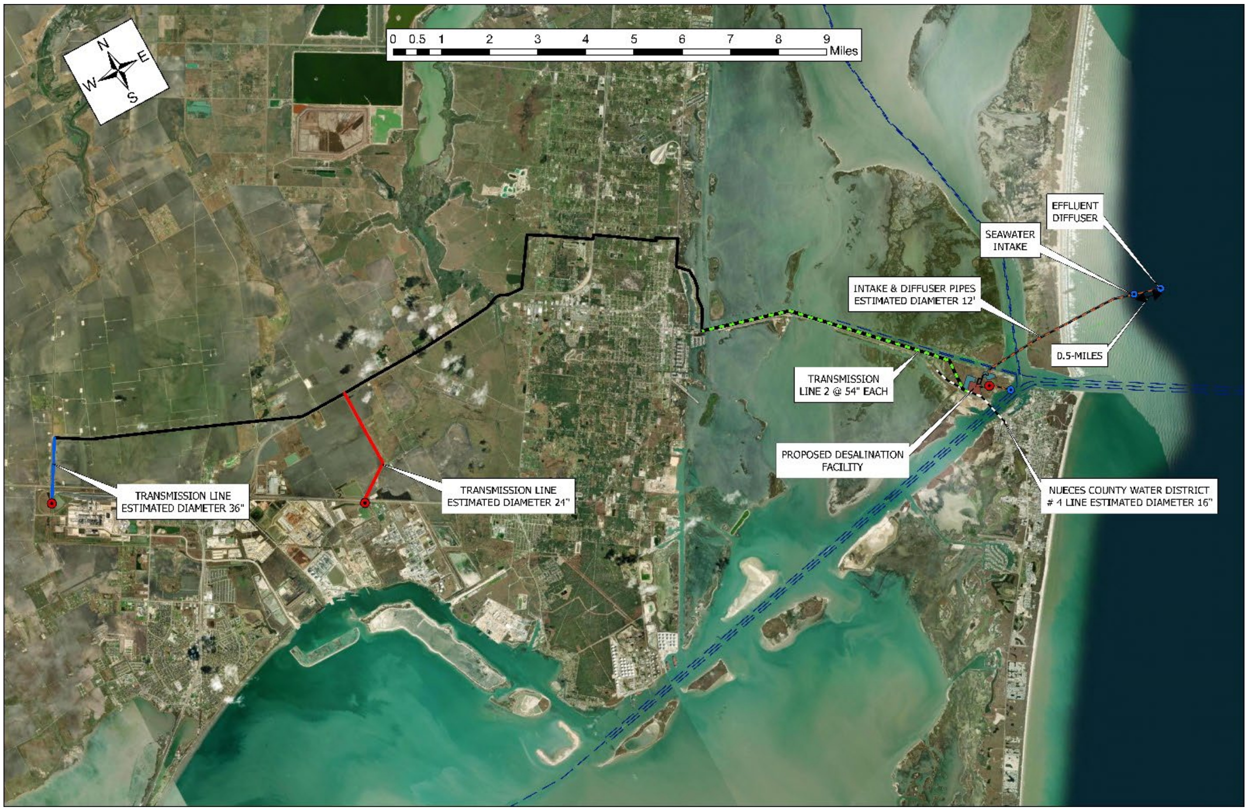
Impact Category	Comment(s)
a. Water supply:	
1. Quantity	1. Project size: 22,402 ac-ft/yr
2. Reliability	2. Highly reliable quantity.
3. Cost of treated water	3. Cost $3,705 per ac-ft.
b. Environmental factors:	
1. Instream flows	1. None or low impact.
2. Bay and estuary inflows and arms of the Gulf of Mexico	2. Some environmental impact to estuary.
3. Wildlife habitat	3. Some. Disposal of concentrated brine created from process may impact fish and wildlife habitats or wetlands.
4. Wetlands	4. Some. Disposal of concentrated brine created from process may impact fish and wildlife habitats or wetlands.
5. Threatened and endangered species	5. Six threatened species and 7 endangered species were identified. Endangered species survey will be needed to identify impacts.
6. Cultural resources	6. Cultural resources survey will be needed to identify any significant sites.
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. 7a-b. Total dissolved solids and salinity of water is removed with reverse osmosis treatment. Brine concentrate disposal issues will need to be evaluated. 7c-i. Bacteria, dissolved oxygen, pH, and temperature were all identified as constituents of concern for Oso Creek. Additional studies regarding impacts on or as a result of project are needed
c. Impacts to Agricultural Resources and State water resources	• Impact to Oso Creek will need to be quantified through modeling • Negligible impacts to agricultural resources
d. Threats to agriculture and natural resources in region	• Some. Temporary damage due to construction of pipeline
e. Recreational impacts	• None
f. Equitable comparison of strategies	• Standard analyses and methods used for portions • Seawater desalination cost modeled after bid and manufacturers' budgets, but not constructed, comparable project
g. Interbasin transfers	• Not applicable
h. Third party social and economic impacts from voluntary redistribution of water	• Not applicable
i. Efficient use of existing water supplies and regional opportunities	• Provides regional opportunities
j. Effect on navigation	• None
k. Impacts to water pipelines and other facilities used for water conveyance	• Connection to existing 42-inch transmission line is expected to meet hydraulic requirements

5B.6.6 Port of Corpus Christi Authority Seawater Desalination Project- Harbor Island

5B.6.6.1 Description of Strategy

The PCCA has proposed two desalination strategies in Nueces and/or San Patricio counties to meet manufacturing water demands beginning in the 2030 planning decade. PCCA is a political subdivision of the State of Texas and is governed by seven commissioners. It is one of the largest energy hubs with a gateway to global markets. PCCA is the third largest in the world in crude exports, largest in the U.S. in crude exports, and second largest in the U.S. in LNG exports. The port is a multi-billion dollar enterprise with an $18 billion impact on the State's economy. Although it has the authority to tax, none of its revenue is generated through taxes. All port revenues are generated through tonnage wharfage fees, dockage fees, and land leases. In 2017, PCCA Port Commission directed staff to evaluate two sites for potential future desalination plants on PCCA's property. For the Harbor Island facility, PCCA has received a discharge permit in the Corpus Christi Ship Channel for 50 mgd net production and a GLO easement for the intake structure in the Gulf of Mexico. PCCA's water rights application for 100 mgd net production at Harbor Island is pending with the TCEQ. In May 2024, the PCCA Port Commission again directed staff to complete the remaining permits necessary to construct a desalination facility at Harbor Island with as much optionality as possible, including the potential to scale facility size. PCCA plans to submit in early 2025 a USACE individual permit application, GLO easement amendment for a discharge structure in the Gulf of Mexico, and a discharge permit to TCEQ for a discharge in the Gulf of Mexico to accommodate up to 100 mgd net production for both municipal and industrial use.

The Harbor Island project site is located on the Corpus Christi Ship Channel near Port Aransas as shown in Figure 5B.6.6.



Source: PCCA, via email January 2025

Figure 5B.6.6.
Proposed Location for PCCA Seawater Desalination Project at Harbor Island

5B.6.6.2 Available Yield- PCCA Harbor Island

Seawater from the Gulf of Mexico is assumed to be available in an unlimited quantity within the context of a supply for the Coastal Bend Region. Also, it is assumed that the cost of Gulf water is zero prior to extraction from the source. The estimated supply is for 112,014 ac-ft/yr (100 mgd) based on the size of the desalination plant to meet end user customer needs.

5B.6.6.3 Environmental Issues- PCCA Harbor Island

The Harbor Island project site is located on the Corpus Christi Ship Channel across from Port Aransas. Construction of the facility would be located upon approximately 33 acres in a former fuel tank storage area, which has previously been decommissioned and remediated and is currently vacant. The proposed desalination plant would use RO to treat seawater from the Gulf of Mexico and produce up to 100 mgd. The port submitted a discharge permit for the project in 2018; and which was subsequently issued in December 2022 for a discharge in the Corpus Christi Ship Channel (TCEQ Segment 2481) from a net 50 mgd production facility via an HDPE pipeline to a multi-port diffuser approximately 300 feet offshore on the south side of Harbor Island. Both near- and far-field monitoring was completed to determine the ability of the proposed diffuser technology to disperse the brine within the defined mixing zones with a discharge going into the Corpus Christi Ship Channel and adjacent Corpus Christi Bay. The issued permit established at 2 parts per trillion at 100 meters monitoring requirement to ensure operation within the modeled parameters.

An authorization by TCEQ of a discharge in the Gulf of Mexico for up to 100 mgd net production may supplant the need for a 50 mgd discharge in the Ship Channel. The 100 mgd discharge in the Gulf of Mexico would be 1.8 miles off the shoreline of San Jose Island, following the route of the Bluewater Texas Terminal Single Point Mooring (SPM) pipeline. With both the intake and the discharge located in the Gulf of Mexico, and upland facilities avoiding any permanent impacts to Waters of the U.S., the potential environmental impacts would be limited to salinity in the offshore mixing zone and limited impingement and entrainment issues of an intake structure, similar to a power plant intake. In addition to voluntarily utilizing the best practices for a 301(b) guidelines for power plant intakes, which includes slowing velocity to <0.5 ft/sec and adding screens, the facility proposes the use of a marine life return system to remove any marine life smaller than 3 inches in size that gets into the intake. The location of the intake structure in the Gulf of Mexico has been sited north of the Aransas Channel and designed at an elevation in the water column so as to minimize intake of larval fish and threatened and endangered species and minimize impact to surrounding benthos.

TPWD maintains the TXNDD, which documents the occurrence of endangered, threatened and rare species, natural communities, and animal aggregations. The TXNDD data was reviewed for recorded occurrences of listed or rare species or natural communities, near the proposed project. The West Indian manatee, a federally listed threatened species, and a marine mammal with protections under the Marine Mammal Protection Act, the green sea turtle (*Chelonia mydas*), a federal and state listed threatened species, the Atlantic hawksbill sea turtle (*Eretmochelys imbricata*) a federal and state listed endangered species, the Texas horned lizard (*Phrynosoma cornutum*) a state threatened species, and the piping plover (*Charadrius melodus*) a federal and state listed threatened species have been documented within two miles of the proposed project. The TXNDD data also identified rookeries near the project area on Harbor Island and on Mustang Island. Additionally, critical habitat for the piping plover and proposed critical habitat for the rufa red knot is present on Mustang Island within 2 miles of the project area.

NWI maps were reviewed and the proposed Harbor Island Desalination site may be in close proximity to estuarine and marine deepwater habitat and freshwater emergent wetlands. A jurisdictional determination of Waters of the US has been approved by the USACE for the desalination plant (produced water infrastructure); all impacts to Waters of the United States have been avoided. Permitting and coordination with the USACE for the discharge, intake, and produced water infrastructure is ongoing.

The proposed desalination plant would be located on Harbor Island, which is adjected to Redfish Bay (Oyster Waters) (TCEQ Segment 2483OW). Redfish Bay (TCEQ Segment 2483_01) and Redfish Bay Oyster Waters (TCEQ Segment 2483OW_01) are listed as impaired for bacteria on the TCEQ 2024 Draft 303(d) List[31]. The Gulf of Mexico (TCEQ Segment 2501) is located within 5 miles of the proposed Harbor Island desalination site. Segment 2501 is listed on the 2020 Draft 303(d) List as impaired for mercury in edible tissue.

Cultural resources protection on public lands in Texas is afforded by the Antiquities Code of Texas (Title 9, Chapter 191, Texas Natural Resource Code of 1977), the National Historic Preservation Act (Pl96-515), and the Archeological and Historic Preservation Act (PL93-291). Based on the review of publicly available GIS records obtained from the Texas Historical Commission, there is potentially one National Register property and one cemetery within one mile of the proposed project area. The Tarpon Inn and Mercer Cemetery are located approximately one mile from the proposed project area in Port Aransas. No State Historic sites, National Register districts, or historical markers were identified within the project area, or within 1 mile of the proposed project area.

Archeological surveys have been conducted in the vicinity of the project area, a review of archaeological resources in the proposed project area should be conducted during the project planning phase. Because the owner or controller of the project will likely be a political subdivision of the State of Texas (i.e., river authority, municipality, county, etc.), they will be required to coordinate with the Texas Historical Commission, under the Texas Antiquities Code, prior to project construction. This coordination will occur as part of the review of the individual permit application to the USACE.

5B.6.6.4 Engineering and Costing- PCCA Harbor Island

Some of the cost associated with the project are summarized below:

- Total estimated costs for a net 100 mgd facility located in Harbor Island at $3,456,000,000.
- Assumed 2x 30,500-linear feet of up to 54-inch diameter pipe to Aransas Pass area and 16-inch pipe (existing) to Nueces County area (not shown in Figure 5B.6.6)
- For delivery to San Patricio County, assumed three pipe segments: 54-inch diameter 21 miles total from WTP to San Patricio County (which includes the 30,500-linear feet of pipe discussed previously), 14-foot diameter 3.1 miles, and 14-ft diameter 3.6 miles
- Assumed 222 mgd intake and 12-foot diameter intake tunnel system of 3.1 miles.
- Assumed 122 mgd brine discharge outfall and 12-foot diameter effluent outfall tunnel system of 3.6 miles (effluent diffuser located approximately 1.8 miles offshore)

The discharge structure is approximately 500-foot long, 84-inch barrel with 50 6.3-inch ports. Cost estimates for the raw water intake, brine discharge, and substation and transmission line

[31] TCEQ, 2024. 2024 Texas Integrated Repot – Texas 303(d) List (Category 5). Accessed online https://www.tceq.texas.gov/downloads/water-quality/assessment/integrated-report-2024/2024-303d December 4, 2024.

upgrades were provided by PCCA. Details regarding site-specific environmental impacts and storage needs are unavailable at this time and are not included in the cost estimate.

Energy is the largest operational cost of a desalination facility, and energy use is directly proportional to salinity of the source water. Using the UCM tool for regional water planning according to TWDB guidelines, which includes a higher cost for operations and maintenance is expected to result in an annual cost around $405,000,000. This results in a unit cost of water of $3,616 per ac-ft with debt service. The information presented in Table 5B.6.9 was developed based on capital costs, project costs, and annual water productions costs with information provided by PCCA.

Table 5B.6.9.
Cost Estimate Summary of the Port of Corpus Christi Authority's 100 mgd Desalination Project at Harbor Island (Sept 2023 Prices)

Item	Estimated Costs for Facilities
Intake Structure and Pump Station (222 MGD)[a]	$59,000,000
Water Treatment Plant (100 MGD)	$1,025,000,000
Treated Water Pump Station	$49,000,000
Transmission Pipeline (54", 30,300 ft and 54", 110,880 ft)	$277,000,000
Intake Tunnel System (12', 3.1 miles)	$367,000,000
Effluent Outfall Tunnel System (12', 3.6 miles)	$429,000,000
Brine Discharge Outfall and Pump Station[b]	$126,000,000
Substation and Transmission[c]	$83,000,000
Total Cost of Facilities	**$2,415,000,000**
- Planning (3%)	$69,000,000
- Design (7%)	$160,000,000
- Construction Engineering (1%)	$23,000,000
Legal Assistance (2%)	$46,000,000
Fiscal Services (2%)	$46,000,000
Pipeline Contingency (15%)	$161,000,000
All Other Facilities Contingency (20%)	$242,000,000
Environmental & Archaeology Studies and Mitigation	$2,000,000
Land Acquisition and Surveying (268 acres)	$4,000,000
Interest During Construction (3.5% for 3 years with a 0.5% ROI)	$288,000,000
Total Cost of Project	**$3,456,000,000**
Annual Cost	
Debt Service (3.5 percent, 20 years)	$228,000,000
Operation and Maintenance	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$12,000,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$3,000,000
Water Treatment Plant[d]	$154,000,000
Pumping Energy Costs (11835834 kW-hr @ 0.09 $/kW-hr)[e]	$8,000,000
Total Annual Cost	**$405,000,000**
Available Project Yield (acft/yr)	112,014
Annual Cost of Water ($ per acft),	$3,616
Annual Cost of Water After Debt Service ($ per acft),	$1,580
Annual Cost of Water ($ per 1,000 gallons),	$11.09
Annual Cost of Water After Debt Service ($ per 1,000 gallons),	$4.85

[a] Cost provided by PCCA for intake structure is $12,100,000. The cost estimate includes design, construction, and a 30% contingency. The total amount ($12,100,000) is included in the Cost of Facilities and not included in the contingencies for Total Cost of Project. The intake pump station cost was estimated by the UCM.
[b] Cost provided by PCCA for discharge is $118,230,000. The cost estimate includes design, construction, and a 30% contingency. The total amount ($118,230,000) is included in the Cost of Facilities and not included in the contingencies for Total Cost of Project. The discharge pump station cost was estimated by the UCM.
[c] Costs provided by PCCA. Substation upgrades are approximately $48,000,000 and transmission line upgrades are approximately $35,000,000.
[d] The water treatment plant annual costs from the TWDB uniform costing model include energy costs associated with use of reverse osmosis membrane treatment to desalinate seawater and produce finished water with TDS levels below the TCEQ regulatory limit.

[e] The pumping energy cost is calculated by the uniform costing model based on pipeline diameter and length, flowrate, and elevation data. This cost accounts for pumping raw water from the intake, brine discharge to the outfall, and treated water to the delivery point.

5B.6.6.5 Implementation Issues- PCCA Harbor Island

Permitting of this facility will require extensive coordination with all applicable regulatory entities. The major project components and issues with implementation will be permitting and construction of pipelines.

The installation and operation of a seawater desalination water treatment plant may have to address the following issues to implementation:

- Disposal of concentrated brine from desalination water treatment plant;
- Permitting and construction, which may include:
  - USACE permitting (including Section 404 Clean Waters Act and Section 10 Rivers & Harbors Act)
  - Endangered Species Act compliance and TPWD coordination, if required
  - Compliance with the Antiquities Code of Texas, the National Historic Preservation Act, and the Archeological and Historic Preservation.
  - TCEQ Water Right, TPDES, stormwater, and associated construction permits
  - Associated TCEQ registrations
  - Local land use and construction permits
  - GLO permitting requirements
- Hydrodynamic Modeling to verify project feasibility;
- High power requirements for desalination process dependent on large, reliable power source;
- Skilled operators of desalination water treatment plants;
- Permitting of a pipeline in existing right-of-way and across urban property; and
- Possibility of using alternate delivery method contract for a desalination water treatment plant.

5B.6.6.6 Evaluation Summary

An evaluation summary of this regional water management strategy is provided in Table 5B.6.10.

Table 5B.6.10.
Evaluation Summary of the Port of Corpus Christi Authority- Harbor Island 100 mgd Seawater Desalination

Impact Category	Comment(s)
a. Water supply:	
1. Quantity	1. Project size: 112,014 ac-ft/yr
2. Reliability	2. Highly reliable quantity.
3. Cost of treated water	3. Unit Cost $3,616 /ac-ft.
b. Environmental factors:	
1. Instream flows	1. None or low impact.
2. Bay and estuary inflows and arms of the Gulf of Mexico	2. Some environmental impact to estuary.
3. Wildlife habitat	3. Some. Disposal of concentrated brine created from process may impact fish and wildlife habitats or wetlands.
4. Wetlands	4. Some. Disposal of concentrated brine created from process may impact fish and wildlife habitats or wetlands.
5. Threatened and endangered species	5. None identified. Endangered species survey will be needed to identify impacts.
6. Cultural resources	6. Cultural resources survey data from adjacent project informed siting to avoid potential cultural resources.
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. 7a-b. Total dissolved solids and salinity of water is removed with reverse osmosis treatment. Brine concentrate disposal issues will need to be evaluated. 7c-i. Bacteria, chlorides, nitrate, alkalinity, ammonia, and copper were all identified as constituents of concern for the Nueces Bay in the TCEQ and NRA Basin Highlights Report. Additional studies regarding impacts on or as a result of project are needed
c. Impacts to Agricultural Resources and State water resources	• None or low impacts on other water resources • Negligible impacts to agricultural resources
d. Threats to agriculture and natural resources in region	• Some. Temporary damage due to construction of pipeline
e. Recreational impacts	• None
f. Equitable comparison of strategies	• Standard analyses and methods used for portions • Seawater desalination cost modeled after bid and manufacturers' budgets, but not constructed, comparable project
g. Interbasin transfers	• Not applicable
h. Third party social and economic impacts	• Not applicable
i. Efficient use of existing water supplies and regional opportunities	• Provides regional opportunities
j. Effect on navigation	• None
k. Impacts of water pipelines and other facilities used for water conveyance	• Construction and maintenance of transmission pipeline corridor (in future). Possible impact to wildlife habitat along pipeline route and right-of-way.

5B.6.7 Port of Corpus Christi Authority Seawater Desalination Project- La Quinta Channel

5B.6.7.1 Description of Strategy

The PCCA has proposed two desalination strategies in Nueces and/or San Patricio counties to meet manufacturing water demands beginning in the 2030 planning decade. PCCA is a political subdivision of the State of Texas and is governed by seven commissioners. It is one of the largest energy hubs with a gateway to global markets, making it the Energy Port of the Americas. PCCA is the third largest in the world in crude exports, largest in the U.S. in crude exports, and second largest in the U.S. in LNG exports. The Port is a multi-billion dollar enterprise with an $18 billion impact on the state’s economy. Although it has the authority to tax, none of its revenue is generated through taxes. All port revenues are generated through tonnage wharfage fees, dockage fees, and land leases. In 2017, PCCA Port Commission directed staff to evaluate two sites for potential future desalination plants on PCCA’s property. The sites are on Harbor Island and at the north end of La Quinta Channel. A water rights permit to divert 102,000 ac-ft has been received for the La Quinta plant.

The La Quinta site is located near the La Quinta Ship Channel in San Patricio County. It will produce up to 30 mgd primarily for industrial use, use RO to treat seawater from Corpus Christi Bay, and a proposed diffuser would discharge into the La Quinta Ship Channel. Approximately 3 miles of pipeline will be used to deliver treated water to customers in the area.

Source: PCCA/Naismith/Hanson, 2019 via email December 2019

Figure 5B.6.7.
Proposed Location for Seawater Desalination Program at La Quinta

5B.6.7.2 Available Yield- PCCA La Quinta Channel

Seawater from the Gulf of Mexico and associated bay system is assumed to be available in an unlimited quantity within the context of a supply for the Coastal Bend Region. Also, it is assumed that the cost of Gulf water is zero prior to extraction from the source. The estimated supply is up to 33,627 ac-ft/yr (30 mgd).

5B.6.7.3 Environmental Issues- PCCA La Quinta Channel

On July 16, 2024, TCEQ authorized the water rights for this project and the discharge permit is still pending. This site, located near the La Quinta Ship Channel in San Patricio County, would use RO to treat seawater and produce approximately 30 mgd of treated water for industrial use. This facility has a design intake flow of 90.4 mgd from Corpus Christi Bay.[32] This project is expected to discharge through a diffuser into the La Quinta Ship Channel.

The TXNDD data was reviewed for documented occurrences of listed or rare species, or natural communities near the project area. There were no documented occurrences of listed or rare species or communities within two miles of the proposed project area.

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[32] PCCA, 2019. TCEQ Water Rights Permitting Application Port of Corpus Christi Authority of Nueces County. Proposed Desalination Plant, La Quinta. Dated August 29, 2019.

NWI maps were reviewed and the proposed PCCA La Quinta Desalination site may be in close proximity to estuarine and marine deepwater habitat and freshwater emergent wetlands. A jurisdictional determination of waters on the uplands exists for the proposed project site. Further coordination with the USACE would be required for impacts to waters of the United States for the intake and diffuser.

The proposed desalination plant would be located on the La Quinta Channel. The site would discharge into Corpus Christi Bay (TCEQ Segment 2481OW), which is listed as impaired on TCEQ's 2024 303(d) List for bacteria in oyster water.[33] Within approximately 5 miles, one Corpus Christi Bay Recreational Beach (TCEQ Segments 2481CB_06) is listed as impaired for bacteria in water. Additionally, the inlet to Nueces Bay (TCEQ Segment 2482) is listed as impaired for bacteria in water. The inlet to Corpus Christi Bay Inner Harbor (TCEQ Segment 2484) is within 5 miles of the proposed desalination plant and are listed as impaired for copper in water.

Cultural resources protection on public lands in Texas is afforded by the Antiquities Code of Texas (Title 9, Chapter 191, Texas Natural Resource Code of 1977), the National Historic Preservation Act (Pl96-515), and the Archeological and Historic Preservation Act (PL93-291). Based on the review of publicly available GIS records obtained from the Texas Historical Commission, there are no State Historic sites, National Register properties or districts, cemeteries or historical markers within the project area, or within 1 mile of the proposed project area.

Coordination with the Texas Historical Commission, under the Texas Antiquities Code, has already occurred. This information should be reviewed during the design phase for any offsets that might be warranted.

5B.6.7.4 Engineering and Costing- PCCA La Quinta Channel

Some of the cost associated with the project are summarized below:

- Total estimated costs for a 30 mgd net facility located in La Quinta at $844,000,000.
- Assumed a 3-mile 48-inch pipeline for delivery to industrial complex in San Patricio County.
- Assumed 500-foot 66-inch raw water intake pipeline and 500-foot 48-inch brine discharge pipeline.
- Brine discharge outfall structure was assumed to cost the same as an intake structure for the designated flow rate based on 45 percent RO recovery.

Details regarding desalination process, site-specific environmental impacts, and storage needs are unavailable at this time and are not included in the cost estimate other than the 3-mile product delivery pipeline mentioned above.

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[33] TCEQ, 2024. 2024 Texas Integrated Repot – Texas 303(d) List (Category 5). Accessed online 2024 Texas IR 303(d) ListJanuary 29, 2025.

Energy is the largest operational cost of a desalination facility. Energy use is directly proportional to salinity of the source water. Using the UCM tool for regional water planning according to TWDB guidelines, which includes a higher cost for operations and maintenance is expected to result in an annual cost around $116,000,000. This results in a unit cost of water of $3,452 per ac-ft with debt service. The information presented in Table 5B.6.11 was developed based on capital costs, project costs, and annual water productions costs with information provided by PCCA.

Table 5B.6.11. Cost Estimate Summary PCCA - 30 mgd Desalination Project at La Quinta (Sept 2023 Prices)

Item	Estimated Costs for Facilities
Intake Structure and Pump Station (66 MGD)	$40,000,000
Water Treatment Plant (30 MGD)	$475,000,000
Treated Water Pump Station	$6,000,000
Transmission Pipeline (48", 3 miles)	$28,000,000
Raw Water Pipeline (66", 500 ft)	$1,000,000
Brine Discharge Pipeline (48", 500 ft)	$1,000,000
Brine Discharge Outfall and Pump Station	$13,000,000
Substation and Transmission[a]	$8,000,000
Total Cost of Facilities	**$572,000,000**
- Planning (3%)	$17,000,000
- Design (7%)	$40,000,000
- Construction Engineering (1%)	$6,000,000
Legal Assistance (2%)	$11,000,000
Fiscal Services (2%)	$11,000,000
Pipeline Contingency (15%)	$4,000,000
All Other Facilities Contingency (20%)	$109,000,000
Environmental & Archaeology Studies and Mitigation	$96,000
Land Acquisition and Surveying (39 acres)	$164,000
Interest During Construction (3.5% for 3 years with a 0.5% ROI)	$74,000,000
Total Cost of Project	**$844,000,000**
Annual Cost	
Debt Service (3.5 percent, 20 years)	$59,000,000
Operation and Maintenance	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$378,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$1,000,000
Water Treatment Plant[b]	$55,000,000
Pumping Energy Costs (2593527 kW-hr @ 0.08 $/kW-hr)[c]	$932,000
Total Annual Cost	**$116,000,000**
Available Project Yield (acft/yr)	33,604
Annual Cost of Water ($ per acft),	$3,452
Annual Cost of Water After Debt Service ($ per acft),	$1,705
Annual Cost of Water ($ per 1,000 gallons),	$10.59
Annual Cost of Water After Debt Service ($ per 1,000 gallons),	$5.23

[a] Cost estimated by HDR, externally from the UCM.

[b] The water treatment plant annual costs from the TWDB uniform costing model include energy costs associated with use of reverse osmosis membrane treatment to desalinate seawater and produce finished water with TDS levels below the TCEQ regulatory limit.

[c] The pumping energy cost is calculated by the uniform costing model based on pipeline diameter and length, flowrate, and elevation data. This cost accounts for pumping raw water from the intake, brine discharge to the outfall, and treated water to the delivery point.

5B.6.7.5 Implementation Issues- PCCA La Quinta Channel

Permitting of this facility will require extensive coordination with all applicable regulatory entities. The major project components and issues with implementation will be permitting and construction of pipelines.

The installation and operation of a seawater desalination water treatment plant may have to address the following issues to implementation:

- Disposal of concentrated brine from desalination water treatment plant;
- Permitting and construction, which may include:
  - USACE permitting (including Section 404 Clean Waters Act and Section 10 Rivers & Harbors Act)
  - Endangered Species Act compliance and TPWD coordination, if required
  - Compliance with the Antiquities Code of Texas, the National Historic Preservation Act, and the Archeological and Historic Preservation.
  - TCEQ Water Right, TPDES, stormwater, and associated construction permits
  - Associated TCEQ registrations
  - Local land use and construction permits
  - GLO permitting requirements
- Hydrodynamic Modeling to verify project feasibility;
- Impact on the bays from removing water for consumptive use and altering existing water rights permit;
- High power requirements for desalination process dependent on large, reliable power source;
- Skilled operators of desalination water treatment plants; and
- Possibility of using a design, build, operate contract for a desalination water treatment plant.

5B.6.7.6 Evaluation Summary

An evaluation summary of this regional water management strategy is provided in Table 5B.6.12.

Table 5B.6.12. Evaluation Summary of the Port of Corpus Christi Authority- La Quinta Channel 30 mgd Project

Impact Category	Comment(s)
a. Water supply:	
1. Quantity	1. Project size: 33,604 ac-ft/yr
2. Reliability	2. Highly reliable quantity.
3. Cost of treated water	3. Cost $3,452 per ac-ft.
b. Environmental factors:	
1. Instream flows	1. None or low impact.
2. Bay and estuary inflows and arms of the Gulf of Mexico	2. Some environmental impact to estuary.
3. Wildlife habitat	3. Some. Disposal of concentrated brine created from process may impact fish and wildlife habitats or wetlands.
4. Wetlands	4. Some. Disposal of concentrated brine created from process may impact fish and wildlife habitats or wetlands.
5. Threatened and endangered species	5. None identified. Endangered species survey will be needed to identify impacts.
6. Cultural resources	6. Cultural resources survey will be needed to identify any significant sites.
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. 7a-b. Total dissolved solids and salinity of water is removed with reverse osmosis treatment. Brine concentrate disposal issues will need to be evaluated. 7c-i. Bacteria, chlorides, nitrate, alkalinity, ammonia, and copper were all identified as constituents of concern for the Nueces Bay in the TCEQ and NRA Basin Highlights Report. Additional studies regarding impacts on or as a result of project are needed
c. Impacts to Agricultural Resources and State water resources	• None or low impacts on other water resources • Negligible impacts to agricultural resources
d. Threats to agriculture and natural resources in region	• Some. Temporary damage due to construction of pipeline
e. Recreational impacts	• None
f. Equitable comparison of strategies	• Standard analyses and methods used for portions • Seawater desalination cost modeled after bid and manufacturers' budgets, but not constructed, comparable project
g. Interbasin transfers	• Not applicable
h. Third party social and economic impacts from voluntary redistribution of water	• Not applicable
i. Efficient use of existing water supplies and regional opportunities	• Provides regional opportunities
j. Effect on navigation	• None
k. Impacts to water pipelines and other facilities used for water conveyance	• Construction and maintenance of transmission pipeline corridor (in future). Possible impact to wildlife habitat along pipeline route and right-of-way.

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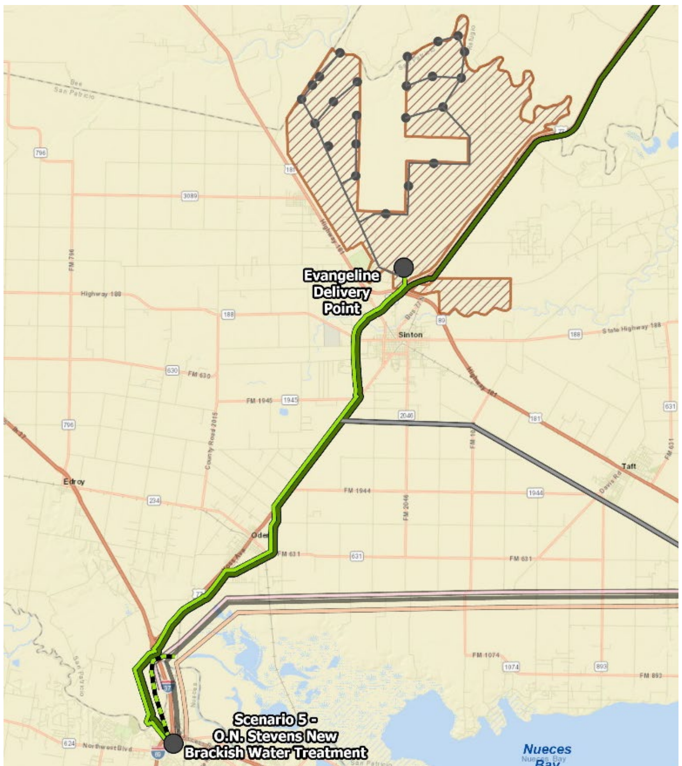

5B.7

Groundwater Desalination

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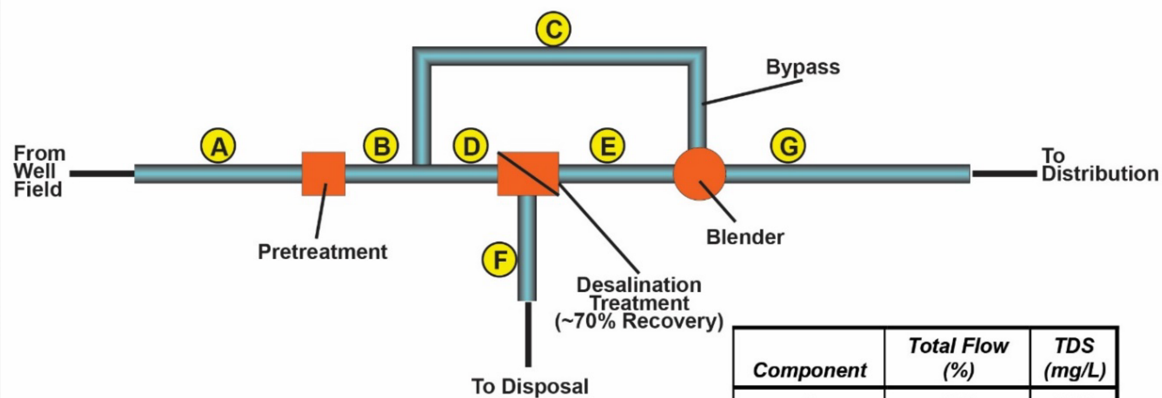
Section 5B.7 Groundwater Desalination

Groundwater desalination is a process whereby pumped groundwater is treated using reverse osmosis (RO), electrodialysis , or similar method to reduce total dissolved solids (TDS), salts, and minerals to make suitable for consumption and/or high quality purposes. Brackish groundwater is defined as groundwater with TDS content of between 1,000 and 10,000 parts per million.

Brackish groundwater is an important water supply source in Texas. The state has more than 3.2 billion acre-feet (ac-ft) of brackish groundwater in 12 of the 31 major and minor aquifers[1]. Factors that affect the implementation of desalination include local conditions, permitting, treatment, and concentrate disposal. Groundwater supplies desalinated to potable standards in areas near the Coastal Bend Region are likely to become more prevalent under the compounding pressures of increasing water demands and climate uncertainty.

Figure 5B.7.1 shows a process diagram for a typical groundwater desalination treatment plant, the percent of water flowing through each component of the system, and the concentration of the TDS.



Component	*Total Flow (%)*	*TDS (mg/L)*
A	100	800
B	100	800
C	25	800
D	75	800
E	55	10
F	20	3,500
G	80	250

Figure 5B.7.1.
Flow Diagram for a Typical Groundwater Desalination Water Treatment Plant

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[1] TWDB, "Desalination: Brackish Groundwater," January 2025
https://www.twdb.texas.gov/publications/shells/doc/Desal_Brackish.pdf

5B.7.1 Evangeline Laguna Groundwater Project

5B.7.1.1 Description of Strategy

The Evangeline Laguna Groundwater Project includes groundwater production of up to 25.4 MGD (28,486 ac-ft/yr) from 23,000+ acres located in San Patricio County for conveyance to a proposed groundwater desalination treatment plant, and delivery to the City of Corpus Christi and/or future industries in San Patricio County. Figure 5B.7.1 shows the approximate location of the project site. Since publication of the *2016 Coastal Bend Regional Water Plan*, project developers have moved this project towards implementation by securing permits from the San Patricio County Groundwater Conservation District (SPCGCD), drilling and collecting data from a test well, and performing a corrosion analysis, as well as a blending analysis. The test well water quality results were all within Texas Commission on Environmental Quality (TCEQ) drinking water standards. TDS and chloride levels measured at the test well were 792 and 269 milligrams per liter (mg/L), respectively. The SPCGCD production permit granted to Evangeline/Laguna LP is for up to 25.4 million gallons per day (mgd) (28,486 acre-feet per year [ac-ft/yr]). After accounting for groundwater production in San Patricio County for current groundwater users, the remaining amount of groundwater available for future projects (based on excess Modeled Available Groundwater (MAG) is 33,783 ac-ft/yr in Year 2030 and increasing to 37,032 ac-ft/yr in Year 2080. Therefore, the unused MAG is sufficient to meet the 25.4 mgd groundwater project contingent on receiving permits from the SPCGCD for the full production amount.

This project was previously evaluated in two ways for the *2021 Coastal Bend Regional Water Plan*: (a) as a raw, groundwater supply with minimal treatment and (b) with groundwater desalination to reduce TDS and chlorides to around 200 mg/L for high water quality use. At the request of project sponsors, the recommended strategy includes groundwater desalination and for this reason it is the only option included in the *2026 Coastal Bend Regional Water Plan*. The strategy presented here is for groundwater desalination for a finished water at a quality around 200 mg/L.

This project does not have a MAG limitation. At full project production, the wellfield consists of approximately 23 wells including contingency. The wells range from 650 feet to 950 feet in depth and have an estimated pumping rate of 1,200 gallons per minute (gpm). The current raw groundwater quality is anticipated to range from 800 mg/L TDS to 1,300 mg/L TDS[2], and wells would be screened and operated in such a manner to target groundwater with lower levels of TDS and chlorides. The Evangeline/Laguna group has tested The pumped groundwater would be conveyed to the O.N. Stevens water treatment plant (WTP) and treated to a finished water goal of 200 mg/L TDS based on future industrial water quality needs. The brine concentrate would be disposed of at the Rincon outfall upstream of Nueces Bay. The delivery option selected for evaluation in this water management strategy was previously evaluated by the City of Corpus Christi in 2023/2024 and includes raw water costs provided by Evangeline Laguna

[2] The broad range is listed here to account for Gulf Coast Aquifer water quality variability that may be experienced across the 23,000 acre+ wellfield site given the heterogeneous nature of the aquifer as well as absence of site-specific information towards the southeast of Evangeline's wellfield.

LLC. The City looked at additional delivery options in their 2023/2024 evaluation, including options to deliver water to San Patricio County near Dressen and raw water integration into the Mary Rhodes Pipeline, deemed viable if Evangeline groundwater supplies were consistently delivered at or below 700 mg/L TDS. Given the project scale and variability in the Gulf Coast/Evangeline aquifer water quality over broad areas in this vicinity, the City of Corpus Christi requested inclusion of Scenario 5 (from their study) with reverse osmosis treatment as a conservative option.

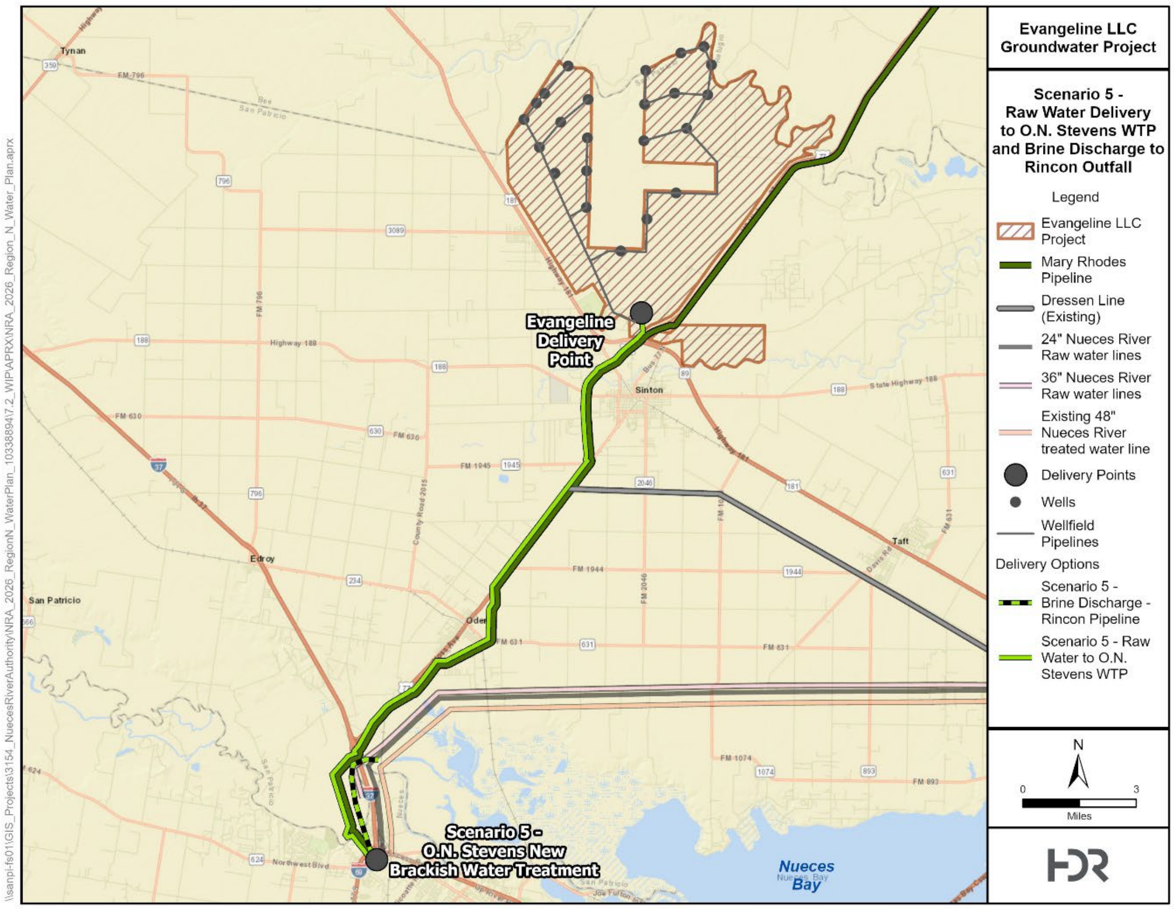

Figure 5B.7.2.
Location of Conceptual Layout of Evangeline Laguna Groundwater Project

5B.7.1.2 Available Yield

In the Coastal Bend region, the Gulf Coast Aquifer System is the primary source of substantial groundwater supplies. The most productive water-bearing zone is the Goliad Sand, also known as the Evangeline Aquifer. The outcrop of the Goliad Sand is about 50 to 75 miles inland. The formation dips toward the coast at about 20 feet per mile. Near the coast, the shallower Chicot Aquifer provides some groundwater supplies. West of the outcrop of the Goliad Sands, the deeper Jasper Aquifer can supply a moderate amount of groundwater in some areas.

Evangeline/Laguna LP secured a water well production permit from SPCGCD on May 16, 2019, which authorizes production of 28,486 ac-ft of water annually at a rate of 1,500 gpm for municipal, industrial, agricultural, irrigation, and wildlife uses. The production permit is expired as of May 16, 2024, and requires renewal with the SPCGCD General Manager or Board representative before any water can be produced from the existing wells. As of July 2024, SPCGCD has issued permits for two testing wells, allowing for current production of 4,840 ac-ft/yr. Additional wells would need to be drilled to reach the full 28,486 ac-ft/yr capacity. Drilling of additional wells would require submittal of water well drilling permit applications to SPCGCD detailing the location of each well, amount of water requested, rate of withdrawal requested, requested well use, a location map, and a $200 permit fee. The permit application requires submittal of a Notice of Intent (NOI) to drill a well, along with a water conservation plan. Once drilled, a water well registration must be submitted, along with a driller's log, which must be submitted within 90 days of drilling the well.

The full groundwater production equal to the 25.4 mgd permit issued by the SPCGCD is available under regional planning guidelines and within existing MAG availability.

5B.7.1.3 Environmental Issues

The primary environmental issues related to the development of groundwater desalination of water from the Evangeline Aquifer in San Patricio County are the development of the well fields and associated pipelines, development of water treatment facilities, integration into the existing pipeline system and discharge of brine concentrate into the Nueces Delta.

The project is located in the Gulf Coastal Plains of Texas Physiographic Province, specifically in the sub-province of the Coastal Prairies. This area is locally characterized as a nearly flat prairie composed of deltaic sands and muds which terminates at the Gulf of Mexico and includes topography changes of less than 1 foot per mile. Elevation levels in the Coastal Prairies range from 0 to 300 feet above mean sea level.

Environmental Considerations Associated with Evangeline Laguna Groundwater Project

The Evangeline Laguna Groundwater project includes a well field of 23 water wells located in San Patricio County near the Bee County line and close to Sinton. Raw water would be delivered from the well field to the desalination facilities at the O.N. Stevens WTP located approximately 17 miles south of the well field, near Calallen. Concentrate disposal for this project would be to the Nueces Delta.

Two new pipelines are proposed, a raw water line from the delivery point at the well field to the O.N. Stevens WTP complex and a brine discharge pipeline from the WTP to the Nueces Delta. Water would be treated at a RO treatment plant, to be co-located near O.N. Stevens WTP, for delivery through existing treated water lines. The proposed raw water pipeline will cross areas previously disturbed by construction of the Mary Rhodes Pipeline (MRP) but may encounter areas primarily used for pasture and crops. The proposed raw water pipeline and the concentrate disposal pipeline would cross possible freshwater emergent and freshwater forested wetland areas associated with the Nueces River. Planning of the pipeline routes should include avoidance of impacts to wetland areas where possible. The potential environmental effects resulting from the disposal of brine concentrate from the Evangeline/Laguna LP Groundwater project will be sensitive to the siting of the project and its associated pipeline and the concentration and quantity of brine effluent in relation to stream flows. Although the construction of portions of the raw water pipeline may include the clearing and removal of woody vegetation, destruction of potential habitat can generally be avoided by diverting the corridor through previously disturbed areas.

Estuaries such as those found near Nueces Bay serve as critical habitat and spawning grounds for many marine species and migratory birds. Estuaries are marine environments maintained in a brackish state by the inflow of freshwater from rivers and streams. The high productivity characteristic of estuaries arises from their large nutrient input, shallow water, and the ability of a few marine species to thrive in environments continually stressed by low, variable salinities, temperature extremes, and, on occasion, low dissolved oxygen concentrations. The potential environmental effects resulting from the disposal of brine concentrate from the project will be sensitive to the siting of the project and its appurtenances. Prior to implementation, water quality studies of discharge impacts to the Nueces River and the Bay system would need to be performed.

The well field area is primarily located within an area used for crops; however, it also contains smaller portions of Mesquite-Live Oak-Bluewood Parks vegetation areas. Mesquite-Live Oak-Bluewood Parks areas commonly contain plants such as huisache, grajeno, lotebush, pricklypear, agarita, purple threeawn, and Mexican persimmon. Distribution of this vegetation type is found primarily within the South Texas Plains. Site selection for the wells should include the avoidance of impacts to wetland areas.

Appropriate pipeline route selection, construction methods and right-of-way selection should avoid or minimize anticipated impacts to potential wetland areas or other waters of the United States along the proposed raw water pipeline.

Area Vegetation and Wildlife Habitat

The groundwater desalination project area is located within the Gulf Prairies and Marshes Vegetational Area. Gulf Prairies have slow surface drainage and elevations that range from sea level to 250 feet. These areas include nearly level and virtually undissected plains. Originally, the Gulf Prairies were composed of tallgrass prairie and post oak savannah. However, tree species such as honey mesquite, and acacia, along with other trees and shrubs have increased in this area forming dense thickets in many places. Typical oak species found in this area include live oak (*Quercus virginiana*) and post oak (*Q. stellata*), in addition to huisache (*Acacia smallii*), black-brush (*A. rigidula*), and a dwarf shrub; bushy sea-ox-eye (*Borrichia frutescens*). Principal climax grasses of the Gulf Prairies include gulf cordgrass (*Spartina spartinae*), indiangrass (*Sorghastrum nutans*), and big bluestem (*Andropogon gerardii* var. *gerardii*). Prickleypear (*Opunita* sp.) are common within this area along with forbs including asters (*Aster* sp.), poppy mallows (*Callirhoe* sp.), bluebonnets (*Lupinus* sp.), and evening primroses (*Oenothera* sp.). Gulf Marshes range from sea level to a few feet in elevation, and include low, wet marshy coast areas commonly covered with saline water. These salty areas support numerous species of sedges (*Carex* and *Cyperus* sp.), bulrushes (*Scirpus* sp.), rushes (*Juncus* sp.), and grasses. Aquatic forbs found in these areas generally include pepperweeds (*Lepidium* sp.), smartweeds (*Polygonum* sp.), cattails (*Typha domingensis*) and spiderworts (*Tradescantia* sp.) among others. Game and waterfowl find these low marshy areas to be excellent natural wildlife habitat.

Threatened and Endangered Species

The Federal Endangered Species Act of 1973 (ESA), as amended, prohibits the "take" of any threatened or endangered species. The term "take" under the ESA means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct." The term "harm" was further defined to include "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering." Designation of critical habitat areas has been established for the public knowledge where the publishing of such information would not cause harm to the species. Additional federal protection is extended to migratory birds, and bald and golden eagles under the Migratory Bird Treaty Act (MBTA) as amended, and the Bald and Golden Eagle Protection Act. Protection is also afforded to Texas state-listed species. The Texas Parks and Wildlife Department (TPWD) enforces the state regulations.

The MBTA protects most bird species, including, but not limited to, cranes, ducks, geese, shore-birds, hawks, and songbirds. Migratory bird pathways, stopover habitats, wintering areas, and breeding areas may occur within and adjacent to the pipeline area, and may be associated with wetlands, ponds, shorelines, riparian corridors, fallow fields and grasslands, and woodland and forested areas. Pipeline construction activities could disturb migratory bird habitats and/or species' activities.

Reasonable and prudent measures should be taken to avoid and minimize the potential effects of the proposed project's activities on threatened and endangered species, as well as bald eagles. Species' locations, activities, and habitat requirements should be considered based on U.S. Fish and Wildlife Service (USFWS) and TPWD recommendations.

In San Patricio and Nueces counties, there may occur 50 state-listed endangered or threatened species and 28 federally listed endangered or threatened wildlife species, according to the county lists of rare species published by the TPWD. A list of these species, their preferred habitat and potential occurrence in the two county areas is provided in Table 5B.7.1.

Table 5B.7.1. Federal- and State-Listed Threatened, and Endangered Listed for San Patricio and Nueces Counties

Common Name	Scientific Name	Summary of Habitat Preference	Potential Occurrence in Project Area	Federal Status	State Status
Black-spotted newt	*Notophthalmus meridionalis*	May be found in resacas and bodies of water with firm bottoms and little or no vegetation.	Resident	--	T
Sheep frog	*Hypopachus variolosus*	Predominantly grassland and savanna.	Resident	--	T
South Texas siren (large form)	*Siren sp. 1*	Mainly found in bodies of quiet water, permanent or temporary, with or without submerged vegetation.	Resident	--	T
Black rail	*Laterallus jamaicensis*	Salt, brackish, and freshwater marshes, pond borders, wet meadows and grassy swamps.	Nesting	T	T
Northern Aplomado Falcon	*Falco femoralis septentrionalis*	Open country, especially savanna and open woodland, and sometimes in very barren areas; grassy plains and valleys with scattered mesquite, yucca, and cactus	Migrant	E	E
Piping plover	*Charadrius melodus*	Beaches and flats of coastal Texas	Migrant	T	T
Reddish egret	*Egretta rufescens*	Brackish marshes and shallow salt ponds and tidal flats.	Resident	--	T
Red knot	*Calidris canutus rufa*	Primarily sea coast on tidal flats and beaches, herbaceous wetland, and tidal flat/shore.	Resident	T	T
Sooty tern	*Onychoprion fuscatus*	Primarily an offshore bird. Does nest on sandy beaches and islands.	Migrant	--	T
Swallow-tailed kite	*Elanoides forficatus*	Lowland forested regions, especially swampy areas, ranging into open woodland.	Resident	__	T
Texas Botteri's Sparrow	*Aimophila botterii texana*	Grassland and short-grass plains with scattered bushes or shrubs, sagebrush, mesquite, or yucca; nests on ground of low clump of grasses	Resident	__	T
Tropical parula	*Setophaga pitiayumi*	Semi-tropical evergreen woodland along rivers and resacas	Resident	--	T
White-faced ibis	*Plegadis chihi*	Prefers freshwater marshes	Resident	--	T
White-tailed hawk	*Buteo albicaudatus*	Coastal prairies, savannahs and marshes in Gulf Coastal Plain	Nesting/Migrant	__	T
Whooping crane	*Grus Americana*	Winters in coastal marshes	Migrant	E	E
Wood stork	*Mycteria Americana*	Forages in prairie ponds, ditches and shallow standing water; formerly nested in Texas	Migrant	__	T
Yellow-billed cuckoo	*Coccyzus americanus*	In Texas, populations of concern are found breeding in riparian areas in the Trans Pecos.	Migrant	T	--
Giant manta ray	*Manta birostris*	Habitat description is not available at this time.	Ocean Resident	T	--

Common Name	Scientific Name	Summary of Habitat Preference	Potential Occurrence in Project Area	Federal Status	State Status
Great hammerhead	*Spyrna mokarran*	Habitat description is not available at this time.	Ocean Resident	--	T
Oceanic whitetip shark	*Carcharhinus longimanus*	Habitat description is not available at this time.	Ocean Resident	T	T
Shortfin mako shark	*Isurus oxyrinchus*	Habitat description is not available at this time.	Ocean Resident	--	T
Migratory monarch butterfly	*Danaus plexippus plexippus*	Habitat description is not available at this time.	Migrant	PT	--
Atlantic spotted dolphin	*Stenella frontalis*	Inhabits warm tropical, subtropical, and temperate waters throughout the Atlantic Ocean, including the Gulf of Mexico.	Ocean Resident	--	T
Blue whale	*Balaenoptera musculus*	Inhabits tropical, subtropical, and subpolar waters worldwide, infrequently sighted in the Gulf of Mexico	Ocean Resident	E	E
Bryde's whale	*Balaenoptera iedeni brydei*	Habitat description is not available at this time.	Ocean Resident	--	E
Cuvier's beaked whale	*Ziphius cavirostris*	Inhabits warm tropical, subtropical, and temperate waters worldwide, including the Gulf of Mexico.	Ocean Resident	--	T
Dwarf sperm whale	*Kogia simus*	Inhabits tropical and temperate waters worldwide.	Ocean Resident	--	T
False killer whale	*Pseudorca crassidens*	Inhabits tropical, subtropical, and temperate waters world wide	Ocean Resident	--	T
Finback whale	*Balaenoptera physalus*	Inhabits tropical, subtropical, temperate, and subpolar waters worldwide, but are less common in the tropics.	Ocean Resident	E	E
Gervais's beaked whale	*Mesoplodon europaeus*	Inhabits tropical, subtropical, and temperate waters of the northern Atlantic Ocean, Gulf of Mexico, and Caribbean.	Ocean Resident	--	T
Humpback whale	*Megaptera novaeangliae*	Open ocean and coastal waters, sometimes including inshore areas such as bays.	Ocean Resident	E	--
Killer whale	*Orcinus orca*	Inhabits tropical, subtropical, temperate, and polar waters worldwide.	Ocean Resident	--	T
North Atlantic right whale	*Eubalaena glacialis*	Inhabits subtropical and temperate waters in the northern Atlantic.	Ocean Resident	E	E
Ocelot	*Leopardus pardalis*	Dense chaparral thickets; mesquite-thorn shrub and live oak stands	Resident	E	E
Pygmy killer whale	*Feresa attenuata*	Inhabits tropical and subtropical waters worldwide, including the Gulf of Mexico.	Ocean Resident	--	T
Pygmy sperm whale	*Kogia breviceps*	Inhabits tropical, subtropical, and temperate waters worldwide.	Ocean Resident	--	T
Rice's whale	*Balaenoptera ricei*	Habitat description is not available at this time.	Ocean Resident	E	E
Roughtoothed dolphin	*Steno bredanensis*	Inhabits tropical, subtropical, and temperate waters worldwide, including the Gulf of Mexico.	Ocean Resident	--	T

Common Name	Scientific Name	Summary of Habitat Preference	Potential Occurrence in Project Area	Federal Status	State Status
Sei whale	*Balaenoptera borealis*	Habitat description is not available at this time.	Ocean Resident	E	E
Short-finned pilot whale	*Globicephala macrorhynchus*	Inhabits tropical, subtropical, and temperate waters worldwide, including the Gulf of Mexico.	Ocean Resident	--	T
Sperm whale	*Physeter macrocephalus*	Inhabits tropical, subtropical, and temperate waters worldwide, avoiding icy waters.	Ocean Resident	E	E
Tricolored bat	*Perimyotis subflavus*	Forest, woodland, and riparian areas are important. Caves are very important	Resident	PE	--
West Indian manatee	*Trichechus manatus*	Large rivers, brackish water bays, coastal waters.	Aquatic Resident	T	T
White-nosed coati	*Nasua narica*	Woodlands, riparian corridors and canyons	Transient	__	T
American alligator	*Alligator mississippiensis*	Coastal marshes, inland natural rivers and marshes, manmade impoundments	Resident	SAT	--
Atlantic hawksbill sea turtle	*Eretmochelys imbricata*	Gulf and bay system, warm shallow waters especially in rocky marine environments	Aquatic Resident	E	E
Green sea turtle	*Chelonia mydas*	Gulf and bay systems; shallow water seagrass beds	Aquatic Resident	T	T
Kemp's Ridley sea turtle	*Lepidochelys kempii*	Inhabits tropical, subtropical, and temperate waters of the northwestern Atlantic Ocean and Gulf of Mexico.	Aquatic Resident	E	E
Leatherback sea turtle	*Dermochelys coriacea*	Inhabits tropical, subtropical, and temperate waters worldwide, including the Gulf of Mexico.	Aquatic Resident	E	E
Loggerhead sea turtle	*Caretta caretta*	Gulf and bay systems for juveniles, adults prefer open waters	Aquatic Resident	T	T
Texas horned lizard	*Phrynosoma cornutum*	Varied; sparsely vegetated uplands, grass, cactus, brush	Resident	__	T
Texas scarlet snake	*Cemophora coccinea lineri*	Mixed hardwood scrub on sandy soils	Resident	__	T
Texas tortoise	*Gopherus berlandieri*	Open bush with grass understory; open grass and bare ground avoided	Resident	__	T
Black lace cactus	*Echinocerus reichenbachii var alberti*	Grasslands, thorn shrublands, mesquite woodlands on sandy somewhat saline soils on coastal prairie.	Resident	E	E
Slender rush pea	*Hoffmanseggia tenella*	Coastal prairie grasslands on level uplands and on gentle slopes.	Resident	E	E
South Texas ambrosia	*Ambrosia cheiranthifolia*	Grasslands and mesquite-dominated shrublands on various soils.	Resident	E	E

Source: TPWD, Annotated County List of Rare Species, San Patricio County, February 11, 2025

PT Proposed Threatened
PE Proposed Endangered
E Endangered
SAT Special Assessment Status
-- Not Listed
T Threatened

Inclusion in Table 5B.7.1 does not imply that a species will occur within the project area but only acknowledges the potential for occurrence in the project area county. A more intensive field reconnaissance would be necessary to confirm and identify specific species habitat that may be present in the project area.

The proposed project occurs primarily in areas which have been previously developed and used for farming and pasture for a long period of time. Disturbance within these areas due to construction of the pipeline routes and well field is anticipated to have minimal effect on the existing environment. Impacts from the disposal of saline concentrate into the Nueces River Delta should be carefully monitored in order to minimize any impacts this may have on aquatic species. Suitable habitat for some listed species may exist within the project areas, additional studies would need to be completed to determine potential impacts to listed species. The presence or absence of potential habitat within an area does not confirm the presence or absence of a listed species. No species-specific surveys were conducted in the project area for this report.

Wetland Areas

Potential wetland impacts could occur along the pipeline and well field areas located near rivers, streams, or marshy areas. The wells, collection system within the well field, and transmission systems should be sited in such a way as to avoid or minimize impacts to these sensitive resources. Potential impacts can be minimized by right-of-way selection and appropriate construction methods, including erosion controls and revegetation procedures. Compensation for net losses of wetland would be required where impacts are unavoidable and a permit from the U.S. Army Corps of Engineers (USACE) would be required for impacts to waters of the United States.

Cultural Resources

Impacts to National Register of Historic Place (NRHP)-listed properties or districts, state historic sites, cemeteries or other cultural resources that are mapped by the Texas Historical Commission should be easily avoided through planning associated with the development of the well fields and pipeline routes.

A cultural resource survey of the well field and pipeline routes for the proposed project areas will need to be performed consistent with requirements of the Texas Antiquities Code.

Summary of Overall Possible Environmental Impacts

Because of the relatively small areas involved and the use of the existing O.N. Stevens WTP, construction and maintenance of surface facilities are not expected to result in substantial environmental impacts. Where environmental resources (e.g., endangered species habitat and cultural resource sites) could be impacted by infrastructure, minor adjustments in facility siting and pipeline alignment would generally be sufficient to avoid or minimize adverse effects. Impacts to aquatic species within the Nueces River and the Nueces Bay due to changes from brine concentrate discharge should be studied early in project design.

The pumping of groundwater from the Evangeline Aquifer could cause a slight reduction on baseflow in downstream reaches. However, no measurable impact on wildlife along the streams is anticipated from this project. Minor land surface subsidence could potentially occur as a result of lowering of groundwater levels. As a result, drainage patterns and other habitats might change to a small extent.

5B.7.1.4 Engineering and Costing

Based on data collected and provided by Evangeline Laguna, the key features identified and evaluated for planning and costing purposes for 2026 regional water plan water management strategy are as follows:

- Wells: The well field consists of 23 wells including contingency. Well depth = 650 - 950 feet. Pumping rate = 1,200 gpm each.
- Raw groundwater quality ranging from 800 mg/L TDS to 1,300 mg/L TDS is expected, and wells would be screened and operated in such a manner to target groundwater with lower levels of TDS and chlorides.
- Although test well data shows water quality meets drinking water standards and could be delivered to an industrial customer untreated (Chapter 5B.8.2 includes evaluation of this option), pumped groundwater will be conveyed to the O.N. Stevens WTP along MRP, which is part of the Evangeline/Laguna LP project and treated to a finished water goal of 200 mg/L TDS based on future industrial water quality needs.
- A purchase cost of raw water of $1,463 per ac-ft (or $4.49 per 1,000 gallons). This purchase cost of raw water includes construction of all wells and wellfield piping including operations and maintenance and raw water fees. This cost also assumes that Evangeline will build and operate the wells, pumps, and wellfield pipeline, and appurtenances to delivery water up to 25 mgd at the delivery point.
- Transmission and treatment plant costed according to full project build-out: 28,486 ac-ft/yr (25 mgd).
- Treatment plant assumes 800-1,300 mg/l TDS influent, 200 mg/l TDS effluent; plant treats 90 percent of raw groundwater (10 percent bypass) at 90 percent process efficiency.
- Brine concentrate disposal to the Rincon outfall upstream of Nueces Bay.
- Treated water yield: 22,788 ac-ft/yr (20.3 mgd).
- Treated water delivery: delivery is at the fence of the O.N. Stevens complex.

Overall, the project cost is $486,499,000. Annual cost is $104,738,000. At a yield of 25,637 ac-ft/yr, the unit cost of water is $4,085 per ac-ft. The cost table for this project is presented in Table 5B.7.2

Table 5B.7.2. Cost Estimate Summary Water Supply Project Option, September 2023 Prices, Evangeline Laguna Treated Groundwater Strategy- Region N Plan

Item	Estimated Costs for Facilities
Intake Pump Stations (26.8 MGD)	$7,183,000
Transmission Pipeline (18-54 in. dia., 22.2 miles)	$204,694,000
Water Treatment Plant (25 MGD)	$143,051,000
Integration, Relocations, Backup Generator & Other	$258,000
TOTAL COST OF FACILITIES	**$355,186,000**
Engineering:	
- Planning (3%)	$10,700,000
- Design (7%)	$24,967,000
- Construction Engineering (1%)	$3,567,000
Legal Assistance (2%)	$7,134,000
Fiscal Services (2%)	$7,134,000
Pipeline Contingency (15%)	$30,928,000
All Other Facilities Contingency (20%)	$30,098,000
Environmental & Archaeology Studies and Mitigation	$765,000
Land Acquisition and Surveying (139 acres)	$667,000
Interest During Construction (3.5% for 1 years with a 0.5% ROI)	$15,353,000
TOTAL COST OF PROJECT	**$486,499,000**
Debt Service (3.5 percent, 20 years)	$34,317,000
Operation and Maintenance	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$2,064,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$180,000
Water Treatment Plant	$26,119,000
Pumping Energy Costs (4231411 kW-hr @ 0.09 $/kW-hr)	$381,000
Purchase of Water (28486 ac-ft/yr @ 1463.06 $/ac-ft)	$41,677,000
TOTAL ANNUAL COST	**$104,738,000**
Available Project Yield (ac-ft/yr)	25,637
Annual Cost of Water ($ per ac-ft), based on PF=1	$4,085
Annual Cost of Water After Debt Service ($ per ac-ft), based on PF=1	$2,747
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$12.54
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$8.43

Note: One or more cost element has been calculated externally.

No land acquisition costs, except for transmission pipeline and brine concentrate disposal ROW.

5B.7.1.5 Implementation Issues

The groundwater availability considered for this water management strategy were based on MAGs adopted by local groundwater conservation district (GCD) and Groundwater Management Areas (GMAs) according to the Texas Water Development Board (TWDB) guidance for regional water planning.

Implementation of the project and the installation and operation of brackish water treatment plant, may have to address the following issues:

- Permitting desalination concentrate discharge to Nueces Estuary;
- Verification of groundwater quality for concentrations of dissolved constituents such as TDS, chloride, sulfate, iron, manganese, radium, uranium, and arsenic;
- Long-term lease of property for well field, and coordination with landowners;
- Competition with others for groundwater in the area;
- Detailed well yield including additional test drilling and aquifer water quality testing;
- Skilled operators of desalination water treatment plants;
- Capital and operations and maintenance costs;
- Impact of water levels in the aquifer, potential intrusion of saline groundwater, land surface subsidence, streamflow, and baseflow in streams;
- USACE Section 10 and 404 dredge and fill permits for pipelines;
- General Land Office (GLO) Sand and Gravel Removal permit for pipeline and crossings of streams and roads;
- GLO Easement for use of state-owned lands, if any;
- Cultural resources investigations in accordance with the Texas Historical Commission and the Texas Antiquities Code;
- TPWD Sand, Gravel, and Marl permit.
- Impact on endangered, other wildlife species, and wetlands;
- The potential exceedances in TDS and chloride in the groundwater will require pretreatment to remove TDS or altering the blending ratio to mitigate the impact;
- Incorporating the Evangeline groundwater into the City's water supply will require corrosivity analysis and permitting with TCEQ.

Mitigation requirements may be needed with the City of Sinton depending on long-term groundwater levels. Additional mitigation could include vegetation restoration, wetland creation or enhancement, or additional land acquisition;

5B.7.1.6 Evaluation Summary

An evaluation summary of this regional water management strategy is provided in Table 5B.7.3.

Table 5B.7.3. Evaluation Summary of the Evangeline Laguna Treated Groundwater Strategy

Impact Category	Comment(s)
a. Water supply:	
1. Quantity	1. Yield is 25,637 ac-ft/yr
2. Reliability	2. High reliability.
3. Cost of treated water	3. Generally moderate to high cost; $4,085 per ac-ft
b. Environmental factors:	
1. Instream flows	1. Moderate impact.
2. Bay and estuary inflows and arms of the Gulf of Mexico	2. None to low, with discharge location at Rincon outfall upstream of Nueces Bay. Greatest impact is during low-flow conditions.
3. Wildlife habitat	3. Disposal of concentrated brine with bay option may impact fish and wildlife habitats or wetlands.
4. Wetlands	4. None to low.
5. Threatened and endangered species	5. None identified. Project can be adjusted to bypass sensitive areas. Endangered species survey will be needed to identify impacts.
6. Cultural resources	6. Cultural resources survey will be needed to identify any significant sites.
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. 7a-b,d. Total dissolved solids and salinity of water is removed with reverse osmosis treatment. Brine concentrated disposal issues will need to be addressed prior to project implementation. 7c. None or low impact. 7e-i. Chloride, sulfate, uranium and arsenic concentrations in groundwater will need to be considered prior to implementation of project.
c. Impacts to Agricultural Resources or State water resources	• Potential impacts to agricultural or seasonal water users along Chiltipin Creek associated with brine discharge. Discharge is at Rincon outfall upstream of Nueces Bay to reduce environmental impacts. Little to minor negative impacts on surface water resources
d. Threats to agriculture and natural resources in region	• Temporary damage due to construction of pipeline
e. Recreational impacts	• None
f. Equitable comparison of strategies	• Standard analyses and methods used for portions • Reverse osmosis treatment costs modeled after bid and manufacturers' budgets, but not constructed
g. Interbasin transfers	• Not applicable
h. Third party social and economic impacts from voluntary redistribution of water	• Not applicable
i. Efficient use of existing water supplies and regional opportunities	• Provides regional opportunities for water that would otherwise be unused
j. Effect on navigation	• None
k. Impacts on water pipelines and other facilities used for water conveyance	• Construction and maintenance of transmission pipeline corridor. Possible impact to wildlife habitat along pipeline route and right-of-way.

5B.7.2 City of Beeville

5B.7.2.1 Description of Strategy

The City of Beeville does not show any water supply needs during the planning time period; however, the city is considering the development of additional supplies of up to 5 mgd. Beeville has an existing supply of approximately 1 mgd near Chase Field and receives supplies from the City of Corpus Christi. Beeville has five existing wells that were abandoned in the 1980s. Given the current drought, the City of Beeville is considering these wells for future supply and redundancy. Given the uncertainty in well conditions and production, the assumptions are that the wells need replacement and treatment to provide drought, and long-term water supplies. This 5-mgd project can be developed without violating MAG constraints for Bee County. The proposed 5 mgd wellfield assumes 10 wells at a depth of 450 feet will operate at 350 to 500 gpm. Groundwater will be delivered through a 5-mile transmission pipeline to an existing treatment plant, and it is anticipated to receive brackish groundwater treatment.

5B.7.2.2 Available Yield

The Evangeline Aquifer within the Gulf Coast Aquifer System is the source of groundwater supply. The City of Beeville Brackish Groundwater Treatment Project assumes a 75 percent efficiency for desalination with 25 percent brine concentration. The planned available yield for the Beeville Project is estimated to be 3.75 mgd (4,204 ac-ft/yr). The project can be developed at the requested amount without violating the MAG constraints for Bee County.

The Evangeline Aquifer contains both fresh and brackish water at depths between 200 and 800 feet. The Evangeline Aquifer in the Bee County vicinity is expected to have quality of 500 to 700 mg/L of TDS. The final treated water quality is expected to achieve a TDS range of 400 to 600 mg/L. Test wells should be drilled to confirm geological conditions of the site.

5B.7.2.3 Environmental Issues

The primary environmental issues related to the development of brackish groundwater desalination of water for the City of Beeville in Bee County are the development of 10 brackish water wells (likely replacing 5 abandoned wells and installing 5 new wells), an approximately 5-mile transmission pipeline, and use of an existing treatment plant (unnamed) with additional brine discharge. The conceptual layout has not been developed to identify the locations of the well field, transmission pipelines, or discharge pipelines so the environmental discussion will be general.

Estuaries such as those found near along the Texas Gulf Coast serve as critical habitat and spawning grounds for many marine species and migratory birds. Estuaries are marine environments maintained in a brackish state by the inflow of freshwater from rivers and streams. The high productivity characteristic of estuaries arises from their large nutrient input, shallow water, and the ability of a few marine species to thrive in environments continually stressed by low, variable salinities, temperature extremes, and, on occasion, low dissolved oxygen concentrations. The potential environmental effects resulting from the disposal of brine concentrate from the City of Beeville brackish water project will be sensitive to the siting of the project and its appurtenances. Prior to implementation, water quality studies of discharge impacts to the receiving creek and the Bay system would need to be performed.

The proposed project area is located within the Coastal Prairies sub-province of the larger Gulf Coastal Plains of Texas Physiographic Province. This area is locally characterized as a nearly flat prairie composed of deltaic sands and muds which terminates at the Gulf of Mexico and includes topography changes of less than 1 foot per mile. Elevation levels in the Coastal Prairies range from 0 to 300 feet above mean sea level.

The location of the well field and transmission pipelines have not yet been determined but they may include clearing and removal of vegetation. Potential wildlife habitat impacts can be minimized by siting the corridor within previously disturbed areas where possible. The project would use existing treatment facilities, thereby minimizing impacts.

Threatened and Endangered Species

In Bee County, 16 state-listed endangered or threatened species and 10 federally-listed endangered or threatened wildlife species may occur, according to the county lists of rare species published by the TPWD. A list of these species, their preferred habitat, and potential occurrence in Bee County is provided in Table 5B.7.4.

Table 5B.7.4. Federal- and State-Listed Threatened, and Endangered Species Listed for Bee County

Common Name	Scientific Name	Summary of Habitat Preference	Potential Occurrence in Project Area	Federal Status	State Status
Black-spotted newt	*Notophthalmus meridionalis*	May be found in resacas and bodies of water with firm bottoms and little or no vegetation. Sometimes in wet areas, such as arroyos, canals, ditches or shallow depressions.	Resident	—	T
Sheep frog	*Hypopachus variolosus*	Predominantly grassland and savanna. Largely fossorial in areas with moist microclimates.	Resident	—	T
South Texas siren (large form)	*Siren sp. 1*	Mainly in quiet bodies of water, permanent or temporary, with or without submergent vegetation. Wet or sometimes wet areas.	Resident	—	T
Black rail	*Laterallus jamaicensis*	Salt, brackish, and freshwater marshes, pond borders, wet meadows and grassy swamps.	Nesting	T	T
Interior Least Tern	*Sternula antillarum athalassos*	Sand and gravel bars within braided streams, rivers or man-made structures.	Resident	E	E
Piping Plover	*Charadrius melodus*	Beaches, sandflats, and dunes along Gulf Coast beaches.	Transient	LT	T
Rufa Red knot	*Calidris canutus rufa*	Primarily sea coast on tidal flats and beaches, herbaceous wetland, and tidal flat/shore.	Resident	T	T
Swallow-tailed Kite	*Elanoides forficatus*	Lowland forested regions, especially swampy areas, ranging into open woodland. Marshes, along rivers, lakes and ponds.	Resident	—	T
White-faced Ibis	*Plegadis chihi*	Prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats.	Resident	—	T
White-tailed Hawk	*Buteo albicaudatus*	Near coast on prairies, cordgrass flats, and scrub-live oak. Further inland on prairies, mesquite and oak savannas and mixed savanna-chaparral.	Resident	—	T
Whooping Crane	*Grus americana*	Small ponds, marshes, and flooded grain fields. Potential migrant via plains through much of state.	Migrant	LE	E
Wood Stork	*Mycteria americana*	Nests in large tracts of baldcypress or red mangrove. Forages in prairie ponds, flooded pastures or fields, ditches or other shallow standing water.	Migrant	—	T
Yellow-billed cuckoo	*Coccyzus americanus*	In Texas, populations of concern are found breeding in riparian areas in the Trans Pecos.	Migrant	T	--
Migratory monarch butterfly	*Danaus plexippus plexippus*	Habitat description is not available at this time.	Migrant	PT	--
Ocelot	*Leopardus pardalis*	Restricted to mesquite-thorn scrub and live-oak mottes, avoids open areas.	Transient	LE	E

Common Name	Scientific Name	Summary of Habitat Preference	Potential Occurrence in Project Area	Federal Status	State Status
Tricolored bat	*Perimyotis subflavus*	Forest, woodland and riparian areas. Caves are very important.	Resident	PE	--
White-nosed coati	*Nasua narica*	Woodlands, riparian corridors, and canyons.	Transient	—	T
American alligator	*Alligator mississippiensis*	Coastal marshes, inland natural rivers, swamps and marshes, manmade impoundments.	Resident	SAT	—
Texas horned lizard	*Phrynosoma cornutum*	Open, arid and semi-arid regions with sparse vegetation.	Resident	—	T
Texas tortoise	*Gopherus berlandieri*	Open brush with a grass understory is preferred.	Resident	—	T

Source: TPWD, Annotated County List of Rare Species, Bee County, updated January 15, 2025.
PE – Proposed Endangered; PT - Proposed Threatened; E – Endangered; T – Threatened; — - Not Listed

Inclusion in Table 5B.7.4 does not imply that a species will occur within the project area but only acknowledges the potential for occurrence in the project area county. A more intensive field reconnaissance would be necessary to confirm and identify specific species habitat that may be present in the project area.

Project details have not been determined to date. Suitable habitat for some listed species may existing within the project area, additional studies would need to be completed to determine potential impacts to listed species. The presence or absence of potential habitat within an area does not confirm the presence or absence of a listed species. No species-specific surveys were conducted in the project area for this report.

Wetland Areas

Potential wetlands could occur within the project area, especially near creeks. The wells, collection lines, transmission pipeline, and concentrate discharge lines should be sited in such a way as to avoid or minimize impacts to these sensitive resources, as much as practical. Potential impacts can be minimized by selective property acquisition and appropriate construction methods, including erosion controls and revegetation procedures. Compensation for net losses of wetland would be required where impacts are unavoidable.

Cultural Resources

Impacts to NRHP-listed properties or districts, state historic sites, cemeteries or other cultural resources that are mapped by the Texas Historical Commission should be easily avoided through planning associated with the development of the well fields and pipeline routes.

A cultural resource survey of the well field and pipeline routes for the proposed project areas will need to be performed consistent with requirements of the Texas Antiquities Code.

Summary of Overall Possible Environmental Impacts

Because of the relatively small areas involved, construction and maintenance of surface facilities are not expected to result in substantial environmental impacts. Where environmental resources (e.g., endangered species habitat and cultural resource sites) could be impacted by infrastructure, minor adjustments in facility siting and pipeline alignment would generally be sufficient to avoid or minimize adverse effects.

The pumping of groundwater from an aquifer could cause a slight reduction on baseflow in downstream reaches. Minor land surface subsidence could potentially occur as a result of lowering of groundwater levels. As a result, drainage patterns and other habitats might change to a small extent. Salinity concentrations in the water receiving the brine discharge and farther downstream should be carefully monitored in order to minimize any impacts this may have on aquatic species.

5B.7.2.4 Engineering and Costing

A few assumptions were made in the cost estimates for the new wells for the City of Beeville. Characteristic well depth and well capacity were developed for costing purposes based on data from existing wells in the vicinity. For the purposes of estimating well pumping power costs, typically a total dynamic head estimate of 300 feet was assumed, to include 200 feet to bring water from pumping levels to the ground surface and 100 feet to pump into a pressurized distribution system maintained at 60 pounds per square inch. This conservative estimate is intended to account for local drawdown and declining water levels with time. Brackish groundwater treatment was the level of treatment assumed for costing purposes. The cost of a 5-mile pipeline to transport groundwater from the wellfield to the existing WTP complex is included in the cost estimate. The total estimated cost of the City of Beeville project is $100,904,000. Assuming a 20-year debt service at an interest rate of 3.5 percent, the annual cost is projected at $16,342,000. With a projected treated water yield of 4,204 acre-feet per year (or 3.75 mgd), the unit cost of water supply is calculated at $3,887 per acre-foot, as detailed in Table 5B.7.5.

The treatment process will involve an advanced brackish desalination facility using RO membranes, capable of processing water with salinity levels up to 3,000 mg/L at a capacity of 5 mgd.

Brine discharge facilities, including injection wells, are not included in the cost estimate. The cost assumes brine discharge for land application or to a local creek near the WTP. If injection wells or brine discharge pipelines are required, this would be an additional cost.

Table 5B.7.5.
Cost Estimate Summary Water Supply Project Option, September 2023 Prices, Region N Local Gulf Coast Supplies – City of Beeville (Additional 3.75 mgd Supply)

Item	Estimated Costs for Facilities
Intake Pump Stations (5.3 MGD)	$7,470,000
Transmission Pipeline (24 in. dia., 5 miles)	$9,459,000
Well Fields (Wells, Pumps, and Piping)	$7,866,000
Water Treatment Plant (5 MGD)	$47,475,000
Integration, Relocations, Backup Generator & Other	$51,000
TOTAL COST OF FACILITIES	**$72,321,000**
Engineering:	
- Planning (3%)	$2,170,000
- Design (7%)	$5,062,000
- Construction Engineering (1%)	$723,000
Legal Assistance (2%)	$1,446,000
Fiscal Services (2%)	$1,446,000
Pipeline Contingency (15%)	$1,419,000
All Other Facilities Contingency (20%)	$12,572,000
Environmental & Archaeology Studies and Mitigation	$257,000
Land Acquisition and Surveying (46 acres)	$313,000
Interest During Construction (3.5% for 1 years with a 0.5% ROI)	$3,175,000
TOTAL COST OF PROJECT	**$100,904,000**
Debt Service (3.5 percent, 20 years)	$7,096,000
Operation and Maintenance	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$174,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$187,000
Water Treatment Plant	$8,632,000
Pumping Energy Costs (2815869 kW-hr @ 0.09 $/kW-hr)	$253,000
TOTAL ANNUAL COST	**$16,342,000**
Available Project Yield (ac-ft/yr)	4,204
Annual Cost of Water ($ per ac-ft), based on PF=2	$3,887
Annual Cost of Water After Debt Service ($ per ac-ft), based on PF=2	$2,199
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$11.93
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$6.75

5B.7.2.5 Implementation Issues

There are several considerations for the South Texas Water Authority Groundwater Desalination Project to include:

- Permitting desalination concentrate discharge to Petronila Creek.
- Verification of the Gulf Coast Aquifer water quality for concentrations of the dissolved constituents such as TDS, chloride, sulfate, iron, manganese, radium, uranium, and arsenic;
- Purchase or lease of property for well field, and coordination with landowners;
- Skilled operators of desalination water treatment plants;
- Impact of water levels in the aquifer, potential intrusion of saline groundwater, land surface subsidence, and streamflow;

- USACE Section 10 and 404 dredge and fill permits for pipelines;
- GLO Sand and Gravel Removal permit for pipeline and crossings of streams and roads;
- GLO Easement for use of State-owned lands, if any;
- TPWD Sand, Gravel, and Marl permit;
- Design requirement of new transmission line through the easement of existing 42" line.
- Mitigation requirements would vary depending on impacts, but could include vegetation restoration, wetland creation or enhancement, or additional land acquisition.
- Federal Emergency Management Agency (FEMA) 100-year flood map coming close to the identified well field location.

5B.7.2.6 Evaluation Summary

An evaluation summary of the City of Beeville regional water management strategies is provided in Table 5B.7.6.

Table 5B.7.6.
Evaluation Summary of the City of Beeville Additional 3.75 mgd Supply

Impact Category	Comment(s)
a. Water supply:	
1. Quantity	1. Yield = 4,204 ac-ft/yr
2. Reliability	2. High reliability.
3. Cost of treated water	3. Generally moderate to high cost; $3,887 per ac-ft
b. Environmental factors:	
1. Instream flows	1. Moderate impact.
2. Bay and estuary inflows and arms of the Gulf of Mexico	2. None to low. Greatest impact is during low-flow conditions.
3. Wildlife habitat	3. Disposal of concentrated brine with bay option may impact fish and wildlife habitats or wetlands.
4. Wetlands	4. None to low.
5. Threatened and endangered species	5. None identified. Project can be adjusted to bypass sensitive areas. Endangered species survey will be needed to identify impacts.
6. Cultural resources	6. Cultural resources survey will be needed to identify any significant sites.
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. 7a-b,d. Total dissolved solids and salinity of water is removed with reverse osmosis treatment. Brine concentrated disposal issues will need to be addressed prior to project implementation. 7c. None or low impact. 7e-i. Chloride, sulfate, uranium and arsenic concentrations in groundwater will need to be considered prior to implementation of project.
c. Impacts to Agricultural Resources or State water resources	• Potential impacts to agricultural or seasonal water users along waterways associated with brine discharge. Little to minor negative impacts on surface water resources
d. Threats to agriculture and natural resources in region	• Temporary damage due to construction of pipeline
e. Recreational impacts	• None
f. Equitable comparison of strategies	• Standard analyses and methods used for portions • Reverse osmosis treatment costs modeled after bid and manufacturers' budgets, but not constructed
g. Interbasin transfers	• Not applicable
h. Third party social and economic impacts from voluntary redistribution of water	• Not applicable
i. Efficient use of existing water supplies and regional opportunities	• Provides regional opportunities for water that would otherwise be unused
j. Effect on navigation	• None
k. Impacts on water pipelines and other facilities used for water conveyance	• Construction and maintenance of transmission pipeline corridor. Possible impact to wildlife habitat along pipeline route and right-of-way.

5B.7.3 Driscoll Brackish Groundwater Treatment Project

5B.7.3.1 Description of Strategy

The South Texas Water Authority (STWA) is actively pursuing the development of a secondary groundwater source as an independent water supply option, in anticipation of future water scarcity and drought conditions expected in the South Texas region. Currently, STWA relies on purchasing treated surface water from the City of Corpus Christi Water for its distribution. However, with projected growth in Nueces County and within the STWA distribution zone, securing a secondary water source has become a strategic priority.

This evaluation was prepared by International Consulting Engineers (ICE), under the direction of STWA. STWA has been working diligently on this initiative for several years, with key milestones outlined as follows:

- STWA engaged International Consulting Engineers to develop a Water Master Plan, focused on evaluating and strategizing for future growth and ensuring the long-term security of operations.
- STWA has formally expressed its interest in securing an alternative water source to the board members and board has approved for processing the feasibility study.
- A contract was issued to a geology team to conduct a groundwater study, assessing both fresh and brackish water availability within the distribution area for future use.
- Phase 2 of the project involves test drilling and evaluating the water yield at locations identified through the groundwater study.
- Based on the yield results, STWA will conduct a feasibility study for the identified sites to evaluate the potential for a desalination facility.
- The anticipated timeline for the approval and construction of the brackish water treatment plant is three years, including all necessary permits.

STWA has already pinpointed potential drilling sites and locations for the construction of the brackish water treatment plant, as determined by the groundwater study. According to MAG value assessments, the plant's expected capacity will be 1.8 mgd, with an anticipated output of 1.35 mgd. The proposed layout for the brackish groundwater desalination project is shown in Figure 5B.7.3.

The first phase of the project includes drilling tests, followed by analysis of the results and integration with STWA's future water needs. The subsequent phase will focus on developing the treatment facility based on the water quality and suitable locations identified by the STWA Water Master Plan.

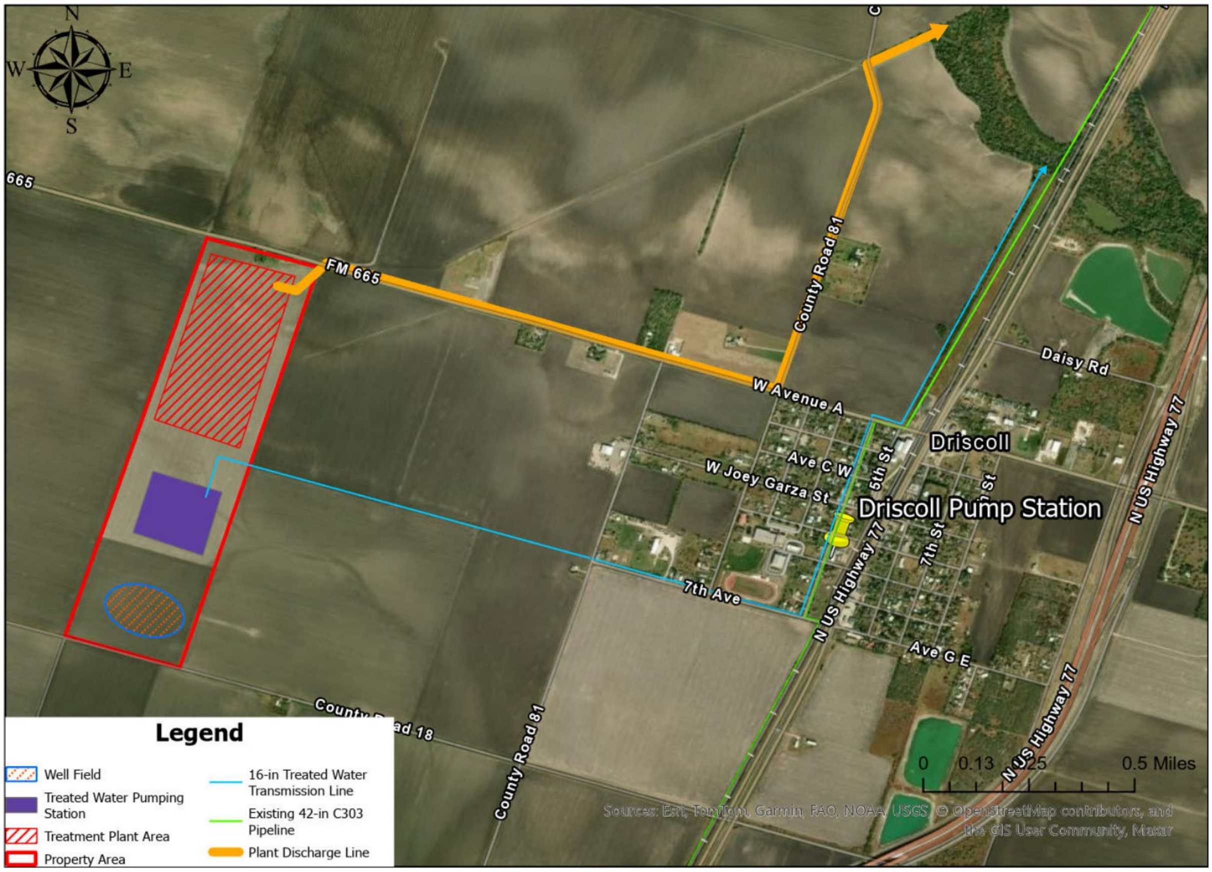

Figure 5B.7.3.
STWA Brackish Desalination Plant Layout

Transmission Strategy

The current water transmission and distribution system primarily relies on the 42-inch AWWA C303 Steel Reinforced Concrete Pipe (SRCP). This pipe serves as the main conduit for transporting water from the Corpus Christi Water source, extending approximately 27 miles southward to Kingsville. Given the pipe's age of 42 years and the external conditions affecting its structural integrity, the STWA has raised concerns regarding its future reliability. To mitigate potential risks and avoid complications from blending different water sources, STWA proposes that the secondary water supply be routed through an independent system, separate from the existing 42-inch line.

The proposed project is strategically located in the heart of the STWA distribution zone and will establish a new transmission line, approximately 6 to 8 miles in length, using a 16-inch pipe. This new line will provide an independent connection to major water user groups within Nueces County. To minimize land acquisition costs and associated expenses, the new 16-inch transmission line will be installed within the easement of the existing 42-inch line.

The new line is designed to interconnect with several key infrastructure points: it will tap into the Tesla water transfer line, the 14-inch line feeding into the Central Pump Station (near the intersection of I-69/E Frontage Road and FM 2826), and the Driscoll Pump Station, which is in proximity to the proposed brackish water treatment plant. The proposed Transmission line is shown in Figure 5B.7.4. The treatment plant's location is also near the Bishop Pump Station and potential future industrial clients, presenting a viable solution for expansion, contingent on the MAG value and the feasibility of extending the plant's capacity in future.

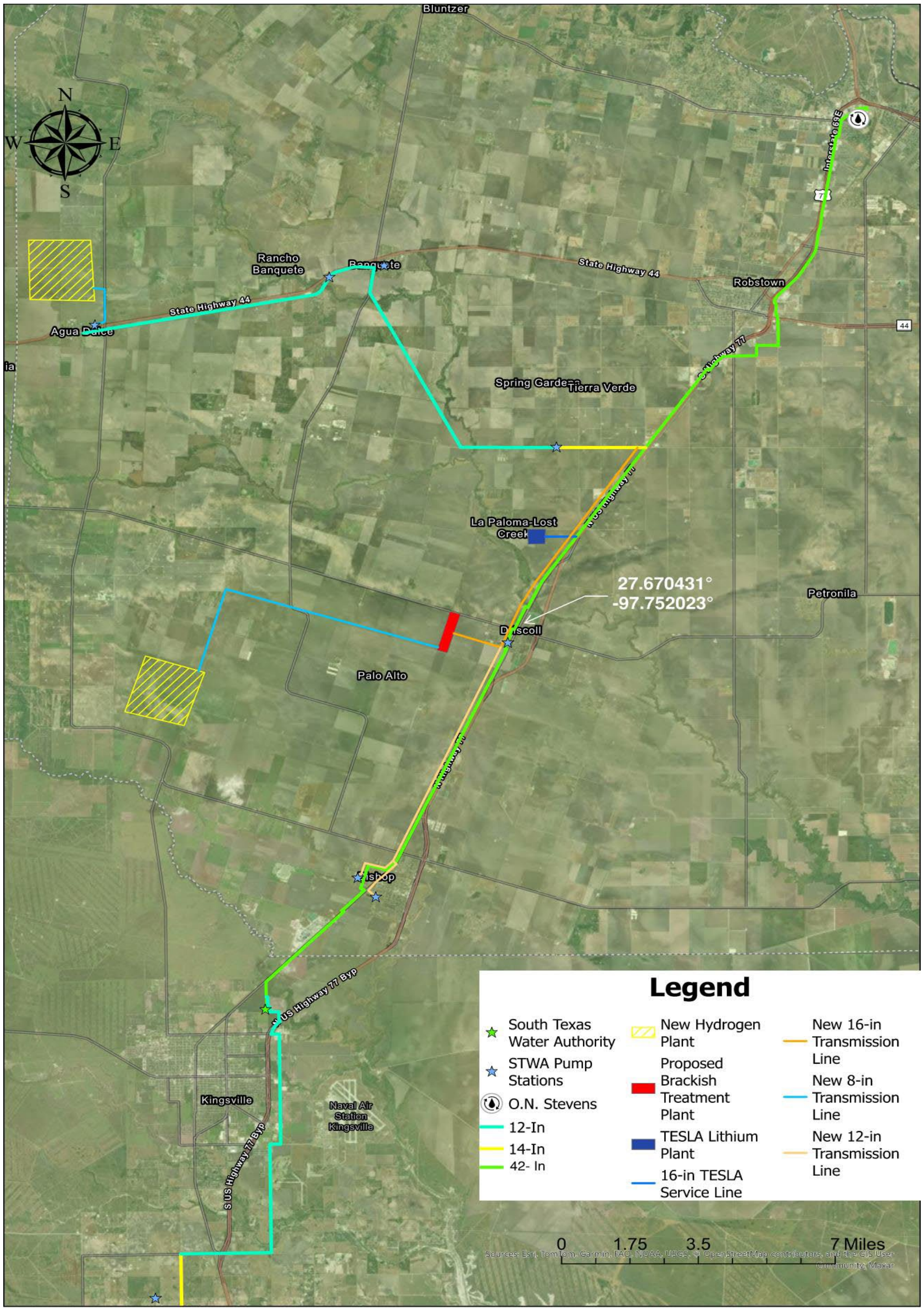

Figure 5B.7.4.
Location of Conceptual Layout of Driscoll Brackish Groundwater Treatment Project

Design and Construction Strategy

According to the TWDB's guidance manual for brackish groundwater desalination, there are standardized strategies for designing and constructing desalination plants in Texas. Desalting systems typically rely on one of two technologies to remove salts from water: evaporation or membrane filtration. For the proposed system, we plan to use a membrane-based system, with the recommended membranes provided by Kovalus Separation Solutions.

STWA will follow a five-phase implementation process to develop the full facility at the identified location, as outlined below:

- Phase 1: Planning
- Phase 2: Permitting
- Phase 3: Design
- Phase 4: Construction
- Phase 5: Operations.

Figure 5B.7.5 illustrates the key process features of a brackish water treatment facility.

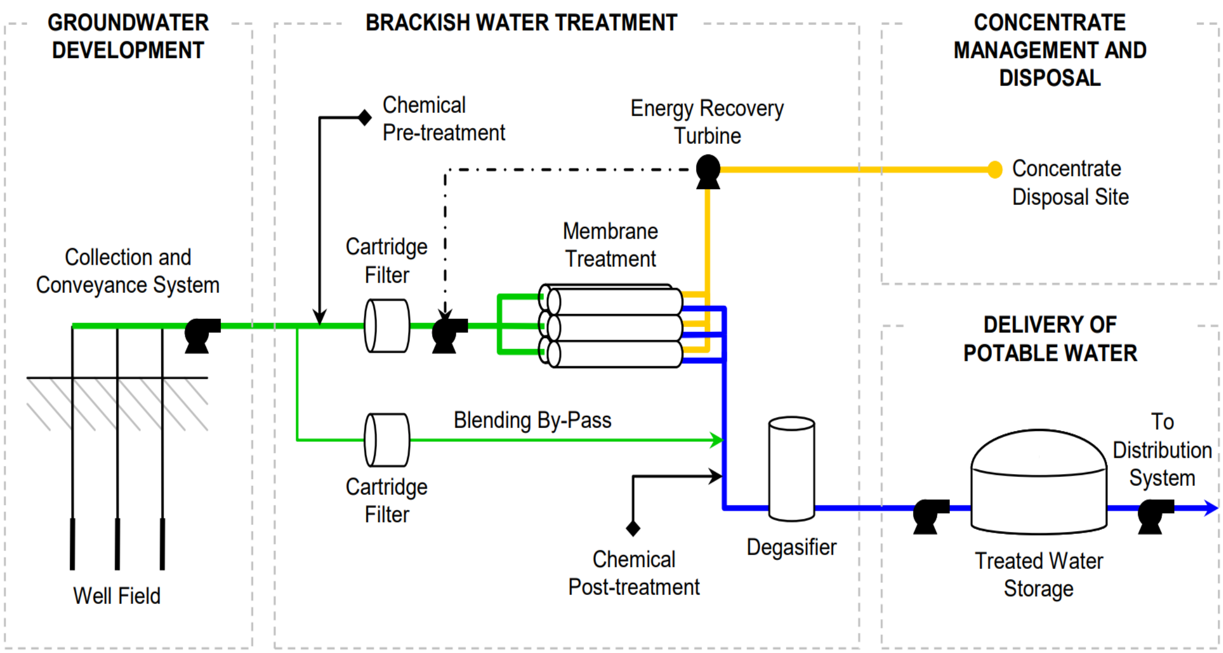

Figure 5B.7.5.
General Flow Process for a Brackish Groundwater Desalination Project[3]

[3]https://www.twdb.texas.gov/publications/reports/contracted_reports/doc/0604830581_BrackishDesal.pdf

5B.7.3.2 Available Yield

The Evangeline Aquifer within the Gulf Coast Aquifer System will be the primary source of groundwater supply for the brackish project in Driscoll. The Driscoll Brackish Groundwater Treatment Project assume a 75 percent efficiency for desalination with 25 percent brine concentration. The Driscoll Brackish Treatment Project will produce groundwater up to 1.8 mgd (2,018 ac-ft/yr), the treated water supply of the project will be 1.35 mgd (1,513 ac-ft/yr) assuming 75 percent water treatment plant efficiency. Approximately 37 percent of the yield (560 ac-ft/yr) is expected to be used by Nueces County Manufacturing, 26 percent of the yield (404 ac-ft/yr) will be used by Nueces County-Other, 15 percent of the yield (224 ac-ft/yr) will be used by Nueces Water Supply Corporation (WSC), 13 percent of the yield (195 ac-ft/yr) will be used by Bishop, and 9 percent of the yield (130 ac-ft/yr) will be used by Driscoll. The project can be developed at requested amounts without violating the MAG constraints for Nueces County.

The STWA contract with the City of Corpus Christi states "Specific written approval by City Council of City will be required before Authority' sells water which Authority has purchased from City to: (f) Any private organization or person not included in the initial water line construction program of Authority within an area where no City has platting jurisdiction, or to governmental unit for resale to such organization." The STWA would need approval to sell City of Corpus Christi purchased water to any private entities.

Based on the STWA Groundwater Study and Evaluation, the proposed site for development is located near the Driscoll Pump Station. Geologically, the area contains brackish water in the Evangeline Aquifer, with a minimum depth of 1,500 feet. According to data from the TWDB, no existing wells have been identified in this area. The study indicates that at a depth of 1,600 feet, the Evangeline Aquifer is expected to provide water with a quality of 2,500 to 3,000 mg/L of TDS. Each well, at this depth, is projected to yield 1 mgd (1,120 ac-ft/yr). The initial project plans call for the installation of three wells, with two operational wells and one reserved for future development, providing a total capacity of at least 2 mgd (2,241 ac-ft/yr) from the two operational wells. The final treated water quality is expected to achieve a TDS range of 400 to 600 mg/L. In line with the available MAG value in Nueces County, the wells are designed to withdraw up to 1.8 mgd (2,016 ac-ft/yr). Test wells will be drilled based on the groundwater study and geological conditions of the site. Additionally, we will assess potential flood impacts on the identified zones as well.

5B.7.3.3 Environmental Issues

The proposal to construct a brackish water treatment plant near the City of Driscoll includes the establishment of the plant and well field area between FM 665 and County Road 18, just outside the city limits. Primary environmental issues related to the extraction of brackish groundwater from the Evangeline Aquifer in Nueces County include the development of a brackish treatment plant, a pumping station for the treated water, a well field from which brackish water would be extracted for treatment, collection pipelines and a concentrate discharge line, and discharge of brine concentrate into Petrolina Creek.

Estuaries and small creek systems like those found near Baffin Bay serve as the critical habitat and spawning grounds for many marine species and migratory birds. Estuaries are marine environments maintained in a brackish state by the inflow of freshwater from rivers and streams. The high productivity characteristic of estuaries arises from their large nutrient input, shallow water, and the ability of a few marine species to thrive in environments continually stressed by low, variable salinities, temperature extremes, and, on occasion, low dissolved oxygen concentrations. The potential environmental effects resulting from the disposal of brine concentrate from the project will be sensitive to the siting of the project and its appurtenances. Prior to implementation, water quality studies of discharge impacts to Petronila Creek and the Bay system would need to be performed.

The proposed project area is located within the Coastal Prairies sub-province of the larger Gulf Coastal Plains of Texas Physiographic Province. This area is locally characterized as a nearly flat prairie composed of deltaic sands and muds which terminates at the Gulf of Mexico and includes topography changes of less than one foot per mile. Elevation levels in the Coastal Prairies range from 0 to 300 feet above mean sea level.

The proposed project site just outside the City of Driscoll and concentrate disposal pipelines would be within areas characterized primarily as farmland and rural low-intensity areas, with smaller areas of coastal prairie, artificial wetland, a section of Highway 77, and floodplain evergreen woodland and native invasive huisache woodland or shrubland near Petronila Creek. Although the construction of the brine disposal or collection pipelines may include clearing and removal of woody vegetation, destruction of potential habitat can be minimized by siting the corridor within previously disturbed areas, where possible.

Area Vegetation and Wildlife Habitat

The City of Driscoll is located within the South Texas Plains Vegetational Area. The South Texas Plains and brush country averages between 20 and 32 inches of rainfall per year with high summer temperatures and very high evaporation rates. Plains with thorny shrubs and trees dominate the region, with scattered patches of palms and subtropical woodlands in the Rio Grande Valley. Thorny brush, such as mesquite, acacia and prickly pear are the primary vegetation mixed with areas of grassland. Historically, the plains were covered with open grasslands with few trees, and the Valley woodlands covered large areas.

Threatened and Endangered Species

In Nueces County, 50 state-listed endangered or threatened species and 25 federally listed endangered or threatened wildlife species may occur, according to the county lists of rare species published by the TPWD. A list of these species and rare species, their preferred habitat, and potential occurrences in Nueces County is provided in Table 5B.7.7.

Table 5B.7.7.
Federal- and State-Listed Threatened, and Endangered Species
Listed for Nueces County

Common Name	Scientific Name	Summary of Habitat Preferences	Potential Occurrence in Project Area	Federal Status	State Status
Black-Spotted Newt	*Notophthalmus meridionalis*	Terrestrial habitats used by adults are typically poorly drained clay soils that allow for the formation of ephemeral wetlands. A wide variety of vegetation associations are known to be used, such as thorn scrub and pasture. Aquatic habitats used for reproduction are a variety of ephemeral and permanent water bodies.	Resident		T
Sheep Frog	*hypopachus variolosus*	Terrestrial and aquatic: Predominantly grassland and savanna; largely fossorial in areas with moist microclimates.	Resident		T
South Texas siren (Large Form)	*Siren sp. 1*	Aquatic: Mainly found in bodies of quiet water, permanent or temporary, without submergent vegetation. Wet of sometimes wet areas, such as arroyos, canals, ditches, or even shallow depressions; aestivates in the ground during dry periods but does require some moisture to remain.	Potential Resident		T
black rail	*Laterallus jamaicensis*	The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine the potential presence of this species in a specific county. Salt, brackish, and freshwater marshes, pond borders, wet meadows, and grassy swamps; nests in or along edge of marsh, sometimes on damp ground, but usually on mats of previous years dead grasses. nest usually hidden in marsh grass or at base of Salicornia	Resident	T	T
northern aplomado falcon	*Falco femoralis septentrionalis*	Open country, especially savanna and open woodland, and sometimes in very barren areas; grassy plains and valleys with scattered mesquite, yucca, and cactus; nests in old stick nests of other bird species	Migratory	E	E

Common Name	Scientific Name	Summary of Habitat Preferences	Potential Occurrence in Project Area	Federal Status	State Status
piping plover	*Charadrius melodus*	The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine the potential presence of this species in a specific county. Beaches, sandflats, and dunes along Gulf Coast beaches and adjacent offshore islands. Also spoil islands in the Intracoastal Waterway. Based on November 30, 1992 Section 6 Job No. 9.1, Piping Plover and Snowy Plover Winter Habitat Status Survey, algal flats appear to be the highest quality habitat. Some of the most important aspects of algae flats are their relative inaccessibility and their continuous availability throughout all tidal conditions. Sand flats often appear to be preferred over algal flats when both are available, but large portions of sand flats along the Texas coast are available only during low-very low tides and are often completely unavailable during extreme high tides or strong north winds. Beaches appear to serve as a secondary habitat to the flats associated with the primary bays, lagoons, and inter-island passes. Beaches are rarely used on the southern Texas coast, where bayside habitat is always available, and are abandoned as bayside habitats become available on the central and northern coast. However, beaches are probably a vital habitat along the central and northern coast (i.e., north of Padre Island) during periods of extreme high tides that cover the flats. Optimal site characteristics appear to be large in area, sparsely vegetated, continuously available or in close proximity to secondary habitat, and with limited human disturbance.	Resident	T	T
reddish egret	*Egretta rufescens*	Resident of the Texas Gulf Coast; brackish marshes and shallow salt ponds and tidal flats; nests on ground or in trees or bushes, on dry coastal islands in brushy thickets of yucca and prickly pear	Resident		T

Common Name	Scientific Name	Summary of Habitat Preferences	Potential Occurrence in Project Area	Federal Status	State Status
rufa red knot	*Calidris canutus rufa*	The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Habitat: Primarily seacoasts on tidal flats and beaches, herbaceous wetland, and Tidal flat/shore. Bolivar Flats in Galveston County, sandy beaches Mustang Island, few on outer coastal and barrier beaches, tidal mudflats and salt marshes.	Resident	T	T
sooty tern	*Onychoprion fuscatus*	Primarily an offshore bird; does nest on sandy beaches and islands, breeding April-July	Transient		T
swallow-tailed kite	*Elanoides forficatus*	The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Lowland forested regions, especially swampy areas, ranging into open woodland; marshes, along rivers, lakes, and ponds; nests high in tall tree in clearing or on forest woodland edge, usually in pine, cypress, or various deciduous trees	Transient/ Migratory		T
Texas Botteri's sparrow	*Peucaea botterii texana*	Grassland and short-grass plains with scattered bushes or shrubs, sagebrush, mesquite, or yucca; nests on ground of low clump of grasses	Resident		T
tropical parula	*Setophaga pitiayumi*	Semi-tropical evergreen woodland along rivers and resacas. Texas ebony, anacua and other trees with epiphytic plants hanging from them. Dense or open woods, undergrowth, brush, and trees along edges of rivers and resacas; breeding April to July.	Resident		T
white-faced ibis	*Plegadis chihi*	The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; currently confined to near-coastal rookeries in so-called hog-wallow prairies. Nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats.			T
white-tailed hawk	*Buteo albicaudatus*	Near coast on prairies, cordgrass flats, and scrub-live oak; further inland on prairies, mesquite and oak savannas, and mixed savanna-chaparral; breeding March-May	Resident		T

Common Name	Scientific Name	Summary of Habitat Preferences	Potential Occurrence in Project Area	Federal Status	State Status
whooping crane	*Grus americana*	The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Small ponds, marshes, and flooded grain fields for both roosting and foraging. Potential migrant via plains throughout most of state to coast; winters in coastal marshes of Aransas, Calhoun, and Refugio counties.	Migratory	E	E
wood stork	*Mycteria americana*	The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Prefers to nest in large tracts of baldcypress (Taxodium distichum) or red mangrove (Rhizophora mangle); forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960.	Transient		T
yellow-billed cuckoo	*Coccyzus americanus*	In Texas, the populations of concern are found breeding in riparian areas in the Trans Pecos (know as part of the Western Distinct Population Segment). It is the Western DPS that is on the U.S. ESA threatened list and includes the Texas counties Brewster, Culberson, El Paso, Hudspeth, Jeff Davis, and Presidio. Riparian woodlands below 6,000' in elevation consisting of cottonwoods and willows are prime habitat. This species is a long-distant migrant that summers in Texas, but winters mainly in South America. Breeding birds of the Trans Pecos populations typically arrive on their breeding grounds possibly in late April but the peak arrival time is in May. Threats to preferred habitat include hydrologic changes that don't promote the regeneration of cottonwoods and willows, plus livestock browsing and trampling of sapling trees in sensitive riparian areas.	Migratory	T	
giant manta ray	*Manta birostris*	Habitat description is not available at this time	Resident		T
great hammerhead	*Sphyrna mokarran*	Habitat description is not available at this time.	Resident	T	

Common Name	Scientific Name	Summary of Habitat Preferences	Potential Occurrence in Project Area	Federal Status	State Status
oceanic whitetip shark	*Carcharhinus longimanus*	Habitat description is not available at this time.	Resident	T	T
shortfin mako shark	*Isurus oxyrinchus*	Habitat description is not available at this time.	Resident		T
migratory monarch butterfly	*Danaus plexippus plexippus*	Habitat description is not available at this time.	Migratory	C	
Atlantic spotted dolphin	*Stenella frontalis*	Inhabits warm tropical, subtropical, and temperate waters throughout the Atlantic Ocean, including the Gulf of Mexico. Commonly found along the continental shelf and coastal waters that are 65-820 feet deep, usually inside or near 185 m contour (within 250-350 km of coast); occasionally found in deeper waters. Often dive to 30-200 feet preying upon fish, invertebrates, and cephalopods.	Resident		T
blue whale	*Balaenoptera musculus*	Inhabits tropical, subtropical, temperate, and subpolar waters worldwide, but are infrequently sighted in the Gulf of Mexico. They migrate seasonally between summer feeding grounds and winter breeding grounds, but specifics vary. Commonly observed at the surface in open ocean	Resident	E	E
Bryde's whale	*Balaenoptera edeni brydei*	Habitat description is not available at this time.	Resident		E
Cuvier's beaked whale	*Ziphius cavirostris*	Inhabits tropical, subtropical, and temperate waters worldwide, including the Gulf of Mexico. Commonly found in water over 3,300 feet deep near the continental shelf near steep slopes or canyons, avoiding coastal areas. Mostly pelagic apparently confined by the 1,00-meter bathymetric contour. frequently make deep dives to capture prey (squids and fishes).	Resident		T
dwarf sperm whale	*Kogia simus*	Inhabits tropical and temperate waters worldwide, Commonly found in deep waters near the continental shelf and rarely seen at the surface but may be more coastal than the pygmy sperm whale (Kogia breviceps). Dives to great depths (1,000 feet) to hunt for squid, fish, and crustaceans. Migration patterns are unknown.	Resident		T
false killer whale	*Pseudorca crassidens*	Inhabits tropical, subtropical, and temperate waters worldwide, including the Gulf of Mexico. Commonly found in deep, offshore waters deeper than 3,300 feet, making dives of up to 2,000 meters to catch their prey (fishes and squids). Gulf of Mexico distinct population segment is not well studied.	Resident		T

Common Name	Scientific Name	Summary of Habitat Preferences	Potential Occurrence in Project Area	Federal Status	State Status
finback whale	*Balaenoptera physalus*	Inhabits tropical, subtropical, temperate, and subpolar waters worldwide, but are less common in the tropics preferring cooler water. Commonly found in deep, offshore waters and migrate in the open ocean from the poles (feeding grounds) to warmer waters in the winter to give birth. They feed on krill, squid, and small schooling fish sometimes with other baleen whale species. They are very rare in the Gulf of Mexico and reported sightings are likely vagrants (Witt et al. 2011).	Resident	E	E
Gervais's beaked whale	*Mesoplodon europaeus*	Inhabits tropical, subtropical, and temperate waters of the northern Atlantic Ocean, Gulf of Mexico, and Caribbean. Commonly found in deep water and open ocean where they prey upon squids. They are difficult to distinguish from others in their family (Mesoplodon) and are cryptic and skittish, but the most commonly stranded species on the US southeastern coast. Migration patterns are unknown.	Resident		T
humpback whale	*Megaptera novaeangliae*	Inhabits tropical, subtropical, temperate, and subpolar waters worldwide. Migrate up to 5,000 miles between colder water (feeding grounds) and warmer water (calving grounds) each year. They will use both open ocean and coastal waters, sometimes including inshore areas such as bays, and are often found near the surface; however, this species is rare in the Gulf of Mexico. The northwest Atlantic/Gulf of Mexico distinct population segment is not considered at risk of extinction and is not listed as Endangered on the Endangered Species Act.	Resident	E	
killer whale	*Orcinus orca*	Inhabits tropical, subtropical, temperate, and polar waters worldwide. In the Gulf of Mexico, they are commonly found in oceanic waters ranging from 256-2,652 meters deep beyond the 1,000-meter isobath and a very rarely found over the continental shelf and may be entirely absent from nearshore waters. May come in contact with pelagic long line fisheries targeting tunas and billfishes.	Resident		T

Common Name	Scientific Name	Summary of Habitat Preferences	Potential Occurrence in Project Area	Federal Status	State Status
North Atlantic right whale	*Eubalaena glacialis*	Inhabits subtropical and temperate waters in the northern Atlantic. Commonly found in coastal waters or close to the continental shelf near the surface. They migrate from feeding grounds in cooler waters (Canada and New England) to warmer waters of the southeast US (South Carolina, Georgia, and Florida) to give birth in the fall/winter - both areas are identified as critical habitat by NOAA-NMFS. Nursery areas are in shallow, coastal waters. This species is very rare in the Gulf of Mexico and the few reported sightings are likely vagrants (Ward-Geiger et al. 2011).	Resident	E	E
ocelot	*Leopardus pardalis*	Restricted to mesquite-thorn scrub and live-oak mottes; avoids open areas. Dense mixed brush below four feet; thorny shrublands; dense chaparral thickets; breeds and raises young June-November.	Resident	E	E
pygmy killer whale	*Feresa attenuata*	Inhabits tropical and subtropical waters worldwide, including the Gulf of Mexico. Commonly found in deeper, offshore waters where they dive for their prey (squids and fishes), but may occasionally occur close to shore. They are very rare and migration patterns are unknown.	Resident		T
pygmy sperm whale	*Kogia breviceps*	Inhabits tropical, subtropical, and temperate waters worldwide. Commonly found in deep water over the continental slope and rarely seen at the surface. Dives to great depths (over 1,000 feet) to hunt for squid, fish, and crustaceans. Migration patterns are unknown.	Resident		T
Rice's whale	*Balaenoptera ricei*	Habitat description is not available at this time.	Resident	E	E
Rough-toothed dolphin	*Steno bredanensis*	Inhabits tropical, subtropical, and temperate waters worldwide, including the Gulf of Mexico. Records in Texas are only known from strandings. Commonly found in deep, oceanic water over 1,500-2,000 meters deep and ranging in temperature from 17-25 degrees Celsius. May associate with other cetaceans. Prey on squids and fish. No known migration patterns.	Resident		T
sei whale	*Balaenoptera borealis*	Habitat description is not available at this time.	Resident	E	E
short-finned pilot whale	*Globicephala macrorhynchus*	Inhabits tropical, subtropical, and temperate waters worldwide, including the Gulf of Mexico. Commonly found in deeper waters (>1,000 feet) and continental shelf where they make deep dives to capture squid but may come closer to shore. Migration patterns unknown.	Resident		T

Common Name	Scientific Name	Summary of Habitat Preferences	Potential Occurrence in Project Area	Federal Status	State Status
sperm whale	*Physeter macrocephalus*	Inhabits tropical, subtropical, and temperate waters worldwide, avoiding icy waters. Distribution is highly dependent on their food source (squids, sharks, skates, fish), breeding, and composition of the pod. In general, this species migrates from north to south in the winter and south to north in the summer; however, individuals in tropical and temperate waters don't seem to migrate at all. Routinely dive to catch their prey (2,000-10,000 feet) and generally occupies water at least 3,300 feet deep near ocean trenches.	Resident	E	E
tricolored bat	*Perimyotis subflavus*	Forest, woodland and riparian areas are important. Caves are very important to this species.	Resident	PE	
West Indian manatee	*Trichechus manatus*	Large rivers, brackish water bays, coastal waters. Warm waters of the tropics, in rivers and brackish bays but may also survive in saltwater habitats. Very sensitive to cold water temperatures. Rarely occurs as far north as Texas. Gulf and bay system; opportunistic, aquatic herbivore.	Resident	T	T
white-nosed coati	*Quadrula quadrula*	Woodlands, riparian corridors and canyons. Most individuals in Texas probably transients from Mexico; diurnal and crepuscular; very sociable; forages on ground and in trees; omnivorous; may be susceptible to hunting, trapping, and pet trade	Resident		T
American alligator	*Alligator mississippiensis*	Aquatic: Coastal marshes; inland natural rivers, swamps and marshes; manmade impoundments.	Resident	SoA, T	
Atlantic hawksbill sea turtle	*Eretmochelys imbricata*	Inhabits tropical and subtropical waters worldwide, in the Gulf of Mexico, especially Texas. Hatchling and juveniles are found in open, pelagic ocean and closely associated with floating algae/seagrass mats. Juveniles then migrate to shallower, coastal areas, mainly coral reefs and rocky areas, but also in bays and estuaries near mangroves when reefs are absent; seldom in water more than 65 feet deep. They feed on sponges, jellyfish, sea urchins, mollusks, and crustaceans. Nesting occurs from April to November high up on the beach where there is vegetation for cover and little or no sand. Some migrate, but others stay close to foraging areas - females are philopatric.	Resident	E	E

Common Name	Scientific Name	Summary of Habitat Preferences	Potential Occurrence in Project Area	Federal Status	State Status
green sea turtle	*Chelonia mydas*	Inhabits tropical, subtropical, and temperate waters worldwide, including the Gulf of Mexico. Adults and juveniles occupy inshore and nearshore areas, including bays and lagoons with reefs and seagrass. They migrate from feeding grounds (open ocean) to nesting grounds (beaches/barrier islands) and some nesting does occur in Texas (April to September). Adults are herbivorous feeding on sea grass and seaweed; juveniles are omnivorous feeding initially on marine invertebrates, then increasingly on sea grass and seaweeds.	Resident	T	T
Kemp's Ridley sea turtle	*Lepidochelys kempii*	Inhabits tropical, subtropical, and temperate waters of the northwestern Atlantic Ocean and Gulf of Mexico. Adults are found in coastal waters with muddy or sandy bottoms. Some males migrate between feeding grounds and breeding grounds, but some don't. Females migrate between feeding and nesting areas, often returning to the same destinations. Nesting in Texas occurs on a smaller scale compared to other areas (i.e., Mexico). Hatchlings are quickly swept out to open water and are rarely found nearshore. Similarly, juveniles often congregate near floating algae/seagrass mats offshore, and move into nearshore, coastal, neritic areas after 1-2 years and remain until they reach maturity. They feed primarily on crabs, but also snails, clams, other crustaceans and plants, juveniles feed on sargassum and its associated fauna; nests April through August.	Resident	E	E
leatherback sea turtle	*Dermochelys coriacea*	Inhabits tropical, subtropical, and temperate waters worldwide, including the Gulf of Mexico. Nesting is not common in Texas (March to July). Most pelagic of the sea turtles with the longest migration (>10,000 miles) between nesting and foraging sites. Are able to dive to depths of 4,000 feet. They are omnivorous, showing a preference for jellyfish.	Resident	E	E

Common Name	Scientific Name	Summary of Habitat Preferences	Potential Occurrence in Project Area	Federal Status	State Status
loggerhead sea turtle	*Caretta caretta*	Inhabits tropical, subtropical, and temperate waters worldwide, including the Gulf of Mexico. They migrate from feeding grounds to nesting beaches/barrier islands and some nesting does occur in Texas (April to September). Beaches that are narrow, steeply sloped, with coarse-grain sand are preferred for nesting. Newly hatched individuals depend on floating algae/seaweed for protection and foraging, which eventually transport them offshore and into open ocean. Juveniles and young adults spend their lives in the open ocean, offshore before migrating to coastal areas to breed and nest. Foraging areas for adults include shallow continental shelf waters.	Resident	T	T
Texas horned lizard	*Phrynosoma cornutum*	Terrestrial: Open habitats with sparse vegetation, including grass, prairie, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive. Occurs to 6,000 feet but largely limited below the pinyon-juniper zone on mountains in the Big Bend area.	Resident		T
Texas scarlet snake	*Cemophora lineri*	Terrestrial: Prefers well drained soils with a variety of forests, grassland, and scrub habitats	Resident		T
Texas tortoise	*Gopherus berlandieri*	Terrestrial: Open scrub woods, arid brush, lomas, grass-cactus association; often in areas with sandy well-drained soils. When inactive occupies shallow depressions dug at base of bush or cactus, sometimes in underground burrow or under object. Eggs are laid in nests dug in soil near or under bushes.	Resident		T
black lace cactus	*Echinocereus reichenbachii var. albertii*	Grasslands, thorn shrublands, mesquite woodlands on sandy, somewhat saline soils on coastal prairie, most frequently in naturally open areas sparsely covered with brush of a low stature not resulting from disturbance or along creeks in ecotonal areas between this upland type and lower areas dominated by halophytic grasses and forbs; flowering April-June	Resident	E	E
slender rush-pea	*Hoffmannseggia tenella*	Coastal prairie grasslands on level uplands and on gentle slopes along drainages, usually in areas of shorter or sparse vegetation; soils often described as Blackland clay, but at some of these site's soils are coarser textured and lighter in color than the typical heavy clay of the coastal prairies; flowering April-November	Resident	E	E

Common Name	Scientific Name	Summary of Habitat Preferences	Potential Occurrence in Project Area	Federal Status	State Status
South Texas ambrosia	*Ambrosia cheiranthifolia*	Grasslands and mesquite-dominated shrublands on various soils ranging from heavy clays to lighter textured sandy loams, mostly over the Beaumont Formation on the Coastal Plain; in modified unplowed sites such as railroad and highway rights-of-way, cemeteries, mowed fields, erosional areas along small creeks; Perennial; Flowering July-November	Resident	E	E

Source: TPWD, Annotated County List of Rare Species, Nueces County, updated January 15, 2025.

PE – Proposed Endangered; PT - Proposed Threatened; E – Endangered; T – Threatened; — - Not Listed, C – Considered, SoA – Similarity of Appearance

Inclusion in Table 5B.7.7 does not imply that a species will occur within the project area but only acknowledges the potential for occurrence in the project area county. A more intensive field reconnaissance would be necessary to confirm and identify specific species habitat that may be present in the project area.

Project details have not been determined to date. Suitable habitat for some listed species may existing within the project area, additional studies would need to be completed to determine potential impacts to listed species. The presence or absence of potential habitat within an area does not confirm the presence or absence of a listed species. No species-specific surveys were conducted in the project area for this report.

Wetland Areas

Potential wetlands could occur within the project area, especially near creeks. The wells, collection lines, transmission pipeline, and concentrate discharge lines should be sited in such a way as to avoid or minimize impacts to these sensitive resources, as much as practical. Potential impacts can be minimized by selective property acquisition and appropriate construction methods, including erosion controls and revegetation procedures. Compensation for net losses of wetland would be required where impacts are unavoidable.

Cultural Resources

Impacts to NRHP-listed properties or districts, state historic sites, cemeteries or other cultural resources that are mapped by the Texas Historical Commission should be easily avoided through planning associated with the development of the well fields and pipeline routes.

A cultural resource survey of the well field and pipeline routes for the proposed project areas will need to be performed consistent with requirements of the Texas Antiquities Code.

Summary of Overall Possible Environmental Impacts

Because of the relatively small areas involved, construction and maintenance of surface facilities are not expected to result in substantial environmental impacts. Where environmental resources (e.g., endangered species habitat and cultural resource sites) could be impacted by infrastructure, minor adjustments in facility siting and pipeline alignment would generally be sufficient to avoid or minimize adverse effects.

The pumping of groundwater from an aquifer could cause a slight reduction on baseflow in downstream reaches. Minor land surface subsidence could potentially occur as a result of lowering of groundwater levels. As a result, drainage patterns and other habitats might change to a small extent. Salinity concentrations in the water receiving the brine discharge and farther downstream should be carefully monitored in order to minimize any impacts this may have on aquatic species.

5B.7.3.4 Engineering and Costing

For the Driscoll Brackish Groundwater Treatment Project, the Level 5 engineering cost estimate encompasses the development of a brackish water extraction well field, desalination plant, and treated water transmission infrastructure, designed to establish an independent secondary water source for all major water user groups (WUGs) under the STWA, excluding the City of Kingsville and Ricardo. The system will consist of three wells drilled to a depth of 1,800 feet (Evangeline Aquifer), with a combined average flow rate of 1,249 gpm. A 10-mile long, 16-inch diameter transmission pipeline will transport treated water from the desalination facility to the WUGs, avoiding any tap into the existing 42-inch transmission line to ensure an independent water source.

The total estimated cost of the project is $36,289,885. Assuming a 20-year debt service at an interest rate of 3.5 percent, the annual cost is projected at $4,353,679. With a projected treated water yield of 1,513 acre-feet per year, the unit cost of water supply is calculated at $2,878 per acre-foot, as detailed in Table 5B.7.8.

The treatment process will involve primary treatment followed by an advanced brackish desalination facility, capable of processing water with salinity levels up to 3,000 mg/L at a capacity of 1.8 mgd. The final design will use RO membranes, ensuring a minimum lifespan of 15 years, to produce drinking water with TDS below 500 mg/L. A degasifier system will be employed to remove undesirable gases, such as carbon dioxide and hydrogen sulfide, from the permeate water, reducing chemical usage and lowering operational and maintenance (O&M) costs. As the final step of the treatment process, the water will be chlorinated to a concentration of at least 2 parts per million to ensure effective disinfection. The treated water will be directly transferred to the WUGs, with the transmission line designed to minimize its length to reach all users in Nueces County.

The project estimate also includes the installation of a 6-inch concentrate discharge line to carry the treatment plant's discharge to Petronila Creek. Additionally, an analyzer system will be incorporated to monitor water quality for the end users, and separate magnetic flow meters will be installed to measure water consumption. The selected transmission line route has been determined through comprehensive engineering analysis, ensuring cost efficiency while preventing blending of water from the City of Corpus Christi with the newly sourced water.

5B.7.3.5 Implementation Issues

There are several considerations for the STWA Groundwater Desalination Project to include:

- Permitting desalination concentrate discharge to Petronila Creek.
- Verification of the Gulf Coast Aquifer water quality for concentrations of the dissolved constituents such as TDS, chloride, sulfate, iron, manganese, radium, uranium, and arsenic;
- Purchase or lease of property for well field, and coordination with landowners;
- Skilled operators of desalination water treatment plants;
- Impact of water levels in the aquifer, potential intrusion of saline groundwater, land surface subsidence, and streamflow;
- USACE Section 10 and 404 dredge and fill permits for pipelines;
- GLO Sand and Gravel Removal permit for pipeline and crossings of streams and roads;
- GLO Easement for use of State-owned lands, if any;
- TPWD Sand, Gravel, and Marl permit;
- Design requirement of new transmission line through the easement of existing 42-inch line.
- Mitigation requirements would vary depending on impacts, but could include vegetation restoration, wetland creation or enhancement, or additional land acquisition.
- FEMA 100-year flood map coming close to the identified well field location.

Table 5B.7.8.
Cost Estimate Summary Water Supply Project Option, September 2023 Prices, Region N Local Gulf Coast Supplies – City of Driscoll Treatment (Additional 1.3 mgd Supply)

Item	Estimated Costs for Facilities
Well Fields (Production Wells, Test Well, and Pumps)	$4,150,000
Transmission Pipeline (16"/8", 10 Miles)	$14,990,600
Pipelines (Concentrate Disposal, 6" 1.5 Miles)	$1,071,840
Transmission Pump Stations (2 MGD)	$250,000
Water Treatment Plant (1.8 MGD)	$2,218,000
Advanced Water Treatment Facility (1.8 MGD)	$6,600,000
Integration, Relocation, Backup Generator	$200,000
SCADA	$300,000
TOTAL COST OF FACILITIES	**$25,630,440**
Engineering:	
* Planning (3%)	$878,413
* Design (7%)	$1,974,602
* Construction Engineering (1%)	$256,304
Legal Assistance (2%)	$585,609
Fiscal Services (2%)	$512,609
Pipeline Contingency (15%)	$2,248,590
All Other Facility Contingency (20%)	$2,643,600
Compensation for the Farm Land and Facilities	$200,000
Environmental & Archeological Studies and Mitigation	$150,000
Land Acquisition and Surveying (45 acres)	$184,500
Interest During Construction (3.5% for 1 years with a 0.5% ROI)	$1,025,218
TOTAL COST OF PROJECT	**$36,289,885**
Debt Service (3.5 percent, 20 years)	$2,553,395
Operation and Maintenance	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$204,624
Intakes and Pump Stations (2.5% of Cost of Facilities)	$110,000
Water Treatment Plant (12% Cost of facility)	$266,160
Advanced Water Treatment Facility (18% Cost of facility)	$1,188,000
Pumping Energy Costs (350000 kW-hr @ 0.09 $/kW-hr)	$31,500
TOTAL ANNUAL COST	**$4,353,679**
Available Project Yield (ac-ft/yr)	1,513
Annual Cost of Water ($ per ac-ft), based on PF=2	$2,878
Annual Cost of Water After Debt Service ($ per ac-ft), based on PF=2	$1,190
Annual Cost of Water ($ per 1,000 gallons), based on PF=2	$8.83
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=2	$3.61

Note: One or more cost element has been calculated externally. No land acquisition costs, except for transmission pipeline and brine concentrate disposal ROW.

5B.7.3.6 Evaluation Summary

An evaluation summary of the City of Beeville and the Driscoll Brackish regional water management strategies is provided in Table 5B.7.9.

Table 5B.7.9. Evaluation Summary of the Driscoll Brackish Groundwater Treatment Project

Impact Category	Comments
a. Water supply:	
1. Quantity	1. Yield: 1,513 ac-ft/yr.
2. Reliability	2. High reliability.
3. Cost of treated water**	3. Generally moderate to high cost; $2,159 per ac-ft.
b. Environmental factors:	
1. Effects on Instream flows	1. None to low impact. Non-continuous flow in Petronila Creek. Monitor impacts of saline discharge.
2. Effects on Bay and estuary inflows and arms of the Gulf of Mexico	2. Moderate impact. However, greatest impact is during low flow conditions to Baffin Bay.
3. Wildlife habitat	3. Disposal of concentrated brine may impact wildlife habitats or wetlands.
4. Wetlands	4. None to low.
5. Threatened and endangered species	5. None identified. Project can be adjusted to bypass sensitive areas. Endangered species survey will be needed to identify impacts.
6. Cultural resources	6. Cultural resources survey will be needed to identify any significant sites.
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7a-b. Total dissolved solids and salinity of water is removed with reverse osmosis treatment. Brine concentrated disposal issues will need to be evaluated. 7d-i. Chloride, sulfate, uranium and arsenic concentrations in groundwater will need to be considered prior to implementation of project.
c. Impacts to Agricultural Resources or State water resources	• Potential impacts to agricultural or seasonal water use from Petronila Creek associated with brine discharge. These impacts will likely intensify if non-potable reuse project (5B.4) is implemented and WWTP discharge are reduced or eliminated. • Little to minor negative impacts on surface water resources
d. Threats to agriculture and natural resources in region	• Temporary damage due to construction of pipeline
e. Recreational impacts	• None
f. Equitable comparison of strategies	• Standard analyses and methods used for portions. • Brackish groundwater desalination cost modeled after bid and manufacturers' budgets, but not constructed, comparable project
g. Interbrain transfers	• Not applicable
h. Third party social and economic impacts from voluntary redistribution of water	• Not applicable
i. Efficient use of existing water supplies and regional opportunities	• Provides regional opportunities for water that would otherwise be unused
j. Effect on navigation	• None
k. Impacts on water pipelines and other facilities used for water conveyance	• Construction and maintenance of transmission pipeline corridor. Possible impact to wildlife habitat along pipeline route and right-of-way.

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5B.8

Local Balancing Storage Reservoir

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Section 5B.8 Local Balancing Storage Reservoir

5B.8.1 Description of Water Management Strategy

The *2026 Coastal Bend Regional Water Plan* water management strategies are sized and scheduled to meet seasonal and daily variations of demand. According to the Texas Water Development Board (TWDB) rules, run of the river availability, evaluated for a municipal sole-source water user must be based on a minimum monthly diversion amount that is available 100 percent of the time during a repeat of the drought of record. Without storage, some current and proposed water supplies may not be fully reliable during extended droughts. In such cases, local balancing reservoirs can store surplus surface water flow that is available during high flow events subject to diversion rates specified in the water rights. This allows a water user to get through drought of record conditions while meeting its water needs. This local balancing storage reservoir WMS involves implementing a surface storage facility for Nueces County Water Control and Improvement District #3 (WCID 3).

Nueces County WCID 3 has four permits for a combined total of 11,546 acre-feet per year (ac-ft/yr)[1]. Nueces County WCID 3 is a wholesale water provider (WWP) and provides treated water supplies to the City of Robstown and River Acres Water Supply Corporation (WSC). While Nueces County WCID 3 has senior water rights, some dating back to February 1909, it does not have storage provisions. The water right will have to be amended to include the off-channel storage, however the existing authorized diversions from the river will not have to be amended, and since they are already authorized, they are not subject to Texas Commission on Environmental Quality (TCEQ) flow standards. During the worse month of the drought of record (DOR), the flow available for diversion is only available to the district's most senior water right[2], CoA 2466_1. In this month, 28 acre-feet (ac-ft) out of a 259 ac-ft monthly target for CoA 2466_1 (or 11 percent of the monthly supply target) is available for diversion resulting in an annual firm supply of 384 ac-ft/yr (11 percent x 3,500 = 384 ac-ft/yr). No water was available for any of the other Nueces County WCID 3 water rights for diversion during the minimum month during the drought of record when flow conditions were at a minimum.

For the planning period through 2080, the maximum water demand for Nueces County WCID 3 and its municipal customers is 3,827 ac-ft/yr in 2050 and declines slightly to 3,754 ac-ft/yr by 2080. With a firm yield of 384 ac-ft/yr, Nueces County WCID 3 and its customers have a maximum shortage of 3,443 ac-ft/yr in 2050 calculated based on minimum flow conditions in the Nueces Basin Water Availability Model (WAM)[3].

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[1] Certificate of Adjudication 2466_1 through 2466_4 for municipal (4,246 ac-ft/yr) and irrigation (7,300 ac-ft/yr) purposes. In 2001, the District amended the water rights to use up to 11,546 ac-ft/yr for municipal purposes.

[2] Certificate of Adjudication 2466_1 is permitted for 3,500 ac-ft/yr and has a priority date of February 7, 1909. It is the only one of the four water rights for which water is available for diversion during the minimum month of the drought of record. During the worse month of the drought of record (August 1995), the flow available for diversion during the minimum month is 10% of the total supply needed to meet 2030 water demands.

[3] Based on TWDB rules, run of the river availability was evaluated using the Nueces Basin WAM Run 3 with no return flows. The hydrologic period of the Nueces Basin WAM is from 1934 to 1996. .

This local balancing storage reservoir water management strategy is recommended for the purpose of storing and recovering surplus supply to meet demands during times of low availability. A balancing storage component that is integrated into the water production and water treatment system has the potential to reduce costs and increase reliability and efficiency of the water management strategies necessary to meet projected need.

Currently, Nueces County is considering flood mitigation projects in the area and have identified a 600 ac-ft pond east of the City of Robstown near U.S. Highway 77. There may be potential opportunities for co-location of the local balancing storage and flood mitigation detention pond that could open new low-interest funding opportunities. The amount of land needed for the local balancing storage is less than 35 acres, whereas the amount of land for the detention pond is about 60 acres. So, a 100-acre parcel is expected to be adequate for both projects provided that Nueces County WCID 3 and Nueces County Drainage District No. 2 deem this to be a favorable for both projects. A map showing this concept is provided in Figure 5B.8.1.

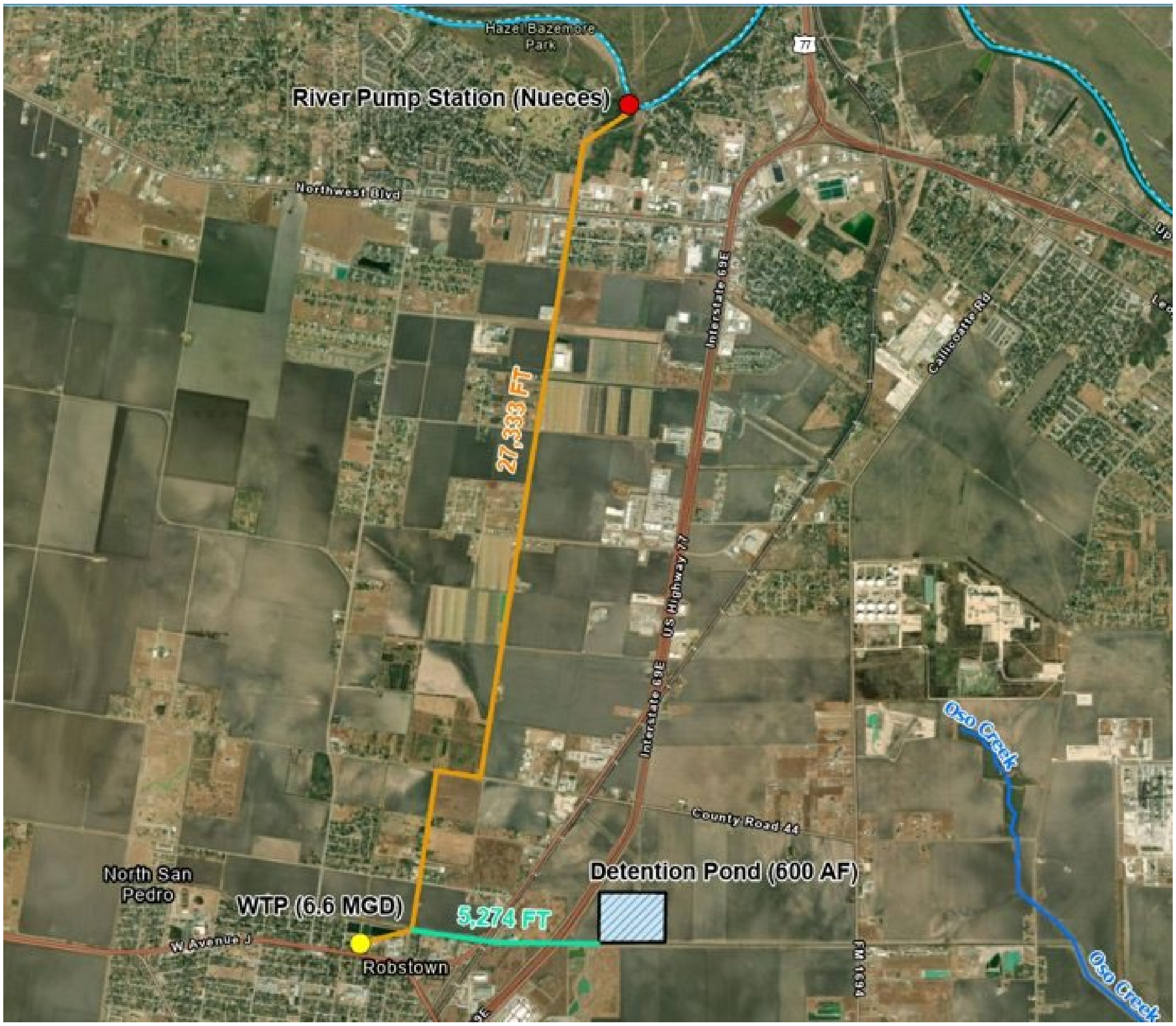

Figure 5B.8.1.
Conceptual Layout for Local Balancing Storage Reservoir (Potential Co-Location Opportunity with Near Nueces County Drainage Project)

5B.8.2 Available Yield

Available yield associated with the local balancing storage was determined using the Nueces River Basin WAM to simulate operations of the run of river rights and water management strategies. The results of the water availability modeling suggested that the minimum month of availability requires an additional 368 ac-ft of supply that could be provided by the balancing reservoir. To address the greatest annual shortage during drought of record conditions, stored water in an amount of 603 ac-ft is required. Considering evaporative losses, a 650 ac-ft capacity local balancing storage reservoir is needed. The projected yield of the strategy is 3,827 ac-ft/yr.

5B.8.3 Environmental Issues

Potential environmental issues associated with implementation of the local balancing storage reservoir includes consideration and mitigation of affected aquatic and terrestrial habitats, cultural resources, and threatened and endangered species, in accordance with applicable state and federal requirements.

5B.8.4 Engineering and Costing

Estimated costs for development of balancing storage assume that 650 ac-ft of storage is needed to meet projected water needs during a repeat of drought conditions and to overcome evaporative losses during this time. The 650 ac-ft storage reservoir is assumed to be approximately 20 feet deep with intake structure sized to refill in one month and infrastructure from storage to the water treatment sized to meet the largest monthly shortage. The pumps are sized based on total storage needed and includes a 7.1-million-gallons-per-day (mgd) pump station and 20-inch diameter pipeline to terminal storage, and a 4.0-mgd pump station and 16-inch piping from terminal storage to the water treatment plant. Cost estimates were computed for capital costs, annual debt service, operation and maintenance, power, and land. These costs are summarized in Table 5B.8.1. The project costs, including capital, are estimated to be $26,014,000. As shown, the annual costs, including debt service, operation and maintenance, and power are estimated to be $2,035,000. This option produces raw water at a unit cost of $532 per ac-ft ($1.63 per 1,000 gallons) and treated water[4] at an estimated cost of $904 per ac-ft ($2.77 per 1,000 gallons).

[4] The treatment costs are based on cost estimates for treatment at O.N. Stevens WTP at $372 per ac-ft from February 12, 2025, correspondence with Corpus Christi Water.

Table 5B.8.1.
Cost Estimate Summary for Local Balancing Storage Reservoir

Item	Estimated Costs for Facilities
Off-Channel Storage/Ring Dike (Conservation Pool 650 acft, 32.5 acres)	$6,305,000
Intake Pump Stations (7.1 MGD)	$7,732,000
Transmission Pipeline (16-20 in. dia., 2 miles)	$4,360,000
Integration, Relocations, Backup Generator & Other	$63,000
Total Cost of Facilities	**$18,460,000**
- Planning (3%)	$554,000
- Design (7%)	$1,292,000
- Construction Engineering (1%)	$185,000
Legal Assistance (2%)	$369,000
Fiscal Services (2%)	$369,000
Pipeline Contingency (15%)	$654,000
All Other Facilities Contingency (20%)	$2,820,000
Environmental & Archaeology Studies and Mitigation	$239,000
Land Acquisition and Surveying (55 acres)	$254,000
Interest During Construction (3.5% for 1 years with a 0.5% ROI)	$818,000
Total Cost of Project	**$26,014,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$1,181,000
Reservoir Debt Service (3.5 percent, 40 years)	$429,000
Operation and Maintenance	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$44,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$193,000
Dam and Reservoir (1.5% of Cost of Facilities)	$95,000
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (1029764 kW-hr @ 0.09 $/kW-hr)	$93,000
Purchase of Water (acft/yr @ $/acft)	$0
Total Annual Cost	**$2,035,000**
Available Project Yield (ac-ft/yr)	3,827
Annual Cost of Water ($ per ac-ft), based on PF=1	$532
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$111
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$1.63
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.34
Annual Cost of Treated Water ($ per ac-ft), with treatment costs of $372 ac-ft	$904

5B.8.5 Implementation Issues

Potentially significant implementation issues associated with a balancing reservoir include the following:

- Quantification and consideration of any potential effects on water rights, streamflows, and freshwater inflows to bays and estuaries to the extent required by TCEQ rules and applicable state and federal law.
- Run-of-river water rights often require surface storage and/or groundwater to firm up supply for municipal water use and a determination as to the most economically feasible of these is necessary.
- Acquisition of State, Federal, and Local permits.
- Environmental studies.
- Relocations of affected roads, railroads, utilities, and cultural resources.

5B.8.6 Evaluation Summary

It is assumed that Nueces County WCID #3 will implement this strategy to reliably meet the needs of its water supply customers. An evaluation summary of this water management option is provided in Table 5B.8.2.

Table 5B.8.2.
Evaluation Summary of Nueces County WCID #3 Local Balancing Storage Reservoir

Impact Category	Comment(s)
a. Water Supply	
1. Quantity	1. Firm Yield: 3,827 ac-ft/yr
2. Reliability 3. Cost of Treated Water	2. Highly reliable quantity. 3. Cost: $904 per ac-ft. Moderate cost as compared to other strategies.
b. Environmental factors	
1. Instream flows	1. Some impact due to increased diversions from the Nueces River, when available, for terminal storage needs during droughts.
2. Bay and Estuary Inflows and arms of the Gulf of Mexico	2. Some impact due to increased diversions from the Nueces River, when available, for terminal storage needs during droughts.
3. Wildlife Habitat	3. None or low impact.
4. Wetlands	4. None or low impact.
5. Threatened and Endangered Species	5. None or low impact.
6. Cultural Resources	6. No cultural resources affected.
7. Water Quality	7. None or low impact.
a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	-
c. Impacts to agricultural resources and State water resources	• No apparent negative impacts on water resources
d. Threats to agriculture and natural resources in region	• None
e. Recreational impacts	• None
f. Equitable Comparison of Strategies	• Standard analyses and methods used
g. Interbasin transfers	• None
h. Third party social and economic impacts from voluntary redistribution of water	• None
i. Efficient use of existing water supplies and regional opportunities	• None
j. Effect on navigation	• None
k. Impacts on water pipelines and other facilities used for water conveyance	• None

5B.9

Gulf Coast Aquifer Supplies- Rural Water Systems

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Section 5B.9 Gulf Coast Aquifer Supplies for Rural Water Systems

The Gulf Coast Aquifer underlies all 11 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 five water-bearing formations: Catahoula, Jasper, Burkeville Confining System, Evangeline, and Chicot. The Evangeline and Chicot Aquifers are the uppermost water-bearing formations, are the most productive and, consequently, are the formations used 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. The Burkeville Confining System is a limited water-bearing formation and characterized as containing substantial amounts of clay.

The Gulf Coast Aquifer is the primary groundwater resource in the Coastal Bend Region and estimated to constitute 97 percent of the region's groundwater availability according to Modeled Available Groundwater (MAG) values developed by the Texas Water Development Board (TWDB). The MAGs used to define groundwater availability for regional water planning were developed based on desired future conditions adopted by local groundwater conservation districts represented in Groundwater Management Area (GMA) 13, GMA 15, and GMA 16.[1] Table 5B.9.1 shows the Gulf Coast Aquifer groundwater availability, projected use by current groundwater users, and estimates on remaining groundwater available for water management strategies. This information serves as a basis for recommended water management strategies which must be limited to MAG values developed by TWDB and approved through the GMA process, according to TWDB guidelines for regional water planning.

[1] McMullen County is located in GMA 13. Aransas and a portion of Bee County are located in GMA 15. The remaining Region N counties (Bee, Brooks, Duval, Jim Wells, Kenedy, Kleberg, Live Oak, McMullen, Nueces, and San Patricio) are located in GMA 16.

Table 5B.9.1. Summary of Gulf Coast Aquifer Supplies in the Coastal Bend Region[1]

County Name	Basin Name	MAG (ac-ft/yr)		Groundwater Use (ac-ft/yr)[2]		Amount Available for WMS (ac-ft/yr)	
		2030	2080	2030	2080	2030	2080
Aransas	San Antonio-Nueces	1,547	1,547	505	453	1,042	1,094
Bee	San Antonio-Nueces	18,869	20,029	5,769	5,795	13,100	14,234
Bee	Nueces	1,007	1,115	352	217	655	898
Brooks	Nueces-Rio Grande	5,123	6,437	2,150	2,244	2,973	4,193
Duval	Nueces	351	428	141	141	210	287
Duval	Nueces-Rio Grande	21,818	26,535	3,787	3,653	18,031	22,882
Jim Wells	Nueces	593	681	406	406	187	275
Jim Wells	Nueces-Rio Grande	8,802	11,368	4,664	4,609	4,138	6,759
Kenedy	Nueces-Rio Grande	10,104	15,421	808	754	9,296	14,667
Kleberg	Nueces-Rio Grande	9,039	12,142	6,137	7,022	2,902	5,120
Live Oak	San Antonio-Nueces	68	61	0	0	68	61
Live Oak	Nueces	11,326	10,233	4,730	4,612	6,596	5,621
McMullen[3]	Nueces	510	510	4	4	506	506
Nueces	San Antonio-Nueces	0	0	0	0	0	0
Nueces	Nueces	756	845	750	835	6	10
Nueces	Nueces-Rio Grande	6,031	6,818	3,926	3,926	2,105	2,892
San Patricio	San Antonio-Nueces	40,514	43,615	6,731	6,583	33,783	37,032
San Patricio	Nueces	4,502	5,619	776	776	3,726	4,843
Region N Gulf Coast Aquifer Availability (ac-ft/yr)		**140,960**	**163,404**	**41,636**	**42,030**	**99,324**	**121,374**
Total Region N Groundwater Availability (includes McMullen County- Carrizo and Minor Aquifer)[1,3,4]		**148,731**	**168,261**	**44,442**	**42,135**	**104,289**	**126,126**

1 Additional groundwater is available (MAG) for the Carrizo Aquifer and Minor Aquifer Systems (Queen City and Sparta) in McMullen County. These MAGs represent less than 5% of the groundwater supply in the region.

2 Groundwater use is based on well capacity, infrastructure limits, projected demand, and other factors limited by MAG as discussed in Chapter 3.

3 Not included in table above- McMullen County has MAG of 7,768 ac-ft/yr from the Carrizo Aquifer and 3 ac-ft/yr from minor aquifers in McMullen County (Queen City and Sparta) in 2030.The MAG for the Carrizo in McMullen County declines to 4,854 ac-ft/yr and remains constant at 3 ac-ft/yr for minor aquifers through 2080. The Yegua Jackson Aquifer, minor aquifer, is present in McMullen County but MAG was not identified for this aquifer by the TWDB. Groundwater use in 2030 is 2,803 ac-ft/yr for the Carrizo Aquifer in and declines to 102 ac-ft/yr by 2080. Groundwater use in 2030 is approximately 3 ac-ft/yr for Queen City and Sparta Aquifers and stays constant through 2080. No WMS are recommended for the Carrizo, Queen City, or Sparta Aquifers.

4 Groundwater use from McCoy WSC and El Oso WSC are not included because the WUGs well systems are located in Region L and therefore, not taking from the Region N MAG. Total groundwater use from McCoy WSC and El Oso WSC is 252 ac-ft/yr in 2030 and 526 ac-ft/yr in 2080. When combined with the total groundwater use shown in the table, the amount of groundwater use is 44,694 ac-ft/yr in 2030 and 42,661 ac-ft/yr consistent with Chapter 4A.

5B.9.1 Description of Strategy

Rural municipal water systems and other non-municipal water user groups (WUGs), such as irrigation, manufacturing, and mining interests in the Coastal Plains area of the Coastal Bend Water Planning Region, commonly use the Gulf Coast Aquifer for their supply. These sources may be a strong preference because the water is usually readily available, inexpensive, and often suitable for public water supplies with minimal treatment, although elevated concentrations of total dissolved solids (TDS) are present in some areas.

The purposes of this option are to:

- Evaluate aquifers and existing well field(s) of each WUG to meet projected water supply requirements through the year 2080, based on groundwater supply estimates derived from reported well capacity for other wells in the area.
- If additional supplies are needed, identify if additional wells are the most likely water management strategy, or whether an alternative strategy, such as purchase from a wholesale water provider, is recommended.
- If the water needs to be treated, estimate when the expansion is needed and how much the facilities will cost.

The evaluation of individual WUG systems is at a reconnaissance level and does not include:

- An engineering analysis of the water system as to the current condition or adequacy of the wells, transmission system, and storage facilities;
- A projection of maintenance costs or replacement costs of existing wells and facilities;
- The potential interference of new wells installed by others near the WUG's wells or at locations identified for new well fields;
- Impact of potential changes in groundwater use patterns in the vicinity of the WUG's well field and the county;
- Changes in rules and regulations that may be developed and implemented by a ground-water conservation district or the State; nor
- Consideration of additional wells or water treatment for local purposes such as reliability, water pressure, peaking capacity, and localized growth.

The evaluation of each WUG consists of the following steps:

1. Compiling information prepared by TWDB for Coastal Bend Regional Water Planning Group (CBRWPG) on current and projected population and water demand for each of the WUGs;
2. Estimated well depth and capacity for each WUG based on publicly available information for the water system from published groundwater reports and the Texas Commission on Environmental Quality (TCEQ) Public Water System (PWS) and TWDB records. For non-municipal groundwater users with groundwater capacities not readily obtained from

publicly available resources, the groundwater supply was calculated based on TWDB historical water use records. The final step in determining groundwater supplies was to compare the MAG-preserved well capacities for each WUG that has historically relied on groundwater to meet projected demands. Groundwater supply was set equal to the amount of capacity or water demand, whichever is lower;

3. If the estimated groundwater supply after adjustments was greater than the estimated groundwater demand in the year 2080 and within the MAG, the evaluation concludes that the existing water supply is adequate;
4. If the estimated supply after adjustments was less than the estimated groundwater demand in the year 2080 and within the MAG, the evaluation concluded that an additional water supply would be needed and that supplies up to the MAG are available to meet needs; and
5. If new wells are the most feasible water management strategy, estimated at what decade it is needed and the capital cost of adding the new wells to the water system.

5B.9.1.1 Evaluation of Additional Groundwater for Water Users with Reported Needs

The following rural municipal water systems rely completely on local groundwater supplies and report a water need during the 2030 to 2080 planning period:

- Bee County- Other (Municipal)
- Bee County- Mining
- TDCJ Chase Field
- Brooks County- Other (Municipal)
- Duval County- Other (Municipal)
- Jim Wells County- San Diego MUD 1
- Jim Wells County- Other (Municipal)
- Jim Wells County- Manufacturing
- Live Oak County- Other (Municipal)
- Nueces County- Mining
- Skidmore WSC

5B.9.1.2 Evaluation of Groundwater for Entities that Do Not Report a Water Supply Need

During development of the *2026 Coastal Bend Regional Water Plan*, the City of Mathis and South Texas Water Authority (STWA) reached out to HDR Engineering, Inc. (HDR) to request groundwater strategies to be shown in the plan for long-term supply reliability and redundancy amid drought uncertainty consistent with Chapter 7-Drought Response approach. Both currently rely on surface water supplies. For purposes of this alternative, additional groundwater development for WUGs are considered in strict accordance with groundwater availability (MAG) and assumes minimal treatment, if any, is required.

Because no specific project data regarding any of the local groundwater supply water management strategies is available, it is necessary to make a number of assumptions for costing and evaluation purposes. For WUGs with needs to be met and/or recommended groundwater projects from local Gulf Coast Aquifers, characteristic well depth and well capacity (gallons per minute [gpm]) estimates were developed for costing purposes based on data from existing wells in the vicinity and by using the TCEQ Source Water Assessment & Protection Viewer[2] and TWDB Groundwater Data Viewer[3].

Key assumptions for this evaluation include:

- For mining groundwater use, it was assumed that groundwater would be supplied at a constant annual rate and that the water would be usable without treatment.
- For irrigation and municipal groundwater use, a peaking factor of two was used in estimating the number of wells necessary for cost estimation.
- It is assumed that irrigation and mining water would not require any treatment.
- No pipelines or pump stations were assigned for costing purposes. It was assumed that these proposed wells would connect directly to the demand center or local distribution system and that the cost of any associated piping would be covered in the 35 percent project cost contingency factor.
- For the purposes of estimating well pumping power costs, typically, a total dynamic head estimate of 300 feet was assumed - 200 feet to bring water from pumping levels to the ground surface and 100 feet to pump into a pressurized distribution system maintained at 60 pounds per square inch (psi). This conservative estimate is intended to account for local drawdown and declining water levels with time.
- For municipal users, including county-other, it was also assumed, in the absence of any specific information to the contrary, that disinfection would be the only treatment needed for the groundwater supply to meet water quality standards, and that adequate treatment capacity would exist to meet peak demand rates.

All cost estimates were performed according to the TWDB's unified costing tool methodology for regional water planning. Costs were amortized over a 20-year loan period, with debt service and annualized operations and maintenance (O&M) often being a significant proportion of costs. In addition, wells are costed according to September 2023 pricing, even if they are not scheduled to be needed until later decades. This is to maintain consistency in cost estimates with other projects. However, it should be noted that individual wells are not usually financed in this manner, and managers of affected WUGs may be more interested simply in the estimated capital cost for the wells. Also, cost estimates for new wells serving economic activities such as mining or irrigation are presented as a group with a single unit cost, although in reality these

[2] Source Water Assessment & Protection Viewer - Texas Commission on Environmental Quality - www.tceq.texas.gov

[3] Groundwater Data Viewer | Texas Water Development Board

costs will be borne individually by multiple independent parties (farmers, mining operations, manufacturing plants, etc.) when and where the wells are needed and constructed.

5B.9.2 Available Yield

All groundwater development alternatives for municipal and non-municipal rural water systems, in the Coastal Bend Region were deemed to be available based on adopted MAGs after considering historical use presented above in Table 5B.9.1. It assumes voluntary groundwater transfers are available and local GCD continues to issue permits. Table 5B.9.2 displays the projected needs, by decade, for each of these entities, project yield, and number of wells estimated to be needed to meet shortages identified. The Ricardo WSC and the City of Mathis are included in Table 5B.9.2 as additional groundwater entities that do not report a water supply need but are developing an additional groundwater supply.

Table 5B.9.2.
Region N Local Needs and Gulf Coast Aquifer Supply Yield Summary

Water User Group	County	Projected Needs (ac-ft/yr)						Maximum Shortage (2030-2080) (acft/yr)	Project Yield Needed to Address Shortage (acft/yr)	Total Wells
		2030	2040	2050	2060	2070	2080			
Groundwater for Water User Groups with Reported Needs										
County-Other	Bee	(1,426)	(1,337)	(1,181)	(984)	(765)	(518)	(1,426)	1,426	5*
Mining	Bee	(25)	(25)	(25)	(25)	(25)	-	(25)	25	1
TDCJ Chase Field*	Bee	(5)	(2)	(2)	(2)	(2)	(2)	(5)	5	1
Skidmore WSC	Bee	(22)	(24)	(27)	(32)	(38)	(44)	(44)	44	1
County-Other	Brooks	(281)	(262)	(234)	(198)	(155)	(101)	(281)	281	1
County-Other	Duval	(253)	(223)	(199)	(179)	(151)	(113)	(253)	253	2
County-Other	Jim Wells	(1,621)	(1,409)	(1,159)	(840)	(484)	(82)	(1,621)	1,621	12*
Manufacturing	Jim Wells	(8)	(11)	(14)	(17)	(21)	(25)	(25)	25	1
San Diego MUD 1	Jim Wells	(102)	(106)	(111)	(116)	(123)	(131)	(131)	131	1
County-Other	Live Oak	(198)	(173)	(164)	(178)	(191)	(202)	(202)	202	2
Mining-Nueces	Nueces	(88)	(98)	(93)	(84)	(95)	(101)	(101)	101	1
Groundwater Strategy Requested by Water User Groups that Do Not Report a Water Supply Need										
City of Mathis	San Patricio	0	0	0	0	0	0	0	561	2
Ricardo Well Project	Kleberg	0	0	0	0	0	0	0	561	2

*Note: Garza East Transfer facility, one of two units on former Chase Field, closed in May 2020. The projected needs shown above may be based on TWDB adopted water demands and current supplies and do not take into consideration the closure of the Garza East facility which formerly housed approximately 2,000 inmates.

**Note: Although the amount of shortage for Bee County-Other and Jim Wells County-Other are similar in magnitude, the assumed well production rates are different and therefore are anticipated to have significantly different well count. For Bee County a rate of 400 gpm was assumed and for Jim Wells County a rate of 160 gpm was assumed. The production rates from TCEQ's Source Water Assessment & Protection Viewer are higher in Bee County as compared to Jim Wells County. Existing wells for Bee County had an average rate of 300 gpm and Jim Wells County had an average rate of 60 gpm.

5B.9.2.1 City of Mathis

The City of Mathis in San Patricio County does not have any needs identified during the planning period but is considering creating an additional groundwater supply of up to 0.5 mgd with the ability to peak at 1 mgd. Mathis currently receives supplies from the City of Corpus Christi. This project can be developed at requested amounts without violating the MAG constraints for San Patricio County. The 1-mgd wellfield assumes 2 wells at a depth of 550 feet will operate at 400 gpm, and it is anticipated that no advanced treatment is needed other than chlorine disinfection.

5B.9.2.2 Ricardo Well Project

The STWA provides water supplies to several rural water users in Nueces and Kleberg counties. STWA and its customers receive treated water supplies through contract from the City of Corpus Christi and do not have any needs identified during the planning period. Based on information provided by STWA, they are considering creating additional groundwater supply of up to 0.5 mgd in Kleberg County in the vicinity of Ricardo in the Nueces- Rio Grande Basin.

International Consulting Engineers (ICE) prepared the following evaluation of the Ricardo Well Project. STWA considers the Ricardo well project a fresh water well (total dissolved solids (TDS)<800), with expected recovery of 100 percent. Ricardo Water Supply Corporation (WSC) is expected to use approximately 90 percent of the yield (505 acre-feet per year [ac-ft/yr]) with the remaining 10 percent for Kingsville (56 ac-ft/yr).

Ricardo WSC has a history of relying on municipal wells as its primary source of drinking water, although these wells are currently plugged and non-operational. The nearest city, Kingsville, has been effectively using fresh groundwater wells to supply its water needs. At present, Ricardo WSC receives water from STWA, which is a blend of treated surface water from Corpus Christi Water and fresh water from the City of Kingsville.

In response to anticipated water scarcity and drought conditions in South Texas, STWA is actively working on developing a secondary groundwater source as an independent water supply option. While STWA currently depends on purchasing treated surface water from Corpus Christi Water, securing a secondary water source for Ricardo has become a strategic priority, given the increasing demand.

- STWA has made significant progress in this initiative over the past few years, with several key milestones achieved:
- STWA engaged ICE to develop a comprehensive water master plan, aimed at evaluating future growth needs and ensuring the long-term security of operations.
- The STWA board has formally expressed interest in securing an alternative water source, and the board has approved the initiation of a feasibility study for this purpose.
- A contract was awarded to a geological team to conduct a groundwater study, assessing the availability of both fresh and brackish water within the service area for potential future use.

- Phase 2 of the project includes test drilling at selected locations identified through the groundwater study, with the goal of evaluating the water yield.
- Based on the results of these tests, STWA will conduct a feasibility study to assess the potential for developing fresh groundwater extraction and pre-treatment facilities if necessary.
- The anticipated timeline for approval and construction of the municipal freshwater wells is 24 months, which includes obtaining all required permits.

STWA has already identified potential drilling sites for municipal wells based on the findings of the groundwater study. Given the projected population growth in Ricardo by 2080, the planned capacity for the new system will be 1 mgd, with 100 percent recovery efficiency from the production wells. The proposed layout for the municipal groundwater project can be found in Figure 5B.9.1.

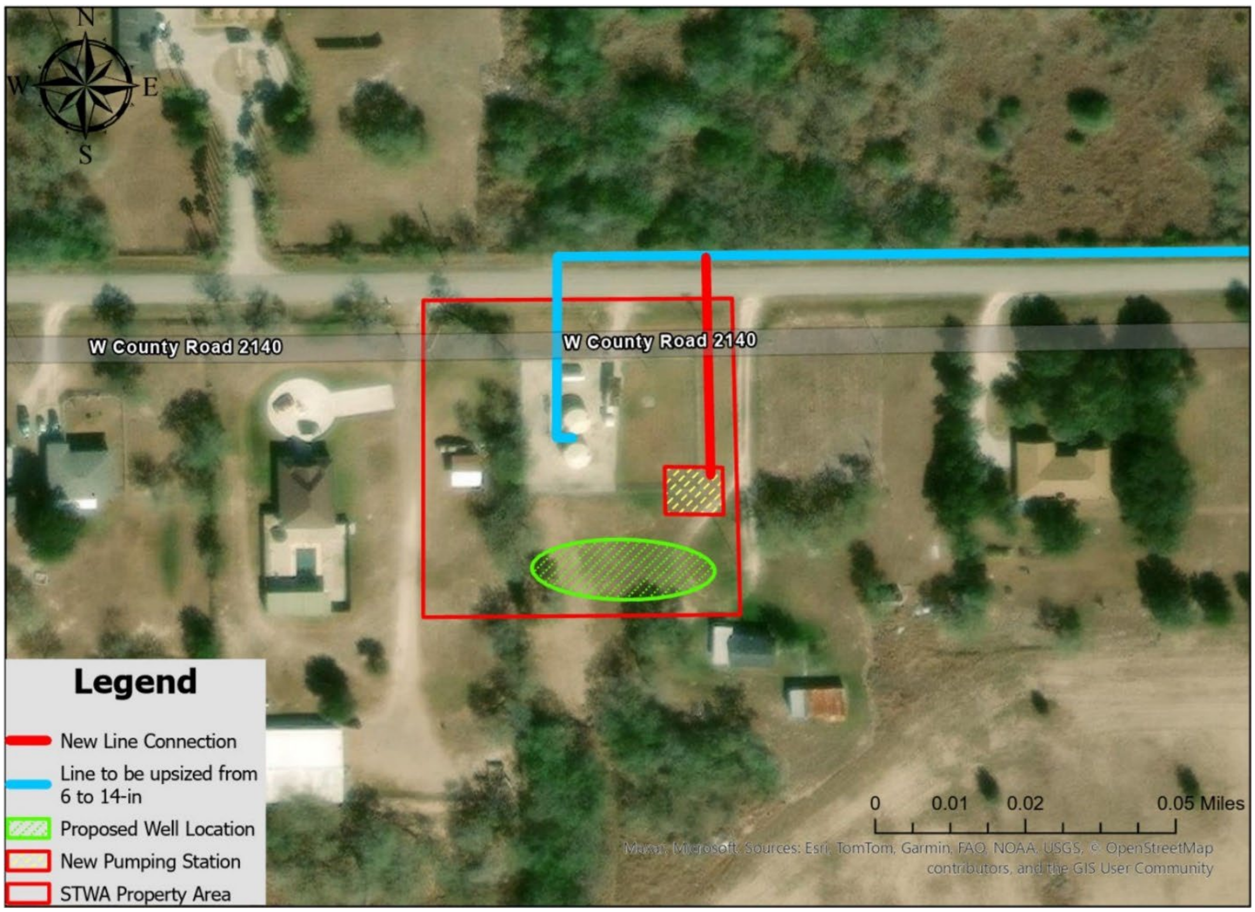

Figure 5B.9.1.
STWA Ground Water Well Project Proposed Layout

Transmission Strategy

The city is currently receiving water through a 14-inch pipeline. Ricardo WSC owns the infrastructure and operates three pump stations within the city, including the identified location.

The proposed test well site is located at Pump Station #3 (0.93 acres), owned by Ricardo WSC, which will serve as the potential area for water extraction. To facilitate water transfer, the existing 6-inch incoming water line at FM 2140, which feeds into Pump Station #3, must be upgraded to a 14-inch line, extending up to the main central trunk line (14 inches), in order to meet the required design capacity. This upgrade will optimize the use of the existing transmission system for distributing water from the new well, significantly reducing the costs associated with water transmission. The proposed transmission line connection strategy is shown in Figure 5B.9.2.

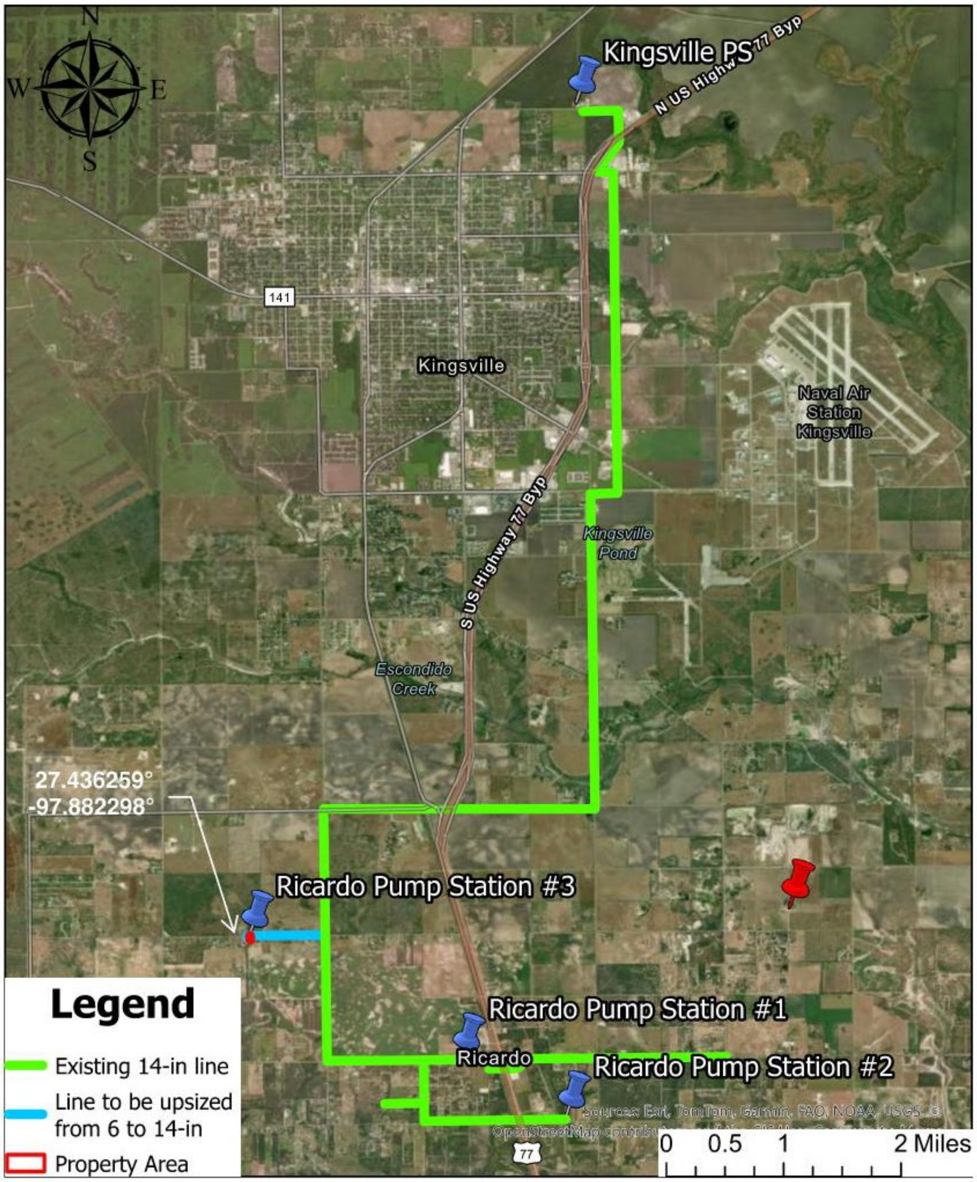

Figure 5B.9.2.
Location of Conceptual Layout of Ricardo Well Project

5B.9.3 Environmental Issues

The pumping of groundwater from the Gulf Coast Aquifer could have a slight negative impact on baseflow in the downstream reaches of streams in these areas. However, many of the streams are dry most all the time; thus, no measurable impact on wildlife along streams is expected.

Although minimal treatment is anticipated for groundwater quality to meet standards of use, the desalination of slightly saline groundwater produces a concentrate of salts in water that requires disposal. Depending upon location, environmental concerns can be addressed by discharging to a saline aquifer by deep well injection, discharging to a salt-water body, or blending with wastewater.

Habitat studies and surveys for protected species may need to be conducted at the proposed well field sites and along any pipeline routes. When potential protected species' habitats or other significant resources cannot be avoided, additional studies would have to be conducted to evaluate habitat use or eligibility for inclusion in the National Register for Historic Places (NRHP), respectively. Wetland impacts and primary pipeline stream crossings can be minimized by right-of-way selection and appropriate construction methods, including erosion controls and revegetation procedures. Compensation for net losses of wetlands may be required where impacts are unavoidable.

With regard to the Ricardo Well Project, the proposal to construct additions to Ricardo WSC Pump Station #3 near the City of Ricardo and the City of Kingsville includes the establishment of a proposed well location, a new pumping station, and a new line connection at the Pump Station site at 350 FCC Monitoring Road in Kleberg County, in the outer areas of the census-designated area of Ricardo itself. Primary environmental issues related to the expansion of the Ricardo WSC Pump Station #3 include upsizing the existing 6-inch transmission line and the development of a new well and pumping station on the property.

The proposed project area is located within the Coastal Prairies sub-province of the larger Gulf Coastal Plains of Texas Physiographic Province. This area is locally characterized as a nearly flat prairie composed of deltaic sands and muds which terminates at the Gulf of Mexico and includes topography changes of less than one foot per mile. Elevation levels in the Coastal Prairies range from 0 to 300 feet above mean sea level.

Although the upsizing of transmission pipelines may include clearing and removal of woody vegetation, destruction of potential habitat can be minimized by siting the corridor within previously disturbed areas, as should be possible given the existing path of the pipeline.

5B.9.3.1 Area Vegetation and Wildlife Habitat

The City of Ricardo is located within the South Texas Plains Vegetational Area. The South Texas Plains and brush country averages between 20 to 32 inches of rainfall per year with high summer temperatures and very high evaporation rates. Plains with thorny shrubs and trees dominate the region, with scattered patches of palms and subtropical woodlands in the Rio Grande Valley. Thorny brush, such as mesquite, acacia and prickly pear are the primary vegetation mixed with areas of grassland. Historically, the plains were covered with open grasslands with few trees, and the Valley woodlands covered large areas.

5B.9.3.2 Threatened and Endangered Species

The Federal Endangered Species Act of 1973 (ESA), as amended, prohibits the “take” of any threatened or endangered species. The term “take” under the ESA means “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct.” The term “harm” was further defined to include “significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.” Designation of critical habitat areas has been established for public knowledge where the publishing of such information would not cause harm to the species. Additional federal protection is extended to migratory birds, and bald and golden eagles under the Migratory Bird Treaty Act (MBTA) as amended, and the Bald and Golden Eagle Protection Act. Protection is also afforded to Texas state-listed species. The Texas Parks and Wildlife Department (TPWD) enforces the state regulations.

The MBTA protects most bird species, including, but not limited to, cranes, ducks, geese, shorebirds, hawks, and songbirds. Migratory bird pathways, stopover habitats, wintering areas, and breeding areas may occur within and adjacent to the project area, and may be associated with wetlands, ponds, shorelines, riparian corridors, fallow fields and grasslands, and woodland and forested areas. Construction activities could disturb migratory bird habitats and/or species’ activities, and care should be taken to avoid impacts to migratory birds and active nests.

Reasonable and prudent measures should be taken to avoid and minimize the potential effects of the proposed project’s activities on threatened and endangered species, as well as bald eagles. Species’ locations, activities, and habitat requirements should be considered based on U.S. Fish and Wildlife Service (USFWS) and TPWD recommendations.

In Kleberg County, 54 state-listed endangered or threatened species and 26 federally-listed endangered or threatened wildlife species may occur, according to the county lists of rare species published by the TPWD. A list of these species and rare species, their preferred habitat, and potential occurrences in Nueces County is provided in Table 5B.9.3

Table 5B.9.3.
Federal- and State-Listed Threatened, Endangered, and Species of Concern Listed for Kleberg County

Common Name	Scientific Name	Summary of Habitat Preference	Potential Occurrence in Project Area	Federal Status	State Status
Black-Spotted Newt	*Notophthalmus meridionalis*	Terrestrial habitats used by adults are typically poorly drained clay soils that allow for the formation of ephemeral wetlands. A wide variety of vegetation associations are known to be used, such as thorn scrub and pasture. Aquatic habitats used for reproduction are a variety of ephemeral and permanent water bodies.	Resident		Threatened
Sheep Frog	*hypopachus variolosus*	Terrestrial and aquatic: Predominantly grassland and savanna; largely fossorial in areas with moist microclimates.	Resident		Threatened
South Texas siren (Large Form)	*Siren sp. 1*	Aquatic: Mainly found in bodies of quiet water, permanent or temporary, with or without submergent vegetation. Wet of sometimes wet areas, such as arroyos, canals, ditches, or even shallow depressions; aestivates in the ground during dry periods but does require some moisture to remain.	Transient		Threatened
black rail	*Laterallus jamaicensis*	The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Salt, brackish, and freshwater marshes, pond borders, wet meadows, and grassy swamps; nests in or along edge of marsh, sometimes on damp ground, but usually on mat of previous years dead grasses. nest usually hidden in marsh grass or at base of Salicornia	Resident	Threatened	Threatened
gray hawk	*Buteo plagiatus*	Locally and irregularly along U.S.-Mexico border; mature riparian woodlands and nearby semiarid mesquite and scrub grasslands; breeding range formerly extended north to southernmost Rio Grande floodplain of Texas	Resident		Threatened
northern aplomado falcon	*Falco femoralis septentrionalis*	Open country, especially savanna and open woodland, and sometimes in very barren areas; grassy plains and valleys with scattered mesquite, yucca, and cactus; nests in old stick nests of other bird species	Migratory	Endangered	Endangered

Common Name	Scientific Name	Summary of Habitat Preference	Potential Occurrence in Project Area	Federal Status	State Status
piping plover	*Charadrius melodus*	The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Beaches, sandflats, and dunes along Gulf Coast beaches and adjacent offshore islands. Also spoil islands in the Intracoastal Waterway. Based on the November 30, 1992 Section 6 Job No. 9.1, Piping Plover and Snowy Plover Winter Habitat Status Survey, algal flats appear to be the highest quality habitat. Some of the most important aspects of algal flats are their relative inaccessibility and their continuous availability throughout all tidal conditions. Sand flats often appear to be preferred over algal flats when both are available, but large portions of sand flats along the Texas coast are available only during low-very low tides and are often completely unavailable during extreme high tides or strong north winds. Beaches appear to serve as a secondary habitat to the flats associated with the primary bays, lagoons, and inter-island passes. Beaches are rarely used on the southern Texas coast, where bayside habitat is always available, and are abandoned as bayside habitats become available on the central and northern coast. However, beaches are probably a vital habitat along the central and northern coast (i.e., north of Padre Island) during periods of extreme high tides that cover the flats. Optimal site characteristics appear to be large in area, sparsely vegetated, continuously available or in close proximity to secondary habitat, and with limited human disturbance.	Resident	Threatened	Threatened
reddish egret	*Egretta rufescens*	Resident of the Texas Gulf Coast; brackish marshes and shallow salt ponds and tidal flats; nests on ground or in trees or bushes, on dry coastal islands in brushy thickets of yucca and prickly pear	Resident		Threatened

Common Name	Scientific Name	Summary of Habitat Preference	Potential Occurrence in Project Area	Federal Status	State Status
rufa red knot	*Calidris canutus rufa*	The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Habitat: Primarily seacoasts on tidal flats and beaches, herbaceous wetland, and Tidal flat/shore. Bolivar Flats in Galveston County, sandy beaches Mustang Island, few on outer coastal and barrier beaches, tidal mudflats and salt marshes.	Resident	Threatened	Threatened
sooty tern	*Onychoprion fuscatus*	Primarily an offshore bird; does nest on sandy beaches and islands, breeding April-July	Transient		Threatened
swallow-tailed kite	*Elanoides forficatus*	The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Lowland forested regions, especially swampy areas, ranging into open woodland; marshes, along rivers, lakes, and ponds; nests high in tall tree in clearing or on forest woodland edge, usually in pine, cypress, or various deciduous trees	Transient/ Migratory		Threatened
Texas Botteri's sparrow	*Peucaea botterii texana*	Grassland and short-grass plains with scattered bushes or shrubs, sagebrush, mesquite, or yucca; nests on ground of low clump of grasses	Resident		Threatened
tropical parula	*Setophaga pitiayumi*	Semi-tropical evergreen woodland along rivers and resacas. Texas ebony, anaqua and other trees with epiphytic plants hanging from them. Dense or open woods, undergrowth, brush, and trees along edges of rivers and resacas; breeding April to July.	Resident		Threatened
white-faced ibis	*Plegadis chihi*	The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; currently confined to near-coastal rookeries in so-called hog-wallow prairies. Nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats.	Transient		Threatened

Common Name	Scientific Name	Summary of Habitat Preference	Potential Occurrence in Project Area	Federal Status	State Status
white-tailed hawk	*Buteo albicaudatus*	Near coast on prairies, cordgrass flats, and scrub-live oak; further inland on prairies, mesquite and oak savannas, and mixed savanna-chaparral; breeding March-May	Resident		Threatened
whooping crane	*Grus americana*	The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Small ponds, marshes, and flooded grain fields for both roosting and foraging. Potential migrant via plains throughout most of state to coast; winters in coastal marshes of Aransas, Calhoun, and Refugio counties.	Migratory	Endangered	Endangered
wood stork	*Mycteria americana*	The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Prefers to nest in large tracts of baldcypress (Taxodium distichum) or red mangrove (Rhizophora mangle); forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960.	Transient		Threatened

Common Name	Scientific Name	Summary of Habitat Preference	Potential Occurrence in Project Area	Federal Status	State Status
yellow-billed cuckoo	*Coccyzus americanus*	In Texas, the populations of concern are found breeding in riparian areas in the Trans Pecos (know as part of the Western Distinct Population Segment). It is the Western DPS that is on the U.S. ESA threatened list and includes the Texas counties Brewster, Culberson, El Paso, Hudspeth, Jeff Davis, and Presidio. Riparian woodlands below 6,000' in elevation consisting of cottonwoods and willows are prime habitat. This species is a long-distant migrant that summers in Texas, but winters mainly in South America. Breeding birds of the Trans Pecos populations typically arrive on their breeding grounds possibly in late April but the peak arrival time is in May. Threats to preferred habitat include hydrologic changes that don't promote the regeneration of cottonwoods and willows, plus livestock browsing and trampling of sapling trees in sensitive riparian areas.	Migratory	Threatened	
giant manta ray	*Manta birostris*	Habitat description is not available at this time	Resident		Threatened
great hammerhead	*Sphyrna mokarran*	Habitat description is not available at this time.	Resident	Threatened	
oceanic whitetip shark	*Carcharhinus longimanus*	Habitat description is not available at this time.	Resident	Threatened	Threatened
shortfin mako shark	*Isurus oxyrinchus*	Habitat description is not available at this time.	Resident		Threatened
migratory monarch butterfly	*Danaus plexippus plexippus*	Habitat description is not available at this time.	Migratory	Considered	
Atlantic spotted dolphin	*Stenella frontalis*	Inhabits warm tropical, subtropical, and temperate waters throughout the Atlantic Ocean, including the Gulf of Mexico. Commonly found along the continental shelf and coastal waters that are 65-820 feet deep, usually inside or near 185 m contour (within 250-350 km of coast); occasionally found in deeper waters. Often dive to 30-200 feet preying upon fish, invertebrates, and cephalopods.	Resident		Threatened
blue whale	*Balaenoptera musculus*	Inhabits tropical, subtropical, temperate, and subpolar waters worldwide, but are infrequently sighted in the Gulf of Mexico. They migrate seasonally between summer feeding grounds and winter breeding grounds, but specifics vary. Commonly observed at the surface in open ocean	Resident	Endangered	Endangered
Bryde's whale	*Balaenoptera edeni brydei*	Habitat description is not available at this time.	Resident		Endangered

Common Name	Scientific Name	Summary of Habitat Preference	Potential Occurrence in Project Area	Federal Status	State Status
Coues' rice rat	*Oryzomys couesi*	Cattail-bulrush marsh with shallower zone of aquatic grasses (Echinochloa, Panicum, Paspalidium) near the shoreline; shade trees around the shoreline are important features. Freshwater marshes.	Resident		Threatened
Coues' rice rat	*Oryzomys couesi aquaticus*	Cattail-bulrush marsh with shallower zone of aquatic grasses near the shoreline; shade trees around the shoreline are important features; prefers salt and freshwater, as well as grassy areas near water; breeds April-August	Resident		Threatened
Cuvier's beaked whale	*Ziphius cavirostris*	Inhabits tropical, subtropical, and temperate waters worldwide, including the Gulf of Mexico. Commonly found in water over 3,300 feet deep near the continental shelf near steep slopes or canyons, avoiding coastal areas. Mostly pelagic apparently confined by the 1,00 meter bathymetric contour. frequently make deep dives to capture prey (squids and fishes).	Resident		Threatened
dwarf sperm whale	*Kogia simus*	Inhabits tropical and temperate waters worldwide, Commonly found in deep waters near the continental shelf and rarely seen at the surface, but may be more coastal than the pygmy sperm whale (Kogia breviceps). Dives to great depths (1,000 feet) to hunt for squid, fish, and crustaceans. Migration patterns are unknown.	Resident		Threatened
false killer whale	*Pseudorca crassidens*	Inhabits tropical, subtropical, and temperate waters worldwide, including the Gulf of Mexico. Commonly found in deep, offshore waters deeper than 3,300 feet, making dives of up to 2,000 meters to catch their prey (fishes and squids). Gulf of Mexico distinct population segment is not well studied.	Resident		Threatened
finback whale	*Balaenoptera physalus*	Inhabits tropical, subtropical, temperate, and subpolar waters worldwide, but are less common in the tropics preferring cooler water. Commonly found in deep, offshore waters and migrate in the open ocean from the poles (feeding grounds) to warmer waters in the winter to give birth. They feed on krill, squid, and small schooling fish sometimes with other baleen whale species. They are very rare in the Gulf of Mexico and reported sightings are likely vagrants (Witt et al. 2011).	Resident	Endangered	Endangered

Common Name	Scientific Name	Summary of Habitat Preference	Potential Occurrence in Project Area	Federal Status	State Status
Gervais's beaked whale	*Mesoplodon europaeus*	Inhabits tropical, subtropical, and temperate waters of the northern Atlantic Ocean, Gulf of Mexico, and Caribbean. Commonly found in deep water and open ocean where they prey upon squids. They are difficult to distinguish from others in their family (Mesoplodon) and are cryptic and skittish, but the most commonly stranded species on the US southeastern coast. Migration patterns are unknown.	Resident		Threatened
humpback whale	*Megaptera novaeangliae*	Inhabits tropical, subtropical, temperate, and subpolar waters worldwide. Migrate up to 5,000 miles between colder water (feeding grounds) and warmer water (calving grounds) each year. They will use both open ocean and coastal waters, sometimes including inshore areas such as bays, and are often found near the surface; however, this species is rare in the Gulf of Mexico. The northwest Atlantic/Gulf of Mexico distinct population segment is not considered at risk of extinction and is not listed as Endangered on the Endangered Species Act.	Resident	Endangered	
killer whale	*Orcinus orca*	Inhabits tropical, subtropical, temperate, and polar waters worldwide. In the Gulf of Mexico, they are commonly found in oceanic waters ranging from 256-2,652 meters deep beyond the 1,000 meter isobath and a very rarely found over the continental shelf and may be entirely absent from nearshore waters. May come in contact with pelagic longline fisheries targeting tunas and billfishes.	Resident		Threatened
North Atlantic right whale	*Eubalaena glacialis*	Inhabits subtropical and temperate waters in the northern Atlantic. Commonly found in coastal waters or close to the continental shelf near the surface. They migrate from feeding grounds in cooler waters (Canada and New England) to warmer waters of the southeast US (South Carolina, Georgia, and Florida) to give birth in the fall/winter - both areas are identified as critical habitat by NOAA-NMFS. Nursery areas are in shallow, coastal waters. This species is very rare in the Gulf of Mexico and the few reported sightings are likely vagrants (Ward-Geiger et al. 2011).	Resident	Endangered	Endangered

Common Name	Scientific Name	Summary of Habitat Preference	Potential Occurrence in Project Area	Federal Status	State Status
ocelot	*Leopardus pardalis*	Restricted to mesquite-thorn scrub and live-oak mottes; avoids open areas. Dense mixed brush below four feet; thorny shrublands; dense chaparral thickets; breeds and raises young June-November.	Resident	Endangered	Endangered
pygmy killer whale	*Feresa attenuata*	Inhabits tropical and subtropical waters worldwide, including the Gulf of Mexico. Commonly found in deeper, offshore waters where they dive for their prey (squids and fishes), but may occasionally occur close to shore. They are very rare and migration patterns are unknown.	Resident		Threatened
pygmy sperm whale	*Kogia breviceps*	Inhabits tropical, subtropical, and temperate waters worldwide. Commonly found in deep water over the continental slope and rarely seen at the surface. Dives to great depths (over 1,000 feet) to hunt for squid, fish, and crustaceans. Migration patterns are unknown.	Resident		Threatened
Rice's whale	*Balaenoptera ricei*	Habitat description is not available at this time.	Resident	Endangered	Endangered
Rough-toothed dolphin	*Steno bredanensis*	Inhabits tropical, subtropical, and temperate waters worldwide, including the Gulf of Mexico. Records in Texas are only known from strandings. Commonly found in deep, oceanic water over 1,500-2,000 meters deep and ranging in temperature from 17-25 degrees Celsius. May associate with other cetaceans. Prey on squids and fish. No known migration patterns.	Resident		Threatened
sei whale	*Balaenoptera borealis*	Habitat description is not available at this time.	Resident	Endangered	Endangered
short-finned pilot whale	*Globicephala macrorhynchus*	Inhabits tropical, subtropical, and temperate waters worldwide, including the Gulf of Mexico. Commonly found in deeper waters (1,000 feet) and continental shelf where they make deep dives to capture squid, but may come closer to shore. Migration patterns unknown.	Resident		Threatened
sperm whale	*Physeter macrocephalus*	Inhabits tropical, subtropical, and temperate waters worldwide, avoiding icy waters. Distribution is highly dependent on their food source (squids, sharks, skates, and fish), breeding, and composition of the pod. In general, this species migrates from north to south in the winter and south to north in the summer; however, individuals in tropical and temperate waters don't seem to migrate at all. Routinely dive to catch their prey (2,000-10,000 feet) and generally occupies water at least 3,300 feet deep near ocean trenches.	Resident	Endangered	Endangered

Common Name	Scientific Name	Summary of Habitat Preference	Potential Occurrence in Project Area	Federal Status	State Status
tricolored bat	*Perimyotis subflavus*	Forest, woodland and riparian areas are important. Caves are very important to this species.	Resident	Proposed Endangered	
West Indian manatee	*Trichechus manatus*	Large rivers, brackish water bays, coastal waters. Warm waters of the tropics, in rivers and brackish bays but may also survive in salt water habitats. Very sensitive to cold water temperatures. Rarely occurring as far north as Texas. Gulf and bay system; opportunistic, aquatic herbivore.	Resident	Threatened	Threatened
white-nosed coati	*Quadrula quadrula*	Woodlands, riparian corridors and canyons. Most individuals in Texas probably transients from Mexico; diurnal and crepuscular; very sociable; forages on ground and in trees; omnivorous; may be susceptible to hunting, trapping, and pet trade	Resident		Threatened
American alligator	*Alligator mississippiensis*	Aquatic: Coastal marshes; inland natural rivers, swamps and marshes; manmade impoundments.	Resident	Similarity of Appearance, Threatened	
Atlantic hawksbill sea turtle	*Eretmochelys imbricata*	Inhabits tropical and subtropical waters worldwide, in the Gulf of Mexico, especially Texas. Hatchling and juveniles are found in open, pelagic ocean and closely associated with floating algae/seagrass mats. Juveniles then migrate to shallower, coastal areas, mainly coral reefs and rocky areas, but also in bays and estuaries near mangroves when reefs are absent; seldom in water more than 65 feet deep. They feed on sponges, jellyfish, sea urchins, mollusks, and crustaceans. Nesting occurs from April to November high up on the beach where there is vegetation for cover and little or no sand. Some migrate, but others stay close to foraging areas - females are philopatric.	Resident	Endangered	Endangered
green sea turtle	*Chelonia mydas*	Inhabits tropical, subtropical, and temperate waters worldwide, including the Gulf of Mexico. Adults and juveniles occupy inshore and nearshore areas, including bays and lagoons with reefs and seagrass. They migrate from feeding grounds (open ocean) to nesting grounds (beaches/barrier islands) and some nesting does occur in Texas (April to September). Adults are herbivorous feeding on sea grass and seaweed; juveniles are omnivorous feeding initially on marine invertebrates, then increasingly on sea grasses and seaweeds.	Resident	Threatened	Threatened

Common Name	Scientific Name	Summary of Habitat Preference	Potential Occurrence in Project Area	Federal Status	State Status
Kemp's Ridley sea turtle	*Lepidochelys kempii*	Inhabits tropical, subtropical, and temperate waters of the northwestern Atlantic Ocean and Gulf of Mexico. Adults are found in coastal waters with muddy or sandy bottoms. Some males migrate between feeding grounds and breeding grounds, but some don't. Females migrate between feeding and nesting areas, often returning to the same destinations. Nesting in Texas occurs on a smaller scale compared to other areas (i.e., Mexico). Hatchlings are quickly swept out to open water and are rarely found nearshore. Similarly, juveniles often congregate near floating algae/seagrass mats offshore, and move into nearshore, coastal, neritic areas after 1-2 years and remain until they reach maturity. They feed primarily on crabs, but also snails, clams, other crustaceans and plants, juveniles feed on sargassum and its associated fauna; nests April through August.	Transient	Endangered	Endangered
leatherback sea turtle	*Dermochelys coriacea*	Inhabits tropical, subtropical, and temperate waters worldwide, including the Gulf of Mexico. Nesting is not common in Texas (March to July). Most pelagic of the sea turtles with the longest migration (>10,000 miles) between nesting and foraging sites. Are able to dive to depths of 4,000 feet. They are omnivorous, showing a preference for jellyfish.	Transient	Endangered	Endangered
loggerhead sea turtle	*Caretta caretta*	Inhabits tropical, subtropical, and temperate waters worldwide, including the Gulf of Mexico. They migrate from feeding grounds to nesting beaches/barrier islands and some nesting does occur in Texas (April to September). Beaches that are narrow, steeply sloped, with coarse-grain sand are preferred for nesting. Newly hatched individuals depend on floating algae/seaweed for protection and foraging, which eventually transport them offshore and into open ocean. Juveniles and young adults spend their lives in open ocean, offshore before migrating to coastal areas to breed and nest. Foraging areas for adults include shallow continental shelf waters.	Resident	Threatened	Threatened
northern cat-eyed snake	*Leptodeira septentrionalis*	Terrestrial: Thorn scrub and deciduous woodland; dense thickets bordering ponds and streams.	Resident	Threatened	
speckled racer	*Drymobius margaritiferus*	Terrestrial: Dense thickets near water, palm groves, riparian woodlands; often in areas with much vegetation litter on ground.	Resident		Threatened

Common Name	Scientific Name	Summary of Habitat Preference	Potential Occurrence in Project Area	Federal Status	State Status
Texas horned lizard	*Phrynosoma cornutum*	Terrestrial: Open habitats with sparse vegetation, including grass, prairie, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive. Occurs to 6000 feet, but largely limited below the pinyon-juniper zone on mountains in the Big Bend area.	Resident		Threatened
Texas scarlet snake	*Cemophora lineri*	Terrestrial: Prefers well drained soils with a variety of forest, grassland, and scrub habitats	Resident		Threatened
Texas tortoise	*Gopherus berlandieri*	Terrestrial: Open scrub woods, arid brush, lomas, grass-cactus association; often in areas with sandy well-drained soils. When inactive occupies shallow depressions dug at base of bush or cactus; sometimes in underground burrow or under object. Eggs are laid in nests dug in soil near or under bushes.	Resident		Threatened
black lace cactus	*Echinocereus reichenbachii var. albertii*	Grasslands, thorn shrublands, mesquite woodlands on sandy, somewhat saline soils on coastal prairie, most frequently in naturally open areas sparsely covered with brush of a low stature not resulting from disturbance or along creeks in ecotonal areas between this upland type and lower areas dominated by halophytic grasses and forbs; flowering April-June	Transient	Endangered	Endangered
slender rush-pea	*Hoffmannseggia tenella*	Coastal prairie grasslands on level uplands and on gentle slopes along drainages, usually in areas of shorter or sparse vegetation; soils often described as Blackland clay, but at some of these sites soils are coarser textured and lighter in color than the typical heavy clay of the coastal prairies; flowering April-November	Resident	Endangered	Endangered
South Texas ambrosia	*Ambrosia cheiranthifolia*	Grasslands and mesquite-dominated shrublands on various soils ranging from heavy clays to lighter textured sandy loams, mostly over the Beaumont Formation on the Coastal Plain; in modified unplowed sites such as railroad and highway rights-of-way, cemeteries, mowed fields, erosional areas along small creeks; Perennial; Flowering July-November	Resident	Endangered	Endangered

5B.9.3.3 Wetland Areas

No wetland areas are known to exist in the immediate vicinity of the project area; the closest aquatic area is the Escondido Creek, approximately 2.25 miles to the north of the Ricardo WSC

Pump Station #3. Due to the lack of discharge infrastructure and the direction of the proposed upsized pipeline, it is unexpected that any negative impact will occur to any wetland area.

5B.9.3.4 Cultural Resources

A review of the Texas Historical Commission Texas Historic Sites Atlas database indicated that there are no National Register properties, historical markers, or cemeteries located near the proposed or alternate project areas. A cultural resource survey of the upsized pipeline route for the proposed project area will need to be performed consistent with requirements of the Texas Historical Commission.

5B.9.3.5 Summary of Overall Possible Environmental Impacts

Because of the relatively small areas involved, construction and maintenance of surface facilities are not expected to result in substantial environmental impacts. Where environmental resources (e.g., endangered species habitat and cultural resource sites) could be impacted by infrastructure, minor adjustments in facility siting and pipeline alignment would generally be sufficient to avoid or minimize adverse effects.

5B.9.4 Engineering and Costing

Cost estimates for new wells were prepared according to the assumptions discussed in Section 5B.9.1. The capital cost, project cost, annual cost, yield, and unit cost (in $/ac-ft and $/1,000 gallons) for water obtained under this strategy are presented in Table 5B.9.4 through Table 5B.9.15 for each entity county.

The cost estimate for the Ricardo Well Project, presented in Table 5B.9.16, includes the construction of a groundwater extraction well, a pre-treatment plant, and a 0.6-mile-long treated water transmission line, all designed to provide an independent secondary water source for Ricardo WSC. The system will feature a single well, drilled to a depth of 700 to 1,000 feet (Evangeline and Chicot aquifers), with a combined average flow rate of 348 gpm. A 14-inch diameter transmission pipeline will deliver treated water from the facility to the two existing Ricardo WSC pump stations, tapping into the current 14-inch central line. The total estimated cost of the project is $10,977,100. With a 20-year debt service at a 3.5 percent interest rate, the projected annual cost is $1,183,941. Given an anticipated water yield of 1,120 ac-ft/yr, the unit cost of water supply is calculated to be $2,114.18 per acre-foot (ac-ft), as outlined in Table 5B.9.16. The treatment process will include a primary treatment facility capable of handling water with salinity levels below 1,000 milligrams per liter (mg/L) at a capacity of 1 mgd. The use of a pre-treatment facility will depend on water quality and O&M costs will likely be lower due to the high-water quality in the identified zone. Additionally, the pumping and transfer of treated water will be easier thanks to the existing pump stations and storage tank, though these may be modified to accommodate the new strategy. As the final step in the treatment process, the water will be chlorinated to a minimum concentration of 2 parts per million for effective disinfection. The treated water will be directly delivered to users, with the transmission line designed to minimize length while ensuring all users in Ricardo are reached. Additionally, an analyzer system will be installed to monitor water quality for end users, and separate magnetic flow meters will be used to measure water consumption. The design, based on preliminary engineering analysis, ensures both cost-efficiency and safe operation.

Table 5B.9.4.
Cost Estimate Summary Water Supply Project Option September 2023 Prices Region N Local Gulf Coast Supplies – County Other Bee County

Item	Estimated Costs for Facilities
Well Fields (Wells, Pumps, and Piping)	$3,645,000
Water Treatment Plant (2.6 MGD)*	$206,000
TOTAL COST OF FACILITIES	**$3,851,000**
Engineering:	
- Planning (3%)	$116,000
- Design (7%)	$270,000
- Construction Engineering (1%)	$39,000
Legal Assistance (2%)	$77,000
Fiscal Services (2%)	$77,000
All Other Facilities Contingency (20%)	$770,000
Environmental & Archaeology Studies and Mitigation	$24,000
Land Acquisition and Surveying (3 acres)	$26,000
Interest During Construction (3.5% for 1 years with a 0.5% ROI)	$171,000
TOTAL COST OF PROJECT	**$5,421,000**
Debt Service (3.5 percent, 20 years)	$381,000
Operation and Maintenance	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$36,000
Water Treatment Plant	$124,000
Pumping Energy Costs (293689 kW-hr @ 0.09 $/kW-hr)	$26,000
TOTAL ANNUAL COST	**$567,000**
Available Project Yield (ac-ft/yr)	1,426
Annual Cost of Water ($ per ac-ft), based on PF=0	$398
Annual Cost of Water After Debt Service ($ per ac-ft), based on PF=0	$130
Annual Cost of Water ($ per 1,000 gallons), based on PF=0	$1.22
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=0	$0.40

* Water treatment plant capacity is based on peak well production capacity

Table 5B.9.5. Cost Estimate Summary Water Supply Project Option, September 2023 Prices, Region N Local Gulf Coast Supplies – Bee County - Mining

Item	Estimated Costs for Facilities
Well Fields (Wells, Pumps, and Piping)	$729,000
TOTAL COST OF FACILITIES	**$729,000**
Engineering:	
- Planning (3%)	$22,000
- Design (7%)	$51,000
- Construction Engineering (1%)	$7,000
Legal Assistance (2%)	$15,000
Fiscal Services (2%)	$15,000
All Other Facilities Contingency (20%)	$146,000
Environmental & Archaeology Studies and Mitigation	$3,000
Land Acquisition and Surveying (1 acres)	$3,000
Interest During Construction (3.5% for 1 years with a 0.5% ROI)	$33,000
TOTAL COST OF PROJECT	**$1,024,000**
Debt Service (3.5 percent, 20 years)	$72,000
Operation and Maintenance	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$7,000
Pumping Energy Costs (32541 kW-hr @ 0.09 $/kW-hr)	$1,000
TOTAL ANNUAL COST	**$80,000**
Available Project Yield (ac-ft/yr)	25
Annual Cost of Water ($ per ac-ft), based on PF=0	$3,200
Annual Cost of Water After Debt Service ($ per ac-ft), based on PF=0	$320
Annual Cost of Water ($ per 1,000 gallons), based on PF=0	$9.82
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=0	$0.98

Table 5B.9.6. Cost Estimate Summary Water Supply Project Option, September 2023 Prices, Region N Local Gulf Coast Supplies – TDCJ Chase Field

Item	Estimated Costs for Facilities
Well Fields (Wells, Pumps, and Piping)	$729,000
Water Treatment Plant (0.1 MGD)*	$31,000
TOTAL COST OF FACILITIES	**$760,000**
Engineering:	
- Planning (3%)	$23,000
- Design (7%)	$53,000
- Construction Engineering (1%)	$8,000
Legal Assistance (2%)	$15,000
Fiscal Services (2%)	$15,000
All Other Facilities Contingency (20%)	$152,000
Environmental & Archaeology Studies and Mitigation	$3,000
Land Acquisition and Surveying (1 acres)	$4,000
Interest During Construction (3.5% for 1 years with a 0.5% ROI)	$34,000
TOTAL COST OF PROJECT	**$1,067,000**
Debt Service (3.5 percent, 20 years)	$75,000
Operation and Maintenance	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$7,000
Water Treatment Plant	$18,000
TOTAL ANNUAL COST	**$100,000**
Available Project Yield (ac-ft/yr)	5
Annual Cost of Water ($ per ac-ft), based on PF=0	$20,000
Annual Cost of Water After Debt Service ($ per ac-ft), based on PF=0	$5,000
Annual Cost of Water ($ per 1,000 gallons), based on PF=0	$61.37
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=0	$15.34

* Water treatment plant capacity is based on peak well production capacity

Table 5B.9.7.
Cost Estimate Summary Water Supply Project Option, September 2023 Prices, Region N Local Gulf Coast Supplies – Skidmore WSC

Item	Estimated Costs for Facilities
Well Fields (Wells, Pumps, and Piping)	$729,000
Water Treatment Plant (0.1 MGD)*	$31,000
TOTAL COST OF FACILITIES	**$760,000**
Engineering:	
- Planning (3%)	$23,000
- Design (7%)	$53,000
- Construction Engineering (1%)	$8,000
Legal Assistance (2%)	$15,000
Fiscal Services (2%)	$15,000
All Other Facilities Contingency (20%)	$152,000
Environmental & Archaeology Studies and Mitigation	$3,000
Land Acquisition and Surveying (1 acres)	$4,000
Interest During Construction (3.5% for 1 years with a 0.5% ROI)	$34,000
TOTAL COST OF PROJECT	**$1,067,000**
Debt Service (3.5 percent, 20 years)	$75,000
Operation and Maintenance	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$7,000
Water Treatment Plant	$18,000
Pumping Energy Costs (9062 kW-hr @ 0.09 $/kW-hr)	$1,000
TOTAL ANNUAL COST	**$101,000**
Available Project Yield (ac-ft/yr)	44
Annual Cost of Water ($ per ac-ft), based on PF=0	$2,295
Annual Cost of Water After Debt Service ($ per acft), based on PF=0	$591
Annual Cost of Water ($ per 1,000 gallons), based on PF=0	$7.04
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=0	$1.81

* Water treatment plant capacity is based on peak well production capacity

Table 5B.9.8.
Cost Estimate Summary Water Supply Project Option, September 2023 Prices, Region N Local Gulf Coast Supplies – County Other- Brooks County

Item	Estimated Costs for Facilities
Well Fields (Wells, Pumps, and Piping)	$712,000
Water Treatment Plant (0.5 MGD)*	$63,000
TOTAL COST OF FACILITIES	**$775,000**
Engineering:	
- Planning (3%)	$23,000
- Design (7%)	$54,000
- Construction Engineering (1%)	$8,000
Legal Assistance (2%)	$15,000
Fiscal Services (2%)	$15,000
All Other Facilities Contingency (20%)	$155,000
Environmental & Archaeology Studies and Mitigation	$4,000
Land Acquisition and Surveying (1 acres)	$5,000
Interest During Construction (3.5% for 1 years with a 0.5% ROI)	$35,000
TOTAL COST OF PROJECT	**$1,089,000**
Debt Service (3.5 percent, 20 years)	$77,000
Operation and Maintenance	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$7,000
Water Treatment Plant	$38,000
Pumping Energy Costs (57873 kW-hr @ 0.09 $/kW-hr)	$5,000
TOTAL ANNUAL COST	**$127,000**
Available Project Yield (ac-ft/yr)	281
Annual Cost of Water ($ per ac-ft), based on PF=0	$452
Annual Cost of Water After Debt Service ($ per ac-ft), based on PF=0	$178
Annual Cost of Water ($ per 1,000 gallons), based on PF=0	$1.39
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=0	$0.55

* Water treatment plant capacity is based on peak well production capacity

Table 5B.9.9. Cost Estimate Summary Water Supply Project Option, September 2023 Prices, Region N Local Gulf Coast Supplies –County Other- Duval County

Item	Estimated Costs for Facilities
Well Fields (Wells, Pumps, and Piping)	$997,000
Water Treatment Plant (0.5 MGD)*	$63,000
TOTAL COST OF FACILITIES	**$1,060,000**
Engineering:	
- Planning (3%)	$32,000
- Design (7%)	$74,000
- Construction Engineering (1%)	$11,000
Legal Assistance (2%)	$21,000
Fiscal Services (2%)	$21,000
All Other Facilities Contingency (20%)	$212,000
Environmental & Archaeology Studies and Mitigation	$8,000
Land Acquisition and Surveying (1 acres)	$9,000
Interest During Construction (3.5% for 1 years with a 0.5% ROI)	$48,000
TOTAL COST OF PROJECT	**$1,496,000**
Debt Service (3.5 percent, 20 years)	$105,000
Operation and Maintenance	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$10,000
Water Treatment Plant	$38,000
Pumping Energy Costs (52106 kW-hr @ 0.09 $/kW-hr)	$5,000
TOTAL ANNUAL COST	**$158,000**
Available Project Yield (ac-ft/yr)	253
Annual Cost of Water ($ per ac-ft), based on PF=0	$625
Annual Cost of Water After Debt Service ($ per ac-ft), based on PF=0	$209
Annual Cost of Water ($ per 1,000 gallons), based on PF=0	$1.92
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=0	$0.64

* Water treatment plant capacity is based on peak well production capacity

Table 5B.9.10. Cost Estimate Summary Water Supply Project Option, September 2023 Prices, Region N Local Gulf Coast Supplies –County Other- Jim Wells County

Item	Estimated Costs for Facilities
Well Fields (Wells, Pumps, and Piping)	$5,983,000
Water Treatment Plant (3 MGD)*	$232,000
TOTAL COST OF FACILITIES	**$6,215,000**
Engineering:	
- Planning (3%)	$186,000
- Design (7%)	$435,000
- Construction Engineering (1%)	$62,000
Legal Assistance (2%)	$124,000
Fiscal Services (2%)	$124,000
All Other Facilities Contingency (20%)	$1,243,000
Environmental & Archaeology Studies and Mitigation	$47,000
Land Acquisition and Surveying (8 acres)	$51,000
Interest During Construction (3.5% for 1 years with a 0.5% ROI)	$276,000
TOTAL COST OF PROJECT	**$8,763,000**
Debt Service (3.5 percent, 20 years)	$617,000
Operation and Maintenance	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$60,000
Water Treatment Plant	$139,000
Pumping Energy Costs (333850 kW-hr @ 0.09 $/kW-hr)	$30,000
TOTAL ANNUAL COST	**$846,000**
Available Project Yield (ac-ft/yr)	1,621
Annual Cost of Water ($ per ac-ft), based on PF=0	$522
Annual Cost of Water After Debt Service ($ per ac-ft), based on PF=0	$141
Annual Cost of Water ($ per 1,000 gallons), based on PF=0	$1.60
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=0	$0.43

* Water treatment plant capacity is based on peak well production capacity

Table 5B. 9.11.
Cost Estimate Summary Water Supply Project Option,
September 2023 Prices,
Region N Local Gulf Coast Supplies – Jim Wells County – Manufacturing

Item	Estimated Costs for Facilities
Well Fields (Wells, Pumps, and Piping)	$499,000
Water Treatment Plant (0.1 MGD)*	$31,000
TOTAL COST OF FACILITIES	**$530,000**
Engineering:	
- Planning (3%)	$16,000
- Design (7%)	$37,000
- Construction Engineering (1%)	$5,000
Legal Assistance (2%)	$11,000
Fiscal Services (2%)	$11,000
All Other Facilities Contingency (20%)	$106,000
Environmental & Archaeology Studies and Mitigation	$3,000
Land Acquisition and Surveying (1 acres)	$4,000
Interest During Construction (3.5% for 1 years with a 0.5% ROI)	$24,000
TOTAL COST OF PROJECT	**$747,000**
Debt Service (3.5 percent, 20 years)	$52,000
Operation and Maintenance	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$5,000
Water Treatment Plant	$18,000
TOTAL ANNUAL COST	**$75,000**
Available Project Yield (ac-ft/yr)	25
Annual Cost of Water ($ per ac-ft), based on PF=0	$3,000
Annual Cost of Water After Debt Service ($ per ac-ft), based on PF=0	$920
Annual Cost of Water ($ per 1,000 gallons), based on PF=0	$9.21
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=0	$2.82

* Water treatment plant capacity is based on peak well production capacity

Table 5B.9.12. Cost Estimate Summary Water Supply Project Option, September 2023 Prices, Region N Local Gulf Coast Supplies– San Diego MUD 1

Item	Estimated Costs for Facilities
Well Fields (Wells, Pumps, and Piping)	$532,000
Water Treatment Plant (0.3 MGD)*	$47,000
TOTAL COST OF FACILITIES	**$579,000**
Engineering:	
- Planning (3%)	$17,000
- Design (7%)	$41,000
- Construction Engineering (1%)	$6,000
Legal Assistance (2%)	$12,000
Fiscal Services (2%)	$12,000
All Other Facilities Contingency (20%)	$116,000
Environmental & Archaeology Studies and Mitigation	$4,000
Land Acquisition and Surveying (1 acres)	$4,000
Interest During Construction (3.5% for 1 years with a 0.5% ROI)	$26,000
TOTAL COST OF PROJECT	**$817,000**
Debt Service (3.5 percent, 20 years)	$57,000
Operation and Maintenance	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$5,000
Water Treatment Plant	$28,000
Pumping Energy Costs (26980 kW-hr @ 0.09 $/kW-hr)	$2,000
TOTAL ANNUAL COST	**$92,000**
Available Project Yield (ac-ft/yr)	131
Annual Cost of Water ($ per ac-ft), based on PF=0	$702
Annual Cost of Water After Debt Service ($ per ac-ft), based on PF=0	$267
Annual Cost of Water ($ per 1,000 gallons), based on PF=0	$2.15
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=0	$0.82

* Water treatment plant capacity is based on peak well production capacity

Table 5B.9.13. Cost Estimate Summary Water Supply Project Option, September 2023 Prices, Region N Local Gulf Coast Supplies – County Other-Live Oak County

Item	Estimated Costs for Facilities
Well Fields (Wells, Pumps, and Piping)	$878,000
Water Treatment Plant (0.4 MGD)*	$55,000
TOTAL COST OF FACILITIES	**$933,000**
Engineering:	
- Planning (3%)	$28,000
- Design (7%)	$65,000
- Construction Engineering (1%)	$9,000
Legal Assistance (2%)	$19,000
Fiscal Services (2%)	$19,000
All Other Facilities Contingency (20%)	$187,000
Environmental & Archaeology Studies and Mitigation	$7,000
Land Acquisition and Surveying (1 acres)	$8,000
Interest During Construction (3.5% for 1 years with a 0.5% ROI)	$42,000
TOTAL COST OF PROJECT	**$1,317,000**
Debt Service (3.5 percent, 20 years)	$93,000
Operation and Maintenance	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$9,000
Water Treatment Plant	$33,000
Pumping Energy Costs (41603 kW-hr @ 0.09 $/kW-hr)	$4,000
TOTAL ANNUAL COST	**$139,000**
Available Project Yield (ac-ft/yr)	202
Annual Cost of Water ($ per ac-ft), based on PF=0	$688
Annual Cost of Water After Debt Service ($ per ac-ft), based on PF=0	$228
Annual Cost of Water ($ per 1,000 gallons), based on PF=0	$2.11
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=0	$0.70

* Water treatment plant capacity is based on peak well production capacity

Table 5B.9.14.
Cost Estimate Summary Water Supply Project Option, September 2023 Prices, Region N Local Gulf Coast Supplies – Nueces-County Mining

Item	Estimated Costs for Facilities
Well Fields (Wells, Pumps, and Piping)	$535,000
TOTAL COST OF FACILITIES	**$535,000**
Engineering:	
- Planning (3%)	$16,000
- Design (7%)	$37,000
- Construction Engineering (1%)	$5,000
Legal Assistance (2%)	$11,000
Fiscal Services (2%)	$11,000
All Other Facilities Contingency (20%)	$107,000
Environmental & Archaeology Studies and Mitigation	$3,000
Land Acquisition and Surveying (1 acres)	$3,000
Interest During Construction (3.5% for 1 years with a 0.5% ROI)	$24,000
TOTAL COST OF PROJECT	**$752,000**
Debt Service (3.5 percent, 20 years)	$53,000
Operation and Maintenance	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$5,000
Pumping Energy Costs (20801 kW-hr @ 0.09 $/kW-hr)	$2,000
TOTAL ANNUAL COST	**$60,000**
Available Project Yield (ac-ft/yr)	101
Annual Cost of Water ($ per ac-ft), based on PF=0	$594
Annual Cost of Water After Debt Service ($ per ac-ft), based on PF=0	$69
Annual Cost of Water ($ per 1,000 gallons), based on PF=0	$1.82
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=0	$0.21

Table 5B.9.15.
Cost Estimate Summary Water Supply Project Option, September 2023 Prices, Region N Local Gulf Coast Supplies – City of Mathis (Additional 0.5 MGD Supply)

Item	Estimated Costs for Facilities
Well Fields (Wells, Pumps, and Piping)	$1,446,000
Water Treatment Plant (1 MGD)*	$102,000
TOTAL COST OF FACILITIES	**$1,548,000**
Engineering:	
- Planning (3%)	$46,000
- Design (7%)	$108,000
- Construction Engineering (1%)	$15,000
Legal Assistance (2%)	$31,000
Fiscal Services (2%)	$31,000
All Other Facilities Contingency (20%)	$310,000
Environmental & Archaeology Studies and Mitigation	$9,000
Land Acquisition and Surveying (2 acres)	$10,000
Interest During Construction (3.5% for 1 years with a 0.5% ROI)	$69,000
TOTAL COST OF PROJECT	**$2,177,000**
Debt Service (3.5 percent, 20 years)	$153,000
Operation and Maintenance	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$14,000
Water Treatment Plant	$61,000
Pumping Energy Costs (230873 kW-hr @ 0.09 $/kW-hr)	$10,000
TOTAL ANNUAL COST	**$238,000**
Available Project Yield (ac-ft/yr)	560
Annual Cost of Water ($ per ac-ft), based on PF=0	$425
Annual Cost of Water After Debt Service ($ per ac-ft), based on PF=0	$152
Annual Cost of Water ($ per 1,000 gallons), based on PF=0	$1.30
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=0	$0.47

* Water treatment plant capacity is based on peak well production capacity

Table 5B.9.16.
Cost Estimate Summary Water Supply Project Option, September 2023 Prices, Region N Local Gulf Coast Supplies– Ricardo WSC (Additional 0.5 MGD Supply)

Item	Estimated Costs for Facilities
Well Fields (Production Wells, Test Well, and Pumps)	$2,300,000
Treatment System (1 MGD)	$2,375,000
Pump Station Upgrades	$2,250,000
Transmission Pipeline (14 ", 0.8 Miles)	$952,500
TOTAL COST OF FACILITIES	**$7,877,500**
Engineering:	
- Planning (3%)	$236,325
- Design (7%)	$551,425
- Construction Engineering (1%)	$78,775
Legal Assistance (2%)	$157,550
Fiscal Services (2%)	$157,550
Pipeline Contingency (15%)	$142,875
All Other Facilities Contingency (20%)	$1,385,000
Environmental & Archaeology Studies and Mitigation	$75,000
Interest During Construction (3.5% for 1 years with a 0.5% ROI)	$315,100
TOTAL COST OF PROJECT	**$10,977,100**
Debt Service (3.5 percent, 20 years)	$772,361
Operation and Maintenance	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$40,500
Intakes and Pump Stations (2.5% of Cost of Facilities)	$13,750
Water Treatment Plant	$356,250
Pumping Energy Costs (41603 kW-hr @ 0.09 $/kW-hr)	$1,080
TOTAL ANNUAL COST	**$1,183,941**
Available Project Yield (ac-ft/yr)	560
Annual Cost of Water ($ per ac-ft), based on PF=0	$2,114
Annual Cost of Water After Debt Service ($ per ac-ft), based on PF=0	$735
Annual Cost of Water ($ per 1,000 gallons), based on PF=0	$6.49
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=0	$2.23

Note: One or more cost element has been calculated externally. No land acquisition costs, except for transmission pipeline and brine concentrate disposal ROW.

5B.9.4.1 Implementation Issues

The groundwater supply analyses considered for this water management strategy were based on MAGs adopted by local groundwater control districts (GCDs) and GMAs according to TWDB guidance for regional water planning. For future planning efforts, new MAGs provided by GCDs and GMAs located in the Coastal Bend Region need to be considered when determining available groundwater supplies.

Local groundwater districts or GMAs should be consulted for well permit requirements and in accordance with MAG conditions. The potential for regulations by groundwater conservation districts in the future is likely based on future MAGs identified by local districts or Groundwater Management Area, including the renewal of pumping permit at periodic intervals in counties where districts have been organized.

Implementation of aquifer supply projects should consider the following:

- Verification of the Gulf Coast Aquifer water quality for concentrations of the dissolved constituents such as TDS, chloride, sulfate, iron, manganese, radium, uranium, and arsenic;
- Impact of water levels in the aquifer, potential intrusion of saline groundwater, land surface subsidence, and streamflow;
- U.S. Army Corps of Engineers (USACE) Section 10 and 404 dredge and fill permits for pipelines;
- General Land Office (GLO) Sand and Gravel Removal permit for pipeline and crossings of streams and roads;
- GLO Easement for use of State-owned lands, if any;
- Cultural resources investigations in accordance with the Texas Historical Commission and the Texas Antiquities Code;
- TPWD Sand, Gravel, and Marl permit; and
- Mitigation requirements would vary depending on impacts, but could include vegetation restoration, wetland creation or enhancement, or additional land acquisition.

If the TDS content in the water is found to be high, treatment to reduce TDS levels will be necessary, along with applying for a Discharge Permit. In this scenario, the following permits will be required to consider:

- USACE Section 10 and 404 dredge and fill permits for pipeline installation.
- GLO Sand and Gravel Removal permit for pipeline installation and stream/road crossings.
- GLO Easement for the use of state-owned lands (if applicable).
- TPWD Sand, Gravel, and Marl permit.

STWA has expressed concerns regarding key elements of the proposed freshwater well project in Kleberg County. These concerns are outlined in the evaluation summary, as follows:

- Verification of water quality from the Gulf Coast Aquifer, specifically testing for concentrations of dissolved constituents, such as TDS, chloride, sulfate, iron, manganese, radium, uranium, and arsenic.
- Assessment of potential impacts on aquifer water levels, risks of freshwater intrusion, land subsidence, and streamflow alterations.
- Compliance with TCEQ permit requirements for a municipal well.
- Mitigation measures, which will vary based on the identified impacts, could include vegetation restoration, wetland creation or enhancement, or the acquisition of additional land.

5B.9.4.2 Evaluation Summary

An evaluation summary of this regional water management option is provided in Table 5B.9.17.

Table 5B.9.17.
Evaluation Summary for Drilling Wells to Provide Additional Groundwater Supply for Municipal and Non-Municipal Rural Water Users

Impact Category	Comment(s)
a. Water supply:	
1. Quantity	1. Firm Yield: Varies from 5 to 2,809 ac-ft.
2. Reliability	2. Good reliability if adequate water quality.
3. Cost of treated water	3. Cost: $398 to $20,000 per ac-ft.
b. Environmental factors:	
1. Instream flows	1. Some. May slightly decrease instream flow and discharge of freshwater into coastal estuaries due to local groundwater-surface water interaction.
2. Bay and estuary inflows and arms of the Gulf of Mexico	2. Some. May slightly decrease instream flow and discharge of freshwater into coastal estuaries due to local groundwater-surface water interaction.
3. Wildlife habitat	3. Negligible impacts.
4. Wetlands	4. Negligible impacts.
5. Threatened and endangered species	5. Negligible impacts.
6. Cultural resources	6. Cultural resources will need to be surveyed and avoided.
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. Negligible impacts. a. Low to moderate impact. b. Low to moderate impact. c. No impact. d. Low to moderate impact. e. Low to moderate impact. f. Low to moderate impact. g-h. Low to moderate impact associated with mining. i. Boron may be a potential water quality concern.
c. Impacts to agricultural resources and State water resources	• Low impacts. No negative impacts on water resources other than slight lowering of Gulf Coast Aquifer levels.
d. Threats to agriculture and natural resources in region	• May slightly increase pumping costs for agricultural users in the area due to localized drawdowns
e. Recreational impacts	• None
f. Equitable comparison of strategies	• Standard analyses and methods used
g. Interbasin transfers	• None
h. Third party social and economic impacts from voluntary redistribution of water	• None
i. Efficient use of existing water supplies and regional opportunities	• Provides regional opportunities with local resources
j. Effect on navigation	• None
k. Impacts on water pipelines and other facilities used for water conveyance	• None

Table 5B.9.18. Evaluation Summary of the STWA Ricardo Well Project

Impact Category	Comments
a. Water supply:	
1. Quantity	1. Yield: 560 ac-ft/yr.
2. Reliability	2. Moderate reliability.
3. Cost of treated water**	3. Generally low to moderate cost; $2,114 per ac-ft.
b. Environmental factors:	
1. Effects on Instream flows	1. None to low impact.
2. Effects on Bay and estuary inflows and arms of the Gulf of Mexico	2. Moderate impact.
3. Wildlife habitat	3. None
4. Wetlands	4. None to low.
5. Threatened and endangered species	5. None identified. Project can be adjusted to bypass sensitive areas. Endangered species survey will be needed to identify impacts.
6. Cultural resources	6. Cultural resources survey will be needed to identify any significant sites.
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7a-b. Total dissolved solids and salinity of water is expected to be below 1000mg/L 7d-i. Chloride, sulfate, uranium and arsenic concentrations in groundwater will need to be considered prior to implementation of project.
c. Impacts to Agricultural Resources or State water resources	• Little to minor negative impacts on surface water resources
d. Threats to agriculture and natural resources in region	• Temporary damage due to construction of pipeline
e. Recreational impacts	• None
f. Equitable comparison of strategies	• Standard analyses and methods used for portions.
g. Interbrain transfers	• Not applicable
h. Third party social and economic impacts from voluntary redistribution of water	• Not applicable
i. Efficient use of existing water supplies and regional opportunities	• Provides regional opportunities for water that would otherwise be unused
j. Effect on navigation	• None
k. Impacts on water pipelines and other facilities used for water conveyance	• Construction and maintenance of transmission pipeline corridor. Possible short-term impact to wildlife habitat along pipeline route and right-of-way.

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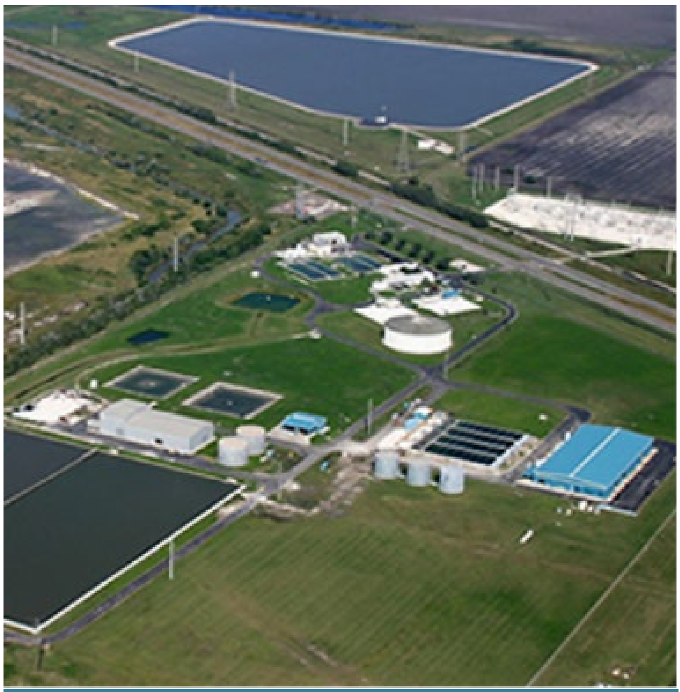

5B.10

Regional Water Supply Management and Treatment Facilities

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Section 5B.10 Regional Water Supply Management and Treatment Facilities

The City of Corpus Christi and San Patricio Municipal Water District (SPMWD) supply over 80 percent of the municipal and industrial water demand in the region. Treated water supply availability is limited by existing water treatment plant (WTP) capacity, as well as raw water availability. Water treatment plant and raw transmission system improvements are necessary for the City of Corpus Christi and San Patricio Municipal Water District to fully use existing water supplies available from the Choke Canyon Reservoir/Lake Corpus Christi System (CCR/LCC)/Lake Texana/ Mary Rhodes Pipeline (MRP) Phase II System (CCR/LCC/Texana/MRP Phase II System or Corpus Christi Regional Water Supply System).

Improvements are underway at the O.N. Stevens WTP improvements to remove bottlenecks and increase treatment capacity to the rated capacity. Beyond these improvements scheduled to be completed by the end of the year, O.N Stevens WTP will need a facility expansion to meet treated water needs for planning period from 2030 to 2080. The City of Corpus Christi is currently conducting a condition assessment of the MRP, the sole transmission pipeline delivering the City's existing supplies from Lake Texana and the Colorado River. Preliminary information from ongoing City studies suggest that rehabilitation is needed for the pipeline to deliver supplies at or near rated capacity.

The SPMWD is considering replacement of the Nueces River raw water transmission pipeline and pump station on the MRP at Dressen to meet future customer water demands and fully and reliably utilize contracted water supplies from the City of Corpus Christi. Furthermore, SPMWD is planning microfiltration improvements at their water treatment plant to provide treated water to meet customer demands.

5B.10.1 O.N. Stevens WTP Improvements

5B.10.1.1 Description of Strategy

The O.N. Stevens WTP provides treated water supplies to the City of Corpus Christi and its customers. As shown in the City of Corpus Christi's needs analysis in Chapter 4A additional treatment capacity is needed at the city's water treatment plant to fulfill contracted future treated water supplies to SPMWD and others needed to meet projected industrial water needs.

The City of Corpus Christi expects to experience increasing municipal and industrial water demands due to a growing population, enterprise, and commerce. Despite the successful water conservation efforts of the City's industrial customers, raw and treated water demand is increasing due to increased manufacturing. Not only have manufacturers indicated that they will need increasing amounts of water in the coming years, other water users have approached the City of Corpus Christi about various efforts slated to come online in the next several years with increasing rates of water consumption over a 10-year period. The projected growth in manufacturing and steam-electric demand, in combination with municipal demand, requires that the City of Corpus Christi develop additional treated water supply over the next few years.

Although the O.N. Stevens WTP is currently rated at 167 million gallons per day (mgd) by the Texas Commission on Environmental Quality (TCEQ), the City of Corpus Christi currently can produce only 160 mgd of treated water through the O.N. Stevens WTP (the sole source of treated water for the City of Corpus Christi municipal supply, various large industrial users, and the South Texas Water Authority [STWA])[1] due to a hydraulic bottleneck at the front end of the O.N. Stevens WTP. The City of Corpus Christi is in the process of O.N. Stevens WTP expansions to increase treatment plant capacity from 160 mgd to 200 mgd and construction activities are underway for an estimated time of completion of 2026. Re-designing the influent end of the plant will allow the plant, operating under acceptable TCEQ detention rates, to produce 200 mgd, which would increase the amount of treated water supplies needed to meet increasing water demands for City of Corpus Christi customers and improve supply reliability. Additional system improvements to the WTP will provide operational cost savings from increased reliability and functionality. The proposed O.N. Stevens WTP Improvements are as follows:

- Raw Water Influent Improvements – these improvements will address the current hydraulic bottleneck at the O.N. Stevens WTP front end that limits total plant capacity to 159 mgd. This project, in combination with uprating the current filter system through TCEQ, will increase total plant capacity to 200 mgd.
- Nueces River Raw Water Intake Pump Station Improvements – these improvements will increase the reliability of water delivery to O.N. Stevens from the Calallen Pool.

The Raw Influent Improvements would allow for blending and pre-sedimentation of 100 percent of the source water which would increase finished water quality, as well as allow for a more uniform treatment regimen which would save operational costs. Full blending and full pre-sedimentation will also accomplish the goal of increasing the quality of the partially treated water that is provided to local industry. Raw Influent Improvements will also increase security at the O.N. Stevens WTP as currently the influent pipelines emerge in an open top meter vault only a few feet from a major road, which is a security concern.

The Nueces River Raw Water Intake Pump Station Improvements will upgrade the pump station in order to increase the reliability of water delivery to O.N. Stevens WTP. The upgrades will also increase the operational capability of the pump station and provide operational cost savings from the increased reliability and capabilities of the improved pump station, including new pump motors and motor starters to be installed.[2]

In addition to the projects detailed above, the City of Corpus Christi is also in the process of adding water treatment plant improvements to the chemical feed system, electrical distribution system, process monitoring instrumentation and automation system, and residual solids

[1] The City of Corpus Christi, STWA, and some industrial users rely solely on the O.N. Stevens WTP for treated water supplies, and do not have backup treatment plants or treated water furnished from other sources.

[2] The O.N. Stevens WTP currently contains emergency generators. Proposed water treatment improvements would be added to the existing electrical distribution system.

handling and water recovery facilities. Such improvements are not fully discussed in this water management strategy and are not included in the cost estimate.

5B.10.1.2 Available Yield

The City of Corpus Christi currently can produce only 160 mgd of treated water due to a hydraulic bottleneck at the front end of the O.N. Stevens WTP treatment train that limits water treatment plant production. With raw water influent improvements, the O.N. Stevens WTP capacity will increase to 200 mgd (peak day).

At a current peak water treatment capacity of 160 mgd, the City is able to produce on average 114.3 mgd[3] (or 128,104 acre-feet per year [ac-ft/yr]). Assuming the same peak to average day ratio, increasing the O.N. Stevens WTP capacity to 200 mgd will produce 142.9 mgd, on average, (or 160,134 ac-ft/yr) which is 32,030 acre-feet (ac-ft) more than the amount that can be currently produced.[4]

5B.10.1.3 Environmental Issues

A summary of environmental issues by water treatment plant improvement component is included in Table 5B.10.1. There is little to no environmental impact from the proposed O.N. Stevens WTP projects. The majority of the work will be on existing facilities and structures.

Table 5B.10.1.
Environmental Issues City of Corpus Christi Water Supply Improvements

Water Management Strategy/Component	Environmental Impact
Raw Influent Improvements	Negligible impact. Possibility of processing more water daily by the WTP could allow for increased consumption if the demand manifests itself, but also increased B&E inflows possible as well.
Nueces River Raw Water Pump Station Improvements	Negligible impact. Upgrades to existing facility will not involve construction in river or alteration of flows, excavation, or dredging.

5B.10.1.4 Engineering and Costing

Figure 5B.10.1 shows the facilities required to develop the Raw Influent Improvements. The improved headworks piping at O.N. Stevens will also allow for 100 percent blending and pre-sedimentation of source waters which will affect water quality improvements and chemical cost savings per unit.

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[3] Assumes a peak to average day rate of 1.4: 1 comparable with recent water use records.

[4] Assumes no raw water shortage.

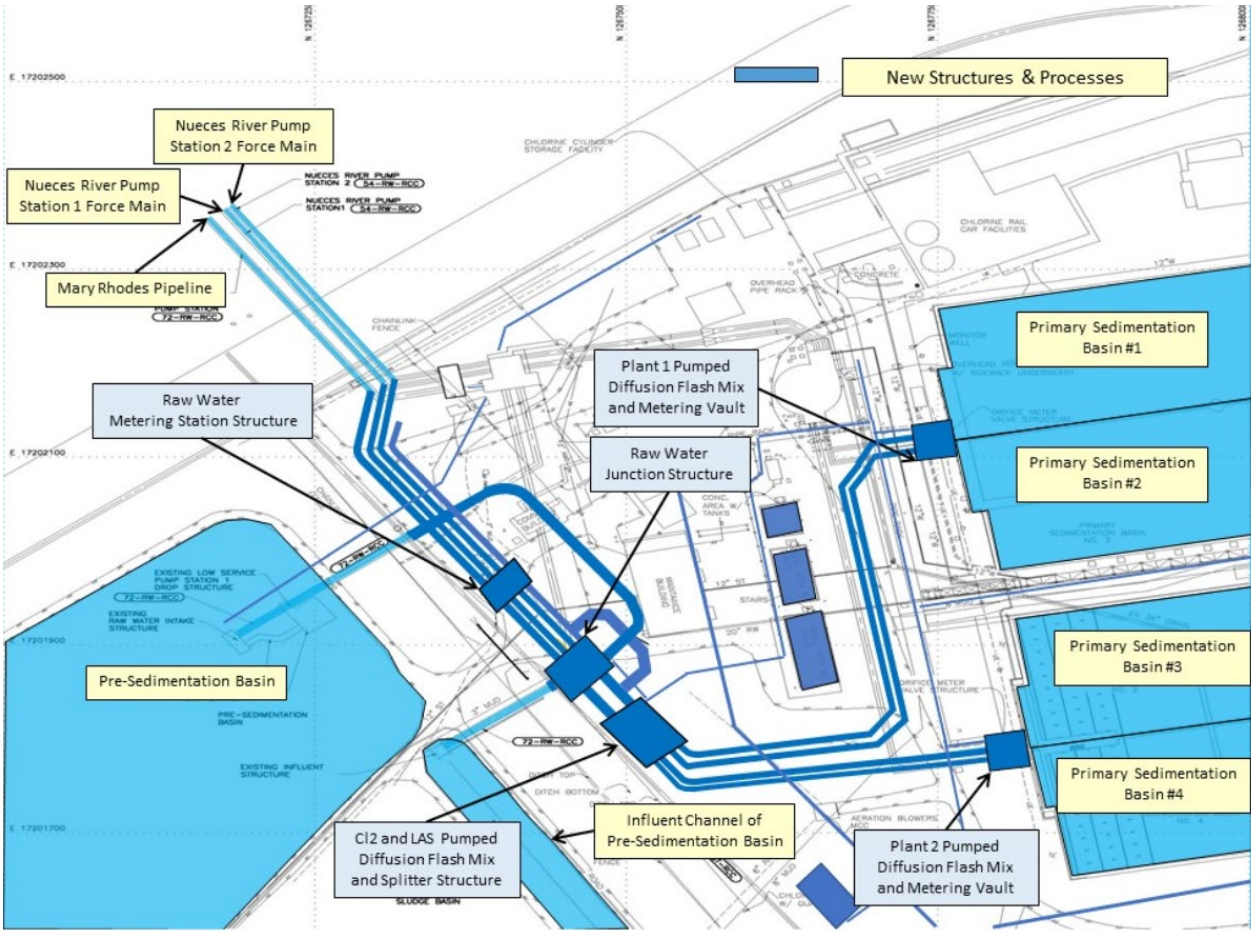

Figure 5B.10.1.
O.N. Stevens Water Treatment Plant Raw Water Influent Improvements

Table 5B.10.2 summarizes the capital and annual costs for the City of Corpus Christi's O.N Stevens WTP improvements, while Table 5B.10.3 summarizes the available project yield subject to raw water constraints and the annual cost of water, including treated water costs with assumption of $369 per ac-ft used for other water management strategies. It is important to note that yield declines in decades subsequent to 2020 due to the need to maintain raw water supplies up to safe yield capacity constraints. With addition of new raw water supplies during the projection period, the supplies generated by O.N. Stevens WTP improvements will amount to 28,025 ac-ft/yr or raw water project yield whichever is the smaller amount.

Table 5B.10.2.
Cost Estimate Summary, ON Stevens WTP Improvements (Sept 2023 Prices)

Item	Estimated Costs for Facilities
Primary Pump Station	$16,799,000
Water Treatment Plant Improvements	$42,570,000
Total Cost of Facilities	**$59,369,000**
- Planning (3%)	$1,781,000
- Design (7%)	$4,156,000
- Construction Engineering (1%)	$594,000
Legal Assistance (2%)	$1,187,000
Fiscal Services (2%)	$1,187,000
All Other Facilities Contingency (20%)	$11,874,000
Interest During Construction (3.5% for 1 years with a 0.5% ROI)	$2,605,000
Total Cost of Project	**$82,753,000**
Annual Cost	
Debt Service (3.5 percent, 20 years)	$5,823,000
Operation and Maintenance	-
Intakes and Pump Stations (2.5% of Cost of Facilities)	$420,000
Pumping Energy Costs (13987500 kW-hr @ 0.09 $/kW-hr)	$1,259,000
Total Annual Cost	**$7,502,000**
Available Project Yield (ac-ft/yr)	32,029
Annual Cost of Water ($ per ac-ft)	$234
Annual Cost of Water After Debt Service ($ per ac-ft)	$52
Annual Cost of Water ($ per 1,000 gallons)	$0.72
Annual Cost of Water After Debt Service ($ per 1,000 gallons)	$0.16

Table 5B.10.3.
Unit Cost of Water Summary

Yield/Cost	Year					
	2030	2040	2050	2060	2070	2080
Available Project Yield (ac-ft/yr)	32,029	32,029	32,029	32,029	32,029	32,029
Annual Cost of Raw Water ($ per ac-ft)	$234	$234	$52	$52	$52	$52
Annual Cost of Treated Water ($ per ac-ft)[a]	$606	$606	$424	$424	$424	$424

[a] The cost of treating water is $372 per ac-ft (from the City of Corpus Christi via email, February 2025).

5B.10.1.5 Implementation Issues

Implementation of these water management strategies will require a National Pollutant Discharge Elimination System (NPDES) Stormwater Pollution Prevention Plan Permit.

There are limited chances for participation by partners. To the extent these improvements will provide improvements in water quality or supply for wholesale finished or wholesale partially treated or wholesale raw water customers, there may be partnership opportunities with the wholesale customers.

The sequencing of construction will have to take into account the fact that the O.N. Stevens WTP is the City of Corpus Christi's only water treatment plant, so it has to keep operating throughout the construction process. There is detention time of only a few hours in the clearwells to allow for switching over to the new hydraulic structures near the end of construction. The Raw Influent Improvements Component is the only portion of the proposed improvements that will require special sequencing consideration.

5B.10.1.6 Evaluation Summary

An evaluation summary of this water management option is provided in Table 5B.10.4.

Table 5B.10.4.
Evaluation Summary of O.N. Stevens Water Treatment Plant Improvements

Impact Category	Comment(s)
a. Water supply:	
1. Quantity	1. Yield: 32,030 ac-ft/yr, with no raw water constraints.
2. Reliability	2. High reliability.
3. Cost of treated water	3. Raw: $234 per ac-ft. Treated: $606 per ac-ft.
b. Environmental factors:	
1. Instream flows	1. Negligible impact. The O.N. Stevens WTP Solids Handling Facilities will reduce demand on river water.
2. Bay and estuary inflows and arms of the Gulf of Mexico	2. Negligible impact. The O.N. Stevens WTP Solids Handling Facilities may have minor reduction in inflows to tidal portion of the Nueces River.
3. Wildlife habitat	3. Negligible impact. The O.N. Stevens WTP Solids Handling Facilities will preserve minimum water levels in the Audubon Society Rookery.
4. Wetlands	4. Low or no impact.
5. Threatened and endangered species	5. Negligible impact. The O.N. Stevens WTP Solids Handling Facilities will preserve minimum water levels in the Audubon Society Rookery.
6. Cultural resources	6. Negligible impact. All work on O.N. Stevens WTP property should be no impact.
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. Low or no impact. The O.N. Stevens WTP Solids Handling Facilities will likely produce water of higher quality than the original source water (including lowered TDS), as the facility would remove solids.
c. Impacts to agricultural and State water resources	No apparent negative impacts on water resources
d. Threats to agriculture and natural resources in region	None
e. Recreational impacts	None
f. Equitable comparison of strategies	Standard analyses and methods used
g. Interbasin transfers	Not applicable
h. Third party social and economic impacts from voluntary redistribution of water	None
i. Efficient use of existing water supplies and regional opportunities	Improvement over current conditions
j. Effect on navigation	None
k. Impacts on water pipelines and other facilities used for water conveyance	None

5B.10.2 Mary Rhodes Pipeline Phase I Rehabilitation

5B.10.2.1 Description of Strategy

The MRP Phase I conveys raw water from an intake pump station at Lake Texana southwest approximately 101 miles to the O.N. Stevens WTP in Corpus Christi, Texas. The MRP Phase I consists of approximately 99 miles of 64-inch diameter B303 Bar-Wrapped Pipe (BWP) and approximately 2 miles of 72-inch Prestressed Concrete Cylinder Pipe (PCCP) in four pressure ratings 100, 125, 150 and 175 pounds per square inch. Construction of the pipeline began in 1997 and was completed by 1998. Figure 5B.10.2 shows the existing MRP Phase I area, which would be adjacent and parallel to or collocated with all pipe and pump station improvements described in this planning document.

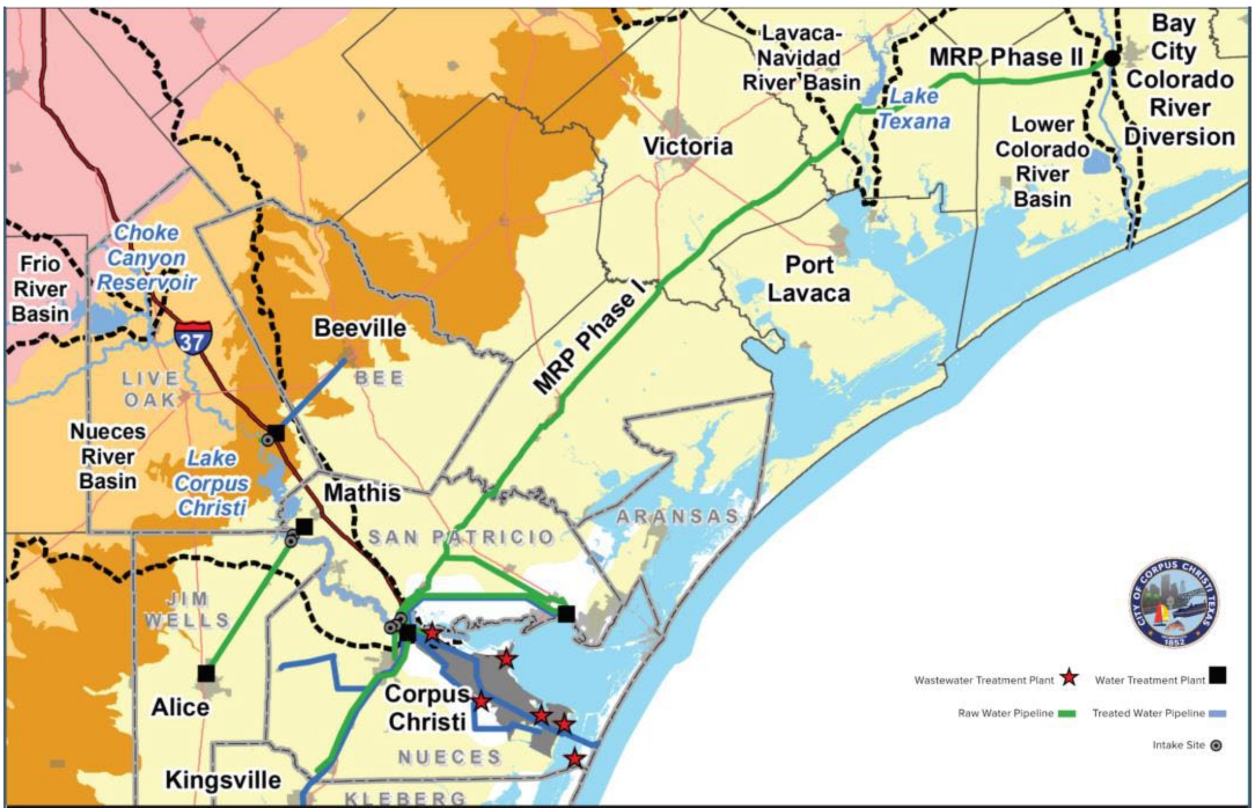

Figure 5B.10.2.
Mary Rhodes Pipeline Phase I Area

The reliability of the MRP is critical since it supplies over half of the City of Corpus Christi's raw water as well as the SPMWD and an industrial customer, Steel Dynamics Incorporated (SDI).

A pumping schedule used by Corpus Christi Water and Lavaca-Navidad River Authority shows that the MRP was designed to convey a variety of flows ranging from 11.5 to 79 mgd in the following scenarios (pumping schedules):

Schedule 1A

Flows ranging from 11.5 to 24.4 mgd are conveyed through the use of one of two variable frequency drive pumps at the Lavaca-Navidad River Authority intake pump station at Lake Texana.

Schedule 1B

Flows ranging from 25 to 32.4 mgd are conveyed through the use of both variable frequency drive pumps at the Lavaca-Navidad River Authority intake pump station at Lake Texana.

Schedule 2A

Flows ranging from 34 to 40 mgd are conveyed through the use of one constant speed and one variable frequency drive pumps at the Lavaca-Navidad River Authority intake pump station at Lake Texana.

Schedule 2B

Flows ranging from 40 to 46 mgd are conveyed through the use of two constant speed and one variable frequency drive pumps at the Lavaca-Navidad River Authority intake pump station at Lake Texana.

Schedule 3

Flows ranging from 55 to 58 mgd are conveyed through the use of various pumps at the Lavaca-Navidad River Authority intake pump station at Lake Texana and the use of all four pumps at the Bloomington Booster Pump Station.

Schedule 4

Flows ranging from 72 to 79 mgd are conveyed through the use of various pumps at the Lavaca-Navidad River Authority intake pump station at Lake Texana, the use of all four pumps at the Bloomington Booster Pump Station, and the use of all four pumps at the Woodsboro Booster Pump Station.

Corpus Christi Water typically operates the MRP Phase I under Schedule 2B, which meets customer demands and does not require the use of the Bloomington and Woodsboro Booster Pump Stations.

However, a condition assessment that was performed on the MRP Phase I in 2023-2024 identified operating pressures that exceeded the pipeline design pressure ratings in approximately 9 miles of the MRP Phase I pipeline during Schedule 2B pumping. Investigation and resolution of the 9 miles of pressure exceedance area will require the MRP to be taken out of service. Unfortunately, because the MRP has no redundancy it cannot be taken out of service. The pressure exceedance areas are shown in Figure 5B.10.3 through Figure 5B.10.5.

The identification of this pressure exceedance condition has the following impacts on Corpus Christi Water:

1. Decreased operational flexibility by effectively removing schedule 2B from use.

2. Decreased reliability and increased risk of pipeline failure in MRP Phase I when operating under Schedules 2B.
3. Increased dependence on Schedule 3 which requires the use of the Bloomington Booster Pump Station.

To date, the MRP Phase I has experienced over 34 pipe leaks/failures. Each leak/failure requires the MRP to be taken out of service while the source of the leak is confirmed and repair made.

Increasing customer water needs also require improvements to the booster pump stations in order to increase the pumping capacity of the MRP.

The City of Corpus Christi expects to experience increasing municipal and industrial water demands due to a growing population, enterprise, and commerce. Despite the successful water conservation efforts of the City of Corpus Christi's industrial customers, raw and treated water demand is increasing due to increased manufacturing. Not only have manufacturers indicated that they will need increasing amounts of water in the coming years, other water users have approached the City of Corpus Christi about various efforts slated to come online in the next several years with increasing rates of water consumption over a 10-year period. The projected growth in manufacturing demand, in combination with municipal demand, requires that the City of Corpus Christi improve the reliability and conveyance capacity of its primary water conveyance system in the coming years.

Although the MRP Ph I was designed to convey a maximum of 100 mgd, the City of Corpus Christi currently can only pump 79 mgd of raw water due to pumping limitations and pressure exceedances in a 9-mile section of pipeline. The City of Corpus Christi is in the process of construction activities to add and replace a total of seven combination air vacuum valves to better protect the MRP from transient events. The City of Corpus Christi is also in the process of making various piping, valve, pump, instrumentation, and electrical improvements at the Bloomington and Woodsboro to improve the reliability and capacity of these stations. Both projects have an estimated time of completion of early 2025 and are not detailed and their costs are not included in this document.

Installing parallel pipe and adding a pump to each of 3 pump stations will allow the MRP Phase I to convey 100 mgd, which would increase the amount of treated water supplies needed to meet increasing water demands for City of Corpus Christi customers and improve supply reliability. Additional system improvements to the MRP Phase I will provide increased reliability, conveyance capacity, and functionality. The proposed MRP Phase I Rehabilitation Improvements are presented as two options as follows:

Option 1

- Parallel Pipeline at high-risk locations – these improvements will address the current pressure exceedances in approximately 9 miles of the MPR Phase I and allow the City of Corpus Christi to pump at Schedule 2B without exceeding the pipeline pressure capacity.

- Pump Station Improvements – the addition of a pump to each of the three pump stations will increase the conveyance of water through the MRP Phase I from Lake Texana to the O.N. Stevens WTP.
- Parallel Pipeline at remaining locations – these improvements will provide redundancy and improve reliability by allowing the MRP to remain in service when the existing pipeline fails or requires maintenance.

Option 2

- Full replacement of the existing MRP Phase I pipeline and pump stations.

The MRP Phase I Rehabilitation Improvements will improve the pipeline reliability, improve operational flexibility, and increase pumping capacity. These improvements will reduce operational and repair costs by allowing the City of Corpus Christi to take pumps and sections of the MRP out of service with minimal to no impact to the City of Corpus Christi's water supply. The improvements will also accomplish the goal of increasing the reliability of the raw water that is provided to local industry.

The Pump Station Improvements will increase the capacity and reliability of the pump stations to deliver raw water to the O.N. Stevens WTP. The upgrades will also increase the operational capability of the pump station and provide operational cost savings from the increased reliability and capabilities of the improved pump station, including new pump motors and motor starters to be installed.

5B.10.2.2 Available Yield

The MRP currently can produce only convey 79 mgd of raw water due to pumping limitations and pipeline pressure exceedances. With pipeline and pump station improvements, the MRP Phase I capacity will increase to 100 mgd (peak day).

5B.10.2.3 Environmental Issues

A summary of environmental issues by pipeline improvement component is included in Table 5B.10.5. There is little to no environmental impact from the proposed projects. The majority of the work will be on existing facilities and structures.

Table 5B.10.5.
Environmental Issues Mary Rhodes Pipeline Phase I Rehabilitation

Water Management Strategy/Component	Environmental Impact
Pipeline Improvements	Negligible impact. Parallel pipeline construction should be performed in previously disturbed areas. Water crossings will be performed using tunneled construction to minimize impacts at those locations.
Pump Station Improvements	Negligible impact. Upgrades to existing facilities will not involve construction in river or alteration of flows, excavation, or dredging.

5B.10.2.4 Engineering and Costing

Figure 5B.10.3 through Figure 5B.10.5 show the parallel pipe locations for the MRP Phase I Rehabilitation Option 1 Improvements.

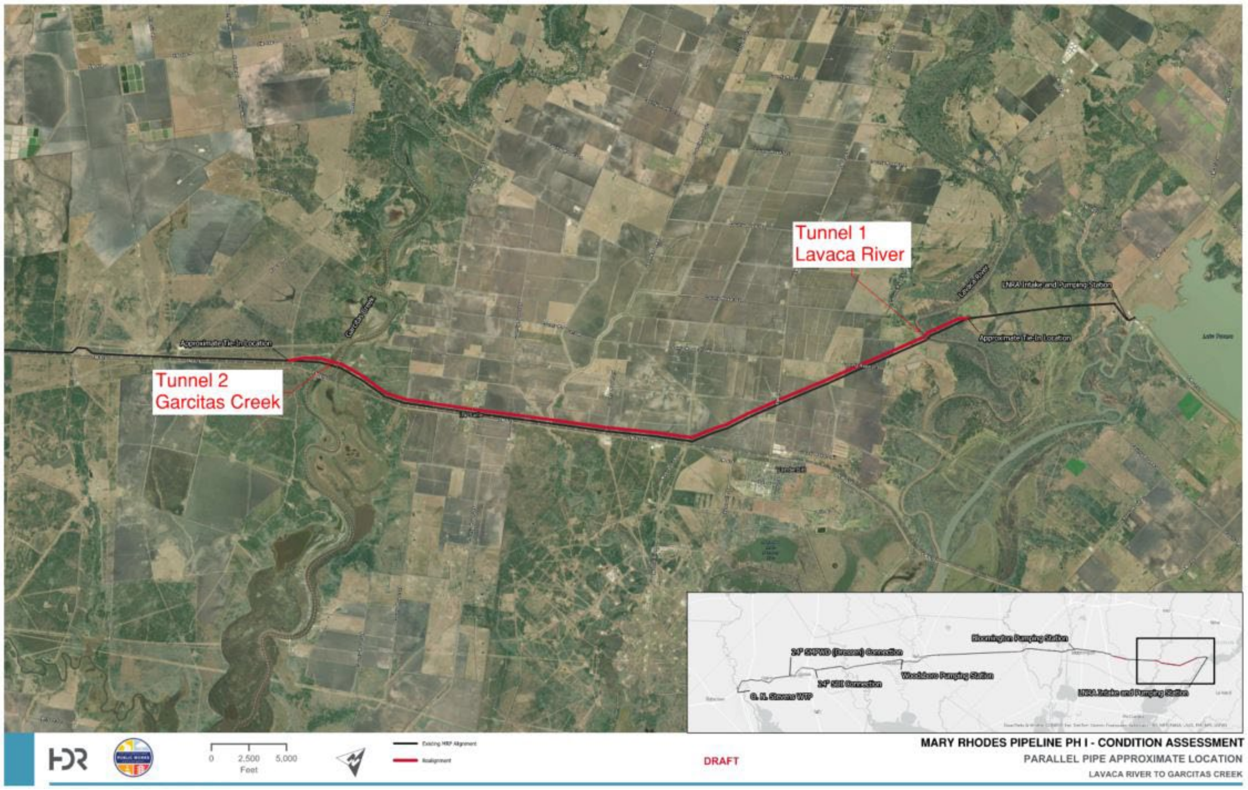

Figure 5B.10.3.
Mary Rhodes Pipeline Phase I Rehabilitation Improvements
High Risk Replacement Section 1

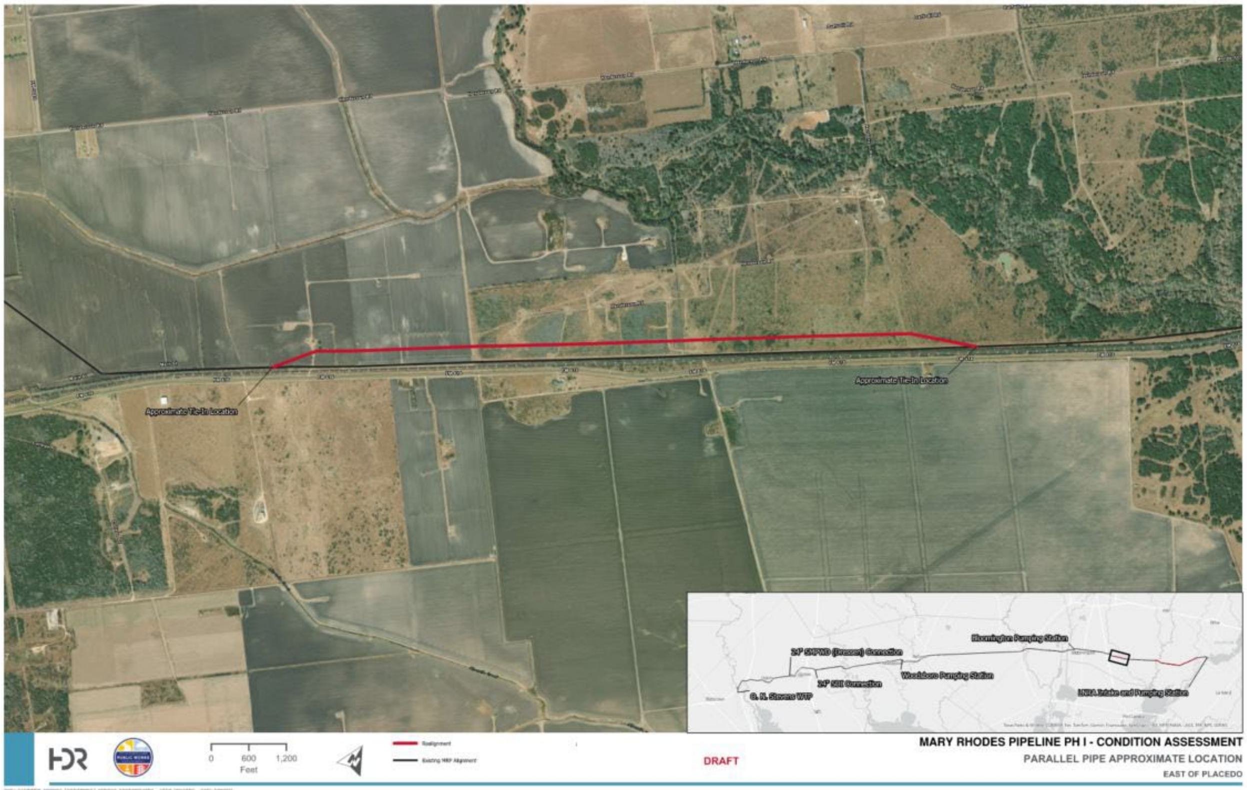

Figure 5B.10.4.
Mary Rhodes Pipeline Phase I Rehabilitation Improvements
High Risk Replacement Section 2

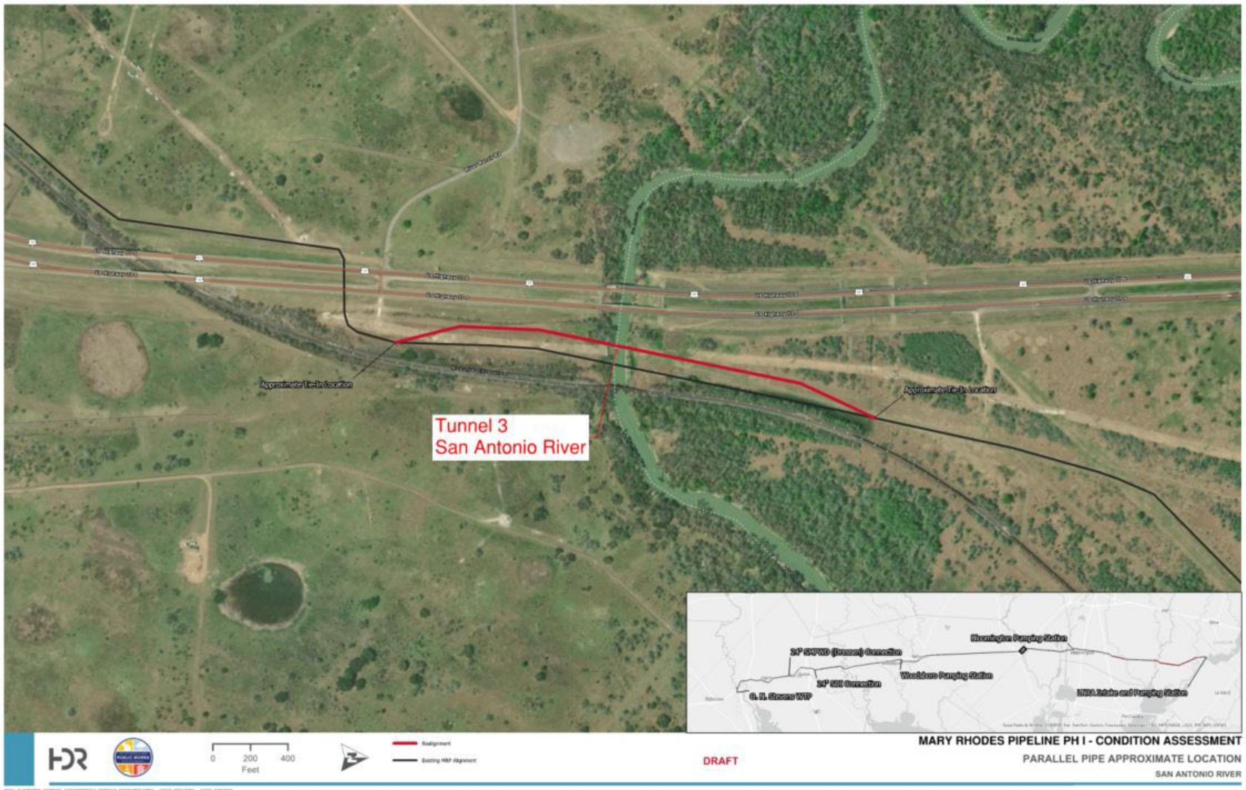

Figure 5B.10.5.
Mary Rhodes Pipeline Phase I Rehabilitation Improvements
High Risk Replacement Section 3

Table 5B.10.6 summarizes the capital and annual costs for the MRP Phase I Improvements Option 1, while Table 5B.10.7 summarizes the available project yield for Option 1 subject to raw water constraints and the annual cost of water, including treated water costs with assumption of $372 per ac-ft used for other water management strategies.

Table 5B.10.6.
Cost Estimate Summary for Mary Rhodes Pipeline Phase I Rehabilitation Option 1 (Sept 2023 Prices)

Item	Estimated Costs for Facilities
Capital Cost	
Transmission Pipeline	$890,000,000
Transmission Pump Station(s) & Storage Tank(s)	$30,000,000
Total Cost of Facilities	**$920,000,000**
- Planning (3%)	$27,600,000
- Design (7%)	$64,400,000
- Construction Engineering (1%)	$9,200,000
Legal Assistance (2%)	$18,400,000
Fiscal Services (2%)	$18,400,000
Pipeline Contingency (15%)	$133,500,000
All Other Facilities Contingency (20%)	$6,000,000
Interest During Construction (3.5% for 1 years with a 0.5% ROI)	$38,919,000
Total Cost of Project	**$1,236,419,000**
Annual Cost	
Debt Service (3.5 percent, 20 years)	$86,996,000
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$8,900,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$750,000
Pumping Energy Costs (176223811 kW-hr @ 0.09 $/kW-hr)	$15,860,000
Total Annual Cost	**$112,506,000**
Available Project Yield (ac-ft/yr)	112,000
Annual Cost of Water ($ per ac-ft)	$1,005
Annual Cost of Water After Debt Service ($ per ac-ft)	$228
Annual Cost of Water ($ per 1,000 gallons)	$3.08
Annual Cost of Water After Debt Service ($ per 1,000 gallons)	$0.70

Table 5B.10.7.
Unit Cost of Water Summary Option 1

Yield/Cost	Year					
	2030	2040	2050	2060	2070	2080
Available Project Yield (ac-ft/yr)	112,000	112,000	112,000	112,000	112,000	112,000
Annual Cost of Raw Water ($ per ac-ft)	$1,005	$1,005	$228	$228	$228	$228
Annual Cost of Treated Water ($ per ac-ft)[a]	$1,377	$1,377	$600	$600	$600	$600

[a] The cost of treating water is $372 per ac-ft (from the City of Corpus Christi via email, February 2025).

Table 5B.10.8 summarizes the capital and annual costs for the MRP Phase I Improvements Option 2, while Table 5B.10.9 summarizes the available project yield for Option 2 subject to raw water constraints and the annual cost of water, including treated water costs with assumption of $372 per ac-ft used for other water management strategies.

Table 5B.10.8.
Cost Estimate Summary for Mary Rhodes Pipeline Phase I Rehabilitation Option 2- With Full Replacement (Sept 2023 Prices)

Item	Estimated Costs for Facilities
Capital Cost	
Primary Pump Station (9177 HP)	$77,560,000
Transmission Pipeline (Lake Texana to brackish WTP: 66 in dia., 100.88 mi.)	$763,538,000
Transmission Pump Station & Storage Tank (2)	$108,604,000
Integration, Relocations, Backup Generator & Other	$10,741,000
Total Cost of Facilities	**$960,443,000**
- Planning (3%)	$28,813,000
- Design (7%)	$67,231,000
- Construction Engineering (1%)	$9,604,000
Legal Assistance (2%)	$19,209,000
Fiscal Services (2%)	$19,209,000
Pipeline Contingency (15%)	$114,531,000
All Other Facilities Contingency (20%)	$39,381,000
Environmental & Archaeology Studies and Mitigation	$3,026,000
Interest During Construction (3.5% for 1 years with a 0.5% ROI)	$40,648,000
Total Cost of Project	**$1,302,095,000**
Annual Cost	
Debt Service (3.5 percent, 20 years)	$90,861,000
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$7,778,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$4,565,000
Pumping Energy Costs (176224100 kW-hr @ 0.09 $/kW-hr)	$15,860,000
Total Annual Cost	**$119,064,000**
Available Project Yield (ac-ft/yr)	112,000
Annual Cost of Water ($ per ac-ft)	$1,063
Annual Cost of Water After Debt Service ($ per ac-ft)	$252
Annual Cost of Water ($ per 1,000 gallons)	$3.26
Annual Cost of Water After Debt Service ($ per 1,000 gallons)	$0.77

Table 5B.10.9.
Unit Cost of Water Summary Option 2

Yield/Cost	Year					
	2030	2040	2050	2060	2070	2080
Available Project Yield (ac-ft/yr)	112,000	112,000	112,000	112,000	112,000	112,000
Annual Cost of Raw Water ($ per ac-ft)	$1,063	$1,063	$252	$252	$252	$252
Annual Cost of Treated Water ($ per ac-ft)[a]	$1,435	$1,435	$624	$624	$624	$624

[a] The cost of treating water is $372 per ac-ft (from the City of Corpus Christi via email, February 2025).

5B.10.2.5 Implementation Issues

Implementation of these pipeline reliability improvement strategies will require an NPDES Stormwater Pollution Prevention Plan Permit.

To the extent these improvements will provide improvements in water supply for wholesale raw water customers, there may be partnership opportunities with the wholesale customers.

The sequencing of construction will have to consider the fact that the MRP has no redundancy and has to keep operating throughout the construction process. Connections between proposed pipeline sections and the existing MRP will likely need to be performed while the MRP is operating.

5B.10.2.6 Evaluation Summary

An evaluation summary of this water management option is provided in Table 5B.10.10.

Table 5B.10.10.
Evaluation Summary of Mary Rhodes Pipeline Phase I Rehabilitation (Options 1 & 2)

Impact Category	Comment(s)
a. Water supply:	
1. Quantity	1. Yield: Variable
2. Reliability	2. High reliability.
3. Cost of treated water	3. Raw: $1,005 to $1,063 per ac-ft. Treated: $1,377 to $1,435 per ac-ft.
b. Environmental factors:	
1. Instream flows	1. None anticipated. The parallel pipe and air valve repairs should not impact instream flows.
2. Bay and estuary inflows and arms of the Gulf of Mexico	2. None anticipated. The parallel pipe and air valve repairs should not impact bay and estuary inflows and arms of the Gulf of Mexico.
3. Wildlife habitat	3. Minimal impact. The parallel pipe and air valve repairs should not impact wildlife habitat.
4. Wetlands	4. None anticipated. Waters of the U.S. (WOTUS) including wetlands would be field delineated and trenchless construction methods would be used to avoid impacts to WOTUS.
5. Threatened and endangered species	5. No adverse effects anticipated at this preliminary stage although a habitat assessment would be required during design; No critical habitat or documented occurrences of state or federally listed threatened or endangered species.
6. Cultural resources	6. Subject to the Antiquities Code of Texas and coordination with the Texas Historical Commission would be required.
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. No impacts anticipated; erosion and sediment control best management practices would be utilized during construction and parallel pipes would be constructed to minimize/avoid water quality impacts.
c. Impacts to agricultural and State water resources	• No apparent negative impacts on water resources
d. Threats to agriculture and natural resources in region	• None
e. Recreational impacts	• None
f. Equitable comparison of strategies	• Standard analyses and methods used
g. Interbasin transfers	• Not applicable
h. Third party social and economic impacts from voluntary redistribution of water	• None
i. Efficient use of existing water supplies and regional opportunities	• Improvement over current conditions
j. Effect on navigation	• None
k. Impacts on water pipelines and other facilities used for water conveyance	• None

5B.10.3 San Patricio Municipal Water District – Conveyance System Improvements and New Water Treatment Plant

5B.10.3.1 Description of Strategy

SPMWD serves as a major wholesale water provider in the Coastal Bend Region providing potable water supplies to municipalities in San Patricio and Aransas counties; these municipal customers include the Cities of Odem, Taft, Portland, Gregory, Ingleside, Ingleside on the Bay, Aransas Pass, Rockport, and Fulton, as well as Nueces County Water Control and Improvement District #4 (WCID 4) and two rural water supply corporations in central and eastern San Patricio County. In addition, SPMWD provides raw and treated water supplies to industries located in San Patricio County.

SPMWD has a water supply agreement with the City of Corpus Christi to receive up to 46,800 ac-ft/yr of raw water and 34,760 ac-ft/yr of treated water from the regional CCR/LCC/Texana/MRP Phase II multi-basin water supply system. However, as noted in previous Coastal Bend Region water plans, SPMWD will still need to develop additional new water supplies beginning in 2030 to meet projected municipal and industrial water demands through 2080. San Patricio County is expecting significant industrial water demand increases in the future based on industrial growth with current manufacturing users and interest by new customers. TWDB's approved projections for this planning cycle for San Patricio County-Manufacturing show water demands of 60,705 ac-ft/yr (54.0 mgd) in 2030 with a slight increase to 60,732 ac-ft/yr by 2080.

SPMWD's water management strategy for this planning cycle focuses on conveyance system improvements for improved reliability and constructing a new water treatment plant to address projected municipal and industrial water demands. Three individual projects identified for the overall SPMWD WMS are detailed below including evaluation summaries for each.

5B.10.3.2 SPMWD WTP Complex: Construct New Water Treatment Plant (20 mgd) at Plant D

The SPMWD WTP complex includes municipal and industrial WTPs (Plants A through C) to provide treated water supplies for its customers with a total treatment capacity of 38.4 mgd (or 43,154 ac-ft/yr). The water plant at Plant C has a peak capacity of 21.4 mgd and is capable of delivering 10.7 mgd average day (or 11,994 ac-ft/yr) assuming a 2:1 peak to average day ratio based on historical use.

In order to meet TWDB's water demand projections for San Patricio County in 2030, SPMWD proposes to construct a new 20 mgd (or 22,418 ac-ft/yr) membrane filtration WTP at Plant D, an existing site at the SPMWD WTP complex. This new 20 mgd WTP will increase the total treatment capacity available for SPMWD's municipal and industrial customers from 38.4 to 58.4 mgd according to the *2023 SPMWD Facility Sequencing Study*. As noted in SPMWD's study, industrial companies have expressed a preference of receiving membrane filtered water (ion exchange or reverse osmosis treatment) versus conventionally treated water for their process needs due to the elimination of chemical addition after the filtration process. Also, industrial users outline a specific type of treatment needed for manufacturing operations in their contractual agreements with SPMWD, which is then incorporated into the cost of service for the industrial user.

5B.10.3.3 Nueces River Improvements: Construct New Raw Water Intake, Pump Station and 60-inch Raw Water Transmission Pipeline

SPMWD currently accesses raw water supply from the Nueces River via the Calallen Pool, a shallow reservoir formed by the Calallen Saltwater Barrier Dam alongside Interstate 37. SPMWD's existing pump station and intake structure, both located along the Nueces River near Labonte Park in the City of Corpus Christi, are used to deliver raw water supplies through a 36-inch pipeline from the Nueces River Calallen Pool to the SPMWD WTP complex, located southeast of the City of Gregory. The replacement of the existing 1960s vintage intake, pump station and transmission pipeline are needed to improve reliability and to also fully use contracted supplies. Proposed improvements include constructing a new intake and pump station (62 mgd) at the existing site on the Nueces River and constructing a new 60-inch transmission pipeline SPMWD alongside the right-of-way to replace the existing 36-inch pipeline.

5B.10.3.4 Lake Texana/Lower Colorado River Improvements: Construct New Pump Station and Replace Sections of Existing 36-inch Raw Water Transmission Pipeline

SPMWD has an existing 36-inch pipeline from the MRP to deliver raw supplies to the SPMWD WTP complex, located southeast of the City of Gregory. A new pump station (25 mgd) is needed for this existing 36-inch transmission pipeline to fully deliver supplies up to the contracted amount and to provide the additional raw water needed to meet demands through 2080. SPMWD has already purchased land for the pump station and improvements will be constructed within existing right-of-way. In addition, proposed improvements to the existing 36-inch transmission pipeline include replacing sections of the HDPE pipe material with PVC under the road crossings to allow for additional pressures from the new 25 mgd pump station.

5B.10.3.5 Available Yield

SPMWD has a water supply agreement with the City of Corpus Christi to receive up to 46,800 ac-ft/yr of raw water and 34,760 ac-ft/yr of treated water from the regional CCR/LCC/Texana/MRP Phase II multi-basin water supply system.

5B.10.3.6 SPMWD WTP Complex: Construct New Water Treatment Plant (20 mgd) at Plant D

SPMWD WTP improvements are needed to increase treatment capacity by 20 mgd (or 22,418 ac-ft/yr) to meet current and projected San Patricio County municipal and industrial water needs. The cost estimate provided below in Table 5B.10.11 includes constructing a new 20 mgd membrane filtration WTP to address the capacity required; Plant A will continue to operate as a conventional treatment facility for potable (municipal) water. This new 20 mgd WTP will increase the total treatment capacity of the SPMWD WTP complex from 38.4 to 58.4 mgd according to the *2023 SPMWD Facility Sequencing Study*.

Table 5B.10.11.
Cost Estimate Summary for New WTP at Plant D

Item	Estimated Costs for Facilities
CAPITAL COST	
Water Treatment Plant (20 MGD)	$49,500,000
TOTAL COST OF FACILITIES	**$49,500,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (35% for WTP)	$17,325,000
Environmental & Archaeology Studies and Mitigation	$50,000
Land Acquisition and Surveying	$0
Interest During Construction (3.5% for 1 year with a 0.5% ROI)	$2,173,000
TOTAL COST OF PROJECT	**$69,048,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$4,858,000
Operation and Maintenance	-
Water Treatment Plant (10% Cost of Facilities)	$4,950,000
Purchase of Raw Water (22,418 ac-ft/yr @ 381 $/ac-ft)	$8,541,000
TOTAL ANNUAL COST	**$18,349,000**
Available Project Yield (ac-ft/yr)	22,418
Annual Cost of Water ($ per ac-ft)	$819
Annual Cost of Water ($ per 1,000 gallons)	$2.51

5B.10.3.7 Nueces River Improvements: Construct New Raw Water Intake, Pump Station and 60-inch Raw Water Transmission Pipeline

Conveyance system improvements, which include constructing a new intake, new pump station (62 mgd) and new 60-inch transmission pipeline, are necessary in order for SPMWD to deliver the additional raw water (up to the contracted amount) to the SPMWD WTP complex for treatment and distribution. The existing infrastructure (intake, pump station and 36-inch raw water pipeline) from Calallen Pool to the SPMWD WTP complex is currently only able to deliver 17.8 mgd; this infrastructure will be replaced by the proposed conveyance system improvements at the existing site. SPMWD previously purchased the existing site for the new intake and new pump station; transmission pipeline improvements will be constructed alongside the right-of-way. The new pump station (62 mgd) will be sized for five 1,000-horse power (hp) pumps. The cost estimate provided below in Table 5B.10.12 includes the proposed conveyance system improvements to meet SPMWD's projected water demands and customer needs through 2080.

Table 5B.10.12.
Cost Estimate Summary for Nueces River Improvements: Conveyance and Transmission

Item	Estimated Costs for Facilities
CAPITAL COST	
Intake and Pump Station (62 MGD)	$27,050,000
Raw Water Transmission Pipeline (60-inch)	$138,415,000
TOTAL COST OF FACILITIES	**$165,465,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$50,992,000
Environmental & Archaeology Studies and Mitigation	$100,000
Land Acquisition and Surveying	$0
Interest During Construction (3.5% for 1 year with a 0.5% ROI)	$7,038,000
TOTAL COST OF PROJECT	**$223,595,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$15,732,000
Operation and Maintenance	-
Intake and Pump Station (2.5% of Cost of Facilities)	$676,300
Raw Water Transmission Pipeline (1% of Cost of Facilities)	$1,384,200
Purchase of Raw Water (69,495 ac-ft/yr @ 381 $/ac-ft)	$26,478,000
TOTAL ANNUAL COST	**$44,271,000**
Available Project Yield (ac-ft/yr)	69,495
Annual Cost of Water ($ per ac-ft)	$637
Annual Cost of Water ($ per 1,000 gallons)	$1.96

5B.10.3.8 Lake Texana/Lower Colorado River Improvements: Construct New Pump Station and Replace Sections of Existing 36-inch Raw Water Transmission Pipeline

Pump station improvements are needed for the existing transmission lines to fully deliver supplies up to the contracted amount and additional raw water needed to meet demands through 2080. The 36-inch pipeline from the MRP (located south of the City of Sinton) is currently able to deliver 9 mgd. By constructing a new 25 mgd pump station, SPMWD will be able to maximize the capacity of the existing 36-inch pipeline. SPMWD has already purchased land for the pump station and improvements will be constructed within existing right-of-way. The cost estimate provided below in Table 5B.10.13 includes constructing a new pump station to deliver adequate raw water from Lake Texana/Lower Colorado River to the treatment plant complex to meet needs through 2080. Proposed transmission pipeline improvements include replacing sections of the existing 36-inch HDPE pipeline with PVC under the roadway crossings to allow for additional pressures from the new 25 mgd pump station.

Table 5B.10.13.
Cost Estimate Summary for Lake Texana/Lower Colorado River Improvements: Conveyance and Transmission

Item	Estimated Costs for Facilities
CAPITAL COST	
Pump Station (25 MGD)	$17,850,000
Transmission Pipeline Improvements (existing 36-inch)	$11,411,000
TOTAL COST OF FACILITIES	**$29,261,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$9,670,800
Environmental & Archaeology Studies and Mitigation	$50,000
Land Acquisition and Surveying	$0
Interest During Construction (3.5% for 1 year with a 0.5% ROI)	$1,267,000
TOTAL COST OF PROJECT	**$40,249,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$2,832,000
Operation and Maintenance	-
Pump Station (2.5% of Cost of Facilities)	$446,300
Transmission Pipeline Improvements (1% of Cost of Facilities)	$114,100
Purchase of Raw Water (33,627 ac-ft/yr @ 381 $/ac-ft)	$12,812,000
TOTAL ANNUAL COST	**$16,204,000**
Available Project Yield (ac-ft/yr)	33,627
Annual Cost of Water ($ per ac-ft)	$482
Annual Cost of Water ($ per 1,000 gallons)	$1.48

5B.10.3.9 Environmental Issues

The environmental impact of the conveyance improvements and new water treatment plant improvements is estimated to be negligible for the first project (Section 5B.10.1.1) and third project (Section 5B.10.1.3). The processing of more water daily by the new WTP could allow for increased consumption if demand estimates materialize, which may increase B&E inflows. Also, the new WTP would likely produce water of higher quality than the original source. The new pump stations, 36-inch pipeline improvements and new WTP will not involve construction in undeveloped areas or excavation outside of existing pipeline right-of-way.

However, low to moderate environmental impact is estimated for the second project (Section 5B.10.1.2) identified in the overall SPMWD WMS. Construction of a new intake and replacing the 36-inch pipeline with a 60-inch pipeline could cause low to moderate impact to wildlife habitat and wetlands.

5B.10.3.10 Engineering and Costing

The capital/construction cost estimates for each of the three individual projects presented in Section 5B.10.1.1through Section 5B.10.1.3were provided by SPMWD. The 2025 raw water rate from the City of Corpus Christi to SPMWD is currently $381 per ac-ft ($1.17 per 1,000 gallons). Table 5B.10.1 through Table 5B.10.3 summarize the capital and annual costs for the three individual projects of the overall SPMWD WMS. The *TWDB Uniform Costing Model User Guide* for the 2026 regional water plans was utilized regarding general guidelines.

5B.10.3.11 Implementation Issues

Implementation of this overall SPMWD water management strategy will require an PDES) Stormwater Pollution Prevention Plan Permit. The sequencing of construction will have to consider that the SPMWD water system will need to continue operating throughout the construction process due to sensitive industrial processes which rely on continuous treatment operation. Modular improvements should be considered, when at all possible, to avoid potential service interruptions.

5B.10.3.12 Evaluation Summary

An evaluation summary of each of the three individual projects identified for the overall SPMWD WMS is provided below in Table 5B.10.14 through Table 5B.10.16. The evaluation criteria are based on TWDB requirements for the 2026 regional water plans.

Table 5B.10.14.
Evaluation Summary for New WTP at Plant D

Impact Category	Comment(s)
a. Water supply:	
1. Quantity	1. 22,418 ac-ft/yr (20 MGD).
2. Reliability	2. High reliability.
3. Cost of treated water	3. $819 per ac-ft
4. Estimated water losses	4. None – new construction
b. Environmental factors:	
1. Effects on Instream flows	1. Negligible impact.
2. Effects on Bay and estuary inflows and arms of the Gulf of Mexico	2. Negligible impact. The SPMWD new WTP may have minor increases in return flows to Nueces Bay and Estuary.
3. Wildlife habitat	3. Negligible impact. The SPMWD new WTP at Plant D will not disturb unaltered and/or new land.
4. Wetlands	4. Negligible impact.
5. Threatened and endangered species (TES)	5. Negligible impact. The SPMWD new WTP at Plant D will not disturb unaltered and/or new land or known TES critical habitat.
6. Cultural resources	6. Negligible impact. All work on existing SPMWD property or existing right-of-way should have no impact.
7. Water quality (WQ) a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other WQ constituents	7. Low or no impact. The SPMWD new WTP will likely produce water of higher quality than the original source water (including lowered TDS), as the facility would remove solids.
c. Impacts to Agricultural Resources or State water resources	• No apparent negative impacts on water resources
d. Threats to agriculture and natural resources in region	• None
e. Recreational impacts	• None
f. Equitable comparison of strategies	• Standard analyses and methods used
g. Interbasin transfers	• Not applicable
h. Third party social and economic impacts from voluntary redistribution of water	• None
i. Efficient use of existing water supplies and regional opportunities	• Improvement over current conditions
j. Effect on navigation	• None
k. Impacts on water pipelines and other facilities used for water conveyance	• None

Table 5B.10.15.
Evaluation Summary for Nueces River Improvements: Conveyance and Transmission

Impact Category	Comment(s)
a. Water supply:	
1. Quantity	1. 69,495 ac-ft/yr (62 MGD).
2. Reliability	2. High reliability.
3. Cost of treated water	3. $637 per ac-ft
4. Estimated water losses	4. None – new construction
b. Environmental factors:	
1. Effects on Instream flows	1. Low impact. Water would be released from Choke Canyon Reservoir into the Nueces River to maintain stream flows. Raw water that would be removed through the Nueces River intake would minimally change instream flows, if at all.
2. Effects on Bay and estuary inflows and arms of the Gulf of Mexico	2. Low impact. Water would be released from Choke Canyon Reservoir to replace raw water which would be removed from the Nueces River. Therefore, only minor impacts to freshwater flows entering Rincon Bayou would be anticipated.
3. Wildlife habitat	3. Low to Moderate impact. New areas would be disturbed for the installation of the transmission pipeline and new intake facility. Some impacts to wildlife habitat, especially within and along the Nueces River and its floodplain.
4. Wetlands	4. Low to Moderate impact. Wetlands are likely present along the intake area and portions of the pipeline route. Delineation and avoidance would be recommended where possible.
5. Threatened and endangered species	5. Low impact. No known impacts to listed species or critical habitats. Habitat assessment would be recommended during design.
6. Cultural resources	6. Unknown impact. The project would be a new alignment, and it is anticipated that a cultural resources survey would be required.
7. Water quality (WQ) a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other WQ	7. Low or no impact. The Nueces River Improvements will likely produce water of higher quality than the original source water (including lowered TDS), as the facility would remove solids.
c. Impacts to Agricultural Resources or State water resources	• No apparent negative impacts on water resources
d. Threats to agriculture and natural resources in region	• None
e. Recreational impacts	• None
f. Equitable comparison of strategies	• Standard analyses and methods used
g. Interbasin transfers	• Not applicable
h. Third party social and economic impacts from voluntary redistribution of water	• None
i. Efficient use of existing water supplies and regional opportunities	• Improvement over current conditions
j. Effect on navigation	• None

Impact Category	*Comment(s)*
k. Impacts on water pipelines and other facilities used for water conveyance	• None

Table 5B.10.16
Evaluation Summary for Lake Texana/Lower Colorado River Improvements: Conveyance and Transmission

Impact Category	Comment(s)
a. Water supply:	
1. Quantity	1. 33,627 ac-ft/yr (25 MGD).
2. Reliability	2. High reliability.
3. Cost of treated water	3. $482 per ac-ft.
4. Estimated water losses	4. None – new construction
b. Environmental factors:	
1. Effects on Instream flows	1. Negligible impact.
2. Effects on Bay and estuary inflows and arms of the Gulf of Mexico	2. Negligible impact. The new pump station and pipeline replacement will have minor impacts to flows to bays and estuaries.
3. Wildlife habitat	3. Low impact. This project will not disturb previously undisturbed areas.
4. Wetlands	4. Negligible impact. Pump station could be sited to avoid wetland impacts and the pipeline replacement would be along the existing pipeline route.
5. Threatened and endangered species (TES)	5. Low impact. No know impacts to listed species or critical habitats. No unaltered land would be disturbed.
6. Cultural resources	6. Negligible to Low impact. It is anticipated this project would take place within areas previously surveyed for cultural resources and then disturbed for pipeline use.
7. Water quality (WQ) a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other WQ constituents	7. Low or no impact. The new pump station and pipeline improvements will likely produce water of higher quality than the original source water (including lowered TDS), as the facility would remove solids.
c. Impacts to Agricultural Resources or State water resources	• No apparent negative impacts on water resources
d. Threats to agriculture/ natural resources	• None
e. Recreational impacts	• None
f. Equitable comparison of strategies	• Standard analyses and methods used
g. Interbasin transfers	• Not applicable
h. Third party social and economic impacts from voluntary redistribution of water	• None
i. Efficient use of existing water supplies and regional opportunities	• Improvement over current conditions
j. Effect on navigation	• None
k. Impacts on water pipelines and other facilities used for water conveyance	• None

5B.11

Diversion to Choke Canyon Reservoir

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Section 5B.11 Diversion to Choke Canyon Reservoir

5B.11.1 Description of Water Management Strategy

The Diversion to Choke Canyon Reservoir strategy diverts unappropriated flows in the Nueces River to Choke Canyon Reservoir (CCR) when Lake Corpus Christi (LCC) is full and unable to store them downstream. Diverting flows in the Nueces River during high-flow events offers mitigation for flood impacts downstream in addition to the water supply that the strategy provides. The diversion leverages two parallel, 2.4-mile, 144-inch pipelines to convey a peak capacity of 731.6 million gallons per day (mgd) (1,132 cubic feet per second) at a velocity of 5 feet per second.

CCR is located on the Frio River upstream of the confluence with the Nueces River. Lake LCC is located on the Nueces River, downstream of the confluence. The City of Corpus Christi operates two reservoirs as a system and inflows are passed in accordance with the agreed order[1] set by the Texas Commission on Environmental Quality (TCEQ) (formerly TRNCC) in 2001. The agreed order defines required in-stream environmental flow requirements for the purpose of maintaining healthy ecosystems in the Nueces Estuary and Corpus Christi Bay. Passthrough requirements for environmental flows are based on the combined storage of the CCR-LCC system at thresholds of 70 percent, 40 percent, and 30 percent. The strategy would divert water from the Nueces River for subsequent discharge and storage in CCR when environmental flow requirements and downstream water rights have been satisfied and LCC is unable to store additional water.

5B.11.2 Available Yield

The firm yield of the project was assessed using the TCEQ's Nueces Basin Run 3 Water Availability Model (WAM). A firm yield was computed for the CCR-LCC system for two scenarios: one representing current conditions and one with the strategy in place. To do this, monthly available flows from the WAM were disaggregated to daily flows using nearby historical data from U.S. Geological Survey (USGS) streamflow gages. The amount of available flow diverted was determined using the strategy's capacity and the daily available streamflows. The WAM was then re-run with targets set to the diversion amounts calculated in the daily analysis.

Results of the modeling indicate the strategy does not increase the firm yield of the system due to no availability of unappropriated flows during the critical drawdown period of the system. Prior to the critical drawdown period (July 1992-August 1996), both reservoirs were full, meaning that no previous diversions would affect the firm yield. However, the strategy does increase the average annual supply from the CCR-LCC system by approximately 2,939 acre-feet per year

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[1] Texas Natural Resource Conservation Commission. 2001. An Agreed Order: Amending the operational procedures and continuing an Advisory Council Pertaining to Special Condition 5.B., Certificate of Adjudications No. 21-3214; Docket No. 2001-0230-WR

(ac-ft/yr). This means that existing water rights that draw from the CCR-LCC system could expect to see a combined 2,393 ac-ft/yr of additional water on average.

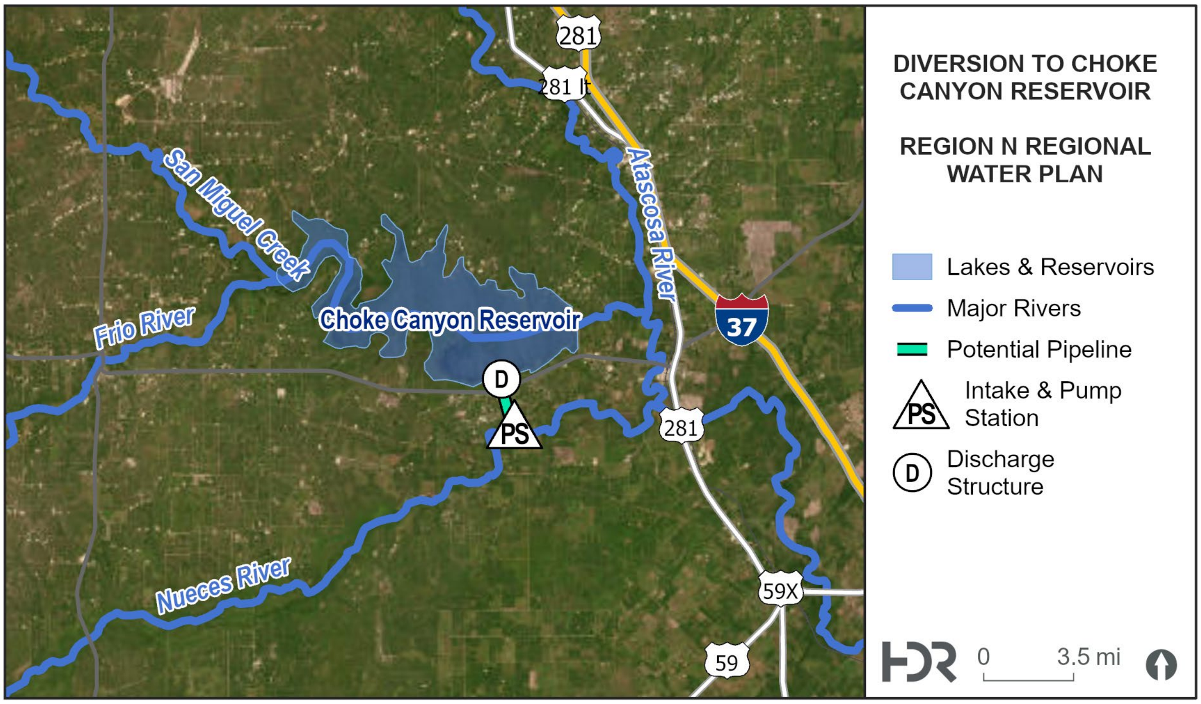

Figure 5B.11.1
Diversion to Choke Canyon Reservoir: Strategy Layout

As shown in Figure 5B.11.2 and Figure 5B.11.3, unappropriated flows are available less than 4 percent of the time (at a daily interval). While there is frequently available storage in CCR (see Figure 5B.11.4), there is also available storage in LCC roughly 90 percent of the time (Figure 5B.11.5), limiting the efficacy of a diversion. Additionally, flows in the Frio River allocated to downstream water rights can be stored in CCR without the use of the diversion (see the map in Figure 5B.11.1). This approach is already being implemented and is improving the efficiency of the CCR-LCC system in the same way that the diversion might.

Diversions made during high flow events do not affect the simulated firm yield of the reservoir system. In the firm yield analysis, there is no available flow for diversion during the critical drawdown period of CCR and LCC, and both reservoirs were full at the onset of the drought. This can be seen in Figure 5B.11.6 and Figure 5B.11.7.

A diversion capacity was determined for two parallel 144-inch pipelines with a peak flow velocity of 5.0 feet per second and applied to the available flows. This pipeline capacity represents the upper bound of common pipelines for water supply projects and was selected because it has lower unit cost of water than smaller projects.

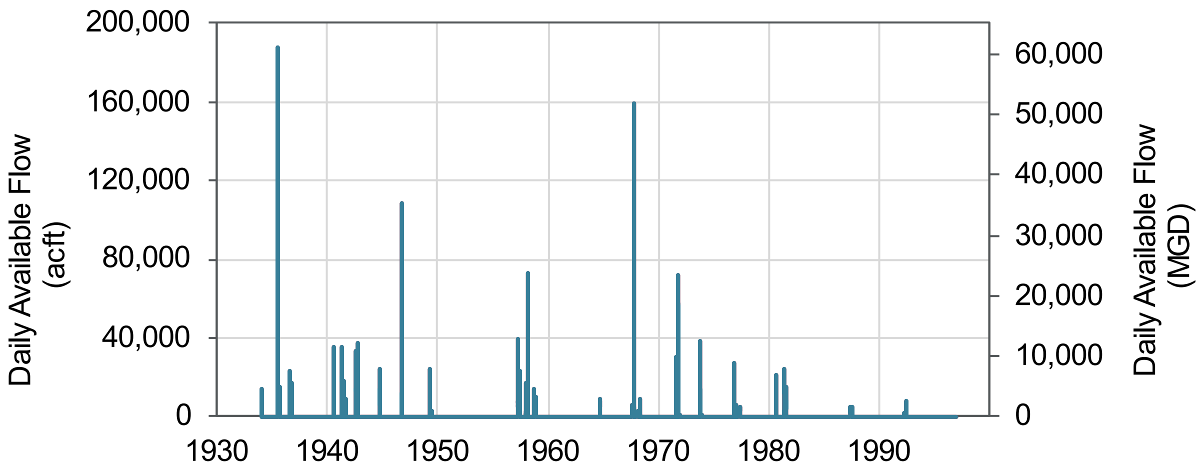

Figure 5B.11.2.
Daily Available Flow in the Nueces River Near Tilden After Senior Water Rights and Environmental Flows Have Been Accounted For

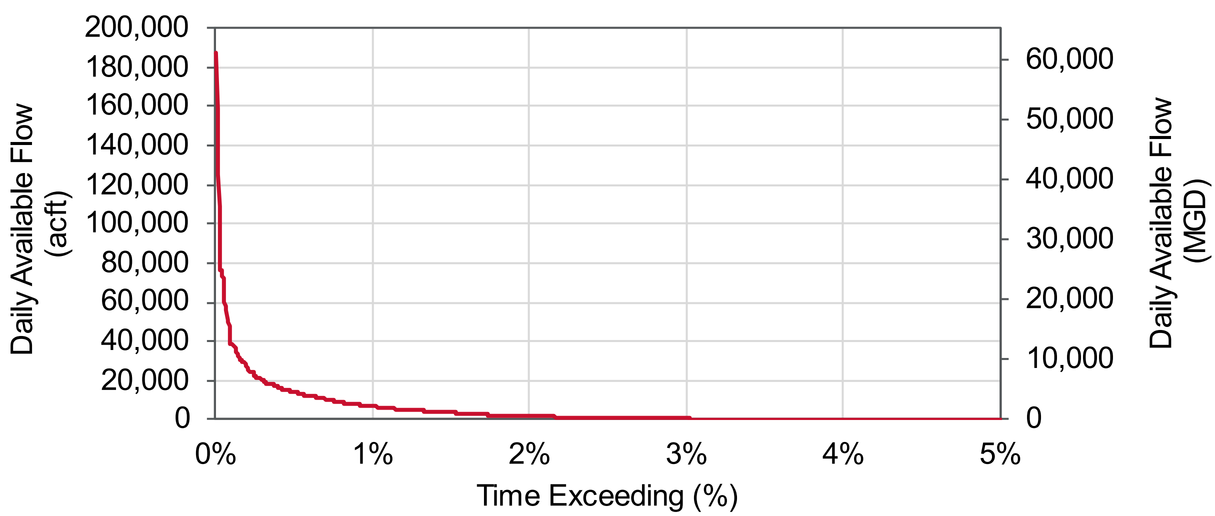

Figure 5B.11.3.
Frequency of Available Flows in the Nueces River Near Tilden After Senior Water Rights and Environmental Flows Have Been Accounted For

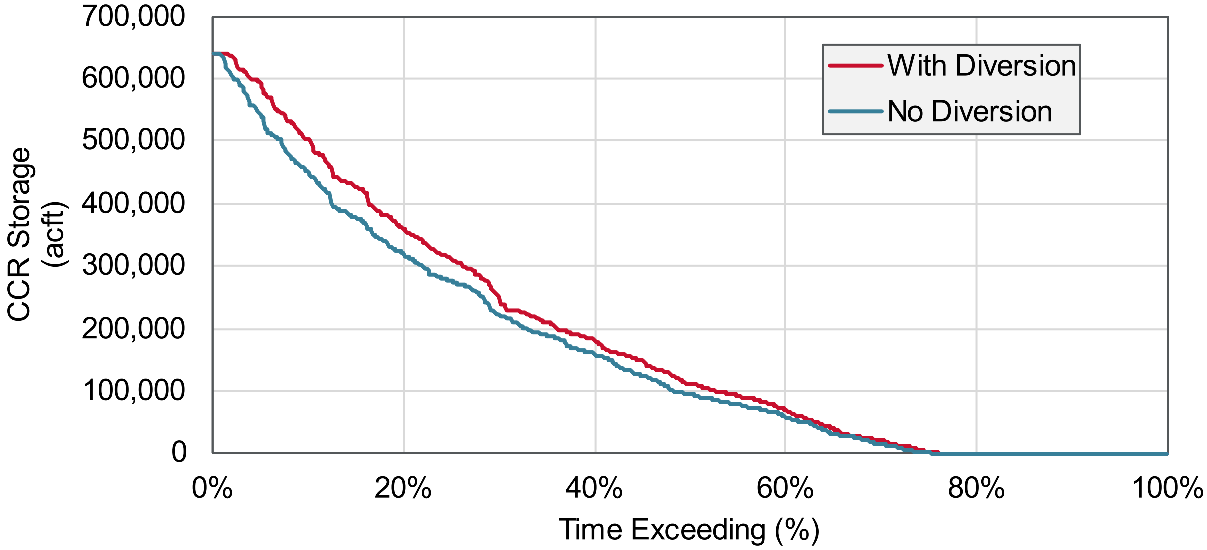

Figure 5B.11.4
Storage Versus Frequency Relationship for CCR

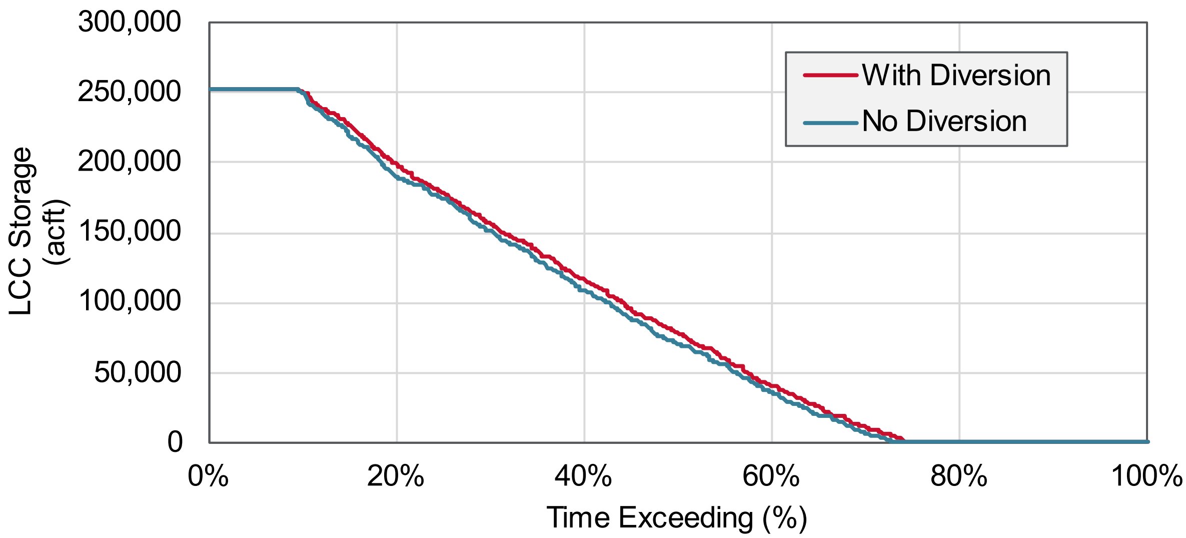

Figure 5B.11.5.
Storage Versus Frequency Relationship for LCC

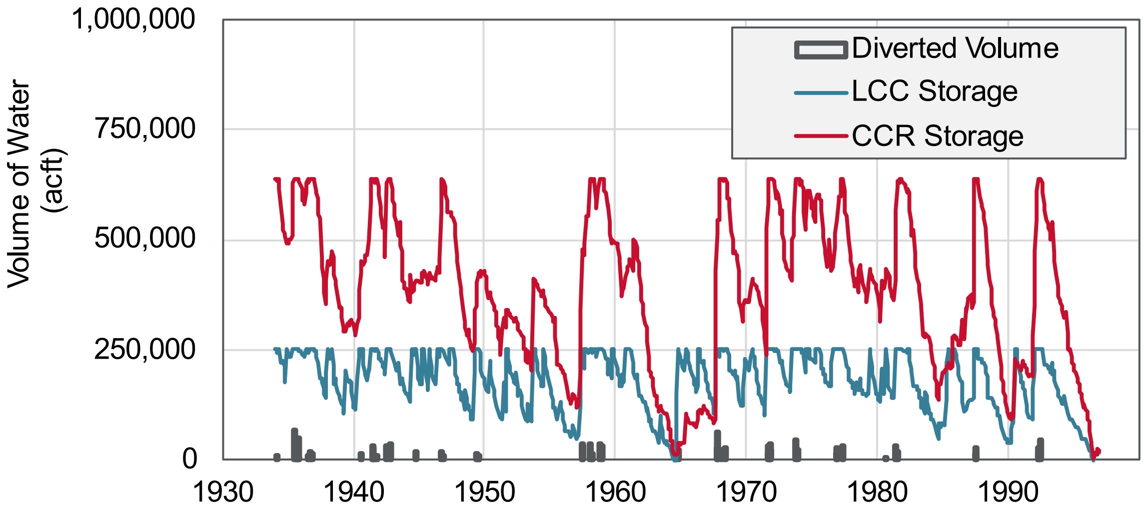

Figure 5B.11.6.
Firm Yield Analysis for CCR-LCC System

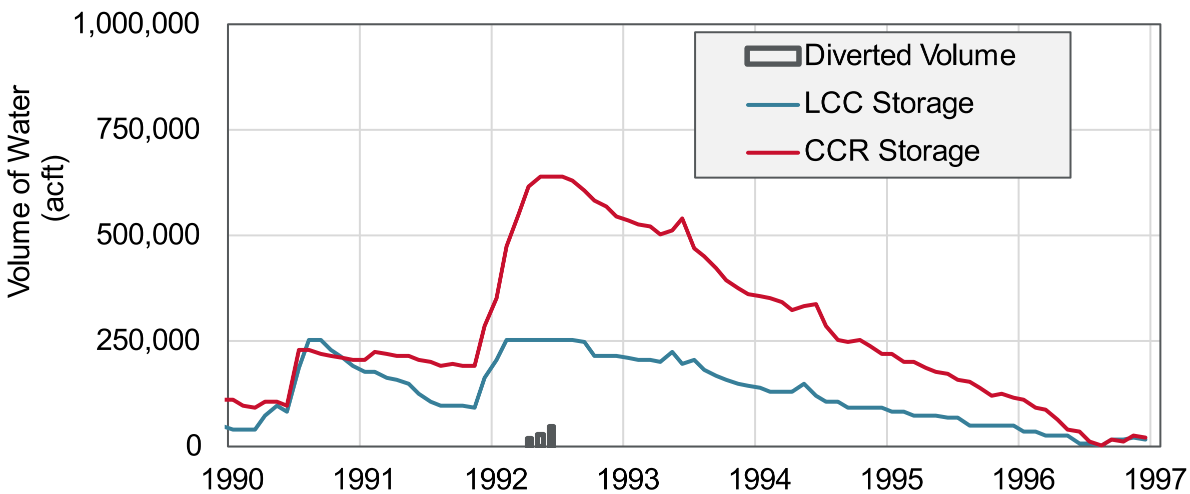

Figure 5B.11.7.
Firm yield Analysis for CCR-LCC System: Critical Drawdown Period

5B.11.3 Environmental Issues

The key environmental consideration to be made for the Diversion to CCR is in-stream environmental flow requirements. The Nueces River is the primary source of Freshwater to the Corpus Christi Bay and surrounding coastal ecosystems. These ecosystems rely on both large pulses of freshwater as well as more consistent lower flows. The environmental flow needs of downstream ecosystems have been addressed by using the TCEQ's Nueces Basin WAM when computing the volume of water available for diversion in the Nueces River. These efforts ensure that the diversion rate would comply with state regulations.

The project infrastructure possesses less potential for negative environmental impacts. The largest of these impacts would likely be from the channel dam, which is part of the intake structure. The channel dam would create a small permanent impoundment that the pump station could draw from. The proposed location of the 2.4-mile pipeline follows an existing road and runs through an area that has experienced at least some level of human disturbance previously. Temporary disruption of water quality in the Nueces River during construction of the intake structure may be a concern.

High levels of suspended solids are common during high flow events. Diverting water from the Nueces River into CCR may negatively affect the water quality of CCR because of suspended solids in the Nueces. Adding a sedimentation facility such as a ring dike to the proposed project could mitigate negative water quality effects due to suspended solids if they prove to be an issue.

5B.11.4 Engineering and Costing

The facility cost for the Diversion to Choke Canyon Reservoir is estimated to be $302,940,000. The total cost of the project is estimated to be $417,731,000. Annually, that equates to $11,939 per acft of increased average supply. The increased supply is an average over the simulation and is not a firm supply.

The key features identified for costing and planning during the 2026 cycle of regional water planning include the following items:

- Intake on the Nueces River
- Roughly 2 miles of pipeline and associated right-of-way
- Pumps and lift station, etc.
- Outfall into Choke Canyon Reservoir

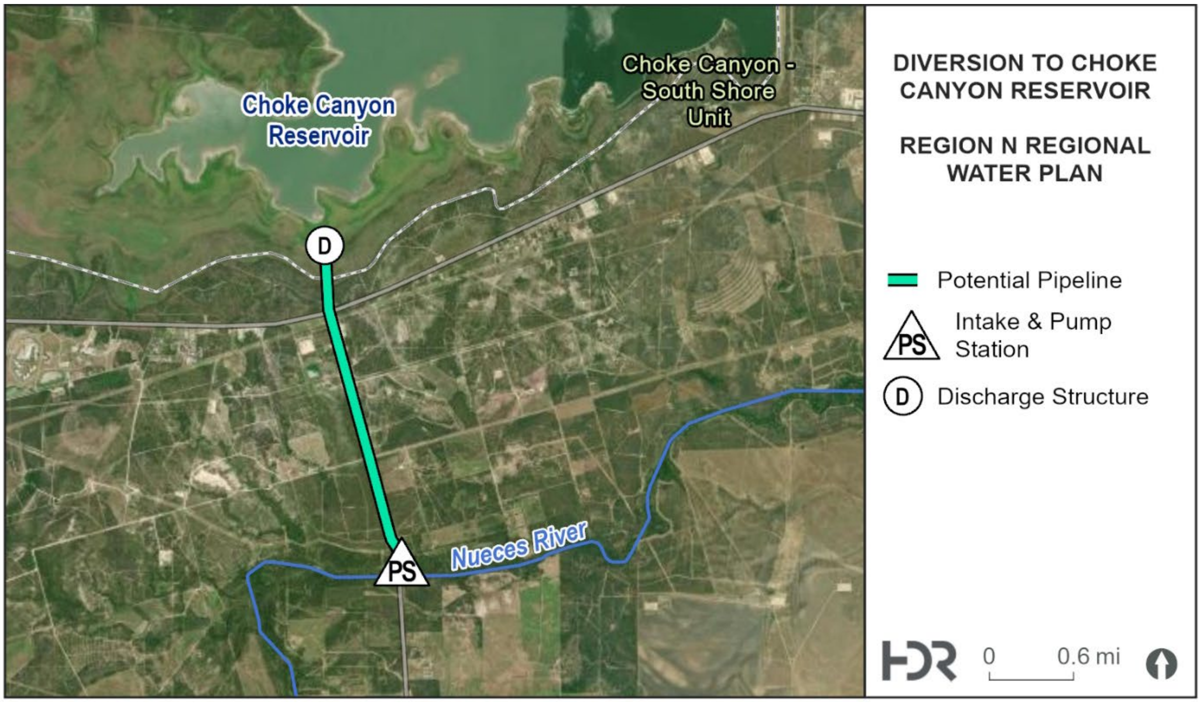

Figure 5B.11.8.
Diversion to Choke Canyon Reservoir Infrastructure

Table 5B.11.1.
Cost Estimate Summary: Diversion to Choke Canyon Reservoir

Table Units: September 2023 Dollars

Item	Estimated Costs for Facilities
CAPITAL COST	
Intake Structure Including Channel Dam	$12,609,000
Intake Pump Stations (731.7 MGD)	$166,500,000
Transmission Pipeline (144 in. dia., 4.5 miles)	$123,831,000
TOTAL COST OF FACILITIES	**$302,940,000**
Engineering:	
- Planning (3%)	$9,088,000
- Design (7%)	$21,206,000
- Construction Engineering (1%)	$3,029,000
Legal Assistance (2%)	$6,059,000
Fiscal Services (2%)	$6,059,000
Pipeline Contingency (15%)	$16,325,000
All Other Facilities Contingency (20%)	$38,822,000
Environmental & Archaeology Studies and Mitigation	$384,000
Land Acquisition and Surveying (46 acres)	$670,000
Interest During Construction (3.5% for 1 years with a 0.5% ROI)	$13,149,000
TOTAL COST OF PROJECT	**$417,731,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$29,392,000
Operation and Maintenance:	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$1,238,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$4,163,000
Dam and Reservoir (1.5% of Cost of Facilities)	$189,000
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (614050 kW-hr @ 0.09 $/kW-hr)	$55,000
TOTAL ANNUAL COST	**$35,037,000**
Additional Annual Supply (non-firm) (acft/yr)	2,939
Annual Cost of Water ($ per acft), based on PF=279	$11,923
Annual Cost of Water After Debt Service ($ per acft), based on PF=279	$1,921
Annual Cost of Water ($ per 1,000 gallons), based on PF=279	$36.58
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=279	$5.89

5B.11.5 Implementation Issues

Constructing an intake, pump station, and outfall will require a U.S. Army Corps of Engineers (USACE) Section 404 permit for modification to a navigable US waterway. Additionally, the TCEQ may need to issue a new water right for the diversion to provide any new supply. This may not be required if City of Corpus Christi only intends to use this project as a method for capturing water allocated by existing water rights. However, this additional diversion point would need to be added to the water rights by amendment. Additionally, adjusting existing water rights associated with the CCR-LRR system might affect the agreed upon order and could entail a renegotiation of environmental flows and passthrough requirements.

5B.11.6 Evaluation Summary

Table 5B.11.2 offers a summary of the Diversion to Choke Canyon Reservoir strategy.

Table 5B.11.2. Evaluation Summary of Diversion to Choke Canyon Reservoir

Impact Category	Comments
a. Water supply:	
1. Quantity	1. 2,939 acft/yr
2. Reliability	2. Non-firm
3. Cost of treated water**	3. $ 11,923 per acft
4. Estimated Water Losses	4. Decrease in water losses to evaporation
b. Environmental factors:	
1. Effects on Instream flows	1. Only used during highwater events
2. Effects on Bay and estuary inflows and arms of the Gulf of Mexico	2. Only used to capture unappropriated flow
3. Wildlife habitat	3.
4. Wetlands	4.
5. Threatened and endangered species	5.
6. Cultural resources	6.
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. Water quality i. Potential increase of suspended solids in CCR when operated
c. Impacts to Agricultural Resources or State water resources	c. 46 acres of rural land acquired for ROW
d. Threats to agriculture and natural resources in region	d. Possible oil and gas pipeline crossings; 46 acres of rural land acquired for ROW
e. Recreational impacts	e. No Impact
f. Equitable comparison of strategies	f. Followed RWP guidelines
g. Interbasin transfers	g. No interbasin transfer
h. Third party social and economic impacts from voluntary redistribution of water	h. No redistribution of water
i. Efficient use of existing water supplies and regional opportunities	i. Improves efficiency by storing water higher in the watershed
j. Effect on navigation	j. Intake structure may impede navigation of the Nueces River
k. Impacts on water pipelines and other facilities used for water conveyance	k. No known effect on water pipelines or other facilities

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5B.12

Lake Corpus Christi Sediment Removal

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Section 5B.12 Lake Corpus Christi Sediment Removal

5B.12.1 Description of Water Management Strategy

The Lake Corpus Christi Sediment Removal strategy would increase the storage capacity of Lake Corpus Christi (LCC) providing additional water supply and flood protection in the southern Nueces River Basin. The strategy also offers a sediment source for coastal restoration projects in the Nueces Delta and other areas in the nearby Corpus Christi Bay.

Lake Corpus Christi Sediment Removal was evaluated during the 2001 regional water planning cycle. The strategy was not considered in subsequent regional water plans due to its high cost and low supply it would develop. New interest in Lake Corpus Christi Sediment Removal has been spurred by recent successful projects undergone by the General Land Office (GLO) that were able to use dredged material for beneficial use in costal restoration projects. Figure 5B.12.1 shows the proposed trucking route and alternative rail route to transport the dredged sediment from LCC to the Nueces Bay, where it could be carried by barge and applied to the Nueces Delta to mitigate the effects of land subsidence and sea level rise. It should be noted that dredging would produce much more sediment than could be put to beneficial use and that a large quantity of sediment would need to be disposed of.

5B.12.2 Available Yield

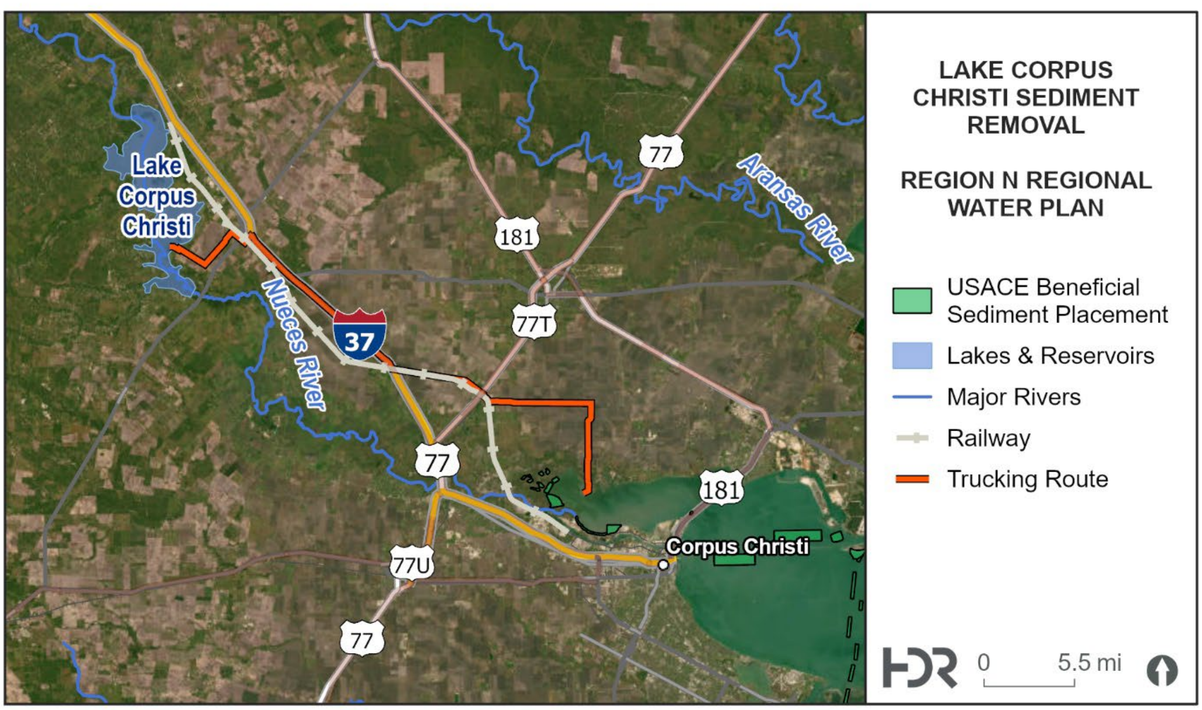

Figure 5B.12.1.
Potential Routes to Disposal Sites for Lake Corpus Christi Sediment Removal

The Lake Corpus Christi Sediment Removal strategy could potentially increase the firm yield of the Choke Canyon Reservoir-Lake Corpus Christi system (CCR-LCC System) by an estimated 2,000 acre-feet per year (ac-ft/yr). This estimate was calculated using the Texas Commission on Environmental Quality (TCEQ) Nueces Basin RUN 3 Water Availability Model (WAM) with current and proposed area-capacity relationships for the LCC-CCR System.

A sedimentation rate of 445 ac-ft/yr was applied to LCC to estimate volume lost to sedimentation by 2024. Because sedimentation in CCR also affects the yield of the system, a corresponding sedimentation rate of 944 ac-ft/yr was applied to CCR. The LCC sedimentation rate was determined from the two most recent TWDB bathymetric surveys, as shown in Table 5B.12.1. Figure 5B.12.2 displays the projected sedimentation in LCC.

Table 5B.12.1.
Sedimentation Estimates for LCC[1]

Survey	Volume at conservation pool elevation 94.0 feet (acft)					
Year of Survey	1948	1957	1972	1987	2002	2016
1948	292,758	<>	<>	<>	<>	<>
1957 re-calculated by McCaughan & Etheridge	<>	297,776	<>	<>	<>	<>
McCaughan & Etheridge 1972	<>	<>	272,352	<>	<>	<>
USGS 1987	<>	<>	<>	266,832	<>	<>
TWDB 2002 re-calculated	<>	<>	<>	<>	262,564	<>
2016 volumetric survey	256,339	256,339	256,339	256,339	256,339	256,339
Volume difference (acre-feet)	36,419 (12.4%)	41,437 (13.9%)	16,013 (5.9%)	10,493 (3.9%)	6,225 (2.4%)	<>
Number of years	68	59	44	29	14	<>
Capacity loss rate (acft/yr)	536	702	364	362	**445**	

[1] TWDB. 2017. Volumetric Survey of Lake Corpus Christi. February 2016 Survey. Table 3.

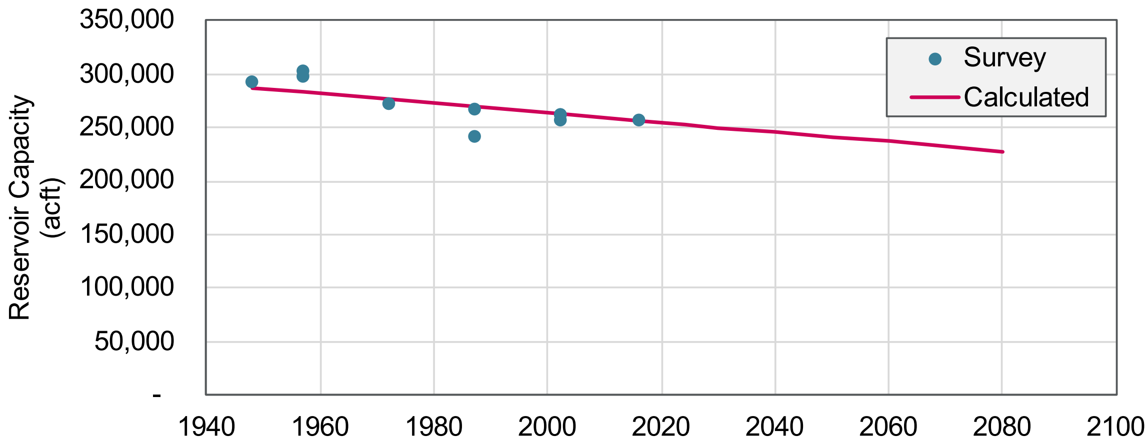

Figure 5B.12.2.
LCC Available Reservoir Storage and Decline Due to Sedimentation

Using updated, 2024 storage capacities, the firm yield of the LCC-CCR System was approximated at 173,000 ac-ft/yr using the TCEQ Nueces Basin RUN 3 WAM. A post-implementation firm yield of 175,000 ac-ft/yr was estimated by restoring LCC's storage capacity to its permitted volume of 300,000 acft in the WAM and performing the same firm yield analysis. The difference, 2,000 acre-feet (ac-ft), represents the yield of the strategy.

5B.12.3 Environmental Issues

Hydraulic dredging would likely increase the total suspended solids in LCC. In doing so, it would also increase the chance for contaminants in the sediment such as heavy metals to become biologically available. For similar reasons, sediments to be applied in beneficial use zones may be screened by comparison with TCEQ Human Health Protective Concentration Levels (PCLs). The chemical makeup of LCC sediment has been tested in the past; however, the current PCLs for many constituents such as mercury and silver are lower than the detection limits of those studies. Therefore, additional testing would be necessary to determine any hazard posed by contaminants in LCC's sediment. Remediation is not included in the estimated cost of this strategy. For this evaluation, it has been assumed that sediment could be dredged and placed without causing water quality issues.

How to dispose of sediment not applied in beneficial use zones is another environmental consideration to be made. This evaluation has assumed that dewatered sediment could be land applied up to 10 feet high. Several thousand acres would be required to store the volume of sediment removed from LCC. This would alter the landscape and drainage of a large area. To minimize the impact of sediment disposal, previously disturbed habitat, such as agricultural land or similar could be prioritized for site selection.

5B.12.4 Engineering and Costing

Cost estimates for Lake Corpus Christi Sediment Removal are based on a 2024 study performed for the GLO by Anchor QEA. This report assesses the feasibility of removing 100,000 cubic yards (CY) (62.0 ac-ft) of sediment from LCC for beneficial use. In comparison, an estimated 76 million CY (47,107 ac-ft) of sediment would need to be removed from LCC to return LCC to its permitted volume of 300,000 ac-ft. This is magnitudes larger than the Anchor QEA evaluation and other projects common in the U.S., and economies of scale may emerge that are specific to this project that might reduce the costs. To model this effect, only the costs of dredging, transporting, and contingencies were scaled up from the smaller project's cost estimates. Costs such as mobilization, access road construction, etc. were left unchanged from Anchor QEA's estimate. The total unit cost of removing sediment is assumed to be $35/CY versus the Anchor QEA's estimate of $55/CY. For an additional reference, the recent expansion of the Suez Canal, completed in 2015, dredged nearly $259 million/CY at an overall unit cost of $43/CY in September 2023 dollars[2][3].

Sediment would need to be dewatered and transported overland by truck or train to a disposal area or pumped via a slurry pipeline to a dewatering and disposal area. In the case of a slurry pipeline, water would then need to be pumped back to LCC. Alone, hydraulically dredging 76 million CY of sediment would cost $528,937,000 before dewatering, transportation, application, or contingencies at an assumed unit cost of $6.94 per CY[4]. The cost to remove 445 ac-ft of sediment per year to prevent future sedimentation has been included in the annual maintenance cost. If this strategy is implemented, further work may be needed to determine the most economical way to remove sediment after the initial dredging project. In this study, it is assumed that preventative sediment removal for maintenance would cost the same per CY as the initial project.

The largest cost associated with the strategy is transportation of the dredged material. It is assumed for this evaluation that sediment would be trucked 28 miles from LCC to the Nueces Delta for beneficial use or would be trucked a comparable distance for disposal. The trucking cost is estimated at $1,461,239,000 in September 2023 dollars, which is equivalent to $4.84 million 20-ton dump truck trips (15.7 CY capacity) over the duration of the project. This number could vary if a different mode of transportation were selected.

More sediment would be removed than can be utilized for beneficial use in the Nueces-Corpus Christi Bay area. This evaluation assumes that 25% of the removed sediment could be put to beneficial use. Land for disposal of the remaining 57 million CY is assumed to be available in

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[2] Suez Canal Authority. 2019. New Suez Canal. Facts and Figures. https://www.suezcanal.gov.eg/English/About/SuezCanal/Pages/NewSuezCanal.aspx

[3] NCESC. 2024. How much did new Suez Canal cost? https://www.ncesc.com/geographic-faq/how-much-did-new-suez-canal-cost/

[4] The unit cost provided here comes from the 2024 Anchor QEA report for the GLO but has been indexed to September 2023 dollars

Live Oak County at the cost of $5,800 per acre. Assuming that dewatered sediment could be stored up to 10 feet tall, roughly 3,542 acres would be required for disposal.

The total project cost is estimated to be $2.67 billion, costing $228 million annually. With a firm yield of 2,000 ac-ft/yr, the unit cost of water is $114,005 per ac-ft, or $349.81 for one thousand gallons.

The key features of the Lake Corpus Christi Sediment Removal strategy that were identified for planning and costing for the *2026 Coastal Bend Regional Water Plan* are the following:

- Dredging
- Transport of dredged material
- Dewatering and staging
- Site construction for staging
- Land acquisition for disposal
- Sediment distribution

Table 5B.12-2.
Cost Estimate Summary: Lake Corpus Christi Sediment Removal

Table Unit: September 2023 Dollars

Item	Estimated Costs for Facilities
CAPITAL COST	
Land Acquisition for Terminal Storage of Sediment	$19,479,000
Dredging and Transportation of Sediment	$1,652,934,000
TOTAL COST OF FACILITIES	**$1,672,413,000**
Engineering:	
- Planning (3%)	$50,172,000
- Design (7%)	$117,069,000
- Construction Engineering (1%)	$16,724,000
Legal Assistance (2%)	$33,448,000
Fiscal Services (2%)	$33,448,000
All Other Facilities Contingency (20%)	$334,483,000
Environmental & Archaeology Studies and Mitigation	$20,541,000
Land Acquisition and Surveying (3542 acres)	$20,754,000
Interest During Construction (3.5% for 5 years with a 0.5% ROI)	$373,597,000
TOTAL COST OF PROJECT	**$2,672,649,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$182,522,000
Reservoir Debt Service (3.5 percent, 40 years)	$3,679,000
Operation and Maintenance:	-
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$41,516,000
Dam and Reservoir (1.5% of Cost of Facilities)	$292,000
TOTAL ANNUAL COST	**$228,009,000**
Available Project Yield (ac-ft/yr)	2,000
Annual Cost of Water ($ per ac-ft), based on PF=1	$114,005
Annual Cost of Water After Debt Service ($ per ac-ft), based on PF=1	$20,904
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$349.81
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$64.14

5B.12.5 Implementation Issues

Dredging projects in navigable waters of the United States such as this require a Clean Water Act, Section 404 permit from the U.S. Army Corps of Engineers (USACE). Additionally, distribution of removed sediment for coastal restoration would likely require USACE authorization under Section 10 of the Rivers and Harbors Act of 1899, as structure is being constructed in navigable waters of the US. Water quality impacts from the dredging and distribution of sediment may warrant a Section 401 permit from the USACE under the Clean Water Act. The above permitting requirements would require a National Environmental Policy Act (NEPA) environmental assessment (EA) and potentially a biological assessment (BA). The results of those assessment determine if an environmental impact statement (EIS) will be required for the Section 404 permit. The removal of Sediment from LCC may require a Sand and Gravel Permit from the Texas Parks and Wildlife Department (TPWD). Coordination with the Texas Historical Commission will likely be required but will be performed during the permitting process with the USACE. Compliance is required with water quality regulation set by the Lower Nueces River Watershed Partnership (LNRWP), the City of Corpus Christi, and the Nueces River Authority.

5B.12.6 Evaluation Summary

Lake Corpus Christi Sediment Removal would improve the storage capacity of LCC, which would offer additional water supply as a well as provide improved floodwater mitigation. However, the strategy would be expensive, with a total project cost of $2.7 billion. It would offer 2,000 ac-ft/yr of additional water supply at the price of $114,005 per ac-ft, or $228 million annually. Sediment removal would more than meet the needs of all beneficial use projects in the area, meaning that a great deal of sediment would need to be disposed of in other locations. Further investigation would need to be performed on sediment to ensure that no harmful chemicals would be released by dredging. Table 5B.12-3 provides a breakdown of the strategy’s notable elements and considerations.

Table 5B.12-3. Evaluation Summary of Lake Corpus Christi Sediment Removal

Impact Category	Comments
a. Water supply:	
1. Quantity	1. 2,000 ac-ft/yr
2. Reliability	2. Firm
3. Cost of raw water**	3. $ 114,005 per ac-ft
4. Estimated Water Losses	4. Decrease in water losses to evaporation
b. Environmental factors:	
1. Effects on Instream flows	1. Mitigated by system operations
2. Effects on Bay and estuary inflows and arms of the Gulf of Mexico	2. Mitigated by system operations
3. Wildlife habitat	3. Temporary degradation; long-term improvement
4. Wetlands	4. Temporary degradation, long-term improvement
5. Threatened and endangered species	5. The presence of T&E species would need to be identified during NEPA process.
6. Cultural resources	6. Impacts to cultural resources would primarily due to construction of transportation and disposal facilities and would be mitigated during project execution.
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. Water quality i. Temporary increase in suspended solids during dredging ii. Potential release of heavy metals and other contaminants during dredging, dewatering, and disposal.
c. Impacts to Agricultural Resources or State water resources	c. No state-level impacts to agricultural or natural resources. Potential improvement to agricultural lands if sediment is land-applied.
d. Threats to agriculture and natural resources in region	d. No regional threat to agriculture or natural resources
e. Recreational impacts	e. Temporary impact only
f. Equitable comparison of strategies	f. Followed RWP guidelines
g. Interbasin transfers	g. No interbasin transfer
h. Third party social and economic impacts from voluntary redistribution of water	h. No redistribution of water
i. Efficient use of existing water supplies and regional opportunities	i. Improves efficiency by creating more storage per surface area
j. Effect on navigation	j. No effect on navigation
k. Impacts on water pipelines and other facilities used for water conveyance	k. No effect on water pipelines or other facilities

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Section 5C Conservation Recommendations

Regional water planning guidelines require each region to consider water conservation to meet projected shortages, although funding to implement such water conservation programs is limited. Conservation is shown as a recommended strategy for all water user groups with needs identified for the planning period. The CBRWPG adopted the following conservation recommendations for the 2026 Coastal Bend Regional Water Plan during their meeting on January 30, 2025:

- Manufacturing water user groups with water demands in their respective categories were recommended to voluntarily reduce water use by 15 percent by 2080 regardless of need. These WUGs report the largest identified needs in the region by category and were recommended to continue to pursue best management practices to reduce water consumption.

Industries in the Coastal Bend Region have a good history of implementing water conservation practices, and report some of the lowest water use in the state per barrel of crude produced. The City of Corpus Christi directly, and indirectly through SPMWD, provides most water for manufacturing WUGs with identified needs during the projection period.

- Mining water user groups with water demands in their respective categories were recommended to voluntarily reduce water use by 15 percent by 2080 regardless of need. Mining companies are continuing to make advancements in water conservation into their processes by constructing and operating non-commercial recycling ponds to provide additional water supply. These activities are regulated by the Texas Railroad Commission, and recycled water use from these ponds varies from 15 percent to 70 percent.

- Conservation recommendations were not made for livestock water user groups, similar to the previous planning cycles.

- Additional conservation for irrigation water user groups was not requested for this planning cycle, as a result of the region showing a decline in water needs (approximately 50 percent less) due to field efficiency achieved with saving water. Although irrigated acreage declined statewide by approximately 2.3 million acres in 2021, the agricultural census indicates that irrigated acreage in the 11-county Coastal Bend area totaled 26,010 acres, with 82 percent of the regional total occurring in Bee, Duval, and San Patricio counties. Table 5C.1 summarizes the variety of crops grown in the Coastal Bend Region and number of irrigated acres for each county in 2021.

Table 5C.1.
Irrigated Acres by Crop (2021) Coastal Bend Region

County	Corn	Cotton	Hay	Sorghum	Vegetables	Other*	Total Acres
Aransas	0	0	0	0	0	0	0
Bee	2,130	2,610	60	2,050	0	250	7,100
Brooks	0	0	440	0	160	50	650
Duval	0	0	3000	0	750	600	4,350
Jim Wells	0	0	550	0	650	530	1,730
Kenedy	0	0	0	0	0	0	0
Kleberg	0	0	330	0	0	0	330
Live Oak	550	470	360	110	0	0	1,490
McMullen	0	0	120	0	0	0	120
Nueces	0	10	40	30	0	410	490
San Patricio	1,880	4,180	20	3,510	160	0	9,750
Total Acres	**4,560**	**7,270**	**4,920**	**5,700**	**1,720**	**1,840**	**26,010**
Percent	**17.53%**	**27.95%**	**18.92%**	**21.91%**	**6.61%**	**7.07%**	

Source: TWDB Historical Agricultural Irrigation Water Use Estimates, 2021
*Other Category: represents crops not captured in an existing TWDB crop category; the “Other” crop category historically includes greenhouse and nursery operations.

- Municipal WUGs with per capita rates exceeding 140 gallons per person per day (gpcd) were recommended to voluntarily reduce per capita consumption by 1 percent annually through 2080 until a 140 gpcd rate is attained. This recommendation from the CBRWPG applies to all municipal WUGs with and without projected water supply needs (or shortage). Although the CBRWPG considered the recommendations of the Water Conservation Advisory Council (WCAC) report to the 88th Texas Legislature[2]; however, the WCAC methodology of calculating the estimated dry-year planning gpcd resulted in a projected gpcd reduction in the later planning decades that might not be realistic for some of the municipal WUGs.

A summary was prepared of common municipal water conservation best management practices appropriate for the region (Table 5C.2) and recommended 5- and 10-year water conservation targets (Table 5C.3). TWDB-provided information on implemented municipal water conservation programs in the Coastal Bend Region based on annual reports submitted by water user groups to TWDB is presented in Table 5C.4 through Table 5C.6. The CBRWPG recommends that water user groups in the region review the list and look to identify water user groups of a relevant size with similar water supply type and consider voluntary implementation of those best management practices, if applicable.

A Coastal Bend Region-specific model water conservation plan for municipal water users is included in Appendix D. These model plans include a list of best management practices in the

[2] *Progress Made in Water Conservation in Texas:* Report and Recommendations to the 88th Texas Legislature, Water Conservation Advisory Council, December 2022.

region, to supplement TCEQ model water conservation plans found on TCEQ's website: https://www.tceq.texas.gov/permitting/water_rights/wr_technical-resources/conserve.html

Table 5C.2. Summary of Water Conservation BMPs in the Coastal Bend Region

Wholesale Water Provider	WCP Available	Date	Best Management Practices							
			Reduce Water Losses/Unaccounted for Water/Leak Detection	Water Conservation Pricing/Seasonal or Inverted Block Rates	Reuse	Improve Meter Accuracy	Toilet Replacement/ Retrofit Programs	Public/School Education	Landscape Conservation/Xeriscape	Others
City of Corpus Christi[1]	Y	2020	√	√	√	√		√	√	√
San Patricio Municipal Water District[1]	Y	2019	√	√	√	√		√	√	√
South Texas Water Authority[1]	Y	2018	√	√		√		√		
Nueces County WCID 3[1,2]	Y	2019	√	√	√	√	√	√		
Water User Group										
Alice[1]	Y	2024	√	√	√	√		√	√	
Aransas Pass	Y	2019	√	√		√	√	√	√	
Beeville[1]	Y	2024	√	√	√	√		√		
El Oso WSC	Y	2008	√	√		√		√		√
Falfurrias[1]	Y	1999	√	√		√		√	√	
Holiday Beach WSC[1]	Y	2018	√	√	√	√	√		√	
Ingleside[1]	Y	2018	√	√	√	√		√	√	√
Kingsville[1]	Y	2018	√	√	√	√		√	√	
Lamar Improvement District[1]	Y	2024	√	√		√		√		
McCoy WSC[1,2]	Y	2014	√	√		√		√		
Nueces County WCID 4[1]	Y	2019	√	√	√	√		√	√	
Nueces WSC[1]	Y	2018	√	√		√		√		
Odem[1]	Y	2013	√	√		√		√	√	√
Portland[1]	Y	2022	√	√	√	√	√	√	√	
Ricardo WSC[1]	Y	2018	√	√		√		√		
River Acres WSC[1,2]	Y	2021	√	√		√		√		
Robstown[2]	Y	2011						√		
Rockport[2]	Y	2015	√	√	√	√				
Taft[1]	Y	2013	√	√	√	√	√	√	√	
Three Rivers[2]	Y	2019	√	√	√	√		√	√	√

[1] Water Conservation Plan on-file with the Nueces River Authority.
[2] Water Conservation Plan provided by the TWDB.

Table 5C.3. Summary of 5- and 10-Year Water Conservation Goals in the Coastal Bend Region

Wholesale Water Provider	5-Year Goal		10-Year Goal	
	GPCD Target	General	GPCD Target	General
City of Corpus Christi[1,2,3]	195[2]	1% annual reduction over next decade & reduce summertime peak demand	184[2]	1% annual reduction over next decade & reduce summertime peak demand
San Patricio Municipal Water District[1]	141	1% annual reduction over next decade	134	1% annual reduction over next decade
South Texas Water Authority[1]	140-145	Not Available	140-145	Not Available
Nueces County WCID 3[1,2]	103	Not Available	108	Not Available
Water User Group				
Alice[1]	145	Reduce per capita use by 3%	141	Reduce per capita use by 3%
Aransas Pass[2]	225	2.5% per capita	260	5% per capita
Beeville[1]	161	1% annual reduction over next decade	160	1% annual reduction over next decade
Corpus Christi[1,2,3]	195	1% annual reduction over next decade	184	1% annual reduction over next decade
El Oso WSC	N/A	Reduce water loss	N/A	Reduce water loss
Falfurrias[1]	N/A	Not Available	N/A	Not Available
Holiday Beach WSC[1]	58	Reduce water loss	56	Reduce water loss
Ingleside[1]	106	1% reduction in water loss and usage within the next 5 years	105	2% within the next 10 years
Kingsville[1,2]	130	1% annual reduction	125	1% annual reduction
Lamar Improvement District[1]	150	Reduce water loss	145	Reduce water loss
McCoy WSC[1]	115	Maintain current per capita usage; Reduce water loss to 4% of water pumped, line flushing/fire fighting	110	Reduce usage by 4.5%; Reduce water loss to 2% of water pumped, not including line flushing/fire fighting
Nueces County WCID 4[1,2]	396	1% annual reduction over next decade	376	1% annual reduction over next decade
Nueces WSC[1]	118	Maintain current per capita usage	118	Maintain current per capita usage
Odem[1]	149	5% over the next 10 years	146	7% reduction in unaccounted-for water over the next 10 years
Portland[1]	88	5% reduction	84	10% reduction
Ricardo WSC[1]	95	Maintain current per capita usage	95	Maintain current per capita usage
River Acres WSC[1]	100	1% annual reduction	99	1% annual reduction
Robstown[2]	N/A	Not Available	N/A	Not Available
Rockport	107	Maintain unaccounted water in the system below 12% annually in 2016 and subsequent years and reduce other water demands	107	Maintain unaccounted water in the system below 12% annually in 2016 and subsequent years and reduce other water demands
Taft[1]	147	Reduce per capita use by 3%	140	Reduce per capita use by 3%
Three Rivers[3]	386	0.5% annual reduction	377	0.5% annual reduction

[1] Water Conservation Plan on-file with the Nueces River Authority.
[2] Information is from the 2019/2020 Water Conservation Plans, Target and Goal Table, provided by the TWDB.
[3] Calculated by taking volume of treated water, excluding water sold to wholesale customers, and dividing by permanent population, divided by 365. Because industrial use is close to 40% of treated water, the per capita rate is higher.

N/A = Not Available

Table 5C.4.
Summary of Water Conservation Implementation Results (2023 Water Use Survey and 2022 Annual Report sent by Utility to TWDB)

Utility Name	Retail Populations	Gallons Saved	Gallons Reused
City of Alice	17,891	0	66,702,930
City of Aransas Pass	10,651	6,000,000	0
City of Beeville	15,612	3,500,000	0
City of Corpus Christi	325,406	*	52,787,862
City of Kingsville	26,213	100,000	0
City of Portland	23,046	160,530,000	10,500,000
City of Rockport	38,269	155,000,000	98,445,000
City of Three Rivers	4,411	0	13,966,575
Nueces County WCID 3	19,000	7,000,000	0
Nueces County WCID 4	3,024	485,000	0
River Acres WSC	2,500	330,000	0

*Data not included in City's 2022 TWDB Annual Report or 2023 TWDB Water Use Survey

Table 5C.5. Details on BMPs Implemented

Utility Provider	Total Estimated Gallons Reused	Total Estimated Gallons Saved	Best Management Practices Category							
			Landscaping	Conservation Technology & Reuse	Financial	System Operations	Education and Public Awareness	Regulatory and Enforcement	Retail	Conservation Analysis and Planning
City of Alice	66,702,930	0	Golf Course Conservation and Park Conservation	Reuse for Plant Washdown	Water Conservation Pricing	Metering New Connections and Retrofitting Existing Connections; System Water Audit and Loss Control	School Education; Public Information	-	Other	-
City of Aransas Pass	0	6,000,000	-	-	-	Metering New Connections and Retrofitting Existing Connections	School Education; Public Information	-	-	-
City of Beeville	0	3,500,000	Golf Course Conservation and Park Conservation; Outdoor Watering Schedule	Reuse for On-site Irrigation, Plant Washdown, Chlorination/ Dechlorination	Water Conservation Pricing	Metering New Connections and Retrofitting Existing Connections; System Water Audit and Loss Control	School Education; Public Information	-	-	-
City of Corpus Christi	52,787,862	*	Irrigation Consultation Program; Golf Course and Park Conservation	-	Water Conservation Pricing	System Water Audit and Loss Control	School Education	Prohibition on Wasting Water	-	-

Utility Provider	Total Estimated Gallons Reused	Total Estimated Gallons Saved	Best Management Practices Category							
			Landscaping	Conservation Technology & Reuse	Financial	System Operations	Education and Public Awareness	Regulatory and Enforcement	Retail	Conservation Analysis and Planning
City of Kingsville	0	100,000	-	-	-	Metering New Connections and Retrofitting Existing Connections; System Water Audit and Loss Control	School Education; Public Information	-	-	-
City of Portland	10,500,000	160,530,000	Landscape Irrigation Conservation and Incentives	Reuse for Chlorination /Dechlorination	Water Conservation Pricing	Metering New Connections and Retrofitting Existing Connections; System Water Audit and Loss Control	Public Information	Prohibition on Wasting Water	-	-
City of Rockport	98,445,000	155,000,000	Golf Course Conservation	Reuse for Chlorination /Dechlorination ; Reuse for On-site Irrigation; Reuse for Plant Washdown	Water Conservation Pricing	System Water Audit and Loss Control	School Education; Public Information	Prohibition on Wasting Water	-	-
City of Three Rivers	13,966,575	0	-	Reuse for Plant Washdown	-	-	School Education; Public Information	-	Other	Conservation Coordinator
Lamar Improvement District	-	Not listed	-	-	Water Conservation Pricing	System Water Audit and Loss Control	School Education; Public Information	-	-	-

Utility Provider	Total Estimated Gallons Reused	Total Estimated Gallons Saved	Best Management Practices Category							
			Landscaping	Conservation Technology & Reuse	Financial	System Operations	Education and Public Awareness	Regulatory and Enforcement	Retail	Conservation Analysis and Planning
Nueces County WCID 3	0	0	Golf Course Conservation; Outdoor Watering Schedule	-	Water Conservation Pricing	Metering New Connections and Retrofitting Existing Connections; System Water Audit and Loss Control	School Education; Public Information	Prohibition on Wasting Water	-	Cost Effective Analysis
Nueces County WCID 4	0	485,000	Athletic Fields and Golf Course Conservation; Outdoor Watering Schedule	-	-	Metering New Connections and Retrofitting Existing Connections; System Water Audit and Loss Control	Public Information	-	Other	Cost Effective Analysis; Conservation Coordinator
Nueces WSC	-	Not listed	-	-	Water Conservation Pricing	Metering of All Connections; System Water Audit and Loss Control	School Education; Public Information	Prohibition on Wasting Water	-	-
Ricardo WSC	-	Not listed	-	-	Water Conservation Pricing	Metering of All Connections; System Water Audit and Loss Control	School Education; Public Information	Prohibition on Wasting Water	-	-
River Acres WSC	-	330,000	Golf Course Conservation; Landscape Irrigation Conservation and Incentives	-	-	New AMR metering for all Connections; System Water Audit and Loss Control	Public Information	Enforcement of Irrigation Standards	-	Conservation Coordinator

*Data not included in City's 2022 TWDB Annual Report or 2023 TWDB Water Use Survey

Table 5C.6.
Summary of Rate Structures Implemented to Encourage Conservation

Utility Name	Summary of Implemented Rate Structures
City of Alice	Non-promotional Rates
City of Beeville	Non-promotional Rates
City of Corpus Christi	Uniform Rates, Water Budget Based Rates, Other
City of Portland	Excess Use Rates, Drought Demand Rates (updated January 2020)
City of Rockport	Inclining/Inverted Block Rates, Drought Demand Rates
City of Taft	Uniform Rates
City of Three Rivers	Water Budget Based Rates
Lamar Improvement District	Inclining Block Rates, Drought Demand Rates
Nueces County WCID 3	Uniform Rates
Nueces WSC	Inclining Block Rates, Drought Demand Rates
Ricardo WSC	Inclining Block Rates, Drought Demand Rates
River Acres WSC	Uniform Rates

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Section 5D Water Supply Plans

5D.1 Coastal Bend Water Supply Plan

This section includes water supply plans for each of the 11-counties in the Coastal Bend Region, as well as wholesale water providers (Section 5D.14) for the planning period from 2030 to 2080. Section 5D.15 discusses Implementation Status and Timeline for Selected Projects, a new provision for 2026 Regional Water Plans.

5D.2 Aransas County Water Supply Plan

Table 5D.1 lists each water user group in Aransas County and their corresponding surplus or shortage in years 2050 and 2080. 2080 For each WUG, a water supply plan is presented in the following subsections. There are no projected shortages for Aransas County water user groups.

Table 5D.1.
Aransas County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1]		Comment
	2050 (ac-ft/yr)	2080 (ac-ft/yr)	
City of Aransas Pass	0	0	Supply equals demand
Rincon WSC	0	0	Supply equals demand
City of Rockport	0	0	Supply equals demand
County-Other	0	0	Supply equals demand
Manufacturing	none	none	No demands projected
Steam-Electric	none	none	No demands projected
Mining	none	none	No demands projected
Irrigation	none	none	No demands projected
Livestock	0	0	Supply equals demand

[1] From Tables 4A.2 and 4A.3, Chapter 4A – Comparison of Water Demands with Water Supplies to Determine Needs.

5D.2.1 City of Aransas Pass

The City of Aransas Pass is located in Aransas, Nueces, and San Patricio Counties. Aransas Pass contracts with the San Patricio Municipal Water District (SPMWD) to purchase treated water. The contract allows the City of Aransas Pass to purchase only the water that it needs. No shortages are projected for the City of Aransas Pass across all three counties.

5D.2.3 City of Rockport

The City of Rockport has a contract with the SPMWD to purchase treated water. The contract allows the City of Rockport to purchase only the water that it needs. No shortages in annual water supplies are projected for the City of Rockport; however, additional water conservation is a recommended water management strategy for the city (Table 5D.2).

Table 5D.2.
Recommended Water Supply Plan for the City of Rockport

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Municipal Water Conservation	0	300	340	332	325	318
New Balance	**0**	**300**	**340**	**332**	**325**	**318**

Estimated costs of the recommended plan for the City of Rockport are shown in Table 5D.3.

Table 5D.3.
Recommended Plan Costs by Decade for the City of Rockport

Plan Element	2030	2040	2050	2060	2070	2080
Municipal Water Conservation (Chapter 5D.1)						
Annual Cost ($/yr)	$0	$173,100	$196,180	$191,564	$187,525	$183,486
Unit Cost ($/ac-ft)*	$577	$577	$577	$577	$577	$577

* Unit costs for this plan element are rounded.

5D.2.4 County-Other

County-Other in Aransas County obtains water from the SPMWD and a small amount from the Gulf Coast Aquifer (approximately 10 percent demand). No shortages in annual water supplies are projected for Aransas County-Other and no changes in water supply are recommended.

5D.2.5 Manufacturing

No manufacturing demand exists or is projected for the county.

5D.2.6 Steam-Electric

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

5D.2.7 Mining

No mining demand exists or is projected for the county.

5D.2.8 Irrigation

No irrigation demand exists or is projected for the county.

5D.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.

5D.3 Bee County Water Supply Plan

Table 5D.4 lists each water user group in Bee County and their corresponding surplus or shortage in years 2050 and 2080. For each WUG with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 5D.4.
Bee County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1]		Comment
	2050 (ac-ft/yr)	2080 (ac-ft/yr)	
City of Beeville	0	0	Supply equals demand
El Oso WSC	0	0	Supply equals demand
Pettus MUD	0	0	Supply equals demand
Skidmore WSC	(27)	(44)	Projected Shortage – see plan below
TDCJ Chase Field	(2)	(2)	Projected shortage – see plan below
County-Other	(1,181)	(518)	Projected shortage – see plan below
Manufacturing	none	none	No demands projected
Steam-Electric	none	none	No demands projected
Mining	(25)	(79)	Projected shortage – see plan below
Irrigation	0	0	Supply equals demand
Livestock	0	0	Supply equals demand

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

5D.3.1 City of Beeville

The City of Beeville obtains water from contracts with the City of Corpus Christi to purchase raw water from the Choke Canyon Reservoir/Lake Corpus Christi System (CCR/LCC System) water supply and from the Gulf Coast Aquifer. The contract with the City of Corpus Christi allows the City of Beeville to purchase only the water that it needs. No shortages are projected for the City of Beeville; however, additional water conservation is a recommended water management strategy for the city (Table 5D.5).

Table 5D.5.
Recommended Water Supply Plan for the City of Beeville

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Municipal Water Conservation	0	272	552	839	889	945
Brackish Groundwater Deslination	4,204	4,204	4,204	4,204	4,204	4,204
New Balance	**4,204**	**4,476**	**4,756**	**5,043**	**5,093**	**5,149**

Estimated costs of the recommended plan for the City of Beeville are shown in Table 5D.6.

Table 5D.6.
Recommended Plan Costs by Decade for the City of Beeville

Plan Element	2030	2040	2050	2060	2070	2080
Municipal Water Conservation (Chapter 5D.1)						
Annual Cost ($/yr)	$0	$156,681	$318,558	$484,281	$513,049	$545,171
Unit Cost ($/ac-ft)*	$577	$577	$577	$577	$577	$577
City of Beeville Brackish Groundwater Deslination (Chapter 5D.9)						
Annual Cost ($/yr)	$16,340,948	$16,340,948	$9,244,596	$9,244,596	$9,244,596	$9,244,596
Unit Cost ($/ac-ft)*	$3,887	$3,887	$2,199	$2,199	$2,199	$2,199

* Unit costs for this plan element are rounded.

5D.3.2 El Oso Water Supply Corporation

El Oso Water Supply Corporation (WSC) is located in Bee and Live Oak counties, with the majority of demand located in Live Oak County. See Live Oak County for the El Oso WSC plan.

5D.3.3 Pettus Municipal Utility District

Pettus Municipal Utility District (MUD) demands are met with groundwater from the Gulf Coast Aquifer. No shortages are projected for Pettus MUD and no changes in water supply are recommended.

5D.3.4 Skidmore Water Supply Corporation

Skidmore WSC obtains water from the Gulf Coast Aquifer. Shortages are projected as early as 2030 with the current supply capacity being just under 81 acre-feet per year (ac-ft/yr) and projected 2030 demand being 103 ac-ft/yr. The following water management strategies are recommended for Skidmore WSC.

Table 5D.7.
Recommended Water Supply Plan for Skidmore WSC

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	(22)	(24)	(27)	(32)	(38)	(44)
Recommended Plan						
Municipal Water Conservation	0	0	0	0	1	0
Drill New Well	44	44	44	44	44	44
Total New Supply	**44**	**44**	**44**	**44**	**45**	**44**
New Balance	**22**	**20**	**17**	**12**	**7**	**0**

Estimated costs of the recommended plan for County-Other entities are shown in Table 5D.8.

Table 5D.8.
Recommended Plan Costs by Decade for the City of Beeville

Plan Element	2030	2040	2050	2060	2070	2080
Municipal Water Conservation (Chapter 5D.1)						
Annual Cost ($/yr)	$0	$233	$153	$234	$530	$281
Unit Cost ($/ac-ft)*	$580	$580	$580	$580	$580	$580
Drill New Well (Chapter 5D.8.1)						
Annual Cost ($/yr)	$100,980	$100,980	$26,004	$26,004	$26,004	$26,004
Unit Cost ($/ac-ft)*	$2,295	$2,295	$591	$591	$591	$591

* Unit costs for this plan element are rounded.

5D.3.5 TDCJ Chase Field

TDCJ Chase Field obtains water supply from the Gulf Coast Aquifer. Shortages are projected for the entity beginning in 2030 and continuing through 2080. The following water management strategies are recommended for TDCJ Chase Field (Table 5D.9).

Table 5D.9.
Recommended Water Supply Plan for TDCJ Chase Field

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	(5)	(2)	(2)	(2)	(2)	(2)
Recommended Plan						
Municipal Water Conservation	0	121	233	334	426	509
Drill New Well	5	5	5	5	5	5
Total New Supply	**5**	**126**	**238**	**339**	**431**	**514**
New Balance	**0**	**124**	**236**	**337**	**429**	**512**

Estimated costs of the recommended plan for County-Other entities are shown in Table 5D.10.

Table 5D.10.
Recommended Plan Costs by Decade for TDCJ Chase Field

Plan Element	2030	2040	2050	2060	2070	2080
Municipal Water Conservation (Chapter 5D.1)						
Annual Cost ($/yr)	$0	$70,180	$135,140	$193,720	$247,080	$295,220
Unit Cost ($/ac-ft)*	$580	$580	$580	$580	$580	$580
Drill New Well (Chapter 5D.8.1)						
Annual Cost ($/yr)	$100,000	$100,000	$25,000	$25,000	$25,000	$25,000
Unit Cost ($/ac-ft)*	$20,000	$20,000	$5,000	$5,000	$5,000	$5,000

* Unit costs for this plan element are rounded.

5D.3.6 County-Other

Bee County-Other entities obtain water supply from the Gulf Coast Aquifer. Shortages are projected beginning in 2030 and continuing through 2080. The following water management strategies are recommended for County-Other entities (Table 5D.11).

Table 5D.11.
Recommended Water Supply Plan for Bee County-Other

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	(1,426)	(1,337)	(1,181)	(984)	(765)	(518)
Recommended Plan						
Drill New Well	1,426	1,426	1,426	1,426	1,426	1,426
Total New Supply	**1,426**	**1,426**	**1,426**	**1,426**	**1,426**	**1,426**
New Balance	**25**	**0**	**0**	**0**	**0**	**0**

Estimated costs of the recommended plan for County-Other entities are shown in Table 5D.12.

Table 5D.12.
Recommended Plan Costs by Decade for Bee County-Other

Plan Element	2030	2040	2050	2060	2070	2080
Drill New Well (Chapter 5D.8.1)						
Annual Cost ($/yr)	$567,548	$567,548	$185,380	$185,380	$185,380	$185,380
Unit Cost ($/ac-ft)*	$398	$398	$130	$130	$130	$130

* Unit costs for this plan element are rounded.

5D.3.7 Manufacturing

No manufacturing demand exists or is projected for the county.

5D.3.8 Steam-Electric

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

5D.3.9 Mining

Mining supply in Bee County is obtained through groundwater from the Gulf Coast Aquifer. Shortages are projected for mining throughout the planning period. The following water management strategies are recommended for mining entities in Bee County (Table 5D.13).

Table 5D.13.
Recommended Water Supply Plan for Bee County Mining

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	(25)	(25)	(25)	(25)	(25)	-
Recommended Plan						
Mining Water Conservation	6	12	18	24	30	0
Drill New Well	25	25	25	25	25	25
Total New Supply	**31**	**37**	**43**	**49**	**55**	**25**
New Balance	**6**	**12**	**18**	**24**	**30**	**25**

Estimated costs of the recommended plan for mining entities are shown in Table 5D.14.

Table 5D.14.
Recommended Plan Costs by Decade for Bee County Mining

Plan Element	2030	2040	2050	2060	2070	2080
Mining Water Conservation (Chapter 5D.4)						
Annual Cost ($/yr)	ND	ND	ND	ND	ND	ND
Unit Cost ($/ac-ft)	ND	ND	ND	ND	ND	ND
Drill New Well (Chapter 5D.8.1)						
Annual Cost ($/yr)	$80,000	$80,000	$8,000	$8,000	$8,000	$8,000
Unit Cost ($/ac-ft)*	$3,200	$3,200	$320	$320	$320	$320

* Unit costs for this plan element are rounded. ND = Not Determined due to high variability in costs associated with mining BMPs.

5D.3.10 Irrigation

Irrigation supply in Bee County is obtained through groundwater from the Gulf Coast Aquifer. No shortages are projected for irrigation and no changes in water supply are recommended.

5D.3.11 Livestock

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

5D.4 Brooks County Water Supply Plan

Table 5D.15 lists each water user group in Brooks County and their corresponding surplus or shortage in years 2050 and 2080. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 5D.15.
Brooks County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1]		Comment
	2050 (ac-ft/yr)	2080 (ac-ft/yr)	
City of Falfurrias	0	0	Supply equals demand
County-Other	(234)	(101)	Projected shortage – see plan below
Manufacturing	none	none	No demands projected
Steam-Electric	none	none	No demands projected
Mining	0	0	Supply equals demand
Irrigation	0	0	Supply equals demand
Livestock	0	0	Supply equals demand

[1] From Tables 4A.6 and 4A.7, Chapter 4A – Comparison of Water Demands with Water Supplies to Determine Needs.

5D.4.1 City of Falfurrias

The City of Falfurrias receives groundwater supplies from the Gulf Coast Aquifer. No shortages are projected for the City of Falfurrias; however, additional water conservation is a recommended water management strategy (Table 5D.16).

Table 5D.16.
Recommended Water Supply Plan for the City of Falfurrias

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Municipal Water Conservation	0	107	207	302	395	494
New Balance	0	107	207	302	395	494

Estimated costs of the recommended plan for the City of Falfurrias are shown in Table 5D.17.

Table 5D.17.
Recommended Plan Costs by Decade for the City of Falfurrias

Plan Element	2030	2040	2050	2060	2070	2080
Municipal Water Conservation (Chapter 5D.1)						
Annual Cost ($/yr)	$0	$62,216	$120,233	$174,878	$228,945	$286,649
Unit Cost ($/ac-ft)*	$580	$580	$580	$580	$580	$580

* Unit costs for this plan element are rounded.

5D.4.2 County-Other

The Brooks County-Other municipal users receive groundwater supplies from the Gulf Coast Aquifer. Shortages are projected for Brooks County-Other throughout the planning period. The following water management strategy is recommended (Table 5D.18).

Table 5D.18.
Recommended Water Supply Plan for Brooks County-Other

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	(281)	(262)	(234)	(198)	(155)	(101)
Recommended Plan						
Drill New Well	281	281	281	281	281	281
Total New Supply	281	281	281	281	281	281
New Balance	0	19	47	**83**	**126**	**180**

Estimated costs of the recommended plan for County-Other users are shown in Table 5D.19.

Table 5D.19.
Recommended Plan Costs by Decade for Brooks County-Other

Plan Element	2030	2040	2050	2060	2070	2080
Drill New Well (Chapter 5D.8.1)						
Annual Cost ($/yr)	$127,012	$127,012	$50,018	$50,018	$50,018	$50,018
Unit Cost ($/ac-ft)*	$452	$452	$178	$178	$178	$178

* Unit costs for this plan element are rounded.

5D.4.3 Manufacturing

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

5D.4.4 Steam-Electric

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

5D.4.5 Mining

Brooks County mining users receive groundwater supplies from the Gulf Coast Aquifer. Shortages are projected for mining users throughout the planning period. The following water management strategies are recommended (Table 5D.20).

Table 5D.20.
Recommended Water Supply Plan for Brooks County Mining

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Mining Water Conservation	0	1	1	2	2	2
Total New Supply	**0**	**1**	**1**	**2**	**2**	**2**
New Balance	**0**	**1**	**1**	**2**	**2**	**2**

Estimated costs of the recommended plan for irrigation users are shown in Table 5D.21.

Table 5D.21.
Recommended Plan Costs by Decade for Brooks County Mining

Plan Element	2030	2040	2050	2060	2070	2080
Mining Water Conservation (Chapter 5D.4)						
Annual Cost ($/yr)	ND	ND	ND	ND	ND	ND
Unit Cost ($/ac-ft)	ND	ND	ND	ND	ND	ND

* Unit costs for this plan element are rounded. ND = Not Determined due to high variability in costs associated with mining BMPs.

5D.4.6 Irrigation

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

5D.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 livestock and no changes in water supply are recommended.

5D.5 Duval County Water Supply Plan

Table 5D.22 lists each water user group in Duval County and their corresponding surplus or shortage in years 2050 and 2080. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 5D.22.
Duval County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1]		Comment
	2050 (ac-ft/yr)	2080 (ac-ft/yr)	
Duval County CRD	0	0	Supply equals demand
Freer WCID	0	0	Supply equals demand
San Diego MUD 1	0	0	Supply equals demand
County-Other	(199)	(113)	Projected shortage – see plan below
Manufacturing	none	none	No demands projected
Steam-Electric	none	none	No demands projected
Mining	0	0	Supply equals demand
Irrigation	0	0	Supply equals demand
Livestock	0	0	Supply equals demand

[1] From Tables 4A.8 and 4A.9, Chapter 4A – Comparison of Water Demands with Water Supplies to Determine Needs.

5D.5.1 Duval County Conservation and Reclamation District

Duval County Conservation and Reclamation District (CRD) receives groundwater supplies from the Gulf Coast Aquifer. No shortages are projected for Duval County CRD and no changes in water supply are recommended.

5D.5.2 Freer Water Control and Improvement District

Freer Water Control and Improvement District (WCID) receives groundwater supplies from the Gulf Coast Aquifer. No shortages are projected for Freer WCID; however, additional water conservation is a recommended water management strategy for the WCID (Table 5D.23). See Section 5C for more details.

Table 5D.23.
Recommended Water Supply Plan for Freer WCID

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Municipal Water Conservation	0	43	79	108	115	108
New Balance	**0**	**43**	**79**	**108**	**115**	**108**

Estimated costs of the recommended plan for Freer WCID are shown in Table 5D.24.

Table 5D.24.
Recommended Plan Costs by Decade for Freer WCID

Plan Element	2030	2040	2050	2060	2070	2080
Municipal Water Conservation (Chapter 5D.1)						
Annual Cost ($/yr)	$0	$24,940	$45,820	$62,640	$66,700	$62,640
Unit Cost ($/ac-ft)*	$580	$580	$580	$580	$580	$580

* Unit costs for this plan element are rounded.

5D.5.3 San Diego Municipal Utility District 1

San Diego MUD 1 is located in Duval and Jim Well counties; however, its water supply plan is presented here. The City of San Diego obtains groundwater supplies from the Goliad Sands of the Gulf Coast Aquifer.

Shortages are projected for San Diego MUD 1. There are sufficient Gulf Coast Aquifer supplies to drill an additional well without exceeding Modeled Available Groundwater (MAG) constraints. The recommended water supply management plan for the MUD is shown in Table 5D.25.

Table 5D.25.
Recommended Water Supply Plan for San Diego MUD 1

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	(102)	(106)	(111)	(116)	(123)	(131)
Recommended Plan						
Municipal Water Conservation	0	62	87	88	89	93
Total New Supply	**131**	**193**	**218**	**219**	**220**	**224**
New Balance	**29**	**87**	**107**	**103**	**97**	**93**

Estimated costs of the recommended plan for San Diego MUD 1 are shown in Table 5D.26.

Table 5D.26.
Recommended Plan Costs by Decade for San Diego MUD 1

Plan Element	2030	2040	2050	2060	2070	2080
Municipal Water Conservation (Chapter 5D.1)						
Annual Cost ($/yr)	$0	$36,051	$50,313	$50,802	$51,396	$53,822
Unit Cost ($/ac-ft)*	$580	$580	$580	$580	$580	$580
Drill New Well (Chapter 5D.8.1)						
Annual Cost ($/yr)	$91,962	$91,962	$34,977	$34,977	$34,977	$34,977
Unit Cost ($/ac-ft)	$702	$702	$267	$267	$267	$267

* Unit costs for this plan element are rounded.

The City of Alice has run a 16-inch water transmission line to Highway 281 bypass, approximately 8 to 9 miles from the City of San Diego. This pipeline could be extended to provide water supply from the City of Alice to San Diego. Although this is not a recommended strategy, it could provide an alternative supply to the City of San Diego.

5D.5.4 County-Other

Shortages are projected for Duval County-Other municipal users beginning in 2030. The recommended water supply management plan for County-Other is shown in Table 5D.27. There are sufficient Gulf Coast Aquifer supplies to meet shortages without exceeding MAG constraints.

Table 5D.27.
Recommended Water Supply Plan for Duval County-Other

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	(253)	(223)	(199)	(179)	(151)	(113)
Recommended Plan						
Gulf Coast Aquifer Supplies	253	253	253	253	253	253
Total New Supply	**253**	**253**	**253**	**253**	**253**	**253**
New Balance	**0**	**30**	**54**	**74**	**102**	**140**

Estimated costs of the recommended plan for Duval County-Other are shown in Table 5D.28.

Table 5D.28.
Recommended Plan Costs by Decade for Duval County-Other

Plan Element	2030	2040	2050	2060	2070	2080
Drill New Well (Chapter 5D.8.1)						
Annual Cost ($/yr)	$158,125	$158,125	$52,877	$52,877	$52,877	$52,877
Unit Cost ($/ac-ft)	$625	$625	$209	$209	$209	$209

* Unit costs for this plan element are rounded.

5D.5.5 Manufacturing

No manufacturing demand exists or is projected for the county.

5D.5.6 Steam-Electric

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

5D.5.7 Mining

No shortages are projected for Duval County mining; however, mining conservation is recommended.

Table 5D.29.
Recommended Water Supply Plan for Duval County Mining

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Mining Water Conservation	0	0	0	1	1	1
Total New Supply	**0**	**0**	**0**	**1**	**1**	**1**
New Balance	**0**	**0**	**0**	**1**	**1**	**1**

Estimated costs of the recommended plan for Duval County Mining are shown in Table 5D.30.

Table 5D.30.
Recommended Plan Costs by Decade for Duval County Mining

Plan Element	2030	2040	2050	2060	2070	2080
Mining Water Conservation (Chapter 5D.4)						
Annual Cost ($/yr)	ND	ND	ND	ND	ND	ND
Unit Cost ($/ac-ft)	ND	ND	ND	ND	ND	ND

* Unit costs for this plan element are rounded.
ND = Not Determined due to high variability in costs associated with mining BMPs.

5D.5.8 Irrigation

Irrigation demands are met by groundwater from the Gulf Coast Aquifer. No shortages are projected for irrigation and no changes in water supply are recommended.

5D.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 livestock and no changes in water supply are recommended.

5D.6 Jim Wells County Water Supply Plan

Table 5D.31 lists each water user group in Jim Wells County and their corresponding surplus or shortage in years 2050 and 2080. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 5D.31. Jim Wells County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1]		Comment
	2050 (ac-ft/yr)	2080 (ac-ft/yr)	
City of Alice	0	0	Supply equals demand
Jim Wells County FWSD 1	0	0	Supply equals demand
City of Orange Grove	0	0	Supply equals demand
City of Premont	0	0	Supply equals demand
San Diego MUD 1			See Duval County
County-Other	(1,159)	(82)	Projected shortage – see plan below
Manufacturing	(14)	(25)	Projected shortage – see plan below
Steam-Electric	none	none	No demands projected
Mining	none	none	No demands projected
Irrigation	0	0	Supply equals demand
Livestock	0	0	Supply equals demand

[1] From Tables 4A.10 and 4A.11, Chapter 4A – Comparison of Water Demands with Water Supplies to Determine Needs.

5D.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 Findley, 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; however, additional water conservation is a recommended water management strategy for the city (Table 5D.32).

Table 5D.32. Recommended Water Supply Plan for the City of Alice

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Municipal Water Conservation	0	389	793	900	953	1,017
New Balance	**0**	**389**	**793**	**900**	**953**	**1,017**

Estimated costs of the recommended plan for the City of Alice are shown in Table 5D.33.

Table 5D.33. Recommended Plan Costs by Decade for the City of Alice

Plan Element	2030	2040	2050	2060	2070	2080
Municipal Water Conservation (Chapter 5D.1)						
Annual Cost ($/yr)	0	$224,453	$457,561	$519,300	$549,881	$586,809
Unit Cost ($/ac-ft)*	$577	$577	$577	$577	$577	$577

* Unit costs for this plan element are rounded.

5D.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; however, additional water conservation is a recommended water management strategy for the city (Table 5D.34).

Table 5D.34. Recommended Water Supply Plan for the City of Orange Grove

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Municipal Water Conservation	0	33	63	88	111	128
New Balance	**0**	**33**	**63**	**88**	**111**	**128**

Estimated costs of the recommended plan for the City of Orange Grove are shown in Table 5D.35.

Table 5D.35. Recommended Plan Costs by Decade for the City of Orange Grove

Plan Element	2030	2040	2050	2060	2070	2080
Municipal Water Conservation (Chapter 5D.1)						
Annual Cost ($/yr)	$0	$19,140	$36,540	$51,040	$64,380	$74,240
Unit Cost ($/ac-ft)*	$580	$580	$580	$580	$580	$580

* Unit costs for this plan element are rounded.

5D.6.3 City of Premont

The City of Premont's water supply is from the Gulf Coast Aquifer. No shortages are projected for the City of Premont; however, additional water conservation is a recommended water management strategy for the city (Table 5D.36).

Table 5D.36.
Recommended Water Supply Plan for the City of Premont

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Municipal Water Conservation	0	50	96	135	171	179
New Balance	**0**	**50**	**96**	**135**	**171**	**179**

Estimated costs of the recommended plan for the City of Premont are shown in Table 5D.37.

Table 5D.37.
Recommended Plan Costs by Decade for the City of Premont

Plan Element	2030	2040	2050	2060	2070	2080
Municipal Water Conservation (Chapter 5D.1)						
Annual Cost ($/yr)	$0	$29,000	$55,680	$78,300	$99,180	$103,820
Unit Cost ($/ac-ft)*	$580	$580	$580	$580	$580	$580

* Unit costs for this plan element are rounded.

5D.6.4 City of San Diego

The City of San Diego is in both Duval and Jim Wells Counties. See Duval County for the city's water management plan.

5D.6.5 County-Other

Jim Wells County-Other municipal users receive groundwater supplies from the Gulf Coast Aquifer. Shortages are projected for Jim Wells County-Other beginning in 2030. The recommended water supply management plan for County-Other municipal users is shown in Table 5D.38. There are sufficient Gulf Coast Aquifer supplies to meet shortages without exceeding MAG constraints.

Table 5D.38.
Recommended Water Supply Plan for Jim Wells County-Other

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	(1,621)	(1,409)	(1,159)	(840)	(484)	(82)
Recommended Plan						
Gulf Coast Aquifer Supplies	1,621	1,621	1,621	1,621	1,621	1,621
New Balance	**0**	**212**	**462**	**781**	**1,137**	**1,539**

Estimated costs of the recommended plan for Jim Wells County-Other are shown in Table 5D.39.

Table 5D.39.
Recommended Plan Costs by Decade for Jim Wells County-Other

Plan Element	2030	2040	2050	2060	2070	2080
Drill New Well (Chapter 5D.8.1)						
Annual Cost ($/yr)	$846,162	$846,162	$228,561	$228,561	$228,561	$228,561
Unit Cost ($/ac-ft)*	$522	$522	$141	$141	$141	$141

* Unit costs for this plan element are rounded.

5D.6.6 Manufacturing

Jim Wells manufacturing users receive groundwater supplies from the Gulf Coast Aquifer. Shortages are projected for manufacturing entities beginning in 2030. The recommended water supply management plan for Jim Wells manufacturing is shown in Table 5D.40. There are sufficient Gulf Coast Aquifer supplies to meet shortages without exceeding MAG constraints.

Table 5D.40.
Recommended Water Supply Plan for Jim Wells County Manufacturing

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	(8)	(11)	(14)	(17)	(21)	(25)
Recommended Plan						
Manufacturing Water Conservation	2	5	7	10	13	16
Gulf Coast Aquifer Supplies	25	25	25	25	25	25
Total New Supply	**27**	**30**	**32**	**35**	**38**	**41**
New Balance	**19**	**19**	**18**	**18**	**17**	**16**

Estimated costs of the recommended plan for Jim Wells County Manufacturing are shown in Table 5D.41.

Table 5D.41.
Recommended Plan Costs by Decade for Jim Wells County Manufacturing

Plan Element	2030	2040	2050	2060	2070	2080
Manufacturing Water Conservation (Chapter 5D.3)						
Annual Cost ($/yr)	ND	ND	ND	ND	ND	ND
Unit Cost ($/ac-ft)	ND	ND	ND	ND	ND	ND
Drill New Well (Chapter 5D.8.1)						
Annual Cost ($/yr)	$75,000	$75,000	$23,000	$23,000	$23,000	$23,000
Unit Cost ($/ac-ft)*	$3,000	$3,000	$920	$920	$920	$920

* Unit costs for this plan element are rounded.
ND = Not Determined due to high variability in costs associated with manufacturing BMPs.

5D.6.7 Steam-Electric

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

5D.6.8 Mining

No mining demand exists in Jim Wells County..

5D.6.9 Irrigation

Irrigation demands are met by groundwater from the Gulf Coast Aquifer. No shortages are projected for irrigation and no changes in water supply are recommended.

5D.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 livestock and no changes in water supply are recommended.

5D.7 Kenedy County Water Supply Plan

Table 5D.42 lists each water user group in Kenedy County and their corresponding surplus or shortage in years 2050 and 2080. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 5D.42.
Kenedy County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1]		Comment
	2050 (ac-ft/yr)	2080 (ac-ft/yr)	
County-Other	0	0	Supply equals demand
Manufacturing	none	none	No demands projected
Steam-Electric	none	none	No demands projected
Mining	0	0	Supply equals demand
Irrigation	none	none	No demands projected
Livestock	0	0	Supply equals demand

[1] From Tables 4A.12 and 4A.13, Chapter 4A – Comparison of Water Demands with Water Supplies to Determine Needs.

5D.7.1 County-Other

The Kenedy County-Other municipal users receive groundwater supplies from the Gulf Coast Aquifer. No shortages are projected for Kenedy County-Other entities; however, additional water conservation is a recommended water management strategy for the entity (Table 5D.43).

Table 5D.43.
Recommended Water Supply Plan for Kenedy County-Other

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Municipal Water Conservation	0	16	27	37	43	48
New Balance	**0**	**16**	**27**	**37**	**43**	**48**

Estimated costs of the recommended plan for Kenedy County-Other are shown in Table 5D-44.

Table 5D-44.
Recommended Plan Costs by Decade for Kenedy County-Other

Plan Element	2030	2040	2050	2060	2070	2080
Municipal Water Conservation (Chapter 5D.1)						
Annual Cost ($/yr)	$0	$9,280	$15,660	$21,460	$24,940	$27,840
Unit Cost ($/ac-ft)*	$580	$580	$580	$580	$580	$580

* Unit costs for this plan element are rounded.

5D.7.2 Manufacturing

No manufacturing demand exists or is projected for the county.

5D.7.3 Steam-Electric

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

5D.7.4 Mining

Kenedy County mining users receive groundwater supplies from the Gulf Coast Aquifer. No shortages are projected for mining and no changes in water supply are recommended.

5D.7.5 Irrigation

No irrigation demand exists or is projected for the county.

5D.7.6 Livestock

The livestock water demands in Kenedy 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.

5D.8 Kleberg County Water Supply Plan

Table 5D.45 lists each water user group in Kleberg County and their corresponding surplus or shortage in years 2050 and 2080. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 5D.45. Kleberg County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1]		Comment
	2050 (ac-ft/yr)	2080 (ac-ft/yr)	
Baffin Bay WSC	0	0	Supply equals demand
City of Kingsville	0	0	Supply equals demand
Naval Air Station Kingsville	0	0	Supply equals demand
Ricardo WSC	0	0	Supply equals demand
Riviera Water System	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	0	0	Supply equals demand
Irrigation	0	0	Supply equals demand
Livestock	0	0	Supply equals demand

[1] From Tables 4A.14 and 4A.15, Chapter 4A – Comparison of Water Demands with Water Supplies to Determine Needs.

5D.8.1 Baffin Bay Water Supply Corporation

Baffin Bay WSC's water supply is from the Gulf Coast Aquifer. No shortages are projected for the WSC and no changes in water supply are recommended.

5D.8.2 City of Kingsville

The City of Kingsville has a contract with the STWA to purchase treated surface water from the CCR/LCC/Texana/MRP Phase II System. The city also has five wells with a combined capacity of 3.7 million gallons per day (mgd) (or 4,130 ac-ft/yr) that pump groundwater from the Gulf Coast Aquifer. No shortages are projected for Kingsville; however, the City of Kingsville will receive 10 percent of the Ricardo Well Project's yield.

Table 5D.46. Recommended Water Supply Plan for City of Kingsville

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Gulf Coast Aquifer Supplies	505	505	505	505	505	505
New Balance	**505**	**505**	**505**	**505**	**505**	**505**

Estimated costs of the recommended plan for City of Kingsville are shown in Table 5D.47.

Table 5D.47.
Recommended Plan Costs by Decade for City of Kingsville

Plan Element	2030	2040	2050	2060	2070	2080
Drill New Well (Chapter 5D.8.1)						
Annual Cost ($/yr)	$11,838	$11,838	$4,116	$4,116	$4,116	$4,116
Unit Cost ($/ac-ft)*	$2,114	$2,114	$735	$735	$735	$735

5D.8.3 Naval Air Station Kingsville

The Naval Air Station in Kingsville obtains water supply from the Gulf Coast Aquifer. No shortages are projected for the air station; however, additional water conservation is a recommended water management strategy (Table 5D.48).

Table 5D.48.
Recommended Water Supply Plan for Naval Air Station Kingsville

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Municipal Water Conservation	0	26	50	75	99	120
New Balance	**0**	**26**	**50**	**75**	**99**	**120**

Estimated costs of the recommended plan for the Naval Air Station in Kingsville are shown in Table 5D.49.

Table 5D.49.
Recommended Plan Costs by Decade for Naval Air Station Kingsville

Plan Element	2030	2040	2050	2060	2070	2080
Municipal Water Conservation (Chapter 5D.1)						
Annual Cost ($/yr)	$0	$15,080	$29,000	$43,500	$57,420	$69,600
Unit Cost ($/ac-ft)*	$580	$580	$580	$580	$580	$580

* Unit costs for this plan element are rounded.

5D.8.4 Ricardo WSC

STWA provides water to the Ricardo Water Supply Corporation via a direct 12-inch transmission line that became operational in December 2013. Ricardo WSC demands are met with surface water supplies. No shortages are projected for Ricardo WSC; however, Ricardo WSC is diversifying their water supply with groundwater resources.

Table 5D.50.
Recommended Water Supply Plan for Ricardo WSC

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Gulf Coast Aquifer Supplies	505	505	505	505	505	505
New Balance	**505**	**505**	**505**	**505**	**505**	**505**

Estimated costs of the recommended plan for Ricardo WSC are shown in Table 5D.51.

Table 5D.51.
Recommended Plan Costs by Decade for Ricardo WSC

Plan Element	2030	2040	2050	2060	2070	2080
Drill New Well (Chapter 5D.8.1)						
Annual Cost ($/yr)	$1,065,456	$1,065,456	$370,440	$370,440	$370,440	$370,440
Unit Cost ($/ac-ft)*	$2,114	$2,114	$735	$735	$735	$735

* Unit costs for this plan element are rounded.

5D.8.5 Riviera Water System

The Riviera Water System obtains groundwater supplies from the Gulf Coast Aquifer. No shortages are projected for the water system and no changes in water supply are recommended.

5D.8.6 County-Other

Kleberg County-Other receives groundwater supplies from the Gulf Coast Aquifer and some surface water supplies from nearby water providers, including the City of Kingsville. No shortages are projected for the Kleberg County-Other; however, additional water conservation is a recommended water management strategy for this entity (Table 5D.52).

Table 5D.52.
Recommended Water Supply Plan for Kleberg County-Other

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Municipal Water Conservation	0	8	8	8	8	9
New Balance	**0**	**8**	**8**	**8**	**8**	**9**

Estimated costs of the recommended plan for Kleberg County-Other are shown in Table 5D.53.

Table 5D.53.
Recommended Plan Costs by Decade for Kleberg County-Other

Plan Element	2030	2040	2050	2060	2070	2080
Municipal Water Conservation (Chapter 5D.1)						
Annual Cost ($/yr)	$0	$4,640	$4,640	$4,640	$4,640	$5,220
Unit Cost ($/ac-ft)*	$580	$580	$580	$580	$580	$580

* Unit costs for this plan element are rounded.

5D.8.7 Manufacturing

Kleberg County manufacturing use, identified by the TWDB, is supplied by groundwater from the Gulf Coast Aquifer. Shortages are projected for manufacturing users beginning in 2040. The recommended water supply management plan is shown in Table 5D.54.

Table 5D.54.
Recommended Water Supply Plan for Kleberg County Manufacturing

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Manufacturing Water Conservation	27	56	88	121	157	196
Total New Supply	**27**	**56**	**88**	**121**	**157**	**196**
New Balance	**27**	**56**	**88**	**121**	**157**	**196**

Estimated costs of the recommended plan for Kleberg County Manufacturing are shown in Table 5D.55.

Table 5D.55.
Recommended Water Supply Plan for Kleberg County Manufacturing

Plan Element	2030	2040	2050	2060	2070	2080
Manufacturing Water Conservation (Chapter 5D.3)						
Annual Cost ($/yr)	ND	ND	ND	ND	ND	ND
Unit Cost ($/ac-ft)	ND	ND	ND	ND	ND	ND

ND = Not determined due to high variability in costs associated with manufacturing BMPs.

5D.8.8 Steam-Electric

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

5D.8.9 Mining

Mining water demands in Kleberg County are met by groundwater from the Gulf Coast Aquifer. No shortages are projected for Kleberg County Mining; however, mining water conservation is recommended. The recommended water supply management plan is shown in Table 5D.56.

Table 5D.56.
Recommended Water Supply Plan for Kleberg County Mining

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Mining Water Conservation	0	1	1	1	1	2
Total New Supply	**0**	**1**	**1**	**1**	**1**	**2**
New Balance	**0**	**1**	**1**	**1**	**1**	**2**

Estimated costs of the recommended plan for Kleberg County Mining are shown in Table 5D.57.

Table 5D.57.
Recommended Water Supply Plan for Kleberg County Mining

Plan Element	2030	2040	2050	2060	2070	2080
Mining Water Conservation (Chapter 5D.4)						
Annual Cost ($/yr)	ND	ND	ND	ND	ND	ND
Unit Cost ($/ac-ft)	ND	ND	ND	ND	ND	ND

ND = Not determined due to high variability in costs associated with mining BMPs.

5D.8.10 Irrigation

Irrigation demands are met by groundwater from the Gulf Coast Aquifer. No shortages are projected for irrigation and no changes in water supply are recommended.

5D.8.11 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 livestock and no changes in water supply are recommended.

5D.9 Live Oak County Water Supply Plan

Table 5D.58 lists each water user group in Live Oak County and their corresponding surplus or shortage in years 2050 and 2080. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 5D.58.
Live Oak County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1]		Comment
	2050 (ac-ft/yr)	2080 (ac-ft/yr)	
El Oso WSC	(94)	(90)	Projected shortage – see plan below
City of George West	0	0	Supply equals demand
McCoy WSC	0	0	Supply equals demand
Old Marbach School WSC	0	0	Supply equals demand
City of Three Rivers	0	0	Supply equals demand
County-Other	0	0	Supply equals demand
Manufacturing	(28)	(28)	Projected shortage – see plan below
Steam-Electric	0	0	Supply equals demand
Mining	0	0	Supply equals demand
Irrigation	(534)	(534)	Projected shortage – see plan below
Livestock	0	0	Supply equals demand

[1] From Tables 4A.16 and 4A.17, Chapter 4A – Comparison of Water Demands with Water Supplies to Determine Needs.

5D.9.1 El Oso Water Supply Corporation

El Oso Water Supply Corporation is located in both Bee and Live Oak counties, with the majority of demand located in Live Oak County. The El Oso Water Supply Corporation receives groundwater supplies from the Gulf Coast Aquifer. No shortages are projected for El Oso WSC in Bee County during the planning period; however, municipal water conservation is recommended. The recommended water supply management plan is shown in Table 5D.59.

Table 5D.59.
Recommended Water Supply Plan for El Oso WSC

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Municipal Water Conservation	0	12	29	44	58	76
Total New Supply	**0**	**12**	**29**	**44**	**58**	**76**
New Balance	**0**	**12**	**29**	**44**	**58**	**76**

Estimated costs of the recommended plan for El Oso WSC are shown in Table 5D.60.

Table 5D.60.
Recommended Water Supply Plan for El Oso WSC

Plan Element	2030	2040	2050	2060	2070	2080
Municipal Water Conservation (Chapter 5D.1)						
Annual Cost ($/yr)	$0	$6,960	$16,820	$25,520	$33,640	$44,080
Unit Cost ($/ac-ft)*	$580	$580	$580	$580	$580	$580

* Unit costs for this plan element are rounded.

5D.9.2 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; however, additional water conservation is a recommended water management strategy for the City (Table 5D.61).

Table 5D.61.
Recommended Water Supply Plan for the City of George West

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Municipal Water Conservation	0	25	29	27	25	23
New Balance	**0**	**25**	**29**	**27**	**25**	**23**

Estimated costs of the recommended plan for the City of George West are shown in Table 5D.62.

Table 5D.62.
Recommended Plan Costs by Decade for the City of George West

Plan Element	2030	2040	2050	2060	2070	2080
Municipal Water Conservation (Chapter 5D.1)						
Annual Cost ($/yr)	$0	$14,500	$16,820	$15,660	$14,500	$13,340
Unit Cost ($/ac-ft)*	$580	$580	$580	$580	$580	$580

* Unit costs for this plan element are rounded.

5D.9.3 McCoy WSC

McCoy WSC's demands are met with groundwater from the Carrizo-Wilcox Aquifer. No shortages are projected for McCoy WSC and no changes in water supply are recommended.

5D.9.1 Old Marbach School WSC

Old Marbach School WSC's demands are met with groundwater from the Gulf Coast Aquifer. No shortages are projected for Old Marbach School WSC and no changes in the water supply are recommended.

5D.9.4 City of Three Rivers

The City of Three Rivers' demands are met with stored water from Choke Canyon Reservoir through contract with the City of Corpus Christi. No shortages are projected for Three Rivers; however, additional water conservation is a recommended water management strategy for the City (Table 5D.63). Note that numbers shown below are positive and represent surpluses.

Table 5D.63.
Recommended Water Supply Plan for the City of Three Rivers

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	2,184	2,089	1,983	1,873	1,760	1,639
Recommended Plan						
Municipal Water Conservation	0	30	30	31	29	31
New Balance	**2,184**	**2,119**	**2,013**	**1,904**	**1,789**	**1,670**

Estimated costs of the recommended plan for the City of Three Rivers are shown in Table 5D.64.

Table 5D.64.
Recommended Plan Costs by Decade for the City of Three Rivers

Plan Element	2030	2040	2050	2060	2070	2080
Municipal Water Conservation (Chapter 5D.1)						
Annual Cost ($/yr)	$0	$17,400	$17,400	$17,980	$16,820	$17,980
Unit Cost ($/ac-ft)*	$580	$580	$580	$580	$580	$580

* Unit costs for this plan element are rounded.

5D.9.5 County-Other

Live Oak County-Other municipal users receive groundwater supplies from the Gulf Coast Aquifer. Shortages are projected for Live Oak County-Other throughout the planning period. The recommended water supply management plan for County-Other municipal users is shown in Table 5D.65. There are sufficient Gulf Coast Aquifer supplies to meet shortages without exceeding MAG constraints.

Table 5D.65.
Recommended Water Supply Plan for Live Oak County-Other

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	(198)	(173)	(164)	(178)	(191)	(202)
Recommended Plan						
Gulf Coast Aquifer Supplies	202	202	202	202	202	202
New Balance	**4**	**29**	**38**	**24**	**11**	**0**

Estimated costs of the recommended plan for Live Oak County-Other are shown in Table 5D.66.

Table 5D.66.
Recommended Plan Costs by Decade for Live Oak County-Other

Plan Element	2030	2040	2050	2060	2070	2080
Drill New Well (Chapter 5D.8.1)						
Annual Cost ($/yr)	$138,976	$138,976	$46,056	$46,056	$46,056	$46,056
Unit Cost ($/ac-ft)*	$688	$688	$228	$228	$228	$228

* Unit costs for this plan element are rounded.

5D.9.6 Manufacturing

Live Oak County manufacturing users receive groundwater supplies from the Gulf Coast Aquifer and surface water supplies from run-of-river rights in the Nueces Basin. The re are no shortages projected for Live Oak County manufacturing; however, manufacturing conservation is a recommend strategy. The recommended water supply management plan is shown in Table 5D.67.

Table 5D.67.
Recommended Water Supply Plan for Live Oak County Manufacturing

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Manufacturing Water Conservation	71	147	229	317	411	511
Total New Supply	**71**	**147**	**229**	**317**	**411**	**511**
New Balance	**71**	**147**	**229**	**317**	**411**	**511**

Estimated costs of the recommended plan for Live Oak County Manufacturing are shown in Table 5D.68.

Table 5D.68.
Recommended Water Supply Plan for Live Oak County Manufacturing

Plan Element	2030	2040	2050	2060	2070	2080
Manufacturing Water Conservation (Chapter 5D.3)						
Annual Cost ($/yr)	ND	ND	ND	ND	ND	ND
Unit Cost ($/ac-ft)	ND	ND	ND	ND	ND	ND

ND = Not Determined due to high variability in costs associated with manufacturing BMPs.

5D.9.7 Steam-Electric

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

5D.9.8 Mining

Live Oak County mining users receive groundwater supplies from the Gulf Coast Aquifer. No shortages are projected for Live Oak Mining and no changes in water supply are recommended; however, surpluses are projected by 2080.

Table 5D.69.
Recommended Water Supply Plan for Live Oak County Mining

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	1,262
Recommended Plan						
Mining Water Conservation	32	63	95	126	158	0
Total New Supply	**32**	**63**	**95**	**126**	**158**	**0**
New Balance	**32**	**63**	**95**	**126**	**158**	**1,262**

Estimated costs of the recommended plan for Live Oak County Mining are shown in Table 5D.70.

Table 5D.70.
Recommended Water Supply Plan for Live Oak County Mining

Plan Element	2030	2040	2050	2060	2070	2080
Mining Water Conservation (Chapter 5D.3)						
Annual Cost ($/yr)	ND	ND	ND	ND	ND	ND
Unit Cost ($/ac-ft)	ND	ND	ND	ND	ND	ND

5D.9.9 Irrigation

Live Oak County irrigation users receive groundwater supplies from the Gulf Coast Aquifer and surface water supplies in 2030. No shortages are projected for Live Oak County Irrigation and no changes in water supply are recommended.

5D.9.10 Livestock

The livestock demands in Live Oak 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.

5D.10 McMullen County Water Supply Plan

Table 5D.71 lists each water user group in McMullen County and their corresponding surplus or shortage in years 2050 and 2080. No water supply shortages are projected for McMullen County throughout the planning period.

Table 5D.71.
McMullen County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1]		Comment
	2050 (ac-ft/yr)	2080 (ac-ft/yr)	
County-Other	0	0	Supply equals demand
Manufacturing	0	0	No demands projected
Steam-Electric	none	none	No demands projected
Mining	0	0	Supply equals demand
Irrigation	0	0	Supply equals demand
Livestock	0	0	Supply equals demand

[1] From Tables 4A.18 and 4A.19, Chapter 4A – Comparison of Water Demands with Water Supplies to Determine Needs.

5D.10.1 County-Other

The McMullen County-Other municipal users receive groundwater supplies from the Carrizo Aquifer. No shortages are projected for McMullen County-Other entities and no changes in water supply are recommended.

5D.10.2 Manufacturing

Manufacturing users in McMullen County obtain groundwater from the Gulf Coast Aquifer. No shortages are projected for McMullen County Manufacturing entities; however, manufacturing water conservation is a recommended water management strategy. The recommended water supply management plan is shown in Table 5D.72.

Table 5D.72.
Recommended Water Supply Plan for McMullen County Manufacturing

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Manufacturing Water Conservation	1	2	3	3	4	5
Total New Supply	**1**	**2**	**3**	**3**	**4**	**5**
New Balance	**1**	**2**	**3**	**3**	**4**	**5**

Estimated costs of the recommended plan for McMullen County Manufacturing are shown in Table 5D.73.

Table 5D.73.
Recommended Water Supply Plan for McMullen County Manufacturing

Plan Element	2030	2040	2050	2060	2070	2080
Manufacturing Water Conservation (Chapter 5D.3)						
Annual Cost ($/yr)	ND	ND	ND	ND	ND	ND
Unit Cost ($/ac-ft)	ND	ND	ND	ND	ND	ND

5D.10.3 Steam-Electric

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

5D.10.4 Mining

Mining users in McMullen County obtain water from the Carrizo, Gulf Coast, Queen City, and Sparta aquifers. No shortages are projected for McMullen County Mining entities; however, surpluses are projected by 2080. The recommended water supply management plan is shown in Table 5D.74.

Table 5D.74.
Recommended Water Supply Plan for McMullen County Mining

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	1,262
Recommended Plan						
Manufacturing Water Conservation	32	63	95	126	158	0
Total New Supply	**32**	**63**	**95**	**126**	**158**	**0**
New Balance	**32**	**63**	**95**	**126**	**158**	**1,262**

Estimated costs of the recommended plan for McMullen County Mining are shown in Table 5D.75.

Table 5D.75.
Recommended Water Supply Plan for McMullen County Mining

Plan Element	2030	2040	2050	2060	2070	2080
Mining Water Conservation (Chapter 5D.3)						
Annual Cost ($/yr)	ND	ND	ND	ND	ND	ND
Unit Cost ($/ac-ft)	ND	ND	ND	ND	ND	ND

5D.10.5 Irrigation

No irrigation demand exists or is projected for the county.

5D.10.6 Livestock

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

5D.11 Nueces County Water Supply Plan

Table 5D.76 lists each water user group in Nueces County and their corresponding surplus or shortage in years 2050 and 2080. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 5D.76.
Nueces County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1]		Comment
	2050 (ac-ft/yr)	2080 (ac-ft/yr)	
City of Aransas Pass	0	0	Supply equals demand
City of Bishop	0	0	Supply equals demand
City of Corpus Christi	0	(5,158)	Projected shortage – see plan below
Corpus Christi Naval Air	0	0	Supply equals demand
City of Driscoll	0	0	Supply equals demand
Nueces County WCID 3	(3,443)	(3,370)	Projected shortage – see plan below
Nueces County WCID 4	0	0	Supply equals demand
Nueces WSC	0	0	Supply equals demand
River Acres WSC	0	0	Supply equals demand
Violet WSC	0	0	Supply equals demand
County-Other	0	0	Supply equals demand
Manufacturing	(11,685)	(16,587)	Projected shortage – see plan below
Steam-Electric	0	0	Supply equals demand
Mining	(93)	(101)	Projected shortage – see plan below
Irrigation	0	0	Supply equals demand
Livestock	0	0	Supply equals demand

[1] From Tables 4A.20 and 4A.21, Chapter 4A – Comparison of Water Demands with Water Supplies to Determine Needs.

5D.11.1 City of Aransas Pass

The City of Aransas Pass is located in Aransas, Nueces, and San Patricio Counties, with the majority of demand lying in San Patricio County. Aransas Pass contracts with SPMWD to purchase treated water. The contract allows the City of Aransas Pass to purchase only the water that it needs. No shortages are projected for the City of Aransas Pass across all three counties, and no changes in water supply are recommended.

5D.11.2 City of Bishop

The City of Bishop has a contract with STWA to purchase treated surface water. Additionally, the City pumps groundwater from the Gulf Coast Aquifer. No shortages are projected for the City of Bishop; however, additional water conservation is a recommended water management strategy for the city (Table 5D.77).

Table 5D.77.
Recommended Water Supply Plan for the City of Bishop

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Municipal Water Conservation	0	37	36	37	36	36
Driscoll Groundwater Desalination	195	195	195	195	195	195
New Balance	**195**	**132**	**131**	**132**	**131**	**131**

Estimated costs of the recommended plan for the City of Bishop are shown in Table 5D.78.

Table 5D.78.
Recommended Plan Costs by Decade for the City of Bishop

Plan Element	2030	2040	2050	2060	2070	2080
Municipal Water Conservation (Chapter 5D.1)						
Annual Cost ($/yr)	$0	$21,460	$20,880	$21,460	$20,880	$20,880
Unit Cost ($/ac-ft)*	$580	$580	$580	$580	$580	$580
Driscoll Groundwater Desalination						
Annual Cost ($/yr)	$566,074	$566,074	$234,061	$234,061	$234,061	$234,061
Unit Cost ($/ac-ft)*	$2,878	$2,878	$1,190	$1,190	$1,190	$1,190

* Unit costs for this plan element are rounded.

5D.11.3 City of Corpus Christi

The City of Corpus Christi meets demands with its own water rights in the CCR/LCC System, through a contract with the Lavaca-Navidad River Authority that provides water from Lake Texana, and supplies associated with water rights in the Colorado River Basin delivered through the MRP-Phase II project. Municipal water supply shortages are projected for the City of Corpus Christi in 2080. The city also provides surface water to SPMWD, STWA, various nearby cities, and manufacturing and steam-electric water user groups in Nueces and San Patricio counties. Shortages are assigned to manufacturing water user groups in Nueces and San Patricio counties. The recommended water supply management plan is shown in Table 5D.79. The total project yield for the seawater desalination project is larger than shown in the table below. The Corpus Christi Inner Harbor seawater desalination project yield is 33,604 ac-ft/yr. Supplies were divided equally between the City of Corpus Christi and Nueces County-Manufacturing for the Inner Harbor seawater desalination project.

Table 5D.79.
Recommended Water Supply Plan for the City of Corpus Christi

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	(5,158)
Recommended Plan						
Municipal Water Conservation	0	5,506	9,883	9,823	9,765	9,706
O.N. Stevens WTP Improvements	10,676	10,676	10,676	10,676	10,676	10,676
Mary Rhodes Rehabilitation	37,333	37,333	37,333	37,333	37,333	37,333
Aquifer Storage and Recovery	0	4,034	4,034	4,034	4,034	40,34
Evangeline/Laguna LP Groundwater Desalination*	0	8,545	8,545	8,545	8,545	8,545
Seawater Desalination – Corpus Christi (Inner Harbor)	16,802	16,802	16,802	16,802	16,802	16,802
Seawater Desalination – Barney Davis	0	16,813	16,813	16,813	16,813	16,813
Seawater Desalination – Port Harbor Island	28,003	28,003	28,003	28,003	28,003	28,003
Total New Supply	**92,814**	**127,712**	**132,089**	**132,029**	**131,971**	**127,878**
New Balance	**92,814**	**127,712**	**132,089**	**132,029**	**131,971**	**122,720**

Estimated costs of the recommended plan for the City of Corpus Christi are shown in Table 5D.80.

Table 5D.80.
Recommended Plan Costs by Decade for the City of Corpus Christi

Plan Element	2030	2040	2050	2060	2070	2080
Municipal Water Conservation (Chapter 5D.1)						
Annual Cost ($/yr)	$0	$3,209,998	$5,761,789	$5,726,809	$5,692,995	$5,658,598
Unit Cost ($/ac-ft)	$583	$583	$583	$583	$583	$583
O.N. Stevens WTP Improvements (Chapter 5D.11)						
Annual Cost ($/yr)	10,676	10,676	10,676	10,676	10,676	10,676
Unit Cost ($/ac-ft)*	10,676	10,676	10,676	10,676	10,676	10,676
Aquifer Storage and Recovery (Chapter 5D.7)						
Annual Cost ($/yr)	$11,435,190	$11,435,190	$4,878,315	$4,878,315	$4,878,315	$4,878,315
Unit Cost ($/ac-ft)	$2,834	$2,834	$1,209	$1,209	$1,209	$1,209
Evangeline/Laguna LP Groundwater Desalination (Chapter 5D.9)						
Annual Cost ($/yr)	$34,909,048	$34,909,048	$23,474,946	$23,474,946	$23,474,946	$23,474,946
Unit Cost ($/ac-ft)	$4,085	$4,085	$2,747	$2,747	$2,747	$2,747
Seawater Desalination – Corpus Christi (Inner Harbor) 10 MGD (Chapter 5D.10)**						
Annual Cost ($/yr)	$52,993,508	$52,993,508	$29,957,966	$29,957,966	$29,957,966	$29,957,966
Unit Cost ($/ac-ft)	$3,154	$3,154	$1,783	$1,783	$1,783	$1,783
Seawater Desalination – Corpus Christi (Barney Davis) 20 MGD						
Annual Cost ($/yr)	$0	$124,588,035	$124,588,035	$62,815,236	$62,815,236	$62,815,236
Unit Cost ($/ac-ft)	$3,705	$3,705	$3,705	$1,868	$1,868	$1,868

Plan Element	2030	2040	2050	2060	2070	2080
Seawater Desalination – PCCA Harbor Island 50 MGD* (Chapter 5D.10)**						
Annual Cost ($/yr)	$101,260,656	$101,260,656	$44,245,530	$44,245,530	$44,245,530	$44,245,530
Unit Cost ($/ac-ft)	$3,616	$3,616	$1,580	$1,580	$1,580	$1,580

* Note: Seawater Desalination costs do not include transmission pipelines for delivery to point of use.

5D.11.4 Corpus Christi Naval Air Station

The Corpus Christi Naval Air Station obtains treated surface water from the City of Corpus Christi. No shortages are projected for the air station; however, additional water conservation is a recommended water management strategy (Table 5D.81).

Table 5D.81.
Recommended Water Supply Plan for the Corpus Christi Naval Air Station

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Municipal Water Conservation	0	199	381	545	692	821
New Balance	**0**	**199**	**381**	**545**	**692**	**821**

Estimated costs of the recommended plan for the Corpus Christi Naval Air Station are shown in Table 5D.82.

Table 5D.82.
Recommended Plan Costs by Decade for the Corpus Christi Naval Air Station

Plan Element	2030	2040	2050	2060	2070	2080
Municipal Water Conservation (Chapter 5D.1)						
Annual Cost ($/yr)	$0	$115,420	$220,980	$316,100	$401,360	$476,180
Unit Cost ($/ac-ft)*	$580	$580	$580	$580	$580	$580

* Unit costs for this plan element are rounded.

5D.11.5 City of Driscoll

The City of Driscoll purchases treated surface water from STWA, which originates from the CCR/LCC/Texana/MRP Phase II System. No shortages are projected for the City of Driscoll; however, the city of Driscoll is to receive 12 percent of the Driscoll Groundwater Desalination Plant's yield. The recommended water supply management plan is shown in Table 5D.83.

Table 5D.83.
Recommended Water Supply Plan for City of Driscoll

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Driscoll Groundwater Desalination	130	130	130	130	130	130
Total New Supply	**130**	**130**	**130**	**130**	**130**	**130**
New Balance	**130**	**130**	**130**	**130**	**130**	**130**

Estimated costs of the recommended plan for City of Driscoll are shown in Table 5D.84.

Table 5D.84.
Recommended Water Supply Plan for City of Driscoll

Plan Element	2030	2040	2050	2060	2070	2080
Driscoll Groundwater Desalination (Chapter 5D.9)						
Annual Cost ($/yr)	$391,897	$391,897	$162,042	$162,042	$162,042	$162,042
Unit Cost ($/ac-ft)	$2,878	$2,878	$1,190	$1,190	$1,190	$1,190

5D.11.6 Nueces County Water Control and Improvement District #3

Nueces County WCID 3 has a water right to divert supply from the Nueces River. Shortages are projected for Nueces County WCID 3 throughout the planning period. The total project yield for the local balancing storage is larger than shown in the table below. The local balancing storage yield is 4,058 ac-ft/yr. Supplies were divided between Nueces County WCID 3 and River Acres WSC and assigned based on need.

The recommended water supply management plan is shown in Table 5D.85.

Table 5D.85.
Recommended Water Supply Plan for Nueces County WCID 3

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	(3,383)	(3,439)	(3,443)	(3,419)	(3,395)	(3,370)
Recommended Plan						
Municipal Water Conservation	0	326	631	900	1,140	1,354
Local Balancing Storage	3,827	3,827	3,827	3,827	3,827	3,827
Total New Supply	**3,827**	**4,153**	**4,458**	**4,727**	**4,967**	**5,181**
New Balance	**444**	**714**	**1,015**	**1,308**	**1,572**	**1,811**

Estimated costs of the recommended plan for Nueces County WCID 3 are shown in Table 5D.86.

Table 5D.86.
Recommended Water Supply Plan for Nueces County WCID 3

Plan Element	2030	2040	2050	2060	2070	2080
Municipal Water Conservation (Chapter 5D.1)						
Annual Cost ($/yr)	$0	$188,102	$364,087	$519,300	$657,780	$781,258
Unit Cost ($/ac-ft)*	$577	$577	$577	$577	$577	$577
Local Balancing Storage (Chapter 5D.6)						
Annual Cost ($/yr)	$3,459,608	$3,459,608	$1,848,441	$1,848,441	$1,848,441	$1,848,441
Unit Cost ($/ac-ft)	$904	$904	$483	$483	$483	$483

* Unit costs for this plan element are rounded.

5D.11.7 Nueces County Water Control and Improvement District #4

Nueces County WCID 4 obtains treated surface water supply from the City of Corpus Christi. No shortages are projected for Nueces County WCID 4; however, additional water conservation is a recommended water management strategy for the WCID (Table 5D.87).

Table 5D.87.
Recommended Water Supply Plan for Nueces County WCID 4

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Municipal Water Conservation	0	130	250	358	452	537
New Balance	**0**	**130**	**250**	**358**	**452**	**537**

Estimated costs of the recommended plan for Nueces County WCID 4 are shown in Table 5D.88.

Table 5D.88.
Recommended Plan Costs by Decade for Nueces County WCID 4

Plan Element	2030	2040	2050	2060	2070	2080
Municipal Water Conservation (Chapter 5D.1)						
Annual Cost ($/yr)	$0	$75,400	$145,000	$207,640	$262,160	$311,460
Unit Cost ($/ac-ft)*	$580	$580	$580	$580	$580	$580

* Unit costs for this plan element are rounded.

5D.11.8 Nueces Water Supply Corporation

Nueces WSC has a contract with the STWA to purchase treated surface water from the CCR/LCC/Texana/MRP Phase II System. No shortages are projected for Nueces WSC; however, additional water conservation is a recommended water management strategy for the WSC (Table 5D.89).

Table 5D.89.
Recommended Water Supply Plan for Nueces WSC

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Municipal Water Conservation	0	45	45	45	45	45
Driscoll Groundwater Desalination	224	224	224	224	224	224
New Balance	**224**	**269**	**269**	**269**	**269**	**269**

Estimated costs of the recommended plan for Nueces WSC are shown in Table 5D.90.

Table 5D.90.
Recommended Plan Costs by Decade for Nueces WSC

Plan Element	2030	2040	2050	2060	2070	2080
Municipal Water Conservation (Chapter 5D.1)						
Annual Cost ($/yr)	$0	$26,100	$26,100	$26,100	$26,100	$26,100
Unit Cost ($/ac-ft)*	$580	$580	$580	$580	$580	$580
Driscoll Groundwater Desalination (Chapter 5D.9)						
Annual Cost ($/yr)	$653,162	$653,162	$270,071	$270,071	$270,071	$270,071
Unit Cost ($/ac-ft)*	$2,878	$2,878	$1,190	$1,190	$1,190	$1,190

* Unit costs for this plan element are rounded.

5D.11.9 River Acres Water Supply Corporation

River Acres WSC obtains its water from Nueces County WCID 3. No shortages are projected for River Acres WSC during the planning period and no changes to water supply management are recommended.

5D.11.10 Violet Water Supply Corporation

Violet WSC obtains treated surface water supply from the City of Corpus Christi. No shortages are projected for the WSC and no changes in water supply are recommended.

5D.11.11 County-Other

Nueces County-Other entities obtain surface water from various water providers, including STWA, and groundwater from the Gulf Coast Aquifer. No shortages are projected for Nueces County-Other entities during the planning period; however, Nueces County-Other entities will receive 27 percent of the Driscoll Groundwater Desalination Project's yield. The recommended water supply management plan is shown in Table 5D.91.

Table 5D.91.
Recommended Water Supply Plan for Nueces County-Other

Plan Element	2020 (ac-ft/yr)	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)

Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Driscoll Groundwater Desalination	404	404	404	404	404	404
New Balance	**404**	**404**	**404**	**404**	**404**	**404**

Estimated costs of the recommended plan for Nueces County-Other are shown in Table 5D.92.

Table 5D.92.
Recommended Plan Costs by Decade for Nueces County-Other

Plan Element	2020	2030	2040	2050	2060	2070
Driscoll Groundwater Desalination (Chapter 5D.9)						
Annual Cost ($/yr)	$1,175,692	$1,175,692	$486,127	$486,127	$486,127	$486,127
Unit Cost ($/ac-ft)*	$2,878	$2,878	$1,190	$1,190	$1,190	$1,190

* Unit costs for this plan element are rounded.

5D.11.12 Manufacturing

The City of Corpus Christi provides treated and raw surface water for manufacturing in Nueces County from the CCR/LCC/Texana/MRP Phase II System. Additional manufacturing supplies are from the Gulf Coast Aquifer and reuse supplies. The City of Corpus Christi also provides surface water for manufacturing in San Patricio County. A shortage in manufacturing supply occurs beginning in 2040. The recommended water supply plan for Nueces County Manufacturing is shown below (Table 5D.93). The recommended strategies Seawater Desalination- Corpus Christi (Inner Harbor) and Evangeline/Laguna LP Groundwater Desalination project shown would likely be jointly developed by the City of Corpus Christi and the SPMWD.

Note: The total project yield for O.N. Stevens Water Treatment Plant (WTP) improvement, Mary Rhodes Rehabilitation, Aquifer Storage and Recovery, Evangeline/Laguna LP Groundwater Desalination project, Corpus Christi Inner Harbor seawater desalination, Barney Davis seawater desalination, and PCCA Harbor Island seawater desalination project is larger than shown Table 5D.93.

The Corpus Christi Inner Harbor seawater desalination project yield is 33,604 ac-ft/yr, the Port Harbor Island seawater desalination project yield is 112,014 ac-ft/yr, the O.N. Stevens WTP Improvement project yield is 32,030 ac-ft/yr, the Mary Rhodes Rehabilitation project yield is 112,000 ac-ft/yr, Aquifer Storage and Recovery project yield is 8,070 ac-ft/yr, the Evangeline Laguna Treated Groundwater project yield is 25,637 ac-ft/yr, and the Barney Davis seawater desalination project yield is 33,627 ac-ft/yr. Supplies were divided equally between Nueces County-Manufacturing and the City of Corpus Christi for the Corpus Christi Inner Harbor seawater desalination project, PCCA Harbor Island seawater desalination project, and the Aquifer Storage and Recovery project. Supplies were divided equally between Nueces County-Manufacturing, San Patricio County-Manufacturing, and the City of Corpus Christi for the O.N. Stevens WTP Improvement, Evangeline/Laguna LP Groundwater Desalination Project, and

Mary Rhodes Rehabilitation project. The PCCA Harbor Island seawater desalination project yield is allocated 25 percent to Nueces County-Manufacturing and 75 percent to San Patricio County-Manufacturing. The manufacturing water conservation yield for Nueces County is 1,259 ac-ft/yr in 2030 and increases to 7,851 ac-ft/yr by 2080.

Table 5D.93. Recommended Water Supply Plan for Nueces County Manufacturing

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	(33,672)	(36,879)	(39,295)	(41,356)	(43,635)	(45,731)
Recommended Plan						
Manufacturing Water Conservation	1,259	2,518	3,777	5,037	6,309	7,851
O.N. Stevens WTP Improvements	10,676	10,676	10,676	10,676	10,676	10,676
Petronila Regional WWTP Reuse	1,120	1,120	1,120	1,120	1,120	1,120
Mary Rhodes Rehabilitation	37,333	37,333	37,333	37,333	37,333	37,333
Aquifer Storage and Recovery	0	4,034	4,034	4,034	4,034	4,034
Evangeline/Laguna LP Groundwater Desalination*	0	8,545	8,545	8,545	8,545	8,545
Driscoll Groundwater Desalination	560	560	560	560	560	560
Seawater Desalination – Corpus Christi (Inner Harbor)	16,802	16,802	16,802	16,802	16,802	16,802
Seawater Desalination – Barney Davis	0	16,813	16,813	16,813	16,813	16,813
Seawater Desalination – Port Harbor Island	28,003	28,003	28,003	28,003	28,003	28,003
Total New Supply	**95,193**	**121,810**	**123,069**	**124,329**	**125,601**	**127,143**
New Balance (Treated)	**61,521**	**84,931**	**83,774**	**82,973**	**81,966**	**81,412**

*Supply increases at 2060 due to yield changes in response to MAG availability.

Estimated costs of the recommended plan for Nueces County Manufacturing are shown in Table 5D.94.

Table 5D.94.
Recommended Plan Costs by Decade for Nueces County Manufacturing

Plan Element	2030	2040	2050	2060	2070	2080
Manufacturing Water Conservation (Chapter 5D.3)						
Annual Cost ($/yr)	ND	ND	ND	ND	ND	ND
Unit Cost ($/ac-ft)	ND	ND	ND	ND	ND	ND
O.N. Stevens WTP Improvements (Chapter 5D.11)						
Annual Cost ($/yr)	10,676	10,676	10,676	10,676	10,676	10,676
Unit Cost ($/ac-ft)*	10,676	10,676	10,676	10,676	10,676	10,676
Petronila Regional WWTP Reuse						
Annual Cost ($/yr)	$1,554,560	$1,554,560	$623,840	$623,840	$623,840	$623,840
Unit Cost ($/ac-ft)	$1,388	$1,388	$557	$557	$557	$557
Mary Rhodes Rehabilitation						
Annual Cost ($/yr)	$51,408,000	$51,408,000	$22,400,000	$22,400,000	$22,400,000	$22,400,000
Unit Cost ($/ac-ft)*	$1,377	$1,377	$600	$600	$600	$600
Aquifer Storage and Recovery (Chapter 5D.7)						
Annual Cost ($/yr)	$0	$11,435,190	$11,435,190	$4,878,315	$4,878,315	$4,878,315
Unit Cost ($/ac-ft)	$2,834	$2,834	$2,834	$1,209	$1,209	$1,209
Evangeline/Laguna LP Groundwater Desalination (Chapter 5D.9)						
Annual Cost ($/yr)	$0	$34,909,048	$34,909,048	$23,474,946	$23,474,946	$23,474,946
Unit Cost ($/ac-ft)	$4,085	$4,085	$4,085	$2,747	$2,747	$2,747
Driscoll Groundwater Desalination (Chapter 5D.9)						
Annual Cost ($/yr)	$1,611,133	$1,611,133	$666,174	$666,174	$666,174	$666,174
Unit Cost ($/ac-ft)	$2,878	$2,878	$1,190	$1,190	$1,190	$1,190
Seawater Desalination – Corpus Christi (Inner Harbor) 10 MGD (Chapter 5D.10)**						
Annual Cost ($/yr)	$52,993,508	$52,993,508	$29,957,966	$29,957,966	$29,957,966	$29,957,966
Unit Cost ($/ac-ft)	$3,154	$3,154	$1,783	$1,783	$1,783	$1,783
Seawater Desalination – Corpus Christi (Barney Davis) 20 MGD						
Annual Cost ($/yr)	$0	$124,588,035	$124,588,035	$62,815,236	$62,815,236	$62,815,236
Unit Cost ($/ac-ft)	$3,705	$3,705	$3,705	$1,868	$1,868	$1,868
Seawater Desalination – PCCA Harbor Island 50 MGD* (Chapter 5D.10)**						
Annual Cost ($/yr)	$101,260,656	$101,260,656	$44,245,530	$44,245,530	$44,245,530	$44,245,530
Unit Cost ($/ac-ft)	$3,616	$3,616	$1,580	$1,580	$1,580	$1,580

* Unit cost for Regional WTP upgrades includes treatment of $369 per ac-ft.

** Note: Seawater Desalination costs do not include transmission pipelines for delivery to point of use.

***Note: Seawater Desalination costs estimate 2 mile line for delivery to point of use.

ND = Not Determined due to high variability in costs associated with manufacturing BMPs.

5D.11.13 Steam-Electric

The steam-electric users in Nueces County are provided water by City of Corpus Christi. No shortages are projected for steam-electric users and no changes in water supply are recommended.

5D.11.14 Mining

Nueces County Mining users obtain water supplies from the Gulf Coast Aquifer. Shortages are projected for mining users throughout the planning period. The recommended water supply management plan is shown in Table 5D.95.

Table 5D.95.
Recommended Water Supply Plan for Nueces County Mining

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	(88)	(98)	(93)	(84)	(95)	(101)
Recommended Plan						
Mining Water Conservation	20	42	64	88	111	134
Gulf Coast Aquifer Supplies	101	101	101	101	101	101
Total New Supply	**121**	**143**	**165**	**189**	**212**	**235**
New Balance	**33**	**45**	**72**	**105**	**117**	**134**

Estimated costs of the recommended plan for Nueces County Mining are shown in Table 5D.96.

Table 5D.96.
Recommended Water Supply Plan for Nueces County Mining

Plan Element	2030	2040	2050	2060	2070	2080
Mining Water Conservation (Chapter 5D.4)						
Annual Cost ($/yr)	ND	ND	ND	ND	ND	ND
Unit Cost ($/ac-ft)	ND	ND	ND	ND	ND	ND
Drill New Well (Chapter 5D.8.1)						
Annual Cost ($/yr)	$59,994	$59,994	$6,969	$6,969	$6,969	$6,969
Unit Cost ($/ac-ft)	$594	$594	$69	$69	$69	$69

ND = Not Determined due to high variability in costs associated with mining BMPs.

5D.11.15 Irrigation

Irrigation users in Nueces County obtain water supplies from the Gulf Coast Aquifer. No shortages are projected for irrigation users during the planning period and no changes to water supply management are recommended.

5D.11.16 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 livestock and no changes in water supply are recommended.

5D.12 San Patricio County Water Supply Plan

Table 5D.97 lists each water user group in San Patricio County and their corresponding surplus or shortage in years 2050 and 2080. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 5D.97.
San Patricio County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1]		Comment
	2050 (ac-ft/yr)	2080 (ac-ft/yr)	
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
Rincon WSC	0	0	Supply equals demand
City of Sinton	0	0	Supply equals demand
City of Taft	0	0	Supply equals demand
County-Other	0	0	Supply equals demand
Manufacturing	6,240	6,289	Supply equals demand
Steam-Electric	0	0	Supply equals demand
Mining	0	0	Supply equals demand
Irrigation	0	0	Supply equals demand
Livestock	0	0	Supply equals demand

[1] From Tables 4A.22 and 4A.23, Chapter 4A – Comparison of Water Demands with Water Supplies to Determine Needs.

5D.12.1 City of Aransas Pass

The City of Aransas Pass is located in Aransas, Nueces, and San Patricio Counties, with the majority of demand lying in San Patricio County. Aransas Pass contracts with SPMWD to purchase treated water. The contract allows the City of Aransas Pass to purchase only the water that it needs. No shortages are projected for the City of Aransas Pass across all three counties, and no changes in water supply are recommended.

5D.12.2 City of Gregory

The City of Gregory has a contract with the SPMWD to purchase treated water. The contract allows the city to purchase only the water that it needs. No shortages are projected for the City of Gregory; however, additional water conservation is a recommended water management strategy for the city (Table 5D.98).

Table 5D.98.
Recommended Water Supply Plan for the City of Gregory

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Municipal Water Conservation	0	10	10	11	11	11
New Balance	0	10	10	11	11	11

Estimated costs of the recommended plan for the City of Gregory are shown in Table 5D.99.

Table 5D.99.
Recommended Plan Costs by Decade for the City of Gregory

Plan Element	2030	2040	2050	2060	2070	2080
Municipal Water Conservation (Chapter 5D.1)						
Annual Cost ($/yr)	$0	$5,800	$5,800	$6,380	$6,380	$6,380
Unit Cost ($/ac-ft)*	$580	$580	$580	$580	$580	$580

* Unit costs for this plan element are rounded.

5D.12.3 City of Ingleside

The City of Ingleside has a contract with the SPMWD to purchase treated water. 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.

5D.12.4 City of Mathis

The City of Mathis has a contract with the City of Corpus Christi to purchase raw water from the CCR/LCC/Texana/MRP Phase II System. The contract allows the city to purchase only the water that it needs. No shortages are projected for the City of Mathis; however, the city is diversifying its water supply with the addition of groundwater supplies.

Table 5D.100.
Recommended Water Supply Plan for City of Mathis

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Gulf Coast Aquifer Supplies	560	560	560	560	560	560
New Balance	**560**	**560**	**560**	**560**	**560**	**560**

Estimated costs of the recommended plan for City of Mathis are shown in Table 5D.101.

Table 5D.101.
Recommended Plan Costs by Decade for City of Mathis

Plan Element	2030	2040	2050	2060	2070	2080
Drill New Well (Chapter 5D.8.1)						
Annual Cost ($/yr)	$238,000	$238,000	$85,120	$85,120	$85,120	$85,120
Unit Cost ($/ac-ft)*	$425	$425	$152	$152	$152	$152

* Unit costs for this plan element are rounded.

5D.12.5 City of Odem

The City of Odem has a contract with the SPMWD to purchase treated water. 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.

5D.12.6 City of Portland

The City of Portland has a contract with the SPMWD to purchase treated water. 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.

5D.12.7 Rincon Water Supply Corporation

Rincon WSC has a contract with the SPMWD to purchase treated water. The contract allows the WSC to purchase only the water that it needs. No shortages are projected for Rincon WSC and no changes in water supply are recommended.

5D.12.8 City of Sinton

The City of Sinton meets its demands with groundwater pumped from the Gulf Coast Aquifer. No shortages are projected for the City of Sinton; however, additional water conservation is a recommended water management strategy for the city (Table 5D.102).

Table 5D.102.
Recommended Water Supply Plan for the City of Sinton

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Municipal Water Conservation	0	99	189	274	335	339
New Balance	**0**	**99**	**189**	**274**	**335**	**339**

Estimated costs of the recommended plan for the City of Sinton are shown in Table 5D.103.

Table 5D.103.
Recommended Plan Costs by Decade for the City of Sinton

Plan Element	2030	2040	2050	2060	2070	2080
Municipal Water Conservation (Chapter 5D.1)						
Annual Cost ($/yr)	$0	$57,420	$109,620	$158,920	$194,300	$196,620
Unit Cost ($/ac-ft)	$580	$580	$580	$580	$580	$580

5D.12.9 City of Taft

The City of Taft has a contract with the SPMWD to purchase treated water. 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.

5D.12.10 County-Other

County-Other demands are met with surface water from the CCR/LCC/Texana/MRP Phase II System provided by 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.

5D.12.11 Manufacturing

The City of Corpus Christi provides the surface water for manufacturing in San Patricio County through the SPMWD from the CCR/LCC/Texana/MRP Phase II System. A small amount of manufacturing supplies are from the Gulf Coast Aquifer and reuse supplies. The city also provides surface water for manufacturing in Nueces County. A shortage in manufacturing supply occurs beginning in 2040. The recommended water supply plan for San Patricio County Manufacturing is shown below (Table 5D.104). The recommended Seawater Desalination-Corpus Christi (La Quinta) project shown would likely be jointly developed by the City of Corpus Christi and the SPMWD. Note: The total project yield for O.N. Stevens WTP improvement, Mary Rhodes Rehabilitation, Evangeline/Laguna LP Groundwater Desalination project, and PCCA Harbor Island seawater desalination project is larger than shown in Table 5D.104. The Port Harbor Island seawater desalination project yield is 112,014 ac-ft/yr, the O.N. Stevens WTP Improvement project yield is 32,030 ac-ft/yr, the Mary Rhodes Rehabilitation project yield is 112,000 ac-ft/yr, and the Evangeline Laguna Treated Groundwater project yield is 25,637 ac-ft/y. Supplies were divided equally between Nueces County-Manufacturing, San Patricio County-Manufacturing, and the City of Corpus Christi for the O.N. Stevens WTP Improvement, Evangeline/Laguna LP Groundwater Desalination Project, and Mary Rhodes Rehabilitation project. The PCCA Harbor Island seawater desalination project yield is allocated 25 percent to Nueces County-Manufacturing and 75 percent to San Patricio County-Manufacturing. The manufacturing water conservation yield for San Patricio Counties is 1,518 ac-ft/yr in 2030 and increases to 9,110 ac-ft/yr by 2080.

Table 5D.104.
Recommended Water Supply Plan for San Patricio County Manufacturing

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	6,791	6,397	6,240	6,318	6,390	6,289
Recommended Plan						
Manufacturing Water Conservation	1,518	3,036	4,553	6,073	7,591	9,110
O.N. Stevens WTP Improvements	10,676	10,676	10,676	10,676	10,676	10,676
Mary Rhodes Rehabilitation	37,333	37,333	37,333	37,333	37,333	37,333
SPMWD Project No. 1 - New WTP (20 MGD) at Plant D	22,418	22,418	22,418	22,418	22,418	22,418
SPMWD Project No. 2 - New Intake, PS and Raw Water Transmission on Nueces River	69,495	69,495	69,495	69,495	69,495	69,495
SPMWD Project No. 3 - New Pump Station at Mary Rhodes Pipeline & Transmission Rehab	33,627	33,627	33,627	33,627	33,627	33,627
Evangeline/Laguna LP Groundwater Desalination*	0	8,545	8,545	8,545	8,545	8,545
Seawater Desalination – Corpus Christi (La Quinta)	0	44,806	44,806	44,806	44,806	44,806
Seawater Desalination – Port La Quinta	0	33,627	33,627	33,627	33,627	33,627
Seawater Desalination – Port Harbor Island	84,011	84,011	84,011	84,011	84,011	84,011
Total New Supply	**259,078**	**347,574**	**349,091**	**350,611**	**352,129**	**353,648**
New Balance (Treated)	**252,287**	**341,177**	**342,851**	**344,293**	**345,739**	**347,359**

*Supply increases at 2060 due to yield changes in response to MAG availability.

Estimated costs of the recommended plan for San Patricio County Manufacturing are shown in Table 5D.105.

Table 5D.105.
Recommended Plan Costs by Decade for San Patricio County Manufacturing

Plan Element	2030	2040	2050	2060	2070	2080
Manufacturing Water Conservation (Chapter 5D.3)						
Annual Cost ($/yr)	ND	ND	ND	ND	ND	ND
Unit Cost ($/ac-ft)	ND	ND	ND	ND	ND	ND
O.N. Stevens WTP Improvements (Chapter 5D.11)						
Annual Cost ($/yr)	$6,469,858	$6,469,858	$4,526,765	$4,526,765	$4,526,765	$4,526,765
Unit Cost ($/ac-ft)*	$606	$606	$424	$424	$424	$424
Mary Rhodes Rehabilitation						
Annual Cost ($/yr)	$51,408,000	$51,408,000	$22,400,000	$22,400,000	$22,400,000	$22,400,000
Unit Cost ($/ac-ft)*	$1,377	$1,377	$600	$600	$600	$600
SPMWD Project No. 1 - New WTP (20 MGD) at Plant D						
Annual Cost ($/yr)	$18,360,342	$18,360,342	$13,450,800	$13,450,800	$13,450,800	$13,450,800
Unit Cost ($/ac-ft)*	$819	$819	$600	$600	$600	$600
SPMWD Project No. 2 - New Intake, PS and Raw Water Transmission on Nueces River						
Annual Cost ($/yr)	$44,268,315	$44,268,315	$44,268,315	$44,268,315	$28,562,445	$28,562,445
Unit Cost ($/ac-ft)*	$637	$637	$411	$411	$411	$411
SPMWD Project No. 3 - New Pump Station at Mary Rhodes Pipeline & Transmission Rehab						
Annual Cost ($/yr)	$16,208,214	$16,208,214	$13,383,546	$13,383,546	$13,383,546	$13,383,546
Unit Cost ($/ac-ft)*	$482	$482	$398	$398	$398	$398
Evangeline/Laguna LP Groundwater Desalination (Chapter 5D.9)						
Annual Cost ($/yr)	$0	$34,909,048	$34,909,048	$23,474,946	$23,474,946	$23,474,946
Unit Cost ($/ac-ft)	$4,085	$4,085	$4,085	$2,747	$2,747	$2,747
Seawater Desalination – Corpus Christi (La Quinta) 20 MGD (Chapter 5D.10)						
Annual Cost ($/yr)	$0	$155,028,760	$155,028,760	$75,139,662	$75,139,662	$75,139,662
Unit Cost ($/ac-ft)	$3,460	$3,460	$3,460	$1,677	$1,677	$1,677
Seawater Desalination – Port La Quinta 30 MGD (Chapter 5D.10)						
Annual Cost ($/yr)	$0	$116,080,404	$116,080,404	$57,334,035	$57,334,035	$57,334,035
Unit Cost ($/ac-ft)	$3,452	$3,452	$3,452	$1,705	$1,705	$1,705
Seawater Desalination – Port Harbor Island 100 MGD (Chapter 5D.10)						
Annual Cost ($/yr)	$303,781,968	$303,781,968	$132,736,590	$132,736,590	$132,736,590	$132,736,590
Unit Cost ($/ac-ft)	$3,616	$3,616	$1,580	$1,580	$1,580	$1,580

* Unit cost for Regional WTP upgrades includes treatment of $369 per ac-ft.

***Note: Seawater Desalination costs estimate 2 mile line for delivery to point of use.

ND = Not Determined due to high variability in costs associated with manufacturing BMPs.

5D.12.12 Steam-Electric

Steam-electric demands in San Patricio County are met by water from the SPMWD. No shortages are projected for steam-electric users and no changes in water supply are recommended.

5D.12.13 Mining

Mining users in San Patricio County obtain water supply from the Gulf Coast Aquifer. No shortages are projected for mining during the planning period; however, mining water conservation is a recommended water management strategy for the county. The recommended water supply management plan is shown in Table 5D.106.

Table 5D.106.
Recommended Water Supply Plan for San Patricio County Mining

Plan Element	2030 (ac-ft/yr)	2040 (ac-ft/yr)	2050 (ac-ft/yr)	2060 (ac-ft/yr)	2070 (ac-ft/yr)	2080 (ac-ft/yr)
Projected Need (Shortage)	0	0	0	0	0	0
Recommended Plan						
Mining Water Conservation	2	5	7	9	12	14
Total New Supply	**2**	**5**	**7**	**9**	**12**	**14**
New Balance	**2**	**5**	**7**	**9**	**12**	**14**

Estimated costs of the recommended plan for San Patricio County Mining are shown in Table 5D.107.

Table 5D.107.
Recommended Plan Costs by Decade for San Patricio County Mining

Plan Element	2030	2040	2050	2060	2070	2080
Mining Water Conservation (Chapter 5D.4)						
Annual Cost ($/yr)	ND	ND	ND	ND	ND	ND
Unit Cost ($/ac-ft)	ND	ND	ND	ND	ND	ND

ND = Not Determined due to high variability in costs associated with mining BMPs.

5D.12.14 Irrigation

Irrigation users in San Patricio County obtain water from the Gulf Coast Aquifer. No shortages are projected for irrigation users during the planning period and no changes to water supply are recommended.

5D.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.

5D.13 Wholesale Water Provider Water Supply Plans

Table 5D.108 lists each Wholesale Water Provider and their corresponding surplus or shortage in years 2050 and 2080. For each Wholesale Water Provider with a projected shortage, a water supply plan has been developed.

Table 5D.108. Wholesale Water Provider Surplus/(Shortage)

Wholesale Water Provider	Surplus/(Shortage)[1]		Comment
	2050 (ac-ft/yr)	2080 (ac-ft/yr)	
City of Corpus Christi[2]	(39,295)	(50,889)	Projected shortage – see plan below
San Patricio MWD	(2,003)	(1,951)	Projected shortage – see plan below
South Texas Water Authority	0	0	Supply equals demand
Nueces County WCID 3	(3,443)	(3,370)	Projected shortage – see plan below

1 Surplus/(Shortage) for each Wholesale Water Provider calculated by taking total surface water availability (constrained by water treatment plant capacity) less municipal retail and wholesale demands, steam-electric demands, manufacturing demands, and/or other water supply contracts (Table 4A.24).

2 The City of Corpus Christi provides water supplies to SPMWD to meet San Patricio County-Manufacturing demands. The total shortages shown for the City of Corpus Christi include both the needs of Nueces County-Manufacturing and those required by SPMWD to meet San Patricio County-Manufacturing demands (i.e. San Patricio MWD shortage).

5D.13.1 City of Corpus Christi

As the primary provider of surface water to the Coastal Bend Region, the City of Corpus Christi is the major WWP in the region. Corpus Christi has 157,000 ac-ft in available safe yield supply in 2080 through its own water right in the CCR/LCC/Texana/MRP Phase II System. This includes contracted supplies with Lavaca-Navidad River Authority from Lake Texana, after exercising Lavaca-Navidad River Authority's call-back provision for Jackson County users in addition to up to 35,000 ac-ft/yr from the Garwood water rights located on the Colorado River.

The city provides treated and raw water from the CCR/LCC/Texana/MRP Phase II System to the WUGs and other entities shown in Table 5D.109.

Table 5D.109.
Purchasers of Water from the City of Corpus Christi

Water User Group / Entity	County
San Patricio MWD	San Patricio
South Texas Water Authority	Kleberg, Nueces
City of Alice	Jim Wells
City of Beeville	Bee
Corpus Christi Naval Air Station	Nueces
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

The shortage listed in Table 5D.110 reflects the entire city's demands — both municipal retail and wholesale, as well as steam-electric and manufacturing demands, taking water treatment plant constraints into consideration. The shortage spans the entire 50-year planning period and is due to large manufacturing demands in Nueces and San Patricio counties. For a list of the water management strategies available to meet these shortages, refer to the water supply plan for manufacturing in Nueces County in Section 5D.11.12.

5D.13.2 San Patricio Municipal Water District

The SPMWD is the second largest Wholesale Water Provider in the region. SPMWD has a contract with the City of Corpus Christi to purchase water from the CCR/LCC/Texana/MRP Phase II System. SPMWD treats this water and provides it to the water user groups and other entities shown in Table 5D.110.

Table 5D.110.
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 Ingleside	San Patricio
City of Ingleside on the Bay	San Patricio
City of Odem	San Patricio
City of Portland	San Patricio
City of Rockport	Aransas
City of Taft	San Patricio
Rincon WSC	San Patricio
Nueces WCID 4 (Port Aransas)	Nueces
Seaboard WSC	San Patricio
Steam- Electric	San Patricio
Manufacturing	San Patricio

The shortage listed in Table 5D.108 reflects all of SPMWD's demands — both municipal retail and wholesale, as well as manufacturing demands. The shortage also takes into account water availability constraints in the CCR/LCC/Texana/MRP Phase II. SPMWD has adequate contracts in place with the City of Corpus Christi to meet demands through 2080. However, the treated water needs exceed treatment capacity with contracted treated water from the City of Corpus Christi, therefore SPMWD is showing a shortage across the entire 50-year planning period. For the water management strategies available to meet these shortages, refer to the water supply plan for manufacturing in San Patricio County in Section 5D.12.11.

5D.13.3 South Texas Water Authority

The South Texas Water Authority (STWA) is the third largest Wholesale Water Provider in the region. STWA has a contract with the City of Corpus Christi to purchase treated water from the CCR/LCC/Texana/MRP Phase II System. STWA provides this water to the water user groups and other entities shown in Table 5D.111.

Table 5D.111.
Purchasers of Water from South Texas Water Authority

Water User Group / Entity	County
City of Bishop	Nueces
City of Driscoll	Nueces
Nueces County-Other[1]	Nueces
Nueces WSC	Nueces
City of Kingsville	Kleberg
Ricardo WSC	Kleberg

[1] Includes City of Agua Dulce and Nueces County WCID #5.

There are no shortages listed in Table 5D.108 for South Texas Water Authority.

5D.13.4 Nueces County Water Control and Improvement District #3

The Nueces County WCID 3 is the smallest WWP in the region. Nueces County WCID 3 receives a firm yield of 324 ac-ft/yr from its Nueces Basin run-of-river rights. Nueces County WCID 3 provides this water to the water user groups and other entities shown in Table 5D.112.

Table 5D.112.
Purchasers of Water from Nueces County WCID 3

Water User Group / Entity	County
City of Robstown	Nueces
River Acres WSC	Nueces

Nueces County WCID 3 is projected to have a water shortage throughout the planning period. The plan for Nueces County WCID 3 is shown in Chapters 5D.11.6 and 5D.11.9.

5D.14 Summary of Recommended Water Management Strategies by Water User Group

A summary of recommended water management strategies for all WUGs is shown in Table 5D.113.

5D.15 Implementation Status and Timeline for Selected Projects in the 2026 Plan

TWDB guidance for 2026 Regional Water Plans includes a new provision that requires Chapter 5 to include a sub-section documenting the implementation status of certain WMSs that are recommended in the plan. The implementation status must be provided for the following types of recommended WMSs with any online decade, based on House Bill 1565, 88th Texas Legislature:

- All reservoir strategies (including major and minor reservoirs);
- All seawater desalination strategies;
- Direct potable reuse strategies that provide greater than 5,000 acre-feet per year (AFY) of supply in any planning decade;
- Brackish groundwater strategies that provide greater than 10,000 AFY of supply in any planning decade;
- Aquifer storage and recovery strategies that provide greater than 10,000 AFY in any Decade;
- All water transfers from out of state; and
- Any other innovative technology projects the RWPG considers appropriate.

This provision is relevant to the City of Corpus Christi's desalination and groundwater strategies, Port of Corpus Christi Authority's desalination projects, and Nueces County WCID 3's local balancing reservoir. HDR obtained implementation status information from the City of Corpus Christi, Port of Corpus Christi Authority, and Nueces County WCID 3, which is attached in TWDB requested format. The seven recommended water management strategies with implementation status and timelines for the *2026 Coastal Bend Regional Water Plan* are shown in Table 5D.120. The project sponsor, region, online decade, capital cost, and anticipated footprint are included in the table. Additionally, the permitting status, design/construction status, and total funds expected to date. Following Table 5D.114 are Figure 5D.1 through Figure 5D.8 showing schedules and major milestones for each recommended water management strategy.

Table 5D.113.
Summary of Recommended Water Management Strategies in the Coastal Bend Region

WMS ID	Recommended WMS	Total Project Cost	First Decade Estimated Unit Cost ($/ac-ft/yr)	Last Decade Estimated Unit Cost ($/ac-ft/yr)	Water Yield (ac-ft/yr)					
					2030	2040	2050	2060	2070	2080
5D.1	**Municipal Water Conservation**	***Variable, Regional Cost up to $94,234,000***	***$498 - $503***	***$498 - $503***	***0***	***7,341***	***14,689***	***16,399***	***17,707***	***18,793***
	Rockport	$1,751,000	$498	$498	0	270	353	327	321	321
	Beeville	$3,991,000	$498	$498	0	254	502	757	806	806
	El Oso WSC	$111,000	$500	$500	0	7	14	22	19	19
	TDCJ Chase Field	$1,947,000	$500	$500	0	85	167	247	322	391
	Falfurrias	$3,423,000	$500	$500	0	132	266	406	546	688
	Freer WCID	$1,070,000	$500	$500	0	54	110	170	211	215
	San Diego MUD 1	$435,000	$500	$500	0	55	88	83	84	87
	Alice	$4,862,000	$498	$498	0	345	725	899	938	981
	Orange Grove	$1,153,000	$500	$500	0	40	83	131	181	232
	Premont	$1,504,000	$500	$500	0	58	120	194	268	302
	San Diego MUD 1	$103,000	$500	$500	0	13	21	19	19	20
	County-Other, Kenedy	$503,000	$500	$500	0	23	45	65	84	101
	County-Other, Kleberg	$51,000	$500	$500	0	10	6	6	6	6
	Naval Air Station Kingsville	$716,000	$500	$500	0	26	54	84	114	144
	El Oso WSC	$186,000	$500	$500	0	13	25	37	30	30
	George West	$207,000	$500	$500	0	30	42	39	38	38
	Three Rivers	$183,000	$500	$500	0	37	24	18	17	17
	Bishop	$213,000	$500	$500	0	43	26	23	22	22
	Corpus Christi	$53,940,000	$503	$503	0	5,028	10,439	10,550	10,648	10,779
	Corpus Christi Naval Air Station	$2,560,000	$500	$500	0	109	220	325	423	515
	Nueces County WCID 3	$7,316,000	$498	$498	0	328	638	936	1,219	1,477
	Nueces County WCID 4	$5,640,000	$500	$500	0	233	473	706	929	1,134
	Nueces WSC	$177,000	$500	$500	0	31	28	29	30	35
	Gregory	$55,000	$500	$500	0	11	6	6	4	4
	Sinton	$2,137,000	$500	$500	0	106	211	319	427	430

WMS ID	Recommended WMS	Total Project Cost	First Decade Estimated Unit Cost ($/ac-ft/yr)	Last Decade Estimated Unit Cost ($/ac-ft/yr)	Water Yield (ac-ft/yr)					
					2030	2040	2050	2060	2070	2080
5D.2	**Irrigation Water Conservation**	***Variable, Regional Cost up to $12,111,317***	***$1,911 - $4,822***	***$1,911 - $4,822***	***561***	***1,122***	***1,683***	***2,244***	***2,806***	***3,367***
	Bee County	$3,041,704	$4,822	$4,822	105	210	315	421	526	631
	Jim Wells County	$548,471	$1,911	$1,911	48	96	143	191	239	287
	Live Oak County	$676,687	$2,768	$2,768	41	82	122	163	204	245
	Nueces County	$15,196	$1,986	$1,986	1	3	4	5	6	8
	San Patricio County	$7,829,259	$3,564	$3,564	366	732	1,098	1,465	1,831	2,197
5D.3	**Manufacturing Water Conservation**				***2,210***	***4,912***	***7,367***	***9,823***	***12,279***	***14,735***
	Jim Wells County	N/A	N/A	N/A	2	5	7	10	12	14
	Kleberg County	N/A	N/A	N/A	45	103	154	206	257	308
	Live Oak County	N/A	N/A	N/A	57	125	187	249	312	374
	Nueces County	N/A	N/A	N/A	1,135	2,518	3,777	5,036	6,295	7,554
	San Patricio County	N/A	N/A	N/A	971	2,161	3,242	4,322	5,403	6,483
5D.4	**Mining Water Conservation**				***76***	***157***	***221***	***273***	***323***	***374***
	Bee County	N/A	N/A	N/A	10	20	28	33	37	42
	Brooks County	N/A	N/A	N/A	9	18	26	32	39	45
	Duval County	N/A	N/A	N/A	35	72	101	124	146	166
	Jim Wells County	N/A	N/A	N/A	2	4	4	4	3	3
	Kenedy County	N/A	N/A	N/A	3	6	7	7	5	4
	Kleberg County	N/A	N/A	N/A	9	18	26	32	39	45
	Nueces County	N/A	N/A	N/A	1	2	3	4	6	8
	San Patricio County	N/A	N/A	N/A	7	17	26	36	49	63
5D.5	**Reuse**									
	Regional Industrial Wastewater Reuse Plan (4.47 MGD)	$115,502,000	$1,692	$1,692	0	5,010	5,010	5,010	5,010	5,010
	City of Alice- Non-potable Reuse	$10,222,000	$1,449	$648	0	897	897	897	897	897
5D.6	**Local Balancing Storage Reservoir**	**$21,575,000**	**$426**	**$98**	**4,058**	**4,058**	**4,058**	**4,058**	**4,058**	**4,058**
5D.7	**City of Corpus Christi Aquifer Storage and Recovery**									
	Phase I (13 MGD)	$68,632,000 to $90,199,000	$479 to $606	$148 to $171	0	14,573	14,573	14,573	14,573	14,573

WMS ID	Recommended WMS	Total Project Cost	First Decade Estimated Unit Cost ($/ac-ft/yr)	Last Decade Estimated Unit Cost ($/ac-ft/yr)	Water Yield (ac-ft/yr)					
					2030	2040	2050	2060	2070	2080
5D.8	**Gulf Coast Aquifer Supplies**									
	Bee County-Other (Municipal)	$4,943,000	$328	$121	1,682	1,682	1,682	1,682	1,682	1,682
	El Oso WSC	$424,000	$553	$234	94	94	94	94	94	94
	Bee County- Irrigation	$1,166,000	$276	$43	352	352	352	352	352	352
	Bee County- Mining	$622,000	$259	$36	197	197	197	197	197	197
	TDCJ Chase Field	$703,000	$404	$168	208	208	208	208	208	208
	Brooks County-Other (Municipal)	$1,207,000	$430	$155	309	309	309	309	309	309
	Brooks County- Mining	$615,000	$291	$55	182	182	182	182	182	182
	Duval County-Other (Municipal)	$2,109,000	$442	$155	516	516	516	516	516	516
	Duval County- Mining	$3,228,000	$357	$61	768	768	768	768	768	768
	Duval County- San Diego MUD 1	$1,856,000	$453	$139	417	417	417	417	417	417
	Jim Wells County-Other (Municipal)	$10,704,000	$392	$108	2,650	2,650	2,650	2,650	2,650	2,650
	Jim Wells County- Irrigation	$753,000	$183	$24	333	333	333	333	333	333
	Jim Wells County- Manufacturing	$129,000	$688	$125	16	16	16	16	16	16
	Jim Wells County- Mining	$202,000	$309	$55	55	55	55	55	55	55
	Kenedy County- Mining	$469,000	$587	$63	63	63	63	63	63	63
	Kleberg County- Manufacturing	$852,000	$275	$32	247	247	247	247	247	247
	Kleberg County- Mining	$638,000	$359	$42	142	142	142	142	142	142
	Live Oak County- Irrigation	$917,000	$142	$21	534	534	534	534	534	534
	Live Oak County- Manufacturing	$188,000	$500	$36	28	28	28	28	28	28
	Nueces County- Other (Municipal)	$4,514,000	$322	$100	1,435	1,435	1,435	1,435	1,435	1,435
	Nueces County- Irrigation	$319,000	$471	$39	51	51	51	51	51	51
	Nueces County-Mining	$2,200,000	$158	$20	1,127	1,127	1,127	1,127	1,127	1,127
	San Patricio County- Irrigation	$420,000	$162	$15	204	204	204	204	204	204
	San Patricio County- Mining	$1,141,000	$229	$28	398	398	398	398	398	398

WMS ID	Recommended WMS	Total Project Cost	First Decade Estimated Unit Cost ($/ac-ft/yr)	Last Decade Estimated Unit Cost ($/ac-ft/yr)	Water Yield (ac-ft/yr)					
					2030	2040	2050	2060	2070	2080
5D.9	**Groundwater Desalination**									
	City of Alice- Brackish Groundwater Desalination	$23,983,000	$1,170	$668	0	3,360	3,360	3,360	3,360	3,360
	Evangeline/Laguna Groundwater Project (Treated)									
	Delivery Option 3- MAG constrained	$157,550,000	$1,767	$1,150	0	19,898	19,898	22,788	22,788	22,788
5D.10	**Seawater Desalination**									
	City of Corpus Christi- Inner Harbor (10 MGD)	$236,693,000	$3,218	$1,731	0	11,201	11,201	11,201	11,201	11,201
	City of Corpus Christi- La Quinta (20 MGD)	$420,372,000	$2,800	$1,479	0	22,402	22,402	22,402	22,402	22,402
	Poseidon Regional Seawater Desalination Project at Ingleside (50 MGD)	$724,984,000	$2,206	$1,296	0	56,044	56,044	56,044	56,044	56,044
	Port of Corpus Christi Authority- Harbor Island (50 MGD)	$802,807,000	$2,323	$1,315	0	56,044	56,044	56,044	56,044	56,044
	Port of Corpus Christi Authority- La Quinta Channel (30 MGD)	$457,732,000	$2,321	$1,362	0	33,604	33,604	33,604	33,604	33,604
5D.11	**Regional Water Treatment Plant Facility Expansions- ON Stevens WTP**	**$68,212,000**	**$565**	**$415**	**32,030**	**32,030**	**32,030**	**32,030**	**32,030**	**32,030**

Table 5D.114. Recommended WMS Implementation Status

						SPONSOR AUTHORIZATION	PERMITTING STATUS (as applicable)									PLANNING, DESIGN, AND CONSTRUCTION STATUS						TOTAL FUNDS EXPENDED TO DATE	Other significant activities completed (summary)
							STATE WATER RIGHT STATUS				FEDERAL 404 PERMIT STATUS (if applicable)		DESALINATION PERMIT STATUS		OTHER KEY PERMITS	GEOTECH/DESIGN	LAND ACQUISITION		CONSTRUCTION				
Water Management Strategy/Project Name	**Project Sponsor**	**WMS Project Sponsor Region**	**Online Decade**	**Capital Cost**	**Anticipated Footprint Acreage (acres)**	**Date(s) that the sponsor took an affirmative vote or other action to make expenditures necessary to construct or file applications for state or federal permits (date(s))**	**Anticipated (or actual) TCEQ application filed (date)**	**Anticipated (or actual) State Water Right Permit Administratively Complete (date)**	**Anticipated (or actual) Draft State Water Right Permit Issued (date)**	**Anticipated (or actual) Date Final State Water Right Permit Issued (date)**	**Anticipated (or actual) application for permit filed (date)**	**Anticipated (or actual) permit issuance (date)**	**Anticipated (or actual) diversion permit issued (date)**	**Anticipated (or actual) Discharge/Disposal Permit Issued (date)**	**Summary of other permits and status (summary)**	**Generally describe the types and amount (as %s) of geotechnical/reconnaissance/ engineering feasibility or other technical, testing, and/or design work etc. performed to date (summary)**	**Percent Land Acquisition Completed (%)**	**Anticiptated land acquisition completion (date)**	**Anticipated start of construction (Date)**	**Percent construction completed (%)**	**Anticipated construction completion (date)**	**Rough approximation of the total expenditures, to date, on ALL activities related to project implementation to date (millions of $s)**	
Local Balancing Storage	Nueces County WCID 3	N	2030	$18,460,000	33	NCWCID3 has been in communication with Nueces County Commissioner Joe Gonzales in regard to potentially utilizing the large storm water detention reservoirs that they will be constructing with General Land Office Mitigation Funds to serve as all or part of our Local Balancing Storage Reservoir needs																	
Corpus Christi Inner Harbor (30 MGD)	City of Corpus Christi	N	2030	$544,904,723	10	Most recently, 6/25/2024, City Council authorized the City Manager to execute a contract with the design-build team for the Inner Harbor Project.					Submitted 5/10/2023. USACE review in progress.		Granted October 10, 2022 for diversions not to exceed 93,148 ac-ft/year with a maximum diversion of 129 cfs	In progress; to be considered on March 13,2025 (TPDES Permit No. WQ0005289000)		20% Geotechnical Investigation 15% Topographic Survey 5% Preliminary Engineering 25% Water Quality Characterization			26-Mar		28-Jul	13M	The City of Corpus Christi is moving forward with a 30MGD seawater desalination treatment plant to be designed, built and commissioned along the Inner Harbor via a progressive design-build project delivery method. The City has chosen Kiewit as the progressive design-builder. The City will use exisiting infrastructure to deliver water to all customers and intends to operate and maintain the plant by 2028.

Corpus Christi La Quinta Channel (40 MGD)	City of Corpus Christi	N	2050	$774,000,000	10	12/17/2019 City Council authorized the development and submission of both diversion and discharge permit applications for the project.							Filed 5/5/2020. Granted 3/28/2024 for diversions not to exceed 186,295 acre-feet per year with a maximum diversion rate of 257 cfs	Application filed1/22/2020. TCEQ review in progress.								.7M	The City is working with the TCEQ to complete the discharge permitting process and review.
Corpus Christi Barney Davis (20 MGD)	City of Corpus Christi	N	2040	$396,590,000	12								725,000 ac-ft/year with up to 6,650 ac-ft/year of consumptive use		Permit for incidental take for threatened and endangered species on August 3, 2020								The City is reviewing the feasibility and future demand needed.
Harbor Island (100 MGD)	Port of Corpus Christi Authority	N	2030	$2,415,000,000	31	Initially April 2017 and direction from Port Commission 5/21/2024 to pursue remaining permits.	2/13/2023	3/14/2023	~Fall 2025	~Q2 2026	To be submitted in early 2025; pre-app meeting with USACE Jan 17, 2025.	~Q2 2026	50 MGD rec'd 12/22/22; anticipate filing GOM outfall application in Mar 2025	Offshore discharge permit application under development	GLO easement for intake/intake pipe approved by Port Commission on 10/2024; GLO easement amendment for discharge structure to be submitted in early 2025	Some geotechnical complete for Blue Water Texas Terminal project and supporting infrastructure follows this route.	NA	NA	~Q2 2027		2030	~$9MIL	Offshore lease and easement approved by Port Commission Oct '24; pending GLO execution.
PCCA- La Quinta Channel (30 MGD)	Port of Corpus Christi Authority	N	2050	$572,000,000	40	Initially April 2017.				6/26/2024	TBD	TBD	7/16/2024 (102,000 ac-ft)	Pending	NA		NA	NA	TBD	TBD	TBD	$2.6MIL	
Evangeline Laguna Treated Groundwater	City of Corpus Christi	N	2030	$204,000,000	23,000	3/14/2023 and 10/13/2023 (Expenditures by City of Corpus Christi to Evaluate Strategy and Negotiations with Project Owner)									4/18/2019 (San Patricio County Grounwater Conservation District Water Well Production Permit)							Consulting services (CCW): $230,400	Constructed and tested two wells for water quality and production rate. Water quality analysis, identified regulatory considerations, evaluated five project configuration/delivery options, stakeholder coordination with muncipal and industrial stakeholders to identify water quality needs and constituents of interest, raw water rate evaluation, performed blending evaluation to identify integration considerations for raw water.

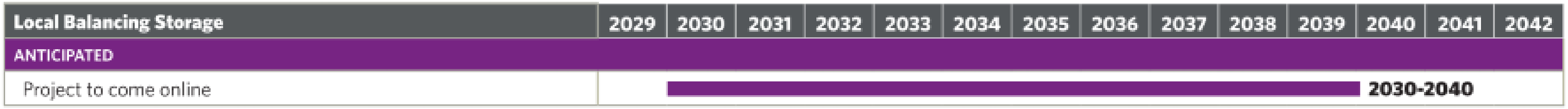

Figure 5D.1.
Local Balancing Storage Schedule

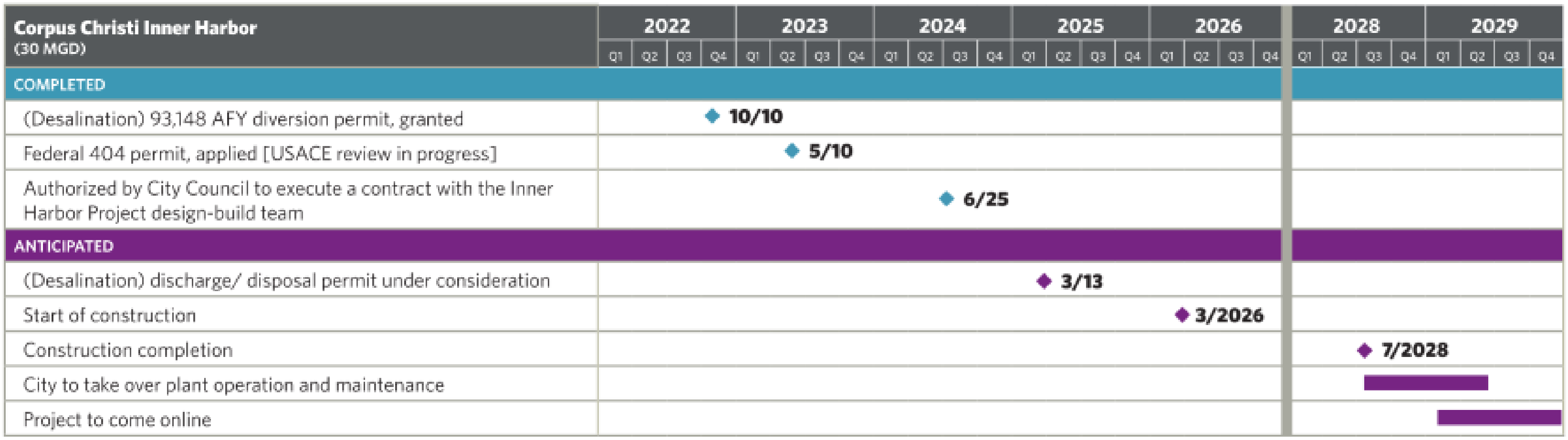

Figure 5D.2.
Corpus Christi Inner Harbor Schedule

Figure 5D.3.
Corpus Christi La Quinta Channel Schedule

Figure 5D.4.
Corpus Christi Barney Davis Schedule

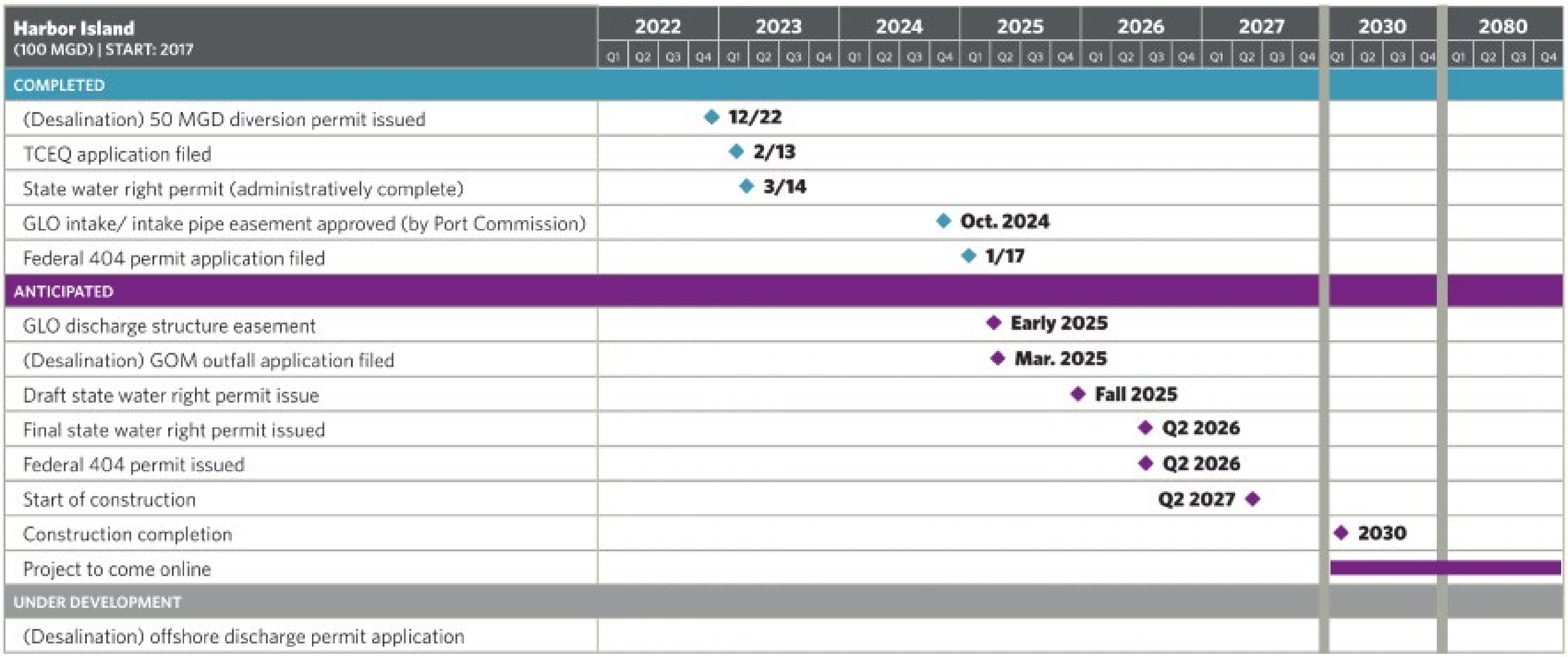

Figure 5D.5.
Harbor Island Schedule

PCCA La Quinta Channel (30 MGD) | START: APRIL 2017	2024	2030	2040	2050	2060	2070	2080
ANTICIPATED							
Final state water wight permit, issued	◆ 6/26						
(Desalination) 102,000 AFY diversion permit, issued	◆ 7/16						
Project to come online							
PENDING							
(Desalination) discharge/ disposal permit, issued							
UNDER DEVELOPMENT							
Federal 404 permit application, filed							
Federal 404 permit application, issued							
Start of construction							
Construction checkpoint							
Construction completion							

Figure 5D.6.
PCCA La Quinta Channel Schedule

Evangeline Laguna Treated Groundwater	2019				2020				2021				2022				2023				2030				2040			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
COMPLETED																												
San Patricio County GCD water well production permit		◆ 4/18																										
City expenditure to evaluate strategy																	◆ 3/14											
Project owner negotiations																				10/12 ◆								
ANTICIPATED																												
Project to come online																												

Figure 5D.7.
Evangeline Laguna Treated Groundwater Schedule

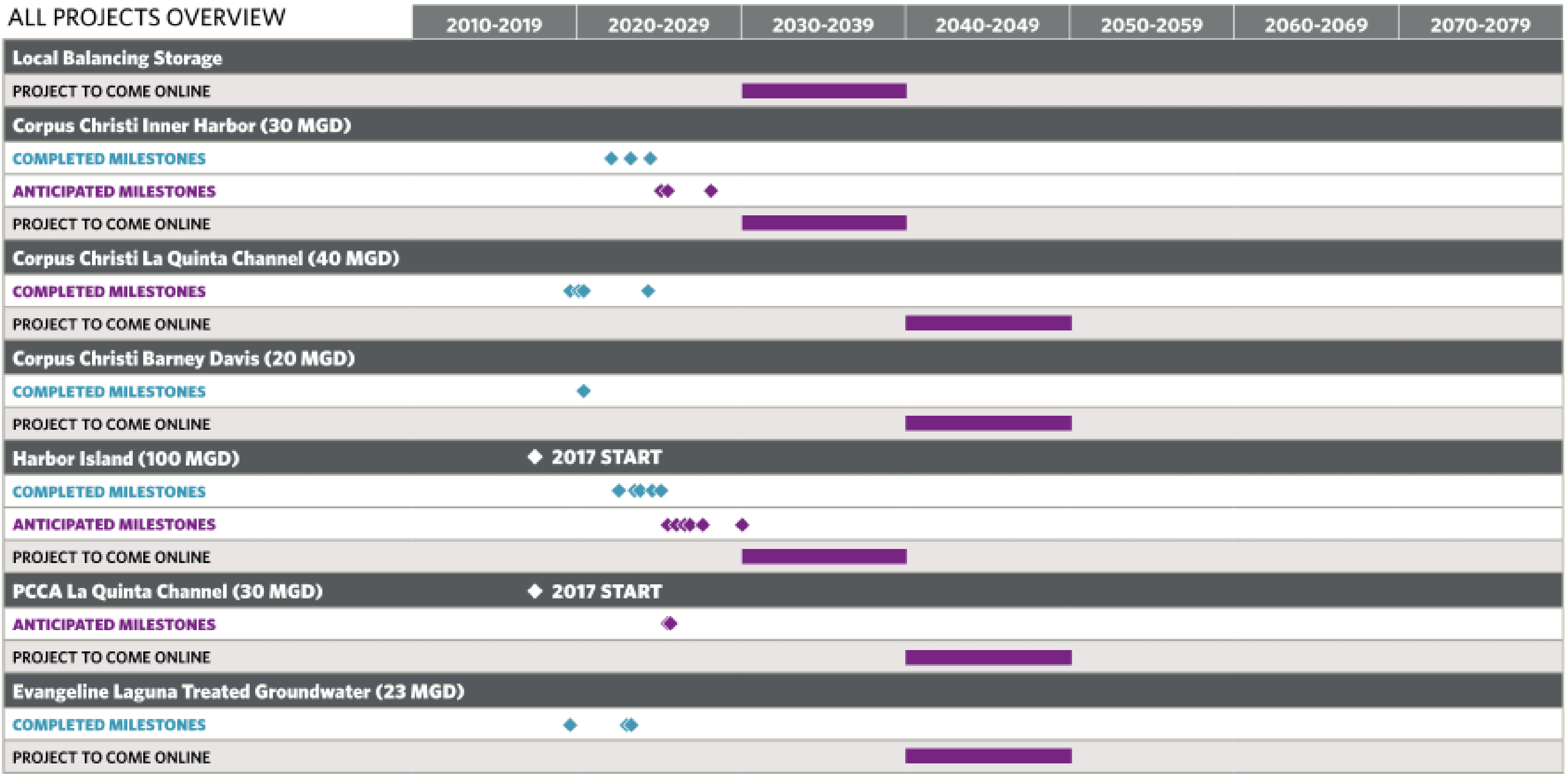

Figure 5D.8.
All Projects Schedule Overview

6

Impacts of Regional Water Plan and Consistency with Protection of Resources [31 TAC §357.40 and §357.41]

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Chapter 6: Impacts of Regional Water Plan and Consistency with Protection of Resources

The guidelines for the 2026 regional water plans include describing major impacts of recommended and alternative water management strategies on key parameters of water quality identified by the regional water planning group. This also includes consideration of third party social and economic impacts associated with voluntary redistribution of water from rural and agricultural areas, and effects of ground and surface water interrelationships on water resources of the state. Furthermore, 2026 regional water plans consider statutory provisions regarding inter-basin transfers of surface water including summation of water needs in basins of origin and receiving basins, as well as how the regional plan is consistent with protection of natural resources. The plan development was guided by the principal that the designated water quality and related water uses as shown in the state water quality management plan shall be improved or maintained. Each water management strategy summary (Chapter 5B) includes a discussion of these environmental considerations, impacts to agricultural resources and State water resources, threats to agricultural and natural resources, effects on navigation, and potential impacts associated with project implementation including impacts on current water supply infrastructure. Other factors included are environmental impacts, possible effects to instream flows, wildlife habitat, cultural resources, environmental water needs, and inflows to bays and estuaries and arms of the Gulf of Mexico. The *2026 Coastal Bend Regional Water Plan* does not have any alternative water management strategies.

6.1 Socioeconomic Impacts of Not Meeting Identified Water Needs

The Texas Water Development Board (TWDB)[1] will be conducting a socioeconomic impact analysis report of not meeting identified water needs for each region in accordance with 31 Texas Administrative Code (TAC) §357.40(a) provisions. The TWDB anticipates releasing the report for the Coastal Bend Region (Region N) in August 2025. The Coastal Bend Regional Water Planning Group (CBRWPG) will consider the results of this report at a regular public meeting in the fall of 2025 and will include in the *Final 2026 Coastal Bend Regional Water Plan*.

6.2 Quantitative Impacts to Agricultural Resources and Environmental Factors

The TWDB guidance for 2026 regional water plans requires evaluation of quantitative impacts to agricultural resources and environmental factors for each evaluated water management strategy in the plan. The CBRWPG adopted agricultural and environmental keys on January 30, 2025, for water management strategy evaluations. Table 6-1 presents the key to the impacts to

[1] TWDB, Socioeconomic Impacts of Projected Water Shortages for the Coastal Bend (Region N) Regional Water Planning Area, November 2019.

agricultural resource descriptors that are presented for each water management strategy evaluation summary (Chapter 5B) based on water management strategy project construction footprint. Additional details regarding impacts to local agricultural resources, such as impacts to ephemeral streams that might be used by local landowners for irrigation purposes are also identified based on information available.

Table 6-1.
Impacts to Agricultural Resources Key

Impacts to Agricultural Resources Key	Criteria
None or Low; Negligible	Temporary impacts to agricultural land during project construction. Occasion disturbances due to maintenance on right of way for pipelines.
Moderate; Some	Loss of up to 50 irrigated acres permanently due to repurposing of land to support the project (i.e., impoundment).
High	Loss of more than 50 irrigated acres permanently due to repurposing of land to support the project (i.e., impoundment).

Each strategy includes a separate environmental issues discussion, which describes environmental factors. Table 6-2 includes the key to the environmental issues that are presented in the evaluation summaries.

Table 6-2.
Impacts to Environmental Factors Key

Impacts to Environmental Factors Key	Criteria
None or Low; Negligible	Reduction in environmental flows with implementation of the strategy is indiscernible (less than 1%) using the approved surface water availability model, as compared to flows without the project. Wildlife habitat is not expected to be altered by the project.
Moderate; Some	Reduction in environmental flows with implementation of the strategy is expected to range from 1% to 10% using the approved surface water availability model, as compared to flows without the project. Due to the nature of the strategy, localized impacts to small creeks or on-site tanks may be noticed (up to 10%). Wildlife habitat may be temporarily impacted during project construction, but long-term impacts to wildlife habitat are not expected.
High	Reduction in environmental flows with implementation of the strategy is expected to exceed 10% using the approved surface water availability model, as compared to flows without the project. Long-term wildlife habitat alteration is highly likely with project.

6.3 Groundwater and Surface Water Interrelationships Impacting Water Resources of the State

The Nueces River from Three Rivers to the Calallen Pool (including Lake Corpus Christi), hereafter referred to as the Lower Nueces Basin, is hydraulically connected to underlying Goliad Sands and alluvial sands of the Gulf Coast Aquifer. During the development of the 2011 regional water plan, studies were conducted to evaluate stream flow interaction with alluvial sands of the Gulf Coast Aquifer downstream of Choke Canyon Reservoir (CCR) to Lake Corpus Christi (LCC), using data collected during a field channel loss study and are summarized in Chapter 9. Groundwater and surface water interaction in the Lower Nueces Basin is very complex and could vary significantly based on seasonal events, antecedent drought or wet conditions and prolonged drought or wet conditions that could impact storage and released water from LCC. Additional studies were performed, as discussed in Chapter 9, to evaluate groundwater and surface water interrelationships considered to potentially impact Lower Nueces Basin water quality that may affect water supplies diverted from the Calallen Pool. The Lower Nueces River Watershed Protection Plan was created based on water quality issues for total dissolved solids (TDS) and Chlorophyll-a. As part of the plan, they have identified and repaired onsite sewage facilities, thus improving water quality.

The Coastal Bend Region recognizes the importance of considering groundwater and surface water interaction when managing water resources and evaluating development of future water supplies. The region encourages groundwater conservation districts and groundwater management areas to consider protection of springs and groundwater-surface water interaction when considering new desired future conditions (DFCs).

6.4 Threats to Agricultural or Natural Resources

Agriculture accounts for a major portion of the land use within the Coastal Bend Region. Cultivated land is typically dryland farming, irrigated agriculture or used for livestock (for more details see Chapter 1). Fishing is another industry that adds to the economic value of the Coastal Bend Region.

Most agricultural business in the region relies on groundwater for irrigation and groundwater and local stock tanks for livestock. Continuing groundwater depletion is a threat to agricultural and natural resources. The Coastal Bend Region also recognizes the following additional potential threats to agricultural and natural resources:

- Shortage of freshwater and economically accessible groundwater attributable to increased irrigation demands.
- Shortage of freshwater and economically accessible groundwater attributable to development of natural gas from the shale in the Eagleford Group and water demands associated with hydraulic fracturing of wells.
- Deterioration of surface water quality associated with sand and gravel operations and other activities.
- Deterioration of groundwater quality and increasing concerns of possible arsenic and uranium contamination attributable to uranium mining activities.
- Potential impacts to threatened, endangered, and other species of concern.
- Potential impacts of brush control and other land management practices as currently considered in federal studies.
- Natural disasters or other critical storms.
- Abandoned wells (oil, gas, and water).

These threats to agricultural or natural resources are considered for each water management strategy, and when applicable, are specifically addressed in the Chapter 5B water management strategy evaluation.

While the Coastal Bend Region is known for its valuable mineral resources, especially oil and gas, the area also contains a rich diversity of living natural resources. This region also has many migratory flyways and birds comprise a major portion of the wildlife population found within the area. The Coastal Bend Region provides many birds unique nesting and forage resources within its coastal prairies, wetlands, and riverine ecosystems. Texas Parks and Wildlife Department (TPWD) and U.S. Fish and Wildlife Service (USFWS) - Southwest Region Ecological Service maintain maps identifying potential habitats (by county) of each endangered or threatened species. A summary of endangered and threatened species for the 11-county region is included in Chapter 1. These potential habitats are considered for each water management strategy and when possibly impacted, are noted in the appropriate water management strategy summary (Chapter 5B).

6.5 Third Party Social and Economic Impacts Resulting from Voluntary Redistribution of Water Including Impacts of Moving Water from Rural and Agricultural Areas

Several opportunities for voluntary redistribution exist for the Coastal Bend Region, including reallocating surface water through use of unused supply and sales of existing rights, or reallocating modeled available groundwater (MAG) through transfer of unused supply for entities with a surplus of groundwater to entities needing to drill additional wells as discussed in Chapter 5B.9.

Reallocation of unutilized surface water supply was considered but not recommended as a water management strategy. Based on existing water supply contract relationships, it is anticipated that the City of Three Rivers will continue to supply water to Live Oak-Manufacturing in addition to future manufacturing needs being met by drilling additional wells. Similarly, Nueces County Water Control and Improvement District #3 (WCID 3) will continue to meet the needs for Robstown and River Acres Water Supply Corporation (WSC) by implementing the recommended strategy identified in Chapter 5B.8. The impacts of voluntary redistribution of un-utilized surface water supply are expected to have minimal or no impacts on third party users or rural and agricultural areas.

Groundwater supplies were determined by comparing the MAG-preserved well capacities for each water user group (WUG) that has historically relied on groundwater to projected demands. Groundwater supply was set equal to the amount of capacity or water demand, whichever is lower. For water user groups that use both groundwater and surface water supplies, it was assumed that the WUG would use groundwater up to its well capacity (limited by MAG) and then use available surface water per rights or contracts to total the projected water demand through combination of groundwater and surface water supplies. The CBRWPG assumes that excess groundwater beyond demands is not pumped and therefore available as a collective resource for future water management strategy development subject to adopted MAGs, which are established based on desired future conditions established by the local groundwater conservation districts and groundwater management areas.

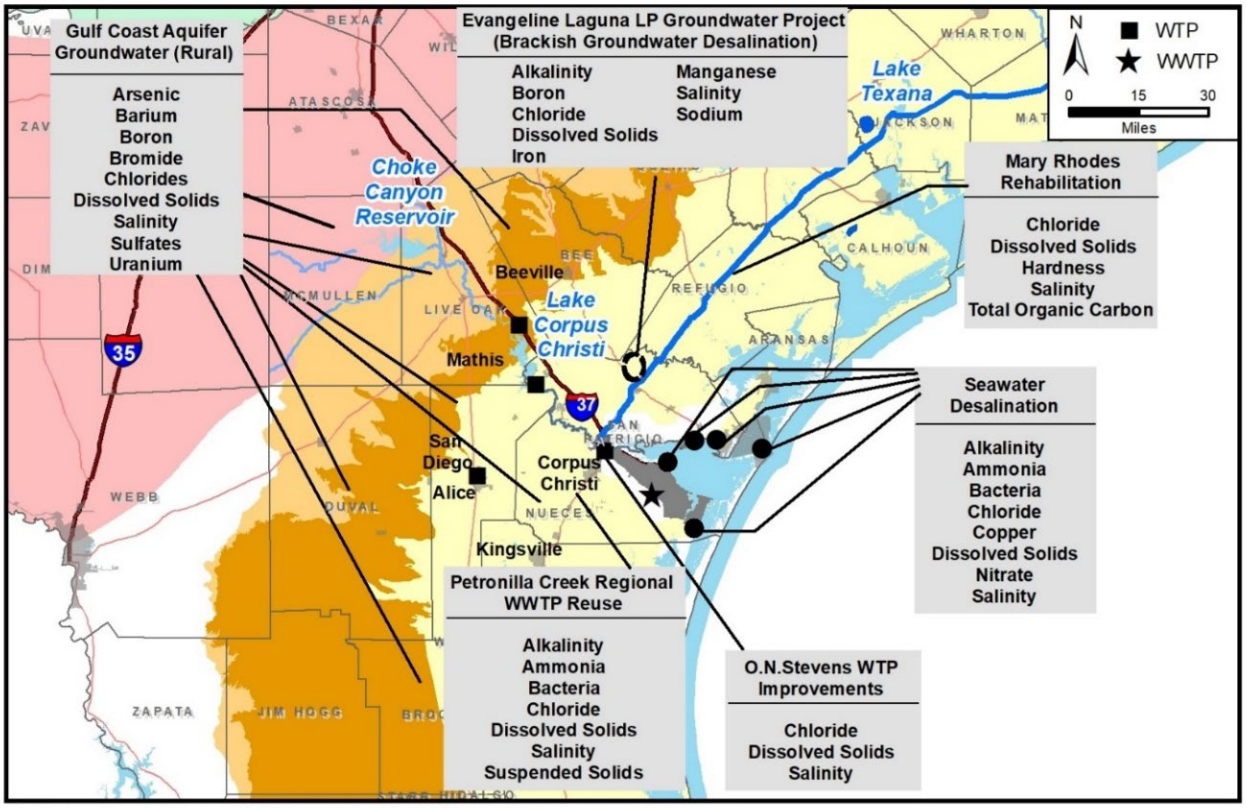
The water management strategies recommended to meet water needs (Chapter 5) do not include transferring water needed by rural and agricultural users and, therefore, are not considered to impact them.

6.6 Impacts of Recommended Water Management Strategies on Key Parameters of Water Quality

The CBRWPG identified the following key parameters of water quality to consider for water management strategy in the 2026 regional water plan. The selection of key water quality parameters is based on water quality concerns identified in the Nueces River Authority's 2021 Basin Highlights Report[2], by planning group members and the public during CBRWPG meetings, and water quality studies conducted for water management strategies included in previous and current regional water plans and other regional studies. The CBRWPG identified water quality parameters for recommended water management strategies, as shown in Figure 6.1 and Figure 6.2.

The major impacts of recommended water management strategy on these key parameters of water quality are described in greater detail in the respective water management strategy summary (Chapter 5B). These identified water quality concerns may present challenges that would need to be overcome before the water management strategy can be implemented as a water supply. For water quality parameters that cannot be fully addressed due to lack of available information or inconclusive water quality studies, the water management strategy write-ups in Chapter 5B include recommendations for further studies prior to implementation as a water management strategy.

[2] Nueces River Authority, "2021 Program Update for San Antonio- Nueces Coastal Basin, Nueces River Basin, Nueces-Rio Grande Coastal Basin, and Bays and Estuaries" for the Texas Clean Rivers Program.



W:\007003\GIS\map_docs\arcmap\Gulf_Coast_Aquifer_Supplies_1_2025.mxd

Figure 6.1.
Water Quality Parameters to Consider for Water Management Strategies (1 of 2)

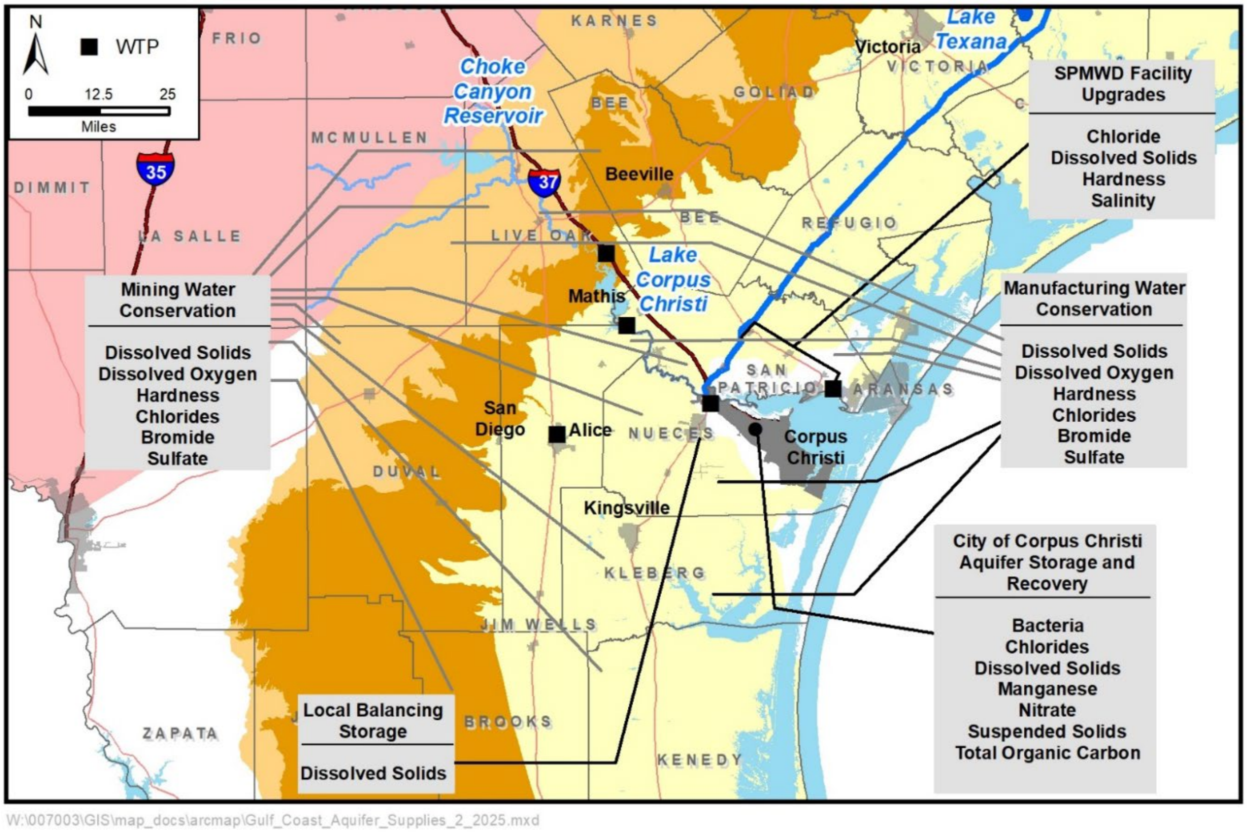


Figure 6.2.
Water Quality Parameters to Consider for Water Management Strategies (2 of 2)

6.7 Effects on Navigation

The water management strategies recommended to meet water needs are not anticipated to impact navigation. However, this consideration is evaluated for each water management strategy and included in the summary table at the end of each water management strategy description (Chapter 5B).

6.8 Summary of Identified Water Needs that Remain Unmet by the RWP

There are no identified water needs that remain unmet for the 2026 regional water plan.

6.9 Interbasin Transfers

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 inter-basin transfer permit[3] and a contract with the Lavaca-Navidad River Authority to divert 31,440 acre-feet per year (ac-ft/yr) on a firm basis and up to 12,000 ac-ft/yr on an interruptible basis from Lake Texana in the Lavaca-Navidad River Basin to the City of Corpus Christi's O.N. Stevens Water Treatment Plant (WTP).[4] This water is delivered to the City of Corpus Christi via the Mary Rhodes Pipeline (MRP), which became operational in 1998. In addition, the pipeline delivers MRP Phase II supplies from the Colorado River to the City through a second interbasin transfer permit owned by the City of Corpus Christi. This permit[5] allows the diversion of up to 35,000 ac-ft/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 the 35,000 ac-ft/yr is available from this run-of-river right during the Nueces Basin drought of record when integrated as part of the Corpus Christi Regional Water Supply System.

6.10 Consistency with Protection of Water Resources, Agricultural Resources, and Natural Resources

The *2026 Coastal Bend Regional Water Plan* is consistent with long-term protection of the state's water resources, agricultural resources, and natural resources and is developed based on guidance principles outlined in the TAC Chapter 358 - State Water Planning Guidelines. The 2026 regional water plan was produced with an understanding of the importance of orderly development, management, and conservation of water resources and is consistent with all laws applicable to water use for the state and regional water planning areas. Furthermore, the plan was developed according to principles governing surface water and groundwater rights. The 2001 Texas Commission on Environmental Quality (TCEQ) Agreed Order governing freshwater pass-throughs to the Nueces Estuary was strictly adhered to for current surface water supply projects and future water management strategies. For groundwater, the 2026 Plan also recognized principles for groundwater use in Texas and the authority of groundwater conservation districts and groundwater management areas within the Coastal Bend Region. The MAG estimates developed by the TWDB based on desired future conditions developed by groundwater conservation districts and groundwater management areas was used to determine groundwater availability. The CBRWPG recognizes the need to protect groundwater quality.

The 2026 regional water plan identifies actions and policies necessary to meet the Coastal Bend Region's near and long-term water needs by developing and recommending water management strategies to meet their needs with reasonable cost, good water quality, and sufficient protection of agricultural and natural resources of the state. The Coastal Bend Region recommended water management strategies that considered public interest of the state, wholesale water providers, protection of existing water rights, and opportunities that encourage voluntary transfers of water resources while balancing economic, social, and ecological viability.

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[3] TCEQ, Certificate of Adjudication No. 16-2095C, held by Lavaca-Navidad River Authority and Texas Water Development Board (TWDB), October 21, 1996.

[4] A call-back of 10,400 ac-ft/yr has been exercised by the LNRA for water needs in Jackson County.

[5] TCEQ, Certificate of Adjudication No. 14-5434B, held by the City of Corpus Christi (via the Garwood Irrigation Company), October 13, 1998.

The 2026 regional water plan considered environmental information resulting from site-specific studies and ongoing water development projects when evaluating water management strategies. Water management strategies that have the potential of impacting instream flows and inflows to bay and estuary systems are discussed in the respective Chapter 5B subchapter. For the 2026 regional water plan, recommended water management strategies either originate from the Gulf of Mexico or groundwater projects that are expected to have minimal to no cumulative adverse effect on Nueces River instream flows and inflows to the Nueces estuary. Possible habitats for endangered and threatened species were considered for each water management strategy (Chapter 5B). The 2001 Agreed Order includes operational procedures for CCR and LCC and requires passage of inflows to the Nueces Bay and Estuary based on maximum harvest studies and inflow recommendations to maintain the health of the Nueces Estuary. It is likely that with additional water supplies from Lake Texana and the Colorado River from adjacent basins, water stored in CCR and LCC is at a higher percent storage capacity than what would have occurred if CCR and LCC were solely responsible for meeting the needs of the City of Corpus Christi and its customers at the same demand. The water supply diversification that has occurred in the region has aided to promote recreational uses at the lakes while meeting 2001 Agreed Order provisions for instream flow to the bay and estuary.

Due to most areas having an underlying impervious clay layer, there has not been much opportunity for springs to form in the Coastal Bend Region.

The 2026 regional water plan consists of initiatives to respond to drought conditions and includes drought contingency measures by regional entities (Chapter 7). Average annual inflows to Choke Canyon Reservoir/Lake Corpus Christi system (CCR/LCC System)continue to trend lower with each successive drought, with the most recent hydrology update[1] for the Corpus Christi Water Supply Model (CCWSM) (through 2015) showing a new drought of record for the Corpus Christi Regional Water Supply System from 2007 to 2013. During the time of the model update, the CCR/LCC System had not yet returned to full capacity, and rainfall events in October 2013 and June 2015 ameliorated the severity of drought and replenished stored water levels temporarily. For the model period (1934-2015), the single lowest inflow year to the CCR/LCC System occurred in 2011. The minimum 2 year (twenty four month) inflow to the CCR/LCC System during this most recent decade occurred from October 2010 to September 2012 at an inflow of 124,000 acre-feet (ac-ft), which is 32 percent less than the minimum 2-year inflow to the CCR/LCC System in the 1990s of 183,000 ac-ft that occurred from August 1994 to July 1996 and was the driver of the previous drought of record as seen in Figure 6.3. During other times, such as in the 1970s and intermittent periods not shown on the figure, inflows to the system are high. These natural, cyclical patterns are important to restore water storage as well as provide important pulses to maintain sediment transport and nutrients for bay and estuary health.

Based on current drought conditions as of February 2024, drought severity has intensified, and it appears that the region is in a new drought of record (DOR). There was insufficient funding allocated in the 2026 regional water plan development to update the CCWSM through current

[1] City of Corpus Christi, Corpus Christi Water Supply Yield Results from Hydrology Update, June 1, 2017.

conditions, however this is considered a high priority for the region for future cycles. The combined CCR/LCC System has not been full since September 2007 and system storage as of January 23, 2025, is approximately 19 percent. Therefore, it is important to understand that estimates of firm or safe yield reported in this report represent maximum values.

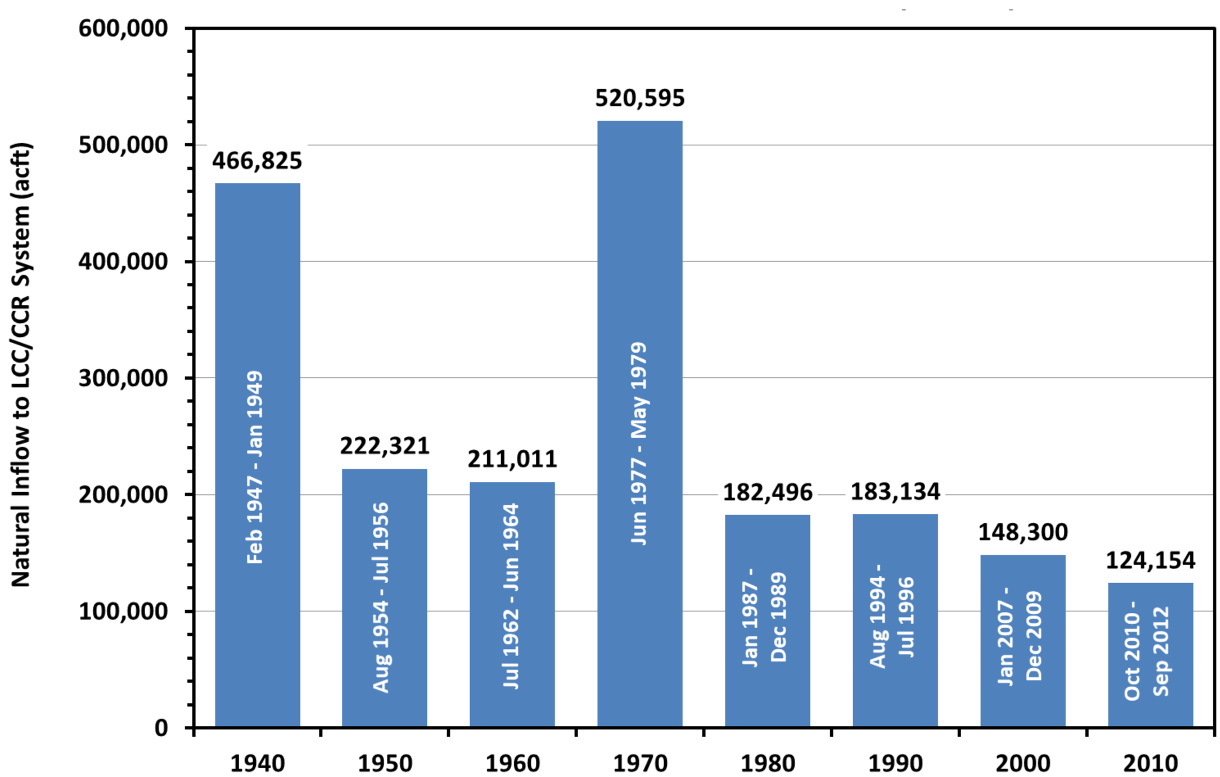

Figure 6.3.
Minimum 24-Month Natural Inflow to LCC/CCR System by Decade

The Coastal Bend Region conducted numerous meetings during the 2026 planning cycle, with meetings open to the public and decisions based on accurate, objective, and reliable information. The region coordinated water planning and management activities with local, regional, state and federal agencies and participated in interregional communication with the South Central Texas Region (Region L) and Lavaca Region (Region P), when needed, to develop interregional strategies in an open, equitable, and efficient manner. The Coastal Bend Region considered recommendations of stream segments with unique ecological value by TPWD and sites of unique value for reservoirs. At this time, the Coastal Bend Region recommends that no stream segments with unique ecological value be designated. The CBRWPG developed policy recommendations for the 2026 regional water plan, including protection of water quality, consideration of environmental issues, interbasin transfers, groundwater management, request for additional studies for water supply projects (such as desalination), and continued funding for regional water planning efforts. The CBRWPG's policy recommendations are included in Chapter 8.

7

Drought Response Information, Activities, and Recommendations

[31 TAC §357.42]

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Chapter 7: Drought Response Information, Activities, and Recommendations

Droughts are of great importance to the planning and management of water resources in Texas. Although droughts can occur in all climatic zones, they have the greatest potential for environmental and public health concern in arid regions such as Texas. It is not uncommon for mild droughts to occur over short periods of time in the state; however, there is no reliable way to fully predict how long or severe a drought will be until it is over. The best defense available to water user groups (WUGs) in drought prone areas, such as those in the Coastal Bend Region, is proper planning and preparation for worst case scenarios with contingencies for drought uncertainty. This requires understanding drought patterns and the historical droughts in the region.

The demand for water will continue to increase in the Coastal Bend Region. This growing demand compounded by climate uncertainty and extended drought periods makes planning even more important to prevent shortages, deterioration of water quality, and lifestyle/financial impacts on water suppliers and users. This chapter presents information on the Coastal Bend Region's drought preparedness, including regional droughts of record, current model drought contingency plans, emergency interconnects, and responses to local drought conditions.

Texas Administrative Code (TAC), Chapter 357.42 presents guidance for drought and emergency response information for inclusion in the regional water plans. A drought template provided by the Texas Water Development Board (TWDB) in March 2024 included guidance on drought information to include in 2026 regional water plans, which the Coastal Bend Regional Water Planning Group (CBRWPG) considered during development of this chapter.

7.1 Droughts of Record in the Coastal Bend (Region N) Regional Water Planning Area

7.1.1 Background

One of the best tools in drought preparedness is a thorough understanding of the drought of record (DOR), or the worst drought to occur for a particular area during the available period of record. However, there are many ways that the "worst drought" can be defined (degree of dryness, agricultural impacts, socioeconomic impacts, effects of precipitation, etc.). Regional planning focuses on the hydrological drought or the drought with the largest shortfalls on surface and/or subsurface water supply. The frequency and severity of hydrological drought is often defined on a watershed or river basin scale, although it could be different from one area to the next, even within a planning region.

7.1.2 Current Drought of Record

The Corpus Christi Water Supply Model (CCWSM) is used to determine water supply availability for the four-basin regional Choke Canyon Reservoir/Lake Corpus Christi/Texana/ Mary Rhodes Pipeline (CCR/LCC/Texana/MRP Phase II) system (or Corpus Christi Regional Water Supply

System). Prior to the *2021 Coastal Bend Regional Water Plan*, the 1992-2002 drought was used to define water availability. With the CCWSM updated during development of the 2021 regional water plan to include hydrology through 2015, a new DOR was identified. In terms of severity and duration, the drought from 2007-2013 is considered to be the DOR for the Coastal Bend Region planning area. During the time of the model update, the Choke Canyon Reservoir/Lake Corpus Christi System (LCC/CCR System) had not yet returned to full capacity, and rainfall events in October 2013 and June 2015 ameliorated the severity of drought and replenished stored water levels temporarily. However, based on drought conditions as of February 2024, drought severity has intensified, and it appears that the region is in a new DOR. There was insufficient funding allocated in the *2026 Coastal Bend Regional Water Plan* development to update the CCWSM through current conditions; however, this is considered a high priority for the region for future cycles. The combined CCR/LCC System has not been full since September 2007 and system storage as of January 23, 2025, is approximately 19percent; therefore, it is important to understand that estimates of firm or safe yield reported in this 2026 regional water plan represent maximum values.

The CCWSM simulated historical hydrology from 1934-2015. From the *2021 Coastal Bend Regional Water Plan* model update, the critical drawdown occurred over 73 months from October 2007 to October 2013, during which time the reservoirs went from full to a minimum storage of 32.6 percent before inflows restored lake storage. From 2010-2012, inflows into LCC and CCR were 32 percent less (or 59,000 acre-feet [ac-ft] less) than the inflows from 1994-1996 into LCC and CCR. For additional comparison, the 2010-2012 inflows were almost 50 percent less (or 98,200 ac-ft less) than the inflow into LCC and CCR from 1954-1956. Annual inflow to the CCR/LCC System for the model period from 1934 to 2015 is shown in Figure 7-1. The 3-year moving average shows the severity and duration of the recent drought relative to other droughts since the 1930s and includes the recovery in 2013 and 2015. In the future, with updates to the model beyond 2015, this graphic should be extended for current drought conditions.

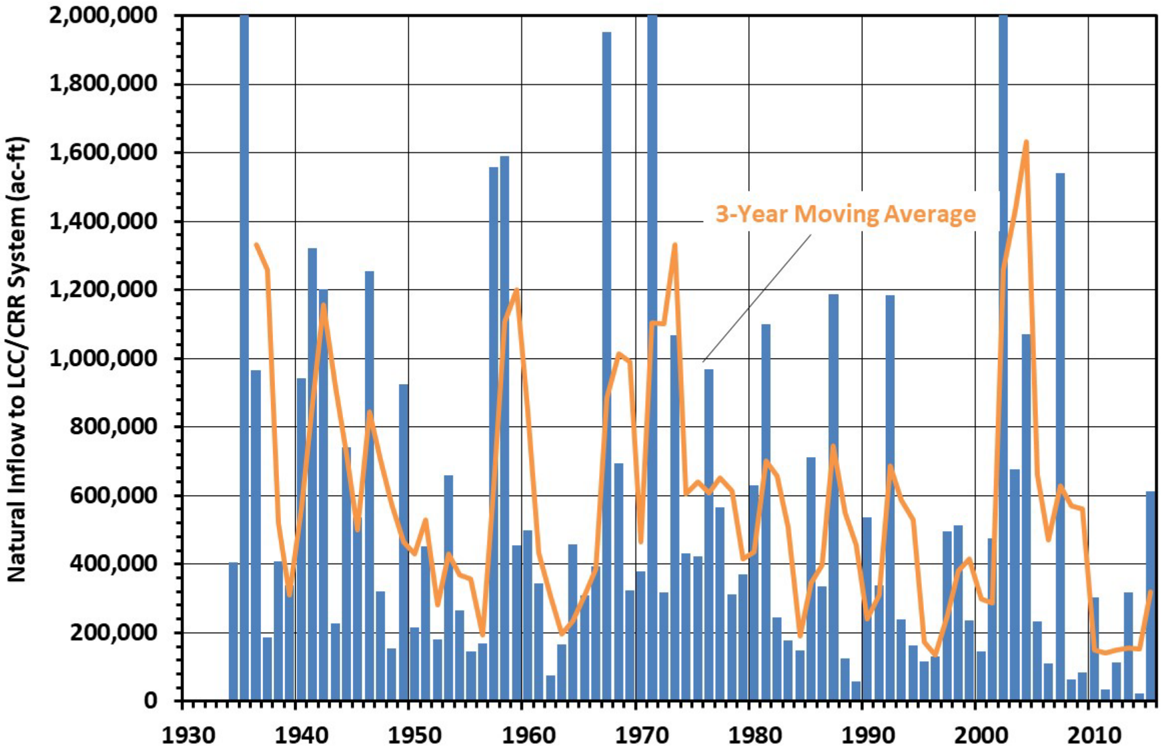

Figure 7-1.
Annual Natural Inflow to the CCR/LCC System

A large amount of water supplied to the region is provided by Lake Texana in Region P and the Colorado River (MRP Phase II) in Region K, which helps mitigate drought impacts in the Nueces Basin. For example, on September 27, 2013, while the combined storage in the CCR/LLC System was at 33 percent of capacity, storage in Lake Texana was at 81.9 percent of capacity. Often, drought occurs at different times and at different levels of severity in the Nueces, Lavaca-Navidad, and Colorado River basins. A recent example of this can be seen in Figure 7-5, which shows that Lake Texana has filled many times during in 2023 and 2024 while the CCR/LCC System is experiencing its lowest combined storage since its construction. This frequent situation gives the City flexibility in operating the CCR/LCC/Texana/MRP Phase II system to optimize water supplies[1]. The DORs for the Lavaca-Navidad and Colorado River basins are December 1952 to April 1957 and October 2007 to April 2015, respectively.[2]

7.1.3 Corpus Christi Water Supply Model

Engineers and planners often use surface water models to demonstrate the effects of historical droughts on water supply. Surface water effects are more readily observed than groundwater; and although reservoirs were not yet constructed before historic droughts, they can be simulated and assessed using historical hydrology. The main tool used to assess the performance of Coastal Bend Region reservoirs under historic drought conditions is the CCWSM. This model simulates

[1] Subject to permitted or contracted supply amounts.

[2] https://www.lcra.org/download/2020-water-management-plan/?wpdmdl=11923 p. 3-2

operations of the CCR/LCC/Texana/MRP Phase II system in addition to adhering to the pass-through schedule from the 2001 Agreed Order between the City of Corpus Christi and the Texas Commission on Environmental Quality (TCEQ) governing freshwater inflows to the Nueces Estuary. Actual pass-thru information can be accessed from the Nueces River Authority website[3].

In the *2021 Coastal Bend Regional Water Plan*, the CCWSM was updated to include:

- Recent hydrology through 2015 to a total model period of 82 years (1934 to 2015), including extensions to net evaporation and ungaged runoff below LCC using methods consistent with the previous model version (1934 to 2003);
- New TWDB volumetric survey data for Lake Corpus Christi (2016), Choke Canyon Reservoir (2012), and Lake Texana (2010) with updated sediment accumulation rates;
- Recent hydrology for Lake Texana and the Colorado River (for MRP Phase II supplies) through 2015;
- Verification that all enhancements adhere to the provisions of the TCEQ 2001 Agreed Order;
- Lake Texana callback of 10,400 acre-feet per year (ac-ft/yr) as exercised by Lavaca-Navidad River Authority for local water users in Jackson County pursuant to City of Corpus Christi contract terms; and
- Operational flexibility to exercise water supply calls on the Colorado River-Garwood water right at a variable rate according to diversion rate and priority date of the rights and based on MRP Phase II system capacities.

At the May 18, 2023, CBRWPG meeting, the planning group considered guidance from the TWDB to consider firm yield when determining surface water availability as well the Coastal Bend Region approach that had been taken in previous planning cycles to determine availability based on safe yield. The CCWSM was used to estimate firm yield of the system for 2030 and 2080 sediment conditions, which is the maximum amount of water volume that can be provided under a repeat of DOR conditions assuming that all senior water rights will be totally used and all permit conditions met. In this case, this is the yield that would be available such that reservoir active storage would be equal to zero during the worst month of the DOR. Figure 7-2 shows a storage trace for the CCR/LCC System under a hypothetical 2030 firm yield demand of 186,000 ac-ft/yr. The critical month of the DOR based on the CCWSM extent of hydrology from 1934-2015 is September 2013.

[3] https://www.nueces-ra.org/CP/CITY/passthru/index.php

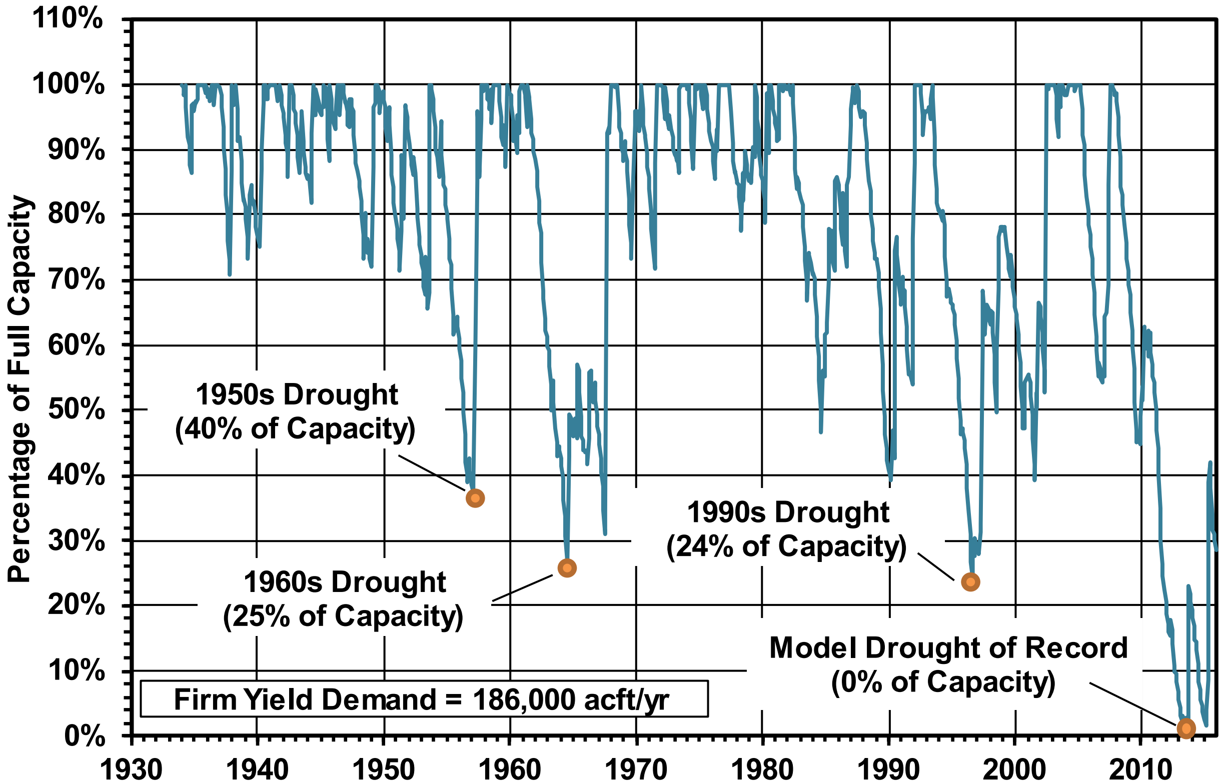

Figure 7-2.
CCR/LCC System Storage Trace- 2030 Firm Yield of 186,000 ac-ft/yr

During the May 2023 meeting, the CBRWPG decided to limit supply availability for the CCR/LCC/Texana/MRP Phase II System based on safe yield to maintain a reserve in storage during the worst, historical DOR that occurred from 2007 to 2013. Safe yield is a standard approach that the CBRWPG and City of Corpus Christi have consistently used in previous planning cycles as a provision for climate and growth uncertainty, such that a *specified reserve amount remains* in storage during the modeled critical drought. On May 18, 2023, the CBRWPG approved submittal of a hydrologic variance request to use safe yield with 75,000 ac-ft reserve in the CCR/LCC System for determining surface water supplies available from the City of Corpus Christi's Regional Water Supply System, which was subsequently granted by the TWDB on January 8, 2024. Figure 7-3 shows a storage trace for the CCR/LCC System similar to Figure 7-2, except that a 75,000 ac-ft reserve is maintained during the critical month of the DOR (September 2013) resulting in a 2030 safe yield of 170,000 ac-ft/yr. This safe yield supply from the City of Corpus Christi's Regional Water Supply System is the basis of the needs analysis of this plan for entities relying on surface water supplies from the City of Corpus Christi, San Patricio Municipal Water District (SPMWD), and South Texas Water Authority (STWA). The safe yield maintains the 75,000 ac-ft reserve through the planning period (2030-2080) and declines to 157,000 ac-ft/yr by 2080 due to sedimentation.

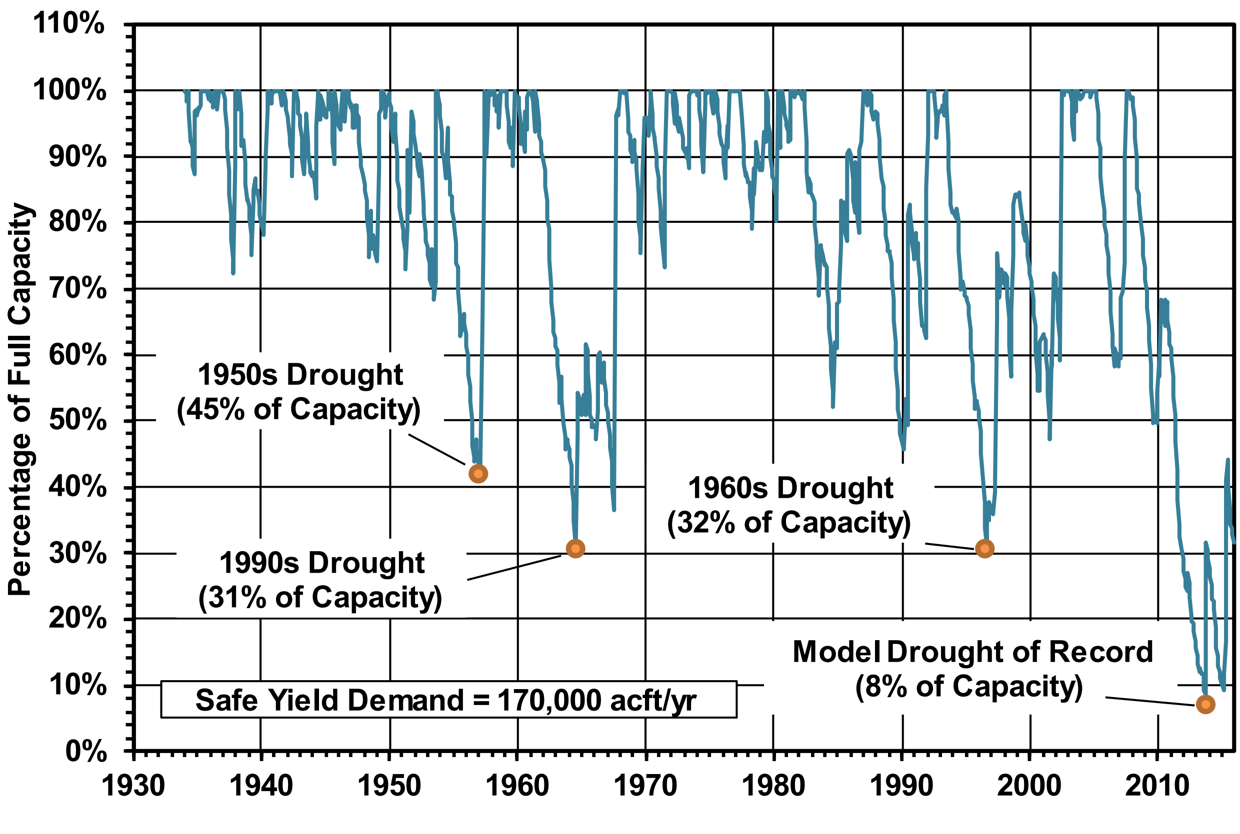

Figure 7-3.
CCR/LCC System Storage Trace- 2030 Safe Yield of 170,000 ac-ft/yr

7.2 Uncertainty and Droughts Worse than Drought of Record

The CBRWPG adopted safe yield measures when determining surface water availability from the Corpus Christi Regional Water Supply System, which provides water supplies for nearly 80 percent of the regional water demands. The regional water plan is developed to meet projected water demands with a safe yield reserve of 75,000 ac-ft in CCR/LCC System storage during worst historical drought conditions (2007-2013) as a provision for future drought uncertainty.

The CBRWPG recognizes the current drought in early 2025 is most likely worse than the DOR, and seeks to address this by over-allocating water management strategies in excess of calculated shortages. This not only identifies additional potential supply to mitigate droughts worse than the DOR, but also includes protection for additional growth beyond TWDB projections and flexibility for water utilities to advance implementation of water management strategies, as needed, to address regional water demands. The importance of this practice is currently being highlighted by the severe drought that Coastal Bend Region is experiencing. During the DOR (2007- 2013) the total storage of the CCR/LCC System was 33 percent of its capacity, whereas it is at 19 percent of its capacity as of January 2025. Figure 7-4 shows the City of Corpus Christi drought stages as well as the storage volume in the CCR/LCC System through time, including years beyond the period of record in current modeling efforts. The City of Corpus Christi is in Stage 3 drought conditions at the time of writing.

Additionally, the CBRWPG encourages WUGs to leverage interconnectedness to combat future droughts worse than the DOR. The City of Corpus Christi's use of the MRP to use Lake Texana water is an excellent example. Currently, due to the low levels in the CCR/LCC System, the city is preparing to move from schedule 3 to schedule 4 pumping, something that has not ever been done and would require the MRP to operate at full capacity. Figure 7-5 shows that Lake Texana has filled several times while the CCR/LCC System has been its lowest since completion. Interconnectedness like this may serve as a lifeblood for the region in droughts worse than the DOR.

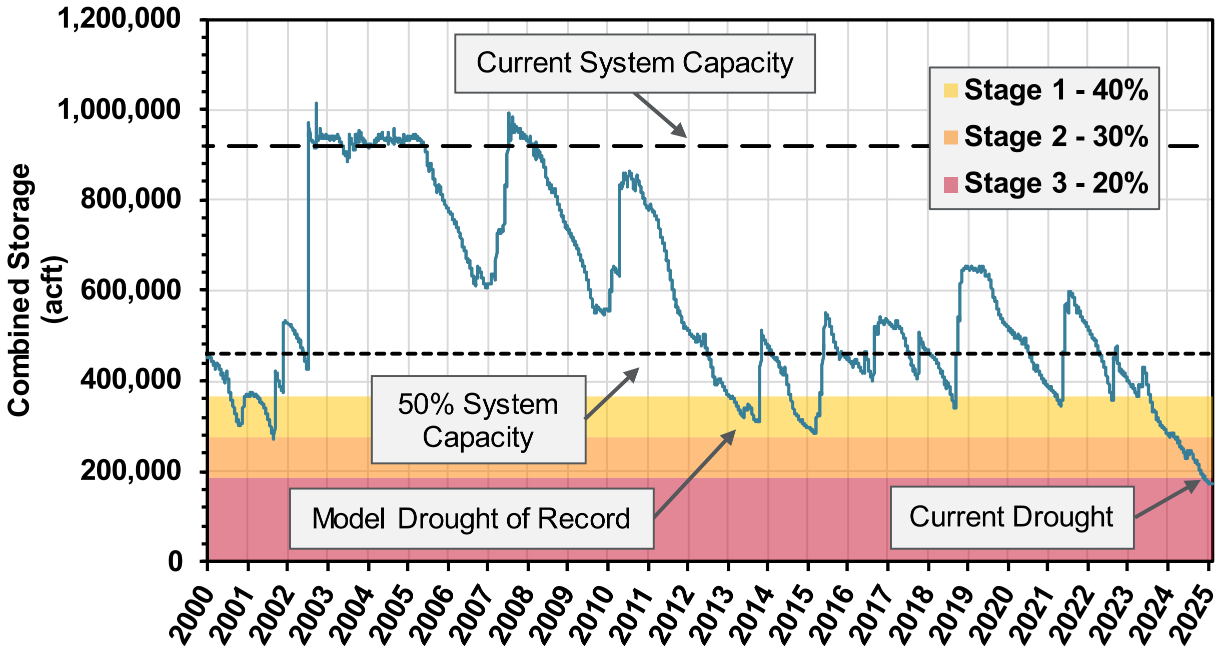

Figure 7-4 Drought Conditions Not Captured in Current Firm and Safe Yield Estimates: CCR/LCC System Storage and Drought Stages[4, 5]

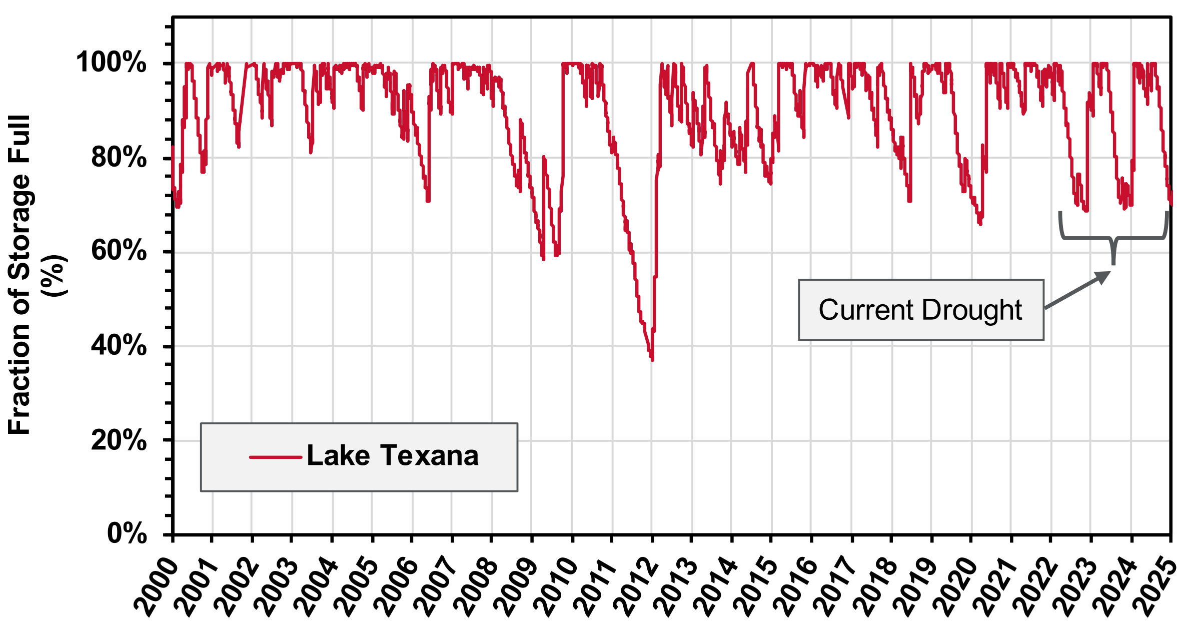

Figure 7-5 Lake Texana Fraction of Capacity in Storage for Recent Years

[4] The drought stages in this figure correspond with the City of Corpus Christi drought stages as set by their Drought Contingency Plan.

[5] A combined system storage capacity of 919,160 ac-ft was assumed for the CCR/LCC system based on the most recent TWDB bathymetric surveys of Choke Canyon Reservoir and Lake Corpus Christi.

The CBRWPG sees the purpose of the planning as ensuring that sufficient supplies are available to meet future water demands. The CBRWPG has not made additional drought management recommendations as a water management strategy for specific WUG needs. Reducing water demands during a drought as a defined water management strategy does not ensure that sufficient supplies will be available to meet the projected water demands; but simply eliminates the demands.

7.3 Current Drought Preparations and Response

7.3.1 Current Drought Preparations and Responses Water Use Group Level Planning

WUGs in Coastal Bend Region prepare for drought by implementing their drought contingency plans and participating in planning discussions. The regional planning process attempts to meet projected water demands during a drought of equal severity to the DOR. WUGs that provide accurate information to the TWDB and consider recommendations accepted by the regional planning group should be able to supply water to customers throughout drought periods. In addition, all wholesale water providers (WWPs) and most municipalities develop individual drought contingency plans (DCPs) or emergency action plans to be implemented at various stages of a drought.

The City of Corpus Christi is in the process of adopting new drought contingency provisions, which would also affect wholesale and treated water customers. The City of Corpus Christi City Council approved the first reading of updates to their DCP during a meeting held on January 28, 2025. The revised draft incorporates several significant modifications aimed at enhancing water conservation efforts and addressing the operational needs of local businesses impacted by drought conditions. The revised DCP, while it does propose changes to provisions at the various drought stages, does not propose changes to the criteria for the drought stages.

Key revisions in the draft DCP:

1. **Water Shortage Watch** - Introduction of a new voluntary stage where residents are encouraged to limit irrigation to once per week when reservoir levels fall below 50 percent. This stage was not present in the previous DCP.

2. **Stage 2 Water Restrictions** - Implementation of restrictions limiting irrigation with hose-end sprinklers or automatic systems to once every other week, whereas the current DCP allows irrigation once a week.

3. **Stage 3 Water Restrictions** - Prohibition of irrigation of landscaped areas at all times, with specific exceptions for limited drip irrigation for foundations and landscaped beds. The previous DCP made no exception for drip irrigation.

The second reading of the updated DCP was discussed by City Council on February 11, 2025, which led to postponement. At the February 25th meeting, City Council voted to postpone until the March 18th meeting.

7.3.2 Unnecessary or Counterproductive Drought Response

The CBRWPG considered the new provision from the TWDB for regional water planning groups to identify unnecessary or counterproductive variations in specific drought response strategies that may confuse the public or otherwise impede drought response efforts. The CBRWPG assumes WUGs during development of their DCPs have identified meaningful triggers, water reduction goals, and best management practices to achieve those goals and are tracking their progress and revising when appropriate in DCP updates.

7.3.3 Overall Assessment of Local Drought Contingency Plans

While it is impossible to predict the timing, severity and length of a drought, it is an inevitable component of water supply planning in Texas. For this reason, it is critical to plan for these occurrences with policy outlining adjustments to the use, allocation, and conservation in response to drought conditions. Drought and other circumstances threaten interruption of supply or water quality of a source, potentially leading to water shortages. When water shortages occur, there is generally a greater demand on the already decreased supply as individuals may attempt to keep lawns green. In the 20 months from June 2013 to February 2015 coinciding with the DOR, when once a week watering was implemented, the residential water use was reduced by 18 percent (or total of 5-6 percent for all users).[6] This behavior reduces the rate of water supply depletion during drought.

The TCEQ requires all wholesale public water suppliers, retail public water suppliers serving 3,300 connections or more, and irrigation districts to submit DCPs. In accordance with the requirements of TAC §288(b), DCPs must be updated every 5 years and adopted by retail public water providers. The TCEQ defines a DCP as "A strategy or combination of strategies for temporary supply and demand management responses to temporary and potentially recurring water supply shortages and other water supply emergencies." [7] According to the TCEQ handbook for drought contingency[8], the underlying philosophy of drought contingency planning is that:

- While often unpreventable, short-term water shortages and other water supply emergencies can be anticipated;
- The potential risks and impacts of drought or other emergency conditions can be considered and evaluated in advance of an actual event; and, most importantly
- Response measures and best management practices can be pre-determined with implementation procedures defined, again in advance, to avoid, minimize, or mitigate the risks and impacts of drought-related shortages and other emergencies.

Example DCPs are available on TCEQ's website; however, it is not possible to create a single DCP model that will adequately address local concerns throughout the State of Texas. The

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[6] Email correspondence from Brent Clayton, March 2015.

[7] http://www.twdb.texas.gov/conservation/training/archives/more-than-a-drop-workshop/doc/5_%20TCEQ%20Rules.pdf.

[8] https://www.rcac.org/wp-content/uploads/2015/08/TX_Drought_Planning_Handbook_2014.pdf.

conditions that define a water shortage are location specific and may vary for water users that use groundwater versus surface water or those that have sole-source of supply versus those with a multiple source, diversified water system. While the approach to planning may be different between entities, all DCPs should include:

- Specific, quantified targets for water use reductions,
- Drought response stages,
- Triggers to begin and end each stage,
- Supply management measures,
- Demand management measures,
- Descriptions of drought indicators,
- Notification procedures,
- Enforcement procedures,
- Procedures for granting exceptions,
- Public input to the plan,
- Ongoing public education,
- Adoption of plan, and
- Coordination with regional water planning group.

For water suppliers, the primary goal of DCP development is to have a plan that can reliably provide an uninterrupted supply of water in an amount that can satisfy essential human needs. A secondary, but also important, goal is to minimize negative impacts on quality of life, the economy, and the local environment. In order to meet these goals, action needs to be taken quickly, which is why an approved DCP needs to be in place before drought conditions occur.

In accordance with TAC, most Coastal Bend Region entities have submitted DCPs to be implemented during drought conditions. Coastal Bend Region was able to obtain DCPs from all four WWPs, the Lavaca-Navidad River Authority, and 27 municipal WUGs and County-Other entities, as seen in Table 7.1. These plans identify multiple triggers for initiation and termination of drought stages, responses to be implemented, and reduction targets based on each stage. The plans also include information regarding public notification procedures and enforcement measures. Some WUGs or WWPs have included a method of granting a variance should the need arise. The most recent DCPs for each entity in Coastal Bend Region range in date from 2000 to 2024.

7.3.4 Drought Response Triggers & Actions

The Texas Water Code, Chapter 11, and TAC Chapter 288 require retail public water suppliers with 3,300 or more connections, irrigation water providers, and wholesale public water suppliers to develop, implement, and submit updated DCPs to the TCEQ every 5 years. Detailed DCP information for the four WWPs who supply water to most WUGs in the region can be found in Table 7.2 through Table 7.6.

Table 7.1.
Region N Entities with Available DCP[9]

Region	County Name	WUG	DB22 Entity RwpId	DCP on File	DCP Date
Wholesale Water Providers and Lavaca Navidad River Authority					
N	NUECES	CORPUS CHRISTI	32	x	2018
N	SAN PATRICIO & NUECES	SAN PATRICIO MUNICIPAL WATER DISTRICT (SPMWD)	119	x	2019
N	KLEBERG	SOUTH TEXAS WATER AUTHORITY	123	x	2024
N	NUECES	NUECES COUNTY WCID #3	104	x	2019
N	JACKSON	LAVACA NAVIDAD RIVER AUTHORITY	n/a	x	2024
Water User Groups					
N	ARANSAS	ARANSAS PASS	185	x	2008
N	ARANSAS	ROCKPORT	2152	x	2013
N	BEE	BEEVILLE	222	x	2024
N	BEE	PETTUS MUD	13190	x	2024
N	BROOKS	FALFURRIAS	710	X	1999
N	DUVAL	FREER WCID	740	x	2000
N	DUVAL	SAN DIEGO MUD #1	2176	x	2000
N	JIM WELLS	ALICE	163	x	2019
N	JIM WELLS	ORANGE GROVE	2033	x	2000
N	KLEBERG	KINGSVILLE	1163	x	2002
N	KLEBERG	RICARDO WSC	2126	x	2018
N	LIVE OAK	EL OSO WSC	4104	x	2009
N	LIVE OAK	MCCOY WSC	4250	x	2000
N	LIVE OAK	THREE RIVERS	2369	x	2014
N	LIVE OAK	OLD MARBACH SCHOOL WSC	10091	x	2006
N	NUECES	NUECES WSC	2871	x	2019
N	NUECES	RIVER ACRES WSC	2141	x	2021
N	SAN PATRICIO	ODEM	2024	x	2013
N	SAN PATRICIO	INGLESIDE	874	x	2018
N	SAN PATRICIO	TAFT	2349	x	2013
N	SAN PATRICIO	PORTLAND	2093	x	2024
N	SAN PATRICIO	RINCON WSC	2846	x	2009
County-Other Entities					
N	ARANSAS	ARANSAS COUNTY MUD #1	n/a	x	2009
N	ARANSAS	COPANO HEIGHTS WATER COMPANY	n/a	x	2018
N	ARANSAS	HOLIDAY BEACH WATER SUPPLY CORPORATION	n/a	x	2018
N	BEE	BLUEBERRY HILLS	n/a	x	2005
N	KLEBERG	BAFFIN BAY WSC	n/a	x	2015
N	KLEBERG	ESCONDIDO CREEK ESTATES	n/a	x	2000
N	KLEBERG	RIVIERA	n/a	x	2000
N	MCMULLEN	MCMULLEN COUNTY WCID #2	n/a	x	2002

[9] The City of Corpus Christi is in the process of adopting new drought contingency provisions. The City of Corpus Christi City Council approved the first reading of updates to the DCP during a meeting held on January 28, 2025. The second reading of the updated DCP is scheduled for February 11, 2025. Upon approval, the revised plan will be enacted on February 12, 2025.

Table 7.2. City of Corpus Christi Surface Water Sources Drought Contingency Response[10]

Drought Contingency Stage	Reservoir System Storage	Actions
Stage I – Mild	*Less than 40%	• Target treated water demand reduction of 10 percent, including for wholesale water contracts. • City Manager issues a public notice implementing required water conservation measures. • More repair crews will be used if necessary to repair leaks. • Irrigation of landscaped areas with hose-end sprinklers or automatic irrigation systems shall be limited to once per week based on the City Manager's watering schedule. • Fire hydrant use is restricted to the interest of public health and safety. • Prohibits use of water for Golf Course irrigation to designated water days unless the course uses a source other than Corpus Christi Utilities. • Use of water to maintain integrity of building foundations is limited to watering days and hand held hose or drip irrigation.
Stage II – Moderate	*Less than 30%	In addition to Actions under Stage I, take the following actions: • Target water demand reduction of 20 percent, including for wholesale water contracts. • Flushing of water mains is eliminated unless in interest of public safety. • Irrigation of landscaped areas with hose-end sprinklers or automatic irrigation systems shall be limited to once every other week. • The watering of golf course fairways with potable water is prohibited
Stage III – Critical	*Less than 20%	In addition to Actions under Stage II, take the following actions: • Target water demand reduction of 30 percent, including for wholesale water contracts. • Irrigation of landscaped areas shall be prohibited at all times. • Use of water to wash any motor vehicle, motorbike, boat, trailer, or other vehicle not occurring on the premises of a commercial car wash and not in the immediate interest of public health, safety, and welfare is prohibited. • The filling, refilling, or adding of water to swimming pools, wading pools, and jacuzzi-type pools, and water parks (unless utilizing water from a non-city source) is prohibited. Fountains may operate to maintain equipment. • Optional: prohibit applications for water service facilities of any kind.
Stage IV – Emergency	Not applicable	In addition to Actions under Stage III, take the following actions: • Achieve a 50% or greater reduction in daily treated water demand relative to treated water demand. • Irrigation of landscaped area is absolutely prohibited. • Use of water to wash any motor vehicle, motorbike, boat, trailer, or other vehicle is absolutely prohibited. • Associated uses of water not related to business process which are discretionary, such as equipment washing, shall be deferred until the Stage 5 emergency has been terminated.

* CCR/LCC combined storage

** Other purposes include vehicle washing, indoor and outdoor pools, golf course irrigation, and use of water for the integrity of building foundations.

[10] The City of Corpus Christi is in the process of adopting new drought contingency provisions. The City of Corpus Christi City Council approved the first reading of updates to the DCP during a meeting held on January 28, 2025. The second reading of the updated DCP is scheduled for February 11, 2025. Upon approval, the revised plan will be enacted on February 12, 2025.

Table 7.3.
San Patricio Municipal Water District Drought Contingency Response

Drought Contingency Stage	Reservoir System Storage	Actions
Stage I – Mild	*less than 40%	• District Manager issues a public notice to inform water users of the Corpus Christi water supply region to begin voluntary conservation measures. • Target water demand reduction of 5 percent, including for wholesale water contracts. • All operations of the District shall adhere to water use restrictions prescribed for Stage 2 of the DCP
Stage II – Moderate	*Less than 30%	• District Manager issues a public notice implementing required water conservation measures. • Irrigation of landscaped areas with hose-end sprinklers or automatic irrigation systems shall be limited to once per week. • District Manager issues a lawn watering schedule and designates watering days and specific exemptions for **other purposes. • Prohibits use of water to wash down of any sidewalks, walkways, driveways, parking lots, tennis courts, or other hard-surfaced areas, except if it is in the interest of public health and safety. • Prohibits use of water to wash down buildings or structures for purposes other than immediate fire protection without permit granted by the District Manager. • Prohibits use of water for dust control without permit granted by the District Manager. • Target water demand reduction of 10 percent, including for wholesale water contracts.
Stage III – Critical	*Less than 20%	In addition to Actions under Stage II, take the following actions: • Irrigation of landscaped areas with hose-end sprinklers or automatic irrigation systems shall be limited to once every other week. • The watering of golf course fairways with potable water is prohibited. • Target water demand reduction of 15 percent, including for wholesale water contracts.
Stage IV – Emergency	When the District Manager, or designee, deems appropriate	• Irrigation of landscaped areas shall be prohibited at all times. • Use of water to wash any motor vehicle, motorbike, boat, trailer, or other vehicle not occurring on the premises of a commercial car wash and not in the immediate interest of public health, safety, and welfare is prohibited. • The filling, refilling, or adding of water to swimming pools, wading pools, and jacuzzi-type pools, and water parks (unless utilizing water from a non-city alternative source) is prohibited. • The use of water to maintain the integrity of a building foundation is permitted on the designated watering day and shall be done by hand or drip irrigation method. • Target water demand reduction of 30 percent, including for wholesale water contracts.

* CCR/LCC combined storage

** Other purposes include vehicle washing, indoor and outdoor pools, golf course irrigation, and use of water for the integrity of building foundations.

Table 7.4. South Texas Water Authority Drought Contingency Response

Drought Contingency Stage	Reservoir System Storage	Actions
Stage I – Mild Water Shortage Conditions	*Less than 40%	• Notify all its wholesale water customers regarding the initiation of the drought response stage and the possibility of pro rata curtailment or water diversions and/or deliveries. • The Executive Director/Administrator or designee will request wholesale water customers to initiate mandatory measures to reduce non-essential water use. • The Executive Director/Administrator or designee will initiate preparations for the implementation of pro rata curtailment of water diversions and/or deliveries by preparing a monthly water usage allocation baseline for each wholesale customer according to the procedures specified in the Plan. • Target water demand reduction of 10 percent.
Stage II – Moderate Water Shortage Conditions	*Less than 30%	• In addition to Actions 1-3 under Stage I, take the following actions: • The Executive Director/Administration or designee will provide reports as needed to the City of Corpus Christi with information regarding wholesale customer usage. • Target water demand reduction of 20percent.
Stage III – Critical Water Shortage Conditions	*Less than 20%	• Request wholesale customers continue with conditions set during Stage II. In addition, request that wholesale customers consider implementation of additional regulations and prohibitions. • The Executive Director/Administration or designee will provide reports as needed to the City of Corpus Christi with information regarding wholesale customer usage.Target water demand reduction of 30 percent.
Stage IV – Emergency Water Shortage Conditions	Not applicable	• Request wholesale customers continue with conditions set during Stage III. In addition, request that wholesale customers consider implementation of additional regulations and prohibitions. • Assess the severity of the problem and identify the actions needed and time required to solve the problem. • Inform the utility director or other responsible official of each wholesale water customer by telephone or in person and suggest actions, as appropriate, to alleviate problems. • If appropriate, notify city, county, and/or state emergency response officials for assistance. • Undertake necessary actions, including repairs and/or cleanup as needed. • Prepare a post-event assessment report on the incident and critique of emergency response procedures and action.

*Corpus Christi/Choke Canyon Reservoirs (CCR/LCC) combined storage

Table 7.5.
Nueces County WCID #3 Drought Contingency Response

Drought Contingency Stage	Reservoir System Storage	Actions
Stage I – Mild Water Shortage Watch	Water in the reservoirs is less than 40% of total storage capacity	• The District will notify all its customers regarding the initiation of the drought response stage. • Target water demand reduction of 10%, preferable during times of peak use. • Agricultural irrigation shall be limited to twice per week. • Stage 1 Drought Condition Water Rates may be initiated.
Stage II – Moderate Water Shortage Watch	Water in the reservoirs is less than 30% storage capacity	• The District will notify all its customers regarding the initiation of the drought response stage. • Target water demand reduction of 20% • Use of water to wash motor vehicle, boat, trailers, other vehicles, refilling swimming pools is prohibited except on designated watering days. Operation of ornamental ponds is prohibited. • Use of water to fill, refill, or add to any indoor or outdoor swimming pools or prohibited except on designated watering days between midnight and 10 AM and 8 pm and midnight. • Use of water from hydrants should be limited to firefighting, related activities, or other activities necessary to maintain public health, safety, and welfare, except that use of water from designated fire hydrants for construction purposes may be allowed under special permit from the District. • If water source is provided by District, use of water for the irrigation of golf course greens, tees, and fairways is prohibited except on designated watering days between the hours of midnight and 10 AM and 8 PM and midnight. • All restaurants are prohibited from serving water to patrons except upon request by the patron. • Non-essential water use such as washing down of surfaces, washing structures, dust control, flushing gutters, or failure to repair leaks are prohibited. • Stage 2 Drought Condition Water Rates may be initiated by the District Manager and Board of Directors.
Stage III – Critical Water Shortage Conditions	Water in the reservoirs is less than 20% of total storage capacity	• The District will notify all its customers regarding the initiation of the drought response stage. • Target water demand reduction of 30% or greater. • All Stage II provisions will be enforced. • The use of potable water for watering golf course tees is prohibited. • The use of water for construction purposes from designated fire hydrants under special permit may be discontinued. • Agricultural irrigation shall be limited to designated watering days. The use of hose-end sprinklers is prohibited at all times. • Upon written notice, the water meters of willful violators will be disconnected if absolutely necessary to prevent the deliberate wasting of water. • Stage 3 Drought Condition Water Rates may be initiated.
Stage IV – Emergency Water Shortage Conditions	Major line break, pump or system failure, water production or distribution limitations, contamination of water supply	• The District will notify all its customers regarding the initiation of the drought response stage. • Target water demand reduction of 50% or greater. • All requirements of Stage 1, 2, and 3 shall remain in effect. • Use of water to wash motor vehicle, boat, trailers, other vehicles, and refilling swimming pools is prohibited. • Agricultural irrigation water will be eliminated. • Associated uses of water not related to business process which are discretionary, such as equipment washing, shall be deferred until Stage 5 is terminated. • District will call the 10 largest water consumers in the area affected by the emergency condition and, if necessary, use runners in key areas to begin spreading the message of a major outage.

Table 7.6.
Lavaca Navidad River Authority's Drought Contingency Response

Drought Condition	Trigger	Actions
Condition I – Mild Water Shortage Condition	Lake Texana Reservoir elevation is at or below elevation 43.00 ft msl	• LRNA will notify TCEQ Watermaster of reservoir condition. • Watermaster will notify water rights permit holders upstream of Lake Texana of reservoir conditions. • Inform public, giving notice of reservoir conditions to the customers served by Lavaca-Navidad River Authority. • Target water demand reduction of 50 percent of the use that would have occurred in the absence of drought contingency measures.
Condition II – Moderate Water Shortage Condition	Lake Texana Reservoir elevation is at or below elevation 40.23 ft msl	• In addition to Actions 1–3 under Conditions I, take the following actions: • Notify TPWD of reservoir condition and change in B&E release schedule. • Include recommendations to conserve water in information to the public. • Target water demand reduction of 5 percent of the use that would have occurred in the absence of drought contingency measures.
Condition III – Severe Water Shortage Condition	Lake Texana Reservoir elevation is at or below elevation 34.09 ft msl Water supply emergency occurs or drought worse than the Drought of Record is declared	• LRNA will notify TCEQ Watermaster and Dam Safety Team of reservoir condition. • Inform public, giving notice of reservoir condition and delivery volume. • Implement pro rata reduction of water deliveries to industrial and municipal customers. • Through the news media, the public should be advised daily of the trigger conditions, the mandatory reduction, and that water users conserve water.
Condition IV – Critical Water Shortage Condition	Contamination of water supply source Failure or damage to the operating structures due to a natural or catastrophic event Water supply emergency occurs or drought worse than the Drought of Record is declared	• Lavaca-Navidad River Authority will notify TCEQ Watermaster and Dam Safety Team of reservoir condition. • Inform public, giving notice of reservoir condition and delivery volume. • Implement pro rata reduction of water deliveries to industrial and municipal customers. • Through the news media, the public should be advised daily of the trigger conditions, the mandatory reduction, and that water users conserve water.

7.3.5 Summary of Existing Triggers and Responses

Through timely implementation of drought response measures, it is possible to meet the goals of the DCP by avoiding, minimizing, or mitigating risks and impacts of water shortages and drought. In order to accomplish this, DCPs are built around a collection of drought responses and triggers based on various drought stages. Inclusion of stages is typical of all DCPs, but stage definition can vary from entity to entity. Stage one will normally represent mild water shortage conditions and the severity of the situation will increase through the stages until emergency water conditions are reached and, in some cases, a water allocation stage is defined.

The CBRWPG conducted an overall assessment of current preparations for drought within the Coastal Bend Region to determine how water suppliers in the region identify and respond to drought. Drought contingency plan information on stage, trigger, and response for 31 DCPs in the region and Lavaca-Navidad River Authority was compiled, including those from WWPs, WUGs and County-Other suppliers. Most of the DCPs in the region have voluntary Stage I and

Mandatory Stage II and III categories. Most entities include a Stage IV and a few entities specify a Stage V scenario. Target reductions, triggers and responses are included for most stages. Triggers for individual Coastal Bend Region WUGs can be found in Table7.7 and corresponding responses can be found in Table7.8.

Table 7.7.
Region N DCP Drought Triggers

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
Water User Groups						
City of Aransas Pass (Aransas County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/AransasPass.pdf	***SW***	***Mild Water Shortage Conditions*** When the LCC/CCR system storage falls below 50% of maximum capacity.	***Moderate Water Shortage Conditions*** When the LCC/CCR system storage falls below 40% of maximum capacity.	***Severe Water Shortage Conditions*** When the LCC/CCR system storage falls below 30% of maximum capacity.	***Critical Water Shortage Conditions*** When the LCC/CCR system storage falls below 15% of maximum capacity. Whenever there is an interruption in the City of Corpus Christi or SPMWD's raw water supply. When there is a mechanical breakdown in the City of Corpus Christi or SPMWD's WTP which causes plant shutdown for an extended period of time.	***Emergency Water Shortage Conditions*** When the City Council or their designee determines that a water supply emergency exists. Major water line breaks, or pump or system failures occur, which cause unprecedented loss of capability to provide water service. Natural or man-made contamination of the water supply source(s).
City of Rockport (Aransas County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Rockport.pdf	***SW***	***Mild Water Shortage Conditions*** When the LCC/CCR system storage falls below 50% of maximum capacity. OR Lake Texana storage declines below 40%	***Moderate Water Shortage Conditions*** When the LCC/CCR system storage falls below 40% of maximum capacity.	***Severe Water Shortage Conditions*** When the LCC/CCR system storage falls below 30% of maximum capacity.	***Critical Water Shortage Conditions*** When the LCC/CCR system storage falls below 20% of maximum capacity.	***Emergency Water Shortage Conditions*** When the City Council or their designee determines that a water supply emergency exists. Major water line breaks, or pump or system failures occur, which cause unprecedented loss of capability to provide water service. Water production or transmission system limitations. Natural or man-made contamination of the water supply source(s).

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
City of Three Rivers (Live Oak County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/3rivers.pdf	***SW***	***Mild Water Shortage Conditions*** When CCR storage falls below 50% of maximum capacity. OR City of Corpus Christi declares Stage 1 *OR* When there is high demand on the system.	***Moderate Water Shortage Conditions*** When CCR storage falls below 40% of maximum capacity. OR City of Corpus Christi declares Stage 2 *OR* When daily water demand exceeds 85% of capacity for 3 consecutive days.	***Severe Water Shortage Conditions*** When CCR storage falls below 30% of maximum capacity. OR City of Corpus Christi declares Stage 3 OR When daily water demand exceeds 90% of capacity for 3 consecutive days.	***Critical Water Shortage Conditions*** When CCR storage falls below 20% of maximum capacity. OR City of Corpus Christi declares Stage 4 OR When daily water demand exceeds 95% of capacity for 3 consecutive days.	***Emergency Water Shortage Conditions*** Major limitations to water system components, water productions or distribution limitations, or supply contamination.
City of Beeville (Bee County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/beeville_cp.pdf	***SW/GW***	***Mild Water Shortage Condition*** Lake Levels less than 40% and production from Chase Wells cannot meet system demand	***Moderate Water Shortage Condition*** Lake Levelsless than 30% and production from Chase Wells cannot meet system demands	***Severe Water Shortage Condition*** Lake Levels less than 20% and production from Chase Wells cannot meet system demands	***Emergency Water Shortage*** In the case of an emergency, contamination, or if water system fails to produce water	-
Pettus MUD (Bee County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/PettusMUD.pdf	***GW***	***Mild Water Shortage Conditions*** Total exceeds daily water demand equals safe or operating 85% of capacity the for system's three consecutive days or equals or exceeds 90% of system capacity on a single day.	***Moderate Water Shortage Conditions*** Total daily water demand equals or exceeds 90% of the systems safe operating capacity for three consecu-tive days or equals or exceeds 95% of system capacity on a single day.	***Severe Water Shortage Conditions*** Total daily water demand equals or exceeds 95% of the systems safe operating capacity for three consecu-tive days or equals or exceeds 100% of system capacity on a single day.	***Critical Water Shortage Conditions*** Total daily water demand equals or exceeds 100% of the systems safe operating capacity for three consecutive days or equals or exceeds 100% of system capacity on a single day.	***Emergency Water Shortage Conditions*** System outage due to equipment failure
Falfurrias (Brooks County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Falfurrias_DCP_WCP_1999.pdf	***GW***	***Mild Water Shortage Conditions*** Static water level in the Falfurrias water wells equal to or below mean sea level OR specific capacity is equal to or less than 5% original specific capacity OR total daily water demand exceeds 2.5 MG for 10 days or 5 MG on a single day; OR falling treated reservoir levels that do not refill above 80% overnight	***Moderate Water Shortage Conditions*** Two or more triggering criteria listed for Stage 1 exist	***Severe Water Shortage Conditions*** Three or more triggering criteria listed for Stage 1 exist	***Critical Water Shortage Conditions*** Four or more triggering criteria listed for Stage 1 exist	***Emergency Water Shortage Conditions*** General manager or designee determines that a water supply emergency exists based on: Major water line breaks or Natural or man-made contamination of the water supply source(s).

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
Freer WCID (Duval County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Freer.pdf	***GW***	***Mild Water Shortage Conditions (voluntary)*** Annually, beginning May 1 through September 1. When the static level in the Freer WCID is equal to or less than 10 feet above sea level. When the specific capacity of the Freer WCID wells are equal to or less than 70% of the well's original specific capacity. When total daily water demand equals or exceeds 700,000 gallons for 10 consecutive days or 700,000 gallons on a single day.	***Moderate Water Shortage Conditions*** When daily water demand total equals or exceeds 700,000 gallons for 10 consecutive days or 700,000 gallons on a single day.	***Severe Water Shortage Conditions*** When the specific capacity of the Freer WCID wells is equal to or less than 70% of the well's original specific capacity.	***Critical Water Shortage Conditions*** When the static water level in the Freer WCID wells is equal to or less than 10 feet above sea level.	***Emergency Water Shortage Conditions*** Major water line breaks, or pump or system failures occur, which cause unprecedented loss of capability to provide water service OR Natural or man-made contamination of the water supply source(s)

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
San Diego MUD #1 (Duval County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/SanDiego.pdf	***GW***	***Mild Water Shortage Conditions*** Annually, beginning on May 1 through October 31 of every year. When the water supply available to the San Diego Municipal Utility District No. 1 is equal or less than 70% of storage capacity. When the static water level in the San Diego Municipal Water Utility District No. 1 well(s) is equal or less than 100 feet above water pump level. When the specific capacity of the San Diego Municipal Utility District No. 1 well(s) is equal to or less than 70% of the well's original specific capacity. When total daily water demands equal or exceed one million gallons for 3 consecutive days.	***Moderate Water Shortage Conditions*** Water levels fall below 70% of storage capacity. Water demands exceed 70% of water well capacity. When the static water level in the San Diego Municipal Utility District No. 1 well(s) is equal to or less than 100 feet above water pumps.	***Severe Water Shortage Conditions*** Water levels fall below 50% of storage capacity. Water demands exceed 90% of water well capacity. When the static water level in the San Diego Municipal Utility District No. 1 well(s) is equal to or less than 100 feet above water pumps. System outages due to equipment failure.	***Emergency Water Shortage Conditions*** Major water line breaks, or pump or system failures occur, which cause unprecedented loss of capability to provide water service OR Natural or man-made contamination of the water supply source(s).	-
City of Alice (Jim Wells County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Alice_DCP_2019.pdf	***SW***	***Mild Water Shortage Conditions*** When the LCC water elevation is below 88 feet.	***Moderate Water Shortage Conditions*** When the LCC water elevation is below 86 feet.	***Severe Water Shortage Conditions*** When the LCC water elevation is below 82 feet.	***Critical Water Shortage Conditions*** When the LCC water elevation is below 74 feet.	***Emergency Water Shortage Conditions*** Major line breaks, or pump or system failures occur, which cause unprecedented loss of capacity to provide water service. Natural or man-made contamination of water supply source(s).

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
City of Orange Grove (Jim Wells County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/OrangeGrove.pdf	***GW***	***Mild Water Shortage Conditions (voluntary)*** When the static water level in City Water Well No. 4 is equal or more than 140 feet below the top of the casing. When total daily water demands equals or exceeds 90% of system safe operating capacity which is 750,000 gallons per day, for 10 consecutive days.	***Moderate Water Shortage Conditions*** When the static water level in City Water Well No. 4 drops to 150 feet below the top of the casing.	***Severe Water Shortage Conditions*** When the static water level in City Water Well No. 4 reaches 160 feet below the top of the casing.	***Critical Water Shortage Conditions*** When the static water level in City Water Well No. 4 reaches 165 feet below the top of the casing.	***Emergency Water Shortage Conditions*** Major line breaks, or pump or system failures occur, which cause unprecedented loss of capacity to provide water service. Natural or man-made contamination of water supply source(s).
City of Kingsville (Kleberg County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Kingsville.pdf	***GW***	***Mild Water Shortage Conditions*** Capacity of groundwater wells less than= 90% capacity AND Total daily water demand exceeds 6 million gallons for 3 consecutive days	***Moderate Water Shortage Conditions*** Capacity of groundwater wells less than= 85% capacity AND Total daily water demand exceeds 7 million gallons for 3 consecutive days	***Severe Water Shortage Conditions*** Capacity of groundwater wells less than= 80% capacity AND Total daily water demand exceeds 7.5 million gallons for 3 consecutive days	***Emergency Water Shortage Conditions*** Major water line breaks, or pump or system failures occur, which cause unprecedented loss of capability to provide water service. Natural or man-made contamination of the water supply source(s).	***Water Allocation*** City manager determines that water shortage conditions threaten public health, safety and welfare.
Ricardo WSC (Kleberg County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Ricardo.pdf	***SW***	***Mild Water Shortage Conditions*** When the LCC/CCR system storage falls below 40% of combined level.	***Severe Water Shortage Conditions*** When the LCC/CCR system storage falls below 30% of combined level.	***Critical Water Shortage Conditions*** When the LCC/CCR system storage falls below 20% of combined level.	***Emergency Water Shortage Conditions*** When the City Council or their designee determines that a water supply emergency exists. Major water line breaks, or pump or system failures occur, which cause unprecedented loss of capability to provide water service. Water production or distribution system limitations. Natural or man-made contamination of the water supply source(s).	-

Water Systems	(SW/GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
Riviera Water System (Kleberg County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Riviera.pdf	*GW*	***Customer Awareness*** Every April 1st, the utility will mail a public announcement to its customers.	***Voluntary Water Conservation*** Overnight Recovery rate reaches 4 ft. 17 Pump hours per day.	***Mandatory Water Use Restrictions*** Overnight Recovery rate reaches 2 ft. 20 Pump hours per day.	***Critical Water Use Restrictions*** Overnight Recovery rate reaches 0 ft. 22 Pump hours per day.	-
El Oso WSC (Service area includes 500 square miles located in Karnes, Bee, Wilson, and **Live Oak Counties**) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Eloso.pdf	*GW*	***Mild Water Shortage Conditions*** Well flow from any regularly used well is less than 90% of full capacity. A storage facility is not filled for 72 consecutive hours. An elevated storage tank is out of service due to repainting or other required maintenance.	***Moderate Water Shortage Conditions*** Well flow from any regularly used well is less than 80% of full capacity. A storage facility is not filled for 96 consecutive hours.	***Severe Water Shortage Conditions*** Well flow from any regularly used well is less than 70% of full capacity. A storage facility is not filled for 120 consecutive hours.	***Critical Water Shortage Conditions*** Well flow from any regularly used well is less than 60% of full capacity. A storage facility is not filled for 144 consecutive hours.	***Emergency Water Shortage Conditions*** Major water line breaks, or pump or system failures occur, which cause unprecedented loss of capability to provide water service. Natural or man-made contamination of the water supply source(s).
Old Marbach School WSC (Live Oak County) https://oldmarbachschoolwsc.com/documents/746/Scan_Doc0155.pdf	*GW*	***Customer Awareness*** Every year utility will mail a public announcement to customers April 30- ends September 30	***Voluntary Water Conservation*** Water supply is reduced to a level that is only 20% greater than the average consumption for previous month, water demand has reached 80% of daily maximum supply for 3 consecutive days, or extended period of at least 8 weeks of low rainfall and daily use has risen 20% above use for same period during previous year	***Mandatory Water Use Restrictions*** Water level in water storage tanks cannot be replenished for three consecutive days or water demand has reached 90% of the amount available for three consecutive days	***Critical Water Use Restrictions*** Water consumption of 100% of the maximum available and the water storage levels drop during one 24 hour period, water demand of 95% or more of max available for three consecutive days, failure of major component of system which reduces pressure <20 psi for >24 hours, events affecting health or safety of public	-

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
McCoy WSC (Service area includes 608 square miles located in Atascosa, Wilson, and **Live Oak Counties**) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/McCoy.pdf	***GW***	***Mild Water Shortage Conditions*** Well flow from any regularly used well is less than 90% of full capacity. A storage facility is not filled for 72 consecutive hours. An elevated storage tank is out of service due to repainting or other required maintenance.	***Moderate Water Shortage Conditions*** Well flow from any regularly used well is less than 80% of full capacity. A storage facility is not filled for 96 consecutive hours.	***Severe Water Shortage Conditions*** Well flow from any regularly used well is less than 70% of full capacity. A storage facility is not filled for 120 consecutive hours.	***Critical Water Shortage Conditions*** Well flow from any regularly used well is less than 60% of full capacity. A storage facility is not filled for 144 consecutive hours.	***Emergency Water Shortage Conditions*** Major water line breaks, or pump or system failures occur, which cause unprecedented loss of capability to provide water service. Natural or man-made contamination of the water supply source(s).
Nueces WSC (Nueces County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/NuecesWSC.pdf	***SW***	***Mild Water Shortage Conditions*** When the LCC/CCR system storage falls below 40% of combined level.	***Severe Water Shortage Conditions*** When the LCC/CCR system storage falls below 30% of combined level.	***Critical Water Shortage Conditions*** When the LCC/CCR system storage falls below 20% of combined level.	***Emergency Water Shortage Conditions*** When the City Council or their designee determines that a water supply emergency exists. Major water line breaks, or pump or system failures occur, which cause unprecedented loss of capability to provide water service. Water production or distribution system limitation. Natural or man-made contamination of the water supply source(s).	**-**
River Acres WSC (Nueces County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/RiverAcres.pdf	***SW***	***Water Shortage Possibility*** Combined water stored in the reservoirs is less than 40%. (LCC/CC)	***Water Shortage Warning*** Combined water supply in the reservoirs is less than 30% (LCC/CC..	***Water Shortage Conditions*** Combined water stored in the reservoirs is less than 20%. (LCC/CC.	***Water Shortage Emergency*** Water line breaks, pump or system failures occur which causes loss of capability to provide water service, water production or distribution system limitations, natural or man-made contamination of the water supply source occurs	**-**

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
City of Odem (San Patricio County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Odem.pdf	***SW***	***Mild Water Shortage Conditions*** When the LCC/CCR system storage falls below 50% of maximum capacity. OR Lake Texana storage declines below 40% Water demand reaches 85% of firm production capacity OR ***A water system issue reduces capacity below 85% during high demand periods.***	***Moderate Water Shortage Conditions*** When the LCC/CCR system storage falls below 40% of maximum capacity. Water demand reaches 90% of firm production capacity OR ***A water system issue reduces capacity below 75% during high demand periods.***	***Severe Water Shortage Conditions*** When the LCC/CCR system storage falls below 30% of maximum capacity. Water demand reaches 95% of firm production capacity OR ***A water system issue reduces capacity below 70% during high demand periods.***	***Critical Water Shortage Conditions*** When the LCC/CCR system storage falls below 20% of maximum capacity. Water demand reaches 100% of firm production capacity.	***Emergency Water Shortage Conditions*** Extended period of the Severe or Critical condition. Major water line breaks, or pump or system failures occur, which cause unprecedented loss of capability to provide water service. Natural or man-made contamination of the water supply source(s).
City of Ingleside (San Patricio County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Ingleside.pdf	***SW***	***Mild Water Shortage Conditions*** Combined storage level of Choke Canyon Reservoir and Lake Corpus Christi declines below 50% or Lake Texana storage level declines below 40%. OR Water demand reaches eighty-five percent (85%) of firm production capacity OR A disruption due to equipment or distribution system failure that would limit the capacity of the water system below eighty-five percent (85%) of capacity during high demand periods	***Moderate Shortage Conditions*** Combined Lake and Reservoir levels declines to below 40%, OR Water demand exceeds ninety percent (90%) of the firm production Capacity OR A disruption due to equipment or distribution system failure that would limit the capacity of the water system below seventy five percent (75%) of capacity during high demand periods	***Severe Water Shortage Conditions*** Combined Lake and Reservoir levels declines to below 30%, OR Water demand reaches ninety-five percent (95%) of firm production capacity OR A disruption due to equipment or distribution system failure that would limit the capacity of the water system below seventy percent (70%) of capacity during high demand periods.	***Critical Water Shortage Conditions*** Combined Lake and Reservoir levels declines to below 20%. OR Water demand reaches one hundred percent (100%) of firm production capacity	***Emergency Water Shortage Conditions*** Extended period of the severe or critical condition, OR Any natural catastrophic situations that interrupt or have the potential to interrupt the City's potable water supply, including but not limited to the following: a) A major water line break, or pump or system failure occurs, which causes unprecedented loss of capability to provide water service: or b) Water distribution system limitations; OR c) Natural or man-made contamination of the water supply source occurs.

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
City of Taft (San Patricio County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Taft.pdf	*SW*	***Mild Water Shortage Conditions*** When the City of Corpus Christi and/or the San Patricio Municipal Water District declares this water shortage condition.	***Moderate Water Shortage Conditions*** When the City of Corpus Christi and/or the San Patricio Municipal Water District declares this water shortage condition.	***Severe Water Shortage Conditions*** When the City of Corpus Christi and/or the San Patricio Municipal Water District declares this water shortage condition.	***Emergency Water Shortage Conditions*** When the City of Corpus Christi and/or the San Patricio Municipal Water District declares this water shortage condition.	***Water Allocation*** When the City of Corpus Christi and/or the San Patricio Municipal Water District declares this water shortage condition. Major water line breaks, or pump or system failures occur, which cause unprecedented loss of capability to provide water service. Natural or man-made contamination of the water supply source(s).
City of Portland (San Patricio County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Portland.pdf	*SW*	***Mild Water Shortage Conditions*** When the LCC/CCR system storage is below 40% of maximum capacity.	***Moderate Water Shortage Conditions*** When the LCC/CCR system storage is below 30% of maximum capacity.	***Critical Water Shortage Conditions*** When the LCC/CCR system storage is estimated to be less than or equal to 20% of maximum capacity.	-	***Emergency Water Shortage Conditions*** When the City of Corpus Christi determines that a water supply emergency exists based on: Major line breaks, or pump or system failures occur, which cause unprecedented loss of capacity to provide water service. Water production or distribution system limitations. Natural or man-made contamination of water supply source(s).
Rincon WSC (San Patricio County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Rincon.pdf	*SW*	***Water Watch*** Any short-term or long-term situation requiring a 10% reduction in water consumption.	***Water Alert*** Any short-term or long-term situation requiring an 11% to 20% reduction in water consumption.	***Water Warning*** Any short-term or long-term situation requiring a 21% to 35% reduction in water consumption.	***Water Emergency*** Any short-term or long-term situation requiring a 36%or greater reduction in water consumption.	-

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
County-Other Entities						
Aransas County MUD #1 (Aransas County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/AransasMUD.pdf	*GW*	***Mild Drought Conditions (voluntary)*** When demand on the District's water supply reaches or exceeds 70% of the production capacity of such facilities for 5 consecutive days.	***Moderate Drought Conditions*** When demand on the District's water supply reaches or exceeds 90% of the production capacity of such facilities for 3 consecutive days.	***Severe Drought Conditions*** When demand on the District's water supply reaches or exceeds 100% of the production capacity of such facilities for 24 hours.	-	-
Blueberry Hills (Bee County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/BlueberryHills.pdf	*GW*	***Customer Awareness*** Every April 1st, the utility will mail a public announcement to its customers.	***Voluntary Water Conservation*** Overnight Recovery fails to restore 90% of full storage capacity. Production or distribution limitations.	***Mandatory Water Use Restrictions*** Overnight Recovery fails to restore 85% of full storage capacity. Production or distribution limitations.	***Critical Water Use Restrictions*** Overnight Recovery fails to restore 80% of full storage capacity. Production or distribution limitations.	-
Copano Heights Water Company (Aransas County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Copano_2018.pdf	*SW*	***Customer Awareness*** Every April 1st, the utility will mail a public announcement to its customers.	***Voluntary Water Conservation*** Pump Flow less than 180 gpm or Total Daily Demand as 60% of pumping capacity	***Mandatory Water Use Restrictions*** Pump Flow less than 170 gpm or Total Daily Demand as 70% of pumping capacity	***Critical Water Use Restrictions*** Pump Flow less than 160 gpm or Total Daily Demand as 80% of pumping capacity	-
Escondido Creek Estates (Hidalgo County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Escondido.pdf	*GW*	***Customer Awareness*** Every April 1st, the utility will mail a public announcement to its customers.	***Voluntary Water Conservation*** Wholesale Supplier, City of Rockport, Implements Drought Stage II (see Rockport)	***Mandatory Water Use Restrictions*** Wholesale Supplier, City of Rockport, Implements Drought Stage III (see Rockport)	***Critical Water Use Restrictions*** Wholesale Supplier, City of Rockport, Implements Drought Stage IV (see Rockport)	-
McMullen County WCID #2 (McMullen County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/McMullen.pdf	*GW*	***Mild Water Shortage Conditions (voluntary)*** When total daily water demands equals or exceeds 2 million gallons on 3 consecutive days or 2.2 million gallons on a single day.	***Moderate Water Shortage Conditions*** When total daily water demands equals or exceeds 2 million gallons on 3 consecutive days or 2.2 million gallons on a single day and/or continually falling treated water reservoir levels do not refill above 90% overnight.	***Severe Water Shortage Conditions*** When total daily water demands equals or exceeds 2 million gallons on 3 consecutive days or 2.2 million gallons on a single day and/or continually falling treated water reservoir levels do not refill above 80% overnight.	***Critical Water Shortage Conditions*** When total daily water demands equals or exceeds 2 million gallons on 3 consecutive days or 2.2 million gallons on a single day and/or continually falling treated water reservoir levels do not refill above 75% overnight.	***Emergency Water Shortage Conditions*** Major line breaks, or pump or system failures occur, which cause unprecedented loss of capacity to provide water service. Natural or man-made contamination of water supply source(s).

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
Baffin Bay WSC (Kleberg County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Baffin%20Bay%20WSC_DCP.pdf	***SW***	***Mild Conditions*** Consumption reaches 80% of Daily Max for 3 days OR Supply is 20% greater than average previous month consumption OR Extended period of low rain and daily use has risen 20% over same time last year.	***Moderate Conditions*** Consumption reaches 90% of Daily Max for 3 days. OR Water level in any storage tank cannot be replenished for 3 consecutive days.	***Severe Conditions*** Failure of major system component reducing minimum pressure in system below 20 psi for at least a day. OR Consumption of 95% or more of the maximum available for 3 days OR Natural of man- made disaster, or safety risk to public ORDeclaration of a state of disaster due to drought conditions in a county OR unforeseen events which could cause imminent health or safety risks to the public	-	-

Table 7.8.
Region N DCP Responses for Each Trigger Level

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
Water User Groups						
City of Aransas Pass (Aransas County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/AransasPass.pdf	***SW***	***Mild Water Shortage Conditions*** *Achieve a voluntary 10% reduction in daily water demand.* All customers will be notified. Industrial customers, wholesale customers, and certain commercial customers will be required to develop and submit individual Water rationing plans to the City. All operations of the City of Aransas Pass shall adhere to water use restrictions.	***Moderate Water Shortage Conditions*** *Achieve a 15% reduction in daily water demand.* All City-owned facilities and operations will be placed on mandatory conservation practices. Restrictions on irrigation of landscaped areas, vehicle washing, use of water for pools, and ponds. Prohibits: Wash down of hard-surfaced areas and structures for purposes other than immediate fire protection; use of fire hydrants for any purpose other than firefighting; use of water for dust control; flushing gutters; failure to repair controllable leak(s).	***Severe Water Shortage Conditions*** *Achieve a 25% reduction in daily water demand.* Continuation of restrictions set forth in previous conditions and implementation of additional regulations and prohibitions. Certain industrial and commercial water users, which are not essential to the health and safety of the community, will be prohibited from water usage. Additional restrictions on irrigation of landscaped areas, watering of golf course, and use of water for construction purposes.	***Critical Water Shortage Conditions*** *Achieve a 35% reduction in daily water demand.* Additional restrictions on irrigation of landscaped areas and use of water for washing vehicles. The use of water for any type of pool is prohibited. No application for new, additional, expanded, or increased-in-size water service connections, meters, service lines, pipeline extensions, mains, or water service facilities of any kind shall be approved during this stage.	***Emergency Water Shortage Conditions*** *Achieve a 45% reduction in daily water demand.* Continuation of restrictions set forth in previous conditions and implementation of additional regulations and prohibitions. Irrigation of landscaped areas and use of water to wash any vehicle is prohibited.

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
City of Rockport (Aransas County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Rockport.pdf	***SW***	***Mild Water Shortage Conditions*** *Achieve a voluntary 5% reduction in daily water demand.* All customers are requested to limit landscape irrigation to once per week. Customers are requested to practice water conservation (minimize or discontinue use for non-essential purposes) All operations of the City of the city will adhere to water use restrictions.	***Moderate Water Shortage Conditions*** *Achieve a 10% reduction in daily water demand.* Use more repair crews for quicker response for water line leak repair. City crews monitor compliance with stage 2 restrictions on daily rounds. Restrictions on irrigation (Once per week) of landscaped areas, vehicle washing, use of water for pools, and ponds. Prohibits: Wash down of hard-surfaced areas and structures for purposes other than immediate fire protection; use of fire hydrants for any purpose other than firefighting; use of water for dust control; flushing gutters; failure to repair controllable leak(s).	***Severe Water Shortage Conditions*** *Achieve a 15% reduction in daily water demand.* Eliminate Main Flushing unless needed for safety. Review customer water usage. Continuation of restrictions set forth in previous conditions and implementation of additional regulations and prohibitions. Irrigation limited to once every other week. Additional restrictions on irrigation of landscaped areas, watering of golf course, and use of water for construction purposes.	***Critical Water Shortage Conditions*** *Achieve a 30% reduction in daily water demand* Landscaped watering prohibited at all times The use of water for any type of pool or vehicle is prohibited. Upon written notice cut off willful violators.	***Emergency Water Shortage Conditions*** *Achieve a 50% reduction in daily water demand.* Continuation of restrictions set forth in previous conditions and implementation of additional regulations and prohibitions. Call 10 largest users and spread message of major outage. Business process discretionary practices are prohibited.
City of Three Rivers (Live Oak County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/3rivers.pdf	***SW***	***Mild Water Shortage Conditions*** *Achieve a 5% reduction in water use.* Formal public notice of drought stage 1; notify TCEQ. Initiate increased public information campaign. Retail customers requested to follow stage 1 watering schedule. Increase leak detection activities.	***Moderate Water Shortage Conditions*** *Achieve a 10% reduction in water use.* Formal public notice of drought stage 2; notify TCEQ. Increase utility oversight of water use restrictions. Retail customers requested to follow stage 2 watering schedule. Increase utility oversight of water waste.	***Severe Water Shortage Conditions*** *Achieve a 15% reduction in water use.* Formal public notice of drought stage 3; notify TCEQ. Increase utility enforcement of water use restrictions. Retail customers requested to follow stage 3 watering schedule. Increase utility enforcement of water waste.	***Critical Water Shortage Conditions*** *Achieve a 30% reduction in water use.* Formal public notice of drought stage 4; notify TCEQ. Increase utility enforcement of water use restrictions. Retail customers requested to follow stage 3 watering schedule. No watering. Consider surcharges for excessive use.	***Emergency Water Shortage Conditions*** *Achieve necessary water use reduction.* Contact county and state emergency management coordinators; notify TCEQ. Implementation of appropriate emergency procedures. Consideration of water purchases by truckload or in bottles.

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
City of Beeville (Bee County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/beeville_cp.pdf	***SW***	***Mild Water Shortage Possibility*** Target limit of total treated water to less than 4.5 MGD. Water customers are requested to voluntarily reduce water use.	***Moderate Water Shortage Warning*** Target limit of total treated water to less than 3.5 MGD. Reduce water use for foundations, washing automobiles, prohibit building washings, restrict use of potable water to irrigate golf courses	***Severe Water Shortage Conditions*** Target limit of total treated water to less than 3 MGD. Reduce water use for foundations, washing automobiles, prohibit building washings, establish maximum monthly use for residential customers	***Critical Water Shortage*** Target limit of total treated water to less than 2.5 MGD. Reduce water use for foundations, washing automobiles, prohibit building washings, establish maximum monthly use for residential customers	***Emergency Water*** All non-essential water uses must cease in accordance with the Corpus Christi DCP. All customers will be notified.
Pettus MUD (Bee County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Pettus MUD.pdf	***GW***	***Mild Water Shortage Conditions*** All customers will be notified and asked to limit non-essential use. Raise Public Awareness	***Moderate Water Shortage Conditions*** Initiate mandatory restrictions on non-essential use (lawn watering etc.)	***Severe Water Shortage Conditions*** Additional restrictions on irrigation of landscaped areas, watering of golf course, and use of water for construction purposes. Initiate water surcharge	***Critical Water Shortage Conditions*** Initiate enforcement, fees, fines, and surcharges	***Emergency Conditions*** Initiate emergency response conditions
Falfurrias (Brooks County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Falfurrias_DCP_WCP_1999.pdf	***GW***	***Mild Water Shortage Conditions*** Achieve a voluntary 30% reduction in total water use or daily water demand. Water customers are requested to voluntarily limit the irrigation of landscaped areas to once per week and are requested to practice water conservation and to minimize or discontinue non-essential water use. No flushing of fire hydrants or hydrant testing at this time. City to adhere to Stage 2 water user restrictions.	***Moderate Water Shortage Conditions*** Achieve a 40% reduction in total water use or daily water demand. Restrictions on irrigation of landscaped areas, vehicle washing, use of water for hydrants pools, and ponds. Prohibits: Wash down of hard-surfaced areas and structures for purposes other than immediate fire protection; use of water for dust control; flushing gutters; failure to repair controllable leak(s); serving water to patrons at restaurants except when requested. No flushing of fire hydrants or flushing of dead end mains. Reduce irrigation of all public landscaped areas.	***Severe Water Shortage Conditions*** Achieve a 50% reduction in total water use or daily water demand Phase 2 restrictions and Prohibitions. Use of water for construction purposes to be discontinued. Prohibited: irrigation, watering of golf courses, pool use, vehicle washing construction and hydrant use under special permit	***Critical Water Shortage Conditions*** Achieve a 60% reduction in total water use or daily water demand All Phase 2 and 3 restrictions and Prohibitions. Prohibits: Irrigation of landscaped areas with hose end sprinkler or automatic sprinkler system, use of water to wash any vehicle, use of water for any type of pool. No application for new, additional, expanded, or increased-in-size water service connections, meters, service lines, pipeline extensions, mains, or water service facilities of any kind shall be approved during this stage.	***Emergency Water Shortage Conditions*** All Phase 2, 3, and 4 restrictions and Prohibitions. Irrigation of landscaped areas and use of water to wash motor vehicle, boat, trailers, or other vehicles is absolutely prohibited.

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
Freer WCID (Duval County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Freer.pdf	***GW***	***Mild Water Shortage Conditions*** *Achieve a voluntary 25% reduction in total water use.* All customers will be notified and asked to limit non-essential use Restricted use of water for ornamental fountains or ponds. All operations of Freer W.C.I.D. adhere to water use restrictions prescribed for Stage II of the plan.	***Moderate Water Shortage Conditions*** *Achieve a 30% reduction in total water use.* Restrictions on irrigation of landscaped areas, vehicle washing, and use of water for pools. Prohibits: Wash down of hard-surfaced areas and structures for purposes other than immediate fire protection; use of fire hydrants for any purpose other than firefighting; use of water for dust control; flushing gutters; failure to repair controllable leak(s).	***Critical Water Shortage Conditions*** *Achieve a 40% reduction in total water use.* Additional restrictions on irrigation of landscaped areas, watering of golf course, and use of water for construction purposes.	***Emergency Water Shortage Conditions*** *Achieve a 50% reduction in total water use.* Prohibits: Irrigation of landscaped areas, use of water to wash any vehicle, use of water for any type of pool. No application for new, additional, expanded, or increased-in-size water service connections, meters, service lines, pipeline extensions, mains, or water service facilities of any kind shall be approved during this stage.	-
San Diego MUD #1 (Duval County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/SanDiego.pdf	***GW***	***Mild Water Shortage Conditions*** Customers requested to voluntarily limit irrigation to twice a week at night. And to discontinue or minimize non-essential use. All operations of the City shall adhere to water use restrictions prescribed.	***Moderate Water Shortage Conditions*** *Achieve a reduction in daily water use.* Restrictions on irrigation of landscaped areas, vehicle washing, use of water for hydrants pools, and ponds. Prohibits: Wash down of hard-surfaced areas and structures for purposes other than immediate fire protection; use of water for dust control; flushing gutters; failure to repair controllable leak(s).	***Severe Water Shortage Conditions*** *Achieve an appropriate reduction in daily water use.* Phase 2 restrictions and Prohibitions. Prohibited: irrigation, pool use, vehicle washing construction and hydrant use under special permit	***Mild Water Shortage Conditions*** Water use may be rationed	-

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
City of Alice (Jim Wells County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Alice_DCP_2019.pdf	***SW***	***Mild Water Shortage Conditions*** *Achieve a voluntary 10% reduction in total water use, daily water demand.* Weekly reports are provided to the news media. Wholesale water customers are contacted to discuss conditions and to request voluntary measures. Customers requested to voluntarily limit irrigation to twice a week. And to discontinue or minimize non-essential use. Flushing of water mains and watering of parks facilities is reduced. Alternative water sources are investigated. City operations shall adhere to Stage 2 water use restrictions.	***Moderate Water Shortage Conditions*** *Achieve a 15% reduction in total water use, daily water demand.* Wholesale water customers are contacted weekly requested to implement mandatory measures. Restrictions on irrigation of landscaped areas, vehicle washing, use of water for pools, and ponds. Prohibits: Wash down of hard-surfaced areas and structures for purposes other than immediate fire protection; use of fire hydrants for any purpose other than firefighting; use of water for dust control; flushing gutters; failure to repair controllable leak(s). Serving water to patrons unless requested.	***Severe Water Shortage Conditions*** *Achieve a 20% reduction in daily water demand.* Wholesale water customers are contacted to discuss conditions and to request additional mandatory measures. Continuation of restrictions set forth in previous conditions and implementation of additional regulations and prohibitions. Additional restrictions on irrigation of landscaped areas, watering of golf course, and use of water for construction purposes. Pro Rata curtailment of water diversions and/or deliveries for retail customers is initiated.	***Emergency Water Shortage Conditions*** *Reduce water use to less than 25% of the City's maximum daily supply capacity.* Utility directors of each wholesale water customer are contacted. Additional restrictions on irrigation of landscaped areas and water use for fountains or ponds. The use of water to wash any vehicle or for any type of pool is prohibited. Applications for new, additional, expanded, or increased-in-size water service connections, meters, service lines, pipeline extensions, mains, or water service facilities of any kind shall require approval.	***Water Allocation*** *Achieve a 45% reduction in daily water demand.* Water is allocated according to the water allocation plan.

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
City of Orange Grove (Jim Wells County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/OrangeGrove.pdf	***GW***	***Mild Water Shortage Conditions*** *Achieve a voluntary 10% reduction in total water use.* All customers will be notified. Restricted use of water for ornamental fountains or ponds. All operations of the City shall adhere to water use restrictions prescribed for Stage II of the plan. Customers requested to practice conservation and minimize non- essential use	***Moderate Water Shortage Conditions*** *Achieve a 20% reduction in total water use.* Restrictions on irrigation of landscaped areas, vehicle washing, and use of water for pools. All restaurants are prohibited from serving water to patrons except upon request of the patron. Prohibits: Wash down of hard-surfaced areas and structures for purposes other than immediate fire protection; use of fire hydrants for any purpose other than firefighting; use of water for dust control; flushing gutters; failure to repair controllable leak(s). Restaurants cannot provide water unless requested.	***Severe Water Shortage Conditions*** *Achieve a 30% reduction in total water use.* Additional restrictions on irrigation of landscaped areas, watering of golf course, and use of water for construction purposes.	***Critical Water Shortage Conditions*** *Achieve a 40% reduction in total water use.* Prohibits: Irrigation of landscaped areas, use of water to wash any vehicle, use of water for any type of pool. Further Restrictions: Irrigation of landscaped areas, use of water to wash any vehicle, No application for new, additional, expanded, or increased-in-size water service connections, meters, service lines, pipeline extensions, mains, or water service facilities of any kind shall be approved during this stage.	***Emergency Water Shortage Conditions*** *Achieve a 40% reduction in total water use.* Prohibits: Irrigation and vehicle washing.

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
City of Kingsville (Kleberg County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Kingsville.pdf	*GW*	***Mild Water Shortage Conditions*** *Achieve a voluntary 10% reduction in total water use.* All customers will be notified. Restricted use of water for ornamental fountains or ponds. All operations of the City shall adhere to water use restrictions prescribed for Stage II of the plan. Restricted flushing of water mains. Meetings are schedules with large industrial and commercial water users to exchange information regarding methods of saving water.	***Moderate Water Shortage Conditions*** *Achieve a 15% reduction in total water use.* Restrictions on irrigation of landscaped areas, vehicle washing, and use of water for pools. All restaurants are prohibited from serving water to patrons except upon request of the patron. Prohibits: Wash down of hard-surfaced areas and structures for purposes other than immediate fire protection; use of fire hydrants for any purpose other than firefighting; use of water for dust control; flushing gutters; failure to repair controllable leak(s).	***Severe Water Shortage Conditions*** *Achieve a 25% reduction in total water use.* Additional restrictions on irrigation of landscaped areas, watering of golf course, and use of water for construction purposes.	***Emergency Water Shortage Conditions*** *Achieve a 35% reduction in total water use.* Prohibits: Irrigation of landscaped areas, use of water to wash any vehicle, use of water for any type of pool. No application for new, additional, expanded, or increased-in-size water service connections, meters, service lines, pipeline extensions, mains, or water service facilities of any kind shall be approved during this stage.	***Water Allocation*** The City Manager is authorized to allocate water according to the water allocation plan.

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
Ricardo WSC (Kleberg County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Ricardo.pdf	***SW***	***Mild Water Shortage Conditions*** *Achieve a voluntary 10% reduction in daily water demand.* All customers will be notified. Restrictions on irrigation of landscaped areas.	***Severe Water Shortage Conditions*** *Achieve a 15% reduction in daily water demand.* Additional restrictions on irrigation of landscaped areas and limits use of water from hydrants.	***Critical Water Shortage Conditions*** *Achieve a 30% reduction in daily water demand.* May prohibit irrigation of landscaped areas. Additional restrictions on vehicle washing, use of water for pools, and use of water for building integrity. Water rate surcharges are implemented for retail and wholesale customers. Water rate surcharges may be implemented for residential customers. Upon written notice cut off willful violators. Applications for new, additional, expanded, or increased-in-size water service connections, meters, service lines, pipeline extensions, mains, or water service facilities of any kind may not be approved during this stage.	***Emergency Water Shortage Conditions*** *Achieve a voluntary 50% reduction in daily water demand.* Contact the largest ten water customers affected Prohibits: Irrigation of landscaped areas, use of water to wash any vehicle, and associated uses of water not related to business processes which are discretionary. Water rate surcharges may be implemented for residential customers.	-
Riviera (Kleberg County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Riviera.pdf	***GW***	***Customer Awareness*** Water customers requested to limit non- essential use	***Voluntary Water Conservation*** Restricted days/hours for outside watering Restriction on wasting water (gutter flushing etc.)	***Mandatory Water Conservation*** Further restrictions on days/hours for outside watering, vehicle washing, pool filling, hydrant use. Prohibited: wash down of hard surfaces, dust control, gutter flushing, other water wasting.	***Critical Water Conservation*** Prohibited: all outdoor water use, vehicle washing.	-

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
El Oso WSC (Service area includes 500 square miles located in Karnes, Bee, Wilson, and Live Oak Counties) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Eloso.pdf	***GW***	***Mild Water Shortage Conditions*** *Achieve a voluntary 20% reduction in total water use.* All customers will be notified. All operations of the corporation shall adhere to water use restrictions prescribed for Stage II of the plan.	***Moderate Water Shortage Conditions*** *Achieve a 30% reduction in total water use.* Restrictions on irrigation of landscaped areas, vehicle washing, and use of water for pools, ornamental fountains, or ponds. All restaurants are prohibited from serving water to patrons except upon request of the patron. Prohibits: Wash down of hard-surfaced areas other than for immediate fire protection; use of fire hydrants for any purpose other than firefighting; use of water for dust control; flushing gutters; failure to repair controllable leak(s).	***Severe Water Shortage Conditions*** *Achieve a 40% reduction in total water use.* Additional restrictions on irrigation of landscaped areas, watering of golf course, and use of water for construction purposes.	***Critical Water Shortage Conditions*** *Achieve a 50% reduction in total water use.* Prohibits: Irrigation of landscaped areas, use of water to wash any vehicle, use of water for any type of pool. No application for new, additional, expanded, or increased-in-size water service connections, meters, service lines, pipeline extensions, mains, or water service facilities of any kind shall be approved during this stage.	***Emergency Water Shortage Conditions*** *Achieve a 60% reduction in total water use.* Prohibits: Irrigation of landscaped areas and use of water to wash any vehicle.
Old Marbach School WSC (Live Oak County) https://oldmarbachschoolwsc.com/documents/746/Scan_Doc0155.pdf	GW	***Customer Awareness*** Every year utility will mail a public announcement to customers April 30- ends September 30	***Voluntary Water Conservation*** Triggering events have ceased to exist for three consecutive days, visually inspect lines and repair links on daily basis, monthly review of customer use records and follow-up on any that have unusually high usage	***Mandatory Water Use Restrictions*** Triggering events have ceased to exist for three consecutive days, visually inspect lines and repair links on a regular basis, flushing is prohibited except for dead end mains	***Critical Water Use Restrictions*** Triggering events have ceased to exist for three consecutive days, visually inspect lines and repair links on a regular basis, flushing is prohibited except for dead end mains and only between 9 PM and 3 AM, emergency interconnects of alternative supply arrangements shall be initiated, all meters read as often as necessary to ensure compliance	**-**

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
McCoy WSC (Service area includes 608 square miles located in Atascosa, Wilson, and Live Oak Counties) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/McCoy.pdf	***GW***	***Mild Water Shortage Conditions*** *Achieve a voluntary 20% reduction in total water use.* All customers will be notified. All operations of the corporation shall adhere to water use restrictions pre-scribed for Stage II of the plan.	***Moderate Water Shortage Conditions*** *Achieve a 30% reduction in total water use.* Restrictions on irrigation of landscaped areas, vehicle washing, and use of water for pools, ornamental fountains, or ponds. All restaurants are prohibited from serving water to patrons except upon request of the patron. Prohibits: Wash down of hard-surfaced areas other than for immediate fire protection; use of fire hydrants for purposes other than firefighting; use of water for dust control; flushing gutters; failure to repair controllable leak(s).	***Severe Water Shortage Conditions*** *Achieve a 40% reduction in total water use.* Additional restrictions on irrigation of landscaped areas, watering of golf course, and use of water for construction purposes.	***Critical Water Shortage Conditions*** *Achieve a 50% reduction in total water use.* Prohibits: Irrigation of landscaped areas, use of water to wash any vehicle, use of water for any type of pool. No application for new, additional, expanded, or increased-in-size water service connections, meters, service lines, pipeline extensions, mains, or water service facilities of any kind shall be approved during this stage.	***Emergency Water Shortage Conditions*** *Achieve a 60% reduction in total water use.* Continuation of restrictions set forth in previous conditions and implementation of additional regulations and prohibitions. Prohibits: Irrigation of landscaped areas and use of water to wash any vehicle.

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
Nueces WSC (Nueces County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/NuecesWSC.pdf	***SW***	***Mild Water Shortage Conditions*** *Achieve a voluntary 10% reduction in daily water demand.* All customers will be notified. Restrictions on irrigation of landscaped areas.	***Severe Water Shortage Conditions*** *Achieve a 15% reduction in daily water demand.* Additional restrictions on irrigation of landscaped areas and limits use of water from hydrants.	***Critical Water Shortage Conditions*** *Achieve a 30% reduction in daily water demand.* May prohibit irrigation of landscaped areas. Additional restrictions on vehicle washing, use of water for pools, and use of water for building integrity. Water rate surcharges are implemented for retail and wholesale customers. Water rate surcharges may be implemented for residential customers. Upon written notice cut off willful violators. Applications for new, additional, expanded, or increased-in-size water service connections, meters, service lines, pipeline extensions, mains, or water service facilities of any kind may not be approved during this stage.	***Emergency Water Shortage Conditions*** *Achieve a voluntary 50% reduction in daily water demand.* Contact the largest ten water customers affected Prohibits: Irrigation of landscaped areas, use of water to wash any vehicle, and associated uses of water not related to business processes which are discretionary. Water rate surcharges may be implemented for residential customers.	-

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
River Acres WSC (Nueces County) https://rawscorp.com/documents/89/River_Acres_Water_Supply_Corporation_-_Drought_Contingency_Plan_2024.pdf	***SW***	***Water Shortage Possibility*** Restrictions on irrigation of landscaped areas.	***Water Shortage Watch*** Additional restrictions on irrigation of landscaped areas, vehicle washing, and use of water for pools, ornamental fountains, or ponds, and wash down of buildings and structures. Prohibits: Wash down of hard-surfaced areas other than for immediate fire protection; use of fire hydrants for any purpose other than firefighting; use of water for dust control; flushing gutters; failure to repair controllable leak(s).	***Water Shortage Warning*** Additional restrictions on irrigation of landscaped areas and new service connections to the City's water system. Mandatory water use limits go into effect. All restaurants are prohibited from serving water to patrons except upon request of the patron. The use of water for any type of pool is prohibited.	***Water Shortage Emergency*** Water allocations to commercial and industrial customers are established. Maximum monthly water use and revised rate schedules established for residential customers. No outside water use Any application for new, additional, expanded, or increased-in-size water service connections, meters, service lines, pipeline extensions, mains, or water service facilities of any kind must be approved.	**-**
City of Odem (San Patricio County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Odem.pdf	***SW***	***Mild Water Shortage Conditions*** All customers will be notified. Water customers will be requested to voluntarily limit landscape irrigation to once a week. Commercial customers will be requested to voluntarily reduce use. Reduced watering of public parks and facilities.	***Moderate Water Shortage Conditions*** All customers will be notified. Additional restrictions on irrigation of landscaped areas, vehicle washing, use of water to maintain buildings, and use of water for pools, fountains, hydrants or ponds. Prohibits: Wash down of hard-surfaced areas and structures for purposes other than immediate fire protection; use of fire hydrants for any purpose other than firefighting; use of water for dust control; flushing gutters.	***Severe Water Shortage Conditions*** All customers will be notified. Additional restrictions on landscape irrigation and commercial nursery facilities. All restaurants are prohibited from serving water to patrons except upon request of the patron. Mandatory water use limits go into effect.	***Critical Water Shortage Conditions*** All customers will be notified. Prohibits irrigation of landscaped areas. Additional restrictions on the use of water for new agricultural land, to wash any vehicle, for building integrity, or for any type of pool. Drought surcharges are applied to deter discretionary water use.	***Emergency Water Shortage Conditions*** All customers will be notified. Prohibits irrigation of land-scaped areas and use of water to wash any vehicle.

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
City of Ingleside (San Patricio County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Ingleside.pdf	***SW***	***Water Shortage Possibility*** All municipal operations are placed on mandatory conservation. Restrictions on irrigation of landscaped areas.	***Water Shortage Watch*** Additional restrictions on irrigation of landscaped areas, vehicle washing, and use of water for pools, ornamental fountains, or ponds, and wash down of buildings and structures. Prohibits: Wash down of hard-surfaced areas; use of fire hydrants for any purpose other than firefighting; use of water for dust control; flushing gutters; failure to repair defective plumbing and controllable leak(s).	***Water Shortage Warning*** Additional restrictions on irrigation and new service connections to the City's water system. Mandatory water use limits go into effect. All restaurants are prohibited from serving water to patrons except upon request of the patron. The use of water for any type of pool is prohibited.	***Water Shortage Emergency*** Water allocations to commercial and industrial customers are established. Maximum monthly water use and revised rate schedules established for residential customers. Any application for new, additional, expanded, or increased-in-size water service connections, meters, service lines, pipeline extensions, mains, or water service facilities of any kind must be approved.	
City of Taft (San Patricio County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Taft.pdf	***SW***	***Mild Water Shortage Conditions*** *Achieve a voluntary 5% reduction in total water use.* All customers will be notified. All operations of the City shall adhere to water use restrictions prescribed for Stage II of the plan.	***Moderate Water Shortage Conditions*** *Achieve a voluntary 10% reduction in total water use.* Restrictions on irrigation of landscaped areas, vehicle washing, and use of water for pools, ornamental fountains, or ponds, and wash down of buildings and structures. All restaurants are prohibited from serving water to patrons except upon request of the patron. Prohibits: Wash down of hard-surfaced areas other than for immediate fire protection; use of fire hydrants for any purpose other than firefighting; use of water for dust control; flushing gutters; failure to repair controllable leak(s).	***Severe Water Shortage Conditions*** *Achieve a voluntary 15% reduction in total water use.* Continuation of restrictions set forth in previous conditions and implementation of additional regulations and prohibitions. Additional restrictions on irrigation of landscaped areas, watering of golf course, and use of water for construction purposes.	***Critical Water Shortage Conditions*** *Achieve a voluntary 30% reduction in total water use.* Additional restrictions on irrigation of landscaped areas and use of water for washing vehicles. The use of hose-end sprinklers and water for any type of pool is prohibited. No application for new, additional, expanded, or increased-in-size water service connections, meters, service lines, pipeline extensions, mains, or water service facilities of any kind shall be approved during this stage.	***Emergency Water Shortage Conditions*** *Achieve a voluntary 30% reduction in total water use.* Continuation of restrictions set forth in previous conditions and implementation of additional regulations and prohibitions. Prohibits: Irrigation of landscaped areas and use of water to wash any vehicle.

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
City of Portland (San Patricio County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Portland.pdf	***SW***	***Mild Water Shortage Conditions*** *Achieve a 10% reduction in daily water demand.* Minimize or discontinue water system flushing and utilize reclaimed water for non-potable uses to the greatest extent possible. Water customers will be requested to voluntarily limit landscape irrigation to once a week. Water customers will be requested to limit or discontinue non- essential use.	***Moderate Water Shortage Conditions*** *Achieve a 20% reduction in daily water demand.* *More repair crews may be used for quicker response to water-line leaks.* Water customers are monitored for compliance. Additional restrictions on irrigation of landscaped areas, vehicle washing, use of water to maintain buildings, and use of water for pools, fountains, hydrants or ponds. Prohibits: Wash down of hard-surfaced areas and structures for purposes other than immediate fire protection; use of fire hydrants for any purpose other than firefighting; use of water for dust control; flushing gutters.	***Critical Water Shortage Conditions*** *Achieve a 30% reduction in daily water demand.* Water meters of willful violators are disconnected as necessary to prevent wasting of water. Prohibits irrigation of landscaped areas. Additional restrictions on the use of water to wash any vehicle or for any type of pool.	***Critical Water Shortage Conditions*** N/A	***Emergency Water Shortage Conditions*** *Achieve a 50% reduction in daily water demand.* Prohibits: Irrigation of landscaped areas and use of water to wash any vehicle. Business process water shall be reduced to a basic amount necessary.

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
Rincon WSC (San Patricio County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Rincon.pdf	***SW***	***Water Watch*** *Achieve a 10% reduction in total water use.* All customers will be notified. Disseminate water conservation information to retail customers. Minimize water system flushing and system water-waste. Intensify efforts of the Leak Detection and Repair Program.	***Water Alert*** *Achieve a 11% to 20% reduction in total water use.* Additional restrictions on irrigation of landscaped areas, and ornamental ponds. Establish mandatory water consumption restrictions. All water taken from flush valves, other than for flushing purposes shall be metered, and the Corporation shall charge for this water in accordance with the current rate schedule. Prohibits: Wash down of hard-surfaced areas; and water to run or accumulate in any gutter or street.	***Water Warning*** *Achieve a 21% to 35% reduction in total water use.* Additional landscape irrigation restrictions. Except when empty, all swimming pools shall be covered when not in use. Restricted use of water to wash any vehicle.	***Water Emergency*** *Achieve a 36% or greater reduction in total water use.* Prohibition of all non-essential water use, unless necessary for the preservation of health, safety, and welfare. Water usage for livestock is exempt.	-
County-Other Entities						
Aransas County MUD #1 (Aransas County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/AransasMUD.pdf	***GW***	***Mild Drought Conditions (voluntary)*** *Target Reduction in Well Run Time = 5%* All customers will be notified. Restricted landscape irrigation.	***Moderate Drought Conditions*** *Target Reduction in Well Run Time = 10%* All outdoor water use must be conducted with a hand-held hose with a manual on-off nozzle. Restricted street washing, fire hydrant flushing, and filling of swimming pools.	***Severe Drought Conditions*** *Target Reduction in Well Run Time = 15%* All outdoor water use is prohibited. A surcharge equal to 200% of the applicable rate for all water used in excess of 10,000 gallons/month shall be imposed on all customers.	-	-

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
Blueberry Hills (Bee County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/BlueberryHills.pdf	***GW***	***Customer Awareness*** Water customers requested to limit non- essential use	***Voluntary Water Conservation*** *Achieve 25% reduction in total use* Restricted days/hours for outside watering Restriction on wasting water (gutter flushing etc.)	***Mandatory Water Conservation*** *Achieve 40% reduction in total use* Further restrictions on days/hours for outside watering, vehicle washing, pool filling, hydrant use. Prohibited: wash down of hard surfaces, dust control, gutter flushing, other water wasting.	***Critical Water Conservation*** *Achieve 55% reduction in total use* Prohibited: all outdoor water use, vehicle washing.	-
Copano Heights Water Company (Aransas County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Copano_2018.pdf	***SW***	***Customer Awareness*** Water customers requested to limit non- essential use and voluntary limit the irrigation of landscaped areas to once per week	***Voluntary Water Conservation*** *Achieve 10% reduction in total use* Restricted days/hours for outside watering Restriction on wasting water (gutter flushing etc.)	***Mandatory Water Conservation*** *Achieve 15% reduction in total use* Further restrictions on days/hours for outside watering, vehicle washing, pool filling, hydrant use. Prohibited: wash down of hard surfaces, dust control, gutter flushing, other water wasting.	***Critical Water Conservation*** *Achieve 30% reduction in total use* Prohibited: all outdoor water use, vehicle washing.	-
Escondido Creek Estates (Hidalgo County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Escondido.pdf	***GW***	***Customer Awareness*** Water customers requested to limit non- essential use	***Voluntary Water Conservation*** Restricted days/hours for outside watering Restriction on wasting water (gutter flushing etc.)	***Mandatory Water Conservation*** Further restrictions on days/hours for outside watering, vehicle washing, pool filling, hydrant use. Prohibited: wash down of hard surfaces, dust control, gutter flushing, other water wasting.	***Critical Water Conservation*** Prohibited: all outdoor water use, vehicle washing.	-

Water Systems	(SW/ GW)	Stage I (Voluntary)	Stage II	Stage III	Stage IV (If applicable)	Stage V
McMullen County WCID #2 (McMullen County) https://www.nueces-ra.org/CP/RWPG/dcp_pdf/McMullen.pdf	***GW***	***Mild Water Shortage Conditions*** *Achieve a voluntary 10% reduction in total water use.* All customers will be notified and asked to limit non-essential use Restricted use of water for ornamental fountains or ponds. All operations of Freer WCID adhere to water use restrictions prescribed for Stage II of the plan.	***Moderate Water Shortage Conditions*** *Achieve a 25% reduction in total water use.* Restrictions on irrigation of landscaped areas, vehicle washing, and use of water for pools. All restaurants are prohibited from serving water to patrons except upon request of the patron. Prohibits: Wash down of hard-surfaced areas and structures for purposes other than immediate fire protection; use of fire hydrants for any purpose other than firefighting; use of water for dust control; flushing gutters; failure to repair controllable leak(s).	***Critical Water Shortage Conditions*** *Achieve a 50% reduction in total water use.* Additional restrictions on irrigation of landscaped areas, watering of golf course, and use of water for construction purposes. No application for new, additional, expanded, or increased-in-size water service connections, meters, service lines, pipeline extensions, mains, or water service facilities of any kind shall be approved during this stage.	***Emergency Water Shortage Conditions*** *Achieve a 75% reduction in total water use.* Prohibits: Irrigation of landscaped areas, use of water to wash any vehicle, use of water for any type of pool.	**-**
Baffin Bay WSC https://www.nueces-ra.org/CP/RWPG/dcp_pdf/Baffin%20Bay%20WSC_DCP.pdf	***SW***	***Mild Conditions*** Outside water use restrictions, reduced flushing operations, encouraged customer use reduction	***Moderate Conditions*** Prohibited outside water use, public service announcements	***Severe Conditions*** All outside watering prohibited. Use will be restricted to a percentage of previous months use. WSC shall continue enforcement and educational efforts.	**-**	**-**

Note: Stages 2- 5 for all drought contingency plans include continuation of restrictions set forth in previous conditions and implementation of additional regulations and prohibitions.

7.4 Existing and Potential Interconnects

A goal of the regional planning process is to plan for sufficient supplies that meet or exceed DOR demands for the next 50 years. However, it is also important for regions to plan for emergency supplies in the event of a prolonged drought or an interruption/impairment of supply from an existing source. An interconnection between two collaborating municipal WUGs can serve as an alternative means of providing drinking water in case of these events in lieu of trucking in supply or other expensive options. In compliance with TAC Chapter 357, Regional Water Planning Guidelines, the CBRWPG collected available information on existing major water infrastructure facilities that may be used for interconnections in event of an emergency shortage of water.

On November 6, 2024, a subcommittee comprised of CBRWPG members met to discuss emergency interconnections identified in the *2016 Coastal Bend Regional Water Plan* and updates for emergency interconnections for new WUGs in the area. TCEQ representatives attended the meeting and reported that no new WUGs have emergency connections. Existing and potential interconnects that were identified for municipal WUGs with populations less than 7,500, utilities with a single source of water supply, or County-Other WUGs, in accordance with TAC 357.42(d)-(g) provisions, are presented in Chapter 7.4, Table7.9. The subcommittee also evaluated potential emergency responses to local drought conditions or loss of existing water supplies and likely alternative water sources and major water infrastructure facilities in the event that the existing supplies become temporarily unavailable due to unforeseeable conditions. Local DCPs were reviewed for information related to emergency connections or facilities that are disallowed for emergency connection. For the purposes of emergency response analysis, it was assumed that entities evaluated would have 180 days or less of remaining supply.

7.5 Emergency Response to Local Drought Conditions or Loss of Municipal Supply

The regional and state water plans aim to prepare entities for worst case drought scenarios based on the DOR, as described in Section 7.1. While rare, it is important to have a back-up plan in case of infrastructure failure or water supply contamination. This is especially important for smaller entities that rely on a sole source of supply or a sole WWP. While many WUGs and WWPs have DCPs, as described in Section 7.2, it is less common for small municipalities or County-Other WUGs to have these emergency plans.

The Coastal Bend Region drought response and emergency connections subcommittee identified 43 potential interconnects as reported in Table7.9 for small WUGs with populations less than 10,000. These potential emergency interconnects were assigned under the general principle that entities relying on surface water supplies would consider groundwater; and entities relying on groundwater would consider surface water supplies from the nearest neighboring water system.

A broad range of emergency situations could result in a loss of a reliable municipal supply and it is not possible to plan one solution to meet any possible emergency, for that reason a range of possible responses were selected for each entity in Table7.9 based on source type and location. A WUG using groundwater was analyzed for potential additional fresh water and brackish water wells based on the existence of appropriate aquifers in the area. Modeled Available Groundwater (MAG) was not considered since the wells are assumed temporary over the course of an emergency. Surface water WUGs were analyzed for curtailment of junior water rights, no releases from upstream reservoirs were considered since most surface water users in the region rely on Corpus Christi reservoirs.

Table 7.9.
Potential Emergency Supply Options for Small WUGs

Entity							Implementation Requirements		
Water User Group	County	2020 Population	Local Groundwater Well	Brackish Groundwater Well	Truck in Water	Supply from Nearby Entity	Known Existing Interconnect	Potential Entity Providing Supply	Type of Infrastructure Required
ARANSAS PASS	ARANSAS	9,416	X	-	X	-	-	-	Well, Pipeline, Transportation
BAFFIN BAY WSC	KLEBERG	735	-	-	X	X	-	-	Pipeline, Transportation
BENAVIDES	DUVAL	1,470	-	-	X	X	-	Alice	Pipeline, Transportation
BISHOP	NUECES	3,160	X	X	X	X	STWA	-	Well, Pipeline, Transportation
BROOKS COUNTY-OTHER	BROOKS	1,765	-	-	X	-	-	-	Transportation
CORPUS CHRISTI NAVAL AIR STATION	NUECES	1,320	X	X	X	-	-	-	Well, Pipeline, Transportation
DRISCOLL	NUECES	621	X	X	X	-	-	-	Well, Pipeline, Transportation
DUVAL COUNTY CRD	DUVAL	1,271	-	-	X	X	-	-	Pipeline, Transportation
DUVAL COUNTY-OTHER	DUVAL	3,771	-	-	X	-	-	-	Transportation
EL OSO WSC	LIVE OAK	1,047	-	-	X	X	-	Karnes City	Pipeline, Transportation
FALFURRIAS	BROOKS	4,443	-	-	X	X	-	Alice or Premont	Pipeline, Transportation
FREER WCID	DUVAL	2,417	-	-	X	X	-	San Diego	Pipeline, Transportation
GEORGE WEST	LIVE OAK	1,888	-	-	X	X	-	Three Rivers	Pipeline, Transportation
GREGORY	SAN PATRICIO	1,714	X	-	X	-	-	-	Well, Pipeline, Transportation
INGLESIDE	SAN PATRICIO	9,402	-	-	X	X	-	SPMWD	Pipeline, Transportation
INGLESIDE ON THE BAY	SAN PATRICIO	653	-	-	X	X	-	SPMWD	Pipeline, Transportation
JIM WELLS COUNTY FWSD 1	JIM WELLS	1,678	-	-	X	X	-	-	Pipeline, Transportation
KENEDY COUNTY-OTHER	KENEDY	463	-	-	X	-	-	-	Transportation

Entity			Local Groundwater Well	Brackish Groundwater Well	Truck in Water	Supply from Nearby Entity	Implementation Requirements		
Water User Group	County	2020 Population					Known Existing Interconnect	Potential Entity Providing Supply	Type of Infrastructure Required
KLEBERG COUNTY-OTHER	KLEBERG	3,568	-	-	X	X	Ricardo WSC	-	Pipeline, Transportation
LIVE OAK COUNTY-OTHER	LIVE OAK	6,499	X	-	X	-	-	-	Well, Pipeline, Transportation
MATHIS	SAN PATRICIO	4,333	X	-	X	X	Interconnection to Mary Rhodes Pipeline Supplies through Corpus Christi	-	Well, Pipeline, Transportation
MCCOY WSC	LIVE OAK	172	-	-	X	X	-	Three Rivers	Pipeline, Transportation
MCMULLEN COUNTY-OTHER	MCMULLEN	734	-	-	X	-	-	-	Transportation
NAVAL AIR STATION KINGSVILLE	KLEBERG	52	-	-	X	X	-	Ricardo WSC	Pipeline, Transportation
NUECES COUNTY WCID 4	NUECES	2,631	-	X	X	X	SPMWD, Corpus Christi	-	Pipeline, Transportation
NUECES WSC	NUECES	5,805	-	X	X	X	Nueces County WCID # 3	Nueces County WCID # 3	Pipeline, Transportation
ODEM	SAN PATRICIO	3,055	X	X	X	X	-	Sinton	Well, Pipeline, Transportation
OLD MARBACH SCHOOL WSC	LIVE OAK	607	-	-	X	X	-	George West	Pipeline, Transportation
ORANGE GROVE	JIM WELLS	1,443	X	-	X	X	-	-	Well, Pipeline, Transportation
PETTUS MUD	BEE	496	-	-	X	X	-	-	Pipeline, Transportation
PREMONT	JIM WELLS	2,330	-	-	X	X	-	Alice	Pipeline, Transportation
RICARDO WSC	KLEBERG	3,030	-	X	X	X	City of Kingsville	City of Kingsville	Pipeline, Transportation
RINCON WSC	SAN PATRICIO	3,698	X	X	X	X	-	Sinton	Well, Pipeline, Transportation

Entity			Local Groundwater Well	Brackish Groundwater Well	Truck in Water	Supply from Nearby Entity	Implementation Requirements		
Water User Group	County	2020 Population					Known Existing Interconnect	Potential Entity Providing Supply	Type of Infrastructure Required
RIVER ACRES WSC[11]	NUECES	1,952	-	-	X	X	NCWCID # 3	City of Corpus Christi	Pipeline, Transportation
RIVIERA WATER SYSTEM	KLEBERG	758	-	-	X	X	-	-	Pipeline, Transportation
SAN DIEGO MUD 1	DUVAL	4,669	-	-	X	X	-	#N/A	Pipeline, Transportation
SINTON	SAN PATRICIO	4,812	-	-	X	X	-	SPMWD	Pipeline, Transportation
SKIDMORE WSC	BEE	632	-	-	X	X	-	-	Pipeline, Transportation
TAFT	SAN PATRICIO	2,549	-	-	X	X	-	Sinton	Pipeline, Transportation
TDCJ CHASE FIELD	BEE	4,363	-	-	X	X	Beeville	-	Pipeline, Transportation
THREE RIVERS	LIVE OAK	2,761	X	-	X	-	-	-	Well, Pipeline, Transportation
VIOLET WSC	NUECES	2,651	-	-	X	X	-	NCWCID #3	Pipeline, Transportation

A nearby entity that could provide supply in the case of an isolated incident was identified for each WUG if existing or potential interconnects were known. In addition, trucking in water was considered as a supply option under severe circumstances. Any infrastructure required for implementation of the options was noted as well. Information on existing and potential interconnect supply capacity or location was generally not available from either source.

The TCEQ provides support to help public water systems plan in advance of an emergency or service interruption at the following website: https://www.tceq.texas.gov/drinkingwater/homeland_security/disasterprep/disasterprep.html.

[11] Information on potential connection to City of Corpus Christi provided by Region N survey completed by River Acres WSC

At the request of the CBRWPG, a list of resources and local Emergency Management Offices in the Coastal Bend Region that can help provide aide and assistance in case of emergency include:

American Red Cross- Coastal Bend (361) 887-9991
Nueces County Emergency Management (361) 888-0513
Texas Division of Emergency Management- Region 3 (956) 565-7120
TCEQ- Region N (361) 825- 3100
Corpus Christi Emergency Management (361) 826-1100

7.6 Coastal Bend RWPG Drought Response Recommendations

On October 17, 2024, a subcommittee[12] comprised of CBRWPG members was formed to develop drought response recommendations and compile information about emergency water interconnections in the region. The subcommittee met on November 6, 2024, and December 2, 2024, and prepared the following recommendations, which the CBRWPG adopted on December 12, 2024:

- **Drought response recommendations for each existing source -** The CBRWPG considered TAC Chapter 357.42(c) provisions to identify factors specific to each source of water supply to be considered in determining whether to initiate a drought response, actions to be taken as part of the drought response, and triggers and actions in response to drought. The CBRWPG supports the drought response triggers and actions identified in local WUG DCPs for existing sources (see Table 7.1 to Table7.8).

- **Recent implementation of measures to respond to drought conditions -** In response to a new TWDB provision to include whether measures have been recently implemented in response to drought conditions, the CBRWPG recognizes that the City of Corpus Christi's direct and indirect customers are required to adhere to the City of Corpus Christi DCP criteria and reductions. A Coastal Bend Region survey was prepared and sent to municipal water providers on November 19, 2024, with reminder sent on December 3, 2024. The results of the municipal survey are included in Table 7.10. At this time, it is impractical to poll all 40+ municipal WUGs to inquire about the implementation status of DCP measures and TWDB funding has not been provided for this activity.

[12] Coastal Bend Drought Response Subcommittee participants included: Mr. Scott Bledsoe, Ms. Teresa Carrillo, Mr. James Dodson, Mr. William Griffin, and Mr. Esteban Ramos.

Table 7.10.
Region N Survey Results from Municipal Water Provides Related to Drought Response (as of February 4, 2025)

City or Municipal Entity	River Acres Water Supply	Mathis	City of Beeville	Portland	Orange Grove	Nueces County WCID No. 3
Please select efforts your utility is taking to prepare for future drought conditions (check all that apply):	Emergency connections - Restrict non-essential water use during severe drought - Implementation of drought plan or water restrictions	Maximum permitted amounts - Restrict non-essential water use during severe drought - Replacement of aging infrastructure - Implementation of drought plan or water restrictions	Restrict non-essential water use during severe drought - Implementation of drought plan or water restrictions	Maximum permitted amounts - Restrict non-essential water use during severe drought - Replacement of aging infrastructure - Implementation of drought plan or water restrictions	Restrict non-essential water use during severe drought - Replacement of aging infrastructure - Implementation of drought plan or water restrictions	Replacement of aging infrastructure
What measures does your utility take to prepare for emergency water supply needs? (check all that apply)	Emergency interconnections	Reduce water rights - Local groundwater well - Brackish groundwater desalination	Release from upstream reservoir		None listed above (only check this box if none are selected above)	Release from upstream reservoir
Does your entity currently have emergency water supply connections?	Yes	No	No	No	No	No
If yes, with whom?	City of Corpus Christi					
Is your entity considering developing new or additional emergency connections?	No	Yes	No	No	No	No
If yes, with whom? 2		NA				
Are there implementation challenges that have prevented your entity from developing emergency connections? (check all that apply)	No implementation challenges		Infrastructure needed - Haven't identified an entity to provide supply	Haven't identified an entity to provide supply	Haven't identified an entity to provide supply	Haven't identified an entity to provide supply

- **Alternative drought management water management strategies for WUGs/WWPs, if desired by regional water planning groups** - The CBRWPG does not recommend alternative drought management water management strategies for WUGs and/or WWPs beyond those identified in the local DCPs. The CBRWPG recognizes that local entities invest time and resources in preparing their DCPs and, for this reason, does not recommend preparing additional recommendations that might deviate, conflict, or alter drought measures identified in local WUG and WWP DCPs.

- **Demand Management** - The CBRWPG adopted safe yield measures when considering water supplies from the Corpus Christi Water Supply System (which provides water for nearly 80 percent of the regional water demands). The regional water plan was developed to meet projected water demands with a safe yield reserve of 75,000 ac-ft in CCR/LCC System storage during worst historical drought conditions as a provision for future drought uncertainty. The CBRWPG has not made additional drought management recommendations as a water management strategy for specific WUG needs. Reducing water demands during a drought as a defined water management strategy does not ensure that sufficient supplies will be available to meet the projected water demands; rather, it simply eliminates the demands. While the CBRWPG encourages entities in the region to promote demand management during a drought; it should not be identified as a "new source" of supply. Recommending demand reductions as a water management strategy is antithetical to the concept of planning to meet projected water demands. It does not make more efficient use of existing supplies as does conservation, but instead effectively turns the tap off when the water is needed most. It is planning to not meet future water demands.

- **Consider not meeting needs as a potentially feasible drought management water management strategy** - The CBRWPG considered not meeting needs as a potentially feasible drought management water management strategy. Although this drought management strategy was considered, the CBRWPG did not recommended it, as discussed in more detail in Section 7.6. The CBRWPG recognizes that the TWDB will conduct a socioeconomic impact need analysis of the cost of not meeting needs.

- **Recommendation of Triggers and Drought Stage Implementation** - The CBRWPG recommends that the triggers and drought stages for severe and critical/emergency conditions identified in local DCPs be implemented and enforced accordingly to protect human health and water supply (see Table7.7 and Table7.8 for details). The 2001 Agreed Order between the Nueces River Authority and City of Corpus Christi, which sets pass through requirements in the Nueces River based on the combined storage of the CCR/LCC System, serves as an excellent example of a staged trigger for drought provisions.

- **Emergency responses to local drought conditions for municipal water user groups with (a) populations less than 7,500; (b) single source of water supply; or (c) all county-other WUGs** - The CBRWPG considered the subcommittee's recommendations on interconnections and emergency supplies for each water user group. The CBRWPG subcommittee discussed emergency connections and prepared a list of potential and known existing interconnections in the region as included in .

- **Region-specific model drought contingency plans (DCPs) and Model plans** - The CBRWPG acknowledges that DCPs are a useful drought management tool for entities with both surface and groundwater sources and recommends that all entitles consider adopting a DCP in preparation for drought conditions. The plan will summarize the most common best practices from across the region, obtained as submitted to the Nueces River Authority, and recommends that municipal and WWPs without a DCP consider these, in addition to TCEQ Model DCPs for Coastal Bend Region entities wishing to develop a new DCP. The plan also includes TCEQ model drought contingency plans for wholesale and retail water suppliers to provide guidance and suggestions to entities with regard to the preparation of drought contingency plans. The CBRWPG considered not meeting needs as a potentially feasible drought management water management strategy and requested at the February 7, 2019, meeting that the TWDB conduct a socioeconomic impact need analysis of the cost of not meeting needs. Although this drought management strategy was considered but the CBRWPG did not recommend it.

7.7 Region Specific Drought Response Recommendations and Model Drought Contingency Plans

7.7.1 Region-Specific Drought Response Recommendations

The CBRWPG acknowledges that DCPs are a useful drought management tool for entities with both surface and groundwater sources and recommends that all entitles consider adopting a DCP in preparation for drought conditions. The region also recommends that in accordance with TCEQ guidelines, entities update their DCPs every 5 years as triggers can change as wholesale and retail water providers reassess their contracts and supplies. The Nueces River Authority obtained 31 DCPs from across the region. Fifteen of these participating water providers and WUGs rely solely on surface water, 11 entities rely solely on groundwater, and 5 of them use both sources to meet needs.

An analysis was performed based on the known DCPs to determine the most common drought contingency measures used in Coastal Bend Region. A summary of the results is shown in Table 7.11 and the detailed information is found in Table 7.12. Coastal Bend Region suggests that entities without a DCP could determine which drought contingency measures to adopt by considering the DCPs of other regional WUGs with similar populations and supply types.

7.7.2 Model Drought Contingency Plans

TCEQ provides model drought contingency plans[13] for wholesale and retail water suppliers to provide guidance and suggestions to entities with regard to the preparation of drought

[13] https://www.tceq.texas.gov/assets/public/permitting/watersupply/drought/dcpiou.pdf

contingency plans. Not all items in the model will apply to every systems situation, but the overall model can be used as a starting point for most entities.

The CBRWPG recommends that a list of the common drought contingency measures for the Coastal Bend Region (Table 7.12) be considered for municipal and WWPs, in addition to TCEQ Model DCPs for Coastal Bend Region entities wishing to develop a new DCP. Region-specific model drought contingency plans are included in Appendix D.

Table 7.11.
Region N Drought Contingency Summary

Common Drought Contingency Measure	Number of Region N DCPs Recommending
Watering schedules/ Landscape irrigation restrictions	31
Water demand reduction targets	28
Potable water use restrictions	10
Vehicle washing restrictions	29
Restrictions on wash down of hard-surfaces, buildings, and/or structures	27
Restrictions on new service connections, pipeline extensions, etc.	16
Restrictions on serving water to patrons at restaurants	15
Restrictions on flushing gutters, controllable leaks, and/or permitting water to run or accumulate	26
Restrictions on the use of water for pools, ponds, or fountains	29
Restrictions on use of water for dust control	23
Others	27

Table 7.12.
Common Drought Response Measures

Wholesale Water Provider/Water User Group	Census 2020 (For Water User Groups Only)	DCP Available	Date	Drought Contingency Measures											Water Supplies	
				Watering schedules/ Landscape irrigation restrictions	Water demand reduction targets	Potable water use restrictions	Vehicle washing restrictions	Restrictions on wash down of hard-surfaces, buildings, and/or structures	Restrictions on new service connections, pipeline extensions, etc.	Restrictions on serving water to patrons at restaurants	Restrictions on flushing gutters, controllable leaks, and/or permitting water to run or accumulate	Restrictions on the use of water for pools, ponds, or fountains	Restrictions on use of water for dust control	Others	SW	GW
Wholesale Water Providers																
City of Corpus Christi		Y	2018	√	√	√	√	√	√			√		√	√	
SPMWD		Y	2019	√	√	√	√	√				√	√	√	√	
South Texas Water Authority		Y	2024	√	√									√	√	
Nueces County WCID #3		Y	2019	√	√	√	√	√				√			√	
LNRA		Y	2024		√									√	√	
Water User Groups																
Aransas Pass	9,416	Y	2008	√	√		√	√	√	√	√	√	√	√	√	√
Rockport	18,088	Y	2013	√	√		√	√			√	√	√	√	√	
Beeville	13,086	Y	2024	√	√	√	√	√	√			√	√	√	√	
City of Three Rivers	2,761	Y	2014	√	√		√	√			√	√	√		√	√
Freer WCID	2,417	Y	2000	√	√		√	√	√	√	√	√	√	√		√
San Diego MUD #1	4,669	Y	2000	√	√		√	√			√	√	√	√		
Alice	20,651	Y	2019	√	√		√	√	√	√	√	√	√	√	√	
Orange Grove	1,443	Y	2000	√	√		√	√	√	√	√	√	√	√		√
Kingsville	25,307	Y	2002	√	√		√	√	√	√	√	√	√	√	√	√
Ricardo WSC	3,030	Y	2018	√	√	√	√	√	√	√	√	√	√	√	√	
El Oso WSC	1,290	Y	2009	√	√		√	√	√	√	√	√	√	√		√
McCoy WSC	170	Y	2000	√	√		√	√	√	√	√	√	√	√		√
Old Marbach School WSC	607	Y	2006	√	√		√	√			√	√	√			√
Nueces WSC	5,805	Y	2019	√	√	√	√	√	√	√	√	√	√	√	√	
River Acres WSC	1,952	Y	2021	√	√	√	√	√	√	√	√	√	√	√	√	
Odem	3,055	Y	2013	√	√	√	√	√	√	√	√	√		√	√	
Ingleside	9,402	Y	2018	√	√	√	√	√	√	√	√	√	√	√	√	√
Taft	2,549	Y	2013	√	√		√	√	√	√	√	√	√	√	√	
Portland	17,910	Y	2024	√	√	√	√	√	√	√	√	√	√	√	√	
Rincon WSC	3,698	Y	2009	√	√		√				√	√		√	√	
County-Other Entities																
Aransas County MUD #1		Y	2009	√							√			√		√
Blueberry Hills		Y	2005	√	√		√	√			√	√	√	√		√
Copano Heights WC		Y	2018	√	√		√	√			√	√	√		√	
Escondido Creek Estates		Y	2000	√			√			√	√	√	√	√		√
Riviera		Y	2000	√			√	√			√	√	√	√		√
Baffin Bay WSC		Y	2015	√	√		√	√			√	√				
Pettus MUD		Y	2024	√			√	√			√	√		√		√

7.8 Drought Management WMS

While the CBRWPG encourages entities in the region to promote demand management during a drought, it should not be identified as a "new source" of supply. Recommending demand reductions as a water management strategy is antithetical to the concept of planning to meet projected water demands. It does not make more efficient use of existing supplies as does conservation, but instead effectively turns the tap off when the water is needed most. It is planning to not meet future water demands.

While the Coastal Bend Region does not identify drought management water management strategies, DCPs are encouraged for all entities and the region supports the implementation of the drought responses outlined in these DCPs when corresponding triggers occur. While the relief provided from these DCP responses can prolong supply and reduce impacts to communities, they are not seen as reliable for all entities under all potential droughts.

7.9 Other Drought-Related Considerations and Recommendations

7.9.1 Model Updates

It is of utmost importance that regional water planning groups have the most up-to-date information available to make decisions. The CCWSM is used to determine both the DOR and the safe yield of the City of Corpus Christi's Regional Water Supply System, which includes historical hydrology from 1934 to 2015. The CBRWPG recommends that the Texas legislature continue to support TCEQ and regional water planning groups to pursue updated Water Availability Models (WAMs) and Water Supply Models. More specifically, that during the next cycle of regional water planning, the model is extended to include current drought conditions. This is especially important as the drought continues with increasing severity beyond the modeled 2015 conditions.

7.9.2 State's Drought Preparedness Council Recommendations

The CBRWPG supports the efforts of the Texas Drought Preparedness Council and recommends that entities review information developed by the council. The CBRWPG suggests that WUGs consider the resources available to them through the Texas Drought Preparedness Council such as the Drought Annex, which describes the activities that help minimize potential impacts of drought and outlines an effective mechanism for proactive monitoring and assessment. The CBRWPG acknowledges the Texas Drought Preparedness Council letter, dated February 8, 2024, that included recommendations to (a) consider planning for drought conditions worse than the DOR, including scenarios that reflect greater rainfall deficits and/or higher surface temperatures, (b) incorporate project future reservoir evaporation rates in their assessments of future surface water availability, and (c) to identify in plans the utilities within planning boundaries that reported having less than 180 days of available water supply during the current or preceding planning cycle.

The CBRWPG has adopted the use of safe yield in determining projected water needs, which includes a provision of leaving an amount of water in storage during the worst month of DOR as a precaution for future droughts worse than the DOR. Related to incorporating future evaporation rates for higher surface temperatures, the TWDB has not allocated budget (nor provided guidance) to regional water plans on approach for evaluating potential future evaporation rates attributed to higher surface temperatures. The City of Aransas Pass (TX2050015) shows up in the TWDB database as having less than 180 days of water available based on reporting to TCEQ between January 2016 and November 2023. The CBRWPG reached out to Aransas Pass representatives on April 2, 2024, and November 1, 2024, and were informed that the reporting was in error and measures would be taken by staff to correct with TCEQ.

The State Drought Preparedness Plan presents resources that are available for mitigation and preparedness, response, and recovery. It continues by identifying climatological, agriculture, and water availability indices for each of ten climatic regions in Texas to consider when assessing drought severity. The Coastal Bend Region counties are located in two climatic regions (Region 7 and 8) and, as discussed in the report, "climatic regions are so large, that drought indices developed across regions of this magnitude routinely mask smaller, regional drought problems and emerging drought conditions". For this reason, the CBRWPG considered the State Drought Preparedness Plan and information from the DPC but selected information provided by local, approved DCPs for development of drought response recommendations.

7.9.3 Water Supply Diversification

Many WUGs are diversifying their water supply sources. City of Beeville is diversifying by drilling groundwater supply wells and City of Alice is developing a new brackish groundwater desalination facility. The STWA is considering brackish groundwater supplies in Nueces and Kleberg counties. Nueces County Water Control and Improvement District #3 (WCID 3) is considering local groundwater supplies to augment existing surface water supplies from the Nueces River.

7.9.4 Agreed Order

The 2001 Agreed Order is an agreement that specifies reservoir operation parameters and environmental flows that must be allowed to pass through the CCR/LCC System to provide freshwater in the Nueces Estuary, thus sustaining the natural habitats that exist there. The City of Corpus Christi City Council had a presentation on August 30, 2016, which described the 2001 Agreed Order provisions and is included in the appendix. The amount of pass-thru required is dependent on the month of the year and the combined storage of the reservoir system based on stages of 70 percent, 40 percent, and 30 percent capacity. The total annual pass-thru targets are based on system storage as follows:

>70%: 138,000 ac-ft
40% - 70%: 97,000 ac-ft
30% - 40%: 14,400 ac-ft
< 30%: 0 ac-ft

The Agreed order specifies that only inflows to the CCR/LCC System may be required to be passed through; the City of Corpus Christi cannot be forced to pass-thru storage from the system. This means that the required pass-thru could be as low as zero if there are no inflows to the system, regardless of storage. During drought conditions, this is often the case.

The Nueces Estuary Advisory Council is granted to ability to call stakeholders together to reassess the Agreed Order should it be necessary. The stakeholders may include (a) TCEQ, which is the party responsible for permitting the agreed order; (b) the City of Corpus Christi, which is the party with operational responsibility of the CCR/LCC System; (c) the Nueces River Authority, which is a third party that assists with pass-thru compliance; (d) the Nueces Estuary Advisory Council itself, which is responsible for monitoring pass-thru implementation and making recommendations; and (e) the U.S. Bureau of Reclamation, which was the entity that provided funding for the construction of Choke Canyon Reservoir.

7.9.5 Monitoring and Assessment

Coastal Bend Region recommends that all entities monitor the drought situation around the state and locally in order to prepare and facilitate decisions. Several state and local agencies are monitoring and reporting on conditions with up to date information. A few informative sources are listed below.

- Nueces River Authority Pass-Through Data: https://www.nuecesra.org/CP/CITY/passthru/index.php.
- TWDB Drought Information: http://waterdatafortexas.org/drought/.
- TCEQ Drought Information: https://www.tceq.texas.gov/response/drought.

In addition, the CBRWPG supports the efforts of the Texas Drought Preparedness Council and recommends that entities review information developed by the council. The Texas Drought Preparedness Council was established by the legislature in 1999 and is composed of 15 representatives from several state agencies. The council is responsible for assessment and public reporting of drought monitoring and water supply conditions, advising the governor on drought conditions, and ensuring effective coordination among agencies. The Texas Drought Preparedness Council is currently promoting outreach to inform entities of the assistance they can provide and looking for input as to how they can be more useful. The CBRWPG suggests that WUGs consider the resources available to them through the Texas Drought Preparedness Council such as the Drought Annex, which describes the activities that help minimize potential impacts of drought and outlines an effective mechanism for proactive monitoring and assessment and was published in 2014. More information on the Texas Drought Preparedness Council can be found here: http://www.txdps.state.tx.us/dem/CouncilsCommittees/droughtCouncil/stateDroughtPrepCouncil.htm.

8

Legislative Recommendations, Unique Stream Segments, and Reservoir Sites

[31 TAC §357.43]

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Chapter 8: Legislative Recommendations, Unique Stream Segments, and Reservoir Sites

Each of the 16 regional water planning groups may make recommendations to the Texas Water Development Board (TWDB) regarding legislative and regional policy recommendations; identification of unique ecological stream segments; and identification of sites uniquely suited for reservoirs. The Coastal Bend Regional Water Planning Group (CBRWPG) formed a subcommittee at an open meeting on October 17, 2024, to consider legislative and regional policy recommendations. The subcommittee met on November 14, 2024, to discuss and prepare recommendations, which the Coastal Bend Region adopted on December 12, 2024. The following are the Coastal Bend Region's recommendations regarding these matters.

8.1 Legislative and Regional Policy Recommendations

Under the authority of Senate Bill 1, the CBRWPG has developed the following legislative and regional policy recommendations.

8.1.1 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, taking into account appropriate provisions for protection of downstream water rights, domestic and livestock uses, and environmental flows.

II. The Coastal Bend Region urges the legislature to support policies and programs to meet Texas' water supply needs and prepare for and respond to drought conditions.

III. The Texas Legislature should continue to provide funding to the TWDB and other state agencies for water conservation initiatives, including providing technical support and assistance to water user groups regarding public information programs; leak detection, repair, and monitoring; meter testing and replacement; or other best management practices included in their water conservation programs.

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

V. The Texas Legislature is urged to provide continued support to the Texas Water Development Board in administering the Texas Water Fund that creates new water sources for the state.

8.1.2 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.

8.1.3 Desalination

I. The Texas Legislature is urged to direct the Texas Commission on Environmental Quality (TCEQ) to investigate the current regulatory status of the "concentrate", "reject water", or "byproduct discharge" produced during the desalination of brackish ground water, brackish surface water and seawater in industrial and municipal treatment processes and compare these to reject water requirements for the oil and gas industry and arrive at a common set of standards for the disposal of these waste products so that safe, economical methods of disposal will be available to encourage the application of these technologies in Texas. TCEQ is encouraged to consider and promulgate regulations to define standards related to quality and quantity of byproduct discharge and location.

II. The Texas Legislature is urged to direct TCEQ to work with TWDB, Texas Parks and Wildlife Department (TPWD) and encouraged to work with the U.S. Fish and Wildlife Services (USFWS), U.S. Army Corps of Engineers (USACE), and National Marine Fisheries Services (NMFS) to develop information on the potential environmental impacts of concentrate discharges from seawater desalination facilities and to facilitate the permitting of these discharges into tidal waters where site specific information shows that minimal environment damage would occur. Stewardship plans, to preserve economic diversification through environmental protection, should be included among the Legislature's support options. Off-shore zones in the Gulf of Mexico identified in the 2018 "Marine Seawater Desalination Diversion and Discharge Zones Study" by the TPWD and the General Land Office in response to House Bill 2031 and at the request of the 84th State Legislature should be considered for seawater desalination projects.

III. Texas Legislature is urged to amend state laws governing the procurement of professional services by public agencies to allow municipalities, water districts, river authorities, smaller communities, and other public entities, provided that they have the expertise, to utilize alternative delivery methods for public work projects, including desalination facilities. For example, some large-scale desalination facilities are now constructed using Construction-Management-at-Risk (CMAR) or Public Private Partnership methods, allowing for a cost-effective transfer of project risks to the private sector.

IV. The Texas Legislature is urged to support evaluation, construction and implementation of a pilot desalination plant in the Coastal Bend Region to quantify and qualify impacts of operating a brackish or seawater desalination facility. Avoidance of environmentally sensitive bay and estuary ecological systems should be considered during planning and evaluation of brine disposal options, which may include considering deep well injection and brackish groundwater options that produce less brine.

V. An evaluation should be undertaken of the feasibility of a local or regional desalination facility for the treatment of poor quality groundwater to improve the quality of potable water for Coastal Bend Region cities.

VI. Studies of desalination options to further reduce the cost of using seawater and/or brackish groundwater should be continued.

8.1.4 Groundwater Management

I. The Texas Legislature is urged to provide funding for the Groundwater Management Areas (GMAs) to support their efforts towards the evaluation of groundwater availability and desired future conditions.

II. Studies of the potential to develop aquifer storage and recovery (ASR) system(s) in the Gulf Coast Aquifer should be continued to help drought-proof water supplies in the Region.

III. The TWDB, TCEQ, 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.

IV. The TWDB is urged to continue funding for updates to the groundwater availability models at least on a five-year basis, specifically the GMA 16 Groundwater Flow Model covering the Coastal Bend Region.

V. The Texas Legislature is urged to require the Texas Railroad Commission to cooperate with TWDB and TCEQ to encourage oil and gas well drillers to furnish e-logs, well logs, and other information and require logging of shallow, groundwater bearing formations to facilitate the better identification of aquifer characteristics.

VI. The Texas Legislature is urged to appropriate funding for TWDB to continue and expand their statewide coastal, environmental flows, surface water, and groundwater data program and to consider additional funds, through regional institutions such as those in the Texas A&M University system, to support research, data collection, monitoring, modeling, and outreach related to coastal, surface water and groundwater management activities in the Coastal Bend Region.

VII. TCEQ is urged to amend rules and regulations to require routine water quality monitoring, by a non-partisan third-party, of mining operations and enforcement of water quality standards, including in situ mining and those with deep well injection practices.

VIII. The Texas Legislature is urged to prohibit in-situ mining in aquifers that serve as drinking water sources for residents and livestock.

XI. The Railroad Commission is urged to continue its identification of improperly plugged and abandoned oil and gas wells that adversely affect local groundwater supplies. Funding should be provided to address known problems and/or force responsible parties to properly plug abandoned wells, including oil, gas, and water wells.

X. The TWDB is urged to consider local mining projects (such as natural gas from the Eagleford shale) when developing mining water demand projections in the future for regional planning. The TWDB is urged to continue to provide guidance on how planning groups should address local mining water projects, especially those associated with gas production from the Eagleford shale or other projects with variable, and often indeterminate production timelines.

XI. Feasibility 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 manage groundwater resources within the Coastal Bend Region.

XII. The Coastal Bend Region recognizes the importance of considering groundwater and surface water interaction when managing water resources and evaluating development of future water supplies. The Region encourages the Texas Legislature to provide funding for groundwater conservation districts and groundwater management areas to consider protection of springs and groundwater-surface water interaction when considering new desired future conditions (DFCs).

8.1.5 Surface Water Management

I. The Texas Legislature is urged to provide funding for the development of periodic updates to surface Water Availability Models, (WAMs), with specific consideration to updating the Nueces River Basin WAM or regional Corpus Christi Water Supply Model to extend through the current drought period. The City of Corpus Christi, who currently directly or indirectly provides water supplies for over 80 percent of the water demands in the 11-county Coastal Bend Region, has invested in a water supply model to simulate their four-river basin surface water supply system that includes 82 years of historical hydrology from 1934-2015. The current drought, beyond 2015, is not represented.

II. The TCEQ is urged to enforce existing rules and regulations with respect to water impoundments.

III. Environmental studies of the segments of the Frio and Nueces Rivers downstream of Choke Canyon Reservoir to the Calallen Pool intakes should be undertaken to fully evaluate the potential impacts of reduced instream flows, including groundwater recharge.

8.1.6 Regional Water Resources Data Collection and Information Management

I. The Texas Legislature is urged to provide Senate Bill 1 planning funds, through the CBRWPG to a regional institution, to support regional water resources data collection and activities to develop and maintain a “Regional Water Resources Information Management System” for the Coastal Bend area.

8.1.7 Role of the RWPGs

I. The regional water planning groups 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 TWDB is encouraged to set up focus work group discussions for regional water planning-related studies and invite participation from regional water planning group representatives to provide local input when developing water demand projections or other data that regional planning groups rely on to develop their plan.

III. The Texas Legislature is urged to continue funding the TWDB to provide support for state mandated regional water planning group activities.

IV. 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 CBRWPG activities.

8.1.8 Water Quality

I. The Texas Legislature is urged to support studies to closely monitor discharges from sand and gravel operations in the Nueces River watershed and particularly Lower Nueces River.

II. Studies should be undertaken to analyze the effects/costs of new U.S. Environmental Protection Agency (EPA) Safe Drinking Water Act requirements regarding the treatment of problematic constituents in water on stakeholders and water users in the Coastal Bend Region.

8.1.9 Additional Recommendations

The following additional recommendations were developed by the CBRWPG:

I. A detailed inventory of irrigation systems, crops, and acreage should be undertaken to more accurately estimate irrigation demands in the region.

II. The Coastal Bend Region requests additional clarification is provided by the Texas Legislature regarding the repercussions of identifying a stream segment as unique.

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

According to Texas Water Code, Section 16.051, the State Water Plan is to include TWDB recommendations to the legislature for designation of river and stream segments of unique ecological value. If the legislature then designates a river or stream segment of unique value, it means that a state agency or political subdivision of the state may not finance construction of a reservoir on the designated river or stream segment.

Planning groups may recommend the designation of river or stream segments of unique ecological value located within their planning area. The following criteria can be used as a basis for designating stream segments of unique ecological value: biological function, hydrologic function, riparian conservation areas, high water quality, exceptional aquatic life, high aesthetic value, and threatened or endangered species/unique communities.[1] The TWDB considers planning group recommendations of unique reservoir sites from adopted regional water plans when developing the State Water Plan.

The CBRWPG formed a subcommittee[2] at an open meeting on October 17, 2024, to consider designation of ecologically unique stream segments for the Coastal Bend Region. The subcommittee met on November 14, 2024, to discuss and prepare recommendations[3] for CBRWPG consideration. The subcommittee considered TPWD's 2002 recommendations of four stream segments in the Coastal Bend Region for designation of ecologically significant value: Aransas River Tidal (Segment 2003), Nueces River Tidal (Segment 2101), Nueces River (below Lake Corpus Christi) (Segment 2102), and Nueces River (above Lake Corpus Christi) (Segment 2103).[4]

The subcommittee's recommendations were considered and adopted by the Coastal Bend Region on December 12, 2024.

On December 12, 2024, the Coastal Bend Region considered and adopted the subcommittee's recommendations that no river or stream segments within the Coastal Bend Region be identified at this time. The unique stream segments of unique ecological value for protection recommended in the 2022 State Water Plan and designated by the Texas Legislature are presented in Figure 8.1. There are no river or stream segments in the Coastal Bend Region area designated by the 2022 State Water Plan or Texas Legislature as having unique ecological value.

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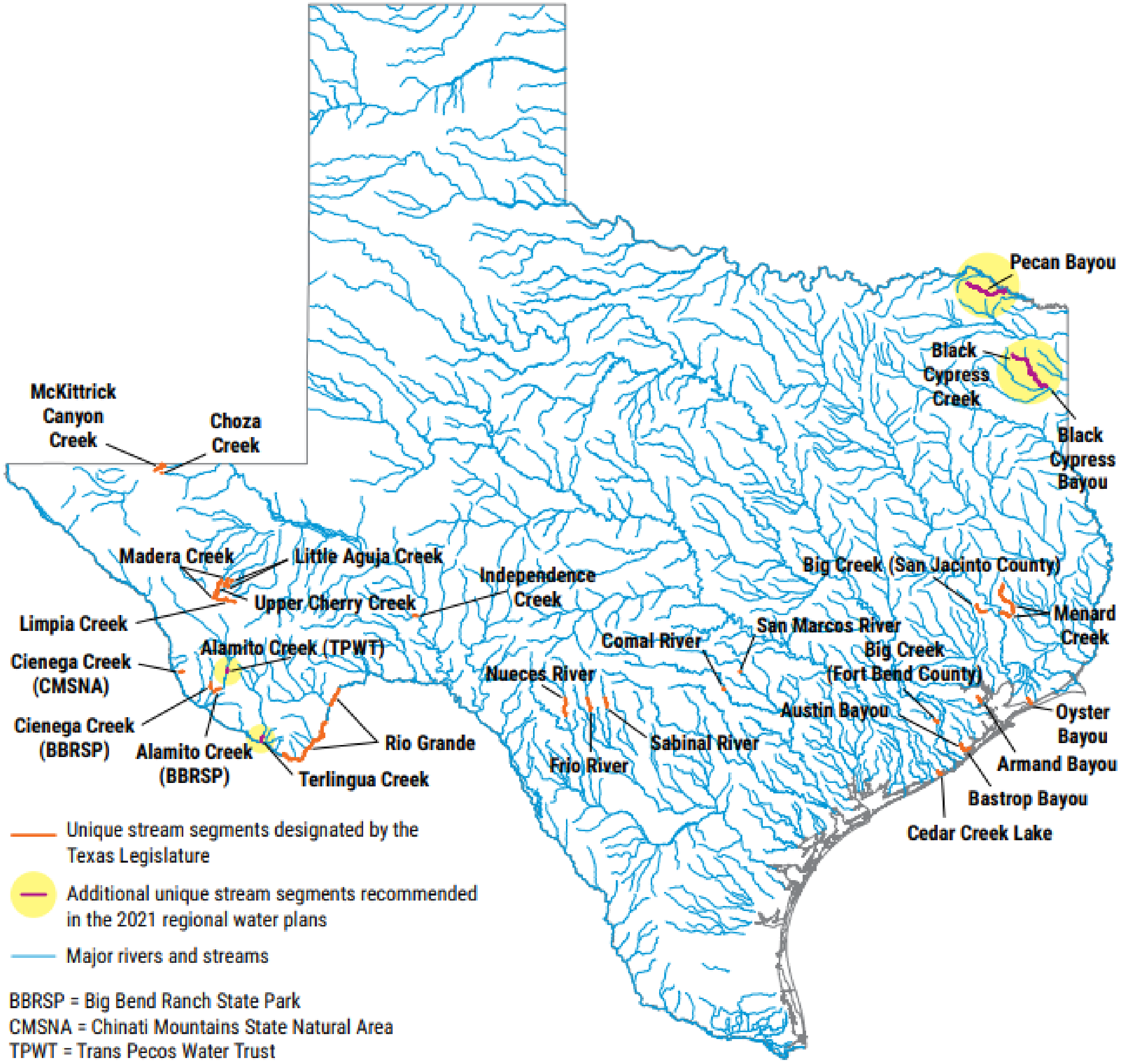
[1] 31 Texas Administrative Code Chapter 358.2

[2] The subcommittee consisted of Carl Crull, Dr. Pancho Hubert, Lonnie Stewart, and Esteban Ramos.

[3] Additional attendees on the call included Michele Foss (TWDB), Brian Williams (SPMWD) and Travis Pruski (Nueces River Authority).

[4] Texas Parks and Wildlife, Ecologically Significant River and Stream Segments of Coastal Bend Water Planning Area (Region N), August 2002.



Source: TWDB, Water for Texas 2022 State Water Plan.

Figure 8.1.
2022 State Water Plan - Designated and Recommended Unique Stream Segments

8.3 Identification of Sites Uniquely Suited for Reservoirs

Planning groups may recommend a site as unique for reservoir construction if: 1) site-specific reservoir development is recommended as a specific water management strategy or an alternative scenario in an adopted regional water plan; or 2) the site is uniquely suited to provide water supply for the current planning period or beyond 50-years. The TWDB considers planning group recommendations of unique sites for reservoir construction from adopted regional water plans when developing the State Water Plan.

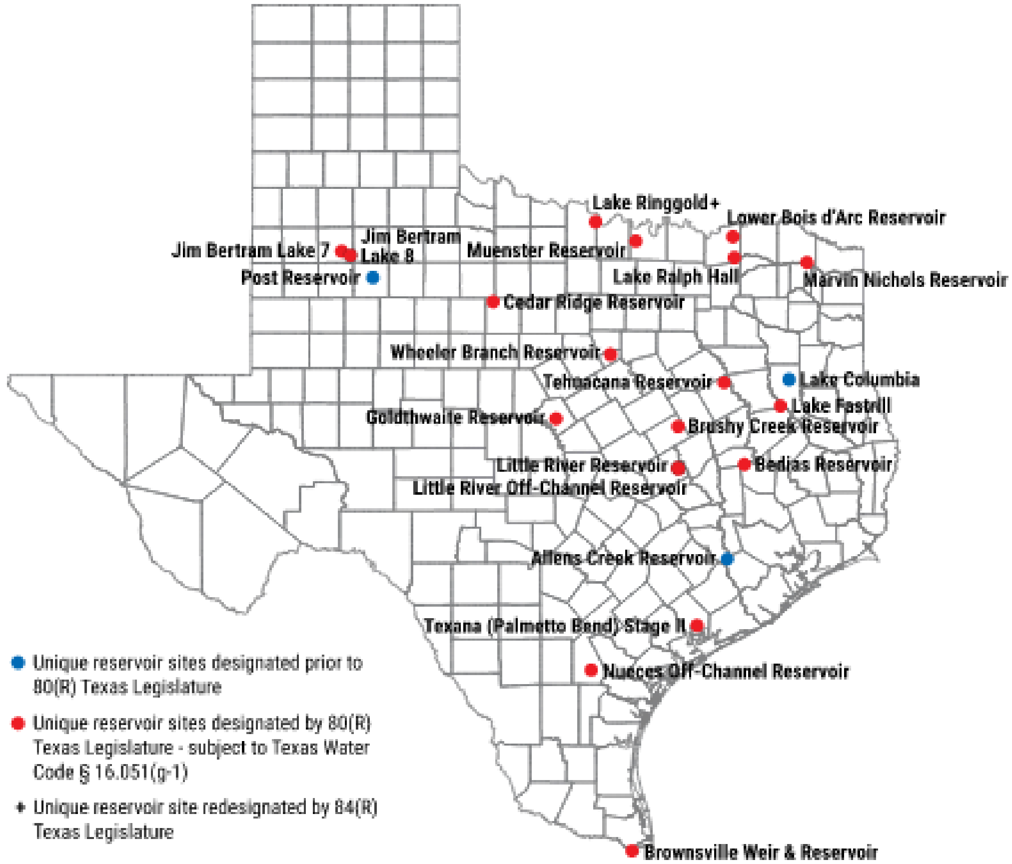
According to Texas Water Code, Section 16.051, the State Water Plan is to include TWDB recommendations to the legislature for unique reservoir sites. If the legislature designates a site of unique value for the construction of a reservoir, a state agency or political subdivision of the state may not obtain a fee title or an easement that would significantly prevent the construction of a reservoir on a designated site.

The CBRWPG formed a subcommittee[5] at an open meeting on October 17, 2024, to consider designation of reservoir sites of unique value for construction. The subcommittee met on November 14, 2024, to discuss previous designations by the Texas Legislature of reservoirs within or related to the Coastal Bend and prepare recommendations[6] for CBRWPG consideration. Furthermore, the City of Corpus Christi provided feedback that they have no active plans to develop new reservoir supplies in the future. On December 12, 2024, the Coastal Bend Region considered and adopted the subcommittee's recommendations that no unique reservoir sites in the Coastal Bend Region be identified at this time.

A map showing the 2022 State Water Plan recommended unique reservoir sites and those previously designated by the Texas Legislature as sites of unique value for reservoir construction is shown in Figure 8.2. Of these, 2 of the 26 sites were shown in the *2011 Coastal Bend Regional Water Plan* as recommended or alternative water management strategies to provide future supplies to the Coastal Bend Region: Nueces off-channel reservoir and Texana (Palmetto Bend) Stage II. Since publication of the *2011 Coastal Bend Regional Water Plan*, both reservoirs have been removed from active study and future water supply for the Coastal Bend Region.

[5] The subcommittee consisted of Carl Crull, Dr. Pancho Hubert, Lonnie Stewart, and Esteban Ramos.

[6] Additional attendees on the call included Michele Foss (TWDB), Brian Williams (SPMWD) and Travis Pruski (Nueces River Authority).



Source: TWDB, Water for Texas 2022 State Water Plan.

Figure 8.2.
2022 State Water Plan - Designated and Recommended Unique Reservoir Sites

The Lavaca Navidad River Authority previously considered an off-channel variation of Stage II Lake Texana (Palmetto Bend) that was included in the *2016 Coastal Bend Regional Water Plan* but removed from active study since then. The Coastal Bend Region supports initiatives by Region P and Lavaca Navidad River Authority for development of their future water supplies. However, the Coastal Bend Region does not recommend specific tracts of land for the Lavaca Off-Channel Reservoir Project and encourages those wishing to pursue such options to discuss with property owners and mediate, if necessary, prior to federal, state, or local recommendation of specific location(s).

8.4 Interregional Planning Council (IPC) Recommendations

The CBRWPG formed a subcommittee[7] at an open meeting on October 17, 2024, to consider Interregional Planning Council (IPC) recommendations from their March 4, 2024 report[8].

The subcommittee met on November 14, 2024, to discuss IPC recommendations[9]. On December 12, 2024, at a regular public meeting of the CBRWPG the planning group confirmed their support of IPC report findings for inclusion in the *2026 Coastal Bend Regional Water Plan*.

8.4.1 Recommendations to the Legislature:

As relates to all three legislative charges, the Council recommends that the legislature appropriate additional funds to the planning process specifically to:

1. support a required task of the regional water planning groups to identify and facilitate interregional coordination;
2. accommodate tasks associated with long-range, visionary planning;
3. fund better methods of disseminating information for the regional water planning process; and
4. accommodate labor costs for administering regional water planning groups rather than permitting a reallocation of existing planning resources, as that would reduce the funding required to meet other required planning tasks.

As relates to Legislative Charge 2, the Council recommends that the legislature:

1. provide financial incentives for local sponsorship of innovative, visionary, multi-benefit projects;
2. provide initial sponsorship of projects by the State without guarantees from local sponsors; and
3. establish a process for coordination amongst state agencies, at the state level, related to installation of infrastructure during planning and construction of large-scale projects.

As relates to Legislative Charge 3, the Council recommends that the legislature:

1. amend the language in Texas Water Code Section 16.053(i) to strike simplified planning from the statute; and
2. authorize the use of one-way conferencing or webinars.

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[7] The subcommittee consisted of Carl Crull, Dr. Pancho Hubert, Lonnie Stewart, and Esteban Ramos.

[8] Source: https://www.twdb.texas.gov/waterplanning/rwp/ipc/docs/2024_02_08_mtg/IPC_FinalReport_030424.pdf

[9] Additional attendees on the call included Michele Foss (TWDB), Brian Williams (SPMWD) and Travis Pruski (Nueces River Authority).

8.4.2 Recommendations to the Texas Water Development Board

As relates to Legislative Charge 3, the Council recommends that the TWDB develop protocols to incorporate annual discussions to evaluate and document best practices for regional water planning in Chairs' conference calls.

8.4.3 Recommendations to Future Interregional Planning Councils

The Council recommends that future Interregional Planning Councils:

1. monitor the effectiveness of enhanced efforts to promote interregional coordination and review how best to utilize interregional liaisons in the development or use of shared water resources;
2. utilize state agencies' expertise to assist regions in developing a vision of planning resources for the state as a whole;
3. consider holding work sessions as needed to "deep dive" into more complicated topics;
4. review materials and meeting notes from the TWDB's "lessons learned" technical meetings with regional water planning group consultants; and
5. review progress on all recommendations in the 2027 State Water Plan Council's report and submit its assessment to the TWDB.

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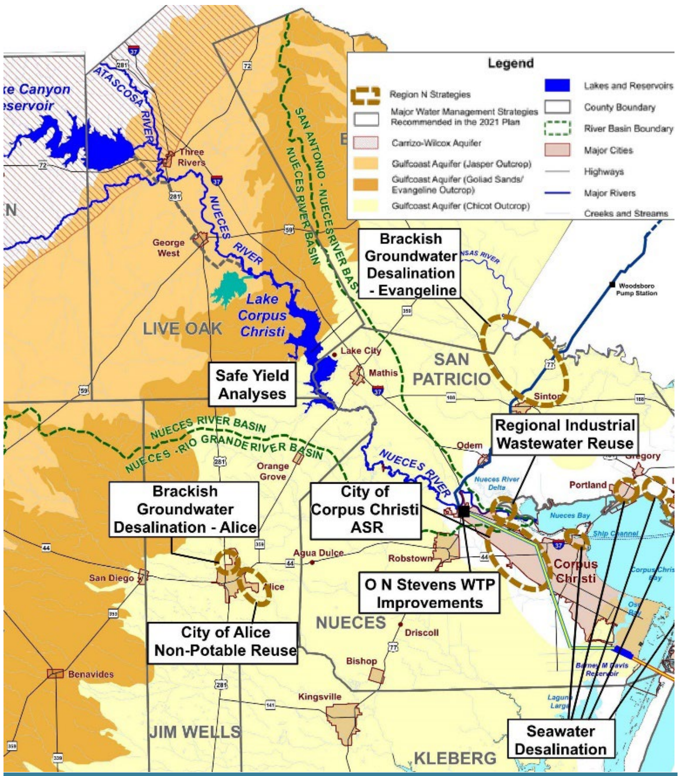

9

Implementation and Comparison to Previous Regional Water Plans

[31 TAC §357.45]

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Chapter 9 Implementation and Comparison to Previous Regional Water Plans

9.1 Implementation of Previous Regional Water Plan

In response to Senate Bill 660 (82nd Legislative Session), the Texas Water Development Board (TWDB) issued guidance for each region to report the level of implementation of previously recommended water management strategies and associated impediments to constructing water projects to meet future water needs in accordance with 31 Texas Administrative Code (TAC) §357.45(a).

The *2021 Coastal Bend Regional Water Plan* included 79 recommended water management strategies, of which 43 (or 54 percent of the total strategies) were related to voluntary water conservation. Emails and follow-up phone calls were placed to water user groups (WUGs) and wholesale water providers (WWPs) to gather information on the implementation status of recommended water management strategies presented in the 2021 regional water plan and preliminary results were discussed at the Coastal Bend Regional Water Planning Group (CBRWPG) meeting on January 16, 2020. Information requested was based on the TWDB survey spreadsheet needs, including the project description, infrastructure type, actions towards supply development, impediments affecting implementation, project phasing, and impacts (if any) on flood control. The WUGs and WWPs were asked to provide updates on the level of implementation currently achieved, the initial volume of water provided, funds expended to date, project cost, funding source and year the project went online. If the project was a phased project, the WUGs were asked about the ultimate volume, project cost, and year that the project will reach maximum capacity. If the project was not implemented, the WUGs were asked to comment on why that was the case. The survey also had a spreadsheet input field regarding inclusion in the 2026 plan for both phased and non-implemented projects.

Comments were received from four WUG/WWPs representatives by February 1, 2020, representing 16 of the 79 water management strategies that were recommended in the 2021 regional water plan. Water conservation plans were reviewed to provide updates for an additional 21 municipal water conservation strategies, thus totaling a status update for 37 of the 79 recommended strategies. Results of the survey are summarized in Table 9.1. There are eight recommended water management strategies, other than water conservation, from the *2021 Coastal Bend Regional Water Plan* that have been implemented: Chase Well Field (Beeville), City of Alice Brackish Groundwater Desalination, San Patricio Municipal Water District (SPMWD) industrial water treatment plant (WTP) improvements, additional Carrizo Well for McMullen County- Mining, Minor Aquifer Development for McMullen County- Mining, and Gulf Coast Aquifer Development for San Patricio County - Irrigation. The following water management strategies have not been implemented due to changed conditions: Gulf Coast Aquifer Development for McMullen County-Mining and Irrigation, South Texas Water Authority (STWA) Interconnections for the City of Alice, and Portland Reuse Pipeline. Others are in various stages of project advancement ranging from the sponsor has taken official action to initiate the project to an ongoing feasibility study to projects being under construction.

The CBRWPG completed the TWDB-provided survey spreadsheet to gather and record this information, along with other project-related details, and the information gathered as of February 1, 2020, which is included in Appendix E.

Table 9.1.
Summary of Project Implementation from 2021 Plan

Responding Entity	WUG/WWP	Projects Implemented	Projects Under Construction	Projects in Design Phase	Feasibility Study Ongoing
Alice	City of Alice	1	0	0	3
San Patricio Municipal Water District	Manufacturing - San Patricio County	2	0	0	0
Local GCD representative	Mining, McMullen	2	0	0	1
Local GCD representative	Irrigation, McMullen	1	0	0	0
Local GCD representative	Irrigation, San Patricio	2	0	0	0

9.2 Comparison to Previous Regional Water Plan

The TWDB guidance and TAC Chapter 357.45(b) require that the *2026 Coastal Bend Regional Water Plan* briefly summarizes differences from the previously adopted 2021 regional water plan.

9.2.1 Water Demand Projections

The total water demand projected in 2030 for the region in the 2026 regional water plan is 16,268 acre-feet (ac-ft) less (a reduction of 6 percent) than in the 2021 regional water plan. In subsequent decades, the 2026 regional water plan continues to show lower water demands, with 2070 water demands being 21,415 ac-ft less (a reduction of 8 percent) as compared to the 2021 regional water plan. Much of this is attributed to a change in the TWDB methodology for projecting non-municipal water demands for the 2026 regional water plan by keeping industrial water demands constant after 2030. **The projected water demand reduction from the 2021 regional water plan projections is not consistent with local water supply plans that indicate industrial growth. For this reason, additional water management strategies are recommended for a total amount that exceeds needs calculated based on TWDB projections.** Figure 9-1 compares water demand projections from the 2026 regional water plan to previous 2021 regional water plan/*2022 State Water Plan* projections. For the 2026 regional water plan, municipal projections generally decreased 1 to 2 percent for each decade from 2030 through 2080. Irrigation projections remain constant for the 2026 regional water plan but are 54 percent lower as compared to the 2021 regional water plan estimates. Manufacturing and steam-electric projections for the 2026 regional water plan are all lower than those from the 2021 regional water plan/*2022 State Water Plan*, while livestock projections for the 2026 regional water plan are all higher than those from the 2021 regional water plan/*2022 State Water Plan*. The largest reduction is in the irrigation projections which is 16,345 acre-feet per year (ac-ft/yr) lower for the 2026 regional water plan, as compared to the previous planning cycle.

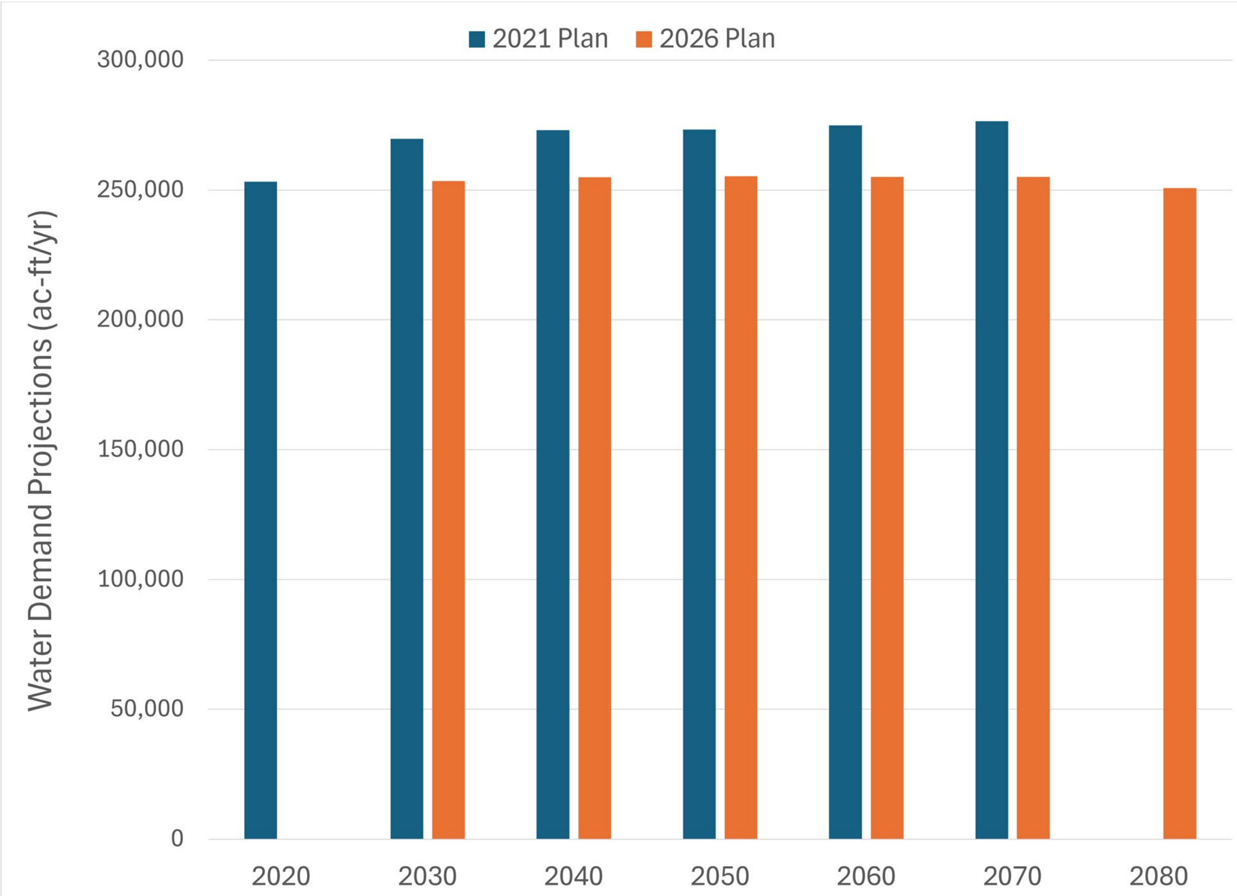

Figure 9-1.
Comparison of Region N Water Demand Projections from 2026 Plan and Previous 2021 Plan, Combined Demands for all Use Types

In the 2021 regional water plan, the total water demands for all entities in the region were projected to increase from 269,766 ac-ft/yr in 2030 to 276,492 ac-ft/yr in 2070. The total water demand projections for the 2026 regional water plan increase from 253,498 ac-ft/yr in 2030 to 255,077 ac-ft/yr in 2070. For the 2026 regional water plan, municipal water demands represent between 42 to 43 percent of the overall water demand in the region through 2080 as compared to 45 to 48 percent of the overall water demand in the 2021 regional water plan. Of the remaining projected water demand which is attributed to non-municipal users (manufacturing, steam-electric, irrigation, mining, livestock), 79 percent is projected to occur within the manufacturing sector in 2030 increasing to 83 percent by 2080. Most of this is attributable to manufacturing in Nueces and San Patricio counties.

Manufacturing demands account for 47 percent of total water demands in 2080. Most of these demands, 96 percent, are in Nueces and San Patricio counties. Jim Wells, Kleberg, Live Oak, and McMullen counties make up the remaining 4 percent. The regional mining demand, 1,026 ac-ft, accounts for only 0.4 percent of total demand in 2080. Irrigation demand remains constant at 13,861 ac-ft over the 50-year planning period and in 2080 represents 5.5 percent of total demand.

9.2.2 Drought of Record and Hydrologic and Modeling Assumptions

Prior to the 2021 regional water plan, the 1992-2002 drought was used to define water availability. With the Corpus Christi Water Supply Model (CCWSM) updated during development of the 2021 regional water plan to include hydrology through 2015, a new drought of record was identified. In terms of severity and duration, the drought from 2007-2013 is considered to be the drought of record (DOR) for the Coastal Bend Region planning area.

For the 2021 regional water plan, the CCWSM was updated to include recent hydrology for the Nueces Basin through 2015 for a total model period of 82 years (1934 to 2015). Additional model updates included extending recent hydrology for Lake Texana and the Colorado River (for Mary Rhodes Pipeline [MRP]Phase II supplies) through 2015 and incorporating new TWDB volumetric survey data for Lake Corpus Christi (2016), Choke Canyon Reservoir (2012), and Lake Texana (2010) and associated updated sedimentation rates.

The updated CCWSM included an 82-year hydrology period through 2015, inclusion of recent MRP Phase II supply, updates for the City of Corpus Christi's reservoir system operations, and Lavaca-Navidad River Authority call-back exercised for a portion of Lake Texana contracted supplies. The model was used to evaluate recent drought conditions to identify a new historic drought of record within the planning area. Average annual inflows to Choke Canyon Reservoir/Lake Corpus Christi and System (CCR/LCC System) continues to trend lower with each successive drought, with the most recent hydrology update[1] for the CCWSM (through 2015) showing a new drought of record for the Corpus Christi Regional Water Supply System (CCR/LCC/Texana/MRP Phase II System) from 2007 to 2013. The critical month of the drought of record, the basis of the Corpus Christi Regional Water System current system yield, occurred in September 2013.

No additional CCWSM updates were incorporated for the 2026 regional water plan.

At the May 18, 2023, CBRWPG meeting, the planning group considered guidance from the TWDB to consider firm yield when determining surface water availability as well the Coastal Bend Region approach that had been taken in previous planning cycles to determine availability based on safe yield. The CCWSM was used to estimate firm yield of the system for 2030 and 2080 sediment conditions, which is the maximum amount of water volume that can be provided under a repeat of DOR conditions assuming that all senior water rights will be totally used and all permit conditions met. In this case, this is the yield that would be available such that reservoir active storage would be equal to zero during the worst month of the DOR. The critical month of the DOR based on the CCWSM extent of hydrology from 1934-2015 is September 2013.

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[1] Corpus Christi Water Supply Yield Results from Hydrology Update, June 1, 2017.

On May 18, 2023, the CBRWPG approved submittal of a hydrologic variance request to use safe yield with 75,000 ac-ft reserve in the CCR/LCC System for determining surface water supplies available from the City of Corpus Christi's Regional Water Supply System, which was subsequently granted by the TWDB on January 8, 2024. This safe yield supply from the City of Corpus Christi's Regional Water Supply System is the basis of the needs analysis of this plan for entities relying on surface water supplies from the City of Corpus Christi, SPMWD, and STWA.

A comparison of water modeling assumptions for the 2026 regional water plan to previous plans is included in Table 9.2.

Table 9.2.
Comparison of Water Modeling Assumptions Used to Develop the 2026 Plan and Previous Coastal Bend Regional Water Plans

2026 Plan	2021 Plan	2016 Plan
Groundwater Availability based on **Modeled Available Groundwater**	Groundwater Availability based on **Modeled Available Groundwater**	Groundwater Availability based on **Modeled Available Groundwater**
Corpus Christi Water Supply Model updated to include hydrology from 1934-2015. Current Supply from CCR/LCC/Lake Texana/**MRP Phase II** System based on Corpus Christi Water Supply Model safe yield analysis (**75,000 ac-ft storage reserve**) for the City of Corpus Christi and its customers only	Corpus Christi Water Supply Model updated to include hydrology from 1934-2015. Current Supply from CCR/LCC/Lake Texana/**MRP Phase II** System based on Corpus Christi Water Supply Model safe yield analysis (**75,000 ac-ft storage reserve**) for the City of Corpus Christi and its customers only	MRP Phase II added. Existing Supply from CCR/LCC/Lake Texana/**MRP Phase II** System based on Corpus Christi Water Supply Model safe yield analysis (**12 month storage reserve**) for the City of Corpus Christi and its customers only
Run of the river water rights in the Nueces Basin, firm yield supplies based on minimum annual supply that could be diverted **limited by minimum month conditions**. No return flows from Region L.	Run of the river water rights in the Nueces Basin, firm yield supplies based on minimum annual supply that could be diverted **limited by minimum month conditions**. No return flows from Region L.	Run of the river water rights in the Nueces Basin, firm yield supplies based on minimum annual supply that could be diverted **limited by minimum month conditions**. Return flows from Region L.
New Surface water management strategies conform to TCEQ Environmental Flow Standards	New Surface water management strategies conform to TCEQ Environmental Flow Standards	New Surface water management strategies conform to TCEQ Environmental Flow Standards

9.2.3 Water Availability, Existing Supplies, and Identified Water Needs

Nearly 75 percent of the water used in the region comes from surface water supplies originating from the CCR/LCC/Texana/MRP Phase II system. In the 2016 regional water plan, the Corpus Christi Regional Water Supply System showed an annual safe yield of 219,000 ac-ft in 2020 declining to 214,000 ac-ft in 2070. For the 2021 regional water plan, the Corpus Christi Regional Water Supply System showed an annual safe yield of 178,000 ac-ft in 2020 declining to 167,000 ac-ft in 2070 due to sedimentation. For the 2026 regional water plan, the Corpus Christi Regional Water Supply System has an annual safe yield of 170,000 ac-ft in 2030 declining to 157,000 ac-ft in 2080 due to sedimentation.

The surface water availability decreased in the 2026 regional water plan as compared to 2021 regional water plan attributed primarily to sedimentation rates for Choke Canyon Reservoir and Lake Corpus Christi, and Lavaca-Navidad River Authority call-backs for a portion of Lake

Texana supplies for Jackson County uses per contract. With the updated model in the 2021 regional water plan to extend through 2015, safe yield reserve was changed from 125,000 ac-ft reserve (roughly equal to 1 year supply) in the 2016 regional water plan to a 75,000 ac-ft reserve for the 2021 regional water plan. The 2026 regional water plan uses a 75,000 ac-ft reserve consistent with the previous 2021 regional water plan.

Surface water availability for all other surface water rights, including run of the river rights, is based on Water Availability Mode (WAM) Run 3. Pursuant to TWDB guidance "Run of river availability, or firm diversion, evaluated for a municipal sole-source water use, is defined as the minimum monthly diversion amount that is available 100% of the time during a repeat of the drought of record (i.e., this minimum volume must be available each and every month)." For surface water withdrawals that do not require permits, such as for livestock purposes, Coastal Bend Region estimated local annual water availability volumes under drought of record conditions based on current water use data provided by the TWDB. For Nueces County Water Control and Improvement District #3 (WCID 3), who has a senior run-of-the-river water right on the Nueces River downstream of Lake Corpus Christi, a firm yield of 1,955 ac-ft/yr was shown in the 2016 regional water plan. For the 2026 regional water plan, the Nueces County WCID 3 firm yield is 384 ac-ft/yr from 2030 to 2080 consistent with the 2021 regional water plan.

The modeling assumptions used to develop groundwater availability for the 2026 regional water plan are the same as those used for the 2021 regional water plan. Groundwater availability was limited to Modeled Available Groundwater estimates (MAGs) developed based on desired future conditions (DFCs) provided by GMA/groundwater control districts (GCDs) within the Coastal Bend Region, but the 2021 regional water plan MAGs have been updated with new information since development of the 2016 regional water plan. The 2016 regional water plan groundwater availability based on MAGs is approximately 227,000 ac-ft and was constant from 2020 to 2070. The 2021 regional water plan groundwater availability based on MAGs increases from 145,269 ac-ft in 2020 to 187,096 ac-ft in 2070. The 2026 regional water plan groundwater availability based on MAGs increases from 148,731 ac-ft in 2030 to 168,261 ac-ft in 2080. Overall, most counties showed similar MAGs as compared to the 2026 regional water plan, with Kleberg and Kenedy counties showing over 5,000 ac-ft and over 10,000 ac-ft, respectively, more than in the previous 2021 regional water plan.

Surface water supplies were determined for most surface water users based on safe yield of the Corpus Christi Regional Water Supply System using an updated model that includes a recent, new drought of record. For Nueces County WCID 3 and River Acres Water Supply Corporation (WSC), the firm yield of run-of-the-river rights was used for current supply. There are no known infrastructure constraints that would preclude these supplies from being delivered at the safe or firm yield capacity, respectively. Groundwater supplies in the 2026 regional water plan are based on MAG projections provided by the TWDB, constrained by well capacity as reported in the Texas Commission on Environmental Quality (TCEQ) Public Water System (PWS) database. For non-municipal groundwater users with groundwater capacities that are not readily obtained from publicly available sources, the groundwater supply was calculated based on TWDB historical water use records.

Municipal supplies have decreased on average by 11,000 ac-ft/yr for the entire 50-year period from 2030 through 2080. Non-Municipal WUG supplies including irrigation and livestock have decreased on an average of 16,000 ac-ft/yr over the same 50-year planning period while manufacturing, steam-electric, and mining supplies are projected to increase by an average of 6,000 ac-ft/yr for the entire 50-year period. Some of this is due to groundwater supplies being limited to average day well capacity according to MAGs, but most is attributable to revised surface water availability and supplies based on new drought of record conditions and changes in volumetric surveys for LCC and CCR. Since most of the expected industrial growth occurs in San Patricio and Nueces counties, the regional CCR/LCC/Texana/MRP Phase II System can accommodate flexibility in delivery of these supplies subject to physical delivery constraints and contract provisions. Overall, the total difference in existing supplies between planning cycles range from a reduction of 17,201 ac-ft in 2030 to a reduction of 1,809 ac-ft in 2070.

Municipal and non-municipal need projections are similar and trending lower in the 2026 regional water plan due to supply constraints discussed previously. When comparing total available supplies to total demands for the 2026 regional water plan, the region shows a water supply need throughout the 50-year planning cycle. Beginning in 2030 a shortage of 38,900 ac-ft exists within the Coastal Bend Region and increases to 47,320 ac-ft by 2070. The previous 2021 regional water plan showed regional needs amounting to 66,926 ac-ft in 2070.

On a regional basis, municipal and industrial entities (manufacturing, steam-electric, and mining) show increasing needs from 38,900 ac-ft in 2030 to 50,742 ac-ft in 2080, due primarily to decreasing manufacturing surface water availability accompanied by increasing manufacturing demand. Shortages based on current supplies provided by the CCR/LCC/Texana/MRP Phase II System were placed on industrial (mining and/or manufacturing) demands in San Patricio and Nueces counties. Surface water supplies provide 89 percent of total manufacturing supplies in 2080 with groundwater and reuse comprising the remaining 9 and 2 percent, respectively. Region-wide, there is a manufacturing supply deficit of 33,680 ac-ft in 2030 increasing to 45,756 ac-ft by 2080.

9.2.4 Recommended and Alternative Water Management Strategies and Projects

The CBRWPG has studied numerous water management strategies as part of previous regional water planning efforts as summarized in Table 9.3. Many of these strategies are no longer actively being considered by local sponsors and, therefore, were not evaluated as part of the 2026 regional water plan. For comparison, the strategies recommend in the 2021 regional water plan are identified in Figure 9-2.

The 2026 regional water plan considers water management strategies that are intended to serve more than one WUG. Many of these strategies are sponsored by the major WWPs in the region. The strategies considered in the 2021 regional water plan were classified as conservation, reuse, aquifer storage and recovery (ASR), seawater desalination, brackish groundwater desalination, local balancing storage, groundwater supplies, or regional water supply management and treatment facilities. The 2026 regional water plan considered the same categories of strategies in addition to Nueces River Diversion to Choke Canyon Reservoir and

Lake Corpus Christi Sediment Removal. The 2021 regional water plan considered 13 water management strategies that serve more than one WUG, not including municipal, irrigation, or manufacturing conservation. The 2026 regional water plan identifies 21 strategies, not including municipal or manufacturing conservation, that serve more than one WUG. Most notably – there are three new reuse strategies and four new regional water supply management and treatment facilities strategies for the 2026 regional water plan compared to the 2021 regional water plan.

The 2026 regional water plan reflects water management strategies identified through conversations with wholesale water providers, water user groups, and potential new providers to address anticipated industrial growth in the Coastal Bend Region. During the development of this plan, cooperation has been encouraged between WWPs and WUGs for the purpose of achieving economies of scale and pursuing strategies that benefit the entire region.

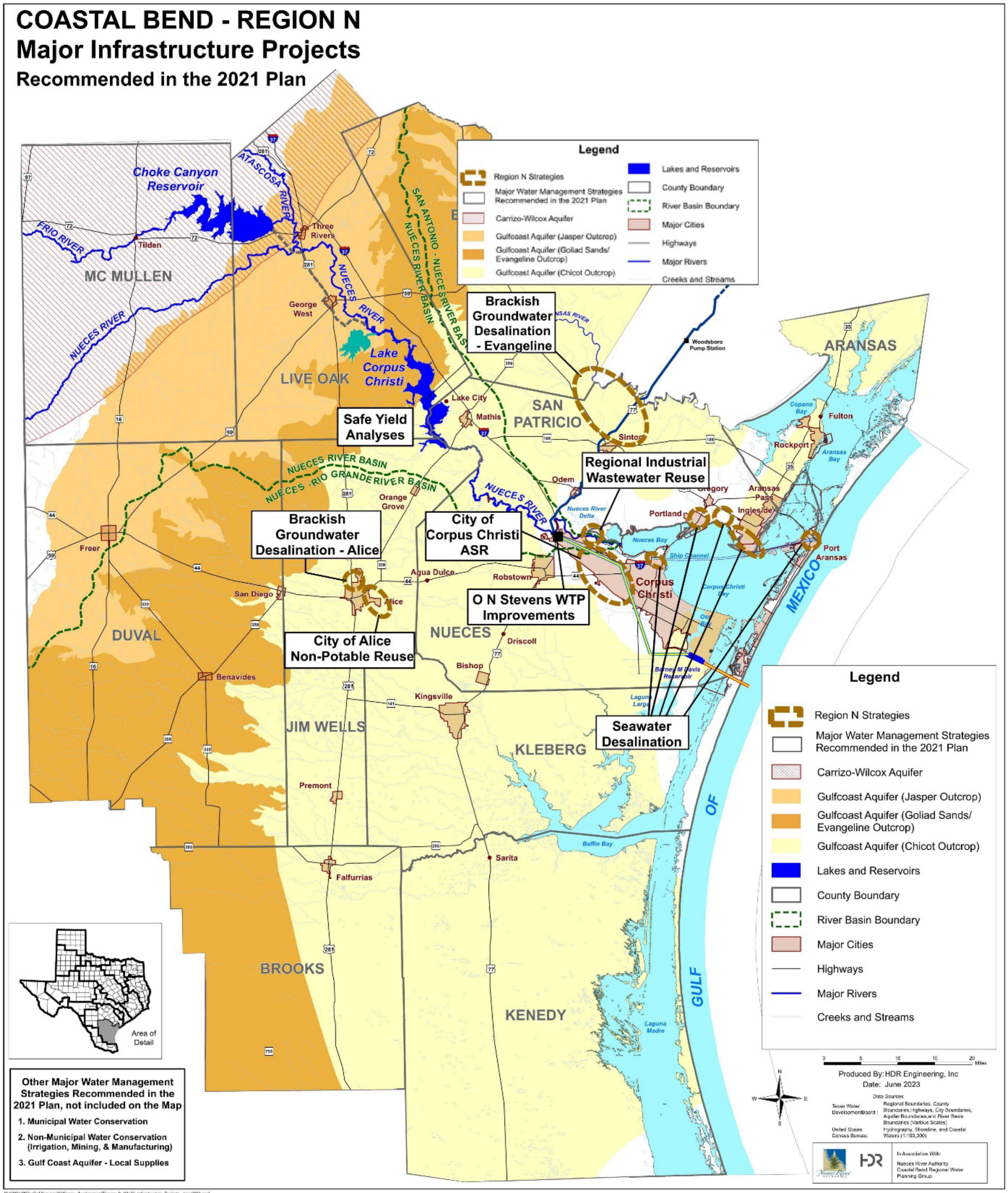


Figure 9-2.
Major Infrastructure Projects Recommended in the 2021 Plan

Table 9.3. Summary of Water Management Strategies from Previous Coastal Bend Regional Water Plans

Water Management Strategies	2001 Plan	2006 Plan	2011 Plan[A]	2016 Plan	2021 Plan	2026 Plan
Recommended Strategies						
Municipal Water Conservation	√	√	√	√	√	√
Irrigation Water Conservation	√	√	√	√	√	√
Manufacturing Water Conservation and Nueces River Water Quality Issues	√	√	√	√	√	√
Mining Water Conservation	-	√	√	√	√	√
ON Stevens WTP Improvements	-	-	√	√	√	√
SPMWD Industrial WTP Improvements	-	-	-	√	-	-
Reclaimed Wastewater Supplies and Reuse[B]		√	√	√	√	√
Gulf Coast Aquifer Supplies	√ [C]	√	√	√	√	√
Modify Existing Reservoir Operating Policy[B]	-	√ [D]	√ [D]	√	-	-
CCR and LCC Pipeline[B]	-	√ [E]	√ [G]	-	-	-
Voluntary Redistribution of Available Supplies	√	√ [F]	√ [F]	√ [H]	-	-
Nueces Off-Channel Reservoir near Lake Corpus Christi	-	√	√	-	-	-
Stage II of Lake Texana[B]	-	√	√ [G]	-	-	-
Lavaca River Diversion and Off-Channel Reservoir	-	-	√	√	-	-
Garwood Pipeline (and other interbasin transfers)	√	√	√	-	-	-
Seawater Desalination	√	√	√ [G]	√	√	√
Brackish Groundwater Desalination	-	-	√ [G]	√	√	√
Potential Water System Interconnections	√	-	-	√	-	-
Interruptible Lake Texana Supplies (2001 Plan)	√	-	-	-	-	-
Recycle and Reuse of Groundwater or Use of Non-Potable Supplies	√	-	-	-	-	-
Aquifer Storage and Recovery (ASR)	√	√	-	-	√	√
Local Balancing Storage Reservoir (Nueces County WCID #3)	-	-	-	√	√	√
Guadalupe-Blanco River Authority Lower Basin Storage Project	-	-	-	√	-	-
Studied and Considered						
Carrizo-Wilcox Aquifer Supplies	√	√	√	-	-	-
Sediment Removal in Lake Corpus Christi	√	-	-	-	-	-
Brush Management	√	√	√	-	-	
Weather Modification	√	√	√	-	-	
Water Quality (TDS Study) - Lake Corpus Christi, Lake Texana, and Calallen Pool	-	-	√	-	-	-
Nueces River Diversion to Choke Canyon Reservoir	-	-	-	-	-	√
Lake Corpus Christi Sediment Removal	-	-	-	-	-	√

[A] The 2011 Plan also included five special studies related to water supply development.
[B] Studied and considered in the 2001 regional water plan but not recommended.
[C] Included short-term overdrafting in the 2001 Plan for generally small groundwater needs.
[D] Safe yield analysis was recommended strategy in 2006 and 2011 regional water plans.
[E] CCR/LCC Pipeline was revised from 2-way pipeline (in 2001 regional water plan) to 1-way pipeline from CCR to LCC.
[F] Includes USCOE Nueces Feasibility Study project opportunities.
[G] Considered an alternative water management strategy in the 2011 regional water plan.
[H] Voluntary Redistribution of Available Supplies included in Gulf Coast Aquifer Supplies (5D.7) for the 2016 regional water plan. Federal or state Opportunities to Participate in Regional Projects was not included in the 2016 regional water plan.

9.3 Summary of Water Management Strategies from the 2021 Regional Water Plan No Longer Relevant or Actively Evaluated in the 2026 Regional Water Plan

At the request of the CBRWPG, this chapter summarizes strategies previously evaluated in the 2021 regional water plan to retain this knowledge and for efficiency should these strategies become applicable during future planning cycles. Section 9.4summarizes strategies evaluated in plans prior to the 2021 regional water plan. Since these strategies are no longer being considered, costs were not updated to current 2026 regional water plan indices.

9.3.1 Reclaimed Wastewater Supplies and Reuse (N-5) (previous 5D.5, Recommended Water Management Strategy)

9.3.1.1 Wastewater Reuse Considerations for Municipal and Industrial Purposes (previous 5D.5.2, Recommend Water Management Strategy)

In general, primary industrial customers use similar facility processes that are mainly responsible for water consumption, such as cooling towers and boilers. However, the primary differences in water usage are product related. Process and product differences affect water quantity and quality needs. For most chemical and refining plants, cooling accounts for 60 to 75 percent of the water use, boiler water use accounts for 20 to 30 percent, process water accounts for 5 to 9 percent, and potable or sanitary use accounts for 1 percent.

The following factors influence and control current water use, the potential for industrial water conservation, and the potential for area industries to use alternative sources of water, including treated municipal wastewater, brackish groundwater, and seawater. The list of important factors includes:

- The location of each water-using industrial plant in relation to a source or sources of water;
- The location of each water-using industrial plant in relation to streams or other features into which wastewater can be discharged;
- The type of industry, which determines the type of water use (i.e., refineries which use varying and/or different grades of crude petroleum, refineries which are producing reformulated gas, chemical plants which produce a range of chemicals and pharmaceuticals, and plants which extract compounds from ores to produce metals and other products); and
- The metallurgy of equipment in the cooling system that would come in contact with the cooling water.

The water quality requirements of industry in the area are determined by the water quality constraints for cooling tower make-up, boiler make-up, process water, and potable water. Because cooling tower make-up can utilize water of poorer quality as compared to the high-quality water required in a boiler, the reuse of wastewater effluent in cooling towers provides the best opportunity for this alternative water supply.

Corpus Christi area industries implemented water conservation and water reuse measures that have significantly reduced quantities of water needed per unit of production.

Major industrial users in the Nueces and San Patricio counties have also implemented various water conservation measures in response to drought and are currently supplementing a portion of their water demands with direct recycled reuse. Following are lists of water conservation measures, which have been implemented by industry as well as future water conservation strategies, including wastewater reuse.

Current Measures

- Recycling Cooling Tower and Boiler Blowdown
- Improved Control Systems
- Dry Cooling, Air Cooled Heat Exchangers
- More Efficient Drift Eliminators
- Changed Washdown Procedures
- Automatic Cooling Tower Blowdown
- Leak Detection/Repair
- Steam Condensate Recovery
- Reuse Wastewater Treatment Effluent for Firewater, Cooling Tower Make-up
- Cycling-Up Cooling Towers
- Stormwater Reuse
- Salt Water for Area Washdown
- Salt Water Lubrication of Circulating Water Feed Pumps
- Reverse Osmosis with Demineralization
- Voluntary Water Conservation Planning
- Regulatory Requirement to Consider Reuse
- Saltwater for Cooling
- Uniform blending of Lake Texana/Nueces River waters to provide consistently better water quality with less variation in dissolved minerals.

Future Measures

- Increased Evaluation of Alternative Water Sources to Replace Treated City Water
- Additional Application of Reverse Osmosis Treatment
- Increased Wastewater Treatment Plant Effluent Reuse
- Possible Side-Stream Softening
- New Process Changes
- Additional Steam Leak Repair
- New Chemical Treatment Technology
- Increased Water Audit by Industry
- Possible Water Conservation Incentives
- Possible Regulatory or Local Government Water Conservation Planning Goals
- Increasing Water Conservation Research and Education
- Additional Industry Pursuing Water Conservation Measures

9.3.1.2 Regional Industrial Wastewater Reuse Plan for Aransas Pass, Gregory, Portland, Ingleside, and Ingleside-by-the-Bay (previous 5D.5.3, Recommended Water Management Strategy)

This strategy investigated the feasibility of a regional wastewater system that could provide a supply of recycled water to industrial users. A proposed San Patricio Regional Wastewater System (SPRWS) would divert wastewater from five customer cities, Aransas Pass, Gregory, Portland, Ingleside, and Ingleside-by-the-Bay, to a new wastewater treatment plant (WWTP). Treated effluent could then be routed to an existing WTP, blended with that plant's effluent, and distributed for industrial reuse. The recycled water project decreases demand on existing freshwater supplies and helps meet water conservation plan requirements for area industries.

The strategy included wastewater transfer pipelines, new or refurbished transfer lift stations, a WWTP, and facilities to treat and deliver recycled water to industrial users, as shown in Figure 9-3. The strategy proposed two WWTP capacity options, 6.47 mgd (7,250 ac-ft/yr) or 4.47 mgd (5,010 ac-ft/yr). The larger capacity reflected the combined projected wastewater flow from all customer cities, while the smaller capacity alternative represented the required regional plant capacity if one of the three larger cities does not participate (Portland, Ingleside, or Aransas Pass). Three potential SPRWS pipeline, or influent flow transfer, scenarios were considered. The recommended flow transfer system included an independent flow transfer from Portland and Gregory and a combined system for Aransas Pass, Ingleside, and Ingleside-on-the-Bay.

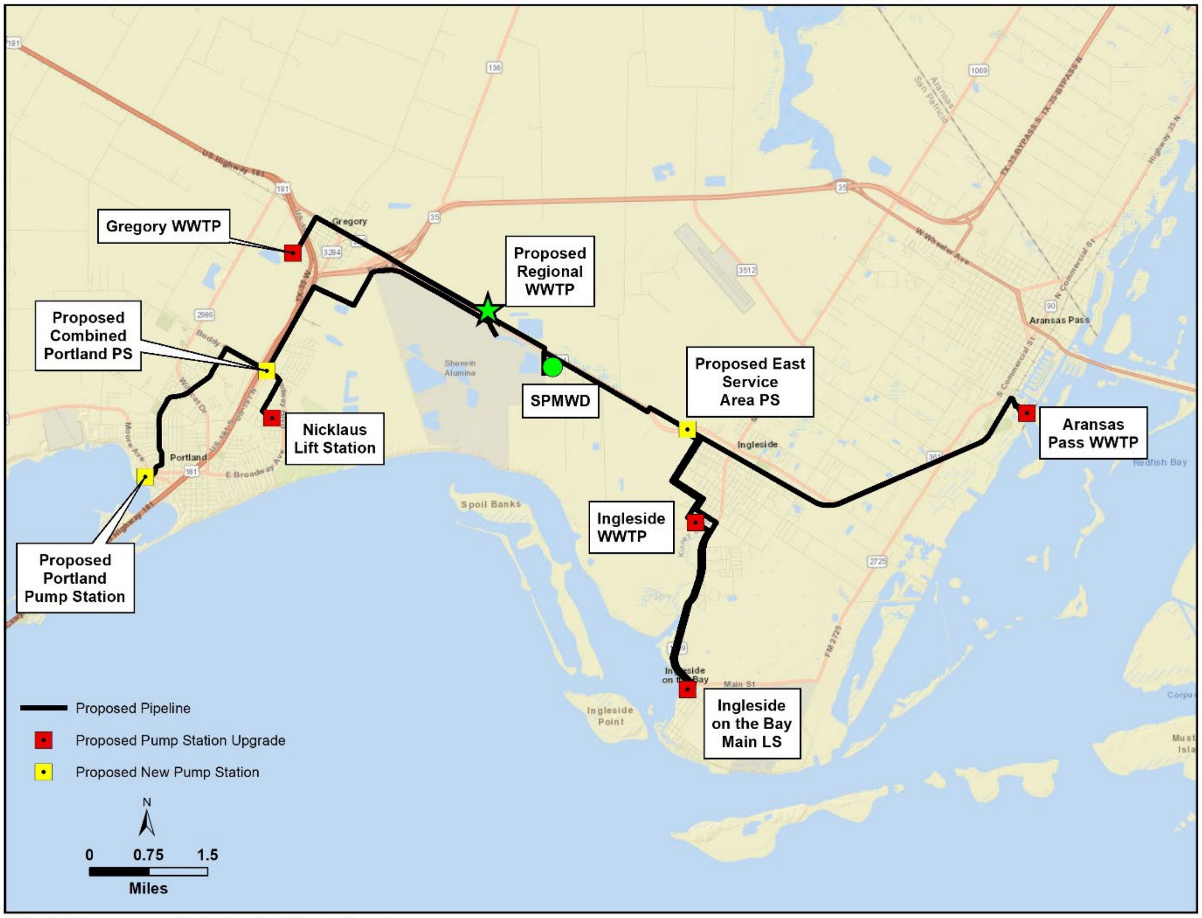


Figure 9-3.
Project Map for Regional Industrial Wastewater Reuse Plan for Aransas Pass, Gregory, Portland, Ingleside, and Ingleside-by-the-Bay

Overall, the project cost is $137,834,000 for the 6.47 mgd plant capacity with an annual cost of $10,046,000, and a unit cost of $1,386 per ac-ft or $4.25 per 1,000 gallons. The project cost for the 4.47 mgd plant capacity is $115,502,000 with an annual cost of $8,475,000 and unit cost of $1,692 per ac-ft or $5.19 per 1,000 gallons. Costs for customer cities, Aransas Pass, Gregory, Portland, Ingleside, and Ingleside-by-the-Bay, vary based on the percentage of capacity reserved for each city.

Studies published between October 2016 and August 2019 identified no major implementation issues.

Table 9.4.
Evaluation Summary for Regional Industrial Wastewater Reuse Plan for Aransas Pass, Gregory, Portland, Ingleside, and Ingleside-by-the-Bay

Impact Category	Comment(s)
a. Water supply:	
1. Quantity	1. Firm Yield: 5,010 to 7,250 ac-ft/yr
2. Reliability	2. Good.
3. Cost of treated water	3. $1,386 to $1,692 per ac-ft
b. Environmental factors:	
1. Instream flows	1. Potential for environmental impacts to streams currently receiving wastewater effluent.
2. Bay and estuary inflows and arms of the Gulf of Mexico	2. Environmental impact to estuary in potential reduction of freshwater inflows.
3. Wildlife habitat	3. None or low impact.
4. Wetlands	4. None or low impact.
5. Threatened & endangered species	5. None or low impact.
6. Cultural resources	6. Cultural resources investigations will be required for all pipeline routes.
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. The City of Corpus Christi Integrated Plan provides ongoing studies of water quality issues of the Nueces Delta and Bay. a. Dissolved solids are a concern to be addressed with further studies. b. Salinity is a concern to be addressed with further studies. c. Bacteria is a concern to be addressed with further studies. d. Chlorides are a concern to be addressed. e-h. None or low impact. i. Alkalinity may be a concern. Zinc in wastewater discharges into Nueces Bay is a concern to be addressed with further studies.
c. Impacts to Ag and State resources	• No negative impacts on other water resources
d. Threats to agriculture and natural resources in region	• Temporary damage due to construction of pipeline(s)
e. Recreational impacts	• None
f. Equitable comparison of strategies	• Standard analyses and methods used for portions
g. Interbasin transfers	• None
h. Third party social/ economic impacts from voluntary redistribution of water	• Not applicable
i. Efficient use of existing water supplies and regional opportunities	• Provides reuse opportunities of water supplies
j. Effect on navigation	• None
k. Impacts on water pipelines and other facilities used for water conveyance	• Additional care should be exercised in construction of pipeline in dense industrial area.

9.3.1.3 City of Alice Non-Potable Projects (previous 5D.5.4, Recommended Water Management Strategy)

This strategy considered potential and beneficial uses for non-potable wastewater effluent from the City of Alice's South WWTP. The City of Alice operates two WWTPs. One is centrally located in the northeast side of town, and the other is located south of the city. On average, the northeast plant treats approximately 0.7 mgd and the south plant treats 1.1 mgd.

Due to the South WWTP's proximity to the airport and commercial/industrial development, the reuse of high quality non-potable water could be a viable alternative to the use of drinking water and provide a source for economic development in that area. The anticipated yield of this strategy is 0.8 mgd (897 ac-ft/yr). Figure 9-4 shows the proximity of the South WWTP to industrial end user and a potential south plant pipeline route.

This strategy proposed a new 1.1-million gallons per day (mgd) WTP, a new pump station and storage tank at the South WWTP, and 13 miles of 12-inch diameter pipeline to deliver the non-potable wastewater effluent to an industrial end user. The total project cost is $10,222,000 with an annual cost of $1,300,000 and unit cost of $1,449 per ac-ft or $1.99 per 1,000 gallons.

The South WWTP currently discharges 100 percent of its 1.1-mgd effluent into the San Fernando Creek. The reuse project would use the treated effluent that would otherwise discharge to San Fernando Creek. Additional studies to evaluate local environmental impacts would need to be undertaken prior to project implementation, as the reduced discharge could impact farming and ranching activities. No major implementation issues were identified for the project considered.

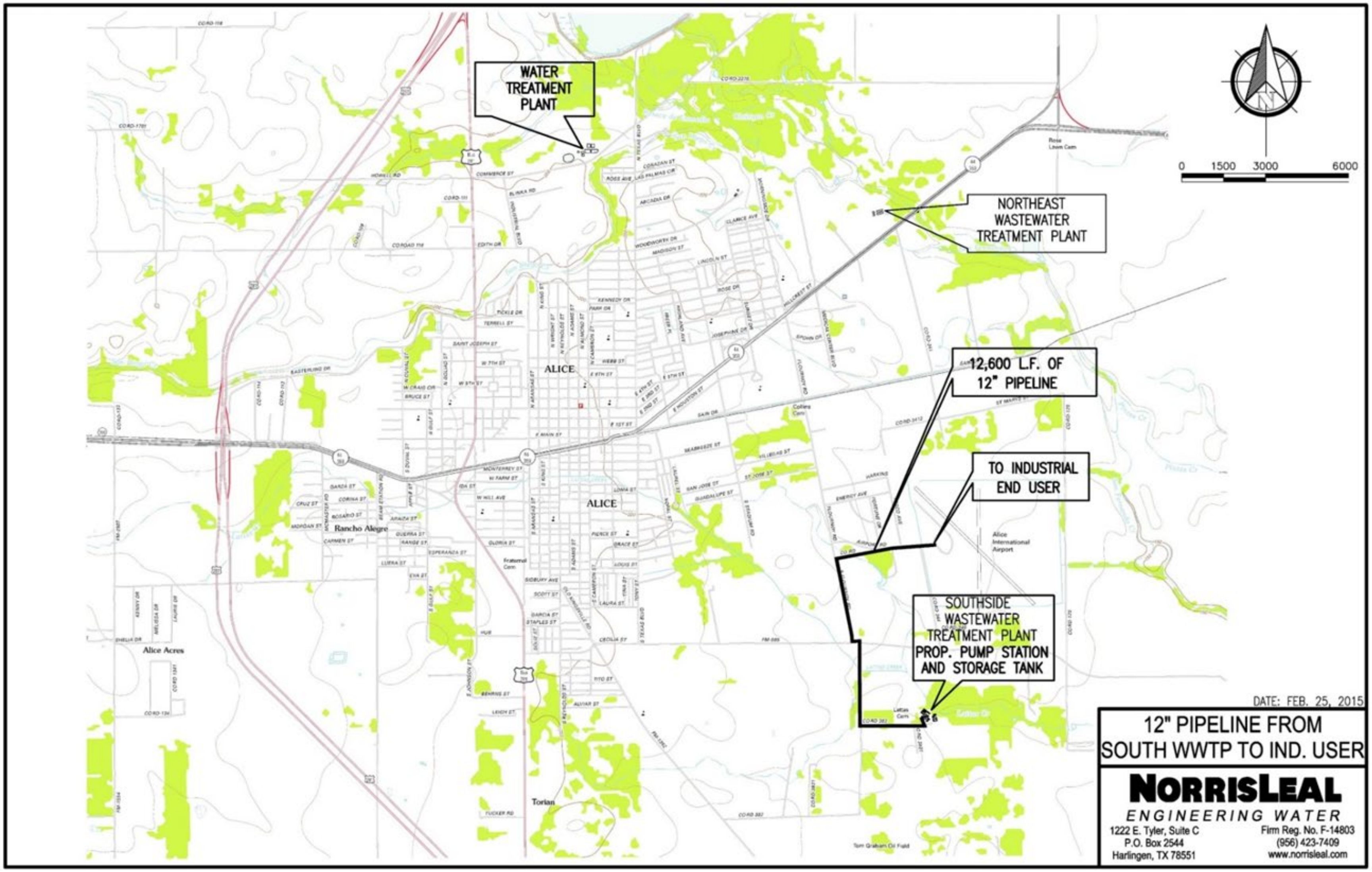


Figure 9-4.
Non-Potable Reuse for Alice

Table 9.5.
Evaluation Summary for City of Alice Non-Potable Reuse

Impact Category	Comment(s)
a. Water supply:	
1. Quantity	1. Firm Yield: 897 ac-ft/yr
2. Reliability	2. Good.
3. Cost of treated water	3. $1,449 per ac-ft
b. Environmental factors:	
1. Instream flows	1. Potential for environmental impacts to streams currently receiving wastewater effluent.
2. Bay and estuary inflows and arms of the Gulf of Mexico	2. None or low impact. It is not anticipated that current return flows reach Cayo del Grullo.
3. Wildlife habitat	3. None or low impact.
4. Wetlands	4. None or low impact.
5. Threatened & endangered species	5. None or low impact.
6. Cultural resources	6. Cultural resources investigations will be required for all pipeline routes.
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. a. Dissolved solids are a concern to be addressed with further studies. b. Salinity is a concern to be addressed with further studies. c. Bacteria is a concern to be addressed with further studies. d. Chlorides are a concern to be addressed. e-h. None or low impact. i. Alkalinity may be a concern.
c. Impacts to Ag and State resources	• No negative impacts on other water resources
d. Threats to agriculture and natural resources in region	• Temporary damage due to construction of pipeline(s)
e. Recreational impacts	• None
f. Equitable comparison of strategies	• Standard analyses and methods used for portions
g. Interbasin transfers	• None
h. Third party social/ economic impacts from voluntary redistribution of water	• Not applicable
i. Efficient use of existing water supplies and regional opportunities	• Provides reuse opportunities of water supplies
j. Effect on navigation	• None
k. Impacts on water pipelines and other facilities used for water conveyance	• Additional care should be exercised in construction of pipeline in dense industrial area.

9.3.2 Gulf Coast Aquifer Supplies (previous 5D.8, Recommended Water Management Strategy)

9.3.2.1 Evangeline/Laguna LP Raw Groundwater Project (previous 5D.8.2, Recommended Water Management Strategy)

This project included groundwater production of up to 25.4 mgd (28,486 ac-ft/yr) from 23,000+ acres located in San Patricio County for conveyance and delivery to the City of Corpus Christi and/or future industries in San Patricio County. Since publication of the 2016 regional water plan, project developers have moved this project toward implementation by securing permits from the San Patricio County Groundwater Conservation District (SPCGCD), drilling and collecting data from a test well, and performing a corrosion analysis, but no blending analysis has been conducted yet. The strategy presented here is for the raw, groundwater supply with minimal treatment options based on the water quality results provided by Evangeline/Laguna LP that shows water quality results within TCEQ drinking water standards.

The project infrastructure was phased based on MAG limitations, with full well field build-out after 2050. The first phase is a well field with 13 wells (production constrained by MAG), but at full project production, the wellfield consists of 18 wells, including contingency. The wells will be around 1,000 feet deep and have an estimated pumping rate of 1,200 gallons per minute (gpm). The current raw groundwater quality is around 800 milligrams per liter (mg/L) total dissolved solids (TDS), and wells would be screened and operated in such a manner to target groundwater with lower levels of TDS and chlorides. Based on test well data, water quality meets drinking water standards and could be delivered to a customer untreated or with minimal chlorine treatment.

Based on data collected and provided by Evangeline/Laguna LP, three strategy configurations were identified and evaluated for planning and costing purposes for 2021 regional water plan water management strategy and are shown in Figure 9-5.

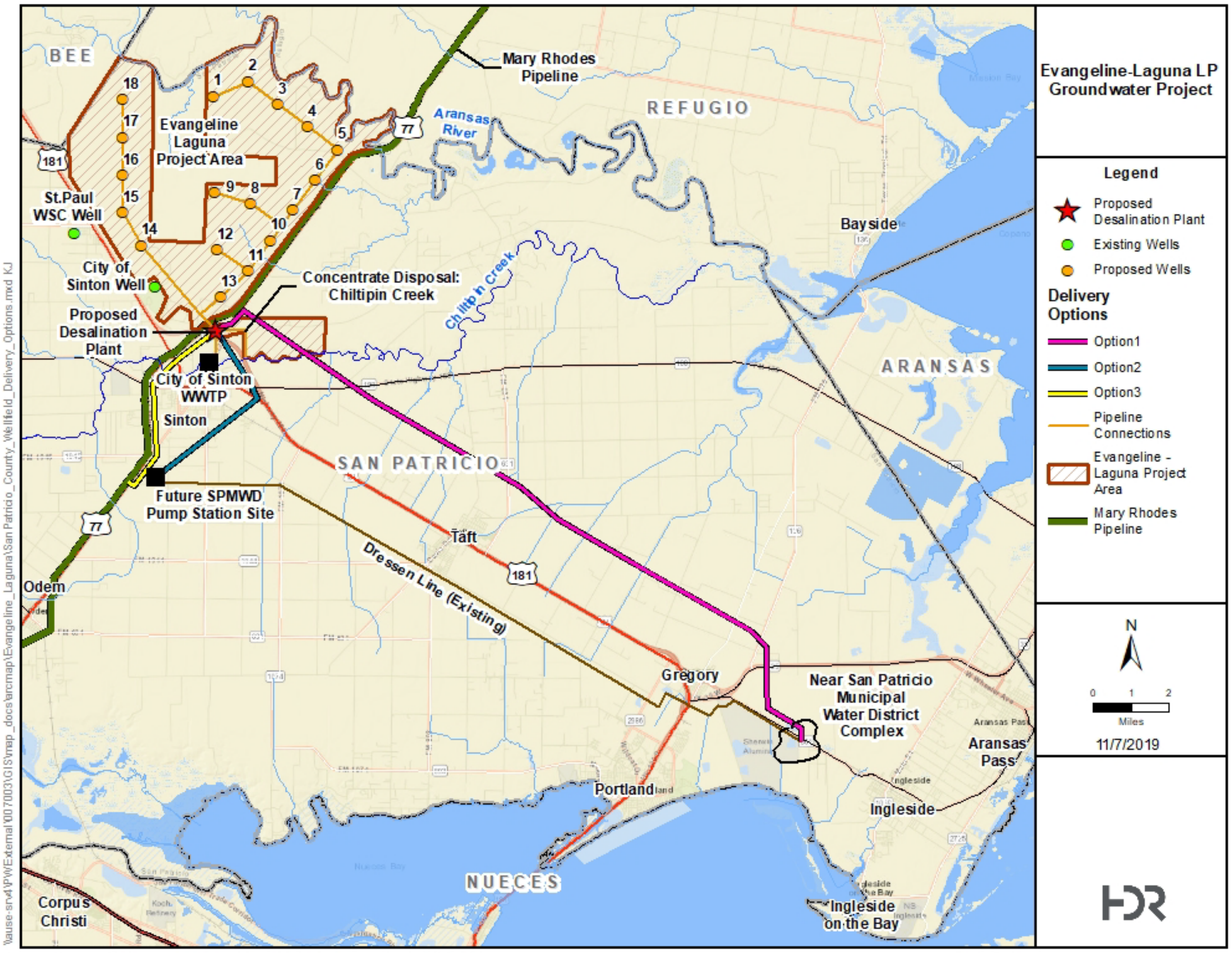


Figure 9-5.
Location of Conceptual Layout of Evangeline/Laguna LP Groundwater Project

Overall, the project cost ranges from $74,596,000 to $115,585,000 depending on delivery option. Annual costs range from $18,492,000 to $22,210,000. At a yield of 24,873 ac-ft/yr, the unit cost of water ranges from $743 to $893 per ac-ft.

Multiple implementation issues were identified for this strategy. Some the issues identified included verification of the Gulf Coast Aquifer water quality, impact of water levels in the aquifer, and USACE Section 10 and 404 dredge and fill permits for pipelines.

Table 9.6. Evaluation Summary of the Evangeline/Laguna LP Raw Groundwater Project Option

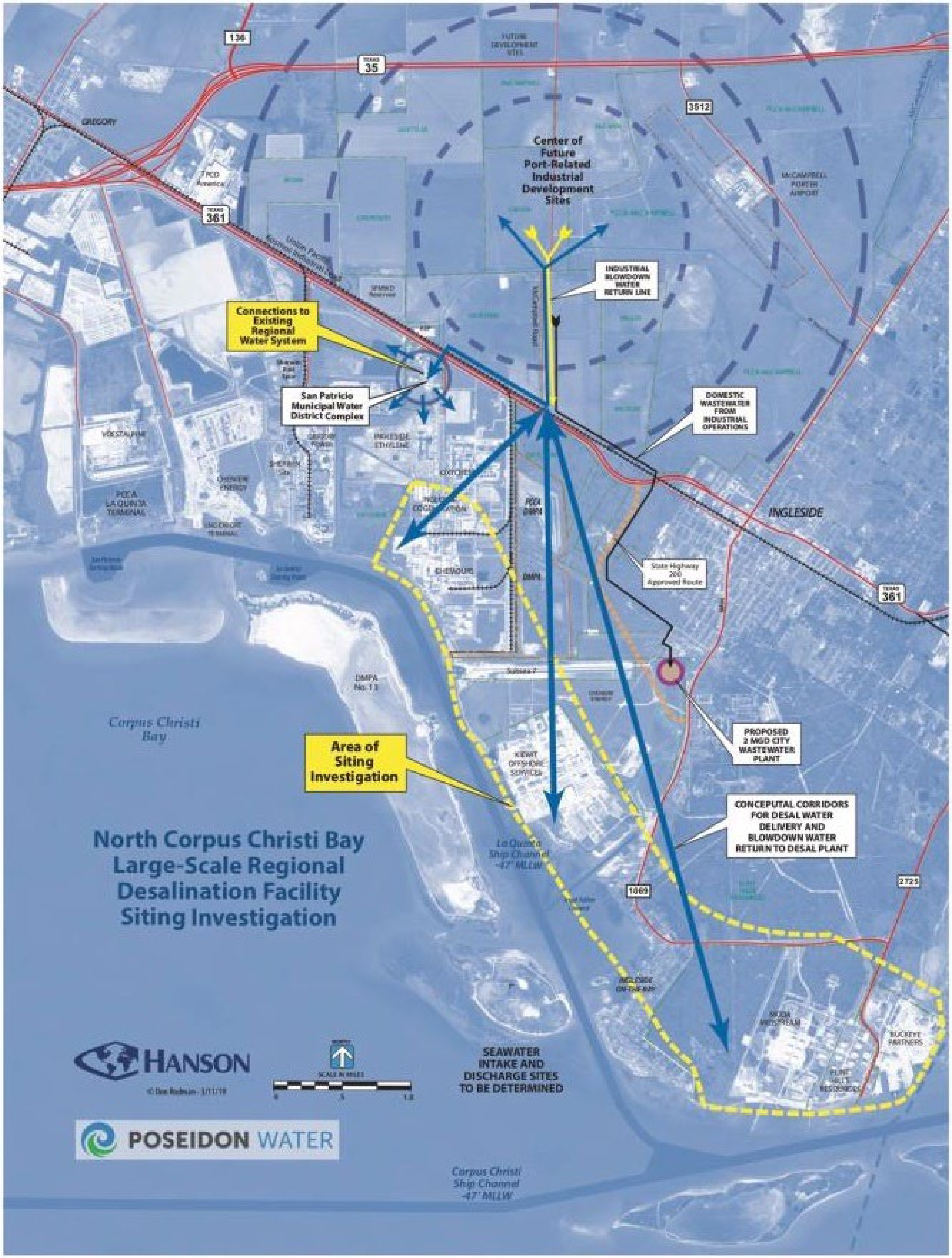
Impact Category	Comment(s)
a. Water supply:	
1. Quantity	1. Yield limited to 24,873 ac-ft/yr through 2050 based on MAG.
2. Reliability	2. High reliability.
3. Cost of treated water	3. Generally moderate cost; between $743 to $893 per ac-ft for three different delivery options.
b. Environmental factors:	
1. Instream flows	1. Moderate impact.
2. Bay and estuary inflows and arms of the Gulf of Mexico	2. None or low impact.
3. Wildlife habitat	3. None or low impact
4. Wetlands	4. None or low impact
5. Threatened and endangered species	5. None identified. Project can be adjusted to bypass sensitive areas. Endangered species survey will be needed to identify impacts.
6. Cultural resources	6. Cultural resources survey will be needed to identify any significant sites.
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. a-b,d. Total dissolved solids, chloride, and salinity of water is expected to be within TCEQ drinking water standards. c. None or low impact. e-i. Sulfate, uranium and arsenic concentrations in groundwater will need to be considered prior to implementation of project.
c. Impacts to Agricultural Resources or State water resources	• Negligible impacts to agricultural resources. • None or low negative impacts on surface water resources
d. Threats to agriculture and natural resources in region	• None or low impacts. Temporary damage due to construction of pipeline
e. Recreational impacts	• None
f. Equitable comparison of strategies	• Standard analyses and methods used for portions
g. Interbasin transfers	• Not applicable
h. Third party social and economic impacts from voluntary redistribution of water	• Not applicable
i. Efficient use of existing water supplies and regional opportunities	• Provides regional opportunities for water that would otherwise be unused
j. Effect on navigation	• None
k. Impacts on water pipelines and other facilities used for water conveyance	• Construction and maintenance of transmission pipeline corridor. Possible impact to wildlife habitat along pipeline route and right-of-way.

9.3.3 Seawater Desalination (N-10) (previous 5D.10, Recommended Water Management Strategy)

9.3.3.1 Poseidon Regional Seawater Desalination Project at Ingleside (Previous 5D.10.6, Recommended Water Management Strategy)

The project involved the City of Ingleside, as a project sponsor, who has initiated a process with Poseidon Water to evaluate, design, build, finance, operate and maintain a large-scale seawater desalination plant in San Patricio County. The project contemplates delivery of the facility via a Public-Private-Partnership (P3).

The initial desalination project is for a 50 mgd desalination facility, expandable to up to 100 mgd (112,000 acre-feet-per-year) to meet future industrial demand. The general location for the siting of the plant is within the city limits of Ingleside and potential service area is shown in the map in Figure 9.6. This project evaluation is based on development, production and treatment of seawater via reverse osmosis for new manufacturing (industrial) uses in San Patricio County.



Source: Poseidon *Water* Map, 2019 via email September 2019

Figure 9.6.
Proposed Location for Poseidon Regional Seawater Desalination Project at Ingleside

The plant is expected to have a 45 percent recovery rate, requiring approximately 225 mgd of seawater to produce 100 mgd of treated desalinated water for manufacturing purposes and potentially additional water for brine dilution. The water quality data at La Quinta Channel in Corpus Christi Bay indicates the seawater (source water) salinity ranges from 14,550 mg/L to 40,500 mg/L, with an average salinity of 31,600 mg/L over a 35-year period from 1985 to 2019. Discharge of the reverse osmosis (RO) concentrate will contribute additional salt load to the La Quinta ship channel, and the design of outfall will seek to minimize impact to intake quality. However, there is potential wastewater reuse from industrial return flows as well as municipal wastewater for use in the desalination process and/or brine disposal treatment facilities to be considered and evaluated.

Details regarding intake, desalination process, concentrate disposal outfall, site-specific environmental impacts, and storage needs is unavailable at this time and was not included in the cost estimate. A 3.5-mile (18,480-foot) product water delivery line for delivery to the industrial complex in San Patricio County is included in the cost estimate, based on information provided by Poseidon Water. Energy is the largest operational cost of a desalination facility, and energy use is directly proportional to salinity of the source water. The total project cost for a 50 mgd facility is $724,984,000 and $1,280,848,000 for a 100 mgd facility. The annual cost is expected to range from around $123,638,000 to $218,932,000. This results in a unit cost of water of $1,955 to $2,206 per ac-ft.

Permitting of this facility will require extensive coordination with all applicable regulatory entities. The major project components and issues with implementation will be permitting and construction of pipelines. Also, this strategy contemplates a P3 delivery mechanism calling for risk transference to a private party to Design-Build-Finance-Operate-and-Maintain the project.

Table 9.7. Evaluation Summary of the Poseidon Regional Seawater Desalination Project at Ingleside Project

Impact Category	Comment(s)
a. Water supply:	
1. Quantity	1. Project size: 56,000-112,000 ac-ft/yr;
2. Reliability	2. Highly reliable quantity.
3. Cost of treated water	3. Unit cost between $1,955 - $2,206 ac-ft.
b. Environmental factors:	
1. Instream flows	1. None or low impact.
2. Bay and estuary inflows and arms of the Gulf of Mexico	2. Some environmental impact to estuary.
3. Wildlife habitat	3. Some. Disposal of concentrated brine created from process may impact fish and wildlife habitats or wetlands.
4. Wetlands	4. Some. Disposal of concentrated brine created from process may impact fish and wildlife habitats or wetlands.
5. Threatened and endangered species	5. None identified. Endangered species survey will be needed to identify impacts.
6. Cultural resources	6. Cultural resources survey will be needed to identify any significant sites.
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. 7a-b. Total dissolved solids and salinity of water is removed with reverse osmosis treatment. Brine concentrate disposal issues will need to be evaluated. 7c-i. Bacteria, chlorides, nitrate, alkalinity, ammonia, and copper were all identified as constituents of concern for the Corpus Christi Bay in the TCEQ and NRA Basin Highlights Report. Additional studies regarding impacts on or as a result of project are needed
c. Impacts to Agricultural Resources and State water resources	• None or low impacts on other water resources • Negligible impacts to agricultural resources
d. Threats to agriculture and natural resources in region	• Some. Temporary damage due to construction of pipeline
e. Recreational impacts	• None
f. Equitable comparison of strategies	• Standard analyses and methods used for portions • Seawater desalination cost modeled after bid and manufacturers' budgets, but not constructed, comparable project • Project does not include off-shore brine disposal.
g. Interbasin transfers	• Not applicable
h. Third party social and economic impacts	• Not applicable
i. Efficient use of existing water supplies and regional opportunities	• Provides regional opportunities
j. Effect on navigation	• None
k. Impact of water pipelines and other facilities used for water conveyance	• Construction and maintenance of transmission pipeline corridor (in future). Possible impact to wildlife habitat along pipeline route and right-of-way.

9.4 Summary of Water Management Strategies from the 2016 Regional Water Plans or Prior No Longer Relevant or Actively Evaluated in the 2026 Regional Water Plan

9.4.1 Manufacturing Water Conservation and Nueces River Water Quality Issues (previous 5D.3, Considered Water Management Strategy)

9.4.1.1 Previous Water Quality Analyses

For the 2001 regional water plan, a surface water and groundwater evaluation was conducted for the Nueces River downstream of Lake Corpus Christi. The study showed the most significant concentration increase in chlorides (and dissolved minerals in general) occurs with increasing depth within the channel. Another phase of this evaluation aimed to identify the possible sources of elevated levels of dissolved solids in the Nueces River water. The results of the surface water and groundwater interaction study are included in the 2001 regional water plan.

The Nueces River Partnership developed a watershed protection plan for the Lower Nueces River for the 182.6 square miles contributing to the Nueces between Lake Corpus Christi and the saltwater barrier dam. The Texas Clean Rivers Program developed a watershed management approach to conducting basin wide water quality assessments required by Senate Bill 818. Water quality data from this effort is available for Lake Corpus Christi and the 39 river miles downstream to the saltwater barrier. The Nueces BBASC Study #3, conducted by HDR Engineering, Inc. (HDR), describes nutrient budgets based on quantitative understanding of natural supply of all nutrient forms and anthropogenic changes in these supplies over time for the Nueces Bay watershed and determines annual loads for pre-development and current conditions.

9.4.1.2 Assessment of Water Budget and Salinity in the Lower Nueces River Basin

The major purpose of this assessment included in the 2016 regional water plan is to improve understanding of: 1) surface water/groundwater interactions; and 2) influences on water quality conditions. The areas of interest are Lake Corpus Christi (LCC) and the Nueces River between LCC and Calallen. A map of the study area and stream gaging stations is shown in Figure 9-7. Data used for the study included streamflow, groundwater levels, groundwater quality, stream water quality, precipitation, lake evaporation, LCC stage, volume, and direct lake diversions, and Calallen diversions.

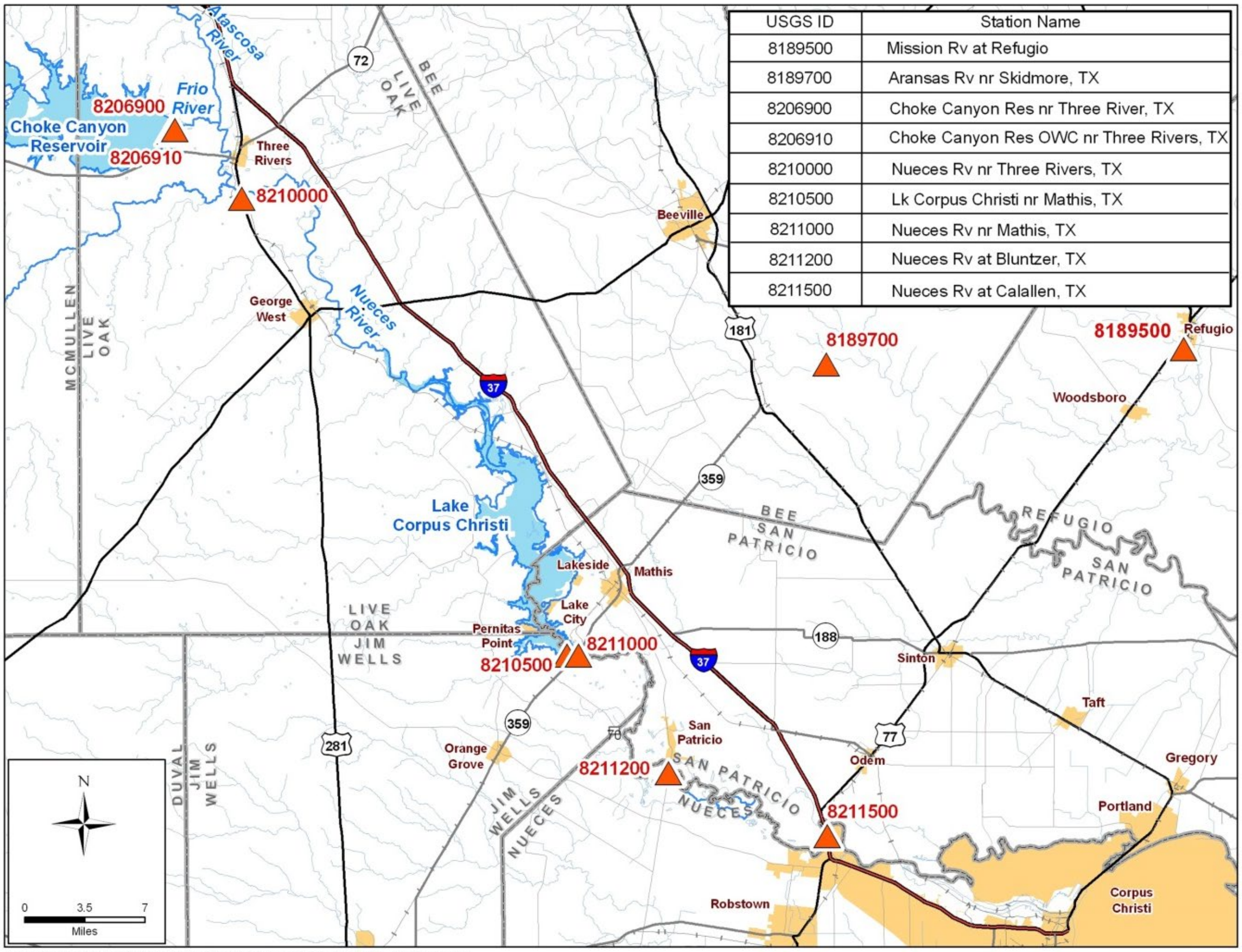


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Figure 9-7.
Location of Study Area and Streamflow Gaging Stations

The interaction or movement of water between the Nueces River, LCC, and major aquifers is studied for the Nueces River reach between Mathis and Calallen (Figure 9-7). For LCC, the interaction is studied by calculating the seepage into and out of the lake from a water budget model. For the Lower Nueces River, the interaction is studied by calculating the streamflow gains and losses between streamflow U.S. Geological Survey (USGS) gaging stations.

A major use of the water from LCC and the Lower Nueces River is for municipal and industrial purposes. As a result, there is a great interest in not only having a sufficient supply during all times but to have water quality meet drinking water standards and be consistent over time. One of the long-term issues with water from the Calallen Pool is variable water quality, especially with regard to salinity (chloride concentrations) during the summer and periods of drought. For LCC, the hydrologic influences on water quality are studied with regard to the inflow from the Nueces River and surface water/groundwater interaction. Other potential significant influences are stratification of the lake, especially in the deep section near the dam, and evaporation. Increasing and decreasing salinity between streamflow gaging stations is studied for the Nueces River downstream of LCC.

9.4.2 Reclaimed Wastewater Supplies and Reuse (previous 5D.5, Recommended Water Management Strategy)

9.4.2.1 Choke Canyon/Lake Corpus Christi Yield Recovery through Diversion of the City of Corpus Christi WWTP Effluent and/or Freshwater River Diversions through the Rincon Pipeline to the Nueces Delta

The TCEQ 1992 Interim Order established operational procedures for the CCR/LCC System that included a monthly schedule of desired inflows to Nueces Bay to be comprised of releases, spills, and return flows. The Interim Order also directed studies such as the feasibility of relocating wastewater discharges to locations where increased biological productivity could justify an inflow credit computed by multiplying the amount of discharge by a number greater than one. Prior to reopening the Rincon Bayou Demonstration Project in 2001, the Nueces River bypassed the Nueces Delta and flowed directly into Nueces Bay except during periods of high flow. Previous studies have shown that diversions of both river water and treated wastewater to the Nueces Delta can be expected to increase primary production by factors of about three to five when compared to allowing these waters to enter Nueces Bay via the Nueces River.

Previous studies indicate that the Nueces Delta and Nueces Bay are critically important as the site of much of the planktonic primary production that drives biological processes throughout the Nueces Estuary. There is evidence that treated wastewater could have as much as a five-fold stimulatory effect on primary productivity if discharged into the Nueces Delta rather than being discharged into the Nueces River. Therefore, it is recommended that wastewater be diverted and discharged into the Nueces Delta to help meet the freshwater inflow requirement, as specified in the 2001 Agreed Order, under which the CCR/LCC System now operates.

This strategy considered in the 2016 regional water plan examines potential yield recovery assuming 2 mgd of wastewater from Allison WWTP and up to 32 mgd of river water from the Calallen Pool through the Rincon Pipeline that could be discharged into the Nueces Estuary. Without biological productivity multipliers, 2 mgd of wastewater would be expected to yield 250 ac-ft/yr. A series of model runs were performed using the updated CCWSM to determine and quantify water supply benefits associated with different quantities of water being delivered to the Nueces Estuary for a range of biological multipliers.

Model simulation results indicate that yield increase ranges from just under 1,000 ac-ft for diverting 2 mgd of treated wastewater to the Nueces Estuary with a multiplier of 2 to over 17,000 ac-ft with a river diversion of 32 mgd and a multiplier of 5. A 2 mgd treated effluent diversion project with a multiplier of 5 is roughly equivalent in terms of increased yield to a combination project of 13 mgd diverted to the Nueces Estuary (11 mgd of river water and 2 mgd of treated effluent) with a multiplier of 2. The 32-mgd scenarios produce the highest yield increases compared to the other scenarios. By changing a biological multiplier of 2 to 5, at least for the volumes evaluated herein, an increase of about 2.4 to 2.5 times in firm yield would be expected.

Much of the infrastructure is already in place for this water management strategy. The Rincon Pipeline was built by the City of Corpus Christi and became operational in November 2007. The

Allison WWTP owned and operated by the City of Corpus Christi also has some infrastructure still in place from the Allison demonstration project. These facilities can deliver about 2 mgd from the plant. The estimated operating costs to deliver 2 mgd from the Allison WWTP are approximately $84,000 per year. This annual costs produces a unit cost ranging from $90.23 per ac-ft for a multiplier of 2 down to $17.25 per ac-ft for a multiplier of 5. The estimated annual operating costs for the Rincon Pipeline are $150,000 for delivering 11 mgd, which results in unit costs ranging from $109.07 per ac-ft for a multiplier of 2 down to $45.08 per ac-ft for a multiplier of 5. If the options were combined with both the 11 mgd of river water and 2 mgd of effluent the annual operating costs are estimated to be $548,000. This annual costs produces a unit cost ranging from $116.35 per ac-ft for a multiplier of 2 down to $45.85 per ac-ft for a multiplier of 5.

9.4.2.2 Wastewater Reuse Considerations for Municipal and Industrial Purposes

In general, primary industrial customers use similar facility processes that are mainly responsible for water consumption, such as cooling towers and boilers. In addition, industry also uses freshwater for drinking water, sanitary use, equipment wash-down, and fire protection. However, the primary differences in water usage are product related. Process requirements influence the size and type of cooling systems and boilers needed for steam production. Process and product differences affect water quantity and quality needs. Depending on the industrial facility's plant size, age, and market conditions, different plants in the same industry category can have different water needs and water use efficiencies.

The following factors influence and control current water use, the potential for industrial water conservation, and the potential for area industries to use alternative sources of water, including treated municipal wastewater, brackish groundwater, and seawater. The list of important factors includes:

- The location of each water-using industrial plant in relation to a source or sources of water;
- The location of each water-using industrial plant in relation to streams or other features into which wastewater can be discharged;
- The type of industry, which determines the type of water use (i.e., refineries which use varying and/or different grades of crude petroleum, refineries which are producing reformulated gas, chemical plants which produce a range of chemicals and pharmaceuticals, and plants which extract compounds from ores to produce metals and other products); and
- The metallurgy of equipment in the cooling system that would come in contact with the cooling water.

9.4.2.3 Analyses and Discussion of Consumptive Wastewater Reuse and Advanced Conservation as Related to Estuaries Inflow Requirements

Without implementation of water conservation measures wastewater discharges are projected to increase at a rate of about 900 ac-ft/yr. If selected accelerated conservation measures are implemented, then wastewater flows could be expected to reduce, depending on the type of conservation measures. Therefore, the benefit of increased water supply associated with advanced conservation must be weighed against the resultant reductions in the steady discharge of treated effluent containing nutrients to primary productivity in the Nueces Estuary.

9.4.3 Modify Existing Reservoir Operating Policy and Safe Yield Analyses (previous 5D.6- Recommended Water Management Strategy)

The City of Corpus Christi operates the Calallen Pool, Lake Corpus Christi, Choke Canyon Reservoir, MRP Phase I (Lake Texana), and MRP Phase II (LCC/CCR/Lake Texana/MRP Phase II System) as a system to supply water for municipal and industrial users of the Coastal Bend Region. Using the CCWSM, this water management strategy examines modifying the current reservoir operating policy from firm yield to safe yield. The maximum yields available under the City of Corpus Christi's current reservoir operating policies and existing schedule governing freshwater pass-throughs to the bay and estuary in 2020 and 2070 are 259,000 and 249,000 ac-ft/yr. With safe yield supplies, the yield of the system is reduced by 40,000 ac-ft/yr in 2020 and 35,000 ac-ft/yr in 2070, based on sedimentation conditions, to 219,000 and 214,000 ac-ft/yr.

The modification of existing reservoir operating policy strategy from firm to safe yield reduces the planned supply (yield) from the LCC/CCR/Lake Texana/MRP Phase II System to account for unprecedented severe drought conditions in the future or underestimation in regional growth. The additional stored water in LCC/CCR under safe yield provisions results in higher system storage levels and therefore more frequent opportunities for larger pass-through events to the Nueces Bay to meet inflow targets of the 2001 TCEQ Agreed Order. With safe yield, the median monthly flow to the Bay is 2,171 acre-feet per month (ac-ft/mo) compared to 1,625 ac-ft/mo under firm yield conditions (increase of 546 ac-ft/mo). A flow frequency showing monthly Bay inflow comparing firm and safe yield is shown in Figure 9-8. An evaluation summary of this regional water management strategy is provided in Table 9.8.

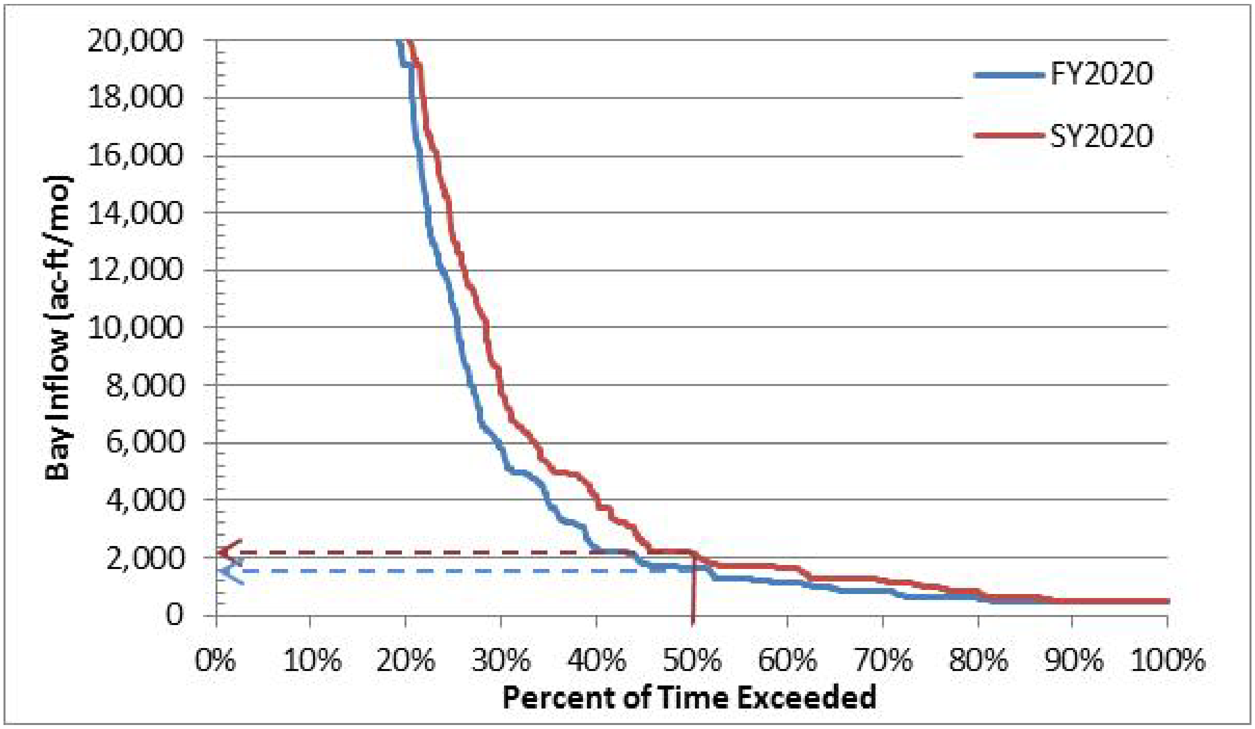

Figure 9-8.
Comparison of Monthly Flow Frequency Distribution for Nueces Bay Inflow for Firm Versus Safe Yield

Table 9.8.
Evaluation Summary for Modifications to Existing Reservoir Operating Policy

Impact Category	Comment(s)
a. Water supply:	
1. Quantity	1. No project yield. Safe yield supply is less than firm yield.
2. Reliability	2. Good reliability. Provides storage reserve of 125,000 ac-ft (equal to one year of demand). Drought management measure amid climate uncertainty.
3. Cost of treated water	3. No cost.
b. Environmental factors:	
1. Instream flows	1. None or low impact.
2. Bay and estuary inflows	2. Potential increase to bay and estuary inflows with higher storage levels to maintain safe yield reserve.
3. Wildlife habitat	3. None or low impact.
4. Wetlands	4. None or low impact.
5. Threatened and endangered species	5. None or low impact.
6. Cultural resources	6. None or low impact.
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. None or low impact.
c. State water resources	• No negative impacts on other water resources • Potential benefit to Nueces Estuary from increased fresh water flow.
d. Threats to agriculture and natural resources in region	• None
e. Recreational	• None
f. Equitable comparison of strategies	• Standard analyses and methods used
g. Interbasin transfers	• None
h. Third party social and economic impacts from voluntary redistribution of water	• Not applicable
i. Efficient use of existing water supplies and regional opportunities	• Provides enhanced recreational opportunities for the lakes.
j. Effect on navigation	• None

9.4.4 Blending Groundwater and Treated Surface Water Strategies (portion of Gulf Coast Aquifer Supplies 5D.7- considered Water Management Strategy)

This strategy evaluated the potential for blending brackish groundwater with existing treated surface water supplies at three different well fields located in Aransas, San Patricio, and Nueces counties, as shown in Figure 9-9. The Aransas and San Patricio counties' options would blend brackish groundwater with treated surface water from SPMWD, while the Nueces County option would blend groundwater with treated City of Corpus Christi surface water from the O.N. Stevens WTP. A key consideration for this strategy is the quantity of brackish groundwater that can be blended with existing surface water supplies while maintaining water quality within acceptable limits and avoiding increased corrosion within the system. Water quality goals are established for the evaluated locations based on existing water quality compared to blended water quality and standard corrosion indices calculations.

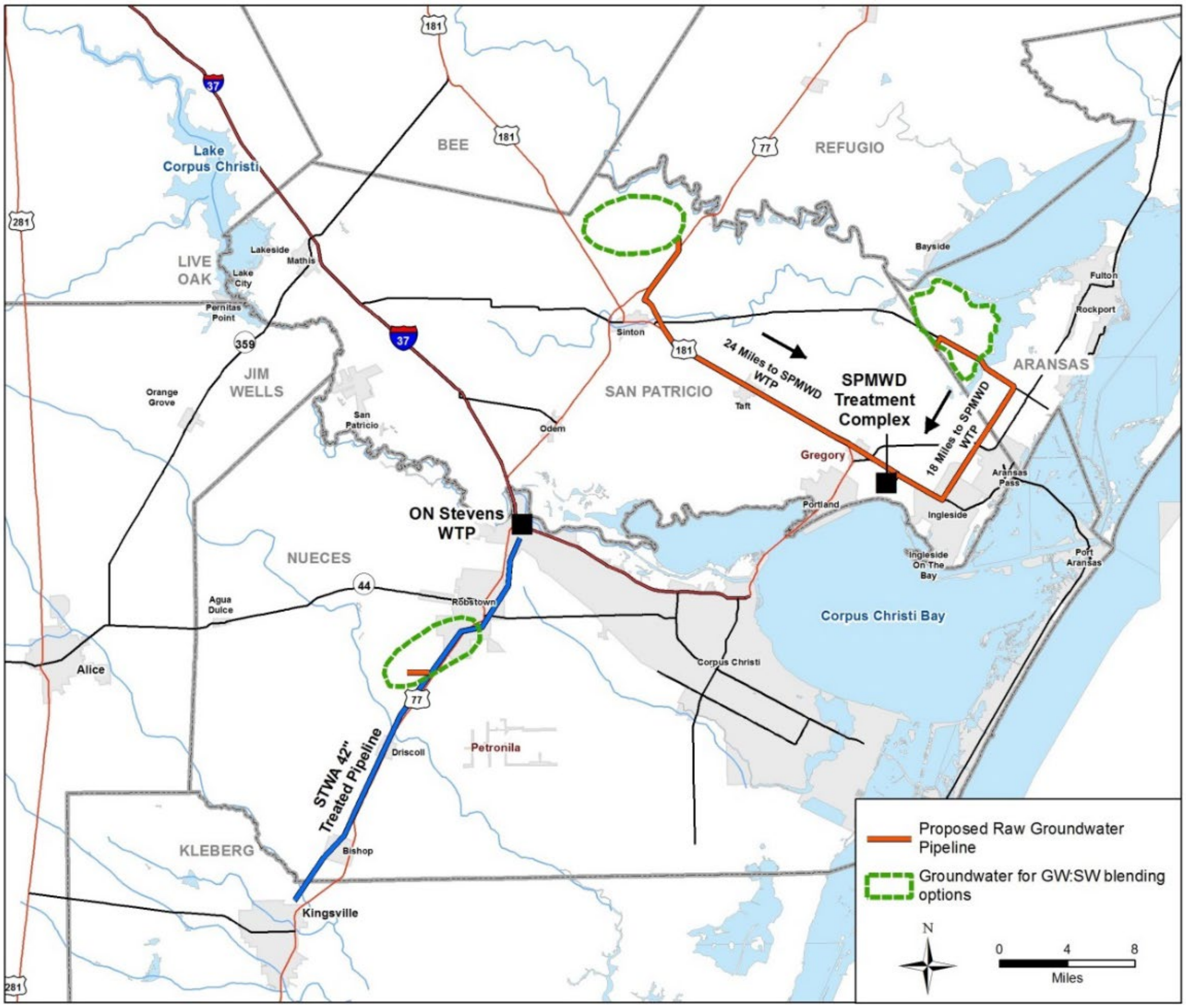

Figure 9-9.
Location of Brackish Groundwater Well Fields

For all three blending options, chloride is the limiting constituent. The target maximum chloride concentration for the Aransas and San Patricio counties' brackish groundwater blended with SPMWD is 210 mg/L based on industrial water quality targets. The Nueces County blend with City of Corpus Christi surface water from O.N. Stevens WTP has a target chloride maximum of 300 mg/L, the regulatory limit. At these target chloride concentrations the maximum percentage of each of groundwater that can be blended with surface is shown in Figure 9-10.

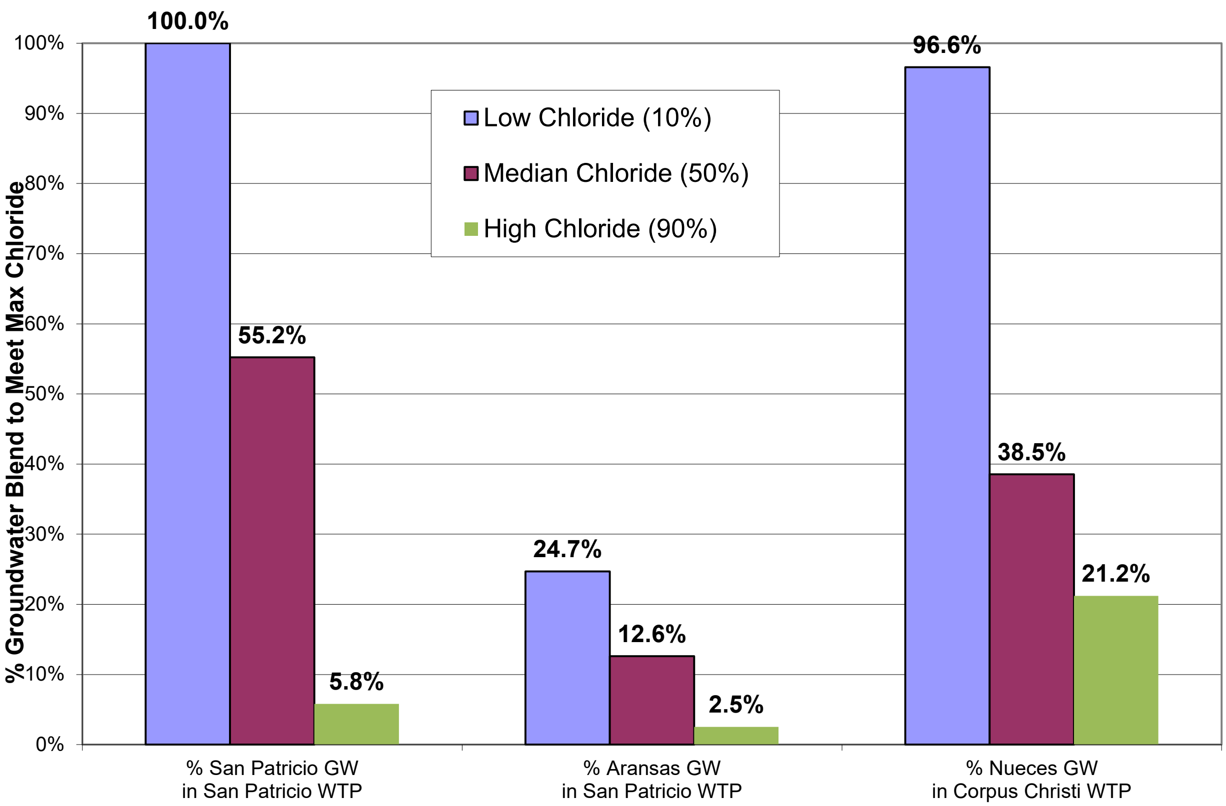

Figure 9-10.
Maximum Brackish Water Blend to Meet Chloride Limits

Cost estimates were performed for each study area considering high (90 percent) chloride concentrations. For the Aransas County well field, 12 wells are suggested with an assumed capacity of 75 gpm at a depth of 400 feet. Eighteen miles of 12-inch diameter transmission line is needed for blending at the SPMWD treatment complex. The total project cost for the Aransas County option is estimated at $13,480,000 with an annual cost of $1,326,000. For an available project yield of 1,174 ac-ft/yr, the treated water will cost $1,129 per ac-ft and have a unit cost of $3.47 per 1,000 gallons. The Nueces County option considers three wells with a capacity of 200 gpm at a depth of 500 feet and 2 miles of 6-inch diameter transmission line. The total project cost is estimated at $4,630,000 with an annual cost of $514,000. The treated water will cost $727 per ac-ft and have a unit cost of $2.23 per 1,000 gallons.

The San Patricio County option considers eight wells with an assumed capacity of 250 gpm at a depth of 600 feet. Twenty-four miles of 14-inch diameter transmission line is needed for blending at the SPMWD treatment complex. The total project cost is estimated at $24,190,000 with an annual cost of $2,667,000. The addition of brackish groundwater to the existing treated water system will cost $902 per ac-ft and have a unit cost of $2.77 per 1,000 gallons. An additional cost estimate for San Patricio County was conducted considering median chloride concentrations and a blend consisting of 55.2 percent brackish groundwater – significantly increasing the project yield from 2,958 to 28,155 ac-ft/yr. This option considers 78 wells with an assumed capacity of 250 gpm at a depth of 600 feet, and 24 miles of 36-inch diameter transmission line. The total project cost is estimated at $110,706,000 with an annual cost of $14,772,000. The treated water will cost $525 per ac-ft and have a unit cost of $1.61 per 1,000 gallons.

Table 9.9 provides a summary of blending groundwater and treated surface water strategies within the Gulf Coast Aquifer.

Table 9.9.
Evaluation Summary for Blending Groundwater and Treated Surface Water

Impact Category	Comment(s)
a. Water supply:	
1. Quantity	1. Firm Yield: 707 to 28,155 ac-ft/yr.
2. Reliability	2. Water Quality: Fair.
3. Cost of treated water	3. Cost: $525 to $1,129 per ac-ft.
b. Environmental factors:	
1. Instream flows	1. May slightly decrease instream flow and discharge of freshwater into coastal estuaries due to local pumping and groundwater-surface water interaction.
2. Bay and estuary inflows	2. May slightly decrease instream flow and discharge of freshwater into coastal estuaries due to local groundwater-surface water interaction.
3. Wildlife habitat	3. Negligible impacts.
4. Wetlands	4. Negligible impacts.
5. Threatened and endangered species	5. Negligible impacts.
6. Cultural resources	6. Cultural resources will need to be surveyed and avoided.
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. Negligible impacts. a. Low to moderate impact. b. Low to moderate impact. c. No impact. d. Low to moderate impact. e. Low to moderate impact. f. Low to moderate impact. g-h. Low to moderate impact associated with mining. i. Boron may be a potential water quality concern.
c. Impacts to State water resources	• No negative impacts on water resources other than lowering Gulf Coast Aquifer; Potential benefit to Nueces Estuary from increased freshwater return flows attributed to increased supplies and demands.
d. Threats to agriculture and natural resources in region	• May slightly increase pumping costs for agricultural users in the area due to localized drawdowns
e. Recreational impacts	• None
f. Equitable comparison of strategies	• Standard analyses and methods used
g. Interbasin transfers	• Not applicable to groundwater sources
h. Third party social and economic impacts from voluntary redistribution of water	• May require the purchase of groundwater rights
i. Efficient use of existing water supplies and regional opportunities	• Provides regional opportunities with local resources
j. Effect on navigation	• None

9.4.5 Regional Well-Field Systems (portion of Brackish Groundwater Desalination 5D.8- Alternative Water Management Strategy)

Brackish groundwater supplies have been desalinated to potable standards in areas near Region N and are likely to become more prevalent under the compounding pressures of increasing water demands and climate uncertainty. The Regional Well Field Systems strategy, included in the 2016 regional water plan, provides an evaluation of three independent well fields, as shown in Figure 9-11, for brackish groundwater supplies from the Gulf Coast Aquifer, and includes treatment and delivery to one or more Coastal Bend Region utilities. A key consideration in developing this strategy is groundwater availability. Groundwater Availability Models (GAMs) used to administer permits and manage groundwater resources do not currently delineate between fresh and slightly brackish water. Therefore, brackish water is often included in MAG estimates, which limits groundwater availability for regional water planning purposes. For any of the three independent well fields to be developed, the MAGs and DFCs from the 2016 regional water plan will need to be increased by the withdrawal amount.

The Bee-San Patricio well field option considers two alternatives for delivery of treated water to the O.N. Stevens WTP and to SPMWD’s water main near U.S. Highway 77 located about 2 miles south of Sinton. There are two options for disposal of concentrate, deep-well injection and discharge to Copano Bay. The project is designed to yield 21.4 mgd (24,000 ac-ft/yr) and provide a treated water supply with a total dissolved solids concentration of about 400 mg/L. Estimated total annual costs for these options range from $20,470,000 to $22,424,000, or $853 to $934 per ac-ft.

The Nueces Northwest well field project is designed to deliver treated water to the O.N. Stevens WTP. Concentrate would be disposed into deep-injection wells. The project design is to yield 16.1 mgd (18,000 ac-ft/yr) and provide a treated water supply with a TDS of about 400 mg/L. The total annual cost of project is estimated at $18,566,000 or $1,031 per ac-ft.

The Nueces South-Central project is designed with two options. One is to deliver treated water to the City of Corpus Christi’s distribution system near the intersection of Texas Highway 286 and Texas Highway 2444 and to dispose the concentrate to Oso Bay through the Barney Davis Power Station. The other option is to deliver treated water to the STWA pipeline near Bishop and dispose of the concentrate to deep-injection wells. This strategy is to make water available for STWA customers and to supplement the supplies at the O.N. Stevens WTP. The projects are designed to yield 10.7 mgd (12,000 ac-ft/yr) at a uniform rate. The project is to provide a treated water supply with TDS of about 400 mg/L. The estimated annual cost to deliver treated water to the City of Corpus Christi and concentrate to Oso Bay is $13,590,000, or $1,133 per ac-ft. The annual cost to deliver treated water to STWA and concentrate to deep-injection wells is $15,028,000 or $1,252 per ac-ft.

A summary of all three well field options is included in Table 9.10.

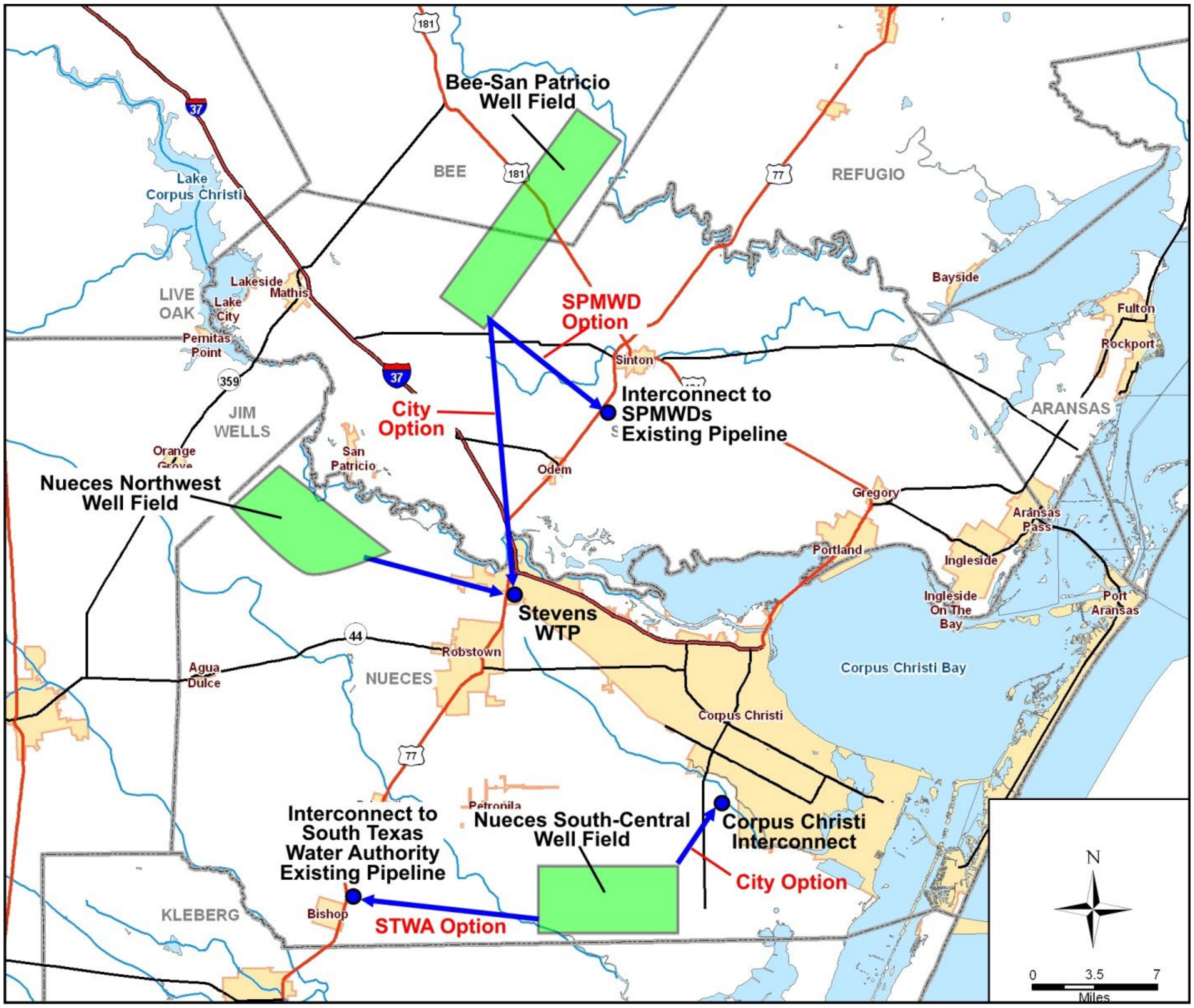

Figure 9-11.
Location of Brackish Groundwater Well Fields

Table 9.10.
Evaluation Summary for the Brackish Groundwater Desalination Option

Impact Category	Comment(s)
a. Water supply:	
1. Quantity	1. Variable, well field capacities ranges from up to about 24,000 ac-ft/yr.
2. Reliability	2. High reliability.
3. Cost of treated water	3. Generally moderate to high cost; between $828 to $1,151/ac-ft for projects ranging from 12,000 to 24,000 ac-ft/yr.
b. Environmental factors:	
1. Instream flows	1. Moderate impact.
2. Bay and estuary inflows	2. None to low. However, greatest impact is during low-flow conditions.
3. Wildlife habitat	3. Disposal of concentrated brine with bay option may impact fish and wildlife habitats or wetlands.
4. Wetlands	4. None to low.
5. Threatened and endangered species	5. None identified. Project can be adjusted to bypass sensitive areas. Endangered species survey will be needed to identify impacts.
6. Cultural resources	6. Cultural resources survey will be needed to identify any significant sites.
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. 7a-b. Total dissolved solids and salinity of water is removed with reverse osmosis treatment. Brine concentrated disposal issues will need to be evaluated. 7d-i. Chloride, sulfate, uranium and arsenic concentrations in groundwater will need to be considered prior to implementation of project.
c. Impacts to State water resources	• Little to minor negative impacts on surface water resources
d. Threats to agriculture and natural resources in region	• Temporary damage due to construction of pipeline
e. Recreational impacts	• None
f. Equitable comparison of strategies	• Standard analyses and methods used for portions • Brackish groundwater desalination cost modeled after bid and manufacturers' budgets, but not constructed, comparable project
g. Interbasin transfers	• Not applicable
h. Third party social and economic impacts from voluntary redistribution of water	• Not applicable
i. Efficient use of existing water supplies and regional opportunities	• Provides regional opportunities for water that would otherwise be unused
j. Effect on navigation	• None
k. Consideration of water pipelines and other facilities used for water conveyance	• Construction and maintenance of transmission pipeline corridor. Possible impact to wildlife habitat along pipeline route and right-of-way.

9.4.6 Potential Water System Interconnections (Previous 5D.10- Recommended Water Management Strategy)

In addition to providing backup water supplies for emergencies, water system interconnections were considered in the 2016 regional water plan as another potential source of freshwater supplies for municipal and industrial uses. Within the Nueces Region, there are a number of municipal water systems that rely totally on local groundwater. Many of these groundwater systems operate under challenges inducing insufficient groundwater supply, insufficient well capacity, and unsuitable water quality. Therefore, connecting to the regional surface water system can make for a more reliable water supply. Community water system candidates considered in 2016 are located in Duval, Jim Wells, Brooks, Kleberg, and San Patricio Counties for interconnection within the Coastal Bend Region. Yields were determined by the maximum demands for each entity over the planning period and infrastructure constraints. For San Diego in Duval County, an additional analysis was run based on needs rather than the demand. Costs were calculated using the TWDB Unified Costing Model.

The interconnection strategies for Duval, Jim Wells, and Brooks counties were dependent on Alice's WTP, which had a treated water capacity of 7,560 ac-ft/yr at the time of analysis. The City of Alice used 4,000 ac-ft of water in 2012 meaning that there are approximately 3,560 ac-ft/yr of water available for potential interconnect strategies. If all of the interconnection strategies that rely on Alice's WTP were to be implemented there would need to be an additional capacity of 2,486 ac-ft/yr.

All proposed water system interconnections are summarized in Table 9.11, and the overall strategy is summarized in Table 9.12.

Table 9.11. Summary of Proposed Water System Interconnections (Sept 2013 prices)

County	Alt.	Pipeline From	Pipeline To	Pipeline Diameter (inches)	Pipeline Length (miles)	Additional Facilities	Yield (ac-ft/yr)	Total Cost of Project	Annual Cost of Water ($ per 1,000 gall)
Duval	1	Alice	San Diego, Benavides, Realitos, Concepcion, and Freer	6,10,18	83	5 Pump Stations	2,708	$34,786,000	$6.43
	2	Alice	San Diego, Benavides, and Freer	6,10,16	52	3 Pump Stations	2,098	$22,515,000	$5.82
	3	Alice	San Diego and Benavides	6,12	28	1 Pump Station	1,344	$10,542,000	$4.92
	4*	Alice	San Diego and Freer	10,14	36	2 Pump Stations	1,826	$18,035,000	$5.57
	5A	Alice	San Diego All Demands	14	11	-	1,072	$5,177,000	$3.99
	5B	Alice	San Diego Needs Only	6	11	-	158	$3,154,000	$8.35
Jim Wells	1	Alice	Orange Grove	8	17	1 Pump Station	494	$6,815,000	$6.86
	2	Alice	Premont	10	24	1 Pump Station	929	$9,398,000	$5.54
Brooks	1	Premont	Falfurrias	14	9	-	2,844	$21,117,000	$4.68
San Patricio	1	SPMWD Transmission Main	Sinton	12	8	-	1,507	$3,042,791	$3.32
	2	SPMWD Transmission Main	Edroy	6	6	-	125	$1,833,000	$6.36
	3	Six New Groundwater Wells	Mathis	6	6	6 Groundwater Wells	700	$5,545,000	$4.58
Kleberg/ Brooks/ Jim Wells	1	Kingsville	Riviera, Falfurrias, and Premont	10, 18	48	1 Pump Station	3,024	$34,899,000	$6.26
Nueces/ Jim Wells	-	STWA Pipeline at Agua Dulce	Alice	12	11.4	Storage Tank and 1 Pump Station	2,800	$5,866,000	$3.55

*September 2008 Prices

Table 9.12.
Evaluation Summary of the Potential Water System Interconnections

Impact Category	Comment(s)
a. Water supply:	
1. Quantity	1. Firm yield: Range from 2,800 ac-ft/yr to 125 ac-ft/yr, depending on interconnection project.
2. Reliability	2. Good reliability.
3. Cost of treated water	3. Generally high project cost; between $2,722 to $336 per ac-ft.
b. Environmental factors:	
1. Instream flows	1. Possible low impact.
2. Bay and estuary inflows	2. Possible low impact.
3. Wildlife habitat	3. Construction and maintenance of transmission pipeline corridor(s) may impact wildlife species.
4. Wetlands	4. None or low impact.
5. Threatened and endangered species	5. Endangered species survey will be needed to avoid significant sites.
6. Cultural resources	6. Cultural resource survey will be needed to avoid significant sites.
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. May potentially enhance water quality for rural communities. 7d. May improve water quality issues associated with chlorides for Sinton. 7f. May improve water quality issues associated with high hydrogen sulfide for Edroy.
c. Impacts to State water resources	• No negative impacts on other water resources
d. Threats to agriculture and natural resources in region	• Temporary damage due to construction of pipeline(s)
e. Recreational impacts	• None
f. Equitable comparison of strategies	• Standard analyses and methods used for portions
g. Interbasin transfers	• Not applicable
h. Third party social and economic impacts from voluntary redistribution of water	• Not applicable
i. Efficient use of existing water supplies and regional opportunities	• Provides regional opportunities
j. Effect on navigation	• None

9.4.7 Lavaca Off-Channel Reservoir Project (previous 5D.12-Recommended Water Management Strategy)

The Lavaca-Navidad River Authority has considered multiple scenarios for construction of new reservoir storage, including both on- and off-channel reservoirs. The Lavaca River Water Supply Project Feasibility Study, completed in 2011 by Freese & Nichols, Inc., compared a variety of these configuration options, as shown in Figure 9-12, and recommended the most feasible scenarios for implementation, including either the West Off-Channel Reservoir Project or the East Off-Channel Reservoir Project Alternative B.

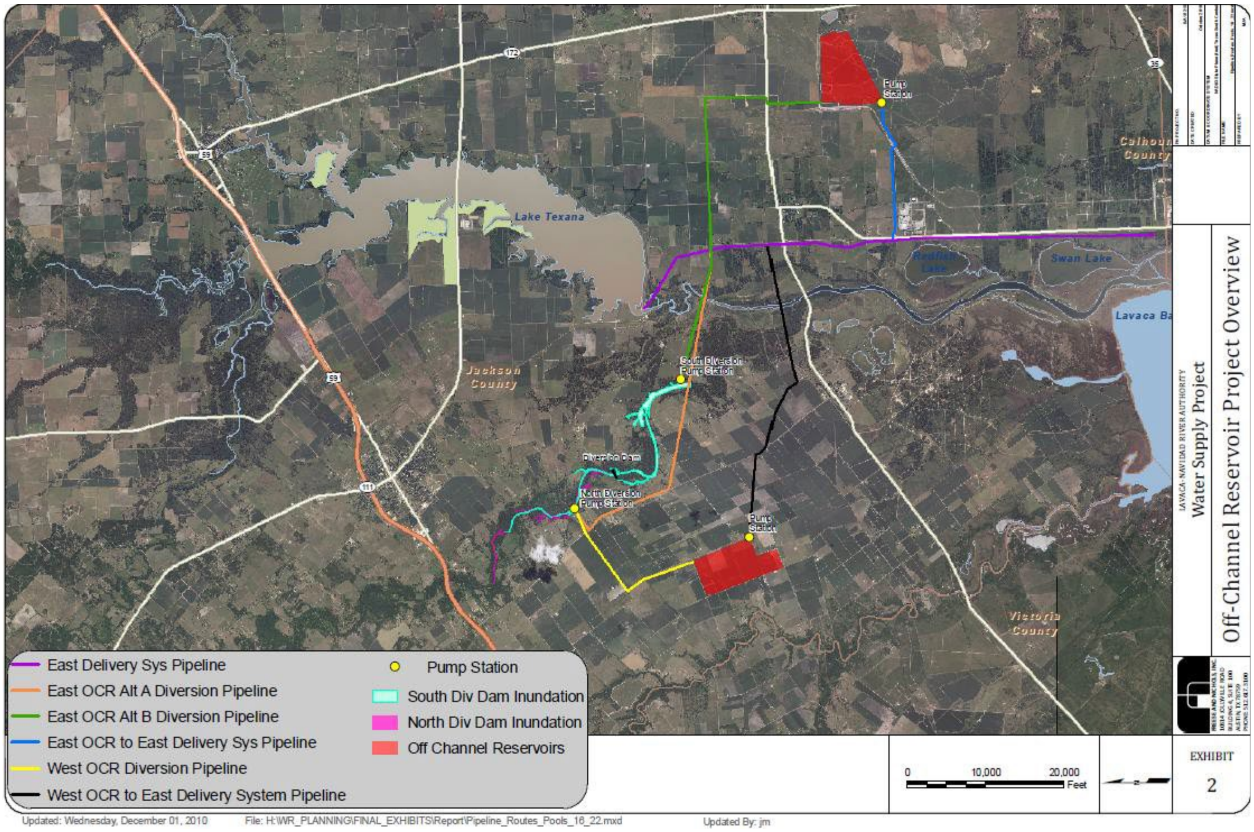

Figure 9-12.
Lavaca Off-Channel Reservoir Project Location

In both cases of the West off-channel and East off-channel B reservoirs, the minimum facility requirements would include the storage reservoir and associated pump stations to deliver water from the river to the reservoir. Diversion points and conceptual level pipeline alignments are different in each scenario and shown in Figure 9-12. Two pump stations are required for both off-channel alternatives, including a Lavaca River diversion pump station to divert flows and an off-channel reservoir pump station to deliver raw water to the existing Lavaca-Navidad River Authority East Delivery System pipeline. A diversion dam to increase the in channel storage and optimize pumping opportunities is also considered in the scenarios in order to increase firm yield. A relatively small amount of in-channel storage could increase the project yield at minimal cost compared to the cost of increasing the size of the off-channel reservoir to store more water.

The total project cost of the Lavaca off-channel reservoir was estimated at $177,485,000 for a yield of 16,963 ac-ft/yr. When considering annual program costs, the unit cost would be approximately $867 per ac-ft for raw water and $1,236 per ac-ft assuming treated water cost of $369 per ac-ft. Costs assumed the more expensive East Off-Channel Alternative B, which is within approximately 10 percent of the cost of the West off-channel scenario. The costs do not include water treatment or raw water purchase. A summary of the Lavaca off-channel reservoir option is described in Table 9.13.

Table 9.13.
Evaluation Summary for Lavaca Off-Channel Reservoir Project

Impact Category	Comment(s)
a. Water supply:	
1. Quantity	1. Firm yield: 16,963 ac-ft
2. Reliability	2. Good reliability.
3. Cost of treated water	3. Moderate cost; $1,236 per ac-ft.
b. Environmental factors:	
1. Instream flows	1. Generally decreases instream flow below diversion.
2. Bay and estuary inflows	2. General reduction in bay and estuary inflows.
3. Wildlife habitat	3. Construction and maintenance of off-channel reservoir site and transmission pipeline corridor(s) may impact wildlife species.
4. Wetlands	4. Low impact to wetlands.
5. Threatened and endangered species	5. Likely low impact to endangered species. Endangered species survey will be needed to avoid significant sites.
6. Cultural resources	6. Cultural resources survey will be needed to avoid significant sites.
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. Minimal impact to water quality.
c. Impacts to State water resources	• No negative impacts on other water resources
d. Threats to agriculture and natural resources in region	• None
e. Recreational impacts	• None
f. Equitable comparison of strategies	• Standard analyses and methods used for portions
g. Inter-basin transfers	• May be required for use in Region N.
h. Third party social and economic impacts from voluntary redistribution of water	• Not applicable
i. Efficient use of existing water supplies and regional opportunities	• Maximizes opportunities to capture water from a large drainage area during high/moderate inflow events after environmental instream flow requirements are satisfied. Less evaporative losses expected than traditional reservoir.
j. Effect on navigation	• None

9.4.8 Guadalupe-Blanco River Authority Lower Basin Storage Project (previous 5D.13- Recommended Water Management Strategy)

To firm up the run-of-river supplies of water available under the Guadalupe-Blanco River Authority/Dow Water Rights, an off-channel reservoir near the Guadalupe-Blanco River Authority Main Canal and Dow Seadrift Operations facilities was considered in the 2016 regional water plan. The off-channel reservoir had a proposed water depth of about 25 feet and the capability of impounding approximately 12,500 ac-ft of water. The off-channel reservoir site was located in the lower Guadalupe – San Antonio River basin in Region L in close proximity to Coastal Bend Region infrastructure, presenting an inter-regional opportunity. The City of Corpus

Christi's MRP and Bloomington Pump Station is located 15 miles north of the previously proposed off-channel reservoir and was considered for delivering raw water supplies from the project to O.N. Stevens or SPMWD WTP prior to distribution to water users. Figure 9-13 shows the conceptual project layout.

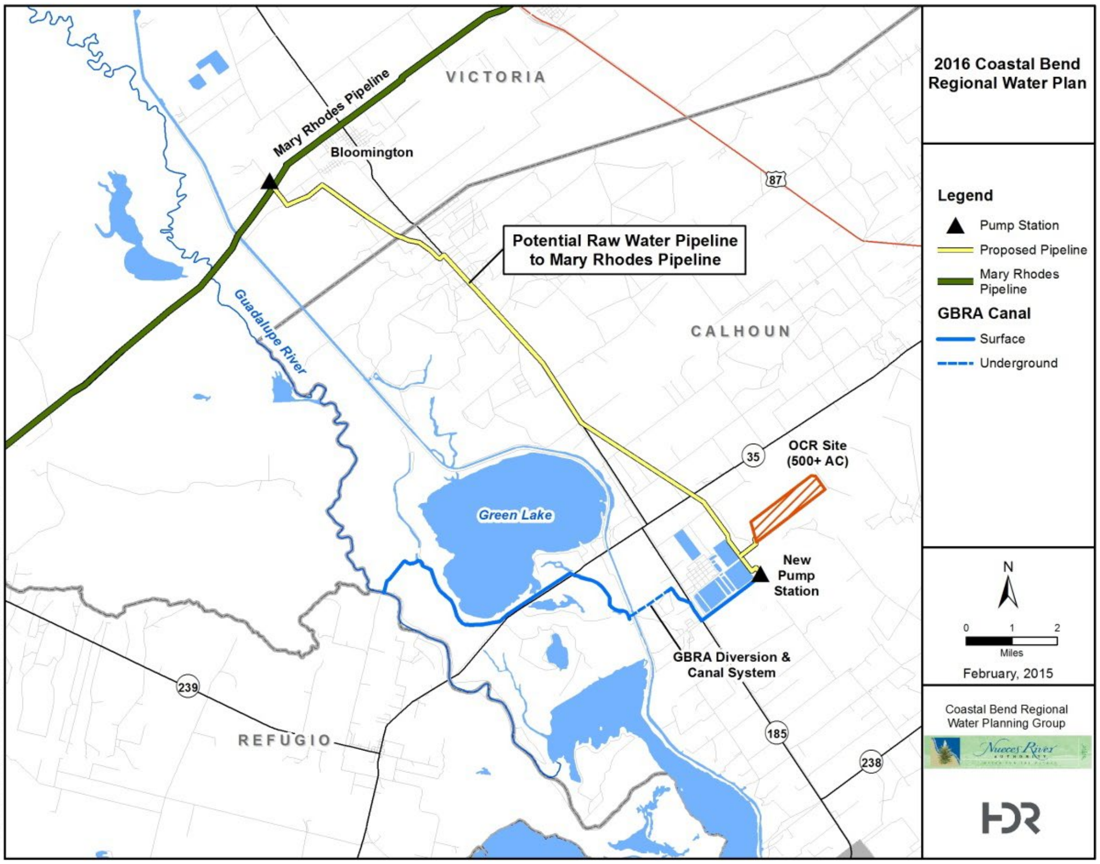

Figure 9-13.
Example Conceptual Route for Delivery of Guadalupe-Blanco River Authority Lower Basin Stored Water to the Mary Rhodes Pipeline at Bloomington Pump Station

The total project and annual costs are $90,543,000 and $7,261,000, respectively, including debt service and operation and maintenance for the 12,500 ac-ft off-channel reservoir and associated facilities, such as the embankment and appurtenant facilities for the off-channel reservoir, a 50 cubic feet per second raw water intake and pump station, a 42-inch transmission pipeline, and a 72-inch outlet pipeline. For a firm yield of 51,800 ac-ft/yr (which assumes 100 percent direct reuse of all treated wastewater in both the Guadalupe and San Antonio river basins), these annual costs translate to an annual unit cost of $140/ac-ft/yr for raw water at the Guadalupe-Blanco River Authority Main Canal during the debt service period.

The Coastal Bend Region's portion of total project and annual costs are $72,546,000 and $8,849,000, respectively, including debt service and operation and maintenance for participation in the 12,500 ac-ft off-channel reservoir and associated facilities on a prorata share basis. For a firm yield of 20,000 ac-ft/yr (38.6 percent of the 51,840 ac-ft project yield), these annual costs translate to an annual unit cost of $442 per ac-ft/yr for raw water at the MRP during the debt service period. This cost assumes that pending upgrades to the MRP to operate at full design capacity are complete at no cost to this water supply strategy. Assuming a treatment cost of $369 per ac-ft comparable to other Coastal Bend Region water management strategies, the annual unit cost of treated water is estimated to be $811 per ac-ft/yr. Table 9.14 provides a summary of the Guadalupe-Blanco River Authority lower basin storage project.

Table 9.14.
Evaluation Summary of Guadalupe-Blanco River Authority Lower Basin Storage Project

Impact Category	Comment(s)
a. Water supply:	
1. Quantity	1. Firm Yield (Region N's portion): 20,000 ac-ft/yr. Firm Yield (total project): 51,800 ac-ft/yr.
2. Reliability	2. Highly reliable quantity.
3. Cost of treated water	3. Moderate cost of $811 per ac-ft.
b. Environmental factors:	
1. Instream flows	1. Although source water is available under existing water rights, there may be some impact due to increased diversions from the Lower Guadalupe River. With Region N participation and project integration into the CCR/LCC/Texana/MRP Phase II system, increases in instream flows in the Nueces River may occur due to reduced water supply demands on the CCR/LCC system and consequently higher inflow pass-through targets according to 2001 Agreed Order provisions.
2. Bay and estuary inflows	2. Although source water is available under existing water rights, there may be some impact due to increased diversions from the Lower Guadalupe River, when available, for off-channel reservoir storage needs to firm yield during droughts. With Region N participation and project integration into the CCR/LCC/Texana/MRP Phase II system, increases in instream flows in the Nueces River may occur due to reduced water supply demands on the CCR/LCC system and consequently higher inflow pass-through targets according to 2001 Agreed Order provisions.
3. Wildlife habitat	3. Some impact and wildlife habitat disturbance due to off-channel reservoir, intake, and transmission pipeline construction.
4. Wetlands	4. Low impact.
5. Threatened and endangered species	5. Several threatened and endangered species are listed in Calhoun County. It is not anticipated that this project will have any permanent adverse effect on any federally listed threatened or endangered species, its habitat, or designated habitat nor would it adversely affect any state listed species. Reasonable and prudent measures should be taken to avoid and minimize the potential effects of the proposed project activities on threatened and endangered species as well as bald eagles.
6. Cultural resources	6. No cultural resources affected.

Impact Category	Comment(s)
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. Low impact. a,b,d. May possibly increase dissolved solids, salinity, and chlorides in the Lower Guadalupe River downstream of the Guadalupe-Blanco River Authority Diversion System during periods when permitted run-of-the-river water is diverted to the off-channel reservoir.
c. Impacts to State water resources	• No apparent negative impacts on water resources
d. Threats to agriculture and natural resources in region	• None
e. Recreational impacts	• None
f. Equitable comparison of strategies	• Standard analyses and methods used
g. Interbasin transfers	• New authorization required for use outside of Guadalupe-Blanco River Authority statutory district and within the San Antonio-Nueces Coastal Basin. More requirements must be met to obtain new authorization for uses in the Nueces River Basin or Nueces- Rio Grande Coastal Basin.
h. Third party social and economic impacts from voluntary redistribution of water	• None
i. Efficient use of existing water supplies and regional opportunities	• This project promotes efficient use of existing supplies and presents opportunities for regional supply development
j. Effect on navigation	• None
k. Consideration of water pipelines and other facilities used for water conveyance	• Reasonable and prudent measures should be taken to avoid and minimize the potential effects of the pipeline construction on the environment

9.4.9 San Patricio Municipal Water District – Transmission and Industrial Water Treatment Plant Improvements (previous 5D.14- Recommended Water Management Strategy)

In order to increase SPMWD system capacity to meet projected industrial water supply shortages, this water management strategy considered pump station and industrial water treatment plant improvements. For the purposes of this option, it was assumed that SPMWD and the City of Corpus Christi would develop recommended water management strategies to provide additional raw water supplies as needed.

At the time of analysis, the 36-inch line that ties into the MRP was able to deliver 28.5 mgd of raw water to the SPMWD WTP complex located southeast of Gregory. With pump station improvements, it will be capable of delivering 40.7 mgd. The 36-inch raw water pipeline from the Nueces River Calallen Pool intake was able to deliver 26.1 mgd to the WTP complex at the time of analysis. The 24-inch treated water pipeline from Corpus Christi delivered 5.5 mgd, which would increase to 10 mgd with a pump station. The total cost of facilities for these two pump stations was estimated at $9,400,000. Additionally, SPMWD Industrial WTP improvements are needed to increase average day treatment capacity by 18,529 ac-ft/yr, or 21.4 mgd, to meet industry needs. Estimated costs for WTP facilities are $32,357,000. The total cost of project, excluding land costs as SPMWD already purchased land for pump stations, is an estimated $58,366,000. The total annual cost of system improvements is $14,997,000. Dividing annual cost by the project yield, and projected 2070 shortage of 18,529 ac-ft, equated to an annual cost of $809 per ac-ft or $2.48 per 1,000 gallons, as shown in Table 9.15.

Table 9.15.
Evaluation Summary for SPMWD Transmission and Industrial WTP Improvements

Impact Category	Comment(s)
a. Water supply:	
1. Quantity	1. 18,529 ac-ft/yr.
2. Reliability	2. High reliability.
3. Cost of treated water	3. $809 per ac-ft.
b. Environmental factors:	
1. Instream flows	1. Negligible impact.
2. Bay and estuary inflows	2. Negligible impact. The SPMWD Transmission and Industrial WTP Improvements may have minor increases in return flows to Nueces Bay and Estuary.
3. Wildlife habitat	3. Negligible impact. The SPMWD Transmission and Industrial WTP Improvements will not disturb unaltered and/or new land.
4. Wetlands	4. Negligible impact.
5. Threatened and endangered species	5. Negligible impact. The SPMWD Transmission and Industrial WTP Improvements will not disturb unaltered and/or new land.
6. Cultural resources	6. Negligible impact. All work on SPMWD property or existing right-of-way should be no impact.
7. Water quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	7. Low or no impact. The SPMWD Transmission and Industrial WTP Improvements will likely produce water of higher quality than the original source water (including lowered TDS), as the facility would remove solids.
c. Impacts to State water resources	• No apparent negative impacts on water resources
d. Threats to agriculture and natural resources in region	• None
e. Recreational impacts	• None
f. Equitable comparison of strategies	• Standard analyses and methods used
g. Interbasin transfers	• Not applicable
h. Third party social and economic impacts from voluntary redistribution of water	• None
i. Efficient use of existing water supplies and regional opportunities	• Improvement over current conditions
j. Effect on navigation	• None
k. Consideration of water pipelines and other facilities used for water conveyance	• None

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10

Public Participation and Plan Adoption

[31 TAC § 357.12;
31 TAC § 357.21;
31 TAC § 357.50;
31 TAC § 358.3]

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Chapter 10: Public Participation and Plan Adoption

10.1 Public Involvement Program

The public involvement program was incorporated at the onset of the Coastal Bend Regional Water Planning Group (CBRWPG) 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 providing comments on the Initially Prepared Regional Water Plan.

The public involvement program included:

- An opportunity at all regional water planning group meetings for the public to comment on any aspect of the plan or planning process;
- Press releases and notices of public meetings; and
- Dedicated website for CBRWPG information.
- **Public Hearing for the Initially Prepared Plan will be held**:

  May 15, 2025
  500 IH69, Suite 805, Robstown, TX 78380

  See Nueces River Authority website for additional details, in accordance with statutory posting notice requirements: https://www.coastalbend-rwpg.org/

The CBRWPG conducted all business in meetings that were posted according to Texas Open Meetings Act and Public Information Act provisions. The plan was developed in accordance with Texas Administrative Code (TAC) public participation requirements specified in 31 TAC §357.12, §357.21, and §357.50(f).

10.2 Coordination with Wholesale and Major Water Providers

Information was provided by wholesale water providers located in the Coastal Bend Planning Region throughout development of the plan. Wholesale water providers (WWPs) were contacted to confirm water supplies and future water supply plans prior to identifying feasible water management strategies. Furthermore, wholesale water providers were provided water supply plan information from the technical consultant for review and comment prior to providing to the CBRWPG for consideration.

Emails were sent to water user groups (WUGs) and WWPs in November 2023, January 2024, and February 2024 with follow-up phone calls to gather information on potentially feasible water management strategies to evaluate for the *2026 Coastal Bend Regional Water Plan*. In the fall 2024, HDR Engineering, Inc. (HDR) received requests from the City of Corpus Christi, Port of Corpus Christi Authority, and City of Mathis on new water management strategies that they would like considered in the Coastal Bend Region plan. In response, the CBRWPG agreed on an approach at the December 12, 2024, meeting that placeholders for new water management strategies in the early stages of development would be included in the Initially Prepared Plan if full evaluations could not be completed in time. In January and February 2025, additional request of four new water management strategies were received which included one new water management strategy for the City of Corpus Christi, one new strategy by the City of Beeville, and two new water management strategies for the South Texas Water Authority (STWA).

Representatives from water supply entities within the CBRWPG were also regularly notified of all CBRWPG meetings and public informational meetings.

10.3 Coastal Bend Regional Water Planning Group Meetings

The CBRWPG regularly met in accordance with the approved bylaws. The CBRPWG met on a more frequent basis as needed in order to facilitate and direct the water planning of the region. The following is a summary of the meetings associated with development of the 2026 regional water plan.

Coastal Bend RWPG Meetings

- February 4, 2021
- July 1, 2021
- October 7, 2021
- August 4, 2022
- March 3, 2022
- January 26, 2023
- May 18, 2023
- October 12, 2023
- January 26, 2024
- February 22, 2024
- May 16, 2024
- October 17, 2024
- December 12, 2024
- January 30, 2025
- February 27, 2025
- May 15, 2025
- September 11, 2025

*Future meetings.

The CBRWPG requested that the TWDB execute the initial contract to develop the 2026 Coastal Bend Regional (Region N) Water Plan on February 4, 2021. Consistent with by-laws, the CBRWPG elected not to re-procure for the 2026 planning cycle and selected HDR as the technical consultant for development of the 2026 regional water plan.

The CBRWPG executive committee was appointed on March 3, 2022, consisting of Scott Bledsoe (co-chair), Dr. Pancho Hubert (co-chair), Lonnie Stewart (secretary), Tom Reding (member-at-large), Joe Almaraz (member-at-large).

The CBRWPG held a pre-planning public meeting on October 7, 2021, to obtain public input on development of the 2026 regional water plan.

The CBRWPG adopted the process to identify potentially feasible water management strategies on October 12, 2023.

On January 26, 2023, the CBRWPG discussed identifying infeasible water management strategies recommended in the 2021 regional water plan. The CBRWPG on October 12, 2023 requested to keep all strategies included in the 2021 regional water plan as responses were not received from WUG or sponsor that projects were infeasible.

The CBRWPG accepted public and wholesale water provider input on potentially feasible water management strategies at the CBRWPG meeting on January 25, 2024, and at a water utility workshop on January 26, 2024. The CBRWPG approved water management strategies for evaluation in the 2026 regional water plan on May 16, 2024.

The CBRWPG chose no Modeled Available Groundwater (MAG) peak factors for groundwater availability on January 26, 2024.

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.

Review Population, Municipal and Mining Water Demand Projections

- Subcommittee Members: Gene Camargo, Carl Crull, Esteban Ramos, and Mark Scott
- Designated by the CBRWPG: March 3, 2022
- Subcommittee meeting: June 1, 2022 (for draft list of municipal WUGs, historical use, and per capita); April 10, 2023 (population and municipal water demand projections)

Review Non-municipal Water Demand Projections (Manufacturing, Steam-Electric, Irrigation, Livestock

- Subcommittee Members: Teresa Carrillo, Andy Garza, Esteban Ramos, Charles Ring, Mark Sugarek, and Lonnie Stewart
- Designated by the CBRWPG: March 3, 2022
- Subcommittee meeting: September 8, 2022

Develop and Review List of Potentially Feasible Water Management Strategies and Prioritize for Evaluation

- Subcommittee Members: Joe Almaraz, Carl Crull, Andy Garza, Esteban Ramos, John Marez, and Lonnie Stewart
- Designated by the CBRWPG: October 12, 2023
- Subcommittee meeting: April 9, 2024

Subcommittee to Discuss Drought Response Recommendations and Identify Emergency Interconnections

- Subcommittee Members: Scott Bledsoe, Teresa Carrillo, James Dodson, William Griffin, and Esteban Ramos
- Designated by the CBRWPG: October 17, 2024
- Subcommittee meeting: November 6, 2024, and December 2, 2024

Subcommittee on Unique Stream Segments/Reservoir Sites and Legislative and Policy Recommendations

- Subcommittee Members: Carl Crull, Dr. Pancho Hubert, Esteban Ramos, and Lonnie Stewart.
- Designated by the CBRWPG: October 17, 2024
- Subcommittee meetings: November 14, 2024

The CBRWPG approved the Initially Prepared Plan on February 27, 2025 for submittal to the Texas Water Development Board (TWDB).

10.4 Regional Water Planning Group Chairs Conference Calls and Meetings

The Texas Water Development Board held conference call meetings with Regional Water Planning Group chairs to provide guidance and respond to issues regarding the planning process on February 22, 2021, June 30, 2021, January 26, 2022, December 8, 2022, June 27, 2023, September 28, 2023, January 16, 2024, May 10, 2024, and December 9, 2024.

10.5 Interregional Coordination

On October 7, 2021, the CBRWPG discussed the process for conducting interregional coordination for water management strategies during development of the 2026 Regional Water Plan. At that time, Carl Crull was appointed as interregional planning council representative, with Teresa Carrillo as an alternate. Carl Crull participated in interregional planning council meetings on November 30, 2023, and February 8, 2024, as well as numerous calls during development of the 2026 regional water plan.

Several coordination calls between the CBRWPG technical consultant and the South Central Texas (Region L) regional water planning group consultant occurred during development of the initially prepared plan.

There are no known interregional coordination conflicts for any recommended or alternative water management strategies in the 2026 Coastal Bend Plan.

10.6 Coordination with Other Entities

Frequent coordination calls occurred between the technical consultant and wholesale water providers and individual WUGs to confirm water supplies and future water supply plans.

Region N surveys were developed for (1) municipal water users and (2) industrial water users. The municipal water survey was sent in response to TWDB guidance to gather information on current supplies, drought response, and emergency connections for rural water users groups. It was sent on November 19, 2024, to over 30 municipal WUGs in the Coastal Bend Region with reminders sent on December 3, 2024. The industrial water survey was developed in response to industrial water conservation discussions to gather information on best practices. The survey was sent on November 22, 2024, with reminders sent on December 4 and 9, 2024.