FINAL PLAN

CHAPTER 1: DESCRIPTION OF THE REGIONAL WATER PLANNING AREA

Rio Grande Regional Water Plan

BV PROJECT NO. 411250

PREPARED FOR

Rio Grande Regional Water Planning Group

7 OCTOBER 2025

BLACK & VEATCH

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List of Abbreviations

ac-ft	Acre-Feet
ac-ft/yr	Acre-Feet per Year
BRACS	Brackish Resource Aquifer Characterization System
CRP	Clean Rivers Program
DCP	Drought Contingency Plan
DMI	Domestic/Municipal/Industrial
DOR	Drought of Record
ESA	Endangered Species Act
IBWC	International Boundary and Water Commission
IWRP	Integrated Water Resources Plan
mg/L	Milligrams per Liter
MUD	Municipal Utility District
MWP	Major Water Provider
NWR	National Wildlife Refuge
PUB	Public Utilities Board
RWP	Regional Water Plan
RWPG	Regional Water Planning Group
SB1	Senate Bill 1
SP	State Park
SUD	Special Utility District
SWP	State Water Plan
TCEQ	Texas Commission on Environmental Quality
TMDL	Total Maximum Daily Load
TPDES	Texas Pollutant Discharge Elimination System
TPWD	Texas Parks and Wildlife Department
TWDB	Texas Water Development Board
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
WAM	Water Availability Model
WID	Water Improvement District
WMA	Wildlife Management Area
WMS	Water Management Strategy
WPP	Watershed Protection Plan
WSC	Water Supply Corporation
WUG	Water User Group

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1.0 Description of the Regional Water Planning Area

1.1 Planning Background

The Texas Water Development Board (TWDB) was established in 1957 through a state constitutional amendment and is charged with preparing a comprehensive and flexible long-term plan for the development, conservation, and management of the state's water resources. Historically, the State Water Plan (SWP) had been prepared by the TWDB with input from other state and local agencies and the public. Senate Bill 1 (SB1) was enacted in 1997 by the 75th Legislature; the bill established a "bottom up" approach whereby SWPs would be based on Regional Water Plans (RWPs) prepared and adopted by the 16 Regional Water Planning Groups (RWPGs). SB1 states the purpose of regional water planning:

"…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 the current SWP. In 2013, House Bill 4 was enacted, which lends greater weight to the SWP by committing an additional funding pool to the implementation of projects recommended in the plan by way of the State Water Implementation Fund for Texas.

The Rio Grande Regional Water Planning Group (Region M) members, listed in Table 1-1, act as the decision-making body for the regional water planning effort. The Lower Rio Grande Valley Development Council serves as the political subdivision to administer the regional water planning grant, and Black & Veatch Corporation was selected as the prime consultant for the planning and engineering tasks required for development of the RWP.

Table 1-1 Region M Water Planning Group

Interest	Name	Resident County
Public	Tomas Rodriguez	Webb
	Laredo	
Counties	Joe Rathmell	Zapata
	County Judge, Zapata County	
	David L. Fuentes	Hidalgo
	Precinct 1 Commissioner, Hidalgo County	
Municipalities	Jorge Flores	Maverick
	Eagle Pass Water Works	
	Marilyn Gilbert	Cameron
	Brownsville Public Utilities Board	

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Interest	Name	Resident County
Industries	Donald K. McGhee, Secretary*	Cameron
	Hydro Systems, Inc., Harlingen	
Agriculture	Neal Wilkins, Ph.D.	Jim Hogg
	East Wildlife Foundation	
	Dale Murden	Hidalgo
	Texas Citrus Mutual, Mission	
Environmental	Jaime Flores	Hidalgo
	The Arroyo Colorado Watershed	
Small Business	Carlos Garza	Hidalgo
	AEC Engineering, LLC, Edinburg	
	Nick Benavides*	Webb
	Nick Benavides Co., Laredo	
River Authorities	Jim Darling, Chairman*	Hidalgo
	Rio Grande Regional Water Authority	
Water Districts	Sonny Hinojosa, Vice-Chairman*	Hidalgo
	Hidalgo County Irrigation District No. 2, San Juan	
	Tom McLemore	Cameron
	Harlingen Irrigation District	
Water Utilities	Steven Sanchez	Hidalgo
	North Alamo Water Supply Corporation (WSC)	
Groundwater Management Area	Louie Peña	(GMA 16)
	Brush Country GCD	
	Debbie Farmer	(GMA 13)
	Wintergarden GCD, Carrizo Springs	
Other	Glenn Jarvis	Hidalgo
	Attorney, McAllen	
	Frank Schuster*	Hidalgo
	Val Verde Vegetable Co., McAllen	
Electric Generating Utilities	Robert Latham	Hidalgo
	Magic Valley Generation Station	
*Executive Committee Member		

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The RWPs are updated every 5 years and used as a part of the update to the SWP. The RWPs, which are based on an assessment of future water demands and currently available water supply, include specific recommendations for meeting identified water needs through the end of a 50-year planning horizon (2030 through 2080 for this plan). The plans also include recommendations regarding policy at the state and local level, including environmental protection, drought response, and resource management.

1.2 The Rio Grande Regional Water Planning Area

The Rio Grande Regional Water Planning Area (Region M) consists of the eight counties along the middle and lower Rio Grande up to the mouth of the river at the Gulf of Mexico (Figure 1-1).

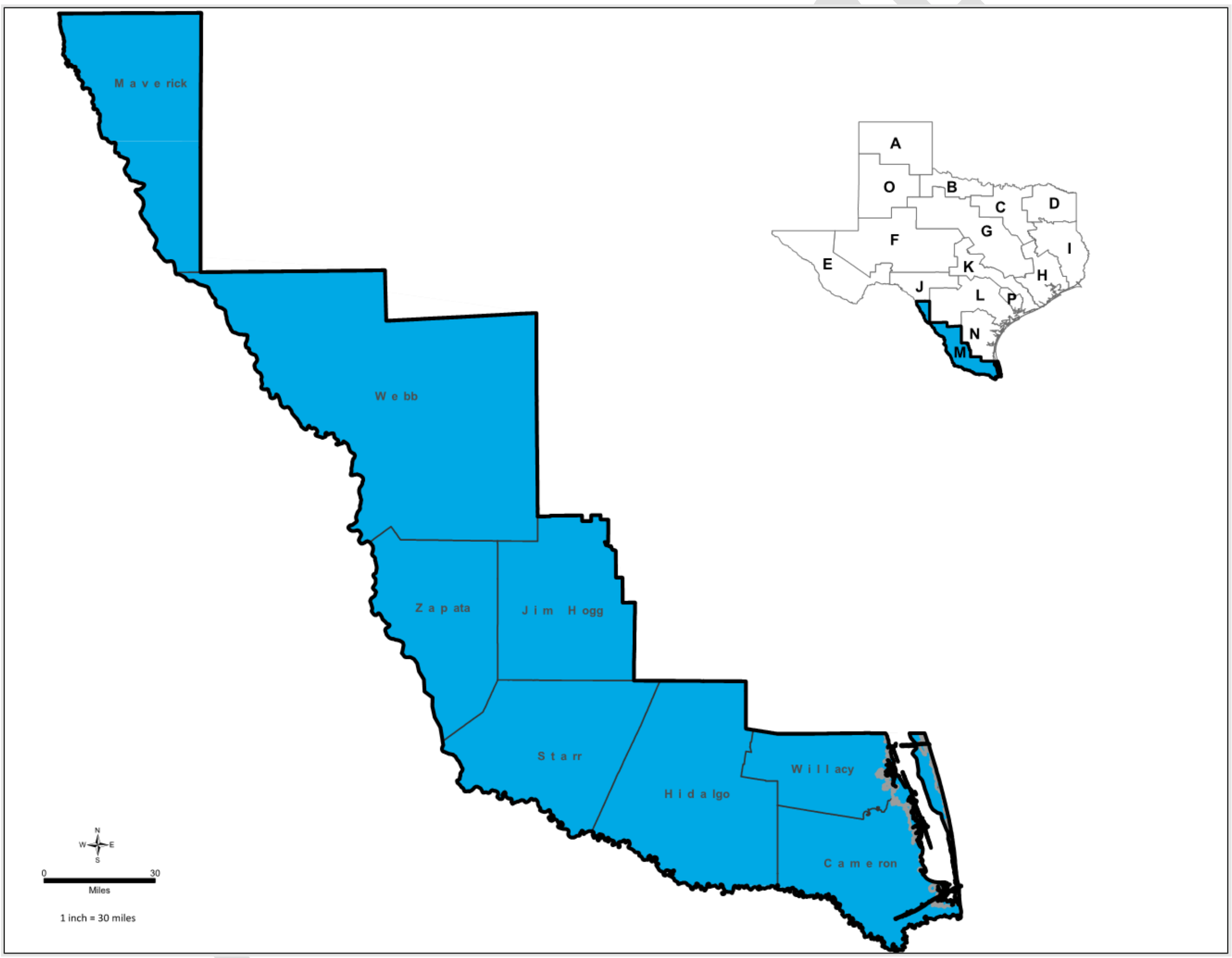

Figure 1-1 Rio Grande Regional Planning Area (Region M)

1.2.1 Climate

The climate ranges from humid subtropical in the eastern portion, nearest to the Gulf Coast, and drier tropical to subtropical in the west. The number of frost-free days varies from 320 days at the coast to 230 days in the northwestern portion of the region near Maverick County, resulting in a long growing season most years.[1] The amount of rainfall varies across the Lower Rio Grande Region from an average of 28 inches at the coast to 18 inches in the northwestern portion of the region; rainfall is primarily from thunderstorms in the spring and occasional hurricanes in the late summer and fall. These storms can generate tremendous amounts of rainfall over a short period of time and cause extensive flooding because of the region's relatively flat terrain. The fall storms provide a large portion of the surface water runoff captured in water supply reservoirs within the Rio Grande basin.

1.2.2 Population and Economy

The population of Region M is concentrated in Cameron, Hidalgo, and Webb counties, accounting for 90.5 percent of the regional total in 2020. Figure 1-2 shows the historical population in each county (US Census historical data).

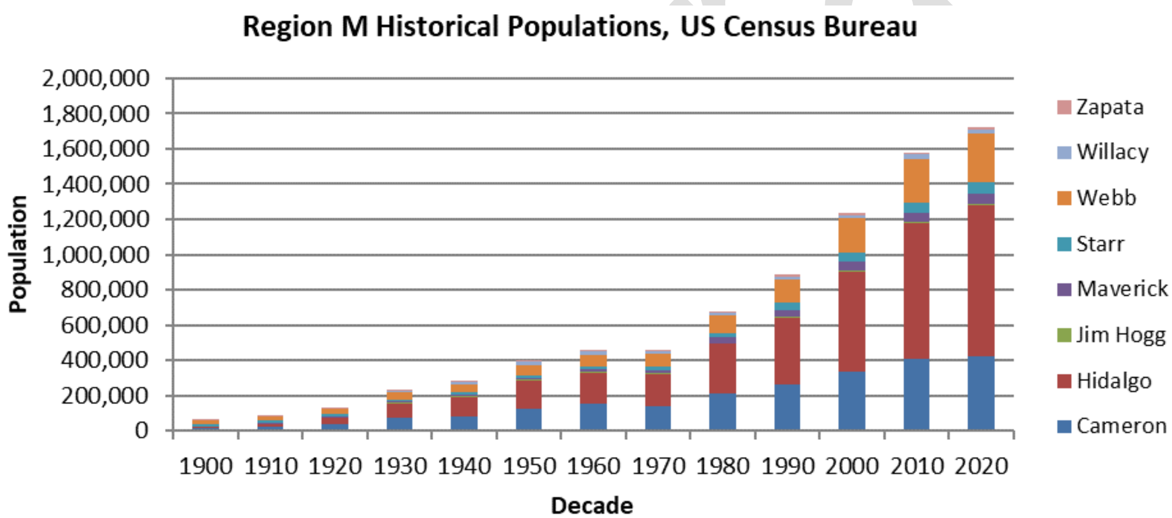

Figure 1-2 Region M Historical Populations, US Census Bureau

[1] "Texas Interactive Average Last Frost Date Map." Plantmaps.com, www.plantmaps.com/interactive-texas-last-frost-date-map.php.

Figure 1-3 shows current population centers in Region M. The population of the region is expected to grow to over 2.1 million people by the end of the current planning horizon, which represents a 11.8 percent population increase from 2030 to 2080. Chapter 2 describes the population and municipal demand projections in detail.

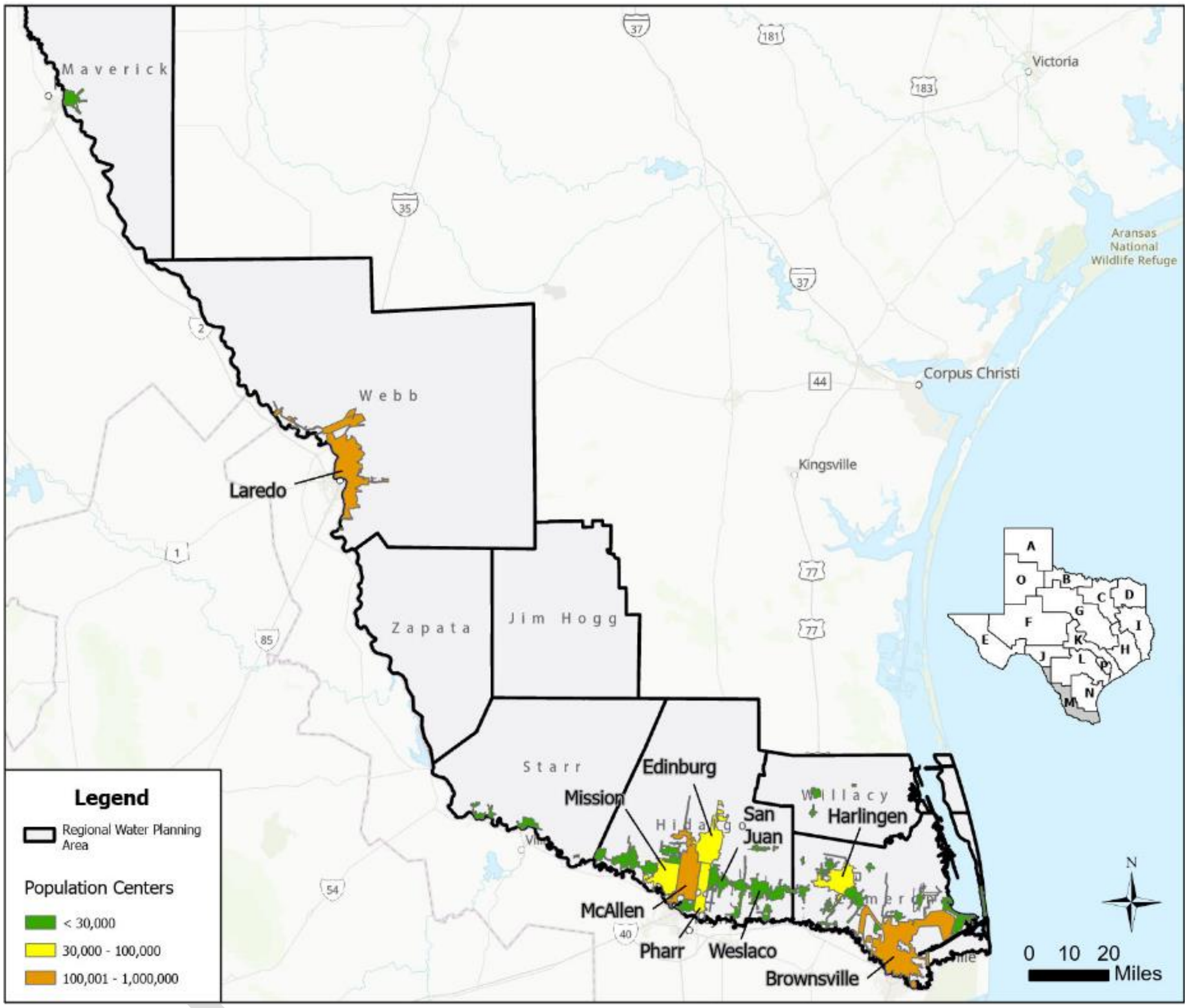

Figure 1-3 Population Centers of Region M

An important factor driving rapid population growth in the Rio Grande Region is its cultural, social, and economic relationship with Mexico. Nationwide, Mexico's population growth rate in 2020 was 0.7 percent, compared with 1 percent for the United States.[2] The Mexican portion of the Rio Grande watershed (known as the Rio Bravo in Mexico) was home to approximately 12.61 million people in 2017 and is anticipated to have 14.4 million inhabitants by 2030.[3] An annual growth rate of 1.01 percent is projected by the World Bank between 2017 and 2030; using this growth rate, the projected population

[2] World Bank Population Growth Data. http://data.worldbank.org/indicator/SP.POP.GROW accessed 6/18/24.
[3] Estadísticas del Agua en México, 2018. Gobierno de la República de México, Secretaría de Medio Ambiente y Recursos Naturales, Comisión Nacional del Agua https://files.conagua.gob.mx/conagua/publicaciones/Publicaciones/EAM2018.pdf. Accessed 06/10/2019.

in 2070 would be over 21 million. Growth on both sides of the border will continue to put pressure on the capabilities of surface and groundwater to meet the region's needs.

Historically, agriculture has dominated the economy of the Rio Grande Region. There has been a shift toward urbanization and diversification of the economy, but agriculture still plays a major role.

The 2022 United States Department of Agriculture (USDA) Census of Agriculture lists the total pre-tax income from farm-related sources as $77.7 million for Region M, of $1.9 billion across Texas. Grain sorghum, sugar cane, cotton, citrus, and onions make up the bulk of the agriculture receipts in the region, and most of this is centered in Hidalgo and Cameron counties (Figure 1-4).[4] Cattle and farmland accounted for just under 6 million acres, almost 80 percent of the region's land area. In 2024, the Rio Grande Valley Sugar Growers, Inc. decided to close the only sugar mill in Texas due to the lack of reliable water supply, including the reduced deliveries from Mexico. The mill supported hundreds of mill workers and over 100 local sugar cane growers, and its closure will have a significant impact on the economy in the Rio Grande Valley.

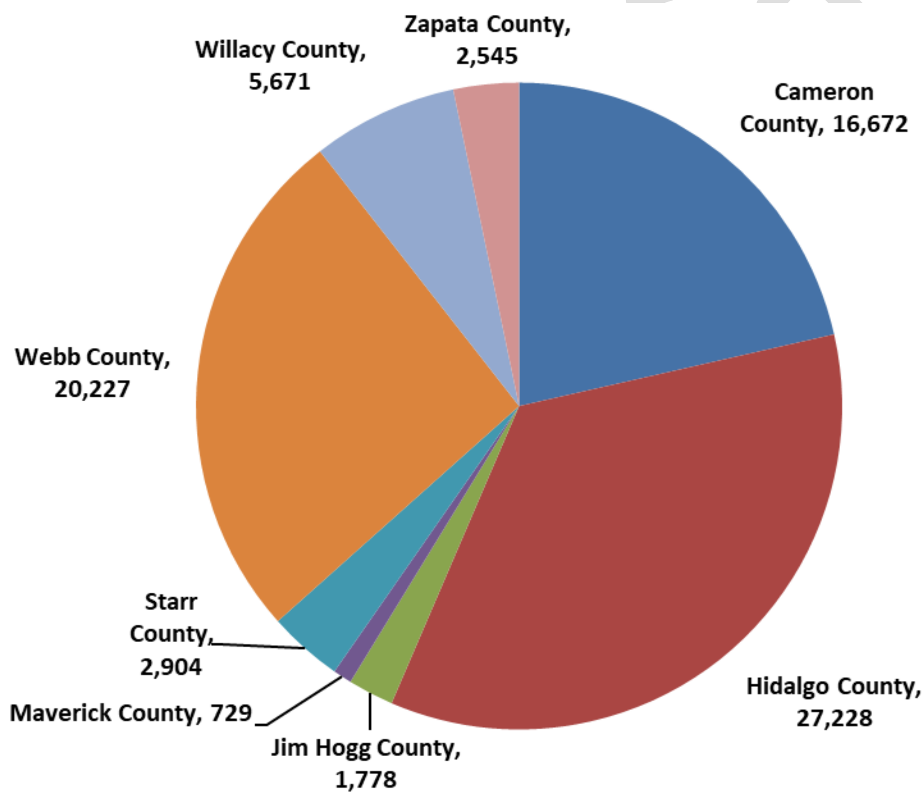

Figure 1-4 Pre-Tax Gross Farm Income by County ($1,000), USDA 2022 Agriculture Census

[4] USDA. *2022 Agricultural Census*. https://www.nass.usda.gov/Publications/AgCensus/2022/Full_Report/Volume_1,_Chapter_2_County_Level/Texas/st48_2_001_001.pdf. Accessed 7/11/2024.

The Texas labor market forecasts for 2020 to 2030 predict 17 percent employment growth in the planning area. The major economic growth areas are construction, professional and business services, education and health services, and leisure and hospitality; information technology and mining show little to no growth.[5]

Oil and gas production in the region changed considerably in the 2000s from traditional oil drilling to hydraulic fracturing and nontraditional development, which had a significant impact on the regional economy and associated water demands. Mining water demands are discussed further in Chapter 2.

Nature tourism contributes considerably to the Rio Grande Valley economy. The Economic Impact of Travel on Texas report from 2018 shows that travel and visitor spending within the Rio Grande Valley had been steadily increasing, but has seen minor decline in recent years (Figure 1-5).[6] The quality of the river and its adjacent wildlife habitat will directly affect the number of ecotourists visiting the region in the future.

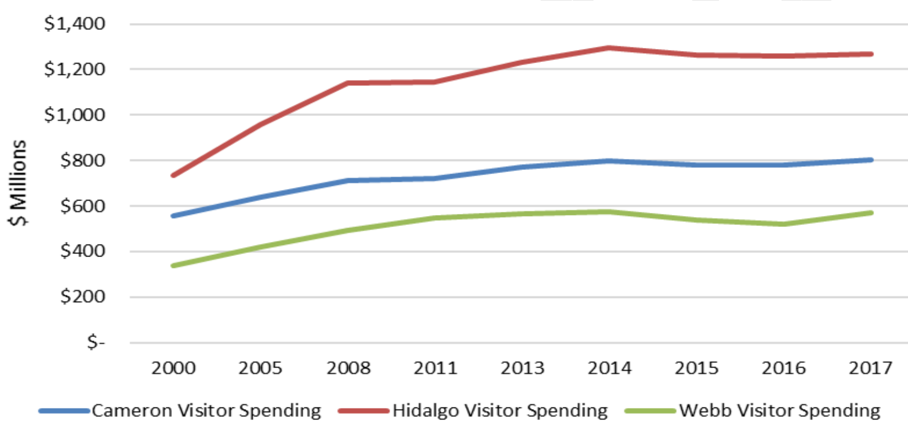

Figure 1-5 Direct County Travel Spending ($ Millions)

Despite growth in some sectors of the economy, the region experiences significantly lower income and higher unemployment than the rest of Texas and the nation as a whole (Table 1-2). A clear division exists between the urban growth centers (Brownsville, McAllen, Harlingen, and Laredo) and smaller rural towns and colonias. Colonias are semi-rural subdivisions that are often built with substandard potable water and sanitary sewer systems. The properties are often sold through a contract for deed, which is a loan from the seller to the buyer that is paid in installments while the seller retains the title. This arrangement does not allow the homeowner to access traditional home ownership financing. There have been efforts at the state, county, and local levels to provide basic services in many of the colonias in Region M.[7]

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[5] Texas Labor Market and Career Information, Texas Workforce Commission. https://texaslmi.com/LMIbyCategory/Projections . Accessed 7/11/2024.

[6] Dean Runyan Associates. The Economic Impact of Travel on Texas. 2020 https://static1.squarespace.com/static/5ea0c297db073c065cc8f3a7/t/6154bb00195acd09f0b205fd/1632942878218/TX_TravelImpacts_2020.pdf. Accessed 7/11/2024.

[7] Texas Secretary of State website. http://www.sos.state.tx.us/border/colonias/faqs.shtml. Accessed 2/25/2015.

Table 1-2 Median Household Income, Poverty, and Unemployment Rate, by County

County	Median Household Income, 2022 ($/Year)[1]	Persons in Poverty Level, 2023 (%)[1]	Unemployment Rate, 2024 (in 2024 $) (%)[2]
Cameron	$47,435	22.60%	4.80%
Hidalgo	$49,371	27.40%	5.40%
Jim Hogg	$42,292	26.90%	4.40%
Maverick	$48,497	21.90%	8.00%
Starr	$35,979	32.80%	8.60%
Webb	$59,984	20.90%	3.70%
Willacy	$42,839	29.00%	6.60%
Zapata	$35,061	32.80%	6.10%

[1] US Census Bureau State and County, QuickFacts. https://www.census.gov/quickfacts/fact/table/tx/INC110217. Accessed 6/26/2024.

[2] Bureau of Labor Statistics, Unemployment. https://data.bls.gov/map/MapToolServlet. Accessed 6/26/2024.

As of 2023, seven out of the eight counties in Region M are labeled as eligible for funds through the Economically Distressed Areas Program.[8]

1.2.3 Surface Water Resources

Region M draws the majority of its water from the Rio Grande via the Amistad-Falcon Reservoir system, which is jointly operated with Mexico. Inflows to the watershed come from both the United States and Mexican watersheds. Two major treaties between Mexico and the United States (1906 and 1944) establish how these waters are shared. Annually, Mexico is to deliver a minimum of 350,000 acre-feet (ac-ft) to the United States on average over a 5-year cycle. Exceptions are provided for years of extraordinary drought, when the watershed in Mexico cannot provide sufficient runoff water, or in cases of serious accident to hydraulic systems. The International Boundary and Water Commission (IBWC) manages the accounting of water in Mexican and US storage. The IBWC began negotiation of a new Minute in 2023 to increase the predictability and reliability of Rio Grande water deliveries to users in both the United States and Mexico. Minute 331 was signed by the United States and Mexico on November 7, 2024.

Releases from Amistad and Falcon reservoirs to deliver water to users are coordinated by the Rio Grande Watermaster. Amistad-Falcon reservoir system water rights are apportioned using classes of water rights (different from prior appropriation, which is used on most rivers in Texas). The three classes are Domestic/Municipal/Industrial (DMI), and Class A and Class B, which are typically designated for irrigation and mining. Each water right holder has an annual maximum diversion, and each withdrawal of water is "charged to" their account. The exception to this is when the system is operating in excess flow and/or storage, so the Watermaster may declare a period of "no charge pumping."

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[8] Texas Water Development Board. Economically Distressed Areas Program Quarterly Report. September 1, 2022 – August 31, 2023. https://www.twdb.texas.gov/publications/reports/edap_reports/doc/SFY2023-EDAP-Annual-Report.pdf?d=5372.600000023842. Accessed 6/26/2024.

The US portion of reservoir storage capacity is divided into storage pools that are designated for reservoir operations or fulfillment of water rights; each class of water rights has a dedicated storage pool in the reservoir accounting system as outlined in the Texas Administrative Code Chapter Subchapter C §303.22.[9] With the amount of U.S. water in storage in the Amistad-Falcon Reservoir System on the last Saturday of each month, the Rio Grande Watermaster performs the following calculation: 4,600 acre feet is deducted for Dead Storage, 225,000 acre feet is deducted to re-establish the Domestic, Municipal, and Industrial Reserve, from the remaining storage, the end-of-month account balances for all Lower and Middle Rio Grande irrigation and mining accounts is deducted, and from the remaining storage, 75,000 acre feet is deducted for the Operational Reserve. If there is water remaining after the computation, it may be allocated to the Class A and Class B (irrigation and mining) accounts with Class A receiving 1.7 times more than Class B accounts.

The Arroyo Colorado (Figure 1-6) flows approximately 90 miles from its headwaters southwest of the City of Mission, to its confluence with the Lower Laguna Madre in the northeast portion of Cameron County. The Arroyo Colorado is an ancient distributary channel of the Rio Grande. The land area that drains into the Arroyo Colorado is known as the Arroyo Colorado Watershed. This area is approximately 706 square miles or 500,000 acres covering portions of three Texas counties (Hidalgo, Cameron, and Willacy) and over 25 municipalities in the Lower Rio Grande Valley. Approximately 330,000 acres of the watershed are used for agriculture. Agricultural producers in the watershed grow cotton, grain sorghum, corn, sugar cane, citrus, and vegetables because of the fertile soil, temperate climate, and access to irrigation water. Almost all the irrigation return flows and urban runoff from these areas are discharged into drainage canals which flow to the Arroyo Colorado and are the main source of excess nutrients entering the waterbody. Perennial (year-round) flow is sustained mainly by flows from municipal wastewater treatment facilities.

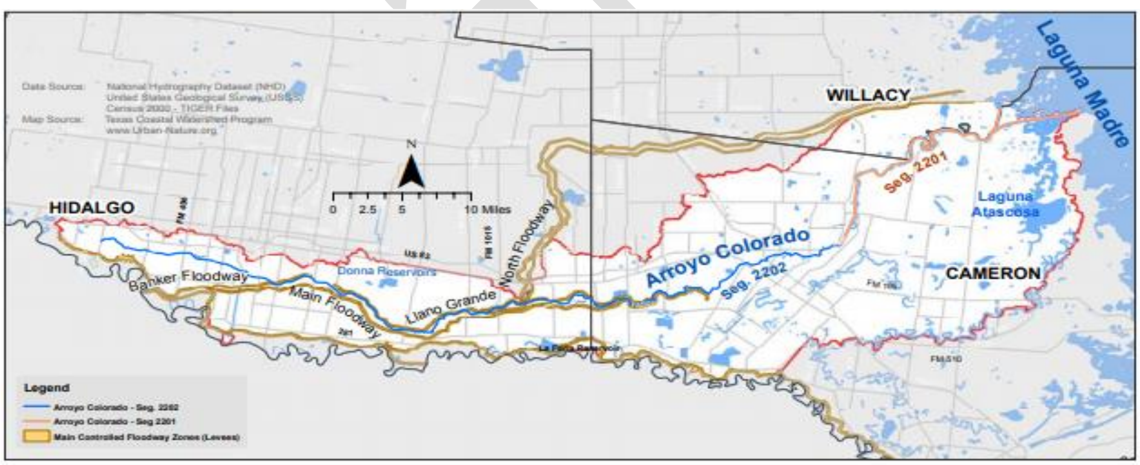

Figure 1-6 Hydrologic Map of the Arroyo Colorado Showing Floodway Systems (Arroyo Colorado Watershed Protection Plan, 2017 update)[10]

The Arroyo Colorado River is the primary source of freshwater for the Lower Laguna Madre, which is one of only three hypersaline lagoons (i.e., saltier than the ocean) in the world and is considered the

[9] Texas Administrative Code https://texreg.sos.state.tx.us/public/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=30&pt=1&ch=303&rl=22. Accessed 6/26/2024.

[10] Arroyo Colorado Watershed Protection Plan. https://arroyocolorado.org/.

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most productive hypersaline lagoon system. As a result of this, it is imperative not only that adequate amounts of freshwater flow into the Lower Laguna Madre but that the water quality meets the needs of the various uses of the water body including irrigation, recreation, industrial, municipal, and aquatic life. Having water of good quality not only improves the uses of the Arroyo Colorado but also improves the economy in the region. The Rio Grande and the Arroyo Colorado are discussed in detail in Chapter 3.

The three river basins in Region M are shown on Figure 1-7. The Rio Grande basin in Hidalgo and Cameron counties is a very narrow strip of land as a result of the river delta. The majority of water that is used in these counties is transported through irrigation districts from the Rio Grande basin for use in the coastal Nueces-Rio Grande basin and drains to the Gulf through drainage channels and the Arroyo Colorado.

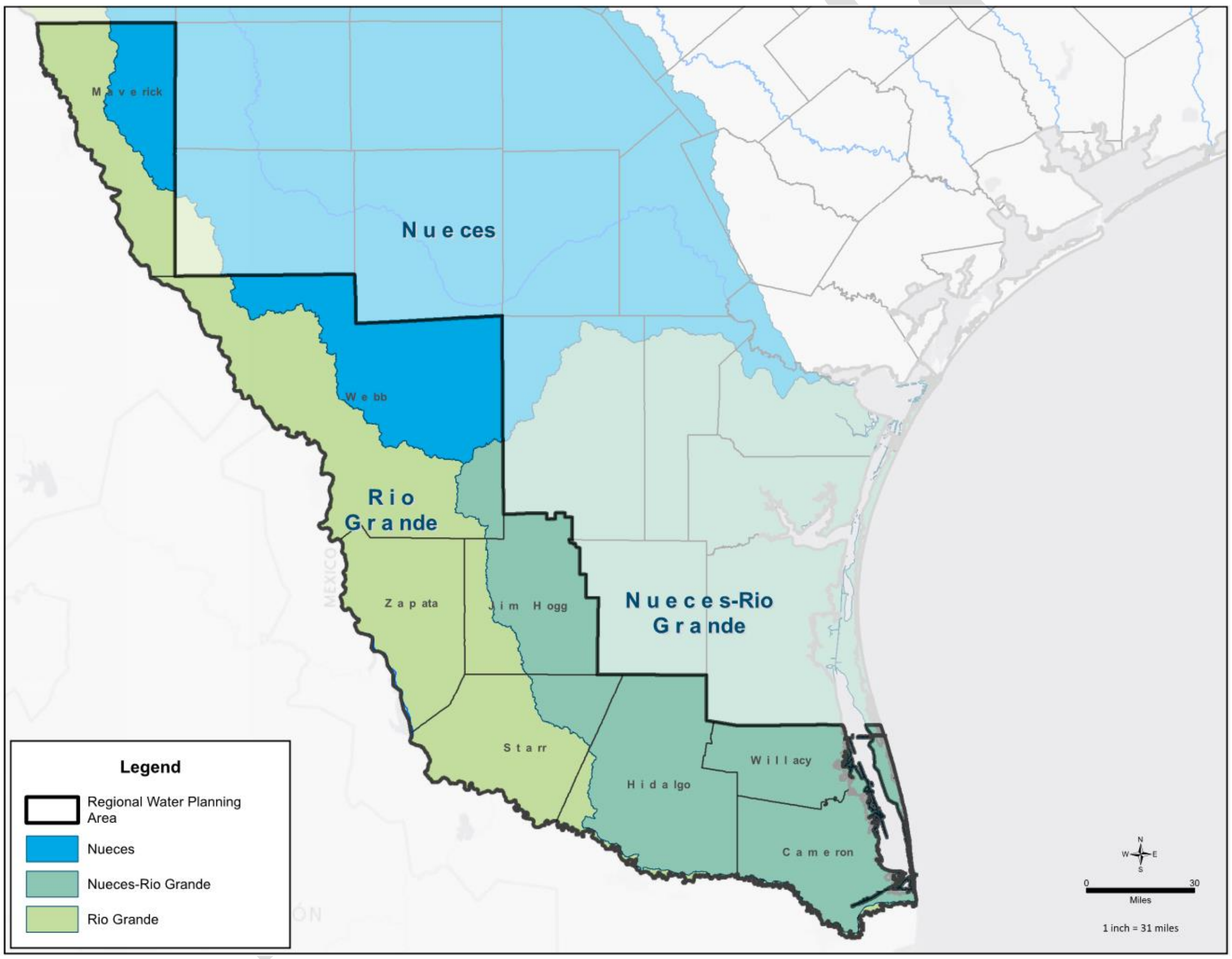

Figure 1-7 River Basins in Region M

1.2.4 Surface Water Quality

To support its charge to restore and maintain the quality of water in the state, the TCEQ establishes the Texas Surface Water Quality Standards (TSWQS) in Title 30 of the Texas Administrative Code (TAC) §307 and then monitors the water bodies to determine whether they meet applicable water quality standards. In 1991, the Texas Legislature created the Texas Clean Rivers Program (CRP) to conduct water quality monitoring and public outreach across the state through partnerships between TCEQ and local agencies in a coordinated manner.[11] The IBWC administers the CRP in the Rio Grande basin, and the Nueces River Authority administers both the Nueces and Nueces-Rio Grande basins.

Using data collected through the CRP, the TCEQ evaluates water quality in the state and identifies water bodies that do not meet the TSWQS. Every 2 years, the TCEQ compiles the *Texas Integrated Report*, which identifies water bodies with water quality impairments[12] and those with concerns for use attainment and screening levels[13]. Impaired segments are water bodies that do not meet one or more water quality standards. Segments with water quality concerns are water bodies that are near nonattainment of the water quality standards based on numeric criteria or that have water quality not meeting screening levels. The TCEQ does not currently have numeric water quality standards for nutrients in rivers, streams, and estuaries. Instead, the TCEQ uses screening methods to evaluate whether a water body exceeds screening levels for phosphorus, ammonia-nitrogen, nitrate-nitrogen, and chlorophyll-a. Water bodies that exceed the screening levels for nutrients are shown as having a water quality concern for the applicable pollutant. For some freshwater reservoirs, the TCEQ has numeric criteria for chlorophyll-a; however, none is included within the Lavaca Regional Water Planning Area.

Table 1-3 provides a list of water bodies in the Rio Grande Region for which the TCEQ assesses and reports water quality. The table identifies whether each water body is listed as having an impairment or a concern, and also identifies the parameter for which there is a water quality impairment or concern.

Table 1-3 TCEQ Rio Grande Region Water Quality Evaluation of Impairments and Concerns

Segment No.	Segment Name	Impairment(s)	Concern(s)
2201	Arroyo Colorado Tidal	Bacteria in Water, Depressed Dissolved Oxygen in Water, Mercury in Edible Tissue, PCBs in Edible Tissue	Chlorophyll-a in Water, Depressed Dissolved Oxygen in Water, Nitrate in Water, Total Phosphorus in Water
2201A	Harding Ranch Drainage Ditch Tributary (A) to the Arroyo Colorado Tidal	NA - None	NA - None
2201B	Unnamed Drainage Ditch Tributary (B) in Cameron County Drainage District No. 3	Bacteria in Water	Chlorophyll-a in Water

[11] International Boundary and Water Commission, US Section Texas Clean Rivers Program. *2022 Basin Highlights Report, Texas Rio Grande Basin Program Update*. http://www.ibwc.state.gov/CRP/Publications.html.
[12] TCEQ *2022 Texas Integrated Report - Index of Water Quality Impairments*. https://www.tceq.texas.gov/downloads/water-quality/assessment/integrated-report-2022/2022-imp-index.pdf.
[13] TCEQ *2022 Texas Integrated Report – Water Bodies with Concerns for Use Attainment and Screening Levels.* https://www.tceq.texas.gov/downloads/water-quality/assessment/integrated-report-2022/2022-concerns.pdf.

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Segment No.	Segment Name	Impairment(s)	Concern(s)
2201C	Drainage ditches flowing into Arroyo Colorado Tidal	NA - None	NA - None
2202	Arroyo Colorado Above Tidal	Bacteria in Water, Mercury in Edible Tissue, PCBs in Edible Tissue	Chlorophyll-a in Water, Nitrate in Water, Total Phosphorus in Water
2202A	Donna Reservoir	PCBs in Edible Tissue	NA - None
2202B	Unnamed Drainage Ditch Tributary (B) to S. Arroyo Colorado	NA - None	Ammonia in Water, Bacteria in Water, Chlorophyll-a in Water
2202C	Unnamed Drainage Ditch Tributary (C) to S. Arroyo Colorado	NA - None	Ammonia in Water, Bacteria in Water
2202D	Unnamed Drainage Ditch Tributary (D) to S. Arroyo Colorado	NA - None	NA - None
2202E	Unnamed Drainage Ditch Tributary (E) to S. Arroyo Colorado	NA - None	NA - None
2202F	Drainage ditches flowing into Arroyo Colorado Above Tidal	NA - None	NA - None
2301	Rio Grande Tidal	NA - None	Bacteria in Water, Chlorophyll-a in Water, Depressed Dissolved Oxygen in Water, Nitrate in Water
2302	Rio Grande Below Falcon Reservoir	Bacteria in Water	Ammonia in Water, Chlorophyll-a in Water, Depressed Dissolved Oxygen in Water, pH
2302A	Arroyo Los Olmos	Bacteria in Water, Depressed Dissolved Oxygen in Water	Chlorophyll-a in Water, Depressed Dissolved Oxygen in Water
2303	International Falcon Reservoir	NA - None	Ambient Toxicity in Water, Fish Kill in Water
2304	Rio Grande Below Amistad Reservoir	Bacteria in Water	Ammonia in Water, Ambient Toxicity in Water
2304B	Manadas Creek	NA - None	Bacteria in Water, Nitrate in Water, Total Phosphorus in Water, Antimony in Sediment
2491	Laguna Madre	Bacteria in Water, Depressed Dissolved Oxygen in Water	Bacteria in Water, Chlorophyll-a in Water, Nitrate in Water

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Segment No.	Segment Name	Impairment(s)	Concern(s)
2491OW	Laguna Madre (Oyster Waters)	Bacteria in Water	NA - None
2491A	Drainage ditches flowing into segment 2491	NA - None	NA - None
2491B	North Floodway	NA - None	Bacteria in Water, Chlorophyll-a in Water, Nitrate in Water
2491C	Drainage ditches flowing into Lower Laguna Madre	NA - None	Bacteria in Water, Chlorophyll-a in Water, Nitrate in Water, Total Phosphorus in Water
2493	South Bay	NA - None	NA - None
2493OW	South Bay (Oyster Waters)	NA - None	NA - None
2494	Brownsville Ship Channel	NA - None	Depressed Dissolved Oxygen in Water
2494A	Port Isabel Fishing Harbor	Bacteria in Water	NA - None
2494B	Drainage ditches flowing into San Martin Lakes	NA - None	NA - None
2494C	San Martin Lakes	NA - None	NA - None
2501	Gulf of Mexico	Bacteria in Water, Mercury in Edible Tissue	NA - None
2501BO	Boca Chica State Park (Recreational Beaches)	NA - None	NA - None
2501SP	South Padre Island (Recreational Beaches)	NA - None	NA - None

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The 1972 Federal Water Pollution Control Act, now called the Clean Water Act, is the federal law that establishes the National Pollutant Discharge Elimination System, which is a permit program to control point source discharges to surface waters.[14] The objective of the Clean Water Act is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. As part of this, a national goal of "fishable, swimmable" water bodies, and states are required to identify any waters that do not meet this goal and develop total maximum daily loads (TMDLs) for the water bodies. TMDLs are intended to guide watershed management and are the basis of the monitoring and identification of river segments as impaired that is undertaken in the CRP.

Rio Grande water quality within Region M is evaluated in four segments over the Middle Rio Grande sub-basin and three segments in the Lower Rio Grande sub-basin. From Amistad Dam south to the confluence with the Rio Salado from Mexico, the river is impaired for contact recreation because of high bacteria, nitrates and low dissolved oxygen, and concern for toxicity and bacteria near Laredo as a result of urban runoff and discharges outside of US jurisdiction. Manadas Creek, an unclassified water body

[14] United States Environmental Protection Agency (USEPA). Clean Water Act, http://www.epa.gov/agriculture/lcwa.html. Accessed 4/29/2019.

northwest of Laredo, has high bacteria and chlorophyll-a caused by urban runoff and high metal content from industrial activity. Falcon Reservoir is not impaired, but there is concern for toxicity near Zapata. San Felipe Creek is impaired for bacteria but has a positive effect on the Rio Grande water quality. The Lower Rio Grande sub-basin is separated into the freshwater stream and the stream impacted by tidal flows. The freshwater portion, which runs from Falcon Reservoir to downstream of Brownsville, is impaired in small reaches from consistently high bacteria counts near urban areas. Additionally, there are concerns across the entire segment for fish consumption because of elevated mercury levels. The tidal stream portion has no impairments but there can be high chlorophyll-a levels.

The Arroyo Colorado is the major drainage waterway for approximately two dozen cities in this area and almost 300,000 acres of farmland. The Arroyo Colorado includes the TCEQ Classified Stream Segments 2201 and 2202, which are impaired for high bacteria and experience high nutrient concentrations. Segment 2201 is also impaired for low dissolved oxygen.

Regular monitoring of water quality as a result of these programs draws attention to the need for continued assessment and evaluation of water data and integrated regional approaches to managing the watersheds to meet quality goals.

1.2.5 Drought of Record

The drought of record (DOR) is the basis of the firm yield projection for each river basin. The DOR identifies the worst drought on record, and the firm yield is the supply that can be expected from that river or system in that most severe drought scenario. The firm yield and DOR are determined using the Rio Grande Water Availability Model (WAM), which models the existing system and demands under historical hydrologic flows. The Rio Grande WAM has a period of record from January 1940 to December 2000.

Typically, the DOR is defined as the longest period between full reservoir storage with firm-yield demands applied to the system over the period of record. The Amistad-Falcon Reservoir system is used to store water for Mexico and the United States using a storage pool accounting system. The total storage capacity and reservoir stages under firm yield demands are shown on Figure 1-8 for the combined storage (United States and Mexico) and the portion belonging to the United States. Critical drought start and end dates are shown, as well as the storage minima and the date they occurred.

This cycle, the DOR has changed due to an update to the TCEQ Rio Grande Water Availability Model to extend the period of record through 2018. The new DOR modeled for both the combined reservoir system and the US portion spans the late 1990s to early 2000s: June 1994 (6/1994) to August 2003 (8/2003) for the US portion and January 1994 (1/1994) to May 2003 (5/2003) for the combined system.

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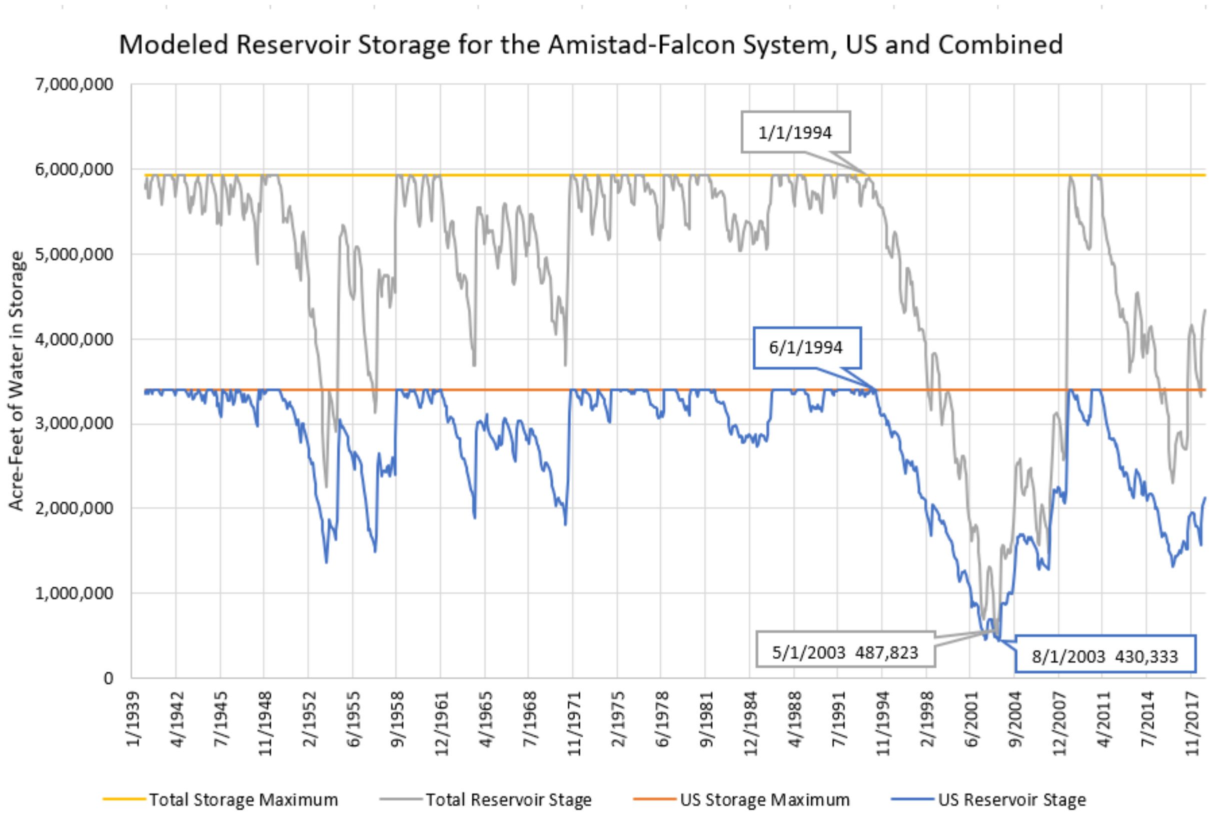

Figure 1-8 Modeled Reservoir Storage for the Amistad-Falcon System, US and Combined

The hydrologic record in the Rio Grande WAM, including all the drought periods discussed, is used to predict firm yield over the planning horizon, given in Table 1-4. The DOR is discussed in detail in Chapter 7.

Table 1-4 Firm Yield Projections, Amistad-Falcon Reservoir System 2030-2080 (ac-ft/yr)

Source	2030	2040	2050	2060	2070	2080
Amistad-Falcon Reservoir	1,001,776	1,001,268	1,000,760	999,553	997,821	995,863

1.2.6 Groundwater Resources

The major aquifer that underlies Region M is the Gulf Coast Aquifer System, which runs the extent of the Texas coast and Hidalgo, Starr, Jim Hogg, and the western portions of Willacy and Cameron counties. This aquifer is predominantly brackish, with irregular pockets of fresh and very saline water. The Carrizo-Wilcox Aquifer also spans Texas and extends through Webb and part of Maverick counties.

The minor aquifers in the region, including the Yegua-Jackson Aquifer, may produce significant quantities of water that supply relatively small areas. Figure 1-9 shows the major and minor aquifers in Region M. A more detailed discussion of each of these groundwater sources is presented in Chapter 3.

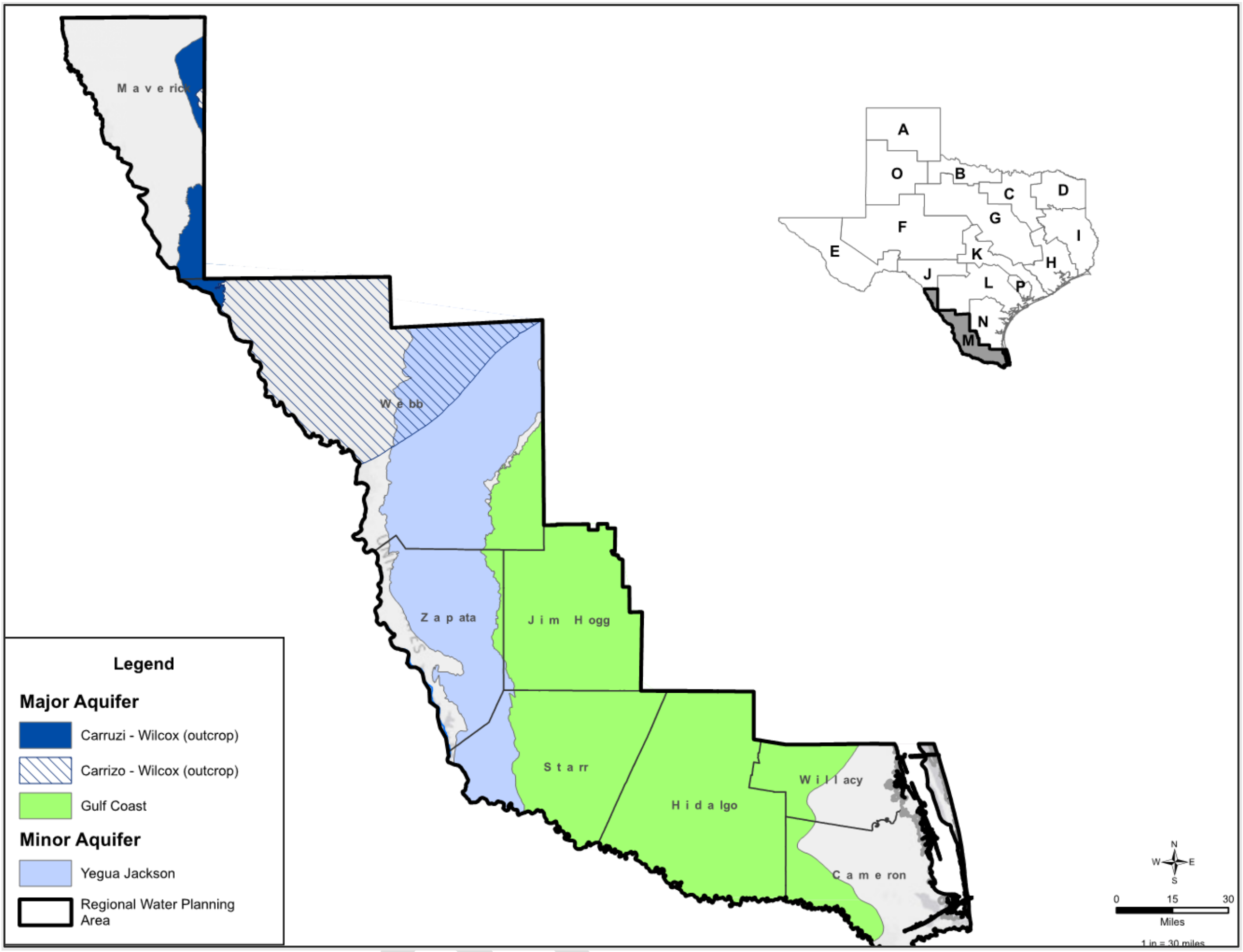

Figure 1-9 Major and Minor Aquifers in Region M

1.2.7 Groundwater Quality

In general, groundwater from the major aquifers in the region has total dissolved solids concentrations exceeding 1,000 milligrams per liter (mg/L) (slightly saline) and often exceeds 3,000 mg/L (moderately saline). Some areas of fresh and useable groundwater constitute a critical supply for many towns, domestic needs in rural areas, and livestock. Localized areas of high boron content occur throughout the study area. In response to increased development of these resources, a 2014 report from TWDB's Brackish Resource Aquifer Characterization System (BRACS) program presented information on the brackish groundwater resources of the Lower Rio Grande Valley. Chapter 3 presents a detailed description of groundwater quality of the significant aquifers in the Rio Grande Region.

1.2.8 Reuse

The use of wastewater treatment plant (WWTP) effluent as reclaimed water is becoming increasingly common as an alternative water supply. Water reuse is classified as direct or indirect and potable or non-potable. Direct reuse is defined as the use of reclaimed water that is piped directly from the WWTP to the place where it is utilized. Indirect reuse is defined as the use of reclaimed water by discharging to a water supply source, such as surface water or groundwater, where it blends with the water supply and may be further purified before being removed for non-potable or potable uses. Potable water is suitable for direct consumption, and non-potable is used to meet a range of other demands.

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Currently, 11 municipalities in Region M use reclaimed water to satisfy municipal demands, which is discussed in more detail in Chapter 3. Most uses are for non-potable purposes; however, there is likely to be increased focus on potential potable reuse water. Several utilities have been identified as feasible candidates to implement potable reuse systems, discussed further in Chapter 5.

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1.3 Current Water Use

The water use category with the largest demand in Region M is Irrigation, followed by Municipal. Demand in other water use categories is comparatively small, as shown on Figure 1-10. Regional demand is concentrated in the Lower Rio Grande Valley, specifically Cameron, Hidalgo, and Willacy counties, with a significant municipal demand in the Laredo area of Webb County. Lower Rio Grande Valley users are primarily served by a network of irrigation districts that divert water to farmers and municipal utilities from the Rio Grande.

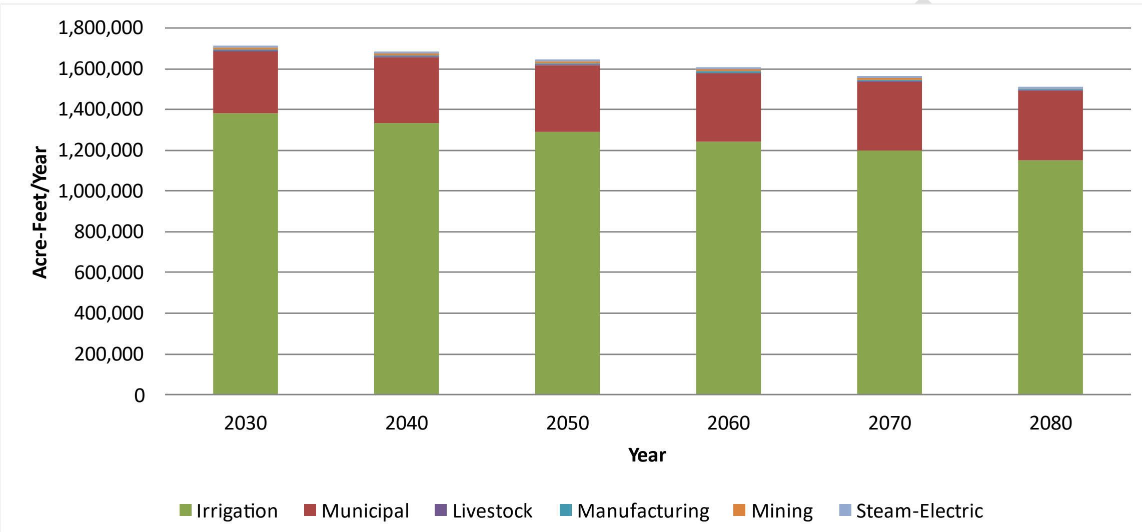

Figure 1-10 Water Demand Projections for Each Water Use Category in Region M (ac-ft/yr)

1.3.1 Water Demands

Municipal demands are expected to increase regionally from a projected 303,225 acre-feet/year (ac-ft/yr) in 2030 to 340,085 ac-ft/yr in 2080. Most municipal demand is currently met by treated surface water from the Rio Grande; however, multiple brackish groundwater desalination plants have been built since 2000. Fresh groundwater availability is limited in the region and is used mostly as a backup water supply for utilities or for individual homes, particularly in rural and unincorporated areas, with a few exceptions.[15]

Projected irrigation demands are significantly greater than municipal demands (1.38 million ac-ft/yr in 2030 and 1.15 million ac-ft/yr in 2080) but are projected to decrease as a result of both urbanization of lands and increasing pressure on the water resources of the region. Supplies available to irrigators are curtailed significantly in drought years because irrigation and mining water rights are treated as residual users of stored water from the reservoirs.

The difference between drought year demand and use in a particular year for agricultural users can be significant. If a drought year is anticipated, farmers can prepare by planting crops and vegetables with lower water demands, which are often of lower value. Increases in farming efficiency can also allow irrigators to maintain higher value crops or higher yields in times with less available water. This RWP

[15] Military Highway Water Supply Corporation and the City of Hidalgo both have significant sources of well water.

represents the worst-case scenario, wherein the demands are based on a dry year, and on-farm conservation is discussed as a water management strategy (WMS).

Livestock, mining, steam-electric power generation, and manufacturing demands make up a small portion of the total water use of the region. However, in some counties (Webb and Maverick), mining demands represent a significant portion of water usage.

1.3.2 Major Water Providers

Major Water Provider (MWP) was a new designation in the 2021 planning cycle; an MWP is any Water User Group (WUG) or wholesale water provider (WWP) of particular significance to the water supply of a region, as determined by the RWPG. At the February 21, 2024, Region M meeting, the planning group approved the same definition of an MWP as in the 2021 Plan, which is any entity that provides 3,000 ac-ft or more of municipal water per year, and then voted to add Mexico as a new MWP due to the region's unique international water-sharing situation. According to current estimates of 2030 municipal supplies, the entities listed in Table 1-5 have been designated as MWP in the 2026 RWP.

While technically not a WUG or WWP, and therefore not allowed to be classified as a MWP per TWDB rules, Mexico is of particular significance to Region M because it provides water to the Amistad-Falcon Reservoir System that it shares with the United States, based on the 1944 Treaty, impacting water levels in the reservoirs and the water users on the United States' side.

Table 1-5 Region M Major Water Providers

Major Water Providers	
Agua Special Utility District (SUD)	Hidalgo County Irrigation District No. 16
Alamo	Hidalgo County Irrigation District No. 2
Bayview Irrigation District No. 11	Hidalgo County Irrigation District No. 6
Brownsville Public Utilities Board	Hidalgo County Water Improvement District (WID) No. 3
Brownsville Irrigation District	Laguna Madre Water District
Cameron County Irrigation District No. 2	Laredo
Cameron County Irrigation District No. 3 - La Feria	McAllen
Cameron County Irrigation District No. 6 - Los Fresnos	Military Highway Water Supply Corporation (WSC)
Cameron County Water Improvement District No. 10	Mission
Delta Lake Irrigation District	North Alamo WSC
Donna Irrigation District-Hidalgo County No. 1	Pharr
Eagle Pass	Rio Grande City
East Rio Hondo WSC	San Benito
Edinburg	San Juan
Harlingen	Sharyland WSC
Harlingen Irrigation District-Cameron County No. 1	Southmost Regional Water Authority

Major Water Providers	
Hidalgo and Cameron Counties Irrigation District No. 9	United Irrigation District
Hidalgo County Irrigation District No. 1	Weslaco

1.3.3 Agricultural and Natural Resources

1.3.3.1 Topography, Geology, and Soils

The Rio Grande Region is located entirely within the Western Gulf Coastal Plains of the United States, an elevated sea bottom with low topographic relief. Topography in the region ranges from a rolling, undulating relief in the northwestern portion and becomes progressively flatter near the Gulf Coast. The lower portion of the region consists of a broad, flat plain that rises gently from sea level at the Gulf of Mexico in the east to an elevation of approximately 960 feet in the northern part of Maverick County at the upper end of the region. The western edge of this plain culminates in a westward-facing escarpment known as the Bordas Escarpment. Drainage in the region is by the Rio Grande and Nueces River basins and their tributaries. The Rio Grande flows southeasterly through the region before turning east to its confluence with the Gulf of Mexico.

Geologic formations exposed in the region include Cretaceous, Tertiary, and Quaternary-aged deposits. In general, the geologic strata of the Rio Grande Region decrease in age from west to east across the area. The oldest strata, which are of Cretaceous age, outcrop in northwestern Maverick County and consist of chalky limestone and marl. The most recent sediments are located in Cameron County. In general, soils in the Rio Grande Region generally consist of calcareous to neutral clays, clay loams, and sandy loams.

1.3.3.2 Vegetation Areas (Biotic Communities)

Located within the Matamoran District of the Tamaulipan Biotic Province,[16] the Lower Rio Grande Valley is the northern boundary of much of the semitropical biota of Mexico. A number of plant and animal species from the more xeric and mesic areas to the west and northeast, respectively, converge in the Lower Rio Grande area.

1.3.3.2.1 Terrestrial Vegetative Types

The predominant vegetation type in this area is thorny brush, but there is overlap with the vegetative communities of the Chihuahuan Desert to the west, the Balconian Province to the north (Texas Hill Country), and the tropical plant communities of Mexico to the south. The result is unique and varied flora and fauna. Xeric plants such as mesquite (*Prosopis glandulosa*), leatherstem (*Jatropha dioica*), lotebrush (*Ziziphus obtusifolia*), and brasil (*Condalia hookeri*) are found in this area. Sugar hackberry (*Celtis laevigata*) and Texas persimmon (*Diospyra texana*), more prevalent to the north, are also located in the Lower Rio Grande Valley. Other common species such as lantana (*Lantana horrida*), Mexican olive (*Cordia boisierri*), and Texas ebony (*Pithecellobium ebano*) are typically more tropical in location. Montezuma bald cypress (*Taxodium mucronatum*), Gregg wild buckwheat (*Eriogonum greggi*), Texas ebony and anacahuita (*Mexican olive*) have their northernmost extension in the Lower Rio Grande Valley. More than 90 percent of total riparian vegetation and 95 percent of Tamaulipan thornscrub have been cleared since the 1900s. Surface water remains only briefly in arroyos following substantial rainfall.

[16] Blair, F. W. 1950. The biotic provinces of Texas. The Texas Journal of Science 1(2):93-117.

Because of this scarcity of water, the resulting vegetation types are closely correlated to topographic characteristics.[17]

Eleven distinct biotic communities compose the Lower Rio Grande Valley, stretching from Falcon Reservoir to the Gulf of Mexico.[18] The communities to the northwest are arid, semi-desert, thorny brush. Vegetation communities toward the coast are comprised of more wetlands, marshes, and saline environments (refer to Figure 1-11).

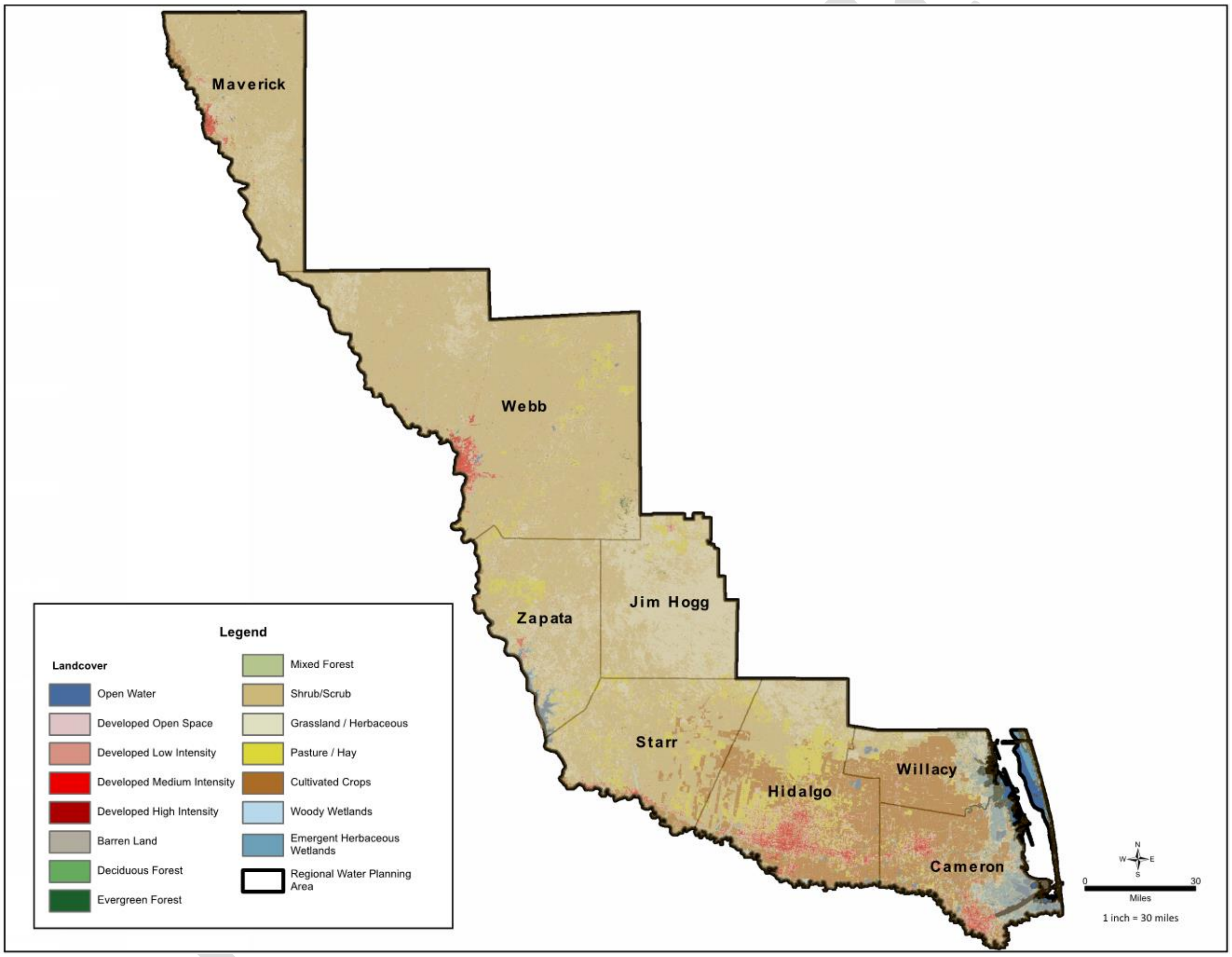

Figure 1-11 Region M Land Use Map

[17] South Texas Sand Sheet, William R. Carr, Plant Resources Center, The University of Texas at Austin. http://w3.biosci.utexas.edu/prc/DigFlora/WRC/Carr-SandSheet.html
[18] U.S. Fish and Wildlife Service, 1997, Final Lower Rio Grande Valley and Santa Ana national wildlife refuges comprehensive conservation plan: U.S. Fish and Wildlife Service, Region 2, Albuquerque, New Mexico.

1.3.3.2.1.1 Ramaderos

This region, which occupies west-central Starr County, consists of arroyos that provide wildlife habitat.

1.3.3.2.1.2 Chihuahuan Thorn Forest

Located below Falcon Dam along the Rio Grande, the Chihuahuan Thorn Forest includes a narrow riparian zone and an upland desert shrub community. Rare plants such as the Montezuma bald cypress and the federally endangered Johnston's frankenia (*Frankenia johnstonii*) are found here, as well as such uncommon birds as the brown jay (*Cyanocorax morio*), ringed kingfisher (*Ceryle torquata*), and red-billed pigeon (*Columba flavirostris*).

1.3.3.2.1.3 Upper Valley Flood Forest

This community is located along the Rio Grande from south-central Starr County to the western border of Hidalgo County. The floodplain narrows in this region, with typical riverbank trees including Rio Grande ash (*Fraxinus berlandieriana*), sugar hackberry, black willow (*Salix nigra*), and cedar elm (*Ulmus crassifolia*). Only a short distance from the river, the dominant species shift to honey mesquite, granjeno (*Celtis pallida*), and prickly pear (*Opuntia lindheimeri*).

1.3.3.2.1.4 Barretal

The Barretal community occurs in southeastern Starr County, just north of the Upper Valley Flood Forest. Barreta (*Helietta parvifolia*), a small tree located on gravelly caliche hilltops, paloverde (*Parkinsonia texana*), guajillo (*Acacia berlandieri*), blackbrush (*Acacia rigidula*), anacahuita, yucca (*Yucca treculeana*), and many species of cacti are typical of this community.

1.3.3.2.1.5 Upland Thorn Scrub

Upland Thorn Scrub, the most common community in the Tamaulipan Biotic Province, occurs in southwestern Hidalgo County. Typical woody plants include anacahuita, cenizo (*Leucophyllum frutescens*), and paloverde.

1.3.3.2.1.6 Mid-Valley Riparian Woodland

This community is located along the Rio Grande from western Hidalgo County eastward to the Sabal Palm Forest. This tall, dense, closed-canopy bottomland hardwood forest is favored by chachalacas (*Ortalis vetula*) and green jays (*Cyanocorax yncas*), birds more typical of Mexico. Trees of this community include Rio Grande ash, sugar hackberry, black willow, cedar elm, Texas ebony, and anaqua (*Ehretia anacua*).

1.3.3.2.1.7 Woodland Potholes and Basins

Central Hidalgo County and western Willacy County contain this community of seasonal wetlands and playa lakes. Additionally, three hypersaline lakes are present, attracting migrating shorebirds. The federally endangered ocelot (*Leopardus pardalis*) occupies dense thickets in this area. Wetlands are located in low woodlands of honey mesquite, granjeno, prickly pear, lotebush, elbow bush (*Forestiera angustifolia*), and brasil.

1.3.3.2.1.8 Mid-Delta Thorn Forest

The Mid-Delta Thorn Forest originally covered eastern Hidalgo County, the western two-thirds of Cameron County, and southwest Willacy County. Conversion of land for agricultural and urban uses has left only isolated pockets of native vegetation remaining. Typical plants include honey mesquite, Texas ebony, coma (*Bumelia lanuginosa*), anacua, granjeno, colima (*Zanthoxylum fagara*), and other thicket-

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forming species. This region provides excellent wildlife habitat and is a preferred area for white-winged dove (*Zenaida asiatica*).

1.3.3.2.1.9 Sabal Palms Forest

This area of riparian forest contains the last remaining acreage of original Sabal Palm Forest in south Texas. It is located on the Rio Grande at the southernmost tip of Texas. Vegetation in this region includes Texas sabal palm (*Sabal texana*), Texas ebony, tepeguaje (*Leucaena pulverulenta*), anacua, brasil, and granjeno. The National Audubon Society's Sabal Palm Grove Sanctuary is located in this area.

1.3.3.2.1.10 Loma Tidal Flats

Located at the mouth of the Rio Grande, this community consists of clay dunes, saline flats, marshes, and shallow bays along the Gulf of Mexico. Sea ox-eye (*Borrichia frutescens*), saltwort (*Batis maritima*), glasswort (*Salicornia sp.*), gulf cordgrass (*Spartina spartinae*), Berlandier's fiddlewood (*Citharexylum berlandieri*), Texas ebony, and yucca are typical plants of this region.

1.3.3.2.1.11 Coastal Brushland Potholes

This community comprises dense brushy woodland around freshwater ponds, changing to low brush and grasslands around brackish ponds, and saline estuaries nearer the Gulf of Mexico. Typical plants include honey mesquite, granjeno, barbed-wire cactus (*Acanthocereus pentagonus*), and gulf cordgrass. Area wetlands provide important habitat for migratory wildlife.

1.3.3.2.2 Lower Laguna Madre

The Lower Laguna Madre is a hypersaline bay in the eastern portions of Cameron and Willacy counties. The Lower Laguna Madre is characterized by its shallow depth, approximately 2 feet on average, extensive seagrass meadows, and tidal flats. Small portions of the Lower Laguna Madre are estuarine in nature with more moderate to brackish salinities. The Arroyo Colorado and Rio Grande provide most of the freshwater inflow to the bay; other drainage canals and floodways have smaller contributions. Fresh water from these sources aid in moderating salinities in the bay and are vital to the success of estuarine dependent aquatic species. The Lower Laguna Madre supports a wide variety of marine aquatic organisms and wildlife. It also supports considerable water-related recreational activities (boating, sport fishing, bird watching, etc.) and commercial fisheries.

1.3.3.3 Protected Areas

Public and private interests have created several refuges and preserves in the Lower Rio Grande Valley to protect remaining vegetation and the habitats of endangered and threatened species. These include the Lower Rio Grande Valley National Wildlife Corridor/Refuge, Laguna Atascosa National Wildlife Refuge (NWR), Santa Ana NWR, Anzalduas County Park, Falcon State Park (SP), Bentsen-Rio Grande Valley SP, Boca Chica SP, Las Palomas Wildlife Management Area (WMA), Arroyo Colorado WMA, Sabal Palm Audubon Center and Sanctuary, the Nature Conservancy's Chihuahua Woods Preserve, the South Bay Coastal Preserve, Estero Llano Grande, and Resaca de la Palma.[19]

Nine local communities, United States Fish and Wildlife Service (USFWS), and the Texas Parks and Wildlife Department (TPWD) developed and completed the final stages of the World Birding Center in

[19] Fish and Wildlife Service. Endangered and threatened species. https://www.fws.gov/. Accessed 4/11/2019.

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2009.[20] These nine sites are considered world class birding destinations and attract thousands of visitors to view migratory birds and learn about conservation of natural resources.[21]

1.3.3.3.1 Lower Rio Grande Valley National Wildlife Refuge and Wildlife Corridor

The USFWS, with the support and assistance of the TPWD and several private organizations and individuals, is creating a wildlife corridor along the Rio Grande from Falcon Dam to the Gulf of Mexico. The wildlife refuge serves as the largest component of the Lower Rio Grande Wildlife Corridor, and it currently includes 150 individual tracts totaling 107,000 acres. The completed refuge is projected to total 132,500 acres in fee and conservation easements. The wildlife refuges described below are part of this system. Additional acreage is purchased from willing sellers at fair market value or obtained through conservation easements.

1.3.3.3.2 Laguna Atascosa National Wildlife Refuge

Laguna Atascosa NWR contains more than 88,378 acres of land, providing essential habitat for a variety of south Texas wildlife. It is located north of the Rio Grande and south of the Arroyo Colorado along the Laguna Madre.

1.3.3.3.3 Santa Ana National Wildlife Refuge

This 2,088-acre refuge receives extensive bird-watching attention because it is located at the convergence of two major migratory waterfowl flyways, the Central and the Mississippi. More than half of all butterfly species in the United States are found in this refuge.

1.3.3.3.4 Falcon State Park

This park, managed by the TPWD, contains over 500 acres above Falcon Dam. It is popular with bird watchers because of its diversity of bird species.

1.3.3.3.5 Sabal Palm Audubon Center and Sanctuary

This sanctuary, owned by the National Audubon Society, is located in the southernmost point of Texas on the Rio Grande. It is a 527-acre forested area that includes a substantial portion of the remaining sabal palm forest. The sanctuary is popular with bird watchers and other nature enthusiasts for its wildlife. The state threatened southern yellow bat (*Lasiurus ega*) is a year-round resident. The ocelot and jaguarundi (*Herpailurus yagouaroundi*) are believed to inhabit parts of the sanctuary.

1.3.3.3.6 Bentsen-Rio Grande Valley State Park

This park, managed by the TPWD, is located west of Mission in Hidalgo County. It consists of almost 600 acres of subtropical resaca woodlands and brushland and is a popular bird-watching area. Boca Chica State Park, administered by Bentsen-Rio Grande Valley SP, is located in Southeastern Cameron County. Endangered and rare birds, such as brown pelicans, reddish egrets, osprey, peregrine falcons, and several others, are commonly found in the park area.

1.3.3.3.7 East Wildlife Foundation Ranchland

The East Wildlife Foundation is a nonprofit tax-exempt organization, the mission of which is to support wildlife conservation and other public benefits of ranching and private land stewardship. The foundation

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[20] Glusac, Elaine. "The Texas Border Draws Frequent Fliers." *The New York Times*. 6 Apr. 2010. www.nytimes.com/2010/04/11/travel/11explorer.html. Accessed 4/11/2019.

[21] World Birding Center. http://www.worldbirdingcenter.org/. Accessed 4/11/2019 and https://pubs.usgs.gov/sir/2016/5078/sir20165078.pdf.

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includes management of over 215,000 acres of native South Texas rangeland. This land is operated as six separate ranches in parts of Jim Hogg, Starr, Willacy, and Kenedy counties. Traditionally maintained as native rangeland and as working cattle ranches, the lands operated by the foundation are now managed as a field laboratory for discovery and problem solving.

1.3.3.4 Rare, Threatened, or Endangered Plant and Animal Species

The federal Endangered Species Act (ESA) of 1973, with amendments, provides a means to conserve endangered and threatened species and the ecosystems on which these species depend. The ESA provides for conservation programs for endangered and threatened species and indicates that agencies are to take steps as may be appropriate for achieving the purposes of conserving species of fish and wildlife protected by international treaty. Federal agencies are required to ensure that no actions that an agency would undertake will jeopardize the continued existence of any endangered or threatened species, except as provided by the ESA. Any federal permits required to implement components of this water plan would be subject to the terms of the ESA. Federally listed species present in Region M and Kinney County (Region J) are shown in Table 1-6.

Table 1-6 Federally Threatened and Endangered Species in Region M and Kinney County [22]

Taxonomy	Scientific Name	Common Name	Federal Designation
Birds	*Falco femoralis septentrionalis*	Northern Aplomado Falcon	Endangered
Birds	*Setophaga chrysoparia*	Golden-cheeked Warbler	Endangered
Birds	*Laterallus jamaicensis*	Black Rail	Threatened
Birds	*Charadrius melodus*	Piping Plover	Threatened
Birds	*Calidris canutus rufa*	Red Knot	Threatened
Birds	*Coccyzus americanus*	Yellow-billed Cuckoo	Threatened
Birds	*Glaucidium brasilianum cactorum*	Cactus Ferruginous Pygmy-owl	Threatened
Fish	*Pristis pectinata*	Smalltooth Sawfish	Endangered
Fish	*Carcharhinus longimanus*	Oceanic Whitetip Shark	Threatened
Fish	*Dionda diaboli*	Devils River Minno	Threatened
Fish	*Manta birostris*	Giant Manta Ray	Threatened
Mammals	*Physeter macrocephalus*	Sperm Whale	Endangered
Mammals	*Balaenoptera physalus*	Finback Whale	Endangered
Mammals	*Balaenoptera borealis*	Sei Whale	Endangered
Mammals	*Balaenoptera musculus*	Blue Whale	Endangered
Mammals	*Balaenoptera ricei*	Rice's Whale	Endangered
Mammals	*Megaptera novaeangliae*	Humpback Whale	Endangered

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[22] Texas PWD Rare Threatened, and Endangered Species of Texas by County. https://tpwd.texas.gov/gis/rtest/. Accessed 7/15/2025.

Taxonomy	Scientific Name	Common Name	Federal Designation
Mammals	*Eubalaena glacialis*	North Atlantic Right Whale	Endangered
Mammals	*Leopardus pardalis*	Ocelot	Endangered
Mammals	*Trichechus manatus*	West Indian Manatee	Threatened
Mollusks	*Popenaias popeii*	Texas Hornshell	Endangered
Reptiles	*Caretta caretta*	Loggerhead Sea Turtle	Threatened
Reptiles	*Chelonia mydas*	Green Sea Turtle	Threatened
Reptiles	*Eretmochelys imbricata*	Atlantic Hawksbill Sea Turtle	Endangered
Reptiles	*Lepidochelys kempii*	Kemp's Ridley Sea Turtle	Endangered
Reptiles	*Dermochelys coriacea*	Leatherback Sea Turtle	Endangered
Plants	*Asclepias prostrata*	Prostrate Milkweed	Endangered
Plants	*Thymophylla tephroleuca*	Ashy Dogweed	Endangered
Plants	*Astrophytum asterias*	Star Cactus	Endangered
Plants	*Physaria thamnophila*	Zapata Bladderpod	Endangered
Plants	*Manihot walkerae*	Walker's Manioc	Endangered
Plants	*Ayenia limitaris*	Texas Ayenia	Endangered
Plants	*Ambrosia cheiranthifolia*	South Texas Ambrosia	Endangered
Plants	*Styrax platanifolius ssp. texanus*	Texas Snowbells	Endangered
Plants	*Sclerocactus brevihamatus ssp. tobuschii*	Tobusch Fishhook Cactus	Threatened

There are 26 USFWS federally listed threatened or endangered animal species. The Texas Fish and Wildlife Service lists over 60 species as threatened or endangered.

1.3.4 Threats to Agricultural and Natural Resources

The Region M planning area is experiencing urbanization and growing demands on water on both sides of the border with Mexico and in neighboring regions.

1.3.4.1 Drought and Inflows from Mexico

Under DOR conditions, hydrologic simulations of reservoir operations indicate that surface water rights for irrigation will only be fulfilled between 25 and 40 percent of their authorized diversion. Irrigation and mining supplies are structured to vary along with availability and bear the associated economic costs of such shortages. In addition to drought, variability in deliveries from Mexico can impact the US water supplies and, therefore, water available for irrigation. The terms of the 1944 treaty grant a minimum of 350,000 ac-ft/yr to the United States storage from Mexico, but this annual target is not always met (Figure 1-12). Figure 1-12 was the most recent graphic available with data through January 18, 2025. More specific (e.g., reservoir levels), and recent data and reports can be found at ibwc.gov.

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The irrigation conservation WMSs discussed in this plan aim to assist farmers in making the most of what water is available in drought years. Agricultural shortages are managed through efficient water use, low water demand crop selection, and other irrigation best management practices, which are recommended in Chapter 5. Additionally, the RWPG has advocated for Mexico to meet the 1944 treaty water delivery obligation, described in Chapter 7.

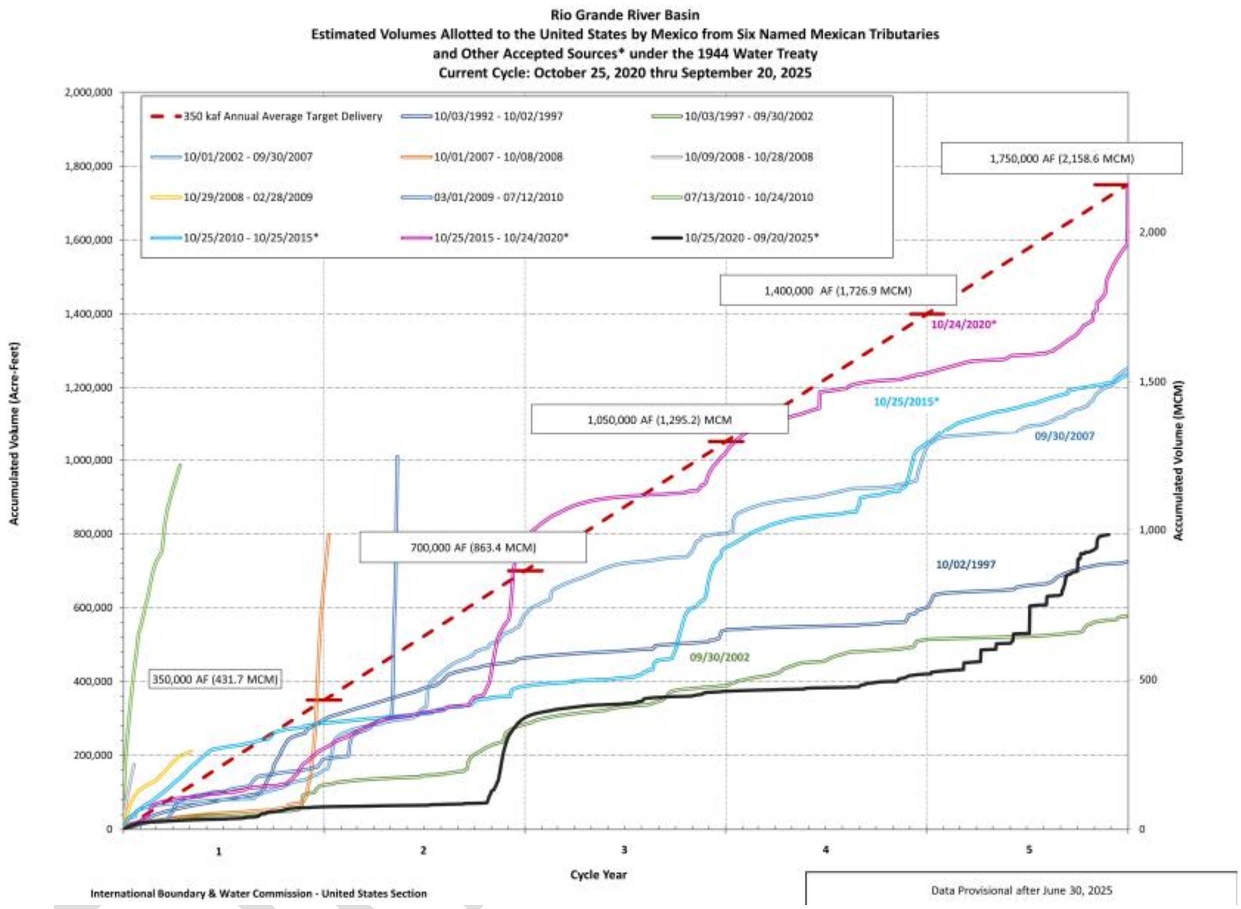

Figure 1-12 Water Delivered to the United States from Mexico, 1992 to 2025[23]

1.3.4.2 Groundwater Marketing

Drilling and marketing of groundwater in locations that may impact surface water, especially near the Amistad Dam, can impact stream and spring flows and reduce availability. Water marketing companies are actively seeking water sources to be sold to entities in need of new water sources. Recently, there has been substantial interest in groundwater in and around Val Verde County. In this particular area, strong evidence suggests interaction between groundwater and surface water. The pumping of groundwater in the Devils and Pecos River basins have been shown to directly impact these streamflows and the flows in Goodenough Springs, which play a significant role in supplying water for Region M. Any reduction in the water supply in the Amistad Reservoir presents a threat to the region. Policy

[23] Mexico Deliveries During the Current 5-Year Cycle. https://ibwc.gov/Water_Data/mexico_deliveries.html. Accessed 5/16/2024.

recommendations from Region M have included further study into groundwater and surface water interactions.

1.3.4.3 Urbanization

Another threat to agricultural and natural resources of the region is the impact of ongoing and projected urbanization on currently undeveloped areas and the loss of water and habitat availability for wildlife. Increased pumping of groundwater from the Gulf Coast Aquifer and the Rio Grande Alluvium may threaten riparian habitats fringing resacas and potholes. This effect would have a negative impact on ecotourism. The lowering of Falcon Lake level due to reduced inflow could negatively impact the diversity of bird species that currently exists. WMSs in this plan that recommend groundwater use will be limited to the modeled available groundwater (MAG) for each aquifer.

Urbanization plays a major role in determining future demand. The impact can be quantified from previous rates of urbanization (loss of flat-rate acres and loss of irrigated acres) and the separation of water rights from the land as a part of the development process. Particularly in Cameron and Hidalgo counties, projected urbanization is expected to significantly reduce the area of irrigable farmland. Within the Lower Rio Grande Valley, urbanization is expected to be concentrated in corridors along State Highways 77 and 83, with some additional development through agricultural areas.

In addition to the direct reduction of irrigable farmland acreage due to change in land use, urbanization also impacts adjacent farmland by increasing property values and restricting some types of agricultural activities (e.g., use of pesticides). Urbanization impacts the effectiveness of irrigation district distribution networks by shifting land use to a patchwork of farmland and developed areas.

Irrigation districts play a critical role in the delivery of almost 85 percent of the water used in the region, including irrigation and municipal water. The improvements discussed in this plan for irrigation districts are intended not only to reduce the losses in their systems but also to allow for better management and controls over their systems and improved service to utilities.

1.4 Existing Local and Regional Water Plans

1.4.1 Drought Planning

TCEQ requires water conservation plans to be developed, implemented, and submitted by municipal, industrial/mining, and other non-agricultural water right holders of 1,000 ac-ft of water per year and agricultural water right holders of 10,000 ac-ft/yr or more. Additionally, all wholesale and retail public water suppliers and irrigation districts are required to develop a drought contingency plan (DCP). Water conservation plans are required to include quantified 5- and 10-year targets for water savings, and DCPs outline entity responses to drought, including triggers for conservation stages and the restrictions of water use in each drought stage.

Because of these requirements and recent drought conditions, many communities in the Rio Grande Region have addressed drought preparedness and water conservation planning. A review of TCEQ records shows that many communities and irrigation districts in the region have water conservation and DCPs. Table 1-7 lists the approval date of the most recently received water conservation and DCPs. It should be noted that smaller public water systems (i.e., those with fewer than 3,300 connections) were required to prepare drought plans but do not have to file their drought plans with the TCEQ.

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Table 1-7 Local Water Plans Filed with TCEQ

Entity	Water Conservation Plan Date	Drought Contingency Plan Date
Agua SUD	4/25/2019	4/8/2024
Alamo	4/16/2024	4/16/2024
Bayview Irrigation District No. 11	5/15/2019	5/6/2019
Brownsville Irrigation District	1/12/2024	1/24/2024
Brownsville Public Utilities Board	4/1/2024	4/1/2024
Cameron County Irrigation District No. 2	4/24/2019	5/1/2024
Cameron County Irrigation District No. 6	-	3/14/2024
Delta Lake Irrigation District	9/19/2014	1/17/2024
Donna	4/27/2022	3/10/2022
Donna Irrigation District	5/3/2024	5/3/2024
Eagle Pass Water Works System	2/2/2022	2/2/2022
East Rio Hondo WSC	2/1/2024	2/1/2024
Edinburg	5/1/2024	5/1/2024
El Jardin Water Supply Corporation	-	5/1/2014
Engelman Irrigation District	7/22/2022	7/22/2022
Harlingen Irrigation District	5/14/2020	8/1/2024
Harlingen Waterworks System	5/1/2024	10/1/2024
Hidalgo	5/1/2024	5/1/2024
Hidalgo Co. Irrigation District No. 1	-	10/19/2023
Hidalgo Co. Irrigation District No. 2	4/18/2019	9/1/2022
Hidalgo Co. Irrigation District No. 5	4/30/2019	4/30/2019
Hidalgo Co. Irrigation District No. 6	6/24/2024	6/24/2024
Hidalgo Co. Irrigation District No. 9	-	9/15/2020
Hidalgo Co. Irrigation District No. 13	-	4/22/2019
Hidalgo Water Improvement District No. 3*	5/15/2024	5/15/2024
La Feria Irrigation District	5/20/2019	5/20/2019
Laguna Madre Water District	9/14/2022	9/14/2022
Laredo	4/1/2024	4/1/2024
Maverick County Water Control and Improvement District No. 1	9/12/2023	5/1/2019

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Entity	Water Conservation Plan Date	Drought Contingency Plan Date
McAllen, McAllen Public Utility	4/24/2023	4/24/2023
Mercedes	-	5/31/2024
Military Highway Water Supply Corporation	5/5/2014	4/25/2024
Mission Public Works Department	9/27/2023	8/1/2024
North Alamo WSC	9/17/2019	9/17/2019
Pharr	5/20/2024	5/20/2024
Rio Grande City	-	5/28/2019
Roma	4/1/2024	4/1/2024
San Benito	5/1/2024	5/1/2024
San Juan	4/19/2024	4/19/2024
Santa Cruz Water Control and Improvement District No. 15*	-	5/29/2024
Sharyland WSC	10/17/2024	10/17/2024
Southmost Regional Water Authority	4/24/2019	4/24/2019
United Irrigation District	5/9/2024	5/9/2024
Weslaco	5/23/2019	5/23/2019
Zapata County Waterworks	11/16/2022	8/30/2024

*In January 2025, Hidalgo County Water Improvement District No. 3 and Santa Cruz Water Control and Improvement District No. 15 consolidated into Hidalgo County Consolidated Water Control and Improvement District.

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The drought response varies from entity to entity, primarily between those who serve customers, including irrigators, with raw water and those who deliver treated water. For those entities, such as irrigation districts, that deliver water to irrigators, the response to drought is focused on the allocation system and how agricultural water rights are fulfilled when supplies are limited by the TCEQ Watermaster. Each water district responds slightly differently, in some cases allowing water to be sold between farmers in their district or for farmers to consolidate their allocation on a portion of their land, leaving other areas for dry land farming.

The entities that deliver treated water generally developed triggers that were either based on the balance remaining in municipal water rights accounts for that year or the capacities of their treatment plants, so that high demands on the plants trigger a conservation stage. The conservation stages for cities included limitations on car washing and lawn watering, ranging from voluntary in early stages to some fines or other penalties in later stages.

1.4.2 Existing Regional Water Plans

Immediately prior to the initiation of the SB1 regional water planning program, two regional water supply planning projects were conducted within the Rio Grande Region. In February 1998, Phase I of the

South Texas Regional Water Supply Plan was completed under the sponsorship of the South Texas Development Council, with funding assistance from the TWDB. This plan addressed water supply needs in Jim Hogg, Starr, Webb, and Zapata counties. The report for this initial planning phase provided background data and identified key issues that need to be addressed in future water planning. Specific recommendations regarding water supply strategies were not developed.

In February 1999, the Integrated Water Resources Plan (IWRP) for the Lower Rio Grande Valley was completed. This planning effort was sponsored by the Lower Rio Grande Valley Development Council with funding from the TWDB, the US Economic Development Administration, the US Bureau of Reclamation, and local sources. This plan addressed water planning issues in Cameron, Hidalgo, and Willacy counties. In addition to comparing projected water supplies and demand, the IWRP makes specific recommendations for meeting future demands, including "improvements to the irrigation canal delivery system; aggressive water conservation efforts in all areas of consumption; and implementation of wastewater reuse, desalination of brackish groundwater, and desalination of seawater where cost effective."

The Arroyo Colorado Watershed Protection Plan (WPP) is a comprehensive watershed-based strategy to improve water quality and aquatic and riparian habitat in the Arroyo Colorado River in South Texas. The Arroyo Colorado WPP was last updated in 2017 and is intended to be updated every 5 years.[24] The Arroyo Colorado Watershed Partnership, which is composed of stakeholders, has grown to over 720 members. In collaboration with the Lower Rio Grande Valley Texas Pollutant Discharge Elimination System (TPDES) stormwater task force and local citizens, the Arroyo Partnership installed more than 1,000 storm drains that read "No Dumping, Drains to Laguna Madre." Education and outreach activities occur on a daily basis, and over 32,000 individuals have experienced the watershed model, a hands-on water quality education tool that demonstrates the impact of pollution within the watershed. Numerous agriculture and wastewater infrastructure best management practices have been implemented.

The Lower Rio Grande Water Quality Initiative was formed to address persistent high bacteria and salinity levels in the Lower Rio Grande. The group led a bi-national effort to identify all potential discharges and develop a hydrologic model with the data, collected in 2014 and 2015.

The Texas Rio Grande Basin Clean Rivers Program includes regular water quality monitoring, special studies as needed, annual Basin Highlight Reports since 2011, and Basin Summary Reports every 5 years. The program also includes outreach and educational components that help volunteers, students, and partner organizations monitor, collect, and analyze samples.[25]

In 2013, the Bureau of Reclamation and the Rio Grande Regional Water Authority evaluated the impacts of climate change on the Lower Rio Grande Valley in a Basin Study and recommended brackish groundwater desalination as the best alternative water source to ensure reliability in the face of uncertain supplies. The study, funded by a grant through the WaterSMART program, reviewed a range of climate scenarios and identified a median of 84,000 ac-ft/yr less water being available. In response to this reduction, the Basin Study proposed four brackish groundwater desalination facilities and a trunk line to connect three clusters of municipalities, centering around McAllen, Weslaco, and Harlingen. The concept was sized and phased using the Southmost Regional Water Authority model, which was designed to meet 40 percent of the demands of the member cities. The Basin Study has been used, in

[24] Arroyo Colorado Watershed Partnership. Update to the Arroyo Colorado Watershed Protection Plan, August 2017. http://arroyocolorado.org/media/671263/arroyo-colorado-wppfinaloptimized.pdf.
[25] IBWC. Clean Rivers Program. https://www.ibwc.gov/CRP/Index.htm.

conjunction with detailed groundwater data gathered by the TWDB in the BRACS report, to inform other studies.

The Lower Rio Grande Valley (LRGV) TPDES Stormwater Management Task Force is a joint program between the Research, Applied, Technology, Education and Service (RATES) and various municipalities across the Rio Grande Valley to educate and improve how cities and civil engineers plan for stormwater management, as a joint effort to develop a proactive regional approach to stormwater management. Task force goals are to reduce stormwater pollution, protect the natural environment and benefit the community.

The LRGV Stormwater Task Force Partnership and RATES, in partnership with NASA, and in collaboration with the TCEQ and USIBWC, kicked-off a 3-year project in Del Rio Texas, on April 18, 2024, with a stakeholder workshop. The project proposes to develop a forecast-capable hydrologic model and prototype decision support tool for water supply decision makers in the Rio Grande Basin using NASA data and technologies. The objective is to analyze and document how NASA data and technology can be applied to support water supply decision making by engaging in co-creation of knowledge with municipalities, irrigation districts, and other stakeholders in the basin. The program will accomplish this objective by engaging with these partners through workshops, developing NASA empowered hydrologic modeling tools that ingest NASA datasets, and examining how the data and outputs from these models could support decision making. Through engagement with stakeholders, RATES will assess how the modeling framework, augmented with NASA data and technology, can be leveraged to support water supply forecasting for the Rio Grande Basin.

In 2025, the *U.S.- Mexico Salinity Study of the Lower Rio Grande/Rio Bravo* was conducted collaboratively by the University of Texas at Austin and the Universidad Nacional Autónoma de México. The study was developed under the Border 2025 Initiative and focuses on the delivery of quality water from the U.S. to Mexico via the Colorado River. It highlights key treaty obligations under the 1944 Water Treaty and Minute 242, salinity control efforts in the U.S., and binational coordination between IBWC and CILA. It also outlines ongoing challenges related to climate change, drought, and infrastructure needs, as well as water and salt exchanges between groundwater and the Lower Rio Grande/Rio Bravo. The study provides insights on organization and cooperation, data and salinity, and recommendations on data, models, and remediation.

1.4.3 Regional and State Flood Plans

In 2019, the Texas legislature passed Senate Bill 8 to establish a new regional and state flood planning process aimed at protecting against loss of life and property from flooding. The TWDB delineated 15 Regional Flood Planning Areas and appointed initial members to the Regional Flood Planning Groups. The Regional Flood Planning Groups then prepared and submitted Regional Flood Plans in January 2023 and submitted Amended Regional Flood Plans to TWDB in July 2023. The approved Regional Flood Plans were then incorporated into the state's first 2024 State Flood Plan. Similar to the regional water planning process, the regional flood planning process will recur in 5-year cycles.

Each Regional Flood Plan includes a Flood Hazard Risk Assessment, Flood Management Evaluations, Flood Management Strategies, Flood Management Projects, and administrative, regulatory, and legislative recommendations. Identification of evaluations, strategies, and projects in the Regional Flood Plan can enable sponsors to be eligible for certain types of funding from the TWDB, including the newly established Flood Infrastructure Fund.

The Rio Grande Regional Water Planning Area is predominantly located in the Region 15 Lower Rio Grande Flood Planning Region, with portions of Maverick, Webb, and Jim Hogg Counties located within the Region 13 Nueces Flood Planning Region. Table 1-8 summarizes the number of structures located in the 100-year floodplain for each county, as identified by the Region 13 and Region 15 Regional Flood Plans.

Table 1-8 Number of Structures in 100-year Floodplain, as Identified by the Regional Flood Plans

County	Region 13 Number of Structures	Region 15 Number of Structures	Total Number of Structures in 100-Year Floodplain
Cameron	--	83,546	83,546
Hidalgo	--	142,880	142,880
Jim Hogg	812	60	872
Maverick	15	1,919	1,934
Starr	--	5,558	5,558
Webb	360	11,076	11,436
Willacy	--	6,685	6,685
Zapata	--	412	412

The Region 13 Regional Flood Plan included a total of 163 flood management evaluations (studies), zero flood mitigation projects, and 40 flood management strategies. The Region 15 Regional Flood Plan included a total of 95 flood management evaluations (studies), 2 flood mitigation projects, and 51 flood management strategies. For more information about the regional flood planning process and for copies of the state and regional flood plans, visit https://www.twdb.texas.gov/flood/planning/.

1.4.4 Public Water Supply Systems

The TWDB conducts water loss audits annually for retail water utilities. The breakdown of the aggregated water loss audits from Region M is summarized in Table 1-9 for 46 unique Public Water Systems reported 2020, 2021, and 2022.

Table 1-9 Summary of Region M Water Loss Audit Data, 2020-2022 (million gallons)

<table>
<tr><th colspan="4">Region M</th></tr>
<tr><td colspan="4">46 Audits Submitted</td></tr>
<tr><td colspan="4">System Input Volume</td></tr>
<tr><td colspan="4">75,328</td></tr>
<tr><td colspan="2">Authorized Consumption</td><td colspan="2">Water Loss</td></tr>
<tr><td colspan="2">65,435</td><td colspan="2">9,893</td></tr>
<tr><td colspan="2">86.9%</td><td colspan="2">13.1%</td></tr>
<tr><td>Billed Consumption</td><td>Unbilled Consumption</td><td>Apparent Loss</td><td>Real Loss</td></tr>
<tr><td>64,102</td><td>1,333</td><td>1,631</td><td>8,262</td></tr>
<tr><td>85.1%</td><td>1.8%</td><td>2.1%</td><td>11.0%</td></tr>
</table>

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Billed Metered	Billed Unmetered	Unbilled Metered	Unbilled Unmetered	Unauthorized Consumption	Customer Meter Accuracy Loss	Systematic Data Handling Discrepancy	Reported Breaks and Leaks	Unreported Loss
64,047	54	393	941	161	1,322	147	407	7,856
85.0%	0.1%	0.5%	1.3%	0.2%	1.7%	0.2%	0.5%	10.5%
Revenue Water		**Non-Revenue Water**						
64,102		11,226						
85.1%		14.9%						

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