RED SANDS GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN

Red Sands Groundwater Conservation District

315 E. Monte Cristo Rd
Edinburg TX 78541

Adopted September 21, 2023

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ACRONYMS AND ABBREVIATIONS

DFCs	desired future condition
District	Red Sands Groundwater Conservation District
GAM	Groundwater Availability Model
GCD	Groundwater Conservation District
GMA	Groundwater Management Area
HB	House Bill
MAG	Modeled Available Groundwater
PDSI	Palmer Drought Severity Index
SB	Senate Bill
TAC	Texas Administrative Code
TWC	Texas Water Code
TWDB	Texas Water Development Board

1.0 DISTRICT MISSION

The Mission of Red Sands Groundwater Conservation District (District) is to develop and implement an efficient, economic, and environmentally sound groundwater management program to protect, preserve for the future, and enhance the water resources of the District.

2.0 PURPOSE OF THE MANAGEMENT PLAN

Senate Bill (SB) 1, enacted by the 75th Legislature in 1997, and SB 2, enacted by the 77th Legislature in 2001, established a comprehensive, statewide planning process and the actions necessary for districts to manage and conserve the groundwater resources of the State of Texas. These bills require each groundwater conservation district (GCD) to develop a management plan which defines (1) the water needs and supply and (2) the goals it will use to manage the underground water to meet these needs. In addition, the 79th Texas Legislature enacted House Bill (HB) 1763 in 2005 that requires joint planning among all districts within a single Groundwater Management Area (GMA). These GCDs must establish the desired future conditions (DFCs) of the aquifers within their respective GMAs and submit these DFCs to the executive administrator of the Texas Water Development Board (TWDB). Technical information, such as the DFCs of the aquifers within the District's jurisdiction, and the amount of modeled available groundwater from such aquifers, is required to be included in the District's management plan and will guide the District's regulatory and management policies.

The District's management plan satisfies the requirements of SB1, SB2, HB 1763, the statutory requirements of Texas Water Code (TWC) Chapter 36, and the rules and requirements of the TWDB.

3.0 DISTRICT INFORMATION

3.1 District Creation

Creation of the District was authorized in 1999 by the 79th Texas Legislature under SB 1911. The citizens of Hidalgo County, within the District, confirmed the creation of the District by an election held in November 2002. The District was formed to protect the groundwater resources for the citizens of north-central Hidalgo County. Beyond its enabling jurisdiction, the District is governed primarily by the provisions of Chapter 36 of the TWC, the District's Management Plan, and the District Rules.

3.2 Management

The Board of Directors consists of five members. These five directors are elected by the voters within the boundaries of the District and serve staggered 4-year terms. To be eligible to serve as director, an individual must reside within the District.

3.3 Authority

The District is governed primarily by the provisions of TWC Chapter 36 and 31 Texas Administrative Code (TAC) Chapter 356. The District has the power and authority to undertake various hydrogeological studies, to adopt a management plan, to establish a program for the permitting of certain wells, and to implement programs to achieve its statutory mandates. The District has rule-making authority to implement its policies and procedures and to help ensure the management of the groundwater resources of north-central Hidalgo County.

3.4 Location and Extent

The jurisdiction of the District includes all territory in north-central Hidalgo County located within the boundaries described in **Exhibit 1**. The District lies in the northern region of Hidalgo County. Exhibit 1 shows the area regulated by the District at the time the management plan was adopted. The District occupies 114 square miles, which is approximately 7.2% of the 1,583 square miles in Hidalgo County.

3.5 Topography and Drainage

Hidalgo County is located within the Lower Rio Grande Valley. The Lower Rio Grande Valley is a broad plain that gradually rises in elevation from east to west. Most drainage flows to either the Rio Grande River or the Laguna Madre. In northern Hidalgo County, drainage is into shallow depressions that allow for either percolation into the subsurface or evaporation. The most prominent drainage feature in Hidalgo County is the Rio Grande River, which forms the southern boundary of the County.

3.6 Groundwater Resources of the District

The District is located within the area of the Gulf Coast Aquifer. The aquifer receives recharge directly from precipitation on the land surface. Generally, the strata composing the Gulf Coast Aquifer are considered to be a large, leaky, artesian system where recharge can occur at formational boundaries such as permeable sands.

The Chicot, Evangeline, and Jasper aquifers comprise the Gulf Coast Aquifer System. **Table 1** provides a simplified stratigraphic and hydrogeologic chart of the Texas Gulf Coast Aquifer System. The Chicot Aquifer includes, from the shallowest to deepest, the Beaumont and Lissie formations of Pleistocene age and the Pliocene-age Willis Formation. The Evangeline Aquifer includes the Upper Goliad Formation of earliest Pliocene and late Miocene age, the Lower Goliad Formation of late Miocene age, and the upper unit of the Lagarto Formation (a member of the Fleming Group) of late and middle Miocene age. The Jasper Aquifer includes the Lower Lagarto unit of early Miocene age and the early Miocene Oakville sandstone member of the Fleming Group.

Exhibit 2a shows the outcrops for the surficial deposits and formations in the vicinity of Hidalgo County. In southern Hidalgo County, surficial deposits include the Rio Grande alluvium and terrace deposits. In northern Hidalgo County, the surficial deposits include wind-deposited sands that form a fairly typical dune topography. **Exhibit 2b** shows the locations of the outcrops for the Chicot Aquifer, Evangeline Aquifer, the Burkeville Confining Unit, and the Jasper Aquifer. **Exhibit 2b** also shows the location of

major growth faults (Ewing, 1990) in the vicinity of Hidalgo County. Growth faults are syndepositional normal faults that form mainly by gravitational failure during rapid sediment loading along an unstable shelf margin and upper slope (Winker and Edwards, 1983). Syndepositional means that sedimentation (deposition) is occurring at the same time as faulting. Growth faults commonly enhance vertical flow and impede horizontal groundwater flow.

Exhibit 3 is a vertical cross-section of the Gulf Coast formations and aquifers along a transect that crosses through the middle of Hidalgo County. Because the Gulf Coast Basin was subsiding at the same time sediments were being deposited, the aquifers tend to increase in thickness towards the coast of the Gulf of Mexico. The numbered grey vertical lines in Exhibit 3 are locations of geophysical logs used by Young and others (2010) to determine the stratigraphy along the transect.

The groundwater in this portion of the Gulf Coast Aquifer may be brackish, with fresh water found in specific localities. In the past, the groundwater system of the Lower Rio Grande area was classified to recognize four such localized sources of fresh groundwater: the Lower Rio Grande Valley groundwater reservoir, the Mercedes-San Sebastian shallow groundwater reservoir, the Linn-Faysville groundwater reservoir, and the Oakville Sandstone. The Baker and Dale (1964) map of these four groundwater sources is shown in **Exhibit 4**. The District is located within the formerly recognized Linn-Faysville groundwater reservoir. This source of fresh groundwater is locally recognized as the Red Sands Aquifer.

Most wells found within the boundaries of the District are less than 100 feet deep. The individual sand beds which contain the groundwater are discontinuous, creating a “hit or miss” scenario when drilling for a productive well. However, where the sand is rather permeable, it is not uncommon to find wells yielding several hundred gallons per minute. Deep wells penetrate much thicker water-bearing sands than the shallow wells, and some may yield greater than 500 gallons per minute when pumped. The water produced from these wells may contain higher amounts of sodium, boron, and chloride than in the shallow wells (Follett and others, 1949).

Table 1 Simplified Stratigraphic and Hydrogeological Chart of the Texas Gulf Coast Aquifer System in Hidalgo County

Period	Epoch	Age (M.Y.)	Stratigraphic Unit	Hydrogeologic Unit
Quaternary	Holocene	0.02	Windblown sediments and Rio Grande Alluvium	Chicot Aquifer
	Pleistocene		Beaumont	
		1.8	Lissie	
Tertiary	Pliocene	5.3	Willis	
	Miocene		Goliad (Upper and Lower)	Evangeline Aquifer
			Upper Lagarto	
		17	Middle Lagarto	Burkeville
			Lower Lagarto	Jasper Aquifer
		22	Oakville	
		34	Catahoula/Vicksburg	Aquitard and aquifer

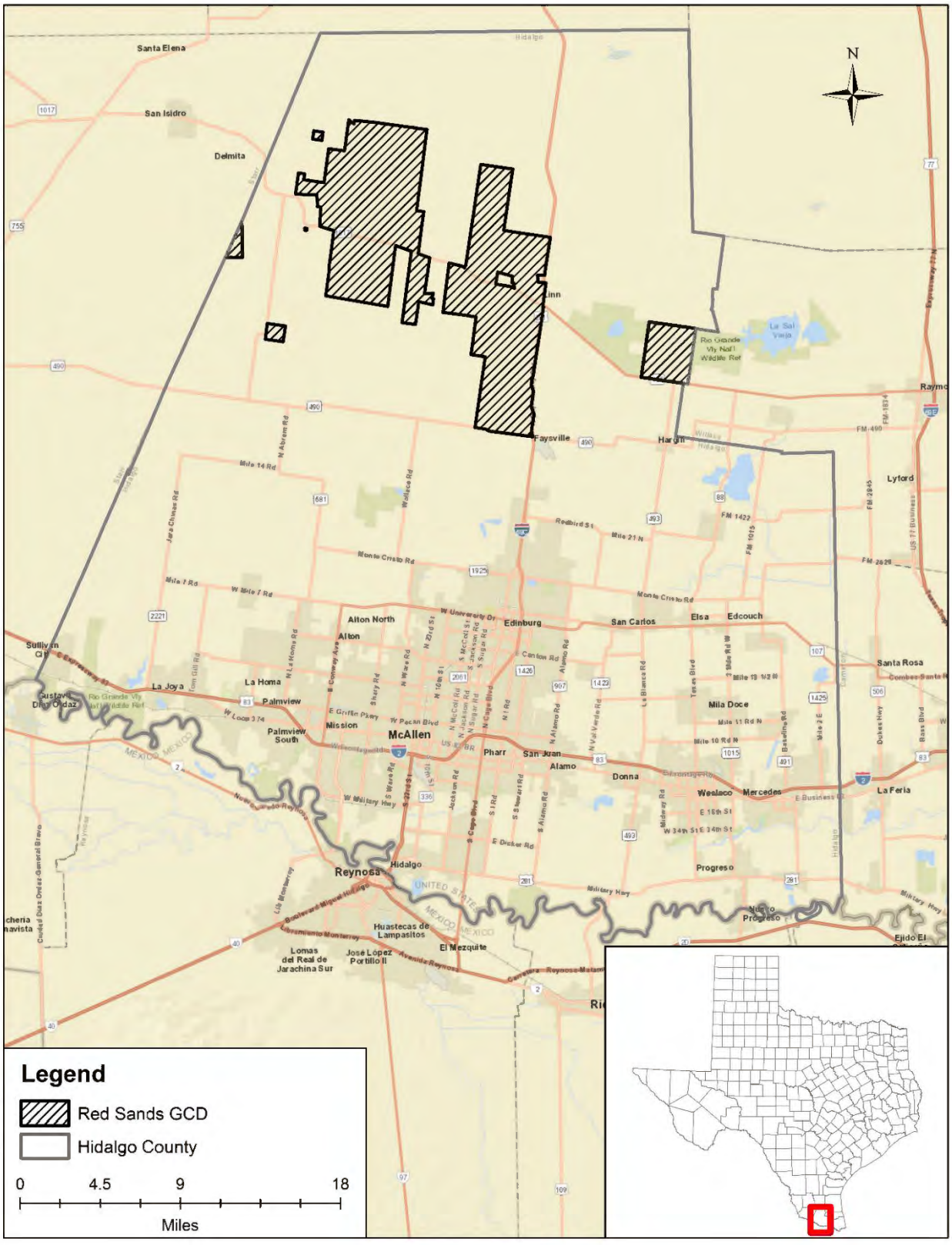

Exhibit 1 Location of the Red Sands Groundwater Conservation District

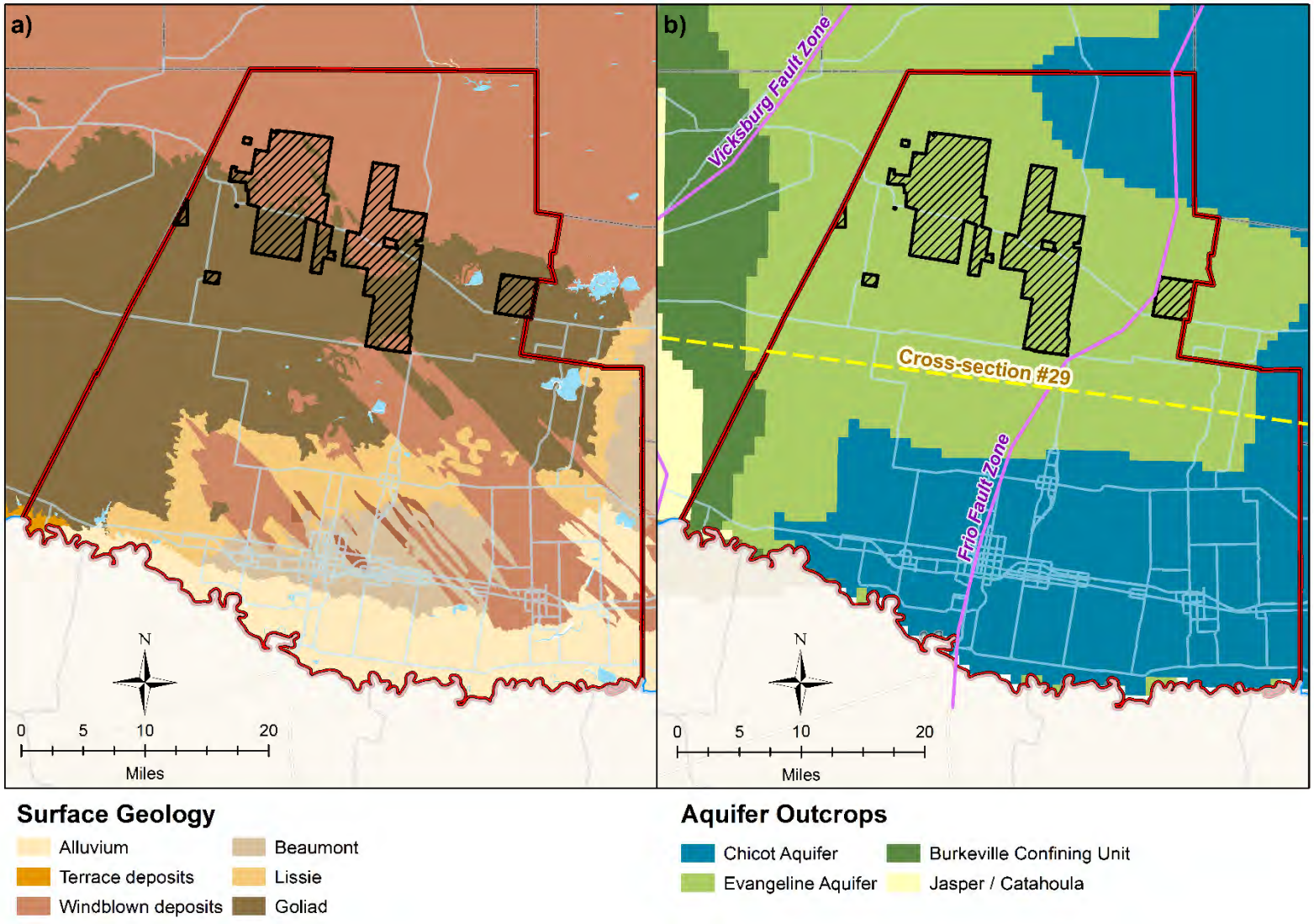

Exhibit 2 Map of Surface Geology Showing Formations Surficial Deposits (a) and Aquifers and Major Growth Faults (b) (Modified from Young and others, (2010)).

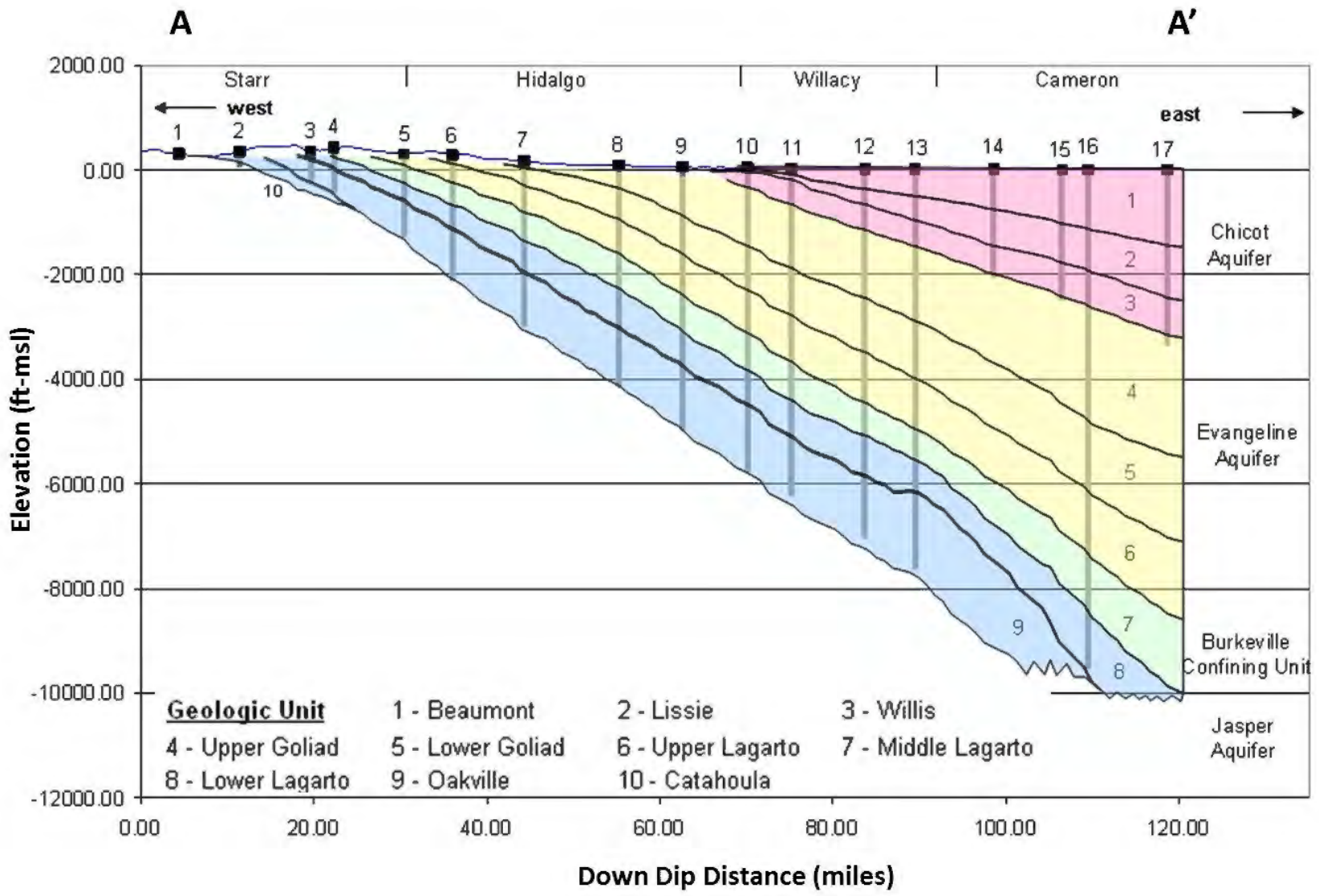

Exhibit 3 Vertical Cross-Section Showing Formations and Aquifers Comprising the Gulf Coast Aquifer System Along Transect A-A' shown in Exhibit 2. Vertical exaggeration is 320:1. (from Young and Others, (2010))

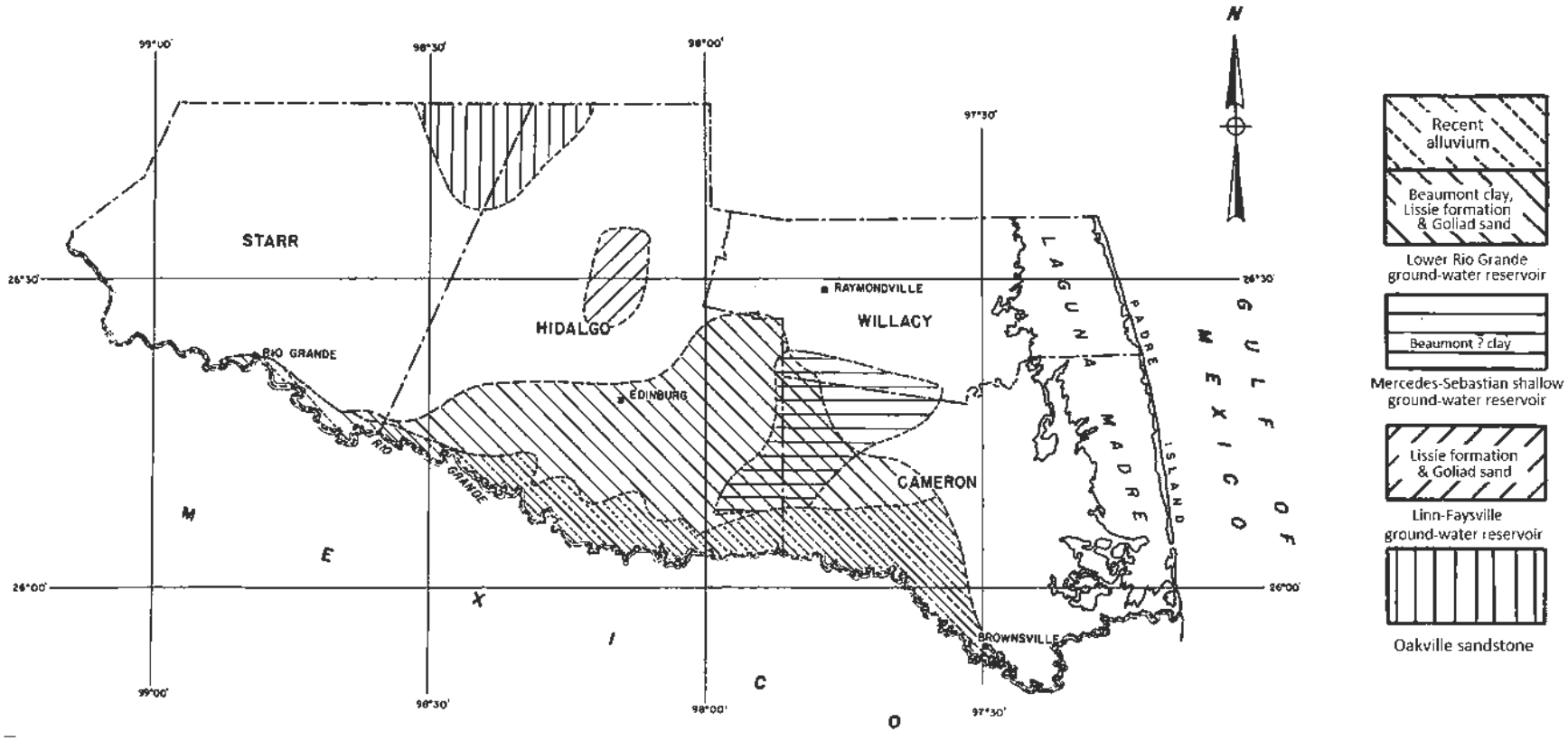

Exhibit 4 Approximate Productive Areas of the Major Sources of Groundwater in the Lower Rio Grande Valley, from Baker and Dale (1964).

4.0 STATEMENT OF GUIDING PRINCIPLES

The District recognizes that the groundwater resources in the north central Hidalgo County region are of vital importance. The preservation of this most valuable resource can be managed in a prudent and cost-effective manner through education, cooperation, and developing a comprehensive understanding of the aquifer. The greatest threat to the District in achieving its stated mission is the inappropriate management of its groundwater resources, based on a lack of understanding of local conditions. The District's management plan is intended to serve as a tool to focus the thoughts and actions of those given the responsibility for the execution of the District's activities.

5.0 CRITERIA FOR PLAN CERTIFICATION

5.1 Planning Horizon

The time period for this plan is 5 years from the date of approval by the executive administrator or, if appealed, on approval by the TWDB. This plan is being submitted as part of the five-year review and re-adoption process as required by TWC 36.1072(e). This plan will remain in effect until a revised management plan is approved by the executive administrator or the TWDB. The plan shall be reviewed annually and updated and readopted in accordance with the requirements of the TWC.

5.2 Board Resolution

A certified copy of the District resolution adopting the plan is provided in **Appendix A**.

5.3 Plan Adoption

Public notices documenting that the plan was adopted following appropriate public meetings and hearings are provided in **Appendix B**.

5.4 Coordination with Surface Water Management Entities

A letter transmitting a copy of this plan to the surface water management entities with jurisdiction within the District is provided in **Appendix C**.

6.0 ESTIMATES OF TECHNICAL INFORMATION REQUIRED BY THE TEXAS WATER CODE--

6.1 DFCs Established and Adopted by GMA 16

Modeled available groundwater is defined in TWC §36.001 as "the amount of water that the executive administrator determines may be produced on an average annual basis to achieve a desired future condition established under TWC Section 36.108." DFCs for the District are determined through joint planning with other GCDs in the GMA 16. **Exhibit 5** shows a map of the GCDs that comprise GMA 16. GMA 16 adopted the DFCs in **Table 2** on November 16, 2021. GMA 16 declared other aquifers outside the Gulf Coast Aquifer System as non-relevant. Other aquifers in GMA 16 include the Yegua-Jackson Aquifer and the Carrizo-Wilcox Aquifer.

Table 2 DFCs Adopted by GMA 16 (from Young, 2022)

GCD or Region	Simulated Average Drawdown (ft) *from January 1, 2010 to December 31, 2079 [1]				
	Chicot	Evangeline	Burkeville	Jasper	Gulf Coast Aquifer System
Bee GCD	126	102	90	75	93
Brush County GCD	60	101	88	89	89
Duval County	99	183	121	109	137
Kenedy County GCD	18	56	18	18	27
Live Oak UWCD	100	83	79	25	45
McMullen GCD	0	0	0	12	12
Red Sands GCD	48	62	61	60	60
San Patricio County GCD	114	84	39	39	69
Starr County GCD	0	112	100	76	94
Non-district Cameron	125	196	78	78	119
Non-district Hidalgo	153	170	119	117	138
Non-district Kleberg	15	46	11	11	21
Non-district Nueces	33	40	15	15	26
Non-district Webb	0	226	0	91	161
Non-district Willacy	47	85	23	23	44
GMA 16 TOTAL	61	110	67	65	78

[1] Drawdowns have a range of ±3 feet

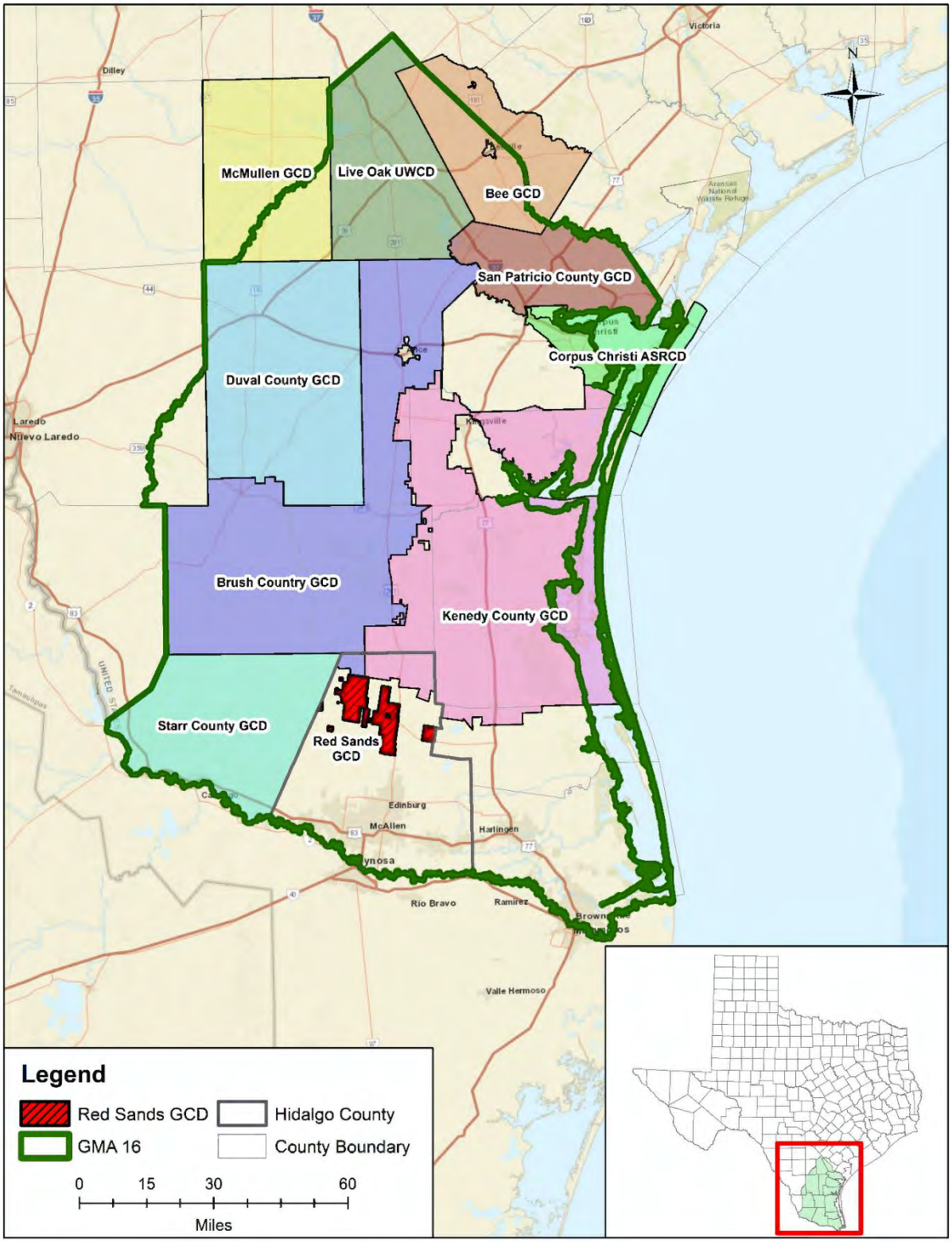

Exhibit 5 Map of Groundwater Management Area 16 and the Groundwater Conservation Districts that comprise GMA 16

6.2 Modeled Available Groundwater in the District

The TWDB (Cha, 2022) determined the Modeled Available Groundwater (MAG) for the Gulf Coast Aquifer System based on the DFC presented in Table 2. As defined in Chapter 36 of the TWC, "modeled available groundwater" is the estimated amount of water that may be produced annually to achieve a DFC. The TWDB determined the MAGs by running the alternative groundwater availability model (GAM) for GMA 16 (Hutchison and others, 2011) using the predictive model files ("Pumping Scenario #2") submitted with the desired future condition explanatory report (Young, 2022). **Table 3** presents the MAGs calculated by TWDB (Cha, 2022) for the District and for No-District Hidalgo County for 2020, 2030, 2040, 2050, 2060, 2070 and 2080. The area designed as "No-District Hidalgo County" includes Hidalgo County without the area associated with the Red Sands GCDs. A copy of Cha(2022) is provided in **Appendix D .**

GAM Run 21-021 MAG: Modeled Available Groundwater for the Gulf Coast Aquifer System in Groundwater Management Area 16 (Cha, 2022)

Table 3 Modeled Available Groundwater (acre-ft) for the District and Hidalgo County for 2010, 2020, 2030, 2040, 2050, and 2060

Region	Year						
	2020	2030	2040	2050	2060	2070	2080
Red Sands GCD	1,667	1,966	2,265	2,563	2,863	2,863	2,863
No-District Hidalgo County	85,634	90,905	96,175	101,445	106,715	106,715	106,715

6.3 Amount of Groundwater Used within the District Annually

Except for municipal use, the historical groundwater use for the District in **Table 4** was estimated by multiplying the annual estimated pumping use amounts in Hidalgo County by 0.072, which is the fraction of the area in Hidalgo County occupied by the District. The municipal use is based on the municipalities located within the District. The values in Table 4 were obtained from a TWDB report to the District (TWDB, 2023). A copy of TWDB(2023) report is provided in **Appendix E**.

Table 4 Estimated Historical Groundwater Use (acre-ft) in the District Calculated by Multiplying the Estimated Historical Groundwater Pumping in Hidalgo County by 0.072.

	With 7.2% Multiplier						
Year	Municipal (acre-ft)	Manufacturing(acre-ft)	Mining (acre-ft)	Steam Electric Power(acre-ft)	Irrigation (acre-ft)	Livestock (acre-ft)	Total (acre-ft)
2019	766	0	34	86	288	17	1,191
2018	738	0	33	83	259	17	1,130
2017	711	0	34	89	108	16	958
2016	938	0	46	85	7	22	1,098
2015	903	0	46	39	9	21	1,018

	With 7.2% Multiplier						
Year	Municipal (acre-ft)	Manufacturing(acre-ft)	Mining (acre-ft)	Steam Electric Power(acre-ft)	Irrigation (acre-ft)	Livestock (acre-ft)	Total (acre-ft)
2014	1,012	0	50	0	42	20	1,124
2013	927	0	48	0	4	21	1,000
2012	889	0	49	0	16	21	975
2011	947	0	29	0	0	25	1,001

6.4 Annual Amount of Recharge from Precipitation to the Groundwater Resources within the District

The TWDB GAM Run 16-008 (Shi, 2016) determined that the amount of recharge from precipitation falling on the outcrop areas of the Gulf Coast aquifers to the District is 675 acre-feet per year. The TWDB GAM Run 16-008 used version 2.0 of the GAM for the southern portion of the Gulf Coast Aquifer System (Chowdhury and Mace, 2007). A copy of TWDB GAM Run 16-008 (Shi, 2016) is provided in **Appendix F.**

6.5 For Each Aquifer, Annual Volume of Water That Discharges From The Aquifer To Springs And Any Surface Water Bodies, Including Lakes, Streams, And Rivers

The TWDB GAM Run 16-008 (Shi, 2016), which is provided in Appendix F, determined that the amount water discharged to the surface water systems by the groundwater resource to the District is 0 acre-feet per year. The TWDB GAM Run 16-008 used version 2.0 of the GAM for the southern portion of the Gulf Coast Aquifer System (Chowdhury and Mace, 2007).

6.6 Annual Volume of Flow into And Out Of The District Within Each Aquifer And Between Aquifers In The District, If Gam Is Available

The TWDB GAM Run 16-008 (Shi, 2016), which is provided in Appendix F, determined that the flow into the District from the Gulf Coast Aquifer System is 6,324 acre-feet per year and that the flow out of the District to the Gulf Coast Aquifer System is 6,548 acre-feet per year. The TWDB GAM Run 16-008 used version 2.0 the GAM for the southern portion of the Gulf Coast Aquifer System (Chowdhury and Mace, 2007). The model used by Chowdhury and Mace (2007) assumes no cross-formational flow at the base of the Gulf Coast Aquifer System the underlying hydrogeologic units.

6.7 Projected Surface Water Supply in The District, According to The Most Recently Adopted State Water Plan

The projected surface water supplies for the District are provided on pages 4 and 5 of Appendix E in the table named “Projected Surface Water Supplies TWDB 2022 State Water Plan Data”. The amounts were calculated by multiplying the projected surface water supply in the 2022 State Water Plan for Hidalgo County by 0.072, which is the fraction of Hidalgo County area occupied by the District. **Table 5** lists the

total projected surface water supplies for the District for the years 2020, 2030, 2040, 2050, 2060, and 2070.

Table 5 Total Projected Surface Water Supply (acre-ft) for the District for the Years 2020, 2030, 2040, 2050, 2060, and 2070

	Year					
Total Projected Surface Water Supply (acre-ft)	2020	2030	2040	2050	2060	2070
	130,719	130,749	127,055	127,041	127,077	127,082

6.8 Projected Total Demand for Water in The District According to The Most Recently Adopted State Water Plan

The projected water demands for the District are provided on pages 6 and 7 of Appendix E in the table named "Projected Surface Water Demands TWDB 2022 State Water Plan Data". The amounts were calculated by multiplying the projected water demands in the 2022 State Water Plan for Hidalgo County by 0.072, which is the fraction of Hidalgo County area occupied by the District. **Table 6** lists the total projected demands for the District for the years 2020, 2030, 2040, 2050, 2060, and 2070.

Table 6 Total Projected Total Demand for Water in the District for the Years 2020, 2030, 2040, 2050, 2060 and 2070

	Year					
Total Projected Surface Water Deman (acre-ft)	2020	2030	2040	2050	2060	2070
	208,922	241,337	274,367	308,311	343,071	377,010

6.9 Consider the Water Supply Needs And Water Management Strategies Included In The Adopted State Water Plan

With regard to developing rules for managing groundwater resources, the District will consider the projected water supply needs for Hidalgo County provided on pages 8 and 9 of Appendix E in the table named "Projected Water Supply Needs TWDB 2022 State Plan Data". **Table 7** lists the total projected water supply needs for the years 2020, 2030, 2040, 2050, 2060, and 2070.

From 2020 to 2070, water supply needs in Hidalgo County (see Appendix E) are projected to increase from a supply need of 440,889 acre-ft to a supply need of 511, 851 acre-ft. In 2020, approximately 90% of the supply need is related to irrigation. By 2070, the percentage of supply need related to irrigation is projected to drop to about 60%. From 2020 to 2070, the increase in supply need is driven by public water supply. The three cities with the greatest increase in supply need are: Edinburg, McAllen, and Mission.

Table 7 Total Projected Water Supply Needs for Water in the Hidalgo County for the Years 2020, 2030, 2040, 2050, 2060 and 2070 (negative values reflect a projected water supply need, positive values reflect a project water supply surplus)

	Year					
Total Projected Water Supply Needs (acre-ft)	2020	2030	2040	2050	2060	2070
	-440,889	-449,869	-466,839	-481,789	-496,952	-511,851

With regard to developing rules for managing groundwater resources, the District will consider the water management strategies in the 2022 State Water Plan for Hidalgo County listed in **Appendix E** on pages 10 through 20 in the table named "Projected Water Management Strategies TWDB 2022 State Water Plan Data." **Table 8** lists the sum of the projected water management strategies for Hidalgo County for the years 2020, 2030, 2040, 2050, 2060, and 2070.

From 2020 to 2070, the total water management strategies in Hidalgo County (see Appendix E) are projected to increase from 84,822 acre-ft to 328,704 acre-ft. The strategies with the greatest amount of water are Wholesale Water Provider (WWP) reduction created from conversion of irrigation water rights to domestic, municipal or industrial (DMI) supplies. Most of the WWP reductions are associated with the Amistad-Falcon Lake/Reservoir System. The strategies with the second greatest amount of water is Advanced Municipal Conservation. Other strategies include potable water reuse and improved drought management. The primary strategy related to the development of groundwater resource is the construction of several brackish groundwater desalination plants.

Table 8 Sum of the Projected Water Management Strategies for Hidalgo County in the District for the Years 2020, 2030, 2040, 2050, 2060 and 2070

	Year					
Sum of Projected Water Management Strategies (acre-ft)	2020	2030	2040	2050	2060	2070
	84,822	132,175	190,973	241,883	285,868	328,704

7.0 MANAGEMENT OF GROUNDWATER SUPPLIES

TWC §36.0015 states that GCDs are the state's preferred method of groundwater management and establishes that GCDs will manage groundwater resources through rules developed and implemented in accordance with TWC Chapter 36. Chapter 36 gives directives to GCDs and the statutory authority to carry out such directives, so that GCDs are provided the proper tools to protect and manage the groundwater resources within their boundaries.

The District will manage the supply of groundwater within the District to conserve groundwater resources while seeking to maintain the economic viability of all groundwater user groups – public and private. In consideration of the economic and cultural activities occurring within the District, the District will identify and engage in such activities and practices which, if implemented, would result in a reduction of groundwater use. The existing observation network of groundwater wells will be used to monitor the changing conditions of the groundwater resources within the District. If necessary, the observation network may be expanded.

The regulatory tools granted to GCDs by TWC Chapter 36 enable GCDs to preserve historic and existing users of groundwater. Some uncertainty exists in permitting based upon historic use following the Texas Supreme Court decision in *Edwards Aquifer Authority v. Day.* To the extent permitted under Chapter 36 and the case following *EAA v. Day,* the District protects historic and existing users by granting such groundwater users historic and existing use permits that have priority over operating permits. TWC Chapter 36 also allows GCDs to establish management zones within an aquifer or aquifer subdivision. The District's rules provide for the designation of management areas as needed to better manage and regulate the groundwater resources of the District.

The District may deny a water well drilling permit or limit groundwater withdrawals in accordance with the requirements stated in the rules of the District. In making a determination to deny a permit or limit groundwater withdrawals, the District will consider criteria identified in TWC §36.113.

In accordance with the District's mission of protecting the groundwater resources of the District, the District may require reduction of groundwater withdrawals to amounts that will not cause harm to the aquifer when considering the DFC of the District's aquifers and the amount of modeled available groundwater within the District. To achieve this purpose, the District may, at the discretion of the Board, amend or revoke permits after notice and hearing. The determination to seek the amendment or revocation of a permit by the District will be based on aquifer conditions as observed by the District. The District will enforce the terms and conditions of permits and the rules of the District by injunction or other appropriate relief in a court of competent jurisdiction as provided for in TWC §36.102.

A contingency plan to cope with the effects of water supply deficits due to climatic or other conditions may be developed by the District and adopted by the Board after notice and a hearing. In developing the contingency plan, the District will consider the economic effect of conservation measures upon all water resource user groups, the local implications of the extent and effect of changes in water storage conditions, the unique hydrogeological conditions of the aquifers within the District and the appropriate conditions under which the contingency plan will be implemented. The District will evaluate the groundwater resources available within the District and determine the effectiveness of regulatory or conservation measures. A public or private user may appeal to the Board for discretion in enforcement of the provisions of the water supply deficit contingency plan on grounds of adverse economic hardship

or unique local conditions. The exercise of said discretion by the Board shall not be construed as limiting the power of the Board.

8.0 ACTIONS, PROCEDURES, PERFORMANCE AND AVOIDANCE FOR PLAN IMPLEMENTATION

The District will implement the provisions of this plan and will utilize the provisions of this plan as a guide for determining the direction or priority for all District activities. All operations of the District, all agreements entered into by the District, and any additional planning efforts in which the District may participate will be consistent with the provisions of this plan.

Rules adopted by the District for the permitting of wells and the production of groundwater shall comply with TWC Chapter 36, including §36.113, and the provisions of this management plan. All rules will be adhered to and enforced. The promulgation and enforcement of rules will be based on the best technical evidence available to the District. A copy of the District rules can are available on the internet are URL: https://rsgcd.org/rules-plan/

9.0 METHODOLOGY FOR TRACKING DISTRICT PROGRESS IN ACHIEVING MANAGEMENT GOALS

The District manager will prepare and present an Annual Report to the Board of Directors on District performance in regard to achieving management goals and objectives for the fiscal year. The report will be presented within 120 days following the completion of the District's fiscal year. The board will maintain the report on file, for public inspection at the District's offices upon adoption.

10.0 GOALS, MANAGEMENT OBJECTIVES AND PERFORMANCE STANDARDS

The management goals, objectives, and performance standards of the District in the areas specified in 31 TAC 356.5 are addressed below.

11.0 MANAGEMENT GOALS

11.1 Providing the Most Efficient Use of Groundwater

Objective: Each year, the District will require the registration of all wells within the District's jurisdiction.

Performance Standard: Each year, the number of new and existing wells registered with the District will be presented in the District's annual report.

11.2 Controlling and Preventing Waste of Groundwater

Objective: Each year, the District will disseminate educational information on eliminating and reducing the wasteful use of groundwater focusing on water quality protection. This may be accomplished by at least two of the following activities:

- Conduct an *annual* contest on water quality protection
- Compile literature packets for distribution to schools within the District
- Conduct classroom presentations to schools with within the District
- Sponsor an educational program/curriculum
- Post information on the District's website
- Provide newspaper articles for publication
- Publish District newsletters
- Conduct public presentations
- Set up displays at public events
- Distribute brochures/literature

Performance Standard: The annual report will include a summary of the District activities during the year to disseminate educational information on eliminating and reducing the wasteful use of groundwater focusing on water quality protection.

11.3 Addressing Conjunctive Surface Water Management Issues

Objective: Each year, the District will participate in the regional planning process by attending at least one meeting of the Rio Grande Regional Water Planning Group per fiscal year to encourage the combined use of groundwater and surface water sources that optimizes the beneficial characteristics of each source.

Performance Standard: The District will , in each annual report, document the participation in Regional Water Planning Group and report on any progress related to improving the conjunctive use of groundwater and surface water.

11.4 Controlling and Preventing Subsidence

The District has reviewed the TWDB study addressing the risk of subsidence across the Texas (Furnans and others, 2017) to assess risk within Hidalgo County. The report considers five factors for assigning a risk ranking of high, medium, or low to the major and minor aquifers. Among the seven aquifers with a high risk rating is the Gulf Coast Aquifer System. Figure 4.23 in Furnans and others (2017) provides a subsidence risk ranking of individual wells in Hidalgo County that range primarily between a medium risk ranking to high risk ranking. An important factor contributing to risk of subsidence in the Gulf Coast Aquifer System is the relatively thick zones of clays.

Objective: Each year the District will manage the withdrawal of groundwater with due consideration to the potential for land subsidence. At least once every five years, the District will report either the measured or projected land subsidence for areas where water levels have decreased more than 200 feet from a baseline year of 2000.

Performance Standard: The number of reports that provide either measured land subsidence or projected land subsidence attributed to groundwater pumping.

11.5 Addressing Natural Resource Issues Which Impact the Use and Availability of Groundwater, and which are Impacted by the Use of Groundwater

Objective: Each year, the District will work towards minimizing cross-contamination and pollution of our aquifers caused by abandoned or deteriorated wells. The District may inspect abandoned or deteriorated wells to ensure proper closing of wells in accordance with rules set forth by the District. Notices will be sent and fines may be assessed against well owners whose wells do not adhere to District Rules.

Performance Standard: Each year, the District will document in their annual report, a summary of the number of notices sent out and possible fines assessed to well owners in violation of plugging number of abandoned or deteriorated wells that are plugged each year, the number of plugging assistance requests each year, and the number of well plugged each year.

11.6 Addressing Drought Conditions

Objective: Each month, the District will download the updated Palmer Drought Severity Index (PDSI) map posted on the Texas Water Information Network website https://waterdatafortexas.org/drought.

Performance Standard: Each year, the downloaded PDSI maps and Situation Reports will be included in the District Annual Report to the Board of Directors.

11.7 Addressing Conservation, Recharge Enhancement, Rainwater Harvesting, Precipitation Enhancement, or Brush Control, Where Appropriate and Cost Effective

Precipitation enhancement is not an appropriate or cost-effective program for the District at this time because there is not an existing precipitation enhancement program operating in nearby counties in which the District could participate and share costs. The cost of operating a single county precipitation enhancement program is prohibitive and would require the District to increase taxes in its annexed territory in Hidalgo County. Therefore, the precipitation enhancement goal is not applicable.

Objective: Each year, the District will promote conservation by one or more of the following methods:

- Conduct an annual contest on water conservation
- Distribute conservation literature packets to schools within the District territory located in Hidalgo County
- Conduct classroom conservation presentations
- Sponsor an educational conservation program/curriculum
- Post conservation information on the District's website
- Provide a newspaper article on conservation for publication
- Publish an article on conservation in the District's newsletter

- Conduct a public conservation presentation
- Set up a conservation display at a public event
- Distribute conservation brochures/literature to the public

Performance Standard: Each year, the annual report will include a summary of the District activity during the year to promote conservation.

Objective: Each year, the District will promote rainwater harvesting by posting information on rainwater harvesting on the District website.

Performance Standard: Each year, the annual report will include a copy of the information on rainwater harvesting that is provided on the District's website.

Objective: Each year, the District will provide information relating to recharge enhancement and brush control on the District's website.

Performance Standard: Each year, the District annual report will include a copy of the information that has been provided on the District's website relating to recharge enhancement and brush control.

11.8 Addressing the DFCs of the Groundwater Resources

Objective: Each year, the District will collect at least two (2) water level measurements from two (2) different locations.

Performance Standard: Each year, the District's annual report will include water level measurements and a discussion of the measured change in water level as compared to previous years' water levels. Every three years, the water level measurements will be combined with other water level measurements in Hidalgo County to estimate temporal changes in water levels for the District and to evaluate compliance with existing DFCs and to assess possible changes in the Desired Future Condition(s) for the District.

12.0 REFERENCES

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Ewing, T.E., 1990, Tectonic map of Texas: University of Texas at Austin, Bureau of Economic Geology, scale 1:750,000, 4 sheets.

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Furnans, J. Keester, M., Colven, D., Bauer, J., Barber, J., Gin, Gary., Danielson, V., Erickson, L., Ryan, R., Khorzad, K., Worsley, A., and Synder, G., ., 2017. Final Report: Identification of the Vulnerability of the Major and Minor Aquifers of Texas to Subsidence with Regard to Groundwater Pumping., Texas Water Development Board TWDB Contract Number 1648302062.

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Shi, J. J., 2016. GAM Run 16-008: Red Sands Groundwater Conservation District Management Plan, Texas Water Development Board, May 16, 2016.

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Winker, C.D., and M.B. Edwards, 1983, Unstable progradational clastic shelf margins, in Stanley, D.J., and Moore, G.T., eds, The shelfbreak; Critical interface on continental margins: SEPM Special Publication 33, p. 139-157.

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Young, S.C., 2022. Desired Future Conditions Explanatory Report for Groundwater Management Area 16, Prepared for Groundwater Management Area Member Districts, INTERA Report , Austin, TX

Appendix A

Resolution of the Board of Directors of RSGCD Meeting

RED SANDS GROUNDWATER CONSERVATION DISTRICT
ORDER ADOPTING ANNUAL BUDGET FOR FISCAL YEAR 2023-2024

Article 1: The Board of Directors of the Red Sands Groundwater Conservation District ("District") hereby adopts as its Annual Budget for Fiscal Year 2023-2024, the annual budget attached hereto as Exhibit "A," which annual budget is made a part of this Order by reference and is incorporated herein for all purposes.

PASSED AND APPROVED at a meeting of the Board of Directors of the Red Sands Groundwater Conservation District, at which a quorum was found to be present, said meeting held pursuant to notice and called in accordance with applicable law, said notice having been duly posted as required by the provisions of the Texas Open Meetings Act, Chapter 551 of the Texas Government Code, as amended, the above Order having been prepared in written form for said meeting held on the 21st day of September, 2023, and said Order being effective immediately upon its adoption.

James McAllen, Board President

ATTEST:

Armando Vela, Board Secretary

Appendix B

Notice of Meeting

AT 4:40 FILED O'CLOCK P M

SEP 13 2023

ARTURO GUAJARDO, JR., COUNTY CLERK
HIDALGO COUNTY, TEXAS
BY _____ DEPUTY

NOTICE OF REGULAR MEETING
of
RED SANDS GROUNDWATER CONSERVATION DISTRICT

A meeting of the Board of Directors of the Red Sands Groundwater Conservation District will be held on September 21, 2023 at 11:30 a.m. at 315 E. Monte Cristo Rd, Edinburg, TX 78541.

At this meeting, the following business may be considered and recommended for board action:

A. Call to Order – Roll Call – Pledge of Allegiance.

B. Public comments.

The Board of Directors allow for a specific portion of the Red Sands Groundwater Conservation District Meeting to be dedicated to public comments. Public comments are limited to three (3) minutes. If you would like to participate under public comments, you must submit a request beginning at 8:00 a.m. the day of the meeting by (a) sending an email to aaron@ekrattorneys.com or (b) calling the RSGCD at (956) 270-2309. All requests must be received no later than 30 minutes before the start of the RSGCD meeting. Your request should include your name, address, and telephone number.

C. Approval of previous board meeting minutes.

D. Consideration and possible action on the request to ratify and pay the District's bills for the preceding month(s).

E. Consideration and possible action on the request to ratify and pay the District's bills for the preceding month(s).

F. Consideration and Action on Proposed Annual Budget for Red Sands Groundwater Conservation District for Fiscal Year 2023-2024.

G. Consideration and Action on Order Levying Ad Valorem Tax and Setting Tax Rate for Maintenance and Operations of Red Sands Groundwater Conservation District for Tax Year 2023

H. Consideration and possible action on the approval and adoption of the groundwater management plan as prepared by INTERA.

I. Consideration and possible action on placing James McAllen on banking authorization or signature card for all accounts owned by the district.

J. Consideration and possible action on amending or removing district's policy of requiring two signatures on checks written.

K. Discuss items for future board meeting agendas.

L. Adjournment.

Agenda items may be considered, deliberated and/or acted upon in a different order than numbered above. The Board of Directors of the Red Sands Groundwater Conservation District reserves the right to adjourn into Executive (Closed) Session at any time during the course of this meeting to discuss any of the items listed on this agenda, as authorized by the Texas Open Meetings Act, Chapter 551, Texas Government Code. No final action will be taken in Executive Session.

Appendix C

Letter to Surface Water Management Entities

Aaron I. Vela

From: Aaron I. Vela <aaron@ekrattorneys.com>
Sent: Tuesday, October 3, 2023 3:47 PM
To: mhwsc.customerservice@gmail.com
Cc: aaron@ekrattorneys.com
Subject: Red Sands Groundwater Conservation District

Mr. Consuelo De La Rosa
General Manager

Please be advised that the Red Sands Groundwater Conservation District adopted its management plan on September 21, 2023. The plan is available at:

https://rsgcd.org/wp-content/uploads/2023/09/District-Management-Plan-2023-Final.pdf

Should you have any questions or concerns please do not hesitate to contact me.

Thank you,

AARON I. VELA
ATTORNEY AT LAW
CERTIFIED PUBLIC ACCOUNTANT
CERTIFIED VALUATION ANALYST
1101 Chicago Ave.
McAllen, TX. 78501
Tel: (956) 682-2440
Fax: (956) 682-0820
Aaron@EKRattorneys.com
EK&R ELLIS KOENEKE & RAMIREZ ATTORNEYS AT LAW

Aaron I. Vela

From: Aaron I. Vela <aaron@ekrattorneys.com>
Sent: Tuesday, October 3, 2023 2:36 PM
To: robertos@aguasud.com
Cc: aaron@ekrattorneys.com
Subject: Red Sands Groundwater Conservation District

Mr. Salinas,

Please be advised that the Red Sands Groundwater Conservation District adopted its management plan on September 21, 2023. The plan is available at:

https://rsgcd.org/wp-content/uploads/2023/09/District-Management-Plan-2023-Final.pdf

Should you have any questions or concerns please do not hesitate to contact me.

Thank you,

AARON I. VELA
ATTORNEY AT LAW
CERTIFIED PUBLIC ACCOUNTANT
CERTIFIED VALUATION ANALYST
1101 Chicago Ave.
McAllen, TX. 78501
Tel: (956) 682-2440
Fax: (956) 682-0820
Aaron@EKRattorneys.com
EK&R ELLIS KOENEKE & RAMIREZ ATTORNEYS AT LAW

Aaron I. Vela

From: Aaron I. Vela <aaron@ekrattorneys.com>
Sent: Tuesday, October 3, 2023 2:35 PM
To: troy@deltalakeid.org
Cc: aaron@ekrattorneys.com
Subject: Red Sands Groundwater Conservation District

Mr. Allen,

Please be advised that the Red Sands Groundwater Conservation District adopted its management plan on September 21, 2023. The plan is available at:

https://rsgcd.org/wp-content/uploads/2023/09/District-Management-Plan-2023-Final.pdf

Should you have any questions or concerns please do not hesitate to contact me.

Thank you,

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ATTORNEY AT LAW
CERTIFIED PUBLIC ACCOUNTANT
CERTIFIED VALUATION ANALYST
1101 Chicago Ave.
McAllen, TX. 78501
Tel: (956) 682-2440
Fax: (956) 682-0820
Aaron@EKRattorneys.com
EK&R ELLIS KOENEKE & RAMIREZ ATTORNEYS AT LAW

Aaron I. Vela

From: Aaron I. Vela <aaron@ekrattorneys.com>
Sent: Tuesday, October 3, 2023 2:33 PM
To: ssanchez@nawsc.com
Cc: mreyes@nawsc.com; aaron@ekrattorneys.com
Subject: Red Sands Groundwater Conservation District

Mr. Sanchez,

Please be advised that the Red Sands Groundwater Conservation District adopted its management plan on September 21, 2023. The plan is available at:

https://rsgcd.org/wp-content/uploads/2023/09/District-Management-Plan-2023-Final.pdf

Should you have any questions or concerns please do not hesitate to contact me.

Thank you,

AARON I. VELA
ATTORNEY AT LAW
CERTIFIED PUBLIC ACCOUNTANT
CERTIFIED VALUATION ANALYST
1101 Chicago Ave.
McAllen, TX. 78501
Tel: (956) 682-2440
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Aaron@EKRattorneys.com
EK&R ELLIS KOENEKE & RAMIREZ ATTORNEYS AT LAW

September 14, 2023

Luis Peña
Brush Country Groundwater Conservation District
732 West Rice Street
Falfurrias, TX 78355
Phone No. 361-325-5093
Email: lpena@brushcountrygcd.com

Re: Notice of meeting for the Red Sands Groundwater Conservation District Management Plan

Mr. Peña:

The Reds Sands Groundwater Conservation District is pleased to announce the development of a draft Groundwater Management Plan. The district will be seeking public input on the development of the draft plan. The draft plan will be discussed at the September 21, 2023 board meeting to be held at 315 E. Monte Cristo Rd., Edinburg, TX 78541 at 11:30 am. Copies of the draft plan will be made available at the meeting.

Sincerely,

Aaron I. Vela, Counsel for Red Sands
Ellis Koeneke & Ramirez L.L.P.
1101 Chicago Ave.
McAllen Texas 78501
Phone No. (956)682-2440
Fax No. (956)682-0820

September 14, 2023

Gustavo Gonzales
Corpus Christi ASR Conservation District
P.O. Box 9277
Corpus Christi, TX 78469
Phone No. 361-826-1681
Email: gustavogo@cctexas.com

Re: Notice of meeting for the Red Sands Groundwater Conservation District Management Plan

Mr. Gonzalez:

The Reds Sands Groundwater Conservation District is pleased to announce the development of a draft Groundwater Management Plan. The district will be seeking public input on the development of the draft plan. The draft plan will be discussed at the September 21, 2023 board meeting to be held at 315 E. Monte Cristo Rd., Edinburg, TX 78541 at 11:30 am. Copies of the draft plan will be made available at the meeting.

Sincerely,

Aaron I. Vela, Counsel for Red Sands
Ellis Koeneke & Ramirez L.L.P.
1101 Chicago Ave.
McAllen Texas 78501
Phone No. (956)682-2440
Fax No. (956)682-0820

September 14, 2023

Jorge Gonzales
Duval County Groundwater Conservation District
P.O. Box 506
231 E. Railroad Avenue
Benavides, TX 78341
Phone No. 361-256-3589
Mobile No. 361-209-2981
Email: duvalgcd.gm@gmail.com

Re: Notice of meeting for the Red Sands Groundwater Conservation District Management Plan

Mr. Gonzalez:

The Reds Sands Groundwater Conservation District is pleased to announce the development of a draft Groundwater Management Plan. The district will be seeking public input on the development of the draft plan. The draft plan will be discussed at the September 21, 2023 board meeting to be held at 315 E. Monte Cristo Rd., Edinburg, TX 78541 at 11:30 am. Copies of the draft plan will be made available at the meeting.

Sincerely,

Aaron I. Vela, Counsel for Red Sands
Ellis Koeneke & Ramirez L.L.P.
1101 Chicago Ave.
McAllen Texas 78501
Phone No. (956)682-2440
Fax No. (956)682-0820

September 14, 2023

Andy Garcia
Kenedy County Groundwater Conservation District
P.O. Box 212
Sarita, TX 78385
Phone No. 361-294-5336
Fax No. 361-294-5244
Email: general_manager@kenedygcd.com

Re: Notice of meeting for the Red Sands Groundwater Conservation District Management Plan

Mr. Garza

The Reds Sands Groundwater Conservation District is pleased to announce the development of a draft Groundwater Management Plan. The district will be seeking public input on the development of the draft plan. The draft plan will be discussed at the September 21, 2023 board meeting to be held at 315 E. Monte Cristo Rd., Edinburg, TX 78541 at 11:30 am. Copies of the draft plan will be made available at the meeting.

Sincerely,

Aaron I. Vela, Counsel for Red Sands
Ellis Koeneke & Ramirez L.L.P.
1101 Chicago Ave.
McAllen Texas 78501
Phone No. (956)682-2440
Fax No. (956)682-0820

September 14, 2023

Lonnie Stewart
Live Oak Underground Water Conservation District
731 FM 799
Geroge West, TX 78022
Phone No. 361-449-1441
Mobile No. 361-449-7017
Email: louwcd@yahoo.com

Re: Notice of meeting for the Red Sands Groundwater Conservation District Management Plan

Mr. Stewart

The Reds Sands Groundwater Conservation District is pleased to announce the development of a draft Groundwater Management Plan. The district will be seeking public input on the development of the draft plan. The draft plan will be discussed at the September 21, 2023 board meeting to be held at 315 E. Monte Cristo Rd., Edinburg, TX 78541 at 11:30 am. Copies of the draft plan will be made available at the meeting.

Sincerely,

Aaron I. Vela, Counsel for Red Sands
Ellis Koeneke & Ramirez L.L.P.
1101 Chicago Ave.
McAllen Texas 78501
Phone No. (956)682-2440
Fax No. (956)682-0820

September 14, 2023

Scott Dilworth
McMullen Groundwater Conservation District
P.O. Box 11
Tilden, TX 78072
Mobile No. 210-970-2750
Email: gordoypepe@protonmail.com

Re: Notice of meeting for the Red Sands Groundwater Conservation District Management Plan

Mr. Dilworth

The Reds Sands Groundwater Conservation District is pleased to announce the development of a draft Groundwater Management Plan. The district will be seeking public input on the development of the draft plan. The draft plan will be discussed at the September 21, 2023 board meeting to be held at 315 E. Monte Cristo Rd., Edinburg, TX 78541 at 11:30 am. Copies of the draft plan will be made available at the meeting.

Sincerely,

Aaron I. Vela, Counsel for Red Sands
Ellis Koeneke & Ramirez L.L.P.
1101 Chicago Ave.
McAllen Texas 78501
Phone No. (956)682-2440
Fax No. (956)682-0820

September 14, 2023

Lonnie Stewart
San Patricio County Groundwater Conservation District
739 FM 799
George West, TX 78022
Phone No. 361-449-7017
Email: louwcd@yahoo.com

Re: Notice of meeting for the Red Sands Groundwater Conservation District Management Plan

Mr. Stewart

The Reds Sands Groundwater Conservation District is pleased to announce the development of a draft Groundwater Management Plan. The district will be seeking public input on the development of the draft plan. The draft plan will be discussed at the September 21, 2023 board meeting to be held at 315 E. Monte Cristo Rd., Edinburg, TX 78541 at 11:30 am. Copies of the draft plan will be made available at the meeting.

Sincerely,

Aaron I. Vela, Counsel for Red Sands
Ellis Koeneke & Ramirez L.L.P.
1101 Chicago Ave.
McAllen Texas 78501
Phone No. (956)682-2440
Fax No. (956)682-0820

September 14, 2023

Lonnie Stewart,
Bee Groundwater Conservation District
RT .1 BOX 212
GEORGE WEST, TX 78022
Phone No. 361-449-1441
Mobile No. 361-449-7017
Email: beegcd@yahoo.com

Re: Notice of meeting for the Red Sands Groundwater Conservation District Management Plan

Mr. Stewart:

The Reds Sands Groundwater Conservation District is pleased to announce the development of a draft Groundwater Management Plan. The district will be seeking public input on the development of the draft plan. The draft plan will be discussed at the September 21, 2023 board meeting to be held at 315 E. Monte Cristo Rd., Edinburg, TX 78541 at 11:30 am. Copies of the draft plan will be made available at the meeting.

Sincerely,

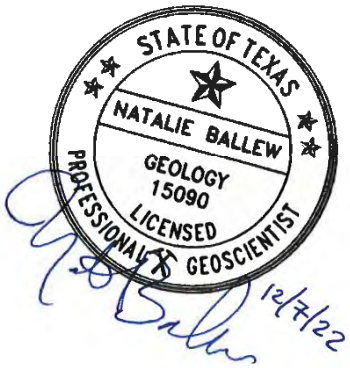
Aaron I. Vela, Counsel for Red Sands
Ellis Koeneke & Ramirez L.L.P.
1101 Chicago Ave.
McAllen Texas 78501
Phone No. (956)682-2440
Fax No. (956)682-0820

Appendix D

GAM RUN 21-021 MAG:
Modeled Available Groundwater for the Gulf Coast Aquifer System in Groundwater Management Area 17 (Cha, 2022)

GAM RUN 21-021 MAG:
MODELED AVAILABLE GROUNDWATER FOR THE GULF COAST AQUIFER SYSTEM IN GROUNDWATER MANAGEMENT AREA 16

Ki Cha, Ph.D., EIT
Texas Water Development Board
Groundwater Division
Groundwater Modeling Department
512-463-5604
October 31, 2022



Natalie Ballew, P.G. 15090, is the Director of the Groundwater Division and is responsible for oversight of work performed by Ki Cha under her supervision.

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GAM RUN 21-021 MAG: MODELED AVAILABLE GROUNDWATER FOR THE GULF COAST AQUIFER SYSTEM IN GROUNDWATER MANAGEMENT AREA 16

Ki Cha, Ph.D., EIT
Texas Water Development Board
Groundwater Division
Groundwater Modeling Department
512-463-5604
October 31, 2022

EXECUTIVE SUMMARY:

The modeled available groundwater for Groundwater Management Area 16 for the Gulf Coast Aquifer System is summarized by decade by groundwater conservation district and county (Table 1) and for use in the regional water planning process by county, regional water planning area, and river basin (Table 2). The modeled available groundwater estimates range from approximately 229,000 acre-feet per year in 2020 to approximately 294,000 acre-feet per year in 2080 (Tables 1 and 2). The estimates are based on the desired future conditions for the Gulf Coast Aquifer System adopted by groundwater conservation districts in Groundwater Management Area 16 on November 23, 2021 and re-adopted with minor clerical corrections on June 28, 2022. The explanatory report and other materials submitted to the TWDB were determined to be administratively complete on August 26, 2022.

REQUESTOR:

Mr. Scott Bledsoe, III, coordinator for Groundwater Management Area 16.

DESCRIPTION OF REQUEST:

In a letter dated January 22, 2022, Dr. Steve C. Young, consultant for Groundwater Management Area 16, provided the TWDB with the desired future conditions of the Gulf Coast Aquifer System adopted by the groundwater conservation district representatives in Groundwater Management Area 16. The Carrizo-Wilcox and Yegua-Jackson aquifers were declared non-relevant for joint planning purposes by Groundwater Management Area 16.

On June 2, 2022, TWDB requested clarifications about the wording of the desired future conditions, as some were unachievable based on TWDB analysis of the submitted model files during administrative review. In response, the Groundwater Management Area 16 consultant and groundwater conservation district representatives submitted an amended explanatory report (Young, 2022) on July 4, 2022. Groundwater Management Area 16

adopted a revised version of the desired future conditions for the Gulf Coast Aquifer System. The final desired future conditions adopted by the groundwater conservation district representatives in Groundwater Management Area 16 as described in Resolution No. 2022-01, on June 28, 2022 (Young, 2022; Appendix C), are presented below:

> *"Groundwater Management Area 16 adopts Desired Future Conditions for each county within the groundwater management area (county-specific DFC's) and adopts a Desired Future Condition for the counties in the groundwater management area (gma-specific DFC's). The Desired Future Condition for the counties in the groundwater management area shall not exceed an average drawdown of 78 feet for the Gulf Coast Aquifer System at December 2080. Desired Future Conditions for each county within the groundwater management area (county-specific DFC's) shall not exceed the values specified in Scenario 2 at December 2080.*
>
> *Table A-1: Desired Future Conditions for GMA 16 expressed as an Average Drawdown between January 2010 and December 2079.*
>
> *Bee GCD: 93 feet of drawdown of the Gulf Coast Aquifer System;*
>
> *Live Oak UWCD: 45 feet of drawdown of the Gulf Coast Aquifer System;*
>
> *McMullen GCD: 12 feet of drawdown of the Gulf Coast Aquifer System;*
>
> *Red Sands GCD: 60 feet of drawdown of the Gulf Coast Aquifer System;*
>
> *Kenedy County GCD: 27 feet of drawdown of the Gulf Coast Aquifer System;*
>
> *Brush Country GCD: 89 feet of drawdown of the Gulf Coast Aquifer System;*
>
> *Duval County GCD: 137 feet of drawdown of the Gulf Coast Aquifer System;*
>
> *San Patricio County GCD: 69 feet of drawdown of the Gulf Coast Aquifer System;*
>
> *Starr County GCD: 94 feet of drawdown of the Gulf Coast Aquifer System;*
>
> *Cameron: 119 feet of drawdown of the Gulf Coast Aquifer System;*
>
> *Hidalgo: 138 feet of drawdown of the Gulf Coast Aquifer System;*
>
> *Kleberg: 21 feet of drawdown of the Gulf Coast Aquifer System;*
>
> *Nueces: 26 feet of drawdown of the Gulf Coast Aquifer System;*
>
> *Webb: 161 feet of drawdown of the Gulf Coast Aquifer System;*
>
> *Willacy: 44 feet of drawdown of the Gulf Coast Aquifer System."*

METHODS:

The alternative groundwater availability model for Groundwater Management Area 16 (version 1.01; Hutchison and others, 2011) was run using the predictive model files ("Pumping Scenario #2") submitted with the desired future condition explanatory report (Young, 2022). Model-calculated water levels were extracted for January 2010 (stress period 11) and December 2079 (stress period 81), and drawdown was calculated as the difference between these water levels. Drawdown averages were calculated for the Gulf Coast Aquifer System by county, groundwater conservation district, and the entire groundwater management area. The calculated drawdown averages were compared with the desired future conditions to verify that the submitted pumping scenario can achieve the desired future conditions within the three-foot tolerance specified by Groundwater Management Area 16.

The modeled available groundwater values were determined by extracting pumping rates by decade from the model results using ZONEBUDGET Version 3.01 (Harbaugh, 2009). The modeled available groundwater can be presented by groundwater conservation district and county within Groundwater Management Area 16 (Figure 1) and by county, regional water planning area, and river basin within Groundwater Management Area 16 (Figure 2)

GAM Run 21-021 MAG: Modeled Available Groundwater for the Gulf Coast Aquifer System in Groundwater Management Area 16
October 31, 2022
Page 6 of 15

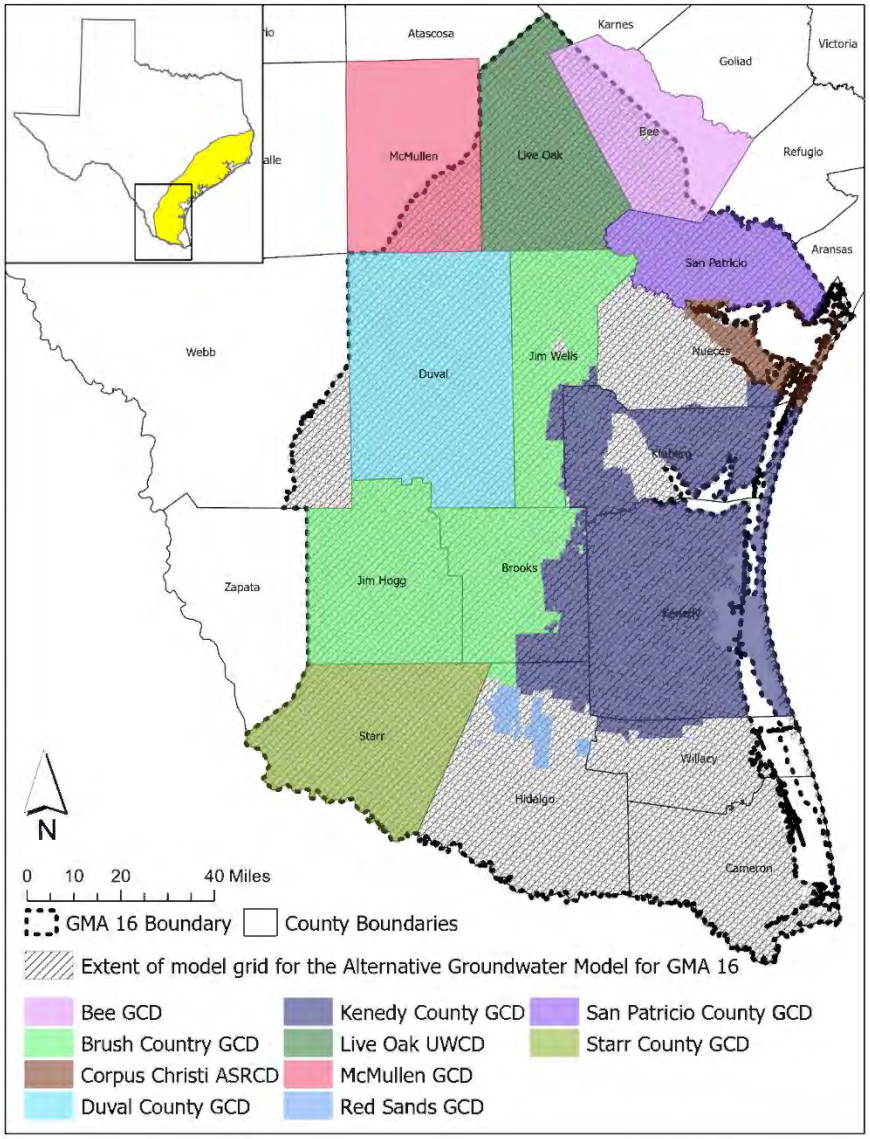

FIGURE 1. MAP SHOWING GROUNDWATER CONSERVATION DISTRICTS (GCDS) AND COUNTIES IN GROUNDWATER MANAGEMENT AREA 16, OVERLAIN ON THE EXTENT OF THE ALTERNATIVE GROUNDWATER AVAILABILITY MODEL FOR GROUNDWATER MANAGEMENT AREA 16.

GAM Run 21-021 MAG: Modeled Available Groundwater for the Gulf Coast Aquifer System in Groundwater Management Area 16
October 31, 2022
Page 7 of 15

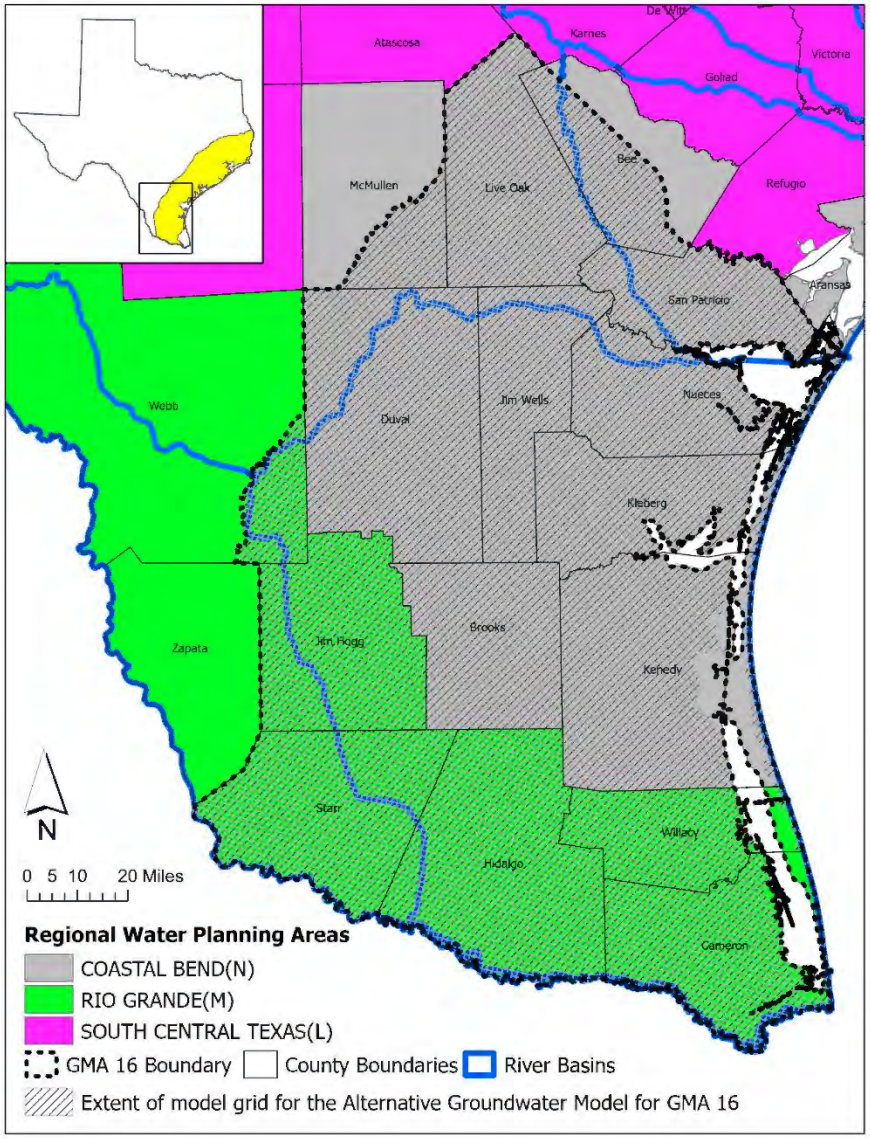

FIGURE 2. MAP SHOWING THE REGIONAL WATER PLANNING AREAS, COUNTIES, AND RIVER BASINS IN GROUNDWATER MANAGEMENT AREA 16, OVERLAIN ON THE EXTENT OF THE ALTERNATIVE GROUNDWATER AVAILABILITY MODEL FOR GROUNDWATER MANAGEMENT AREA 16.

Modeled Available Groundwater and Permitting

As defined in Chapter 36 of the Texas Water Code (2011), "modeled available groundwater" is the estimated average amount of water that may be produced annually to achieve a desired future condition. Groundwater conservation districts must consider modeled available groundwater when issuing permits in order to manage groundwater production to achieve the desired future condition(s). Districts must also consider annual precipitation and production patterns, the estimated amount of pumping exempt from permitting, existing permits, and a reasonable estimate of actual groundwater production under existing permits.

PARAMETERS AND ASSUMPTIONS:

The parameters and assumptions for the modeled available groundwater estimates are described below:

- Version 1.01 of the alternate groundwater availability model for Groundwater Management Area 16 was the base model for this analysis. See Hutchison and others (2011) for assumptions and limitations of the model. Groundwater Management Area 16 constructed a predictive model simulation to extend the base model to 2080 for planning purposes. See Young (2022) for the assumptions of this predictive model simulation.

- The model has six layers that represent the Chicot aquifer (Layer 1), the Evangeline aquifer (Layer 2), the Burkeville confining unit (Layer 3), the Jasper aquifer (Layer 4), the Yegua-Jackson Aquifer (Layer 5), and the Queen-City, Sparta and Carrizo-Wilcox Aquifer System (Layer 6). Layers 1 through 4 were lumped to calculate modeled available groundwater for the Gulf Coast Aquifer System.

- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).

- To be consistent with Groundwater Management Area 16, the TWDB model grid file dated May 1, 2014 (alt1_gma16) was used to determine model cell entity assignment (county, groundwater management area, groundwater conservation district, river basin, regional water planning area).

- Although the original groundwater availability model was only calibrated to the end of 1999, an analysis during the previous round of joint planning verified that the measured water levels did not change significantly for the period from 2000 to 2010 (Goswami, 2017). For this reason, TWDB considers it acceptable to use 2010 as the reference year for drawdown calculations.

- Drawdown averages and modeled available groundwater values are based on the official TWDB boundary for the groundwater conservation district, county, regional water planning area, river basin, and Regional Water Planning Areas within Groundwater Management Area 16 (Figures 1 and 2).

- Drawdown values for cells with water levels below the base elevation of the cell ("dry" cells) were included in the average drawdown calculations. The groundwater availability model for Groundwater Management Area 16 was constructed using the confined aquifer assumption (and LAYCON=0 option), meaning the transmissivity of "dry" cells remains constant and pumping from those cells continues. The desired future conditions adopted by Groundwater Management Area 16 are based on the average drawdowns that include "dry" cells. Therefore, pumping values from "dry" cells were also included in the calculation of modeled available groundwater. Please note that the confined aquifer assumption may also lead to physically unrealistic conditions, with pumping in a model cell continuing even when water levels have dropped below the base of the model cell.

- Drawdown was calculated as the difference in modeled water levels between the baseline date January 2010 (stress period 11) and the final date December 2079 (stress period 81). Average drawdowns were calculated as the sum of drawdowns for all model cells within a specified area divided by the number of cells in that specified area.

- Estimates of modeled available groundwater from the model simulation were rounded to whole numbers.

RESULTS:

The modeled available groundwater for the Gulf Coast Aquifer System that achieves the desired future conditions adopted by Groundwater Management Area 16 increases from approximately 229,000 acre-feet per year in 2020 to 294,000 acre-feet per year in 2080. The modeled available groundwater is summarized by groundwater conservation district and county (Table 1) and by county, regional water planning area, and river basin (Table 2) for use in the regional water planning process.

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TABLE 1. MODELED AVAILABLE GROUNDWATER FOR THE GULF COAST AQUIFER SYSTEM IN GROUNDWATER MANAGEMENT AREA 16 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2080. VALUES ARE IN ACRE-FEET PER YEAR.

Groundwater Conservation District (GCD)	County	2020	2030	2040	2050	2060	2070	2080
Bee GCD	Bee	10,338	11,849	12,593	12,944	13,146	13,146	13,146
Brush Country GCD	Brooks	3,660	3,660	3,660	3,660	3,660	4,205	4,205
Brush Country GCD	Hidalgo	131	131	131	131	131	150	150
Brush Country GCD	Jim Hogg	6,167	6,167	6,167	6,167	6,167	7,084	7,084
Brush Country GCD	Jim Wells	8,701	9,065	9,393	9,758	10,050	11,544	11,544
Brush Country GCD Total		**18,659**	**19,023**	**19,351**	**19,716**	**20,00B**	**22,9B3**	**22,983**
Duval County GCD	Duval	20,571	22,169	23,764	25,363	26,963	26,963	26,963
Kenedy County GCD	Brooks	1,308	1,463	1,693	1,847	2,078	2,232	2,232
Kenedy County GCD	Hidalgo	412	460	534	582	654	703	703
Kenedy County GCD	Jim Wells	296	330	383	417	469	505	505
Kenedy County GCD	Kenedy	9,040	10,104	11,698	12,762	14,358	15,421	15,421
Kenedy County GCD	Kleberg	4,291	4,796	5,553	6,058	6,815	7,320	7,320
Kenedy County GCD	Nueces	171	191	221	241	271	291	291
Kenedy County GCD	Willacy	328	365	424	462	520	558	558
Kenedy County GCD Total		**15,846**	**17,709**	**20,506**	**22,369**	**25,165**	**27,030**	**27,030**
Live Oak UWCD	Live Oak	10,169	11,394	10,444	10,294	10,294	10,294	10,294
McMullen GCD	McMullen	510	510	510	510	510	510	510
Red Sands GCD	Hidalgo	1,667	1,966	2,265	2,563	2,863	2,863	2,863
San Patricio County GCD	San Patricio	43,611	45,016	46,422	47,828	49,234	49,234	49,234
Starr County GCD	Starr	3,798	4,797	5,797	6,794	7,795	7,795	7,795

GAM Run 21-021 MAG: Modeled Available Groundwater for the Gulf Coast Aquifer System in Groundwater Management Area 16
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TABLE 1. CONTINUED

Groundwater Conservation District (GCD)	County	2020	2030	2040	2050	2060	2070	2080
No District-Cameron	Cameron	6,688	7,999	9,311	10,620	11,932	11,932	11,932
No District-Hidalgo	Hidalgo	85,634	90,905	96,175	101,445	106,715	106,715	106,715
No District-Kleberg	Kleberg	4,051	4,243	4,436	4,629	4,822	4,822	4,822
No District-Nueces	Nueces	6,339	6,596	6,857	7,115	7,372	7,372	7,372
No District-Webb	Webb	620	789	959	1,129	1,299	1,299	1,299
No District-Willacy	Willacy	664	785	905	1,024	1,145	1,145	1,145
No District-Total		**103,996**	**111,317**	**118,643**	**125,962**	**133,285**	**133,285**	**133,285**
GMA 16 Total		**229,165**	**245,750**	**260,295**	**274,343**	**289,263**	**294,103**	**294,103**

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TABLE 2. MODELED AVAILABLE GROUNDWATER FOR THE GULF COAST AQUIFER SYSTEM IN GROUNDWATER MANAGEMENT AREA 16. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), AND RIVER BASIN FOR EACH DECADE BETWEEN 2030 AND 2080.

County	RWPA	River Basin	2030	2040	2050	2060	2070	2080
Bee	N	Nueces	981	1,043	1,072	1,089	1,089	1,089
Bee	N	San Antonio-Nueces	10,868	11,550	11,872	12,057	12,057	12,057
Brooks	N	Nueces-Rio Grande	5,123	5,353	5,507	5,738	6,437	6,437
Cameron	M	Nueces-Rio Grande	7,536	8,771	10,005	11,241	11,241	11,241
Cameron	M	Rio Grande	463	540	615	691	691	691
Duval	N	Nueces	351	376	401	428	428	428
Duval	N	Nueces-Rio Grande	21,818	23,388	24,962	26,535	26,535	26,535
Hidalgo	M	Nueces-Rio Grande	91,421	96,658	101,867	107,103	107,171	107,171
Hidalgo	M	Rio Grande	2,041	2,447	2,854	3,260	3,260	3,260
Jim Hogg	M	Nueces-Rio Grande	5,230	5,230	5,230	5,230	6,008	6,008
Jim Hogg	M	Rio Grande	937	937	937	937	1,076	1,076
Jim Wells	N	Nueces	593	593	593	593	681	681
Jim Wells	N	Nueces-Rio Grande	8,802	9,183	9,582	9,926	11,368	11,368
Kenedy	N	Nueces-Rio Grande	10,104	11,698	12,762	14,358	15,421	15,421
Kleberg	N	Nueces-Rio Grande	9,039	9,989	10,687	11,637	12,142	12,142
Live Oak	N	Nueces	11,326	10,382	10,233	10,233	10,233	10,233
Live Oak	N	San Antonio-Nueces	68	62	61	61	61	61
McMullen	N	Nueces	510	510	510	510	510	510
Nueces	N	Nueces	756	787	816	845	845	845
Nueces	N	Nueces-Rio Grande	6,031	6,291	6,540	6,798	6,818	6,818
San Patricio	N	Nueces	4,502	4,874	5,247	5,619	5,619	5,619
San Patricio	N	San Antonio-Nueces	40,514	41,548	42,581	43,615	43,615	43,615

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TABLE 2. CONTINUED

County	RWPA	River Basin	2030	2040	2050	2060	2070	2080
Starr	M	Nueces-Rio Grande	1,958	2,366	2,772	3,180	3,180	3,180
Starr	M	Rio Grande	2,839	3,431	4,022	4,615	4,615	4,615
Webb	M	Nueces	22	27	32	37	37	37
Webb	M	Nueces-Rio Grande	642	780	918	1,056	1,056	1,056
Webb	M	Rio Grande	125	152	179	206	206	206
Willacy	M	Nueces-Rio Grande	1,150	1,329	1,486	1,665	1,703	1,703
GMA 16 Total			**245,750**	**260,295**	**274,343**	**289,263**	**294,103**	**294,103**

*GCAS: Gulf Coast Aquifer System

LIMITATIONS:

The groundwater model used in completing this analysis is the best available scientific tool that can be used to meet the stated objectives. To the extent that this analysis will be used for planning purposes and/or regulatory purposes related to pumping in the past and into the future, it is important to recognize the assumptions and limitations associated with the use of the results. In reviewing the use of models in environmental regulatory decision making, the National Research Council (2007) noted:

> *"Models will always be constrained by computational limitations, assumptions, and knowledge gaps. They can best be viewed as tools to help inform decisions rather than as machines to generate truth or make decisions. Scientific advances will never make it possible to build a perfect model that accounts for every aspect of reality or to prove that a given model is correct in all respects for a particular regulatory application. These characteristics make evaluation of a regulatory model more complex than solely a comparison of measurement data with model results."*

A key aspect of using the groundwater model to evaluate historic groundwater flow conditions includes the assumptions about the location in the aquifer where historic pumping was placed. Understanding the amount and location of historic pumping is as important as evaluating the volume of groundwater flow into and out of the district, between aquifers within the district (as applicable), interactions with surface water (as applicable), recharge to the aquifer system (as applicable), and other metrics that describe the impacts of that pumping. In addition, assumptions regarding precipitation, recharge, and streamflow are specific to a particular historic time period.

Because the application of the groundwater model was designed to address regional scale questions, the results are most effective on a regional scale. The TWDB makes no warranties or representations relating to the actual conditions of any aquifer at a particular location or at a particular time.

It is important for groundwater conservation districts to monitor groundwater pumping and groundwater levels in the aquifer. Because of the limitations of the groundwater model and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine this analysis in the future given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future. Historic precipitation patterns also need to be placed in context as future climatic conditions, such as dry and wet year precipitation patterns, may differ and affect groundwater flow conditions.

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Appendix E

Estimated Historical Groundwater Use and 2022 State Water Plan Datasets (TWDB, 2023)

Estimated Historical Groundwater Use And 2022 State Water Plan Datasets:

Red Sands Groundwater Conservation District

Texas Water Development Board
Groundwater Division
Groundwater Technical Assistance Section
stephen.allen@twdb.texas.gov
(512) 463-7317
January 5, 2023

GROUNDWATER MANAGEMENT PLAN DATA:

This package of water data reports (part 1 of a 2-part package of information) is being provided to groundwater conservation districts to help them meet the requirements for approval of their five-year groundwater management plan. Each report in the package addresses a specific numbered requirement in the Texas Water Development Board's groundwater management plan checklist. The checklist can be viewed and downloaded from this web address:

http://www.twdb.texas.gov/groundwater/docs/GCD/GMPChecklist0113.pdf

The five reports included in this part are:

1. Estimated Historical Groundwater Use (checklist item 2)
   from the TWDB Historical Water Use Survey (WUS)
2. Projected Surface Water Supplies (checklist item 6)
3. Projected Water Demands (checklist item 7)
4. Projected Water Supply Needs (checklist item 8)
5. Projected Water Management Strategies (checklist item 9)
   from the 2022 Texas State Water Plan (SWP)

Part 2 of the 2-part package is the groundwater availability model (GAM) report for the District (checklist items 3 through 5). The District should have received, or will receive, this report from the Groundwater Availability Modeling Section. Questions about the GAM can be directed to Grayson Dowlearn, grayson.dowlearn@twdb.texas.gov, (512) 475-1552.

DISCLAIMER:

The data presented in this report represents the most up-to-date WUS and 2022 SWP data available as of 1/5/2023. Although it does not happen frequently, either of these datasets are subject to change pending the availability of more accurate WUS data or an amendment to the 2022 SWP. District personnel must review these datasets and correct any discrepancies in order to ensure approval of their groundwater management plan.

The WUS dataset can be verified at this web address:

http://www.twdb.texas.gov/waterplanning/waterusesurvey/estimates/

The 2022 SWP dataset can be verified by contacting Sabrina Anderson (sabrina.anderson@twdb.texas.gov or 512-936-0886).

The values presented in the data tables of this report are county-based. In cases where groundwater conservation districts cover only a portion of one or more counties the data values are modified with an apportioning multiplier to create new values that more accurately represent conditions within district boundaries. The multiplier used in the following formula is a land area ratio: (data value * (land area of district in county / land area of county)). For two of the four SWP tables (Projected Surface Water Supplies and Projected Water Demands) only the county-wide water user group (WUG) data values (county other, manufacturing, steam electric power, irrigation, mining and livestock) are modified using the multiplier. WUG values for municipalities, water supply corporations, and utility districts are not apportioned; instead, their full values are retained when they are located within the district, and eliminated when they are located outside (we ask each district to identify these entity locations).

The remaining SWP tables (Projected Water Supply Needs and Projected Water Management Strategies) are not modified because district-specific values are not statutorily required. Each district needs only "consider" the county values in these tables.

In the WUS table every category of water use (including municipal) is apportioned. Staff determined that breaking down the annual municipal values into individual WUGs was too complex.

TWDB recognizes that the apportioning formula used is not perfect but it is the best available process with respect to time and staffing constraints. If a district believes it has data that is more accurate it can add those data to the plan with an explanation of how the data were derived. Apportioning percentages that the TWDB used are listed above each applicable table.

For additional questions regarding this data, please contact Stephen Allen (stephen.allen@twdb.texas.gov or 512-463-7317).

Estimated Historical Water Use
TWDB Historical Water Use Survey (WUS) Data

Groundwater and surface water historical use estimates are currently unavailable for calendar year 2020. TWDB staff anticipates the calculation and posting of these estimates at a later date.

HIDALGO COUNTY *7.2% (multiplier)* All values are in acre-feet

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2019	GW	766	0	34	86	288	17	1,191
	SW	8,328	153	3	271	44,097	26	52,878
2018	GW	738	0	33	83	259	17	1,130
	SW	8,064	171	7	433	47,096	26	55,797
2017	GW	711	0	34	89	108	16	958
	SW	8,690	195	7	289	49,935	25	59,141
2016	GW	938	0	46	85	7	22	1,098
	SW	8,250	257	0	308	35,547	32	44,394
2015	GW	903	0	46	39	9	21	1,018
	SW	7,057	201	0	343	17,992	31	25,624
2014	GW	1,012	0	50	0	42	20	1,124
	SW	7,673	136	1	0	29,505	31	37,346
2013	GW	927	0	48	0	4	21	1,000
	SW	8,227	128	1	10	21,776	31	30,173
2012	GW	889	0	49	0	16	21	975
	SW	8,142	123	1	17	35,640	32	43,955
2011	GW	947	0	29	0	0	25	1,001
	SW	8,587	134	0	15	49,584	39	58,359
2010	GW	628	0	84	0	0	24	736
	SW	6,844	161	73	0	29,160	36	36,274
2009	GW	677	0	131	0	110	29	947
	SW	8,213	157	71	21	44,285	43	52,790
2008	GW	513	1	89	0	5	25	633
	SW	7,827	162	84	1	43,956	38	52,068
2007	GW	388	1	55	0	82	22	548
	SW	6,764	181	0	79	37,342	33	44,399
2006	GW	378	1	52	0	75	23	529
	SW	7,456	169	0	66	38,114	35	45,840
2005	GW	371	1	52	84	120	21	649
	SW	8,804	175	0	33	36,842	31	45,885
2004	GW	298	1	52	82	109	15	557
	SW	7,588	161	0	87	22,486	27	30,349

Projected Surface Water Supplies
TWDB 2022 State Water Plan Data

HIDALGO COUNTY *7.2% (multiplier)* All values are in acre-feet

RWPG	WUG	WUG Basin	Source Name	2020	2030	2040	2050	2060	2070
M	Agua SUD	Nueces-Rio Grande	Amistad-Falcon Lake/Reservoir System	7,148	7,148	7,149	7,147	7,148	7,148
M	Agua SUD	Rio Grande	Amistad-Falcon Lake/Reservoir System	1,357	1,357	1,357	1,358	1,358	1,357
M	Alamo	Nueces-Rio Grande	Amistad-Falcon Lake/Reservoir System	1,694	1,694	1,694	1,694	1,694	1,694
M	County-Other, Hidalgo	Nueces-Rio Grande	Amistad-Falcon Lake/Reservoir System	138	138	138	138	138	138
M	County-Other, Hidalgo	Rio Grande	Amistad-Falcon Lake/Reservoir System	7	7	7	7	7	7
M	Donna	Nueces-Rio Grande	Amistad-Falcon Lake/Reservoir System	3,126	3,125	3,125	3,125	3,125	3,125
M	Edcouch	Nueces-Rio Grande	Amistad-Falcon Lake/Reservoir System	262	262	262	262	262	262
M	Edinburg	Nueces-Rio Grande	Amistad-Falcon Lake/Reservoir System	6,139	6,139	4,222	4,222	4,222	4,222
M	Elsa	Nueces-Rio Grande	Amistad-Falcon Lake/Reservoir System	568	568	568	567	567	567
M	Hidalgo	Nueces-Rio Grande	Amistad-Falcon Lake/Reservoir System	136	136	136	136	136	136
M	Hidalgo	Rio Grande	Amistad-Falcon Lake/Reservoir System	1	1	1	1	1	1
M	Hidalgo County MUD 1	Nueces-Rio Grande	Amistad-Falcon Lake/Reservoir System	604	604	604	604	604	604
M	Irrigation, Hidalgo	Nueces-Rio Grande	Amistad-Falcon Lake/Reservoir System	18,836	18,831	18,825	18,797	18,815	18,810
M	Irrigation, Hidalgo	Rio Grande	Amistad-Falcon Lake/Reservoir System	784	783	783	782	783	783
M	La Joya	Nueces-Rio Grande	Amistad-Falcon Lake/Reservoir System	288	288	288	288	288	288
M	La Joya	Rio Grande	Amistad-Falcon Lake/Reservoir System	76	76	76	76	76	76
M	La Villa	Nueces-Rio Grande	Amistad-Falcon Lake/Reservoir System	236	236	236	236	236	236

M	Livestock, Hidalgo	Nueces-Rio Grande	Amistad-Falcon Lake/Reservoir System	0	1	1	1	1	1
M	Livestock, Hidalgo	Rio Grande	Amistad-Falcon Lake/Reservoir System	5	4	4	4	4	4
M	Manufacturing, Hidalgo	Nueces-Rio Grande	Amistad-Falcon Lake/Reservoir System	30	30	30	30	30	30
M	McAllen	Nueces-Rio Grande	Amistad-Falcon Lake/Reservoir System	33,544	33,544	31,744	31,744	31,744	31,744
M	Mercedes	Nueces-Rio Grande	Amistad-Falcon Lake/Reservoir System	2,267	2,267	2,267	2,267	2,267	2,267
M	Military Highway WSC	Nueces-Rio Grande	Amistad-Falcon Lake/Reservoir System	327	327	327	327	327	327
M	Military Highway WSC	Rio Grande	Amistad-Falcon Lake/Reservoir System	6	6	6	6	6	6
M	Mining, Hidalgo	Nueces-Rio Grande	Amistad-Falcon Lake/Reservoir System	87	87	87	87	87	86
M	Mining, Hidalgo	Rio Grande	Amistad-Falcon Lake/Reservoir System	7	7	7	7	7	7
M	Mission	Nueces-Rio Grande	Amistad-Falcon Lake/Reservoir System	11,550	11,550	11,550	11,550	11,550	11,550
M	Mission	Rio Grande	Amistad-Falcon Lake/Reservoir System	6	6	6	6	6	6
M	North Alamo WSC	Nueces-Rio Grande	Amistad-Falcon Lake/Reservoir System	11,707	11,744	11,772	11,789	11,805	11,817
M	Pharr	Nueces-Rio Grande	Amistad-Falcon Lake/Reservoir System	7,978	7,978	7,978	7,978	7,978	7,978
M	Pharr	Rio Grande	Amistad-Falcon Lake/Reservoir System	2	2	2	2	2	2
M	San Juan	Nueces-Rio Grande	Amistad-Falcon Lake/Reservoir System	3,166	3,166	3,166	3,166	3,166	3,166
M	Sharyland WSC	Nueces-Rio Grande	Amistad-Falcon Lake/Reservoir System	13,195	13,195	13,195	13,195	13,195	13,195
M	Steam-Electric Power, Hidalgo	Nueces-Rio Grande	Amistad-Falcon Lake/Reservoir System	25	25	25	25	25	25
M	Steam-Electric Power, Hidalgo	Rio Grande	Amistad-Falcon Lake/Reservoir System	9	9	9	9	9	9
M	Weslaco	Nueces-Rio Grande	Amistad-Falcon Lake/Reservoir System	5,408	5,408	5,408	5,408	5,408	5,408
	Sum of Projected Surface Water Supplies (acre-feet)			**130,719**	**130,749**	**127,055**	**127,041**	**127,077**	**127,082**

Projected Water Demands
TWDB 2022 State Water Plan Data

Please note that the demand numbers presented here include the plumbing code savings found in the Regional and State Water Plans.

HIDALGO COUNTY *7.2% (multiplier)* All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
M	Agua SUD	Nueces-Rio Grande	6,198	7,465	8,781	10,138	11,533	12,904
M	Agua SUD	Rio Grande	1,177	1,418	1,668	1,926	2,191	2,451
M	Alamo	Nueces-Rio Grande	3,230	3,908	4,607	5,326	6,064	6,786
M	County-Other, Hidalgo	Nueces-Rio Grande	196	244	304	361	418	478
M	County-Other, Hidalgo	Rio Grande	10	13	16	19	22	25
M	Donna	Nueces-Rio Grande	2,610	3,126	3,659	4,218	4,802	5,374
M	Edcouch	Nueces-Rio Grande	343	401	463	531	603	675
M	Edinburg	Nueces-Rio Grande	12,974	15,730	18,573	21,484	24,459	27,374
M	Elsa	Nueces-Rio Grande	832	987	1,150	1,322	1,504	1,683
M	Hidalgo	Nueces-Rio Grande	1,841	2,233	2,637	3,051	3,473	3,888
M	Hidalgo	Rio Grande	17	20	24	28	32	35
M	Hidalgo County MUD 1	Nueces-Rio Grande	816	896	979	1,063	1,147	1,228
M	Irrigation, Hidalgo	Nueces-Rio Grande	47,604	46,075	44,547	43,019	41,491	39,963
M	Irrigation, Hidalgo	Rio Grande	1,981	1,917	1,853	1,790	1,726	1,663
M	La Joya	Nueces-Rio Grande	515	619	727	839	955	1,068
M	La Joya	Rio Grande	136	164	192	221	252	282
M	La Villa	Nueces-Rio Grande	277	332	388	448	509	570
M	Livestock, Hidalgo	Nueces-Rio Grande	51	51	51	51	51	51
M	Livestock, Hidalgo	Rio Grande	5	5	5	5	5	5
M	Manufacturing, Hidalgo	Nueces-Rio Grande	161	196	196	196	196	196
M	McAllen	Nueces-Rio Grande	39,787	48,510	57,403	66,492	75,765	84,820
M	Mercedes	Nueces-Rio Grande	2,222	2,648	3,090	3,558	4,048	4,530
M	Military Highway WSC	Nueces-Rio Grande	2,891	3,395	3,919	4,479	5,062	5,650
M	Military Highway WSC	Rio Grande	57	67	77	88	100	111
M	Mining, Hidalgo	Nueces-Rio Grande	190	242	280	322	369	429
M	Mining, Hidalgo	Rio Grande	15	19	22	25	29	34
M	Mission	Nueces-Rio Grande	20,059	24,519	29,070	33,699	38,393	42,978
M	Mission	Rio Grande	11	13	16	18	21	24
M	North Alamo WSC	Nueces-Rio Grande	26,417	32,031	37,785	43,670	49,653	55,513
M	Pharr	Nueces-Rio Grande	9,920	11,930	14,016	16,178	18,410	20,601
M	Pharr	Rio Grande	3	3	4	4	5	5
M	San Juan	Nueces-Rio Grande	4,947	5,990	7,063	8,166	9,298	10,407
M	Sharyland WSC	Nueces-Rio Grande	12,901	15,628	18,421	21,302	24,263	27,160
M	Steam-Electric Power, Hidalgo	Nueces-Rio Grande	545	545	545	545	545	545
M	Steam-Electric Power, Hidalgo	Rio Grande	286	286	286	286	286	286

M	Weslaco	Nueces-Rio Grande	7,697	9,711	11,550	13,443	15,391	17,218
		Sum of Projected Water Demands (acre-feet)	**208,922**	**241,337**	**274,367**	**308,311**	**343,071**	**377,010**

Projected Water Supply Needs
TWDB 2022 State Water Plan Data

Negative values (in red) reflect a projected water supply need, positive values a surplus.

HIDALGO COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
M	Agua SUD	Nueces-Rio Grande	950	-317	-1,632	-2,991	-4,385	-5,756
M	Agua SUD	Rio Grande	180	-61	-311	-568	-833	-1,094
M	Alamo	Nueces-Rio Grande	-1,014	-1,692	-2,391	-3,110	-3,848	-4,570
M	County-Other, Hidalgo	Nueces-Rio Grande	-564	-1,223	-2,057	-2,850	-3,648	-4,472
M	County-Other, Hidalgo	Rio Grande	-40	-70	-113	-155	-197	-241
M	Donna	Nueces-Rio Grande	516	-1	-534	-1,093	-1,677	-2,249
M	Edcouch	Nueces-Rio Grande	-81	-139	-201	-269	-341	-413
M	Edinburg	Nueces-Rio Grande	-6,835	-9,591	-14,351	-17,262	-20,237	-23,152
M	Elsa	Nueces-Rio Grande	-264	-419	-582	-755	-937	-1,116
M	Hidalgo	Nueces-Rio Grande	-103	-331	-735	-1,149	-1,571	-1,986
M	Hidalgo	Rio Grande	-1	-3	-7	-11	-15	-18
M	Hidalgo County MUD 1	Nueces-Rio Grande	-212	-292	-375	-459	-543	-624
M	Irrigation, Hidalgo	Nueces-Rio Grande	-394,005	-372,832	-351,678	-330,853	-309,369	-288,215
M	Irrigation, Hidalgo	Rio Grande	-16,391	-15,511	-14,630	-13,765	-12,870	-11,989
M	La Joya	Nueces-Rio Grande	-227	-331	-439	-551	-667	-780
M	La Joya	Rio Grande	-60	-88	-116	-145	-176	-206
M	La Villa	Nueces-Rio Grande	-41	-96	-152	-212	-273	-334
M	Livestock, Hidalgo	Nueces-Rio Grande	0	0	0	0	0	0
M	Livestock, Hidalgo	Rio Grande	0	0	0	0	0	0
M	Manufacturing, Hidalgo	Nueces-Rio Grande	679	194	194	194	194	194
M	McAllen	Nueces-Rio Grande	-2,872	-11,595	-22,288	-31,377	-40,650	-49,705
M	Mercedes	Nueces-Rio Grande	671	245	-197	-665	-1,155	-1,637
M	Military Highway WSC	Nueces-Rio Grande	461	-43	-567	-1,127	-1,710	-2,298
M	Military Highway WSC	Rio Grande	8	-2	-12	-23	-35	-46
M	Mining, Hidalgo	Nueces-Rio Grande	-798	-1,517	-2,054	-2,630	-3,290	-4,127
M	Mining, Hidalgo	Rio Grande	-113	-170	-212	-257	-310	-376
M	Mission	Nueces-Rio Grande	-8,509	-12,969	-17,520	-22,149	-26,843	-31,428
M	Mission	Rio Grande	-5	-7	-10	-12	-15	-18
M	North Alamo WSC	Nueces-Rio Grande	-5,443	-10,798	-16,503	-22,356	-28,312	-34,151
M	Pharr	Nueces-Rio Grande	448	-1,361	-3,238	-5,184	-7,192	-9,164
M	Pharr	Rio Grande	1	1	0	0	-1	-1
M	San Juan	Nueces-Rio Grande	1	-1,042	-2,115	-3,218	-4,350	-5,459
M	Sharyland WSC	Nueces-Rio Grande	294	-2,433	-5,226	-8,107	-11,068	-13,965
M	Steam-Electric Power, Hidalgo	Nueces-Rio Grande	-1,137	-1,014	-948	-948	-948	-948
M	Steam-Electric Power, Hidalgo	Rio Grande	-655	-589	-555	-555	-555	-555

M	Weslaco	Nueces-Rio Grande	-1,519	-3,332	-5,090	-6,983	-8,931	-10,758
		Sum of Projected Water Supply Needs (acre-feet)	**-440,889**	**-449,869**	**-466,839**	**-481,789**	**-496,952**	**-511,851**

Projected Water Management Strategies
TWDB 2022 State Water Plan Data

HIDALGO COUNTY

WUG, Basin (RWPG)

All values are in acre-feet

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
Agua SUD, Nueces-Rio Grande (M)							
Advanced Municipal Conservation - Agua SUD	DEMAND REDUCTION [Hidalgo]	0	0	0	338	901	1,581
Agua SUD - East WWTP Potable Reuse	Direct Reuse [Hidalgo]	0	0	1,874	1,874	1,874	1,874
Agua SUD - West WWTP Potable Reuse	Direct Reuse [Hidalgo]	468	468	1,874	1,874	1,874	1,874
Drought Management	DEMAND REDUCTION [Hidalgo]	0	291	347	404	460	516
Hidalgo County ID 16 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	236	273	308	345	382	419
Hidalgo County ID 6 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	603	669	737	804	871	939
Urbanization - WWP Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	0	0	1,189	2,091	2,804	3,381
		1,307	**1,701**	**6,329**	**7,730**	**9,166**	**10,584**
Agua SUD, Rio Grande (M)							
Advanced Municipal Conservation - Agua SUD	DEMAND REDUCTION [Hidalgo]	0	0	0	64	171	300
Agua SUD - East WWTP Potable Reuse	Direct Reuse [Hidalgo]	0	0	356	356	356	356
Agua SUD - West WWTP Potable Reuse	Direct Reuse [Hidalgo]	89	89	356	356	356	356
Drought Management	DEMAND REDUCTION [Hidalgo]	0	55	66	77	88	98
Hidalgo County ID 16 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	45	52	59	66	72	79
Hidalgo County ID 6 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	114	127	140	153	165	178
Urbanization - WWP Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	0	0	225	398	534	643
		248	**323**	**1,202**	**1,470**	**1,742**	**2,010**
Alamo, Nueces-Rio Grande (M)							
Advanced Municipal Conservation - Alamo	DEMAND REDUCTION [Hidalgo]	0	0	46	278	587	952
Alamo - Brackish Groundwater Desalination Plant	Gulf Coast Aquifer System [Hidalgo]	0	896	896	896	896	896
Alamo - Fresh Groundwater Well	Gulf Coast Aquifer System [Hidalgo]	1,120	1,120	1,120	1,120	1,120	1,120
Drought Management	DEMAND REDUCTION [Hidalgo]	118	146	175	203	232	260

Hidalgo County ID 2 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	8	57	107	156	205	254
Urbanization - WWP Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	245	606	1,185	1,591	1,948	2,230
		1,491	**2,825**	**3,529**	**4,244**	**4,988**	**5,712**
County-Other, Hidalgo, Nueces-Rio Grande (M)							
Donna ID Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	27	93	155	216	280	340
Urbanization - WUG Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	546	1,139	1,911	2,643	3,378	4,141
		573	**1,232**	**2,066**	**2,859**	**3,658**	**4,481**
County-Other, Hidalgo, Rio Grande (M)							
Donna ID Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	12	11	13	17	18	23
Urbanization - WUG Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	29	60	101	139	179	219
		41	**71**	**114**	**156**	**197**	**242**
Donna, Nueces-Rio Grande (M)							
Advanced Municipal Conservation - Donna	DEMAND REDUCTION [Hidalgo]	0	0	0	69	300	578
Donna - WTP Expansion, New Raw Water Reservoir, and Raw Water Pump Station	Amistad-Falcon Lake/Reservoir System [Reservoir]	950	950	2,240	2,240	2,240	2,240
Donna ID Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	64	170	276	382	488	594
Drought Management	DEMAND REDUCTION [Hidalgo]	0	0	147	171	195	218
Urbanization - WWP Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	1,415	2,240	2,361	2,721	2,943	3,107
		2,429	**3,360**	**5,024**	**5,583**	**6,166**	**6,737**
Edcouch, Nueces-Rio Grande (M)							
Advanced Municipal Conservation - Edcouch	DEMAND REDUCTION [Hidalgo]	0	0	0	0	0	16
Drought Management	DEMAND REDUCTION [Hidalgo]	13	16	19	23	26	29
Edcouch - New Groundwater Supply	Gulf Coast Aquifer System [Hidalgo]	725	725	725	725	725	725
Hidalgo and Cameron County ID 9 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	14	24	35	45	56	66
		752	**765**	**779**	**793**	**807**	**836**
Edinburg, Nueces-Rio Grande (M)							
Advanced Municipal Conservation - Edinburg	DEMAND REDUCTION [Hidalgo]	0	0	329	1,290	2,549	4,035
Drought Management	DEMAND REDUCTION [Hidalgo]	488	606	724	843	961	1,076
Edinburg Non-Potable Reuse	Direct Reuse [Hidalgo]	3,243	3,920	3,920	3,920	3,920	3,920

Hidalgo County ID 1 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	259	350	216	261	305	350
Hidalgo County ID 2 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	11	79	146	214	281	349
Urbanization - WUG Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	1,499	210	2,097	302	0	0
Urbanization - WWP Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	1,737	4,862	8,661	12,109	13,824	14,969
		7,237	**10,027**	**16,093**	**18,939**	**21,840**	**24,699**
Elsa, Nueces-Rio Grande (M)							
Advanced Municipal Conservation - Elsa	DEMAND REDUCTION [Hidalgo]	0	0	0	0	44	128
Drought Management	DEMAND REDUCTION [Hidalgo]	30	38	45	52	60	67
Hidalgo and Cameron County ID 9 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	33	58	82	107	132	157
Urbanization - WWP Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	225	355	499	655	799	934
		288	**451**	**626**	**814**	**1,035**	**1,286**
Hidalgo, Nueces-Rio Grande (M)							
Advanced Municipal Conservation - Hidalgo	DEMAND REDUCTION [Hidalgo]	0	0	46	182	361	572
Drought Management	DEMAND REDUCTION [Hidalgo]	43	54	63	73	84	94
Hidalgo - Expand Existing Groundwater Wells	Gulf Coast Aquifer System [Hidalgo]	0	0	297	297	297	297
Urbanization - WWP Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	76	294	656	916	1,580	1,339
		119	**348**	**1,062**	**1,468**	**2,322**	**2,302**
Hidalgo, Rio Grande (M)							
Advanced Municipal Conservation - Hidalgo	DEMAND REDUCTION [Hidalgo]	0	0	0	2	3	5
Drought Management	DEMAND REDUCTION [Hidalgo]	0	0	1	1	1	1
Hidalgo - Expand Existing Groundwater Wells	Gulf Coast Aquifer System [Hidalgo]	0	0	3	3	3	3
Urbanization - WWP Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	2	4	6	8	14	13
		2	**4**	**10**	**14**	**21**	**22**
Hidalgo County MUD 1, Nueces-Rio Grande (M)							
Advanced Municipal Conservation - Hidalgo County MUD 1	DEMAND REDUCTION [Hidalgo]	0	0	0	39	93	153
Drought Management	DEMAND REDUCTION [Hidalgo]	60	68	75	82	89	96
Hidalgo County ID 1 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	42	56	71	85	100	115

Urbanization - WWP Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	148	218	254	293	284	292
		250	**342**	**400**	**499**	**566**	**656**
Irrigation, Hidalgo, Nueces-Rio Grande (M)							
Arundo Donax Biological Control	Amistad-Falcon Lake/Reservoir System [Reservoir]	1,177	1,177	1,177	1,177	1,177	1,177
Delta Lake ID - ID Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	1,387	2,481	3,573	4,666	5,757	6,848
Donna ID Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	576	1,537	2,498	3,458	4,418	5,377
Engleman ID Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	566	650	734	818	901	985
Hidalgo and Cameron County ID 9 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	1,996	3,490	4,984	6,477	7,968	9,459
Hidalgo County ID 1 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	1,537	2,078	2,617	3,157	3,696	4,235
Hidalgo County ID 13 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	69	82	94	107	119	131
Hidalgo County ID 16 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	1,045	1,205	1,366	1,526	1,687	1,847
Hidalgo County ID 2 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	204	1,408	2,612	3,816	5,019	6,221
Hidalgo County ID 5 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	829	829	829	829	829	830
Hidalgo County ID 6 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	1,209	1,343	1,478	1,613	1,747	1,882
Hidalgo County WCID 18 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	81	86	91	96	101	106
Hidalgo County WID 19 (Sharyland) Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	377	394	410	426	442	458
Hidalgo County WID 3 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	375	375	375	375	375	375
La Feria ID Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	6,305	6,305	6,305	6,305	6,305	6,305
On-Farm Irrigation Conservation	DEMAND REDUCTION [Hidalgo]	12,149	12,149	12,149	12,149	12,149	12,149
Santa Cruz ID Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	2,020	2,759	3,497	4,236	4,974	5,711
United ID Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	2,286	2,286	2,286	2,286	2,286	2,286

Valley Acres ID Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	300	402	503	605	706	807
		34,488	**41,036**	**47,578**	**54,122**	**60,656**	**67,189**
Irrigation, Hidalgo, Rio Grande (M)							
Arundo Donax Biological Control	Amistad-Falcon Lake/Reservoir System [Reservoir]	49	49	49	49	49	49
Delta Lake ID - ID Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	58	103	149	194	240	285
Donna ID Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	24	64	104	144	184	224
Engleman ID Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	24	27	31	34	38	41
Hidalgo and Cameron County ID 9 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	83	145	207	269	332	394
Hidalgo County ID 1 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	64	86	109	131	154	176
Hidalgo County ID 13 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	3	3	4	4	5	5
Hidalgo County ID 16 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	43	50	57	64	70	77
Hidalgo County ID 2 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	8	59	109	159	209	259
Hidalgo County ID 5 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	34	34	34	35	35	35
Hidalgo County ID 6 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	50	56	62	67	73	78
Hidalgo County WCID 18 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	3	4	4	4	4	4
Hidalgo County WID 19 (Sharyland) Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	16	16	17	18	18	19
Hidalgo County WID 3 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	16	16	16	16	16	16
La Feria ID Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	262	262	262	262	262	262
On-Farm Irrigation Conservation	DEMAND REDUCTION [Hidalgo]	505	505	505	505	505	505
Santa Cruz ID Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	84	115	146	176	207	238
United ID Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	95	95	95	95	95	95

Valley Acres ID Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	13	17	21	25	29	34
		1,434	**1,706**	**1,981**	**2,251**	**2,525**	**2,796**
La Joya, Nueces-Rio Grande (M)							
Advanced Municipal Conservation - La Joya	DEMAND REDUCTION [Hidalgo]	0	0	0	24	70	126
Drought Management	DEMAND REDUCTION [Hidalgo]	13	17	20	23	26	28
Hidalgo County ID 16 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	31	36	40	45	50	55
Urbanization - WWP Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	298	309	398	484	534	583
		342	**362**	**458**	**576**	**680**	**792**
La Joya, Rio Grande (M)							
Advanced Municipal Conservation - La Joya	DEMAND REDUCTION [Hidalgo]	0	0	0	6	19	33
Drought Management	DEMAND REDUCTION [Hidalgo]	4	4	5	6	7	8
Hidalgo County ID 16 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	8	9	11	12	13	14
Urbanization - WWP Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	79	82	105	127	141	154
		91	**95**	**121**	**151**	**180**	**209**
La Villa, Nueces-Rio Grande (M)							
Advanced Municipal Conservation - La Villa	DEMAND REDUCTION [Hidalgo]	0	0	0	6	29	59
Drought Management	DEMAND REDUCTION [Hidalgo]	8	10	12	14	16	18
Hidalgo and Cameron County ID 9 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	11	19	27	35	43	51
Urbanization - WWP Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	37	97	141	188	202	218
		56	**126**	**180**	**243**	**290**	**346**
Manufacturing, Hidalgo, Nueces-Rio Grande (M)							
Implementation of Industrial Best Management Practices	DEMAND REDUCTION [Hidalgo]	224	272	272	272	272	272
		224	**272**	**272**	**272**	**272**	**272**
McAllen, Nueces-Rio Grande (M)							
Advanced Municipal Conservation - McAllen	DEMAND REDUCTION [Hidalgo]	0	3,558	8,804	15,340	22,992	28,889
Drought Management	DEMAND REDUCTION [Hidalgo]	1,071	1,330	1,589	1,850	2,110	2,363
Hidalgo County ID 1 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	196	264	333	402	471	540
Hidalgo County ID 2 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	29	204	378	552	727	901

Hidalgo County WID 3 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	1,672	1,672	1,672	1,672	1,672	1,672
McAllen - AMI Project	DEMAND REDUCTION [Hidalgo]	1,140	1,140	1,140	1,140	1,140	1,140
McAllen - Brackish Groundwater Desalination Plant	Gulf Coast Aquifer System [Hidalgo]	0	2,688	2,688	2,688	2,688	2,688
McAllen - North WWTP Potable Reuse	Direct Reuse [Hidalgo]	0	3,880	3,880	6,060	6,060	6,060
McAllen - Raw Water Line Project	Nueces-Rio Grande Run-of-River [Hidalgo]	800	800	800	800	800	800
United ID Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	1,227	1,227	1,227	1,227	1,227	1,227
Urbanization - WUG Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	0	0	0	33	0	1,085
Urbanization - WWP Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	0	0	2,968	3,589	5,223	7,285
		6,135	**16,763**	**25,479**	**35,353**	**45,110**	**54,650**
Mercedes, Nueces-Rio Grande (M)							
Advanced Municipal Conservation - Mercedes	DEMAND REDUCTION [Hidalgo]	0	0	0	0	170	399
Drought Management	DEMAND REDUCTION [Hidalgo]	0	0	128	150	171	191
Hidalgo and Cameron County ID 9 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	95	167	239	310	382	453
Urbanization - WWP Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	0	0	0	220	448	609
		95	**167**	**367**	**680**	**1,171**	**1,652**
Military Highway WSC, Nueces-Rio Grande (M)							
Advanced Municipal Conservation - Military Highway WSC	DEMAND REDUCTION [Hidalgo]	0	0	134	337	600	910
Drought Management	DEMAND REDUCTION [Hidalgo]	0	88	103	118	134	149
Harlingen ID Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	17	25	34	43	43	43
Urbanization - WWP Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	44	375	648	888	1,091	1,369
		61	**488**	**919**	**1,386**	**1,868**	**2,471**
Military Highway WSC, Rio Grande (M)							
Advanced Municipal Conservation - Military Highway WSC	DEMAND REDUCTION [Hidalgo]	0	0	3	7	12	18
Drought Management	DEMAND REDUCTION [Hidalgo]	0	2	2	2	3	3
Harlingen ID Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	0	1	1	1	1	1
Urbanization - WWP Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	1	7	13	17	22	27
		1	**10**	**19**	**27**	**38**	**49**

Mining, Hidalgo, Nueces-Rio Grande (M)

Implementation of Industrial Best Management Practices	DEMAND REDUCTION [Hidalgo]	263	336	389	447	513	596
		263	**336**	**389**	**447**	**513**	**596**

Mining, Hidalgo, Rio Grande (M)

Implementation of Industrial Best Management Practices	DEMAND REDUCTION [Hidalgo]	21	26	31	35	40	47
		21	**26**	**31**	**35**	**40**	**47**

Mission, Nueces-Rio Grande (M)

Advanced Municipal Conservation - Mission	DEMAND REDUCTION [Hidalgo]	0	1,915	4,632	7,717	10,203	12,951
Drought Management	DEMAND REDUCTION [Hidalgo]	948	1,177	1,407	1,638	1,869	2,093
Mission - Brackish Groundwater Desalination Plant	Gulf Coast Aquifer System [Hidalgo]	0	2,687	2,687	2,687	2,687	2,686
Mission - Potable Reuse	Direct Reuse [Hidalgo]	3,913	3,918	3,918	7,556	7,556	7,556
United ID Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	1,482	1,482	1,482	1,482	1,482	1,482
Urbanization - WUG Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	452	0	0	0	0	0
Urbanization - WWP Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	1,748	2,585	5,269	4,126	6,284	8,079
		8,543	**13,764**	**19,395**	**25,206**	**30,081**	**34,847**

Mission, Rio Grande (M)

Advanced Municipal Conservation - Mission	DEMAND REDUCTION [Hidalgo]	0	1	3	4	6	7
Drought Management	DEMAND REDUCTION [Hidalgo]	1	1	1	1	1	1
Mission - Brackish Groundwater Desalination Plant	Gulf Coast Aquifer System [Hidalgo]	0	1	1	1	1	2
Mission - Potable Reuse	Direct Reuse [Hidalgo]	7	2	2	4	4	4
United ID Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	1	1	1	1	1	1
Urbanization - WUG Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	0	0	0	0	0	0
Urbanization - WWP Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	0	2	3	2	3	4
		9	**8**	**11**	**13**	**16**	**19**

North Alamo WSC, Nueces-Rio Grande (M)

Advanced Municipal Conservation - North Alamo WSC	DEMAND REDUCTION [Hidalgo]	0	1,265	2,910	5,142	7,916	11,105
Drought Management	DEMAND REDUCTION [Hidalgo]	711	879	1,048	1,217	1,386	1,551
ERHWSC & NAWSC - North Cameron Regional WTP Wellfield Expansion	Gulf Coast Aquifer System [Cameron]	0	752	754	755	756	757
Hidalgo and Cameron County ID 9 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	155	272	390	508	625	743

Hidalgo County ID 1 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	64	87	110	133	156	179
Hidalgo County ID 2 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	13	83	154	226	297	369
NAWSC - Delta Area Brackish Groundwater Desalination Plant	Gulf Coast Aquifer System [Cameron]	0	2,105	2,110	2,114	2,116	2,118
NAWSC - Delta WTP Expansion Phase 1-2	Amistad-Falcon Lake/Reservoir System [Reservoir]	0	0	4,220	5,813	5,819	5,825
Santa Cruz ID Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	45	61	78	94	111	127
Urbanization - WUG Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	0	1,608	478	2,595	3,094	1,239
Urbanization - WWP Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	5,024	7,855	16,255	23,121	25,362	29,483
		6,012	**14,967**	**28,507**	**41,718**	**47,638**	**53,496**
Pharr, Nueces-Rio Grande (M)							
Advanced Municipal Conservation - Pharr	DEMAND REDUCTION [Hidalgo]	0	0	0	458	1,354	2,432
Drought Management	DEMAND REDUCTION [Hidalgo]	0	555	664	773	882	988
Hidalgo County ID 2 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	39	271	502	734	965	1,190
Pharr - Direct Potable Reuse	Direct Reuse [Cameron]	6,719	6,719	6,719	6,719	6,719	6,719
Urbanization - WWP Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	0	19	19	19	19	19
		6,758	**7,564**	**7,904**	**8,703**	**9,939**	**11,348**
Pharr, Rio Grande (M)							
Advanced Municipal Conservation - Pharr	DEMAND REDUCTION [Hidalgo]	0	0	0	0	0	1
Drought Management	DEMAND REDUCTION [Hidalgo]	0	1	1	1	1	1
Hidalgo County ID 2 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	0	0	0	0	0	7
Pharr - Direct Potable Reuse	Direct Reuse [Cameron]	2	2	2	2	2	2
Urbanization - WWP Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	0	1	1	1	1	1
		2	**4**	**4**	**4**	**4**	**12**
San Juan, Nueces-Rio Grande (M)							
Advanced Municipal Conservation - San Juan	DEMAND REDUCTION [Hidalgo]	0	0	93	451	928	1,491
Drought Management	DEMAND REDUCTION [Hidalgo]	0	128	153	179	204	228
Hidalgo County ID 2 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	10	71	133	194	255	316

San Juan - Brackish Groundwater Well and Desalination	Gulf Coast Aquifer System [Hidalgo]	0	1,120	1,120	1,120	1,120	1,120
San Juan - Potable Reuse	Direct Reuse [Hidalgo]	0	0	2,240	2,240	2,240	2,240
San Juan - WTP 1 Upgrade, Expansion, and BGD	Gulf Coast Aquifer System [Hidalgo]	0	1,792	1,792	1,792	1,792	1,792
Urbanization - WWP Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	0	0	0	612	1,181	1,643
		10	**3,111**	**5,531**	**6,588**	**7,720**	**8,830**
Sharyland WSC, Nueces-Rio Grande (M)							
Advanced Municipal Conservation - Sharyland WSC	DEMAND REDUCTION [Hidalgo]	0	831	2,016	3,143	4,560	6,172
Drought Management	DEMAND REDUCTION [Hidalgo]	287	356	425	495	565	633
Hidalgo County ID 1 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	483	653	823	993	1,163	1,333
Santa Cruz ID Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	127	174	220	267	313	360
Sharyland WSC - Well and RO Unit at WTP 2	Gulf Coast Aquifer System [Hidalgo]	0	900	900	900	900	900
Sharyland WSC - Well and RO Unit at WTP 3	Gulf Coast Aquifer System [Hidalgo]	0	900	900	900	900	900
United ID Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	639	639	639	639	639	639
Urbanization - WWP Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	0	343	1,836	3,475	4,904	6,076
		1,536	**4,796**	**7,759**	**10,812**	**13,944**	**17,013**
Steam-Electric Power, Hidalgo, Nueces-Rio Grande (M)							
Edinburg Non-Potable Reuse	Direct Reuse [Hidalgo]	444	0	0	0	0	0
Implementation of Industrial Best Management Practices	DEMAND REDUCTION [Hidalgo]	757	757	757	757	757	757
		1,201	**757**	**757**	**757**	**757**	**757**
Steam-Electric Power, Hidalgo, Rio Grande (M)							
Edinburg Non-Potable Reuse	Direct Reuse [Hidalgo]	233	0	0	0	0	0
Implementation of Industrial Best Management Practices	DEMAND REDUCTION [Hidalgo]	397	397	397	397	397	397
		630	**397**	**397**	**397**	**397**	**397**
Weslaco, Nueces-Rio Grande (M)							
Advanced Municipal Conservation - Weslaco	DEMAND REDUCTION [Hidalgo]	0	547	1,219	1,924	2,829	3,844
Drought Management	DEMAND REDUCTION [Hidalgo]	258	333	401	470	539	603
Hidalgo and Cameron County ID 9 Conservation	Amistad-Falcon Lake/Reservoir System [Reservoir]	235	411	588	764	940	1,117
Urbanization - WWP Reduction - Conversion of Irrigation Water Rights to DMI	Amistad-Falcon Lake/Reservoir System [Reservoir]	0	1,000	1,792	2,735	3,533	4,105
Weslaco - Groundwater Development and Blending	Gulf Coast Aquifer System [Hidalgo]	560	560	560	560	560	560

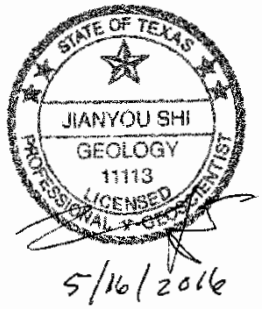
Weslaco North WWTP Potable Reuse	Direct Reuse [Hidalgo]	1,120	1,120	1,120	1,120	1,120	1,120
		2,173	**3,971**	**5,680**	**7,573**	**9,521**	**11,349**
Sum of Projected Water Management Strategies (acre-feet)		**84,822**	**132,175**	**190,973**	**241,883**	**285,868**	**328,704**

Appendix F

GAM Run 16-008: Red Sands Groundwater Conservation District Management Plan (Shi, 2016)

GAM RUN 16-008: RED SANDS GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN

Jerry Jianyou Shi, Ph.D., P.G.
Texas Water Development Board
Groundwater Division
Groundwater Availability Modeling Section
(512) 463-5076
May 16, 2016



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GAM RUN 16-008: RED SANDS GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN

Jerry Jianyou Shi, Ph.D., P.G.
Texas Water Development Board
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Groundwater Availability Modeling Section
(512)463-5076
May 16, 2016

EXECUTIVE SUMMARY:

Texas State Water Code, Section 36.1071, Subsection (h) (Texas Water Code, 2015), states that, in developing its groundwater management plan, a groundwater conservation district shall use groundwater availability modeling information provided by the executive administrator of the Texas Water Development Board (TWDB) in conjunction with any available site-specific information provided by the district for review and comment to the executive administrator. Information derived from groundwater availability models that shall be included in the groundwater management plan includes:

- the annual amount of recharge from precipitation, if any, to the groundwater resources within the district;
- for each aquifer within the district, the annual volume of water that discharges from the aquifer to springs and any surface-water bodies, including lakes, streams, and rivers; and
- the annual volume of flow into and out of the district within each aquifer and between aquifers in the district.

This report—Part 2 of a two-part package of information from the TWDB to the Red Sands Groundwater Conservation District—fulfills the requirements noted above. Part 1 of the two-part package is the Estimated Historical Water Use/State Water Plan data report. The district will receive this data report from the TWDB Groundwater Technical Assistance Section. Questions about the data report can be directed to Mr. Stephen Allen, stephen.allen@twdb.texas.gov, (512)463-7317.

The groundwater management plan for the Red Sands Groundwater Conservation District should be adopted by the district on or before May 15, 2017, and submitted to the Executive Administrator of the TWDB on or before June 14, 2017. The current management plan for the Red Sands Groundwater Conservation District expires on August 13, 2017.

This report discusses the methods, assumptions, and results from a model run using version 2.01 of the groundwater availability model for the southern portion of the Gulf Coast Aquifer System (Chowdhury and Mace, 2007). After GAM Run 11-002 was completed for the previous district groundwater management plan, the boundary of the Red Sands Groundwater Conservation District changed. GAM Run 16-008 used the new district boundary (Figure 1) and replaces GAM Run 11-002 (Hassan, 2011). Table 1 summarizes the groundwater availability model data required by statute. Figure 1 shows the area of the model from which the values in the table were extracted. If after review of the figure Red Sands Groundwater Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the TWDB at your earliest convenience.

METHODS:

In accordance with the provisions of the Texas State Water Code, Section 36.1071, Subsection (h), the groundwater availability model for the southern portion of the Gulf Coast Aquifer System was used for this analysis. The water budget for the Red Sands Groundwater Conservation District was extracted for selected years of the historical model period (1981 to 2000) using ZONEBUDGET Version 3.01 (Harbaugh, 2009). The average annual water budget values for recharge, surface-water outflow, inflow to the district, and outflow from the district for the Gulf Coast Aquifer System within the district is summarized in this report. Since the Gulf Coast Aquifer System is the only hydrogeologic unit in the groundwater flow model within the Red Sands Groundwater Conservation District, the cross-formation flow between the Gulf Coast Aquifer System and other hydrogeologic units are not applicable in this analysis.

PARAMETERS AND ASSUMPTIONS:

Gulf Coast Aquifer System

- We used version 2.01 of the groundwater availability model for the southern portion of the Gulf Coast Aquifer System. See Chowdhury and Mace (2007) for assumptions and limitations of the model.
- The groundwater availability model for the southern portion of the Gulf Coast Aquifer System contains four layers: Layer 1 (Chicot Aquifer), Layer 2

(Evangeline Aquifer), Layer 3 (Burkeville Confining Unit), and Layer 4 (Jasper Aquifer).

- The Rio Grande River was simulated using MODFLOW-96 river package. The Gulf of Mexico was simulated using MODFLOW-96 constant head boundary. However, neither of these surface features is present in the Red Sands Groundwater Conservation District. As a result, groundwater discharge to surface water is calculated as zero for this management plan analysis.

- The model was run with MODFLOW-96 (Harbaugh and McDonald, 1996).

RESULTS:

A groundwater budget summarizes the amount of water entering and leaving the aquifer according to the groundwater availability model. Selected groundwater budget components listed below were extracted from the model results for the Gulf Coast Aquifer System located within the district and averaged over the duration of the calibration and verification portion of the model run in the district, as shown in Table 1.

- Precipitation recharge—The areally distributed recharge sourced from precipitation falling on the outcrop areas of the aquifers—where the aquifer is exposed at land surface—within the district.

- Surface-water outflow—The total water discharging from the aquifer (outflow) to surface-water features such as streams, reservoirs, and drains (springs).

- Flow into and out of district—The lateral flow within the aquifer between the district and adjacent counties.

- Flow between aquifers—The net vertical flow between aquifers or confining units. This flow is controlled by the relative water levels in each aquifer or confining unit and aquifer properties of each aquifer or confining unit that define the amount of leakage that occurs. Please note that the Gulf Coast Aquifer System is the only aquifer in the groundwater flow model within the Red Sands Groundwater Conservation District and the model assumes no cross-formational flow at the base of the Gulf Coast Aquifer System. Therefore, no cross-formational flow between the Gulf Coast Aquifer System and other hydrogeologic units was calculated by the model.

The information needed for the district's management plan is summarized in Table 1. It is important to note that sub-regional water budgets are not exact. This is due to

the size of the model cells and the approach used to extract data from the model. To avoid double accounting, a model cell that straddles a political boundary, such as a district or county boundary, is assigned to one side of the boundary based on the location of the centroid of the model cell. For example, if a cell contains two counties, the cell is assigned to the county where the centroid of the cell is located.

TABLE 1: SUMMARIZED INFORMATION FOR GULF COAST AQUIFER SYSTEM THAT IS NEEDED FOR RED SANDS GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Gulf Coast Aquifer System	675
Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, rivers, springs, and flowing wells	Gulf Coast Aquifer System	0
Estimated annual volume of flow into the district within each aquifer in the district	Gulf Coast Aquifer System	6,324
Estimated annual volume of flow out of the district within each aquifer in the district	Gulf Coast Aquifer System	6,548
Estimated net annual volume of flow between each aquifer in the district	Not applicable*	Not applicable

*The Gulf Coast Aquifer System is the only aquifer in the groundwater flow model within the Red Sands Groundwater Conservation District. The model assumes no cross-formational flow at the base of the Gulf Coast Aquifer System. Therefore, no cross-formational flow between the Gulf Coast Aquifer System and other hydrogeologic units was calculated by the model.

GAM Run 16-008: Red Sands Groundwater Conservation District Management Plan
May 16, 2016
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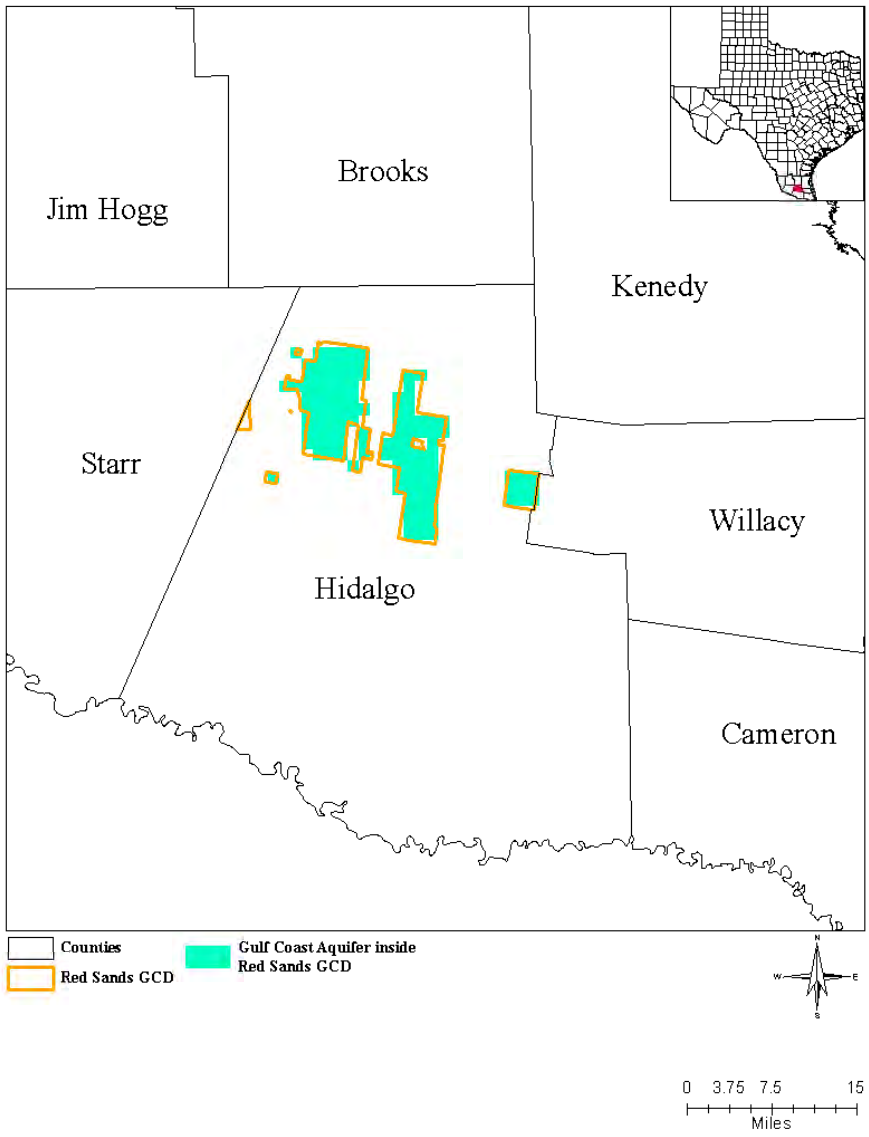

FIGURE 1: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE GULF COAST AQUIFER SYSTEM FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED FOR THE RED SANDS GROUNDWATER CONSERVATION DISTRICT (GCD).

LIMITATIONS:

The groundwater models used in completing this analysis are the best available scientific tools that can be used to meet the stated objectives. To the extent that this analysis will be used for planning purposes and/or regulatory purposes related to pumping in the past and into the future, it is important to recognize the assumptions and limitations associated with the use of the results. In reviewing the use of models in environmental regulatory decision making, the National Research Council (2007) noted:

> *"Models will always be constrained by computational limitations, assumptions, and knowledge gaps. They can best be viewed as tools to help inform decisions rather than as machines to generate truth or make decisions. Scientific advances will never make it possible to build a perfect model that accounts for every aspect of reality or to prove that a given model is correct in all respects for a particular regulatory application. These characteristics make evaluation of a regulatory model more complex than solely a comparison of measurement data with model results."*

A key aspect of using the groundwater model to evaluate historic groundwater flow conditions includes the assumptions about the location in the aquifer where historic pumping was placed. Understanding the amount and location of historic pumping is as important as evaluating the volume of groundwater flow into and out of the district, between aquifers within the district (as applicable), interactions with surface water (as applicable), recharge to the aquifer system (as applicable), and other metrics that describe the impacts of that pumping. In addition, assumptions regarding precipitation, recharge, and interaction with streams are specific to particular historic time periods.

Because the application of the groundwater models was designed to address regional-scale questions, the results are most effective on a regional scale. The TWDB makes no warranties or representations related to the actual conditions of any aquifer at a particular location or at a particular time.

It is important for groundwater conservation districts to monitor groundwater pumping and overall conditions of the aquifer. Because of the limitations of the groundwater model and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine this analysis in the future given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future. Historic precipitation patterns also need to be placed in context as future climatic conditions, such as dry and wet year precipitation patterns, may differ and affect groundwater flow conditions.

REFERENCES:

Chowdhury, A. and Mace, R., 2007, Groundwater Resource Evaluation and Availability Model of the Gulf Coast Aquifer in the Lower Rio Grande Valley of Texas: Texas Water Development Board Report 368 (June 2007), 129 p., http://www.twdb.texas.gov/publications/reports/numbered_reports/doc/R368/R368_GulfCoastGAM.pdf.

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Hassan, M., 2011, GAM Run 11-002: Texas Water Development Board GAM Run 11-002 Report, 8 p., http://www.twdb.texas.gov/groundwater/docs/GAMruns/GR11-002.pdf.

National Research Council, 2007, Models in Environmental Regulatory Decision Making Committee on Models in the Regulatory Decision Process, National Academies Press, Washington D.C., 287 p., http://www.nap.edu/catalog.php?record_id=11972.

Texas Water Code, 2015, http://www.statutes.legis.state.tx.us/docs/WA/pdf/WA.36.pdf.

Appendix G

Red Sands GCD Rules