INITIALLY PREPARED PLAN

CHAPTER 7: DROUGHT RESPONSE INFORMATION, ACTIVITIES, AND RECOMMENDATIONS

Rio Grande Regional Water Plan

B&V PROJECT NO. 192863

PREPARED FOR

Rio Grande Regional Water Planning Group

3 MARCH 2020

BLACK & VEATCH

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List of Abbreviations

acft	Acre-Feet
acft/yr	Acre-Feet per Year
DCP	Drought Contingency Plan
DMI	Domestic, Municipal, and Industrial
DOR	Drought of Record
ERHWSC	East Rio Hondo Water Supply Corporation
IBWC	International Boundary Water Commission
NCRWP	North Cameron Regional Water Plant
No.	Number
PUB	Public Utilities Board
RWPG	Regional Water Planning Group
SRWA	Southmost Regional Water Supply Corporation
US	United States
WAM	Water Availability Model
WMS	Water Management Strategy
WTP	Water Treatment Plant
WUG	Water User Group
WWP	Wholesale Water Provider

CHAPTER 7: DROUGHT RESPONSE INFORMATION, ACTIVITIES, AND RECOMMENDATIONS

7.1 DROUGHTS OF RECORD IN THE REGIONAL WATER PLANNING AREA

Region M relies heavily on water from the Rio Grande, managed through Amistad and Falcon Reservoirs; although, brackish and fresh groundwater provide supplemental and locally critical supplies. Response to drought varies across the region depending on the primary source of water and type of water use.

Severe drought has affected Region M in the period of record of the Water Availability Model (WAM) (1940 through 2000) as well as in the years since 2000. The drought record helps to understand the firm yield from the Amistad-Falcon Reservoir system, and if droughts after 2000 have been more severe that those encompassed by the model's period of record, the firm yield is likely to be overestimated in the WAM.

Because of the unique mechanism for fulfillment of water rights of the Rio Grande system, and the heavy reliance on that source, drought impacts Region M somewhat differently than other regions. In addition, a significant portion of the water used in Region M comes from the Mexican side of the Rio Grande watershed.

Drought and other circumstances can contribute to a water shortage, which is any situation when there is less supply of water than there is demand for water. Shortages can be the result of low rainfall, operational decisions, higher than normal temperatures, or growing populations causing increased demand. Drought preparation and response can help to mitigate the impacts of these shortages by finding ways to reduce demands and supplement supplies in response to water shortages.

The Texas Division of Emergency Management submitted recommendations from the Drought Preparedness Council to all Regional Water Planning Groups (RWPGs) on August 1, 2019. The Council advised the RWPGs to follow the Texas Water Development Board (TWDB) template for this chapter and to develop region-specific model drought contingency plans for all water use categories in the region that account for more than 10 percent of water demands in any decade over the 50 year planning horizon. These recommendations have been considered in the development of this chapter.

This chapter consolidates the existing information on current drought preparation and response activities for Region M and makes recommendations where needed.

7.1.1 Current Drought of Record

The drought of record (DOR) is the basis of the firm yield projection for each surface water supply. The DOR identifies the worst drought during the period of record, and the firm yield is the supply that can be expected from that river or system in that most severe drought scenario. The Rio Grande WAM includes hydrologic information from 1940 through 2000.

The longest duration drought modeled for both the combined reservoir system and the US portion spans the 1960s: 12/1959 through 10/1971 for the combined storage belonging to the United States and Mexico (11 years, 10 months) and 6/1961 through 10/1971 for the US portion (10 years, 4 months).

The drought spanning from July of 1992 to the end of the modeled period includes the minimum storage events for both the United States and combined systems, and the extent of the model does not include the end of the drought. The duration shown (8 years, 5 months) is shorter than the 1960s drought but is not a complete record. Refer to Figure 7-1.

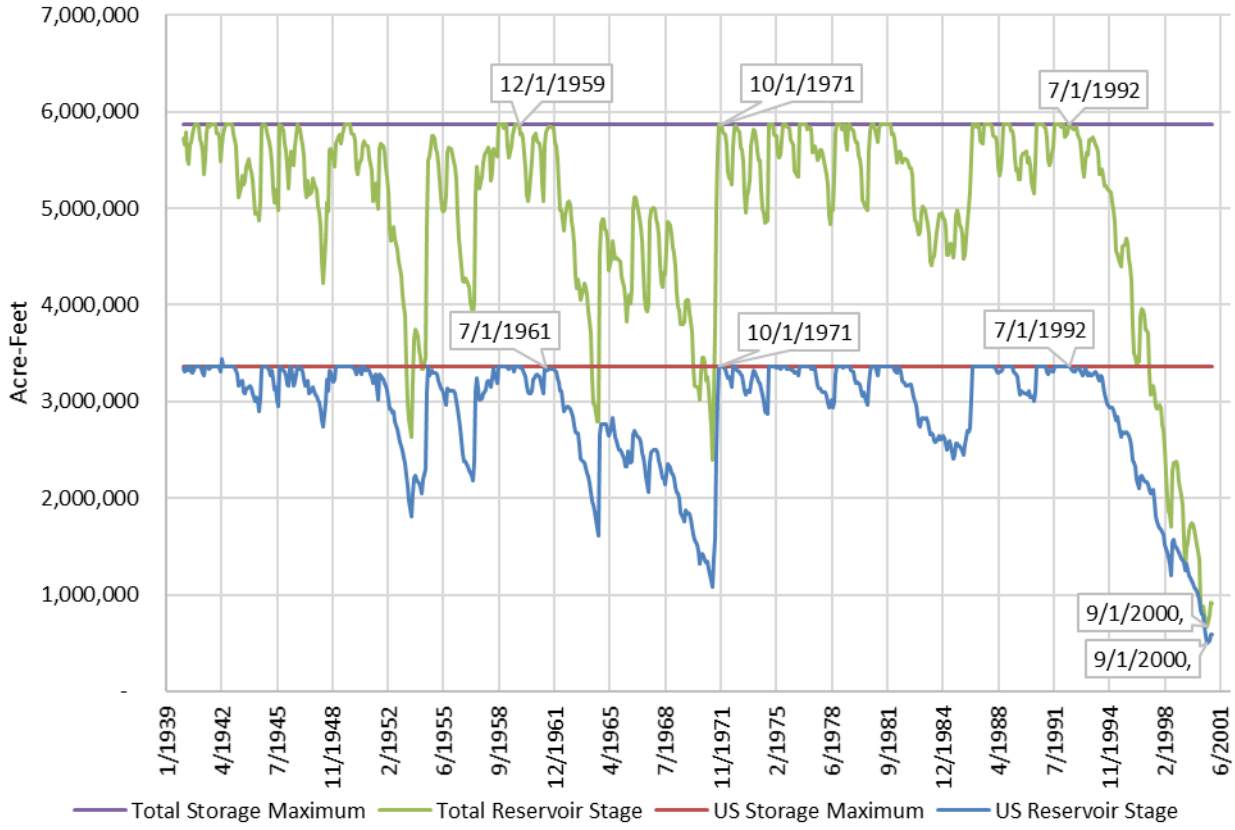

Figure 7-1 Modeled Reservoir Storage for the Amistad-Falcon System, US and Combined

The WAM takes into account inflows from both Mexican and US tributaries associated with the drought of record, volumes and locations of demands along the river, channel losses along the river, and other factors. The deliveries from Mexico are not modeled according to the 1944 treaty, which establishes 350,000 acre-feet/year to be delivered to the United States; the deliveries are modeled according to historical supplies and demands rather than assuming that the treaty obligation will be met in full each year. Firm yield decreases slightly each decade from reduced reservoir capacity due to sedimentation.

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

Table 7-1 Firm Yield Projections, Amistad-Falcon Reservoir System 2020-2070 (Acre-feet/year)

	2020	2030	2040	2050	2060	2070
Amistad-Falcon Reservoir System	1,079,381	1,079,175	1,078,968	1,078,762	1,078,555	1,078,349

Because the hydrologic data in the WAM extends only through the year 2000, more recent drought years are not considered in the determination of the DOR. The 2011 and 2016 Regional Water Plans (RWPs) recommended that the Rio Grande WAM should be regularly updated; this recommendation is the opinion of the current RWPG. Legislation passed in the 2019 session mandates and funds updating the naturalized flow records for the Rio Grande WAM through 2017, which will be available for use in development of the 2026 RWP update.

7.1.2 Potential Droughts of Record

The naturalized flow record that is used in the WAM is one way to evaluate the scale and duration of drought. That flow record extends only through 2000 in the Rio Grande WAM; severe droughts have occurred since then that are not currently evaluated in the WAM. Without a full naturalized flow record for comparison, it is difficult to know whether there has been a new DOR since 2000, but other measures and indicators of drought can be used to compare recent years with the historical record.

7.1.2.1 Drought Indices

Drought indices have been developed to assess the effects of drought through parameters, including severity, duration, and spatial extent. One of the first comprehensive efforts using precipitation and temperature for estimating a region's moisture was the Palmer Drought Severity Index (PDSI). Index values range from up to 6, indicating wetter-than-normal conditions, and as low as -6 for severe drought. The PDSI includes values across the country through 2019, which makes it a valuable addition to drought analysis. Graphs for yearly PDSI values for Texas Climate Divisions 9 and 10 (Figure 7-2) show more recent and severe droughts in the 21st century than the drought of the 1950s, but over a shorter duration for Region M (Figure 7-3 and Figure 7-4).

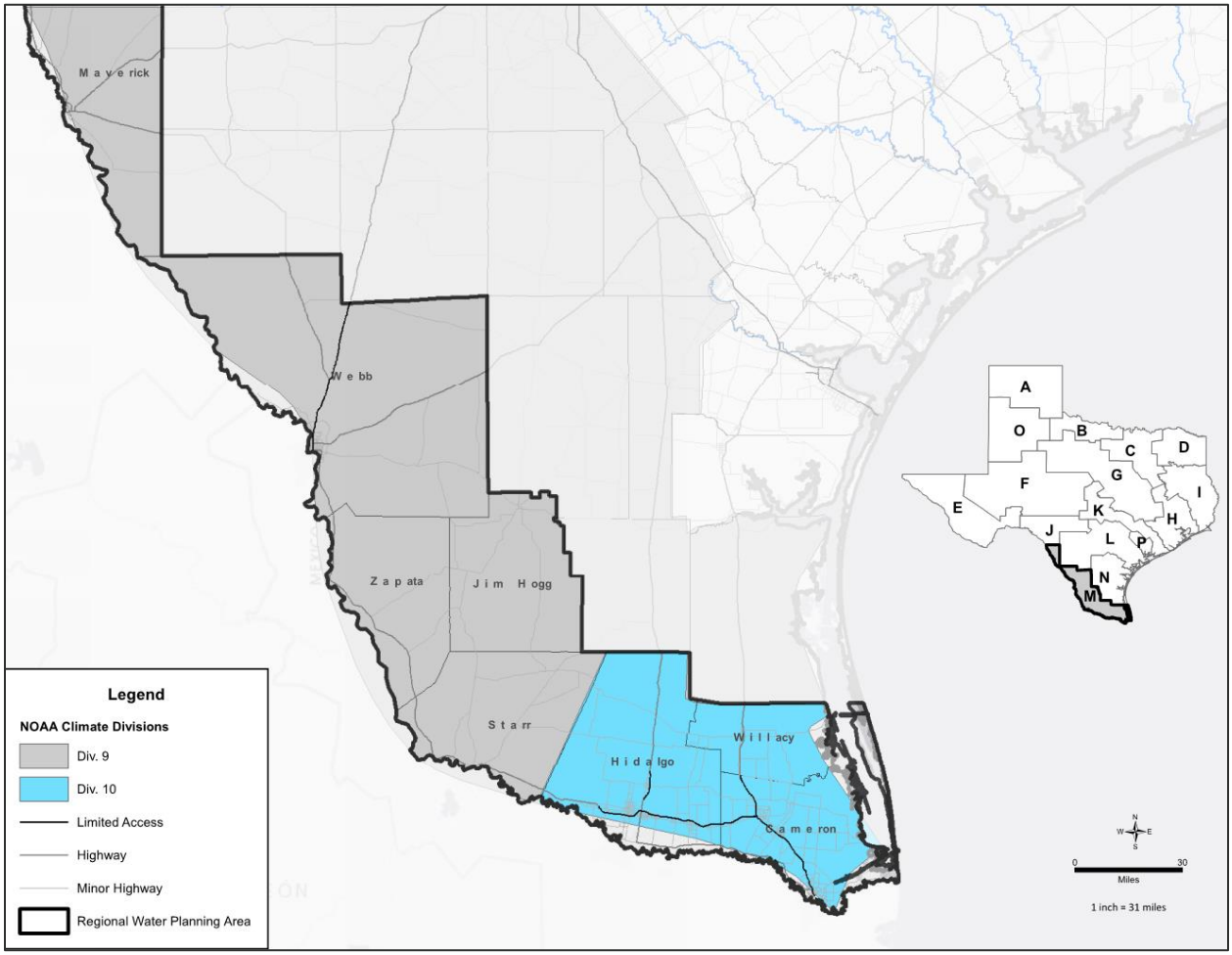

Figure 7-2 National Oceanic and Atmospheric Administration Climate Divisions 9 and 10

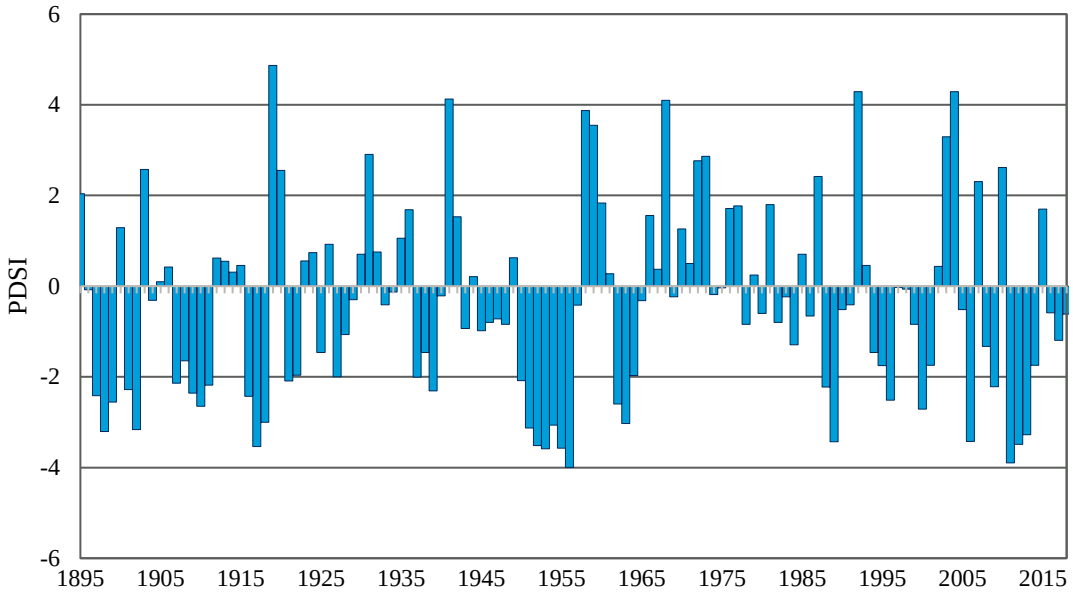

Figure 7-3 **Palmer Drought Severity Index for Division 9**

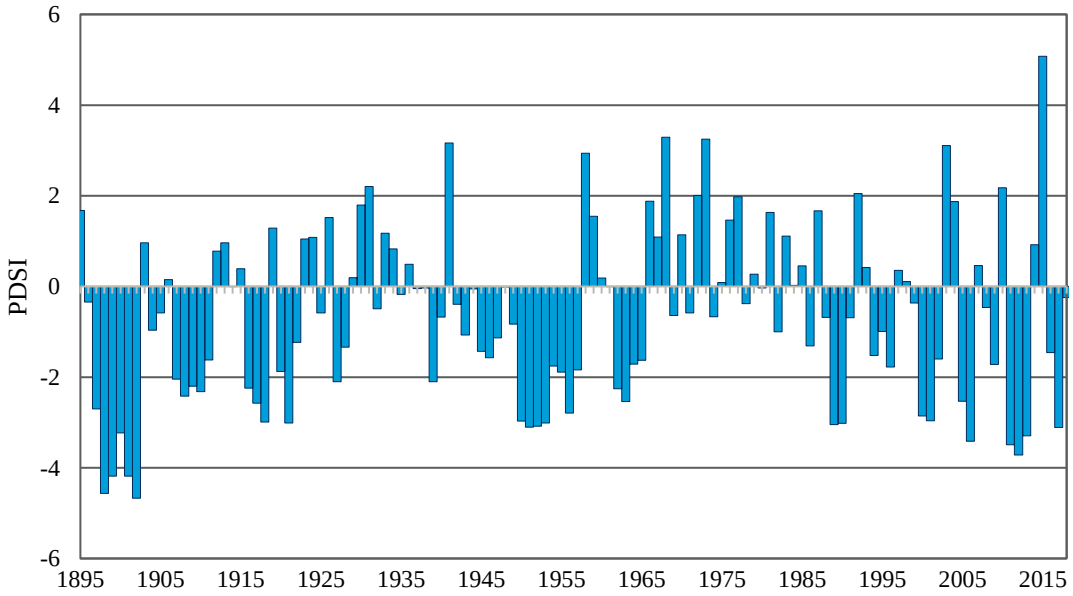

Figure 7-4 **Palmer Drought Severity Index for Division 10**

7.2 CURRENT DROUGHT PREPARATIONS AND RESPONSE

7.2.1 Overview

All water user groups (WUGs) in Region M can prepare for drought by participating in the regional planning process, which plans for long-term supplies that are reliable for the DOR. The regional planning process attempts to meet projected water demands during a drought of severity equivalent to the DOR. Statewide, there have been increased efforts in recent years to establish both long-term drought management strategies to avoid shortages and Drought Contingency Plans (DCPs) to plan for temporary water supply shortages and other water supply emergencies.

The Texas Commission on Environmental Quality (TCEQ) requires that anyone applying for a water right, irrigation districts, wholesale public water suppliers, and all retail public water suppliers serving 3,300 connections or more submit a DCP to the TCEQ. Public water suppliers serving fewer than 3,300 connections are required to have a DCP on file but are not required to submit it to TCEQ. May 1, 2019, was the most recent deadline for DCP submittals.

All the entities that are required to submit a DCP, as well as all users of 1,000 acre-feet or more domestic, municipal, or industrial (DMI) surface water rights and 10,000 acre-feet or more of irrigation surface water rights, are required to submit a Water Conservation Plan (WCP) to TCEQ and TWDB.

Because of these requirements and recent drought conditions, many communities in the Rio Grande Region have addressed drought preparedness and water conservation planning. A complete list of the DCP and WCP that have been submitted to TCEQ at this time is shown in Table 7-2 .

DCPs for retail or wholesale water suppliers are required to include the following:

- 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 the RWPG.

Table 7-2 Submitted Water Conservation and Drought Contingency Plans

ENTITY	WATER CONSERVATION PLAN DATE	DROUGHT CONTINGENCY PLAN DATE
Agua Special Utility District (SUD)	4/25/2019	4/25/2019
Alamo	-	3/28/2014
Bayview Irrigation District No. 11	5/6/2019	5/6/2019
Brownsville Irrigation District	5/15/2009	4/1/2014
Brownsville Public Utilities Board	4/24/2019	4/24/2019
Bruni Rural Water Supply Corporation (WSC)	1/24/2011	1/24/2011
Cameron County Irrigation District No. 2	4/24/2019	4/24/2019
Cameron County Irrigation District No. 6	-	3/14/2016
Delta Lake Irrigation District	9/19/2014	9/19/2014
Donna	-	9/1/2007
Donna Irrigation District	-	-
Eagle Pass Water Works System	9/15/2017	9/15/2017
East Rio Hondo WSC	6/25/2019	6/25/2019
Harlingen Irrigation District	5/19/2003	5/19/2003
Harlingen Waterworks System	6/15/2015	6/15/2015
Hidalgo	8/5/2019	-
Hidalgo Co. Drainage District No. 1	8/25/2014	8/25/2014
Hidalgo Co. Irrigation District No. 1	-	2/22/2007
Hidalgo Co. Irrigation District No. 2	4/18/2019	8/28/2014
Hidalgo Co. Irrigation District No. 5	4/30/2019	4/30/2019
Hidalgo Co. Irrigation District No. 6	4/30/2019	4/30/2019
Hidalgo Co. Irrigation District No. 9	-	-
Hidalgo Co. Irrigation District No. 13	-	4/22/2019
Hidalgo Water Improvement District No. 3	5/20/2019	5/20/2019
Jim Hogg County Irrigation District No. 2	3/31/2011	3/31/2011
La Feria Irrigation District	5/20/2019	5/20/2019
Laguna Madre Water District	3/13/2019	3/3/2019
Laredo	8/9/2019	8/9/2019
Los Fresnos	8/23/2019	8/23/2019
Lyford	-	7/24/2000

ENTITY	WATER CONSERVATION PLAN DATE	DROUGHT CONTINGENCY PLAN DATE
Maverick County Water Control and Improvement District No. 1	4/29/2019	4/29/2019
McAllen, McAllen Public Utility	5/29/2018	5/29/2018
Military Highway WSC	5/5/2014	5/5/2014
Mission Public Works Department	9/25/2019	9/25/2019
North Alamo WSC	9/17/2019	9/17/2019
North Cameron Regional WSC	-	9/11/2014
Olmito WSC	3/11/2019	3/11/2019
Pharr	4/22/2019	4/22/2019
Raymondville	8/28/2014	8/28/2014
Rio Grande City	5/28/2019	5/28/2019
Roma	6/17/2014	6/17/2014
San Benito	8/1/2014	8/1/2014
San Juan	8/17/2011	-
San Ygnacio Municipal Utility District	-	4/8/2014
Santa Cruz Irrigation District No. 15	5/31/2019	5/31/2019
Sharyland WSC	7/16/2019	7/16/2019
Southmost Regional Water Authority	4/24/2019	4/24/2019
Union WSC	-	11/29/2011
United Irrigation district	8/31/2015	8/31/2015
Valley Municipal Utility District No. 2	-	6/18/2013
Valley Acres Irrigation District	-	-
Weslaco	5/1/2009	5/1/2009
Zapata County Water Works	7/13/2014	5/28/2013

7.2.2 Drought Response Triggers

Drought response varies from entity to entity, primarily between groundwater and surface water sources, and those who serve customers with raw water, and those who deliver treated water. For irrigation districts, which deliver raw surface water, the response to drought is largely determined by the Rio Grande water right system. For treated water suppliers, triggers are specific to their users' demand in relation to treatment capacity, wellfield capacity, or the account balance on DMI water rights held.

7.2.2.1 Irrigation Districts

The TCEQ Rio Grande operating rules determine how the United States' share of surface water stored in Amistad and Falcon Reservoirs is apportioned among water right holders in the Region M planning area. A 225,000 acre-foot storage pool within the reservoir is replenished at the beginning of each month for DMI water right accounts. After the DMI storage pool and reservoir operating requirements are met, Class A and B water rights, used primarily for irrigation and mining, are allotted what remains on their account balances if there is sufficient water in the reservoir. In the history of the Watermaster Program, the DMI reserves have always been replenished in full, but the water available annually for Class A and B water rights is often significantly less than the annual maximum authorization of those water rights. Class A and B water rights absorb the impacts of drought on the reservoir system by having less than 100 percent reliability.

Irrigation districts deliver a significant portion of the water used in the Lower Rio Grande Valley (Cameron, Hidalgo, Willacy, and Starr Counties) and Maverick County. The majority of Rio Grande water rights are delivered by irrigation districts. Farmers pay an annual flat rate assessment that entitles them to receive irrigation water on the basis of acreage. When an irrigation district crosses its drought trigger, it goes on water allocation. This means that the district's available water is allocated to irrigation account balances as it becomes available.

Each water district has slightly different rules when on allocation; in some cases, water is allowed to be sold between farmers in their district, or farmers may consolidate their allocation on a portion of their land, leaving other areas for dry land farming. These measures allow farmers to adjust to anticipated water shortages.

A summary of the drought triggers and responses as listed by the irrigation districts that submitted DCPs at the time of writing is shown in Table 7-3.

Table 7-3 Summary of Irrigation District Drought Triggers and Responses

ENTITY	DATE		
Bayview Irrigation District	May 6, 2019	TRIGGERS:	Water assignments are initiated upon approval of the board.
		ACTIONS:	Each irrigation user shall be allocated one irrigation or 0.70 acre-feet of water each flat rate acre on which all taxes, fees, and charges have been paid. As additional water supplies become available to the district, water will be equally distributed, on a pro-rata basis, to those irrigation users whose storage balance in the district's irrigation water rights account reaches 9,000 acre-feet.

ENTITY	DATE		
Brownsville Irrigation District	April 24, 2019	TRIGGERS:	Water assignments are initiated upon approval of the board.
		ACTIONS:	Each irrigation user shall be assigned three irrigations or 1 acre-foot of water for each acre planted in the previous year. As additional water supplies become available to the district, water will be equally distributed as described in Section 11.039 in the Texas Water Code.
Cameron County Irrigation District No. 2	April 24, 2019	TRIGGERS:	Water allocations for irrigators go into effect as determined by the board of the district.
		ACTIONS:	The total water allocated to the irrigation district by the Watermaster will be divided among flat-rate customers evenly so that no one user can irrigate more than their portion.
Delta Lake Irrigation District	Sept. 19 2014	TRIGGERS:	Upon approval of the board, water allocation will become effective when the storage balance in the district's irrigation water rights account reaches 60,000 acre-feet.
		ACTIONS:	Each irrigation user shall be allocated three irrigations or 2 acre-feet of water each flat rate acre. Additional water available to the district will be equally distributed, on a pro-rata basis, to users having an account balance of less than 1 acre-foot of water for each flat rate acre. Transfers of allotments within the district are allowed.
Harlingen Irrigation District	June 15, 2015	TRIGGERS:	Water allocations for irrigators go into effect when either (1) the storage balance in the district's irrigation water rights account has declined to one irrigation-per-acre level or (2) the board determines that there is not sufficient water to complete the traditional crop year.
		ACTIONS:	The total water allocated to the irrigation district by the Watermaster will be divided among flat-rate customers evenly so that no one user can irrigate more than their portion.
Hidalgo Co. Irrigation District No. 1	Feb. 22, 2007	TRIGGERS:	When the Watermaster initiates diversions on the basis of allocations, the district's board of directors determines the total allocation available to the district and stored in the Falcon/Amistad Reservoir System is less than 2.5 acre-feet/year of the estimated active parcels of land.
		ACTIONS:	The district initiates allocation of water to active irrigation users, on a pro-rata basis, provided that no parcel receives an allocation that will result in an account balance exceeding 1.83 acre-feet per acre.

ENTITY	DATE		
Hidalgo Co. Irrigation District No. 2	April 18, 2019	TRIGGERS:	Water allocation goes into effect when the district's total irrigation water account storage balance amounts to a maximum of irrigations for each flat rate acre in which all flat rate is paid and current, and for each net irrigable acre as shown by District records with respect to land in the International Boundary and Water Commission (IBWC) floodway.
		ACTIONS:	Additional water allocated to the district will be equally distributed to those irrigation accounts having a balance of less than three irrigations (or 2 acre-feet equivalent) based on flat rate or net floodway acreage.
Hidalgo Co. Irrigation District No. 5	April 30, 2019	TRIGGERS:	Upon approval of the board, water allocation will become effective when the water allocated to Irrigation District No. 5 for irrigation by the Rio Grande Watermaster amounts to 2-1/2 acre-feet per compliant acre or less.
		ACTIONS:	Water will be allocated on a pro-rata-per-acre basis to the compliant acreage.
Hidalgo Co. Irrigation District No. 6	April 30, 2019	TRIGGERS:	Upon approval of the board, water allocation will become effective when the water allocated to Irrigation District No. 6 for irrigation by the Rio Grande Watermaster amounts to 2-1/2 acre-feet per compliant acre or less.
		ACTIONS:	Water will be allocated on a pro-rata-per-acre basis to the compliant acreage. Transfers of allotments within (but not outside) the district, with the consent of the allotted, will be permitted.
Hidalgo Co. Irrigation District No. 13	April 22, 2019	TRIGGERS:	Upon approval of the board, water allocation will go into effect when the storage balance in the district's irrigation water storage account reaches 1,600 acre-feet and/or Hidalgo County Irrigation District No. 1 notifies the district that water deliveries will be limited to less than 2,000 acre-feet/year.
		ACTIONS:	Upon initiation of water allocation, each irrigation user shall be allocated 1.33 acre-feet of water for each flat rate acre. Additional water allocated to the district will be equally distributed, on a pro rata basis, to those irrigation accounts having account balances less than one irrigation for each flat rate acre.

ENTITY	DATE		
Hidalgo County Water Improvement District No. 3	May 20, 2019	TRIGGERS:	Upon approval of the board, water allocation will go into effect when the district's total water right from the Rio Grande Watermaster amounts to less than 1 year supply as determined by the board.
		ACTIONS:	Water is pro-rated to irrigable land on which all flat rate assessment is paid in accordance with the district's Water Allocation Program. Additional water will be equally distributed, on a pro-rata acreage basis. When the Water Allocation Program is in effect, the district will not supply out-of-district water except in accordance with policy adopted as a result of US Bureau of Reclamation WaterSMART Grant. Additionally, the district does not have issues with push water, as the majority of the water supplied is municipal and does not require irrigation push water.
La Feria Irrigation District	May 20, 2019	TRIGGERS:	Upon approval of the board, water allocation becomes effective when the storage balance in the water rights account reaches an amount less than or equal to two irrigations for each flat rate acre.
		ACTIONS:	Each user is allocated one irrigation or 1 acre-foot of water, if metered, for each flat rate acre. Transfer within the district is allowed. Transfer from outside of the district to a user in the district is allowed.
Santa Cruz Irrigation District	May 31, 2019	TRIGGERS:	Allocation will become effective, upon board approval, when the combined storage in the Amistad and Falcon Reservoirs is at or less than 80% of storage capacity for the district water balance.
		ACTIONS:	Each user is allocated three irrigations or 2 acre-feet of water for each flat rate acre for which taxes, fees, and charges have been paid. Transfer within the district is allowed. Transfer from outside of the district to a user in the district is allowed, but transfers out of the district are not allowed.

7.2.2.2 Retail Public Water Suppliers

Although some cities rely on groundwater exclusively or groundwater comprises a part of their supply, most cities in Region M rely on surface water from the Rio Grande. Because municipal water rights have priority in the Amistad-Falcon Reservoir system, these water rights have historically been considered “guaranteed” in their full authorized diversion volume.

Those entities who deliver treated water generally developed triggers that were either based on the remaining municipal water rights available to the city for that year or the capacities of their treatment plants, so that high demands on the plants trigger a conservation stage. The conditions of the reservoirs are occasionally listed among triggers in public water supply DCPs but have little bearing on the

availability of municipal water. 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.

A summary of the DCPs available for cities and water supply corporations at the time of writing is included as Appendix 7.A, and summary tables for some of the larger systems are shown in Table 7-4 through Table 7-9.

Table 7-9

Table 7-4 East Rio Hondo Water Supply Corporation Drought Response

EAST RIO HONDO WATER SUPPLY CORPORATION		6/25/2019
Basis of Drought	Reservoir level, irrigation district notice to disallow irrigation, water demand, system break/failure or contamination, distribution system pressure	
Drought Stage	**TRIGGERS:**	**ACTIONS:**
Stage 1	Falcon and Amistad Reservoirs reach 40% of capacity as determined by the TCEQ	Customers shall be requested to voluntarily conserve water and adhere to the prescribed restrictions on certain water uses.
Stage 2	(1) Cameron County Irrigation District No. 2 or other irrigation districts provide notice to East Rio Hondo WSC that they will disallow farm irrigation water use within 60-90 days. (2) Distribution system pressures fall below 35 pounds per square inch (psi) requirements for two consecutive days. (3) East Rio Hondo WSC consumer demand exceeds 85% of East Rio Hondo WSC plan capacity for 15 days out of any consecutive 30 day period. (4) Falcon and Amistad Reservoirs reach 15% of capacity as determined by TCEQ.	Customers shall be required to comply with the requirements and restrictions on certain nonessential water uses, such as irrigation, washing vehicles, and ornamental fountains and ponds.
Stage 3	(1) Major water line breaks, or pump or system failures occur, which cause loss of capability to provide water service. (2) Natural or man-made contamination of the water supply source(s). (3) Rapidly occurring low-pressure conditions (less than 20 psi) for any reason.	All requirements of Stage 2 shall remain in effect, except the following are prohibited: all irrigation of landscape, using water to wash any vehicle, and adding water to any type of pool.

Table 7-5 Brownsville Public Utilities Board Drought Response

BROWNSVILLE PUBLIC UTILITIES BOARD		4/24/2019
Basis of Drought	Time of year, reservoir level, system break/failure or contamination, water demand/water treatment plant (WTP) capacity, projected water demand	
Drought Stage	**TRIGGERS:**	**ACTIONS:**
Stage 1	Automatically initiated on May 1 of each year and for any of the following: (1) Rio Grande Watermaster advises that a water shortage is possible because of low levels in Amistad and Falcon reservoirs. (2) Level of US' water in Amistad and Falcon reservoirs reaches 51%. (3) Line break, pump, or system failure may result in unprecedented loss of capability to provide service. (4) Peak demand on the distribution system and/or treatment plants is nearing capacity limits.	Customers shall be requested to voluntarily conserve water and adhere to the prescribed restrictions on certain water uses.
Stage 2	(1) Level of US' water in Amistad and Falcon reservoirs reaches 25%. (2) Analyses of water supply and demand indicate that the annual water allotment may be exhausted. (3) Line break or pump, or system failure will result in unprecedented loss of capability to provide service. (4) Peak demands on the distribution system and/or treatment plants are nearing capacity levels. (5) Contamination of the water supply and/or transmission system may result in unprecedented loss of capability to provide service.	Customers shall only be allowed to irrigate and wash vehicles following a certain schedule, golf courses shall follow restrictions in their approved water management plans, restaurants may only serve water to customers upon request, and the following are prohibited unless necessary for public health and safety: washing hard-surfaced areas, washing buildings or structures, using water for dust control, flushing gutters, and failing to repair controllable leaks within a reasonable period of time.
Stage 3	(1) Level of US' water in Amistad and Falcon reservoirs reaches 15%. (2) Analyses of water supply and demand the annual water allotment will be exhausted. (3) Major line break, or pump or system failure may result in unprecedented loss of capability to provide service. (4) Peak demand on the distribution system and/or treatment plants has exceeded capacity levels for three days. (5) Contamination of the water supply and/or transmission system will result in unprecedented loss of capability to provide service. (6) The inability to maintain or replenish adequate volumes of water in storage to provide for public health and safety.	All requirements of Stage 2 shall remain in effect, and in addition, the schedule irrigation and vehicle washing will be further restricted, the use of water from hydrants is only allowed when necessary to maintain public health, safety, and/or welfare, and the following are prohibited: refilling outdoor pools (with some exceptions), operation of outdoor fountains or ponds without recirculation systems unless required to maintain aquatic life, hydrant and sewer flushing except for emergencies, and use of water from or pumping water into resacas.

BROWNSVILLE PUBLIC UTILITIES BOARD		4/24/2019
Stage 4	(1) Major line breaks, or pump or system failures occur which cause unprecedented loss of capability to provide water service, or (2) contamination of water supply and/or transmission system	All requirements of Stage 3 shall remain in effect, and in addition, the following are prohibited: all landscaping watering, use of water for construction purposes under special permit, adding water to swimming pools, adding water to any outdoor or indoor fountain or pond, except to maintain aquatic life.

Table 7-6 City of Laredo Drought Response

CITY OF LAREDO		8/9/2019
Basis of Drought:	Water demand/WTP capacity, reservoir level	
Drought Stage	**TRIGGERS:**	**ACTIONS:**
Stage 1	(1) WTP flow is less than 85% capacity for 5 consecutive days. (2) Amistad Reservoir level reaches 51% capacity.	Customers are asked to voluntarily reduce their water usage and the following are prohibited: allowing irrigation water to run off into a gutter, ditch, drain, or street and failure to repair a controllable leak.
Stage 2	(1) WTP flow is at 85% capacity for 3 consecutive days. (2) Amistad Reservoir level reaches 25% capacity.	All requirements for Stage 1 remain in effect, and the following are only allowed during certain scheduled times: irrigation with sprinkler systems, washing of vehicles, adding water to pools, irrigating parks/plazas/squares. The following are prohibited: operating any ornamental fountain or similar structure without a recycling system and washing paved areas, except to alleviate immediate fire hazards.
Stage 3	(1) WTP flow is at 90% capacity for 1 day. (2) Amistad Reservoir level reaches 20% capacity.	All requirements for Stage 2 remain in effect, except the schedules to use water for certain activities are even stricter, and irrigating athletic fields is also held to a certain schedule. No bulk water sales will be made by the city when the water will be transported outside of the city except for domestic/residential/livestock use. Fire hydrant water sales shall cease.
Stage 4	(1) WTP flow is at 95% capacity for 1 day. (2) Amistad Reservoir level is less than 20% capacity.	All requirements for Stage 3 remain in effect, and no applications for new or expanded water service connections will be approved without permission from the utilities director, water delivered to nonessential industrial and commercial customers will be reduced, and a maximum monthly water use allocation may be established for residential customers. The following are prohibited: irrigation, washing vehicles, adding water to pools.

Table 7-7 McAllen Public Utility Drought Response

MCALLEN PUBLIC UTILITY		12/12/2013
Basis of Drought:	WTP capacity being used, reservoir levels, system outages or failures	
Drought Stage	**TRIGGERS:**	**ACTIONS:**
Stage 1	In effect at all times.	Customers asked to voluntarily limit water use to an amount absolutely necessary for health, business, and irrigation.
Stage 2	(1) Demand reaches or exceeds 85% of capacity for 3 consecutive days. (2) Amistad-Falcon reservoirs reach 40% capacity. (3) Including, but not limited to, system outage, equipment failure, or supply contamination.	The following are restricted: irrigation, but drip method or hand-held buckets permitted at any time; washing motor vehicles, except commercial carwashes or service stations; washing or sprinkling foundations; adding water to swimming pools; operation of fountains or ponds, except with a recycling system; irrigation for golf courses, except those using wastewater effluent; hydrants restricted to firefighting and necessary activities. The following are absolutely prohibited: allowing irrigation water to run off into gutter, ditch, or rain; failure to repair controllable leaks; washing paved surfaces.
Stage 3	(1) Demand reaches or exceeds 90% of capacity for 3 consecutive days. (2) Amistad-Falcon reservoirs reach 25% capacity. (3) Including, but not limited to, system outage, equipment failure, or supply contamination.	All Stage 2 restrictions except further restrictions on means and schedule for irrigation, except by drip or hand-held buckets; watering of golf fairways is prohibited unless with wastewater effluent, reused water, or well water; customers to pay a water surcharge.
Stage 4	(1) Demand reaches or exceeds 95% of capacity for 3 consecutive days. (2) Amistad-Falcon reservoirs reach 20% capacity. (3) Including, but not limited to, system outage, equipment failure, or supply contamination.	All Stage 2 and 3 restrictions except further restrictions on means and schedule for irrigation; washing of motor vehicles not occurring on commercial carwashes and not in the immediate interest of public health and safety is prohibited; carwashes in the interest of public health and safety limited to 50% of monthly average; commercial nurseries, sod farmers, etc., limited to means and schedule restrictions; adding water to pools, except to maintain structural integrity, is prohibited; operation of fountains prohibited; customers to pay a water surcharge.

MCALLEN PUBLIC UTILITY		12/12/2013
Stage 5	(1) Demand reaches or exceeds 100% of capacity. (2) Amistad-Falcon reservoirs reach 15% capacity. (3) Including, but not limited to, system outage, equipment failure, or supply contamination.	All Stage 2, 3, and 4 restrictions except no applications for new, additional, or expanded water connections, lines, etc., are allowed except as approved by the public utility board; water allocations to nonessential customers reduced as established by the public utility board; maximum monthly water allocation for residential customers established with revised rate schedules and penalties by the public utility board; irrigation permitted only by handheld hoses, handheld faucet filled buckets; drip irrigation on set schedule; customers to pay a water surcharge.

Table 7-8 Southmost Regional Water Authority Drought Response

SOUTHMOST REGIONAL WATER AUTHORITY		4/24/2019
Basis of Drought	Time of year, reservoir levels, system malfunction or failure, contamination of water	
Drought Stage	**TRIGGERS:**	**ACTIONS:**
Stage 1	Automatically initiated from May 1 to Sept. 30 of each year or if one or more of the following occur: (1) Watermaster advises the Brownsville public utility board that a water shortage is possible. (2) Level of Amistad and Falcon reservoirs reach 51% or 1.66 million acre-feet. (3) Line breaks or system failures cause loss of service. (4) WTP is nearing capacity levels.	Customers asked to voluntarily conserve water and adhere to the following restrictions: restrict means and/or schedule of irrigation of landscaped areas; minimize or discontinue use of nonessential purposes; and reduce fire hydrant and sewer line flushing.
Stage 2	(1) Levels of Amistad and Falcon reservoirs reach 25% or 834,600 acre-feet. (2) Line breaks or system failures cause loss of service. (3) Demands on Brownsville public utility board distribution and/or WTPs near capacity levels. (4) Contamination of water supply or distribution system causes loss of service.	All Stage 1 restrictions in effect and any or all of the following restrictions: means and schedule of landscape irrigation restricted further; means and schedule of washing motor vehicles, boasts, planes, etc., restricted; water use for golf courses based on water management plan; restaurants prohibited from serving water unless requested; all nonessential uses prohibited.

SOUTHMOST REGIONAL WATER AUTHORITY		4/24/2019
Stage 3	(1) Levels of Amistad and Falcon reservoirs reach 15% or 504,600 acre-feet. (2) Line breaks or system failures cause loss of service. (3) Demands on Southmost Regional Water Authority distribution and/or WTP exceed capacity for 3 days. (4) Contamination of water supply or distribution system causes loss of service. (5) Inability to maintain or replenish water in storage for public health and safety.	All Stage 1 and 2 restrictions and any or all of the following: means and schedule of landscape irrigation and residential car washing restricted further; water from hydrants limited to firefighting or other activities necessary to maintain public health and safety or for construction under special permit; filling swimming pools prohibited; operation of fountain or pond prohibited except for aquatic life; hydrant and sewer line flushing permitted only for emergency; use of water for scenic and recreational ponds and lakes prohibited.
Stage 4	(1) Line breaks or system failures cause loss of service. (2) Contamination of water supply and/or distribution system.	All Stage 1, 2, and 3 restrictions remain in effect and any or all of the following: all landscape watering is prohibited; use of water for construction under special permit prohibited; washing of motor vehicles, boats, planes, etc., prohibited; filling of pools to a maintenance level is prohibited; water for maintenance level of fountains or ponds except to support aquatic life is prohibited. Water rationing can be initiated with any or all of Stage 4 restrictions.

Table 7-9 City of Weslaco Drought Response

CITY OF WESLACO		5/1/2009
Basis of Drought:	Reservoir level, projected water demand, system break/failure	
Drought Stage	**TRIGGERS:**	**ACTIONS:**
Stage 1	(1) Levels of US waters in Amistad and Falcon reservoirs reach 51%. (2) Water demand projections for the year suggest available water rights may be used at 95%.	Request customers to voluntarily reduce water usage.

CITY OF WESLACO		5/1/2009
Stage 2	(1) Levels of US water in Amistad and Falcon reservoirs reach 25%. (2) A condition causes systemwide problems so the normal level of water service may be diminished for a period of time. (3) Water demand projections for the year suggest available water rights may be used at 98%.	The means and/or schedule for the following will be restricted: watering of grass and vegetation, washing of vehicles, adding water to pools, and irrigating golf courses. The following are prohibited: allowing water to run off into gutters or streets, washing of buildings, trailers, railroad cars, failure to maintain defective home plumbing, use of hydrants except for firefighting, ornamental fountain without recirculation, use of water to wash down hard surfaced area, and use of water for dust control.
Stage 3	(1) Levels of US water in Amistad and Flacon reservoirs reach 15%. (2) A condition related to extraordinary circumstances severely and immediately diminish the ability to deliver a normal level of water. (3) Water demand projections for the year suggest available water rights may be used at 100%.	The following are prohibited: new service connections to the water system if another water source is already used, serving restaurant customers water when they do not ask for it, use of water for scenic and recreational ponds or lakes, use of water for pools, use of water to put new agricultural land into production, use of water for new planting or landscaping, and acceptance of applications for new or extended water service connections without approval by the city. Industrial and commercial users must implement an individual curtailment plan, and residential customers will receive a maximum monthly usage amount.

7.3 EXISTING AND POTENTIAL EMERGENCY INTERCONNECTS

7.3.1 Information Collection Methodology

In accordance with Texas Administrative Code (31 TAC 357.42(d)), the RWPG has collected high-level information on existing interconnects. Most water users in Region M are located along the Rio Grande or along canals that convey Rio Grande water. In a sense, the region is highly interconnected.

The distribution system for raw Rio Grande water includes the reservoir system and the 27 Irrigation districts, many of which are either interconnected or have high potential to be connected. The RWPG has reached out through representatives of the Lower Rio Grande Valley Water District Managers Association to the district managers for information about interconnects between raw water systems.

Municipal utilities supplying treated water to retail customers are becoming more interconnected across the region. To evaluate current connections between systems, the Region M Planning Group appointed a member to evaluate information about existing interconnects.

7.3.2 Local Drought Contingency Plans with Emergency Interconnects

Although utilization of emergency interconnects was not included in the DCPs that were reviewed, Table 7-10 shows the known interconnections between public water supply systems and whether the connections are used for regular service or only in emergencies. Detailed information about these interconnections was submitted securely to the Executive Administrator of the TWDB.

Table 7-10 Emergency Interconnections Between Public Water Supply Systems

PUBLIC WATER SUPPLY SYSTEM	INTERCONNECTS	TYPE OF CONNECTION
Agua SUD	La Joya	One-way emergency interconnect
	Peñitas, Palmview, Sullivan City, Mission	All within Agua SUD service area
East Rio Hondo WSC	Harlingen WW	Connection for regular service with capacity to increase in emergencies
	City of Los Fresnos	Connection for regular service
	Olmito WSC	Connection for regular service with capacity to increase in emergencies
	North Cameron Regional	Connection for regular service
	Combes	Emergency Interconnect
Harlingen Water Works (WW)	City of La Feria	Emergency Interconnect
	City of Combes	5 Connections for regular service
	City of Primera	2 Connections for regular service
	City of San Benito	Emergency Interconnect
	City of Palm Valley	2 Connections for regular service
	East Rio Hondo WSC	Connection for regular service

PUBLIC WATER SUPPLY SYSTEM	INTERCONNECTS	TYPE OF CONNECTION
	Military Highway WSC	Connection for regular service
City of McAllen	Edinburg	Used only during times of high demand
	Pharr	Used only during times of high demand
	Mission	Used only during times of high demand
	Hidalgo	Used only during times of high demand
	Hidalgo Co. Irrigation District No. 2, Hidalgo Co. Irrigation District No. 3, United Irrigation District	McAllen receives raw water from these districts
Military Highway WSC	Harlingen WW (see above)	
	Los Indios, Progreso, San Juan	Military Highway serves these entities
North Alamo WSC	City of Mercedes	Emergency interconnect
	Sebastian Municipal Utility District (MUD)	Emergency interconnect
	City of Lyford	Emergency interconnect
	City of Raymondville	Emergency interconnect
	City of Edcouch	Emergency interconnect
	City of Elsa	Emergency interconnect
	City of La Villa	Emergency interconnect
	City of Donna	Connection for regular service
	City of Edinburg	2 Connections for regular service
	Military Highway WSC	Connection for regular service
	Quiet Village Utilities	Connection for regular service
	Port Mansfield PUB	Connection for regular service
	Delta Lake ID, Donna Irrigation District, Hidalgo Co. Irrigation District No. 2, Hidalgo Co. Irrigation District No. 1, East Rio Hondo WSC	North Alamo WSC receives raw water from these districts
Olmito WSC	Los Fresnos	Two-Way emergency interconnect
	Valley MUD No. 2	Two-Way emergency interconnect
Zapata County Waterworks	Zapata Co. Water Control & Improvement District No. 16	Connection for regular service
Brownsville PUB	El Jardin WSC	Connection for regular service

PUBLIC WATER SUPPLY SYSTEM	INTERCONNECTS	TYPE OF CONNECTION
Laguna Madre Water District	Laguna Vista, Port Isabel, South Padre Island	Connection for regular service
Valley MUD No. 2	Military Highway WSC	Emergency interconnect
	Olmito WSC	Emergency interconnect
	Southmost Regional Water Authority	Connection for regular service
	Rancho Viejo	Connection for regular service
Rio Grande City	Rio WSC	Connection for regular service
City of Roma	Escobares	Connection for regular service
Weslaco	Mercedes	Emergency interconnect

7.4 EMERGENCY RESPONSES TO LOCAL DROUGHT CONDITIONS OR LOSS OF MUNICIPAL SUPPLY

Municipal WUGs that are of concern for emergency drought response are identified as those that have a population of 7,500 or less and have a sole source of water, even if that water is provided by a wholesale water provider, or in the case of the Rio Grande region, if those entities receive waters from the Rio Grande from multiple irrigation districts. Additionally, all "county-other" WUGs are considered.

WUGs that meet these criteria are shown in Table 7-11, with the 2010 census population and current suppliers. Most of these districts rely exclusively on water from the Rio Grande system and have no secondary source available to them (the districts that provide Rio Grande surface water are listed as the "Current Supply"). Those that indicate their sole supply is groundwater are generally geographically constrained and limited to local groundwater supplies.

Table 7-11 WUGs Identified for Emergency Drought Response Evaluation

COUNTY	ENTITY	CENSUS POPULATION 2010	CURRENT SUPPLY (1)	CURRENT SUPPLY (2)
Cameron	County-Other	44,311	Surface Water (various)	Groundwater (various)
Cameron	La Feria	7,302	La Feria Irrigation District 3	La Feria (emergency)
Cameron	Laguna Vista	3,117	Laguna Madre Water District	limited non-potable reuse available
Cameron	Olmito WSC	3,361	Cameron Co. Irrigation District No. 6	
Cameron	Palm Valley	1,304	Harlingen Irrigation District No. 1	
Cameron	Primera	4,036	Harlingen Irrigation District No. 1	North Alamo WSC

COUNTY	ENTITY	CENSUS POPULATION 2010	CURRENT SUPPLY (1)	CURRENT SUPPLY (2)
Cameron	Rio Hondo	2,356	Cameron Co. Irrigation District No. 2	
Cameron	Santa Rosa	2,873	La Feria Irrigation District	
Hidalgo	County-Other	32,223	Surface water (various)	Groundwater (various)
Hidalgo	Edcouch	3,161	Hidalgo Co. Irrigation District No. 9	North Alamo WSC emergency interconnect
Hidalgo	Elsa	5,660	Hidalgo Co. Irrigation District No. 9	North Alamo WSC emergency interconnect
Hidalgo	Hidalgo County MUD No. 1	5,412	Hidalgo Co. Irrigation District No. 1	
Hidalgo	La Joya	3,985	Hidalgo County Irrigation District No. 16	Agua SUD one-way emergency interconnect
Hidalgo	La Villa	1,957	Hidalgo Co. Irrigation District No. 9	North Alamo WSC emergency interconnect
Jim Hogg	County-Other	742	Local groundwater	
Jim Hogg	Jim Hogg County Water Control & Improvement District No. 2	4,155	Gulf Coast groundwater	
Maverick	County-Other	28,010	Surface water (various)	Groundwater (various)
Starr	County-Other	24,657	Surface water (various)	Groundwater (various)
Starr	El Sauz WSC	1,504	Rio Grande City	
Starr	El Tanque WSC	1,850	Rio Grande City	
Starr	La Grulla	1,622	Direct Rio Grande	
Starr	Rio WSC	3,298	Rio Grande City	
Webb	County-Other	6,146	Surface water (various)	Groundwater (various)
Webb	Mirando City WSC	541	Mirando City WSC	
Willacy	County-Other	468	Surface water (various)	Groundwater (various)

COUNTY	ENTITY	CENSUS POPULATION 2010	CURRENT SUPPLY (1)	CURRENT SUPPLY (2)
Willacy	Lyford	2,611	Delta Lake Irrigation District	North Alamo WSC emergency interconnect
Willacy	Port Mansfield Public Utility District	277	North Alamo WSC	North Alamo WSC emergency interconnect
Willacy	Sebastian MUD	1,834	La Feria	North Alamo WSC emergency interconnect
Zapata	County-Other	2,321	Surface water (various)	Groundwater (various)
Zapata	San Ygnacio MUD	835	Self-supplied surface water	
Zapata	Siesta Shores Water Control & Improvement District	1,373	Siesta Shores Water Control & Improvement District	

7.4.1.1 Sole Source: Surface Water

Entities that depend entirely on surface water in Region M are very common. If shortages occur as a result of having insufficient water rights to meet demand or to deliver water, there is a water market and provisions that allow for entities to purchase water. Special provisions enable purchase of emergency water. It is recommended that all WUGs procure sufficient water rights or long-term contracts to meet projected demands when feasible. Additionally, access to off-channel storage reservoirs or additional sources of water (groundwater, reuse, etc.) for sole-source utilities may provide increased resilience.

Interconnections

Interconnections between utilities build greater resilience by providing utilities an alternate source of treated water if either system is damaged or fails. Entities that experience push-water requirements when irrigation deliveries are curtailed may also benefit from both raw and treated water interconnects, which could allow districts and utilities to coordinate and consolidate deliveries in a limited number of canals.

Water Quality

Any emergency that impacts the quality of the water in the Rio Grande has the potential to cause significant harm to the region. Because contamination could be released from either the US or Mexican side of the river, there is an additional level of uncertainty regarding potential contaminants. In the past, there have been releases into Rio Grande tributaries that were identified only by a widespread fish kill.

No emergency response plan is currently in place to handle the release of contaminants into the Rio Grande.

A release in April of 2014 on the Rio Salado (a Rio Grande tributary in Mexico) was identified by the Mexican counterpart to the International Boundary and Water Commission (IBWC), the Comisión Internacional de Límites y Aguas, which reported that a release had occurred, but the quantity and the material were unknown.[1] Later information showed that the release was on April 8, but the notification was not until April 30.

TCEQ conducted testing on the Rio Grande upstream and downstream of the inflows from the Rio Salado, which took 5 days to analyze. In this case, the results of broad-spectrum pollutant analysis showed that there were no contaminants that could endanger human health, and other contaminants of concern such as heavy metals were beneath federal and state limits for drinking water. However, this incident drew attention to the lack of emergency plan for the region.

Regular water quality testing and reporting is already in place in some locations to alert farmers of high total dissolved solids in the river. This type of system could be expanded upon to provide regular reports of water quality to utility managers and agencies such as IBWC and TCEQ. This kind of water quality analysis is complicated by the fact that the potential contaminants are not known in many cases. Understanding the timing of contaminant transport through the system could allow entities to pump enough water to fill reservoirs before the contaminant has reached that location. However, the success of this approach is contingent on timely information about releases. At a minimum, information must be communicated to utilities and to the public in an accurate and timely manner so that safe drinking water can be provided immediately.

Recommendations

Long-term recommendations for entities that rely solely on surface water include expansion of alternate water supplies, including fresh and brackish groundwater where available. Emergency recommendations are listed in Table 7-12.

Table 7-12 Recommended Emergency Water Shortage Responses: Surface Water Dependent WUGs

EMERGENCY SHORTAGE	RESPONSES
Insufficient Surface Water Rights	Purchase surface water. Highest stage drought restrictions. Long term: purchase DMI water rights.
Water Treatment Plant Failure	Interconnects with other systems. Truck in water. Highest stage drought restrictions. Long term: facility improvements, system evaluation, and phased improvement plan.

[1] Taylor, Steve. "Darling: Fish Kill Highlights Need For Rio Grande Emergency Plan" Rio Grande Guardian, March 14, 2014. http://riograndeguardian.com/darling-fish-kill-highlights-need-for-rio-grande-emergency-plan/, accessed April 6, 2015.

EMERGENCY SHORTAGE	RESPONSES
Rio Grande Contamination	Immediate testing. Pumping and storage of safe water to any existing storage facilities. Interconnects with systems that have alternate supplies. Truck in water. Emergency communication with boil water or other guidance to customers. Highest stage drought restrictions. Long term: emergency response plan including communications, provision of safe water to critical facilities, etc.

7.4.1.2 Sole Source: Groundwater

Utilities that depend exclusively on groundwater tend to be isolated from other sources and other cities. For instance, Hebbronville is over 30 miles from the nearest city, Falfurrias. For entities that are dependent on groundwater, the entities are encouraged to actively monitor water levels in wells, especially in high-demand periods. Water levels can be used to trigger drought responses, and to guide expansion of wellfields or deepening of wells. Additionally, groundwater quality may be an indicator of decreasing availability from a well or wellfield.

Emergency responses for entities that rely solely on groundwater are shown in Table 7-13.

Table 7-13 Recommended Emergency Water Shortage Responses: Groundwater Dependent WUGs

EMERGENCY SHORTAGE	RESPONSES
Insufficient Well Production	Highest stage drought restrictions. Deepen wells (if possible). Interconnects with other systems (if possible). Truck in water. Long term: facility improvements, system evaluation, and phased improvement plan.
Water Treatment Plant Failure	Highest stage drought restrictions. Interconnects with other systems (if possible). Truck in water. Long term: facility improvements, system evaluation, and phased improvement plan.
Groundwater Quality	Immediate testing. Highest stage drought restrictions. Additional emergency treatment (if possible). Interconnects with other systems (if possible). Truck in water. Long term: supply or treatment facility improvements, system evaluation, and phased improvement plan.

7.5 REGION-SPECIFIC DROUGHT RESPONSE RECOMMENDATIONS AND MODEL DROUGHT CONTINGENCY PLANS

The drought response recommendations made for each water source in the following subsections should be considered in the development of drought response preparations. Model DCPs and WCPs are included for all WUG types in Appendix 7.B.

7.5.1 Amistad-Falcon Reservoir System Drought Response Recommendations

Water supplies from the Amistad-Falcon reservoir system are managed with a unique operating and water rights system, which reserves a significant portion of the reservoir to effectively guarantee DMI water rights and fills irrigation and mining water right accounts as water is available to that storage pool.

This system ensures that, even in the worst recorded drought, a WUG may divert its full annual authorized diversion each year. If a WUG has sufficient water rights to meet its needs, and a reasonable means of delivering the water from the diversion point to the point of need, there should be no issues getting that water in a year similar to the DOR.

Water shortages among municipal WUGs can result from a range of scenarios (discussed in Subsection 7.2.2) including insufficient water rights, issues with water rights account budgeting, delivery issues, and water treatment or storage issues. The primary impact of drought on municipal utilities that rely on the Amistad-Falcon reservoir system is an increase in demands, and not a reduction of supplies.

7.5.1.1 DMI Water Rights Holders

Cities and industrial users in Region M experience drought under the following scenarios, described in Table 7-14 with recommendations specific to each.

Table 7-14 Municipal Shortage Scenarios and Recommendations

SHORTAGE SCENARIO AND TRIGGERS	RECOMMENDED RESPONSES
Insufficient water rights to meet demand. An entity may have sufficient treatment capacity to meet its demands but have insufficient water rights to meet drought year demands. Triggers should be based on useable balance calculations and monthly/weekly demand projections. When the balance of water available for the remainder of the year does not exceed the demand projections by a reasonable margin, severe drought response should be implemented. When the projected demands exceed the balance of water, critical drought response should be implemented.	**Best Practices:** Use of water rights should be managed carefully, and cities should track their useable balance over the year compared with seasonal/monthly demand projections. This will allow a city to implement conservation measures early in the year to stay within its water budget. It is recommended that any city that projects a shortage should purchase water rights when feasible. **Severe Conditions:** Request voluntary municipal and industrial conservation, limit unnecessary municipal usage, consider billing rate incentives for conservation in severe drought periods, and purchase water as it is available. **Critical Conditions:** Implement mandatory municipal and industrial water use restrictions, restrict nonessential municipal water use, consider billing rate incentives for conservation in critical drought periods, and purchase water as it is available.

SHORTAGE SCENARIO AND TRIGGERS	RECOMMENDED RESPONSES
Water treatment plant capacity. Municipal utilities with sufficient water rights may experience a shortage if, during their peak demand months, the capacity of the WTP is not sufficient to meet permit requirements. Triggers should be based on daily treatment volumes and TCEQ WTP capacity rules. When 85% capacity is reached for three consecutive days, severe drought response should be implemented. When 95% capacity is reached, critical drought response should be implemented.	**Best Practices:** Conservation programs can reduce demands on the WTP. The long-term solution is expansion of WTPs' capacity and interconnections with other facilities. **Severe Conditions:** Request voluntary municipal and industrial conservation, limit unnecessary municipal usage, consider billing rate incentives for conservation in severe drought periods, and utilize emergency interconnects. **Critical Conditions:** Implement mandatory municipal and industrial water use restrictions, restrict nonessential municipal water use, consider billing rate incentives for conservation in critical drought periods, and utilize emergency interconnects.
Push water. Even with sufficient water rights to meet demands and to cover normal delivery losses, some municipalities, especially those who receive surface water from irrigation districts that serve mostly irrigation water users, may need additional water to meet minimum operational requirements in the district conveyance system if irrigation water is curtailed. Triggers should be based on (1) the requirement of irrigation water to deliver DMI water in a given district, (2) the useable balance available to irrigators in the district, and whether those irrigators are on allocation, and (3) the storage capacity available to the utility. Severe drought restrictions should be implemented if stored water is at or within a small margin of the projected demands before the next feasible delivery from the district. Critical drought restrictions should be implemented if water in storage is less than the projected demands before the next feasible delivery from the district.	**Best Practices:** First, utilities should have a clear communication plan in place with the irrigation district that alerts the city when irrigation water users may be put on allocation. This may include a drought trigger associated with Amistad/Falcon reservoir storage levels and the useable balance of irrigation accounts in the district. Second, utilities should evaluate their current conveyance methods to see if there are alternate canals or districts that may be able to serve their systems in the case of a push water shortage. Third, where possible, entities should increase their raw water storage to allow for more time between deliveries that need to be timed to coincide with irrigation deliveries. Last, interconnections and emergency agreements with other utilities and other sources are recommended. **Severe Conditions:** Request voluntary municipal and industrial conservation, limit unnecessary municipal usage, consider billing rate incentives for conservation in severe drought periods, utilize emergency interconnects, and identify water that may be available for purchase as push water. **Critical Conditions:** Implement mandatory municipal and industrial water use restrictions, restrict nonessential municipal water use, consider billing rate incentives for conservation in critical drought periods, utilize emergency interconnects, and identify water that may be available for purchase as push water.

7.5.1.2 Irrigation and Mining Water Rights Holders

Farmers can respond to drought through planning, crop selection, highly efficient operations, and on-farm demand reduction strategies (such as narrow border citrus and drip irrigation). Farmers and irrigation districts should maintain useable balance calculations and monitor reservoir levels to facilitate planning. Selection of crops, in conjunction with available demand reduction strategies, can allow farmers to maximize their yield in years of drought. Crop selection tools that take current costs and market values into account have been made available to farmers in the High Plains and could be updated with information specific to the region.

Cooperation with the irrigation districts to increase the operational and conveyance efficiency could yield a significant amount of water to farmers. This is discussed as a water management strategy in Chapter 5.

Mining water use, including oil and gas drilling, can be decreased by close controls of leaks and spills, on-site reuse, and new technology or approaches that require less water. Because mining water rights are subject to the same decrease in reliability in drought years, mining water users are highly encouraged to identify and implement water conservation measures. Both irrigation and mining water demand can be scaled according to available water, and alternate sources, such as reuse or groundwater, may be used when surface water is scarce.

7.5.2 Groundwater Supply Drought Response Recommendations

Many users in Region M rely on groundwater as their main source of supply. The aquifers and subsections of aquifers within Region M exhibit a broad range of drought response characteristics, which require specific drought triggers and responses to be developed for each situation. In general, groundwater wells may be impacted by increased pumping in the area and by decreasing recharge resulting from drought. Insufficient groundwater or groundwater of acceptable quality may result in a shortage.

For general drought preparedness, wells should regularly be monitored for changing water levels and changes in quality. If required, additional temporary treatment may need to be implemented to meet drinking water standards. It is important to understand what temporary treatment options may be used in the case of a shortage. Additional wells and emergency rehabilitation or deepening of existing wells can help to increase supplies in a shortage.

Under severe conditions, established when supplies may be insufficient to meet demands within 60 days or decrease in well productivity or quality, it is recommended that city utility managers request voluntary municipal and industrial conservation, limit unnecessary municipal usage, consider billing rate incentives for conservation in severe drought periods, and utilize any available emergency interconnects.

Under critical conditions, established when demands are expected to exceed supplies within 30 days, it is recommended that city utility managers implement mandatory municipal and industrial water use restrictions, restrict nonessential municipal water use, consider billing rate incentives for conservation in critical drought periods, and utilize emergency interconnects. In the most extreme cases, trucking in water may be the best alternative to meet immediate needs.

7.6 DROUGHT MANAGEMENT WATER MANAGEMENT STRATEGIES

Drought water management strategies (WMS), such as voluntary or mandatory drought water restrictions, are those which are intended to be implemented only in times of drought. While conservation as a whole may be implemented as a long-term strategy, the ability of a WUG to reduce demands in times of severe water shortage can enable reliable delivery of water at levels that maintain near-term health and safety.

It has been demonstrated across the state that municipal WUGs that focus on reducing discretionary outdoor water use first in response to drought and avoid water use reductions in the commercial and manufacturing use sectors may find drought management to be economically viable and cost-competitive with other WMS. Drought WMS may be economically viable as an interim strategy to meet near-term needs through demand reduction until such time as economically viable long-term water supplies can be developed. For planning purposes, it is important that a utility understand the amount of demand reduction that can be expected when drought restrictions are put in place.

All WMS are discussed in more detail in Chapter 5.

7.6.1 Drought Management WMS Considered

The drought management WMS that were considered for Region M included conservation strategies intended to reduce demand or reduce losses and the development of new supplies, which is intended to make the region more resilient to drought. Drought management WMS that were evaluated for all possible WUGs include the following:

- Municipal Drought Management. Water demand reductions, by voluntary or mandatory restrictions, were considered for all municipal WUGs with needs in drought years.
- On-Farm Irrigation Conservation. This strategy is categorized as water management practices, land management systems, and on-farm water delivery systems. However, farming practices considered as drought management WMS include water budgeting, fallowing and consolidating available water supplies, crop selection for low water use, and dry year option contracts.

7.6.2 Recommended/Alternative Drought Management WMS and Triggers

7.6.2.1 Municipal Drought Management WMS

Water demand reductions, by voluntary or mandatory restrictions, were recommended for all municipal WUGs with needs. The RWP is representative of the worst historical drought conditions, and municipal water utilities in Region M and across the state have successfully integrated water demand reduction into their DCPs as a way to respond to drought. Subsection 7.2.2.2 includes examples of drought triggers and responses from municipal water utilities in Region M.

The RWPG has determined that 5 percent demand reduction is an attainable demand reduction for any utility with needs in a drought year. This reduction has been applied to all municipal WUGs with needs.

7.6.2.2 On-Farm Irrigation Conservation

The recommended WMS for on-farm conservation are divided into three categories: water management practices, land management systems, and on-farm water delivery systems. However, farming practices considered as drought management WMS could include water budgeting, fallowing and consolidating available water supplies, crop selection for low water use, and dry year option contracts, which are not specifically included in the on-farm conservation WMS.

Farmers and irrigation districts should maintain useable balance calculations and monitor reservoir levels to facilitate planning. Selection of crops, in conjunction with available demand reduction strategies, can allow farmers to maximize their yield in years of drought. Crop selection tools that take current costs and market values into account have been made available to farmers in the High Plains and could be updated with information specific to the region. Triggers may need to be specific to the irrigation district or the farmer, depending on specific water needs, but should be tied to reservoir levels and water right account balances.

These practices are common and represent the region's response to unmet needs for irrigated agriculture in previous RWPs. An estimated 10 percent reduction in irrigation water demand is applied to all irrigation WUGs with needs.

7.6.3 Drought Management WMS Not Recommended

An approach to water marketing known as "dry year option contracts" or "water supply option contracts" (WSOC) may reduce the impact on agricultural production while providing drought supplies for other uses. This concept involves temporary transfers of irrigation water to provide secure water supplies to non-agricultural users during droughts. This option would transfer water to other users when needed while preserving the water for agriculture during normal water supply situations. In Texas, WSOC is a practice in the Edwards Aquifer area to provide water for endangered species and San Antonio water users during drought.

The Lower Rio Grande Valley and Region M have some unique institutional, hydrologic, and economic conditions that would need to be addressed to provide seller and buyer incentives to enter into a WSOC. Unlike many other areas of the Western United States, water rights are held by the irrigation districts rather than farmers. Given this and the generally low price of agricultural water, farmers have little incentive to conserve water except in drought and lack the ability to sell water conserved by more efficient irrigation methods or fallowing land such as for WSOC payments. While the potential exists for irrigation districts to enter into a WSOC with another user, irrigation districts would need to work with farmers and pass through exercise payments to make WSOCs feasible from the farmer's point of view. In addition, with the generally low cost of irrigation district water, the purchase of this water may be the lowest cost to urban providers and other users compared to alternative sources such as desalination or reuse.

Urban demand has the highest priority in drought conditions, and therefore, urban communities may feel little need to have WSOCs unless there is concern about the agricultural community and/or irrigation district welfare. This strategy would require significant legislative changes and is not recommended at this time.

7.7 OTHER CONSIDERATIONS AND RECOMMENDATIONS

7.7.1 Relevant Recommendations from Drought Preparedness Council

In a letter addressed to all the RWPGs of Texas dated August 1, 2019, the Drought Preparedness Council recommended developing region-specific model DCPs for all water use categories that account for more than 10 percent of water demands in any decade over the 50 year planning horizon. As detailed in the TWDB (refer to Table 7-15), irrigation and municipal WUG water use categories for Region M accounted for more than 10 percent of water demands in all projected decades. Therefore, model DCPs have been developed for irrigation and municipal WUG water use categories and are discussed in Subsection 7.2.2.

Table 7-15 2021 WUG Water Demand Project Data and Drought Contingency Plan Selection Criteria by WUG Water User Category (TWDB 2019)

WUG WATER USE CATEGORY	MODEL DROUGHT CONTINGENCY PLAN	2020	2030	2040	2050	2060	2070
PROJECTED DEMANDS (ACRE-FEET./YEAR)							
IRRIGATION	**YES**	1,426,960	1,381,152	1,335,343	1,289,533	1,243,724	1,197,914
LIVESTOCK	NO	4,748	4,748	4,748	4,748	4,748	4,748
MANUFACTURING	NO	4,305	5,055	5,055	5,055	5,055	5,055
MINING	NO	17,051	16,480	14,952	12,823	10,458	10,361
MUNICIPAL	**YES**	315,689	373,896	433,312	494,887	558,022	620,040
STEAM ELECTRIC POWER	NO	15,240	15,240	15,240	15,240	15,240	15,240
PROJECTED DEMANDS (%)							
IRRIGATION	**YES**	80%	77%	74%	71%	68%	65%
LIVESTOCK	NO	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
MANUFACTURING	NO	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%
MINING	NO	1.0%	0.9%	0.8%	0.7%	0.6%	0.6%
MUNICIPAL	**YES**	18%	21%	24%	27%	30%	34%
STEAM ELECTRIC POWER	NO	0.9%	0.8%	0.8%	0.8%	0.8%	0.8%

7.7.2 Other Drought Management Measures

Livestock water supplies are from both groundwater and surface water in Region M. In a drought scenario, it is important that windmill pumps that fill stock ponds and tanks be used only when needed, rather than allowed to run at all times. Agricultural and livestock demands may be significantly increased in severe drought, which can impact groundwater supplies. In addition to careful management of water

supplies, drought relief programs may be pursued to assist with livestock demands in a severe drought, including the emergency Haying and Grazing Program.

7.7.3 Recommendations Regarding the Drought Preparedness Council and State Drought Preparedness Plan

The 2019 Texas Legislature and Governor Abbott greatly expanded the TWDB's role in flood planning and financing. In addition to existing flood programs, the TWDB will be administering new state and regional flood planning process with flood planning regions based on river basins. The regional flood planning process will be developed and initial regional flood planning groups formed by mid-2020; the first regional flood plans will be due in 2023, and the first state flood plan will be due September 1, 2024.

The legislature has allocated funds to collect flood-related data, support river and coastal modeling capabilities, distribute critical flood information, and create a new flood funding program to be administered by the TWDB. The funding program will be designed to make the implementation of drainage and flood projects more affordable for Texas communities and to meet immediate needs for funding. The funding will become available in 2020.