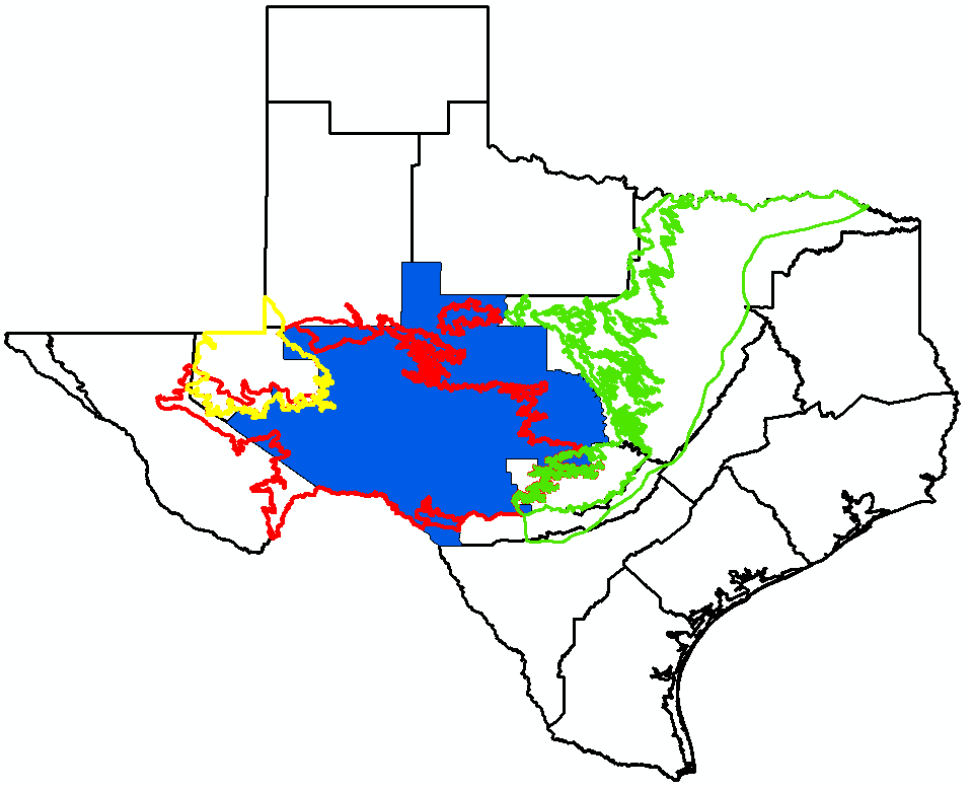
GMA 7 Technical Memorandum 15-06
Final

Edward-Trinity (Plateau), Pecos Valley and Trinity Aquifers: Nine Factor Documentation and Predictive Simulations



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GMA 7 Technical Memorandum 15-06 (Final)
Edwards-Trinity (Plateau), Pecos Valley and Trinity Aquifers: Nine Factor Documentation and Predictive Simulations

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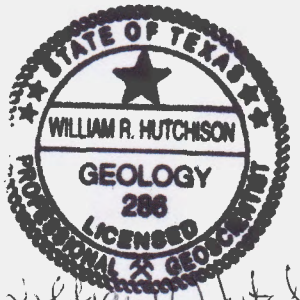

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1.0 Introduction and Objective

This technical memorandum documents data and information related to the nine factors that GMA 7 considered before developing and adopting a proposed desired future condition for the Edwards-Trinity (Plateau), Pecos Valley and Trinity aquifers on April 21, 2016.

This technical memorandum also presents summary results from predictive simulations using the alternative to the groundwater availability model of the Edwards-Trinity (Plateau) and Pecos Valley aquifers, commonly known as the one-layer model (Hutchison and others, 2011), which also includes pertinent portions of the Trinity Aquifer in Gillespie, Real and Uvalde counties. The predictive simulations presented here can either form the quantitative basis of an updated desired future condition or be modified to run additional simulations after review and discussion of these results.

1.1 Aquifer Descriptions

As described in George and others (2011):

> ***The Edwards-Trinity (Plateau) Aquifer*** *is a major aquifer extending across much of the southwestern part of the state. The water-bearing units are composed predominantly of limestone and dolomite of the Edwards Group and sands of the Trinity Group. Although maximum saturated thickness of the aquifer is greater than 800 feet, freshwater saturated thickness averages 433 feet. Water quality ranges from fresh to slightly saline, with total dissolved solids ranging from 100 to 3,000 milligrams per liter, and water is characterized as hard within the Edwards Group. Water typically increases in salinity to the west within the Trinity Group. Elevated levels of fluoride in excess of primary drinking water standards occur within Glasscock and Irion counties. Springs occur along the northern, eastern, and southern margins of the aquifer primarily near the bases of the Edwards and Trinity groups where exposed at the surface. San Felipe Springs is the largest exposed spring along the southern margin. Of groundwater pumped from this aquifer, more than two-thirds is used for irrigation, with the remainder used for municipal and livestock supplies. Water levels have remained relatively stable because recharge has generally kept pace with the relatively low amounts of pumping over the extent of the aquifer. The regional water planning groups, in their 2006 Regional Water Plans, recommended water management strategies that use the Edwards Trinity (Plateau) Aquifer, including the construction of a well field in Kerr County and public supply wells in Real County.*
>
> ***The Pecos Valley Aquifer*** *is a major aquifer in West Texas. Water-bearing sediments include alluvial and windblown deposits in the Pecos River Valley. These sediments fill several structural basins, the largest of which are the Pecos Trough in the west and Monument Draw Trough in the east. Thickness of the alluvial fill reaches 1,500 feet, and freshwater saturated thickness averages about 250 feet. The*

water quality is highly variable, the water being typically hard, and generally better in the Monument Draw Trough than in the Pecos Trough. Total dissolved solids in groundwater from Monument Draw Trough are usually less than 1,000 milligrams per liter. The aquifer is characterized by high levels of chloride and sulfate in excess of secondary drinking water standards, resulting from previous oil field activities. In addition, naturally occurring arsenic and radionuclides occur in excess of primary drinking water standards. More than 80 percent of groundwater pumped from the aquifer is used for irrigation, and the rest is withdrawn for municipal supplies, industrial use, and power generation. Localized water level declines in south-central Reeves and northwest Pecos counties have moderated since the late 1970s as irrigation pumping has decreased; however, water levels continue to decline in central Ward County because of increased municipal and industrial pumping. The Region F Regional Water Planning Group recommended several water management strategies in their 2006 Regional Water Plan that would use the Pecos Valley Aquifer, including drilling new wells, developing two well fields in Winkler and Loving counties, and reallocating supplies.

***The Trinity Aquifer**, a major aquifer, extends across much of the central and northeastern part of the state. It is composed of several smaller aquifers contained within the Trinity Group. Although referred to differently in different parts of the state, they include the Antlers, Glen Rose, Paluxy, Twin Mountains, Travis Peak, Hensell, and Hosston aquifers. These aquifers consist of limestones, sands, clays, gravels, and conglomerates. Their combined freshwater saturated thickness averages about 600 feet in North Texas and about 1,900 feet in Central Texas. In general, groundwater is fresh but very hard in the outcrop of the aquifer. Total dissolved solids increase from less than 1,000 milligrams per liter in the east and southeast to between 1,000 and 5,000 milligrams per liter, or slightly to moderately saline, as the depth to the aquifer increases. Sulfate and chloride concentrations also tend to increase with depth. The Trinity Aquifer discharges to a large number of springs, with most discharging less than 10 cubic feet per second. The aquifer is one of the most extensive and highly used groundwater resources in Texas. Although its primary use is for municipalities, it is also used for irrigation, livestock, and other domestic purposes. Some of the state's largest water level declines, ranging from 350 to more than 1,000 feet, have occurred in counties along the IH-35 corridor from McLennan County to Grayson County. These declines are primarily attributed to municipal pumping, but they have slowed over the past decade as a result of increasing reliance on surface water. The regional water planning groups, in their 2006 Regional Water Plans, recommended numerous water management strategies for the Trinity Aquifer, including developing new wells and well fields, pumping more water from existing wells, overdrafting, reallocating supplies, and using surface water and groundwater conjunctively.*

1.2 Existing Desired Future Conditions

GMA 7 adopted a desired future condition for the Edwards-Trinity (Plateau), Pecos Valley and Trinity aquifers on July 29, 2010 as follows:

1. An average drawdown of 7 feet for the Edwards-Trinity (Plateau) aquifer, except for the Kinney County GCD, based on Scenario 10 of the TWDB GAM run 09-035, which is incorporated in its entirety into this resolution; and
2. In Kinney County, that drawdown which is consistent with maintaining at Las Moras Springs, and annual average flow of 23.9 cfs and a median flow of 24.4 cfs based on Scenario 3 of the Texas Water Development Board's flow model presented on July 27, 2010; and
3. The Edwards-Trinity aquifer is not relevant for joint planning purposes within the boundaries of the Lipan-Kickapoo WCD, the Lone Wolf GCD, and the Hickory Underground Water Conservation District No. 1; and
4. The Trinity (Hill Country) portion of the aquifer is not relevant for joint planning purposes within the boundaries of the Uvalde County UWCD in GMA 7.

1.3 Overview of Process to Adopt a New Desired Future Condition

Senate Bill 660, adopted by the legislature in 2011, changed the process by which groundwater conservation districts within a groundwater management area develop and adopt desired future conditions. The new process includes nine steps as presented below:

- The groundwater conservation districts within a groundwater management area consider nine factors outlined in the statute.
- The groundwater conservation districts adopt a "proposed" desired future condition
- The "proposed" desired future condition is sent to each groundwater conservation district for a 90-day comment period, which includes a public hearing by each district
- After the comment period, each district compiles a summary report that summarizes the relevant comments and includes suggested revisions. This summary report is then submitted to the groundwater management area.
- The groundwater management area then meets to vote on a desired future condition.
- The groundwater management area prepares an "explanatory report".
- The desired future condition resolution and the explanatory report are then submitted to the Texas Water Development Board and the groundwater conservation districts within the groundwater management area.
- Districts then adopt desired future conditions that apply to that district.

The nine factors that must be considered before adopting a proposed desired future condition are:

1. Aquifer uses or conditions within the management area, including conditions that differ substantially from one geographic area to another.
2. The water supply needs and water management strategies included in the state water plan.

3. Hydrological conditions, including for each aquifer in the management area the total estimated recoverable storage as provided by the executive administrator (of the Texas Water Development Board), and the average annual recharge, inflows and discharge.
4. Other environmental impacts, including impacts on spring flow and other interactions between groundwater and surface water.
5. The impact on subsidence.
6. Socioeconomic impacts reasonably expected to occur.
7. The impact on the interests and rights in private property, including ownership and the rights of management area landowners and their lessees and assigns in groundwater as recognized under Section 36.002 (of the Texas Water Code).
8. The feasibility of achieving the desired future condition.
9. Any other information relevant to the specific desired future condition.

In addition to these nine factors, statute requires that the desired future condition provide a balance between the highest practicable level of groundwater production and the conservation, preservation, protection, recharging, and prevention of waste of groundwater and control of subsidence in the management area.

Legislation in 2013 set the deadline for a proposed desired future condition as May 1, 2016.

2.0 Nine Factor Information

2.1 Groundwater Demands and Uses

Groundwater demands and uses from 2000 to 2012 in the Edwards-Trinity (Plateau), Pecos Valley, and Trinity aquifers are presented in Appendix A. Data were obtained from the Texas Water Development Board historic pumping database:

http://www.twdb.state.tx.us/waterplanning/waterusesurvey/historical-pumpage.asp

The Modeled Available Groundwater values for the Edwards-Trinity Aquifer are summarized below in Table 1. In the Pecos Aquifer, the modeled available groundwater in Crockett County is 31 AF/yr, is 113 AF/yr in Ector County, is 1,448 in Pecos County, and is 2 AF/yr in Upton County. In the Trinity Aquifer, the modeled available groundwater in Gillespie County is 2,482 AF/yr, and is 52 AF/yr in Real County. Hydrographs that compare the historic pumping and the modeled available groundwater values are presented in Appendix B.

Table 1. Modeled Available Groundwater for the Edwards-Trinity (Aquifer)

County	Modeled Available Groundwater (2010 to 2070) (Acre-feet/yr)	County	Modeled Available Groundwater (2010 to 2070) (Acre-feet/yr)
Coke	998	Pecos	115,938
Crockett	5,426	Reagan	68,278
Ector	5,422	Real	7,477
Edwards	5,638	Schleicher	8,050
Gillespie	2,514	Sterling	2,497
Glasscock	65,213	Sutton	6,438
Irion	2,293	Taylor	489
Kimble	1,283	Terrell	1,421
Kinney	70,338	Tom Green	426
McCulloch	4	Upton	22,379
Menard	2,194	Uvalde	1,635
Midland	23,251	Val Verde	24,988
Nolan	693	Total	445,283

2.2 Groundwater Supply Needs and Strategies

Total future demand estimates from the Texas Water Development Board are summarized in Table 2.

Recommended strategies in the 2011 Region F Water Plan for desalination, new groundwater, and well replacement are shown in Table 3.

Two alternative water supply strategies are listed for the Edwards-Trinity (Plateau) Aquifer in the 2011 Region F Water Plan. In Kimble County, a 1,000 AF/yr strategy for manufacturing is listed for the years 2010 to 2060. In Schleicher County, a 12,000 AF/yr strategy for municipal supply for the City of San Angelo is listed for the years 2040 to 2060.

2.3 Hydrologic Conditions, including Total Estimated Recoverable Storage

The groundwater budget as presented by Hutchison and others (2011) the Edwards-Trinity (Plateau) Aquifer is presented in Table 4.

Jones and others (2013) documented the total estimated recoverable storage for the aquifers in GMA 7. Table 5 presents storage for the Edwards-Trinity (Plateau) Aquifer. Table 6 presents storage for the Pecos Aquifer. Table 7 presents storage for the Trinity.

2.4 Other Environmental Impacts, including Impacts on Spring Flow

Table 4 (referenced above) includes groundwater budget estimates of spring flow as estimated by Hutchison and others (2011). Additional information on impacts to spring flow will be provided when presenting the results of future simulations.

2.5 Other Factors

Subsidence is not an issue in the Edwards-Trinity (Plateau), Pecos Valley, or Trinity aquifers in GMA 7. The factors related to socioeconomic impacts and private property rights will be covered in the draft preliminary explanatory report.

Table 2. Future Water Demands

County	Water Use (AF/yr)						Change (2020 to 2070)
	2020	2030	2040	2050	2060	2070	
Coke	2806	2823	2808	2811	2839	2848	42
Coleman	3335	3319	3274	3255	3241	3233	-102
Concho	11586	11535	11433	11335	11250	11173	-413
Crockett	5229	5563	5144	4770	4529	4541	-688
Ector	44084	48868	53855	59381	65707	72767	28,683
Edwards	1230	1211	1193	1184	1173	1166	-64
Gillespie	9142	9424	9658	9973	10338	10709	1,567
Glasscock	60554	59780	58603	57440	56409	55659	-4,895
Irion	5134	5261	4287	3317	2511	2109	-3,025
Kimble	4943	4871	4794	4722	4679	4647	-296
Kinney	8406	8397	8384	8380	8378	8378	-28
Llano	9499	9638	9563	9434	9543	9663	164
Mason	11493	11274	10907	10640	10412	10207	-1,286
McCulloch	15535	14986	13247	12230	11449	10830	-4,705
Menard	4468	4434	4298	4161	4043	3940	-528
Midland	75263	76803	79343	82052	85072	88465	13,202
Mitchell	19575	19622	19297	18942	18611	18347	-1,228
Nolan	25413	35845	35841	35883	35919	35979	10,566
Pecos	133971	134725	135119	135287	135455	135633	1,662
Reagan	24397	23330	22112	20785	19624	19007	-5,390
Real	913	890	870	855	843	835	-78
Runnels	6605	6581	6494	6441	6399	6363	-242
San Saba	9448	9323	8988	8740	8577	8442	-1,006
Schleicher	3453	3561	3371	3179	3005	2889	-564
Scurry	10891	11078	11015	10884	10785	10746	-145
Sterling	2394	2532	2349	2018	1726	1558	-836
Sutton	4134	4456	4488	4284	4081	3931	-203
Taylor	28806	29355	29801	30284	30868	31396	2,590
Terrell	1511	1604	1556	1416	1283	1178	-333
Tom Green	119070	120885	121841	122946	124361	125908	6,838
Upton	14974	14309	13442	12399	11515	11054	-3,920
Uvalde	75595	73694	71705	69993	68451	67179	-8,416
Val Verde	16777	17664	18519	19398	20262	21127	4,350
Total	770634	787641	787599	788819	793338	801907	31,273

Table 3. Recommended Groundwater Strategies in 2011 Region F Water Plan

Entity	County Used	Basin Used	Total Capital Cost	1st Decade Unit Cost	Supply (Ac-ft/yr)						2060 Unit Cost
					2010	2020	2030	2040	2050	2060	
Desalination											
City of Andrews	Andrews	Colorado	$6,717,000	$1,163	0	950	950	950	950	950	$546
CRMWD			$131,603,990	$0	0	0	0	9,500	9,500	9,500	$251
San Angelo			$75,440,000	$0	0	0	0	5,600	5,600	5,600	$473
Total			**$213,760,990**	**$1,163**	**0**	**950**	**950**	**16,050**	**16,050**	**16,050**	**$346**
New Groundwater											
Colorado City	Mitchell	Colorado	$17,855,000	$0	0	2,200	2,200	2,200	2,200	2,200	$445
City of Menard	Menard	Colorado	$1,684,000	$1,664	140	139	140	140	141	141	$610
County-Other	Menard	Colorado	$0	$0	20	21	20	20	19	19	$0
City of Midland	Midland	Colorado	$168,507,000	$0	0	0	13,600	13,600	13,600	13,600	$342
CRMWD	Multiple	Colorado	$76,268,000	$0	0	0	6,000	6,000	6,000	6,000	$251
San Angelo	Tom	Colorado	$173,307,000	$0	0	6,700	10,000	12,000	12,000	12,000	$1,670
Total			**$437,621,000**	**$1,664**	**160**	**9,060**	**31,960**	**33,960**	**33,960**	**33,960**	**$3,318**
Replacement Wells											
City of Eden	Concho	Colorado	$1,800,000	NA	0	0	0	0	0	0	NA
Richland SUD	McCulloc	Colorado	$1,701,000	NA	0	0	0	0	0	0	NA
CRMWD	Multiple	Colorado	$10,440,000	NA	0	0	0	0	0	0	NA
Total			**$13,941,000**	**NA**	**0**	**0**	**0**	**0**	**0**	**0**	**NA**

Table 4. Groundwater Budget of Edwards-Trinity (Plateau), Pecos Valley, and Trinity Aquifers from One-Layer Model

	Water Budget 1930-1939 (acre-feet per year)	Water Budget 1940-1949 (acre-feet per year)	Water Budget 1950-1959 (acre-feet per year)	Water Budget 1960-1969 (acre-feet per year)	Water Budget 1970-1979 (acre-feet per year)	Water Budget 1980-1989 (acre-feet per year)	Water Budget 1990-1999 (acre-feet per year)	Water Budget 2000-2005 (acre-feet per year)
Inflow								
Rivers	993,229	1,009,160	1,054,950	1,107,275	1,092,402	1,048,220	1,033,690	1,033,726
Inter-aquifer Flow	1,095,795	1,100,269	1,112,419	1,123,952	1,135,663	1,131,445	1,137,506	1,136,281
Recharge	1,641,803	1,688,928	1,545,021	1,621,125	1,680,625	1,671,631	1,669,556	1,703,227
Total Inflow	3,730,827	3,798,357	3,712,390	3,852,352	3,908,690	3,851,296	3,840,752	3,873,234
Outflow								
Pumpage	-194,233	-570,080	-947,024	-1,210,949	-935,718	-651,331	-706,359	-677,860
Springs	-1,216,432	-1,210,615	-1,129,334	-1,082,433	-1,092,612	-1,101,266	-1,120,187	-1,093,636
Rivers	-1,893,959	-1,841,710	-1,767,816	-1,722,471	-1,715,415	-1,741,168	-1,756,911	-1,755,300
Inter-aquifer Flow	-560,262	-557,538	-546,381	-532,124	-526,554	-531,894	-533,580	-535,091
Total Outflow	-3,864,885	-4,179,943	-4,390,555	-4,547,978	-4,270,298	-4,025,658	-4,117,038	-4,061,887
In-Out	-134,058	-381,585	-678,165	-695,626	-361,608	-174,362	-276,286	-188,653
Storage Change	-133,865	-372,190	-678,034	-695,534	-358,631	-166,175	-250,497	-188,648
Model Error	-194	-9,395	-131	-92	-2,977	-8,187	-25,789	-5
Model Error (Percent)	-0.01	-0.25	0.00	0.00	-0.08	-0.21	-0.67	0.00

Table 5. Total Estimated Recoverable Storage - Edwards-Trinity (Plateau) Aquifer

County	Total Storage (acre-feet)	25 percent of Total Storage (acre-feet)	75 percent of Total Storage (acre-feet)
Coke	120,000	30,000	90,000
Concho	79,000	19,750	59,250
Crockett	1,500,000	375,000	1,125,000
Ector	220,000	55,000	165,000
Edwards	5,000,000	1,250,000	3,750,000
Gillespie	430,000	107,500	322,500
Glasscock	270,000	67,500	202,500
Irion	420,000	105,000	315,000
Kimble	1,100,000	275,000	825,000
Kinney[20]	4,400,000	1,100,000	3,300,000
Mason	51,000	12,750	38,250
McCulloch	93,000	23,250	69,750
Menard	250,000	62,500	187,500
Midland	240,000	60,000	180,000
Nolan	170,000	42,500	127,500
Pecos	3,100,000	775,000	2,325,000
Reagan	560,000	140,000	420,000
Real	1,600,000	400,000	1,200,000

County	Total Storage (acre-feet)	25 percent of Total Storage (acre-feet)	75 percent of Total Storage (acre-feet)
Schleicher	890,000	222,500	667,500
Sterling	150,000	37,500	112,500
Sutton	1,800,000	450,000	1,350,000
Taylor	78,000	19,500	58,500
Terrell	4,500,000	1,125,000	3,375,000
Tom Green	250,000	62,500	187,500
Upton	550,000	137,500	412,500
Uvalde	1,000,000	250,000	750,000
Val Verde	10,000,000	2,500,000	7,500,000
Total	38,821,000	9,705,250	29,115,750

[20] Total storage values for Kinney County are based on the alternative model by Hutchison and others (2011), the other total storage values were based on the groundwater availability model by Anaya and Jones (2009).

Table 6. Total Estimated Recoverable Storage - Pecos Valley Aquifer

County	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
Crockett	160,000	40,000	120,000
Ector	5,900,000	1,475,000	4,425,000
Pecos	910,000	227,500	682,500
Upton	4,400,000	1,100,000	3,300,000
Total	11,370,000	2,842,500	8,527,500

Table 7. Total Estimated Recoverable Storage - Trinity Aquifer

County	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
Gillespie	270,000	67,500	202,500
Real	23,000	5,750	17,250
Uvalde	230,000	57,500	172,500
Total	523,000	130,750	392,250

3.0 Predictive Simulation Results

In 2010, GMA 7 evaluated the results of 10 alternative predictive scenarios using the alternative one-layer model of the Edwards-Trinity (Plateau) and Pecos Valley aquifers. The model is documented in Hutchison and others (2011), and the simulation results are documented in Hutchison (2010). Hutchison (2010) includes an eleventh scenario that was used in the development of the desired future condition for GMA 3. Hutchison (2010) is included in this reported as Appendix C.

Drawdowns calculated in Hutchison (2010) were for predictive simulations through the year 2060. The proposed desired future conditions that must be adopted prior to May 1, 2016, the Texas Water Development Board has required that any predictive simulations be completed through the year 2070.

For purposes of discussion at the April 23, 2015 GMA 7 meeting, a simulation was completed that simply extended the time period of Scenario 10 of Hutchison (2010). This was designated Scenario 1. After discussion and review of the results, adjustments to pumping were made in Irion County, and the model was run again and designated as Scenario 2. Table 8 summarizes the results of the pumping, drawdown in 2060 and drawdown in 2070 on a county-by-county basis for both scenarios.

Table 8. Summary of Drawdown in feet from 2010 Conditions
Edwards-Trinity (Plateau) and Pecos Valley Aquifer Groundwater Model
(One Layer Model, GMA 7 Area Only)
Edwards-Trinity (Plateau), Pecos Valley and Trinity Aquifers
Simulation for period 2006 to 2070, comparison to 2010 DFC (2010 to 2060)

County	Scenario 10 (Existing DFC)		Scenario 1		Scenario 2	
	Pumping (AF/yr)	Drawdown in 2060 (ft)	Pumping (AF/yr)	Drawdown in 2070 (ft)	Pumping (AF/yr)	Drawdown in 2070 (ft)
Coke	1,000	0	1,000	0	1,000	0
Concho	490	0	490	0	490	0
Crockett	5,475	9	5,475	10	5,475	10
Ector	5,534	7	5,534	8	5,534	8
Edwards	5,659	2	5,659	2	5,659	2
Gillespie	5,000	5	5,000	5	5,000	5
Glasscock	65,177	34	65,177	40	65,177	40
Irion	2,300	10	2,300	10	3,300	10
Kimble	1,400	1	1,400	1	1,400	1
Kinney	65,000	0	65,000	0	65,000	0
McCulloch	150	0	150	0	150	0
Mason	20	0	20	0	20	0
Menard	2,580	1	2,580	1	2,580	1
Midland	23,243	10	23,243	12	23,243	12
Nolan	700	0	700	0	700	0
Pecos	240,000	11	240,000	12	240,000	12
Reagan	68,243	37	68,243	41	68,243	42
Real	7,533	4	7,533	4	7,533	4
Schelicher	8,060	8	8,060	8	8,060	8
Sterling	2,500	6	2,500	7	2,500	7
Sutton	6,450	6	6,450	6	6,450	6
Taylor	490	0	490	0	490	0
Terrell	1,443	2	1,443	2	1,443	2
TomGreen	2,800	2	2,800	2	2,800	2
Upton	22,375	13	22,375	16	22,375	16
Uvalde	2,000	2	2,000	2	2,000	2
ValVerde	25,000	1	25,000	1	25,000	1
GMA 7	**570,622**	**7**	**570,622**	**8**	**571,622**	**8**

4.0 References

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Appendix A

Historic Pumping from the Edwards-Trinity (Plateau), Pecos Valley, and Trinity Aquifers

Appendix A - Historic Pumping from the Edwards-Trinity (Plateau), Pecos Valley and Trinity Aquifers

Year	County	Aquifer	Municipal	Manufacturing	Mining	Steam Electric Power	Irrigation	Livestock	Total
2000	COKE	EDWARDS-TRINITY-PLATEAU AQUIFER	30	0	0	0	50	10	90
2001	COKE	EDWARDS-TRINITY-PLATEAU AQUIFER	30	0	0	0	50	12	92
2002	COKE	EDWARDS-TRINITY-PLATEAU AQUIFER	30	0	0	0	61	10	101
2003	COKE	EDWARDS-TRINITY-PLATEAU AQUIFER	30	0	0	0	26	6	62
2004	COKE	EDWARDS-TRINITY-PLATEAU AQUIFER	29	0	0	0	47	7	83
2005	COKE	EDWARDS-TRINITY-PLATEAU AQUIFER	32	0	0	0	47	61	140
2006	COKE	EDWARDS-TRINITY-PLATEAU AQUIFER	26	0	0	0	59	68	153
2007	COKE	EDWARDS-TRINITY-PLATEAU AQUIFER	21	0	0	0	38	62	121
2008	COKE	EDWARDS-TRINITY-PLATEAU AQUIFER	24	0	0	0	43	92	159
2009	COKE	EDWARDS-TRINITY-PLATEAU AQUIFER	25	0	0	0	25	88	138
2010	COKE	EDWARDS-TRINITY-PLATEAU AQUIFER	26	0	0	0	54	80	160
2011	COKE	EDWARDS-TRINITY-PLATEAU AQUIFER	51	0	0	0	56	82	189
2012	COKE	EDWARDS-TRINITY-PLATEAU AQUIFER	58	0	0	0	33	73	164
2000	CONCHO	EDWARDS-TRINITY-PLATEAU AQUIFER	1	0	0	0	0	144	145
2001	CONCHO	EDWARDS-TRINITY-PLATEAU AQUIFER	0	0	0	0	0	141	141
2002	CONCHO	EDWARDS-TRINITY-PLATEAU AQUIFER	0	0	0	0	0	144	144
2003	CONCHO	EDWARDS-TRINITY-PLATEAU AQUIFER	0	0	0	0	0	116	116
2004	CONCHO	EDWARDS-TRINITY-PLATEAU AQUIFER	0	0	0	0	0	303	303
2005	CONCHO	EDWARDS-TRINITY-PLATEAU AQUIFER	0	0	0	0	0	195	195
2006	CONCHO	EDWARDS-TRINITY-PLATEAU AQUIFER	17	0	0	0	0	241	258
2007	CONCHO	EDWARDS-TRINITY-PLATEAU AQUIFER	14	0	0	0	0	292	306
2008	CONCHO	EDWARDS-TRINITY-PLATEAU AQUIFER	15	0	0	0	0	204	219
2009	CONCHO	EDWARDS-TRINITY-PLATEAU AQUIFER	16	0	0	0	0	204	220
2010	CONCHO	EDWARDS-TRINITY-PLATEAU AQUIFER	16	0	0	0	0	187	203
2011	CONCHO	EDWARDS-TRINITY-PLATEAU AQUIFER	17	0	0	0	0	184	201
2012	CONCHO	EDWARDS-TRINITY-PLATEAU AQUIFER	13	0	0	0	0	163	176
2000	CROCKETT	EDWARDS-TRINITY-PLATEAU AQUIFER	1,561	0	31	0	123	608	2,323
2001	CROCKETT	EDWARDS-TRINITY-PLATEAU AQUIFER	1,240	0	22	0	165	572	1,999
2002	CROCKETT	EDWARDS-TRINITY-PLATEAU AQUIFER	1,317	0	42	0	150	515	2,024
2003	CROCKETT	EDWARDS-TRINITY-PLATEAU AQUIFER	1,215	0	50	0	289	435	1,989
2004	CROCKETT	EDWARDS-TRINITY-PLATEAU AQUIFER	1,209	0	50	0	242	487	1,988

Appendix A - Historic Pumping from the Edwards-Trinity (Plateau), Pecos Valley and Trinity Aquifers

Year	County	Aquifer	Municipal	Manufacturing	Mining	Steam Electric Power	Irrigation	Livestock	Total
2005	CROCKETT	EDWARDS-TRINITY-PLATEAU AQUIFER	1,312	0	49	0	328	607	2,296
2006	CROCKETT	EDWARDS-TRINITY-PLATEAU AQUIFER	1,366	0	40	0	373	641	2,420
2007	CROCKETT	EDWARDS-TRINITY-PLATEAU AQUIFER	1,309	0	25	0	293	631	2,258
2008	CROCKETT	EDWARDS-TRINITY-PLATEAU AQUIFER	1,331	0	30	0	279	612	2,252
2009	CROCKETT	EDWARDS-TRINITY-PLATEAU AQUIFER	1,409	0	20	0	0	605	2,034
2010	CROCKETT	EDWARDS-TRINITY-PLATEAU AQUIFER	1,426	0	20	0	115	557	2,118
2011	CROCKETT	EDWARDS-TRINITY-PLATEAU AQUIFER	1,760	0	60	0	221	549	2,590
2012	CROCKETT	EDWARDS-TRINITY-PLATEAU AQUIFER	1,509	0	120	0	162	493	2,284
2000	ECTOR	EDWARDS-TRINITY-PLATEAU AQUIFER	1,809	2,479	99	0	304	151	4,842
2001	ECTOR	EDWARDS-TRINITY-PLATEAU AQUIFER	2,008	1,826	98	0	418	92	4,442
2002	ECTOR	EDWARDS-TRINITY-PLATEAU AQUIFER	2,079	2,278	98	0	392	78	4,925
2003	ECTOR	EDWARDS-TRINITY-PLATEAU AQUIFER	1,684	2,228	99	0	116	55	4,182
2004	ECTOR	EDWARDS-TRINITY-PLATEAU AQUIFER	1,662	3,510	98	0	717	62	6,049
2005	ECTOR	EDWARDS-TRINITY-PLATEAU AQUIFER	1,787	767	98	0	918	224	3,794
2006	ECTOR	EDWARDS-TRINITY-PLATEAU AQUIFER	2,781	1,965	98	0	17	210	5,071
2007	ECTOR	EDWARDS-TRINITY-PLATEAU AQUIFER	1,738	906	13	0	170	224	3,051
2008	ECTOR	EDWARDS-TRINITY-PLATEAU AQUIFER	1,959	938	13	0	0	202	3,112
2009	ECTOR	EDWARDS-TRINITY-PLATEAU AQUIFER	2,948	586	13	0	0	224	3,771
2010	ECTOR	EDWARDS-TRINITY-PLATEAU AQUIFER	4,420	584	12	0	748	211	5,975
2011	ECTOR	EDWARDS-TRINITY-PLATEAU AQUIFER	4,862	590	12	0	351	213	6,028
2012	ECTOR	EDWARDS-TRINITY-PLATEAU AQUIFER	4,455	587	12	0	100	185	5,339
2000	EDWARDS	EDWARDS-TRINITY-PLATEAU AQUIFER	371	0	0	0	160	448	979
2001	EDWARDS	EDWARDS-TRINITY-PLATEAU AQUIFER	383	0	0	0	130	143	656
2002	EDWARDS	EDWARDS-TRINITY-PLATEAU AQUIFER	343	0	0	0	202	126	671
2003	EDWARDS	EDWARDS-TRINITY-PLATEAU AQUIFER	294	0	0	0	137	122	553
2004	EDWARDS	EDWARDS-TRINITY-PLATEAU AQUIFER	312	0	0	0	315	121	748
2005	EDWARDS	EDWARDS-TRINITY-PLATEAU AQUIFER	355	0	0	0	347	416	1,118
2006	EDWARDS	EDWARDS-TRINITY-PLATEAU AQUIFER	345	0	0	0	359	352	1,056
2007	EDWARDS	EDWARDS-TRINITY-PLATEAU AQUIFER	286	0	0	0	104	280	670
2008	EDWARDS	EDWARDS-TRINITY-PLATEAU AQUIFER	349	0	0	0	57	465	871
2009	EDWARDS	EDWARDS-TRINITY-PLATEAU AQUIFER	327	0	0	0	0	463	790

Appendix A - Historic Pumping from the Edwards-Trinity (Plateau), Pecos Valley and Trinity Aquifers

Year	County	Aquifer	Municipal	Manufacturing	Mining	Steam Electric Power	Irrigation	Livestock	Total
2010	EDWARDS	EDWARDS-TRINITY-PLATEAU AQUIFER	261	0	0	0	33	432	726
2011	EDWARDS	EDWARDS-TRINITY-PLATEAU AQUIFER	387	0	0	0	257	425	1,069
2012	EDWARDS	EDWARDS-TRINITY-PLATEAU AQUIFER	329	0	0	0	97	372	798
2000	GILLESPIE	EDWARDS-TRINITY-PLATEAU AQUIFER	5	0	0	0	102	275	382
2001	GILLESPIE	EDWARDS-TRINITY-PLATEAU AQUIFER	2	0	0	0	116	261	379
2002	GILLESPIE	EDWARDS-TRINITY-PLATEAU AQUIFER	3	0	0	0	116	258	377
2003	GILLESPIE	EDWARDS-TRINITY-PLATEAU AQUIFER	3	0	0	0	116	242	361
2004	GILLESPIE	EDWARDS-TRINITY-PLATEAU AQUIFER	7	0	0	0	123	245	375
2005	GILLESPIE	EDWARDS-TRINITY-PLATEAU AQUIFER	14	0	0	0	100	374	488
2006	GILLESPIE	EDWARDS-TRINITY-PLATEAU AQUIFER	319	0	0	0	109	372	800
2007	GILLESPIE	EDWARDS-TRINITY-PLATEAU AQUIFER	257	0	0	0	9	388	654
2008	GILLESPIE	EDWARDS-TRINITY-PLATEAU AQUIFER	294	0	0	0	102	426	822
2009	GILLESPIE	EDWARDS-TRINITY-PLATEAU AQUIFER	289	0	0	0	99	398	786
2010	GILLESPIE	EDWARDS-TRINITY-PLATEAU AQUIFER	281	0	0	0	66	691	1,038
2011	GILLESPIE	EDWARDS-TRINITY-PLATEAU AQUIFER	311	0	0	0	163	711	1,185
2012	GILLESPIE	EDWARDS-TRINITY-PLATEAU AQUIFER	297	0	0	0	100	335	732
2000	GLASSCOCK	EDWARDS-TRINITY-PLATEAU AQUIFER	156	0	0	0	30,528	135	30,819
2001	GLASSCOCK	EDWARDS-TRINITY-PLATEAU AQUIFER	157	0	0	0	22,176	133	22,466
2002	GLASSCOCK	EDWARDS-TRINITY-PLATEAU AQUIFER	148	0	0	0	22,729	122	22,999
2003	GLASSCOCK	EDWARDS-TRINITY-PLATEAU AQUIFER	146	0	0	0	38,824	95	39,065
2004	GLASSCOCK	EDWARDS-TRINITY-PLATEAU AQUIFER	124	0	0	0	38,147	86	38,357
2005	GLASSCOCK	EDWARDS-TRINITY-PLATEAU AQUIFER	145	0	0	0	38,083	109	38,337
2006	GLASSCOCK	EDWARDS-TRINITY-PLATEAU AQUIFER	134	0	0	0	40,105	119	40,358
2007	GLASSCOCK	EDWARDS-TRINITY-PLATEAU AQUIFER	108	1	0	0	32,560	163	32,832
2008	GLASSCOCK	EDWARDS-TRINITY-PLATEAU AQUIFER	122	0	0	0	36,919	84	37,125
2009	GLASSCOCK	EDWARDS-TRINITY-PLATEAU AQUIFER	124	3	0	0	39,479	89	39,695
2010	GLASSCOCK	EDWARDS-TRINITY-PLATEAU AQUIFER	126	3	0	0	49,218	107	49,454
2011	GLASSCOCK	EDWARDS-TRINITY-PLATEAU AQUIFER	143	3	0	0	45,848	118	46,112
2012	GLASSCOCK	EDWARDS-TRINITY-PLATEAU AQUIFER	167	3	0	0	38,915	84	39,169
2000	IRION	EDWARDS-TRINITY-PLATEAU AQUIFER	179	0	0	0	808	248	1,235
2001	IRION	EDWARDS-TRINITY-PLATEAU AQUIFER	170	0	0	0	640	226	1,036

Year	County	Aquifer	Municipal	Manufacturing	Mining	Steam Electric Power	Irrigation	Livestock	Total
2002	IRION	EDWARDS-TRINITY-PLATEAU AQUIFER	206	0	0	0	640	218	1,064
2003	IRION	EDWARDS-TRINITY-PLATEAU AQUIFER	188	0	0	0	288	150	626
2004	IRION	EDWARDS-TRINITY-PLATEAU AQUIFER	185	0	0	0	104	148	437
2005	IRION	EDWARDS-TRINITY-PLATEAU AQUIFER	190	0	0	0	180	158	528
2006	IRION	EDWARDS-TRINITY-PLATEAU AQUIFER	185	0	0	0	573	169	927
2007	IRION	EDWARDS-TRINITY-PLATEAU AQUIFER	164	0	0	0	341	168	673
2008	IRION	EDWARDS-TRINITY-PLATEAU AQUIFER	168	0	0	0	542	202	912
2009	IRION	EDWARDS-TRINITY-PLATEAU AQUIFER	175	0	0	0	225	197	597
2010	IRION	EDWARDS-TRINITY-PLATEAU AQUIFER	186	0	0	0	43	208	437
2011	IRION	EDWARDS-TRINITY-PLATEAU AQUIFER	193	0	0	0	258	218	669
2012	IRION	EDWARDS-TRINITY-PLATEAU AQUIFER	212	0	0	0	47	158	417
2000	KIMBLE	EDWARDS-TRINITY-PLATEAU AQUIFER	209	2	0	0	10	359	580
2001	KIMBLE	EDWARDS-TRINITY-PLATEAU AQUIFER	211	2	0	0	11	347	571
2002	KIMBLE	EDWARDS-TRINITY-PLATEAU AQUIFER	212	2	0	0	11	314	539
2003	KIMBLE	EDWARDS-TRINITY-PLATEAU AQUIFER	210	2	0	0	11	278	501
2004	KIMBLE	EDWARDS-TRINITY-PLATEAU AQUIFER	203	2	0	0	19	288	512
2005	KIMBLE	EDWARDS-TRINITY-PLATEAU AQUIFER	221	2	0	0	35	259	517
2006	KIMBLE	EDWARDS-TRINITY-PLATEAU AQUIFER	205	2	0	0	5	249	461
2007	KIMBLE	EDWARDS-TRINITY-PLATEAU AQUIFER	171	2	0	0	98	268	539
2008	KIMBLE	EDWARDS-TRINITY-PLATEAU AQUIFER	188	2	0	0	40	223	453
2009	KIMBLE	EDWARDS-TRINITY-PLATEAU AQUIFER	195	2	0	0	165	222	584
2010	KIMBLE	EDWARDS-TRINITY-PLATEAU AQUIFER	203	2	0	0	115	302	622
2011	KIMBLE	EDWARDS-TRINITY-PLATEAU AQUIFER	229	2	0	0	66	306	603
2012	KIMBLE	EDWARDS-TRINITY-PLATEAU AQUIFER	221	2	0	0	84	172	479
2000	KINNEY	EDWARDS-TRINITY-PLATEAU AQUIFER	7	0	0	0	10,454	236	10,697
2001	KINNEY	EDWARDS-TRINITY-PLATEAU AQUIFER	7	0	0	0	4,435	115	4,557
2002	KINNEY	EDWARDS-TRINITY-PLATEAU AQUIFER	7	0	0	0	4,357	106	4,470
2003	KINNEY	EDWARDS-TRINITY-PLATEAU AQUIFER	7	0	0	0	7,337	78	7,422
2004	KINNEY	EDWARDS-TRINITY-PLATEAU AQUIFER	7	0	0	0	3,355	36	3,398
2005	KINNEY	EDWARDS-TRINITY-PLATEAU AQUIFER	7	0	0	0	2,959	74	3,040
2006	KINNEY	EDWARDS-TRINITY-PLATEAU AQUIFER	14	0	0	0	3,551	67	3,632

Appendix A - Historic Pumping from the Edwards-Trinity (Plateau), Pecos Valley and Trinity Aquifers

Year	County	Aquifer	Municipal	Manufacturing	Mining	Steam Electric Power	Irrigation	Livestock	Total
2007	KINNEY	EDWARDS-TRINITY-PLATEAU AQUIFER	12	0	0	0	1,220	61	1,293
2008	KINNEY	EDWARDS-TRINITY-PLATEAU AQUIFER	13	0	0	0	1,519	87	1,619
2009	KINNEY	EDWARDS-TRINITY-PLATEAU AQUIFER	30	0	0	0	665	100	795
2010	KINNEY	EDWARDS-TRINITY-PLATEAU AQUIFER	536	0	0	0	640	50	1,226
2011	KINNEY	EDWARDS-TRINITY-PLATEAU AQUIFER	670	0	0	0	3,425	51	4,146
2012	KINNEY	EDWARDS-TRINITY-PLATEAU AQUIFER	621	0	0	0	1,663	46	2,330
2000	MASON	EDWARDS-TRINITY-PLATEAU AQUIFER	0	0	0	0	0	6	6
2001	MASON	EDWARDS-TRINITY-PLATEAU AQUIFER	0	0	0	0	0	7	7
2002	MASON	EDWARDS-TRINITY-PLATEAU AQUIFER	0	0	0	0	0	6	6
2003	MASON	EDWARDS-TRINITY-PLATEAU AQUIFER	0	0	0	0	0	9	9
2004	MASON	EDWARDS-TRINITY-PLATEAU AQUIFER	0	0	0	0	0	10	10
2005	MASON	EDWARDS-TRINITY-PLATEAU AQUIFER	0	0	0	0	0	14	14
2006	MASON	EDWARDS-TRINITY-PLATEAU AQUIFER	1	0	0	0	0	17	18
2007	MASON	EDWARDS-TRINITY-PLATEAU AQUIFER	1	0	0	0	0	14	15
2008	MASON	EDWARDS-TRINITY-PLATEAU AQUIFER	1	0	0	0	0	14	15
2009	MASON	EDWARDS-TRINITY-PLATEAU AQUIFER	1	0	0	0	0	12	13
2010	MASON	EDWARDS-TRINITY-PLATEAU AQUIFER	2	0	0	0	0	8	10
2011	MASON	EDWARDS-TRINITY-PLATEAU AQUIFER	2	0	0	0	0	12	14
2012	MASON	EDWARDS-TRINITY-PLATEAU AQUIFER	2	0	0	0	0	11	13
2000	MCCULLOCH	EDWARDS-TRINITY-PLATEAU AQUIFER	0	0	0	0	0	17	17
2001	MCCULLOCH	EDWARDS-TRINITY-PLATEAU AQUIFER	0	0	0	0	0	12	12
2002	MCCULLOCH	EDWARDS-TRINITY-PLATEAU AQUIFER	0	0	0	0	0	15	15
2003	MCCULLOCH	EDWARDS-TRINITY-PLATEAU AQUIFER	0	0	0	0	0	11	11
2004	MCCULLOCH	EDWARDS-TRINITY-PLATEAU AQUIFER	0	0	0	0	0	3	3
2005	MCCULLOCH	EDWARDS-TRINITY-PLATEAU AQUIFER	0	0	0	0	0	4	4
2006	MCCULLOCH	EDWARDS-TRINITY-PLATEAU AQUIFER	1	0	0	0	0	3	4
2007	MCCULLOCH	EDWARDS-TRINITY-PLATEAU AQUIFER	1	0	0	0	0	3	4
2008	MCCULLOCH	EDWARDS-TRINITY-PLATEAU AQUIFER	1	0	0	0	0	3	4
2009	MCCULLOCH	EDWARDS-TRINITY-PLATEAU AQUIFER	3	0	0	0	0	4	7
2010	MCCULLOCH	EDWARDS-TRINITY-PLATEAU AQUIFER	5	0	0	0	0	6	11
2011	MCCULLOCH	EDWARDS-TRINITY-PLATEAU AQUIFER	6	0	0	0	0	3	9

Year	County	Aquifer	Municipal	Manufacturing	Mining	Steam Electric Power	Irrigation	Livestock	Total
2012	MCCULLOCH	EDWARDS-TRINITY-PLATEAU AQUIFER	5	0	72	0	0	3	80
2000	MENARD	EDWARDS-TRINITY-PLATEAU AQUIFER	358	0	0	0	111	307	776
2001	MENARD	EDWARDS-TRINITY-PLATEAU AQUIFER	338	0	0	0	126	306	770
2002	MENARD	EDWARDS-TRINITY-PLATEAU AQUIFER	329	0	0	0	126	273	728
2003	MENARD	EDWARDS-TRINITY-PLATEAU AQUIFER	315	0	0	0	56	292	663
2004	MENARD	EDWARDS-TRINITY-PLATEAU AQUIFER	256	0	0	0	42	297	595
2005	MENARD	EDWARDS-TRINITY-PLATEAU AQUIFER	261	0	0	0	65	304	630
2006	MENARD	EDWARDS-TRINITY-PLATEAU AQUIFER	289	0	0	0	468	318	1,075
2007	MENARD	EDWARDS-TRINITY-PLATEAU AQUIFER	255	0	0	0	318	326	899
2008	MENARD	EDWARDS-TRINITY-PLATEAU AQUIFER	306	0	0	0	0	276	582
2009	MENARD	EDWARDS-TRINITY-PLATEAU AQUIFER	339	0	0	0	244	314	897
2010	MENARD	EDWARDS-TRINITY-PLATEAU AQUIFER	73	0	0	0	256	256	585
2011	MENARD	EDWARDS-TRINITY-PLATEAU AQUIFER	81	0	0	0	100	245	426
2012	MENARD	EDWARDS-TRINITY-PLATEAU AQUIFER	79	0	0	0	301	211	591
2000	MIDLAND	EDWARDS-TRINITY-PLATEAU AQUIFER	1,308	0	1	0	9,262	226	10,797
2001	MIDLAND	EDWARDS-TRINITY-PLATEAU AQUIFER	1,717	0	1	0	8,382	223	10,323
2002	MIDLAND	EDWARDS-TRINITY-PLATEAU AQUIFER	1,861	0	1	0	7,921	191	9,974
2003	MIDLAND	EDWARDS-TRINITY-PLATEAU AQUIFER	1,257	0	1	0	5,828	102	7,188
2004	MIDLAND	EDWARDS-TRINITY-PLATEAU AQUIFER	1,261	0	1	0	8,389	94	9,745
2005	MIDLAND	EDWARDS-TRINITY-PLATEAU AQUIFER	1,324	0	1	0	8,982	181	10,488
2006	MIDLAND	EDWARDS-TRINITY-PLATEAU AQUIFER	1,643	0	1	0	9,851	216	11,711
2007	MIDLAND	EDWARDS-TRINITY-PLATEAU AQUIFER	1,376	0	1	0	7,403	243	9,023
2008	MIDLAND	EDWARDS-TRINITY-PLATEAU AQUIFER	1,636	0	0	0	9,584	157	11,377
2009	MIDLAND	EDWARDS-TRINITY-PLATEAU AQUIFER	2,191	0	0	0	9,997	211	12,399
2010	MIDLAND	EDWARDS-TRINITY-PLATEAU AQUIFER	2,112	0	0	0	7,128	158	9,398
2011	MIDLAND	EDWARDS-TRINITY-PLATEAU AQUIFER	3,229	0	0	0	10,087	165	13,481
2012	MIDLAND	EDWARDS-TRINITY-PLATEAU AQUIFER	3,114	0	0	0	9,715	140	12,969
2000	NOLAN	EDWARDS-TRINITY-PLATEAU AQUIFER	669	70	0	0	39	22	800
2001	NOLAN	EDWARDS-TRINITY-PLATEAU AQUIFER	2,559	76	0	0	23	10	2,668
2002	NOLAN	EDWARDS-TRINITY-PLATEAU AQUIFER	2,908	79	0	0	23	10	3,020
2003	NOLAN	EDWARDS-TRINITY-PLATEAU AQUIFER	3,390	79	0	0	25	7	3,501

Year	County	Aquifer	Municipal	Manufacturing	Mining	Steam Electric Power	Irrigation	Livestock	Total
2004	NOLAN	EDWARDS-TRINITY-PLATEAU AQUIFER	2,454	79	0	0	33	11	2,577
2005	NOLAN	EDWARDS-TRINITY-PLATEAU AQUIFER	2,210	105	0	0	43	143	2,501
2006	NOLAN	EDWARDS-TRINITY-PLATEAU AQUIFER	3,108	105	0	0	42	165	3,420
2007	NOLAN	EDWARDS-TRINITY-PLATEAU AQUIFER	2,905	136	0	0	47	156	3,244
2008	NOLAN	EDWARDS-TRINITY-PLATEAU AQUIFER	2,945	132	0	0	81	150	3,308
2009	NOLAN	EDWARDS-TRINITY-PLATEAU AQUIFER	2,283	86	0	0	90	143	2,602
2010	NOLAN	EDWARDS-TRINITY-PLATEAU AQUIFER	1,927	11	0	0	65	131	2,134
2011	NOLAN	EDWARDS-TRINITY-PLATEAU AQUIFER	2,307	15	0	0	98	133	2,553
2012	NOLAN	EDWARDS-TRINITY-PLATEAU AQUIFER	2,046	19	0	0	100	117	2,282
2000	PECOS	EDWARDS-TRINITY-PLATEAU AQUIFER	5,373	263	6	938	43,237	718	50,535
2001	PECOS	EDWARDS-TRINITY-PLATEAU AQUIFER	4,235	143	5	908	38,367	757	44,415
2002	PECOS	EDWARDS-TRINITY-PLATEAU AQUIFER	4,100	54	2	908	36,575	669	42,308
2003	PECOS	EDWARDS-TRINITY-PLATEAU AQUIFER	4,171	52	0	647	22,477	573	27,920
2004	PECOS	EDWARDS-TRINITY-PLATEAU AQUIFER	3,667	88	0	0	25,364	630	29,749
2005	PECOS	EDWARDS-TRINITY-PLATEAU AQUIFER	4,656	92	0	0	24,722	669	30,139
2006	PECOS	EDWARDS-TRINITY-PLATEAU AQUIFER	4,415	79	0	0	36,964	749	42,207
2007	PECOS	EDWARDS-TRINITY-PLATEAU AQUIFER	4,831	129	0	0	32,579	581	38,120
2008	PECOS	EDWARDS-TRINITY-PLATEAU AQUIFER	5,533	75	0	0	33,983	654	40,245
2009	PECOS	EDWARDS-TRINITY-PLATEAU AQUIFER	5,203	73	0	0	54,244	603	60,123
2010	PECOS	EDWARDS-TRINITY-PLATEAU AQUIFER	5,369	149	0	0	73,249	594	79,361
2011	PECOS	EDWARDS-TRINITY-PLATEAU AQUIFER	6,925	152	0	0	74,691	586	82,354
2012	PECOS	EDWARDS-TRINITY-PLATEAU AQUIFER	4,601	159	0	0	65,828	523	71,111
2000	REAGAN	EDWARDS-TRINITY-PLATEAU AQUIFER	148	0	0	0	15,735	167	16,050
2001	REAGAN	EDWARDS-TRINITY-PLATEAU AQUIFER	848	0	0	0	11,624	132	12,604
2002	REAGAN	EDWARDS-TRINITY-PLATEAU AQUIFER	849	0	0	0	14,746	132	15,727
2003	REAGAN	EDWARDS-TRINITY-PLATEAU AQUIFER	848	0	0	0	9,911	73	10,832
2004	REAGAN	EDWARDS-TRINITY-PLATEAU AQUIFER	845	0	0	0	10,300	79	11,224
2005	REAGAN	EDWARDS-TRINITY-PLATEAU AQUIFER	750	0	0	0	12,164	150	13,064
2006	REAGAN	EDWARDS-TRINITY-PLATEAU AQUIFER	879	0	0	0	18,599	120	19,598
2007	REAGAN	EDWARDS-TRINITY-PLATEAU AQUIFER	796	0	0	0	16,863	127	17,786
2008	REAGAN	EDWARDS-TRINITY-PLATEAU AQUIFER	751	0	0	0	19,305	223	20,279

Year	County	Aquifer	Municipal	Manufacturing	Mining	Steam Electric Power	Irrigation	Livestock	Total
2009	REAGAN	EDWARDS-TRINITY-PLATEAU AQUIFER	762	0	0	0	16,577	224	17,563
2010	REAGAN	EDWARDS-TRINITY-PLATEAU AQUIFER	603	0	0	0	19,238	189	20,030
2011	REAGAN	EDWARDS-TRINITY-PLATEAU AQUIFER	767	0	0	0	26,164	188	27,119
2012	REAGAN	EDWARDS-TRINITY-PLATEAU AQUIFER	717	0	0	0	19,681	167	20,565
2000	REAL	EDWARDS-TRINITY-PLATEAU AQUIFER	103	0	0	0	21	131	255
2001	REAL	EDWARDS-TRINITY-PLATEAU AQUIFER	89	0	0	0	22	85	196
2002	REAL	EDWARDS-TRINITY-PLATEAU AQUIFER	95	0	0	0	22	86	203
2003	REAL	EDWARDS-TRINITY-PLATEAU AQUIFER	105	0	0	0	17	76	198
2004	REAL	EDWARDS-TRINITY-PLATEAU AQUIFER	224	0	0	0	72	74	370
2005	REAL	EDWARDS-TRINITY-PLATEAU AQUIFER	251	0	0	0	92	118	461
2006	REAL	EDWARDS-TRINITY-PLATEAU AQUIFER	263	0	0	0	284	93	640
2007	REAL	EDWARDS-TRINITY-PLATEAU AQUIFER	214	0	0	0	0	105	319
2008	REAL	EDWARDS-TRINITY-PLATEAU AQUIFER	254	0	0	0	50	93	397
2009	REAL	EDWARDS-TRINITY-PLATEAU AQUIFER	269	0	0	0	0	98	367
2010	REAL	EDWARDS-TRINITY-PLATEAU AQUIFER	471	0	0	0	88	187	746
2011	REAL	EDWARDS-TRINITY-PLATEAU AQUIFER	511	0	0	0	188	194	893
2012	REAL	EDWARDS-TRINITY-PLATEAU AQUIFER	442	0	0	0	99	79	620
2000	RUNNELS	EDWARDS-TRINITY-PLATEAU AQUIFER	0	0	0	0	0	4	4
2001	RUNNELS	EDWARDS-TRINITY-PLATEAU AQUIFER	0	0	0	0	0	4	4
2002	RUNNELS	EDWARDS-TRINITY-PLATEAU AQUIFER	0	0	0	0	0	4	4
2003	RUNNELS	EDWARDS-TRINITY-PLATEAU AQUIFER	0	0	0	0	0	3	3
2004	RUNNELS	EDWARDS-TRINITY-PLATEAU AQUIFER	0	0	0	0	0	3	3
2005	RUNNELS	EDWARDS-TRINITY-PLATEAU AQUIFER	0	0	0	0	0	15	15
2006	RUNNELS	EDWARDS-TRINITY-PLATEAU AQUIFER	3	0	0	0	0	16	19
2007	RUNNELS	EDWARDS-TRINITY-PLATEAU AQUIFER	2	0	0	0	0	15	17
2008	RUNNELS	EDWARDS-TRINITY-PLATEAU AQUIFER	3	0	0	0	0	17	20
2009	RUNNELS	EDWARDS-TRINITY-PLATEAU AQUIFER	3	0	0	0	0	16	19
2010	RUNNELS	EDWARDS-TRINITY-PLATEAU AQUIFER	4	0	0	0	0	17	21
2011	RUNNELS	EDWARDS-TRINITY-PLATEAU AQUIFER	4	0	0	0	0	18	22
2012	RUNNELS	EDWARDS-TRINITY-PLATEAU AQUIFER	4	0	0	0	0	11	15
2000	SCHLEICHER	EDWARDS-TRINITY-PLATEAU AQUIFER	657	0	18	0	2,150	438	3,263

Year	County	Aquifer	Municipal	Manufacturing	Mining	Steam Electric Power	Irrigation	Livestock	Total
2001	SCHLEICHER	EDWARDS-TRINITY-PLATEAU AQUIFER	552	0	18	0	1,294	273	2,137
2002	SCHLEICHER	EDWARDS-TRINITY-PLATEAU AQUIFER	591	0	17	0	1,300	243	2,151
2003	SCHLEICHER	EDWARDS-TRINITY-PLATEAU AQUIFER	461	0	18	0	964	222	1,665
2004	SCHLEICHER	EDWARDS-TRINITY-PLATEAU AQUIFER	485	0	18	0	734	247	1,484
2005	SCHLEICHER	EDWARDS-TRINITY-PLATEAU AQUIFER	473	0	18	0	762	477	1,730
2006	SCHLEICHER	EDWARDS-TRINITY-PLATEAU AQUIFER	480	0	18	0	1,005	506	2,009
2007	SCHLEICHER	EDWARDS-TRINITY-PLATEAU AQUIFER	484	0	17	0	500	508	1,509
2008	SCHLEICHER	EDWARDS-TRINITY-PLATEAU AQUIFER	610	0	0	0	1,095	467	2,172
2009	SCHLEICHER	EDWARDS-TRINITY-PLATEAU AQUIFER	613	0	0	0	1,432	463	2,508
2010	SCHLEICHER	EDWARDS-TRINITY-PLATEAU AQUIFER	616	0	0	0	1,442	422	2,480
2011	SCHLEICHER	EDWARDS-TRINITY-PLATEAU AQUIFER	806	0	0	0	1,941	414	3,161
2012	SCHLEICHER	EDWARDS-TRINITY-PLATEAU AQUIFER	652	0	0	0	2,020	364	3,036
2000	STERLING	EDWARDS-TRINITY-PLATEAU AQUIFER	4	0	0	0	235	214	453
2001	STERLING	EDWARDS-TRINITY-PLATEAU AQUIFER	5	0	0	0	251	270	526
2002	STERLING	EDWARDS-TRINITY-PLATEAU AQUIFER	5	0	0	0	264	236	505
2003	STERLING	EDWARDS-TRINITY-PLATEAU AQUIFER	5	0	0	0	226	145	376
2004	STERLING	EDWARDS-TRINITY-PLATEAU AQUIFER	5	0	0	0	183	164	352
2005	STERLING	EDWARDS-TRINITY-PLATEAU AQUIFER	5	0	0	0	166	208	379
2006	STERLING	EDWARDS-TRINITY-PLATEAU AQUIFER	20	0	0	0	221	217	458
2007	STERLING	EDWARDS-TRINITY-PLATEAU AQUIFER	16	0	0	0	176	236	428
2008	STERLING	EDWARDS-TRINITY-PLATEAU AQUIFER	19	0	0	0	272	196	487
2009	STERLING	EDWARDS-TRINITY-PLATEAU AQUIFER	19	0	0	0	378	208	605
2010	STERLING	EDWARDS-TRINITY-PLATEAU AQUIFER	20	0	0	0	253	183	456
2011	STERLING	EDWARDS-TRINITY-PLATEAU AQUIFER	20	0	0	0	360	176	556
2012	STERLING	EDWARDS-TRINITY-PLATEAU AQUIFER	19	0	0	0	313	157	489
2000	SUTTON	EDWARDS-TRINITY-PLATEAU AQUIFER	1,389	0	0	0	1,234	440	3,063
2001	SUTTON	EDWARDS-TRINITY-PLATEAU AQUIFER	1,338	0	0	0	1,114	208	2,660
2002	SUTTON	EDWARDS-TRINITY-PLATEAU AQUIFER	1,339	0	0	0	1,114	188	2,641
2003	SUTTON	EDWARDS-TRINITY-PLATEAU AQUIFER	1,243	0	0	0	292	150	1,685
2004	SUTTON	EDWARDS-TRINITY-PLATEAU AQUIFER	1,108	0	0	0	292	141	1,541
2005	SUTTON	EDWARDS-TRINITY-PLATEAU AQUIFER	1,142	0	0	0	1,249	396	2,787

Year	County	Aquifer	Municipal	Manufacturing	Mining	Steam Electric Power	Irrigation	Livestock	Total
2006	SUTTON	EDWARDS-TRINITY-PLATEAU AQUIFER	1,247	0	0	0	1,407	363	3,017
2007	SUTTON	EDWARDS-TRINITY-PLATEAU AQUIFER	1,024	0	0	0	1,542	395	2,961
2008	SUTTON	EDWARDS-TRINITY-PLATEAU AQUIFER	1,141	0	0	0	342	469	1,952
2009	SUTTON	EDWARDS-TRINITY-PLATEAU AQUIFER	891	0	0	0	567	458	1,916
2010	SUTTON	EDWARDS-TRINITY-PLATEAU AQUIFER	928	0	0	0	958	477	2,363
2011	SUTTON	EDWARDS-TRINITY-PLATEAU AQUIFER	1,285	0	0	0	1,256	495	3,036
2012	SUTTON	EDWARDS-TRINITY-PLATEAU AQUIFER	1,267	0	0	0	859	360	2,486
2000	TAYLOR	EDWARDS-TRINITY-PLATEAU AQUIFER	88	0	0	0	3	25	116
2001	TAYLOR	EDWARDS-TRINITY-PLATEAU AQUIFER	88	0	0	0	8	10	106
2002	TAYLOR	EDWARDS-TRINITY-PLATEAU AQUIFER	88	0	0	0	6	7	101
2003	TAYLOR	EDWARDS-TRINITY-PLATEAU AQUIFER	87	0	0	0	1	6	94
2004	TAYLOR	EDWARDS-TRINITY-PLATEAU AQUIFER	85	0	0	0	1	11	97
2005	TAYLOR	EDWARDS-TRINITY-PLATEAU AQUIFER	91	0	0	0	28	32	151
2006	TAYLOR	EDWARDS-TRINITY-PLATEAU AQUIFER	123	0	0	0	26	42	191
2007	TAYLOR	EDWARDS-TRINITY-PLATEAU AQUIFER	102	0	0	0	14	36	152
2008	TAYLOR	EDWARDS-TRINITY-PLATEAU AQUIFER	113	0	0	0	0	90	203
2009	TAYLOR	EDWARDS-TRINITY-PLATEAU AQUIFER	219	0	0	0	7	82	308
2010	TAYLOR	EDWARDS-TRINITY-PLATEAU AQUIFER	328	0	0	0	21	44	393
2011	TAYLOR	EDWARDS-TRINITY-PLATEAU AQUIFER	279	0	0	0	52	47	378
2012	TAYLOR	EDWARDS-TRINITY-PLATEAU AQUIFER	293	0	0	0	19	37	349
2000	TERRELL	EDWARDS-TRINITY-PLATEAU AQUIFER	217	0	5	0	0	292	514
2001	TERRELL	EDWARDS-TRINITY-PLATEAU AQUIFER	200	0	5	0	0	280	485
2002	TERRELL	EDWARDS-TRINITY-PLATEAU AQUIFER	178	0	5	0	0	234	417
2003	TERRELL	EDWARDS-TRINITY-PLATEAU AQUIFER	175	0	5	0	0	189	369
2004	TERRELL	EDWARDS-TRINITY-PLATEAU AQUIFER	147	0	5	0	0	207	359
2005	TERRELL	EDWARDS-TRINITY-PLATEAU AQUIFER	181	0	4	0	0	233	418
2006	TERRELL	EDWARDS-TRINITY-PLATEAU AQUIFER	196	0	5	0	0	211	412
2007	TERRELL	EDWARDS-TRINITY-PLATEAU AQUIFER	192	0	4	0	255	170	621
2008	TERRELL	EDWARDS-TRINITY-PLATEAU AQUIFER	178	0	4	0	0	193	375
2009	TERRELL	EDWARDS-TRINITY-PLATEAU AQUIFER	196	0	4	0	154	206	560
2010	TERRELL	EDWARDS-TRINITY-PLATEAU AQUIFER	202	0	4	0	173	182	561

Year	County	Aquifer	Municipal	Manufacturing	Mining	Steam Electric Power	Irrigation	Livestock	Total
2011	TERRELL	EDWARDS-TRINITY-PLATEAU AQUIFER	218	0	9	0	398	179	804
2012	TERRELL	EDWARDS-TRINITY-PLATEAU AQUIFER	186	0	9	0	41	163	399
2000	TOM GREEN	EDWARDS-TRINITY-PLATEAU AQUIFER	123	0	0	0	131	137	391
2001	TOM GREEN	EDWARDS-TRINITY-PLATEAU AQUIFER	75	0	0	0	171	125	371
2002	TOM GREEN	EDWARDS-TRINITY-PLATEAU AQUIFER	94	0	0	0	183	143	420
2003	TOM GREEN	EDWARDS-TRINITY-PLATEAU AQUIFER	95	0	0	0	166	122	383
2004	TOM GREEN	EDWARDS-TRINITY-PLATEAU AQUIFER	92	0	0	0	538	98	728
2005	TOM GREEN	EDWARDS-TRINITY-PLATEAU AQUIFER	97	0	0	0	615	841	1,553
2006	TOM GREEN	EDWARDS-TRINITY-PLATEAU AQUIFER	129	0	0	0	731	921	1,781
2007	TOM GREEN	EDWARDS-TRINITY-PLATEAU AQUIFER	109	0	0	0	1,520	615	2,244
2008	TOM GREEN	EDWARDS-TRINITY-PLATEAU AQUIFER	199	0	0	0	1,896	844	2,939
2009	TOM GREEN	EDWARDS-TRINITY-PLATEAU AQUIFER	448	0	0	0	1,474	764	2,686
2010	TOM GREEN	EDWARDS-TRINITY-PLATEAU AQUIFER	613	0	0	0	836	786	2,235
2011	TOM GREEN	EDWARDS-TRINITY-PLATEAU AQUIFER	825	0	0	0	174	864	1,863
2012	TOM GREEN	EDWARDS-TRINITY-PLATEAU AQUIFER	672	0	0	0	1,166	747	2,585
2000	UPTON	EDWARDS-TRINITY-PLATEAU AQUIFER	1,006	0	0	0	12,236	131	13,373
2001	UPTON	EDWARDS-TRINITY-PLATEAU AQUIFER	1,051	0	0	0	8,553	60	9,664
2002	UPTON	EDWARDS-TRINITY-PLATEAU AQUIFER	683	0	0	0	7,962	53	8,698
2003	UPTON	EDWARDS-TRINITY-PLATEAU AQUIFER	779	0	0	0	7,792	35	8,606
2004	UPTON	EDWARDS-TRINITY-PLATEAU AQUIFER	369	0	0	0	7,000	40	7,409
2005	UPTON	EDWARDS-TRINITY-PLATEAU AQUIFER	759	0	0	0	6,584	98	7,441
2006	UPTON	EDWARDS-TRINITY-PLATEAU AQUIFER	663	0	0	0	7,195	98	7,956
2007	UPTON	EDWARDS-TRINITY-PLATEAU AQUIFER	297	0	0	0	6,253	94	6,644
2008	UPTON	EDWARDS-TRINITY-PLATEAU AQUIFER	305	0	0	0	8,984	113	9,402
2009	UPTON	EDWARDS-TRINITY-PLATEAU AQUIFER	411	0	0	0	7,873	111	8,395
2010	UPTON	EDWARDS-TRINITY-PLATEAU AQUIFER	430	0	0	0	9,395	90	9,915
2011	UPTON	EDWARDS-TRINITY-PLATEAU AQUIFER	450	0	0	0	13,651	87	14,188
2012	UPTON	EDWARDS-TRINITY-PLATEAU AQUIFER	286	0	0	0	10,033	75	10,394
2000	UVALDE	EDWARDS-TRINITY-PLATEAU AQUIFER	30	0	0	0	0	381	411
2001	UVALDE	EDWARDS-TRINITY-PLATEAU AQUIFER	39	0	0	0	0	351	390
2002	UVALDE	EDWARDS-TRINITY-PLATEAU AQUIFER	41	0	0	0	0	343	384

Year	County	Aquifer	Municipal	Manufacturing	Mining	Steam Electric Power	Irrigation	Livestock	Total
2003	UVALDE	EDWARDS-TRINITY-PLATEAU AQUIFER	42	0	0	0	0	374	416
2004	UVALDE	EDWARDS-TRINITY-PLATEAU AQUIFER	41	0	0	0	0	40	81
2005	UVALDE	EDWARDS-TRINITY-PLATEAU AQUIFER	44	0	0	0	0	61	105
2006	UVALDE	EDWARDS-TRINITY-PLATEAU AQUIFER	25	0	0	0	0	59	84
2007	UVALDE	EDWARDS-TRINITY-PLATEAU AQUIFER	21	0	0	0	0	60	81
2008	UVALDE	EDWARDS-TRINITY-PLATEAU AQUIFER	23	0	0	0	0	53	76
2009	UVALDE	EDWARDS-TRINITY-PLATEAU AQUIFER	95	0	0	0	0	45	140
2010	UVALDE	EDWARDS-TRINITY-PLATEAU AQUIFER	466	0	0	0	0	47	513
2011	UVALDE	EDWARDS-TRINITY-PLATEAU AQUIFER	417	0	0	0	0	49	466
2012	UVALDE	EDWARDS-TRINITY-PLATEAU AQUIFER	440	0	0	0	0	42	482
2000	VAL VERDE	EDWARDS-TRINITY-PLATEAU AQUIFER	15,766	0	0	0	245	604	16,615
2001	VAL VERDE	EDWARDS-TRINITY-PLATEAU AQUIFER	15,769	0	0	0	287	607	16,663
2002	VAL VERDE	EDWARDS-TRINITY-PLATEAU AQUIFER	15,783	0	0	0	293	541	16,617
2003	VAL VERDE	EDWARDS-TRINITY-PLATEAU AQUIFER	15,778	0	0	0	209	464	16,451
2004	VAL VERDE	EDWARDS-TRINITY-PLATEAU AQUIFER	15,746	0	0	0	97	419	16,262
2005	VAL VERDE	EDWARDS-TRINITY-PLATEAU AQUIFER	15,828	0	0	0	133	482	16,443
2006	VAL VERDE	EDWARDS-TRINITY-PLATEAU AQUIFER	11,297	0	0	0	136	464	11,897
2007	VAL VERDE	EDWARDS-TRINITY-PLATEAU AQUIFER	834	0	0	0	31	408	1,273
2008	VAL VERDE	EDWARDS-TRINITY-PLATEAU AQUIFER	903	0	0	0	16	497	1,416
2009	VAL VERDE	EDWARDS-TRINITY-PLATEAU AQUIFER	1,755	0	0	0	0	488	2,243
2010	VAL VERDE	EDWARDS-TRINITY-PLATEAU AQUIFER	11,292	0	0	0	251	458	12,001
2011	VAL VERDE	EDWARDS-TRINITY-PLATEAU AQUIFER	13,053	0	0	0	130	459	13,642
2012	VAL VERDE	EDWARDS-TRINITY-PLATEAU AQUIFER	12,677	0	0	0	61	407	13,145
2000	CROCKETT	PECOS AQUIFER	0	0	0	0	0	0	0
2001	CROCKETT	PECOS AQUIFER	0	0	0	0	0	0	0
2002	CROCKETT	PECOS AQUIFER	0	0	0	0	0	0	0
2003	CROCKETT	PECOS AQUIFER	0	0	0	0	0	0	0
2004	CROCKETT	PECOS AQUIFER	0	0	0	0	0	0	0
2005	CROCKETT	PECOS AQUIFER	0	0	0	0	0	0	0
2006	CROCKETT	PECOS AQUIFER	0	0	0	0	0	0	0
2007	CROCKETT	PECOS AQUIFER	0	0	0	0	0	0	0

Year	County	Aquifer	Municipal	Manufacturing	Mining	Steam Electric Power	Irrigation	Livestock	Total
2008	CROCKETT	PECOS AQUIFER	0	0	0	0	0	0	0
2009	CROCKETT	PECOS AQUIFER	0	0	0	0	0	0	0
2010	CROCKETT	PECOS AQUIFER	0	0	0	0	0	0	0
2011	CROCKETT	PECOS AQUIFER	0	0	0	0	0	0	0
2012	CROCKETT	PECOS AQUIFER	0	0	0	0	0	0	0
2000	ECTOR	PECOS AQUIFER	158	0	24	0	0	19	201
2001	ECTOR	PECOS AQUIFER	209	0	24	0	0	6	239
2002	ECTOR	PECOS AQUIFER	213	0	13	0	0	5	231
2003	ECTOR	PECOS AQUIFER	214	0	13	0	0	4	231
2004	ECTOR	PECOS AQUIFER	207	0	13	0	0	0	220
2005	ECTOR	PECOS AQUIFER	222	0	13	0	0	0	235
2006	ECTOR	PECOS AQUIFER	0	0	13	0	0	0	13
2007	ECTOR	PECOS AQUIFER	0	0	13	0	0	0	13
2008	ECTOR	PECOS AQUIFER	0	0	13	0	0	0	13
2009	ECTOR	PECOS AQUIFER	0	0	13	0	0	0	13
2010	ECTOR	PECOS AQUIFER	0	0	13	0	0	0	13
2011	ECTOR	PECOS AQUIFER	0	0	13	0	0	0	13
2012	ECTOR	PECOS AQUIFER	0	0	13	0	0	0	13
2000	PECOS	PECOS AQUIFER	411	0	9	0	19,797	188	20,405
2001	PECOS	PECOS AQUIFER	382	0	7	0	17,567	198	18,154
2002	PECOS	PECOS AQUIFER	361	0	6	0	16,747	175	17,289
2003	PECOS	PECOS AQUIFER	328	0	6	0	10,292	149	10,775
2004	PECOS	PECOS AQUIFER	327	0	5	0	11,613	58	12,003
2005	PECOS	PECOS AQUIFER	328	0	5	0	11,320	61	11,714
2006	PECOS	PECOS AQUIFER	331	0	5	0	16,925	69	17,330
2007	PECOS	PECOS AQUIFER	351	0	5	0	14,917	53	15,326
2008	PECOS	PECOS AQUIFER	425	63	2	0	15,560	60	16,110
2009	PECOS	PECOS AQUIFER	431	63	2	0	24,837	55	25,388
2010	PECOS	PECOS AQUIFER	45	65	0	0	33,539	54	33,703
2011	PECOS	PECOS AQUIFER	241	75	0	0	34,200	54	34,570
2012	PECOS	PECOS AQUIFER	208	76	13	0	30,142	48	30,487
2000	UPTON	PECOS AQUIFER	0	0	0	0	0	1	1

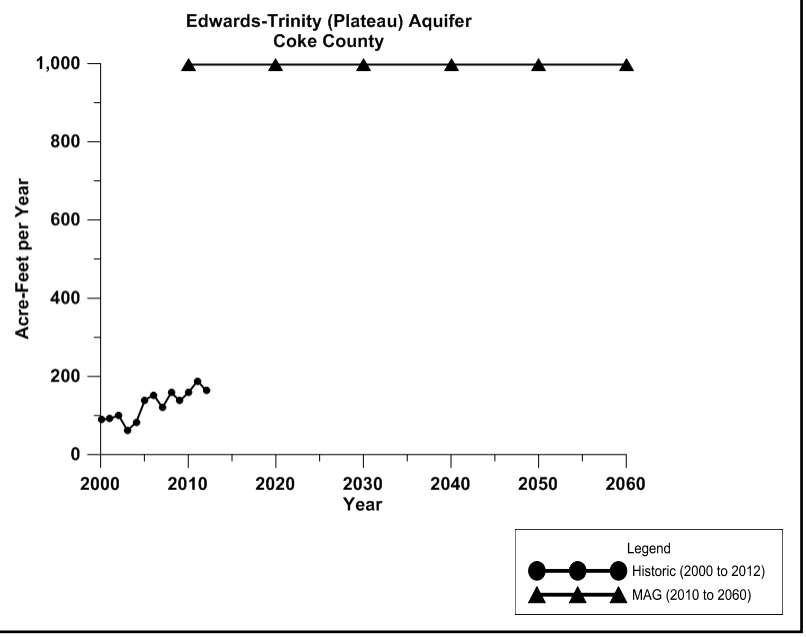
Year	County	Aquifer	Municipal	Manufacturing	Mining	Steam Electric Power	Irrigation	Livestock	Total
2001	UPTON	PECOS AQUIFER	0	0	0	0	0	0	0
2002	UPTON	PECOS AQUIFER	0	0	0	0	0	0	0
2003	UPTON	PECOS AQUIFER	0	0	0	0	0	0	0
2004	UPTON	PECOS AQUIFER	0	0	0	0	0	0	0
2005	UPTON	PECOS AQUIFER	0	0	0	0	0	1	1
2006	UPTON	PECOS AQUIFER	0	0	0	0	0	1	1
2007	UPTON	PECOS AQUIFER	0	0	0	0	0	1	1
2008	UPTON	PECOS AQUIFER	0	0	0	0	0	0	0
2009	UPTON	PECOS AQUIFER	0	0	0	0	0	0	0
2010	UPTON	PECOS AQUIFER	0	0	0	0	0	0	0
2011	UPTON	PECOS AQUIFER	0	0	0	0	0	0	0
2012	UPTON	PECOS AQUIFER	0	0	0	0	0	0	0
2000	GILLESPIE	TRINITY AQUIFER	542	0	0	0	982	148	1,672
2001	GILLESPIE	TRINITY AQUIFER	517	0	0	0	1,123	128	1,768
2002	GILLESPIE	TRINITY AQUIFER	553	0	0	0	1,123	127	1,803
2003	GILLESPIE	TRINITY AQUIFER	629	0	0	0	1,123	119	1,871
2004	GILLESPIE	TRINITY AQUIFER	610	0	0	0	1,189	73	1,872
2005	GILLESPIE	TRINITY AQUIFER	666	0	0	0	968	111	1,745
2006	GILLESPIE	TRINITY AQUIFER	719	0	0	0	1,059	110	1,888
2007	GILLESPIE	TRINITY AQUIFER	616	0	0	0	90	115	821
2008	GILLESPIE	TRINITY AQUIFER	681	0	0	0	985	127	1,793
2009	GILLESPIE	TRINITY AQUIFER	653	0	0	0	958	118	1,729
2010	GILLESPIE	TRINITY AQUIFER	706	0	0	0	638	245	1,589
2011	GILLESPIE	TRINITY AQUIFER	774	0	0	0	1,577	252	2,603
2012	GILLESPIE	TRINITY AQUIFER	748	0	0	0	971	119	1,838
2000	REAL	TRINITY AQUIFER	0	0	0	0	2	9	11
2001	REAL	TRINITY AQUIFER	0	0	0	0	2	7	9
2002	REAL	TRINITY AQUIFER	0	0	0	0	2	7	9
2003	REAL	TRINITY AQUIFER	0	0	0	0	1	6	7
2004	REAL	TRINITY AQUIFER	0	0	0	0	6	6	12
2005	REAL	TRINITY AQUIFER	0	0	0	0	8	10	18
2006	REAL	TRINITY AQUIFER	0	0	0	0	24	8	32

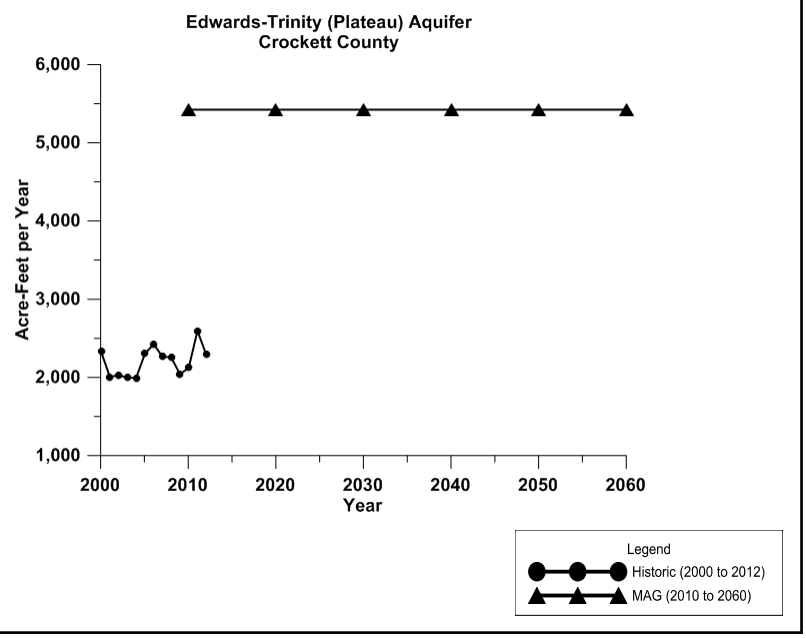
Appendix A - Historic Pumping from the Edwards-Trinity (Plateau), Pecos Valley and Trinity Aquifers

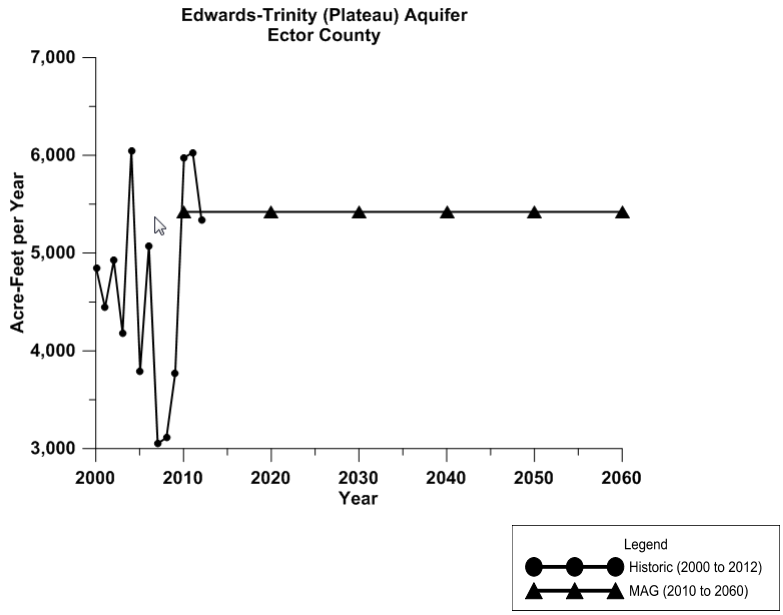
Year	County	Aquifer	Municipal	Manufacturing	Mining	Steam Electric Power	Irrigation	Livestock	Total
2007	REAL	TRINITY AQUIFER	0	0	0	0	0	9	9
2008	REAL	TRINITY AQUIFER	0	0	0	0	4	8	12
2009	REAL	TRINITY AQUIFER	0	0	0	0	0	8	8
2010	REAL	TRINITY AQUIFER	0	0	0	0	7	15	22
2011	REAL	TRINITY AQUIFER	31	0	0	0	15	15	61
2012	REAL	TRINITY AQUIFER	2	0	0	0	8	6	16
2000	UVALDE	TRINITY AQUIFER	0	0	0	0	0	49	49
2001	UVALDE	TRINITY AQUIFER	0	0	0	0	0	46	46
2002	UVALDE	TRINITY AQUIFER	0	0	0	0	0	45	45
2003	UVALDE	TRINITY AQUIFER	0	0	0	0	0	43	43
2004	UVALDE	TRINITY AQUIFER	0	0	0	0	0	40	40
2005	UVALDE	TRINITY AQUIFER	0	0	0	0	0	61	61
2006	UVALDE	TRINITY AQUIFER	37	0	0	0	0	59	96
2007	UVALDE	TRINITY AQUIFER	31	0	0	0	0	60	91
2008	UVALDE	TRINITY AQUIFER	117	0	0	0	0	53	170
2009	UVALDE	TRINITY AQUIFER	118	0	0	0	0	45	163
2010	UVALDE	TRINITY AQUIFER	199	0	0	0	0	47	246
2011	UVALDE	TRINITY AQUIFER	208	0	0	0	0	49	257
2012	UVALDE	TRINITY AQUIFER	153	0	0	0	0	42	195

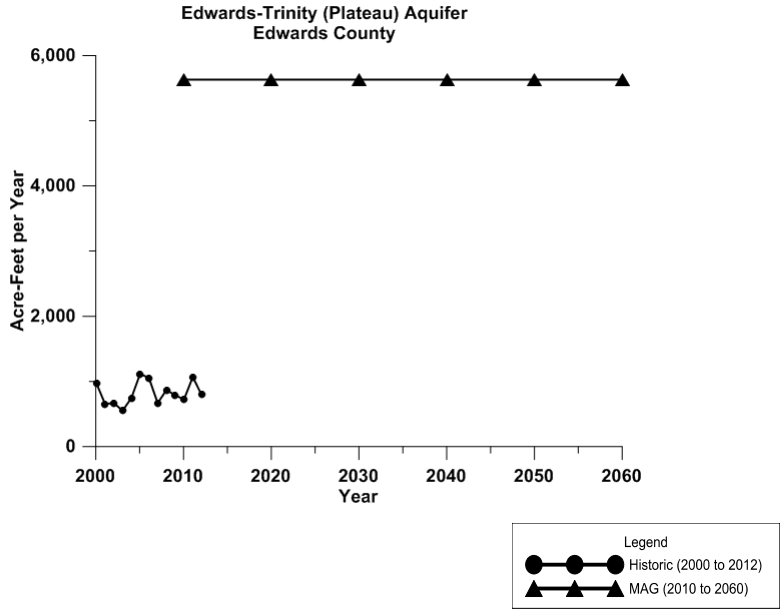
Appendix B

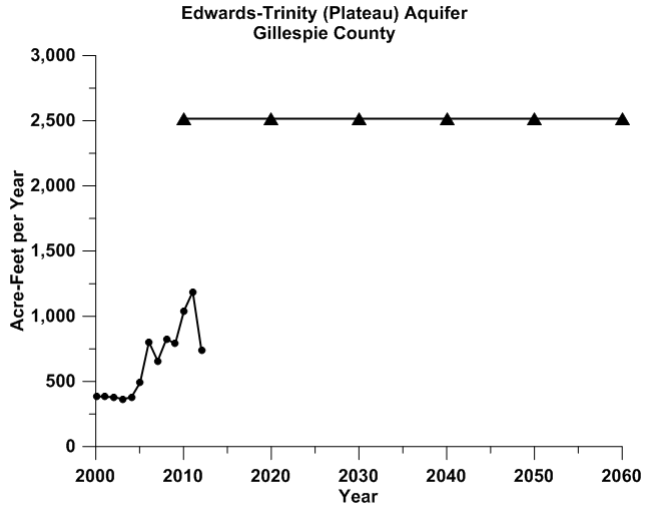
Hydrographs Comparing Historic Pumping and Modeled Available Groundwater from the Edwards-Trinity (Plateau), Pecos Valley, and Trinity Aquifers

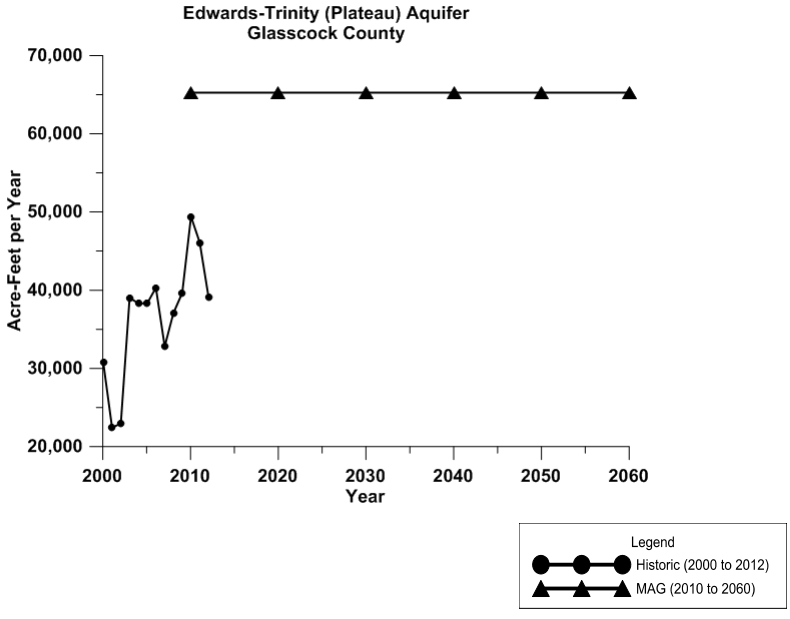

Edwards-Trinity (Plateau) Aquifer
Coke County
Acre-Feet per Year
1,000
800
600
400
200
0
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)

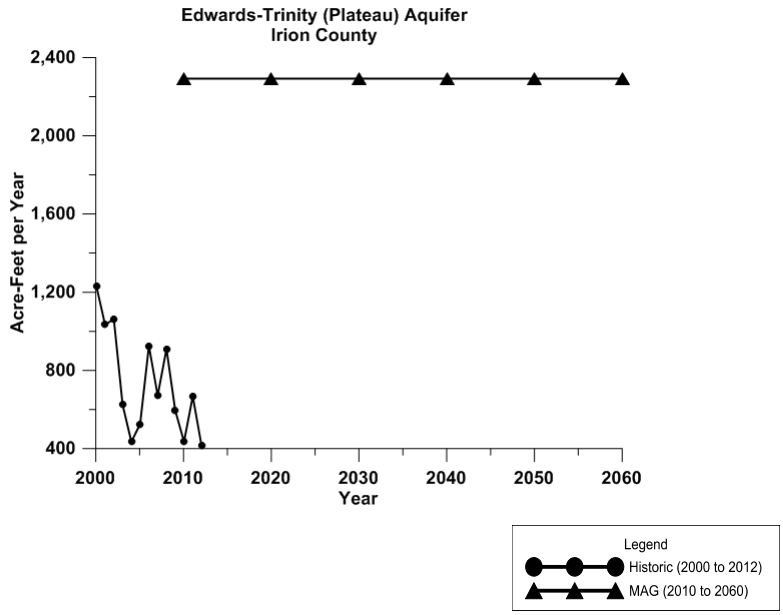

Edwards-Trinity (Plateau) Aquifer
Crockett County
Acre-Feet per Year
6,000
5,000
4,000
3,000
2,000
1,000
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)

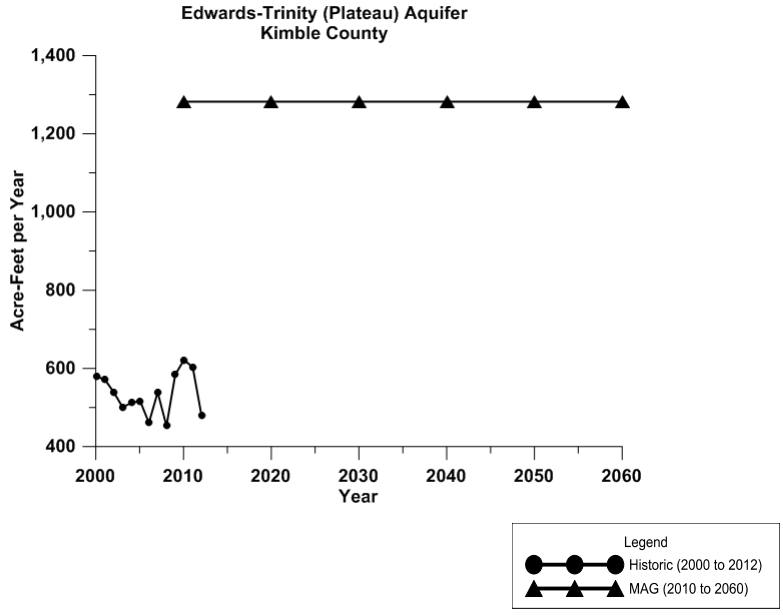

Edwards-Trinity (Plateau) Aquifer
Ector County
7,000
6,000
5,000
4,000
3,000
Acre-Feet per Year
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)

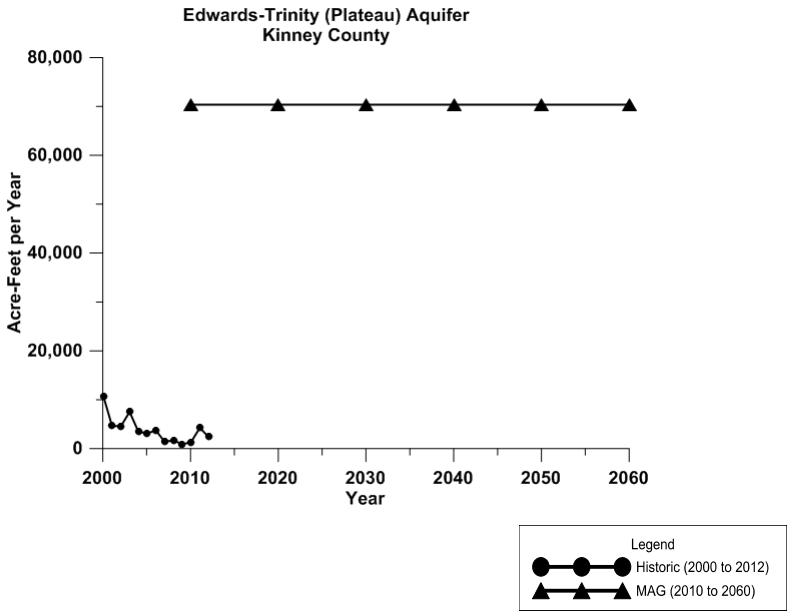

Edwards-Trinity (Plateau) Aquifer
Edwards County
6,000
4,000
2,000
0
Acre-Feet per Year
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)

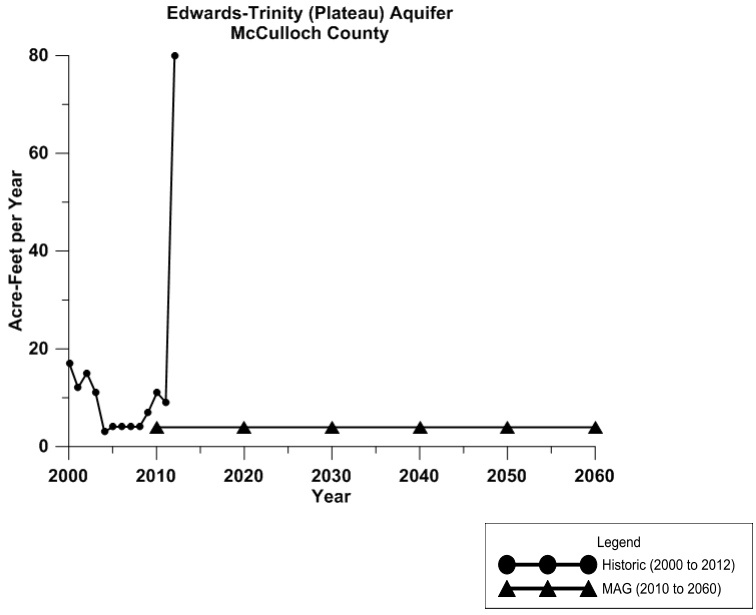

Edwards-Trinity (Plateau) Aquifer
Gillespie County
Acre-Feet per Year
3,000
2,500
2,000
1,500
1,000
500
0
2000
2010
2020
2030
2040
2050
2060
Year

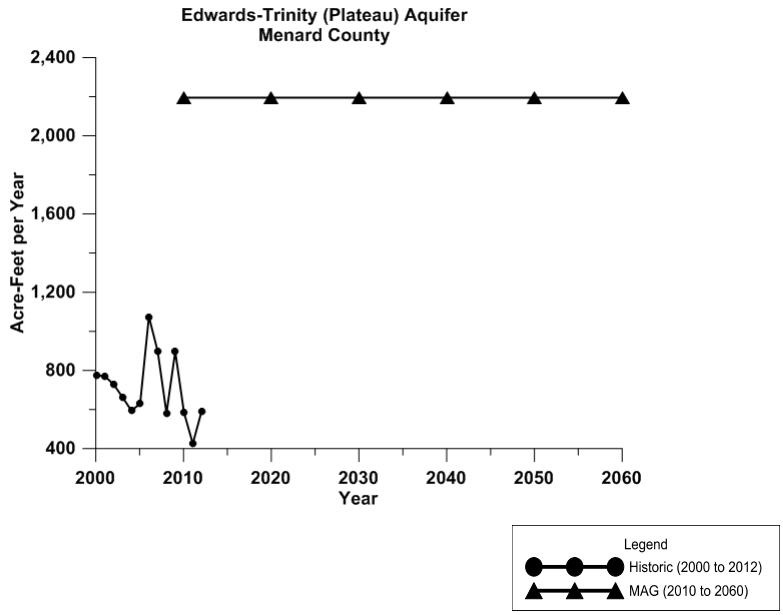

Edwards-Trinity (Plateau) Aquifer
Glasscock County
Acre-Feet per Year
70,000
60,000
50,000
40,000
30,000
20,000
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)

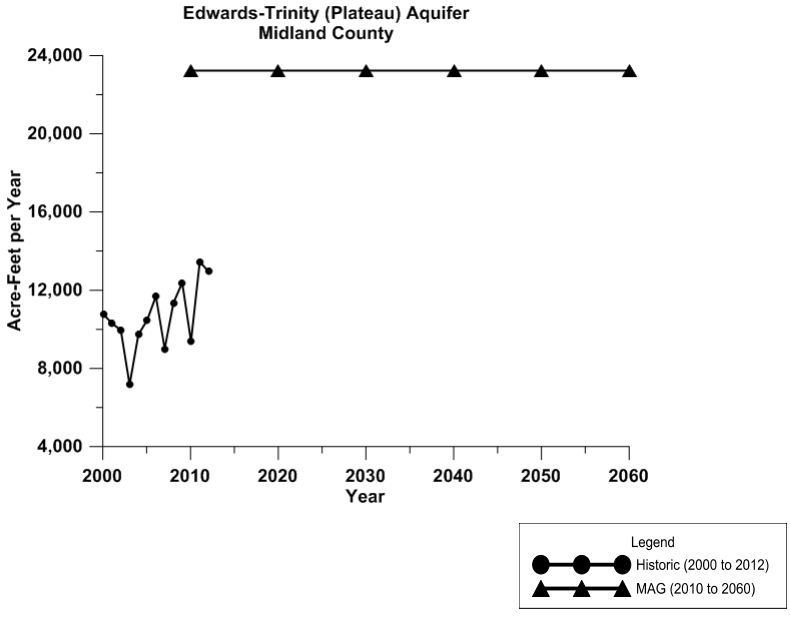

Edwards-Trinity (Plateau) Aquifer
Irion County
Acre-Feet per Year
2,400
2,000
1,600
1,200
800
400
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)

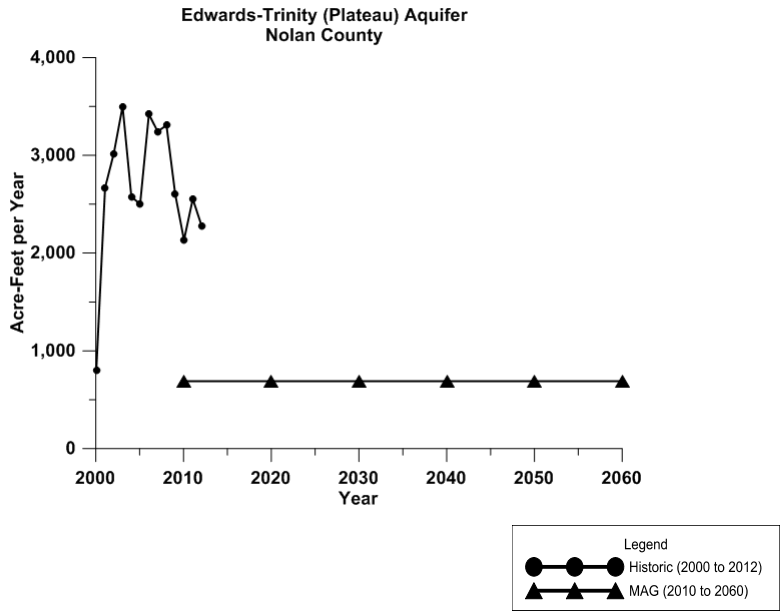

Edwards-Trinity (Plateau) Aquifer
Kimble County
Acre-Feet per Year
1,400
1,200
1,000
800
600
400
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)

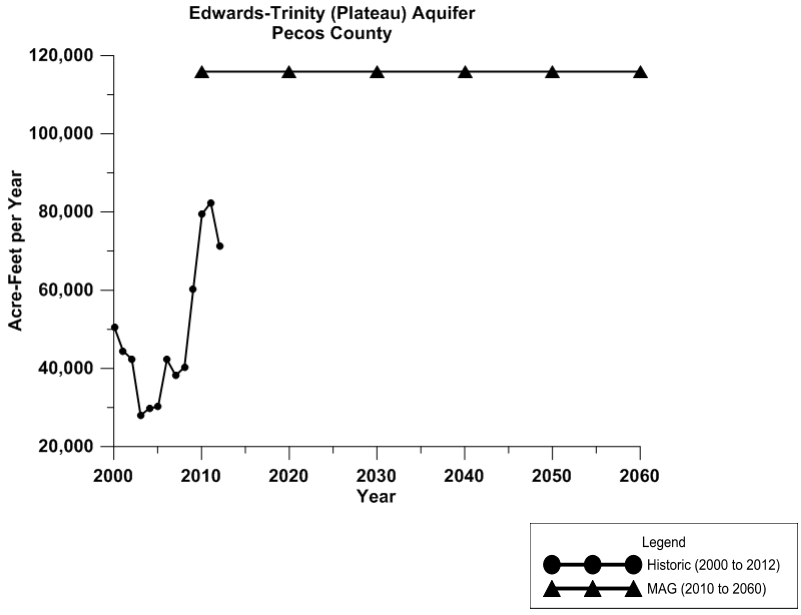

Edwards-Trinity (Plateau) Aquifer
Kinney County
80,000
60,000
40,000
20,000
0
Acre-Feet per Year
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)

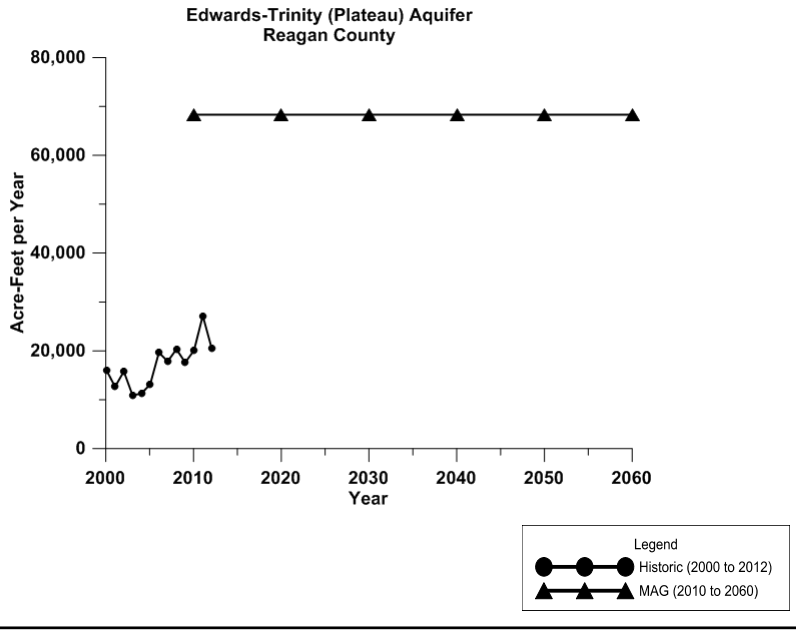

Edwards-Trinity (Plateau) Aquifer
McCulloch County
80
60
40
20
0
Acre-Feet per Year
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)

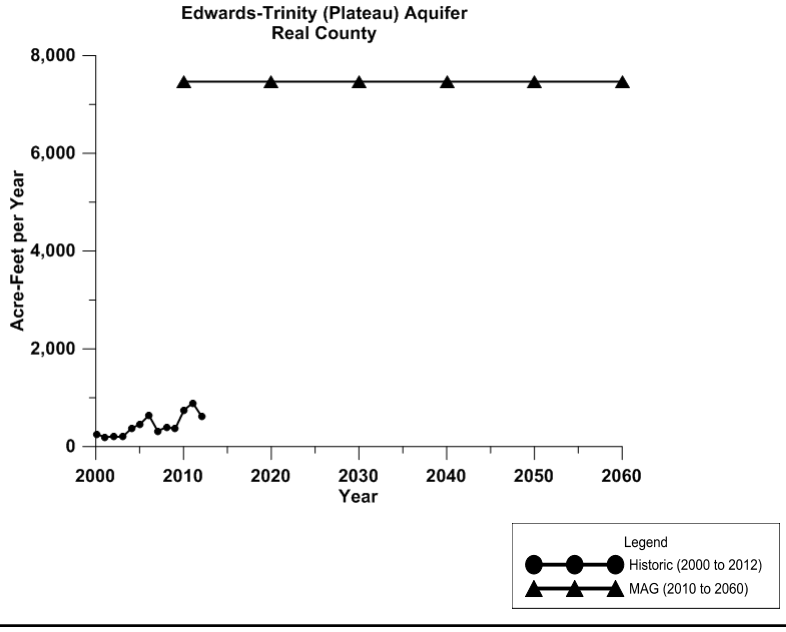

Edwards-Trinity (Plateau) Aquifer
Menard County
Acre-Feet per Year
2,400
2,000
1,600
1,200
800
400
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)

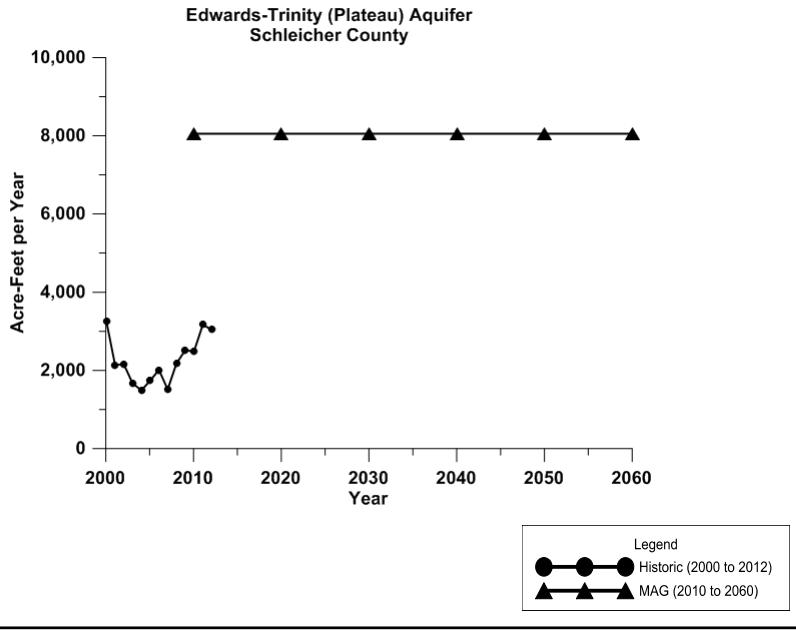

Edwards-Trinity (Plateau) Aquifer
Midland County
Acre-Feet per Year
24,000
20,000
16,000
12,000
8,000
4,000
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)

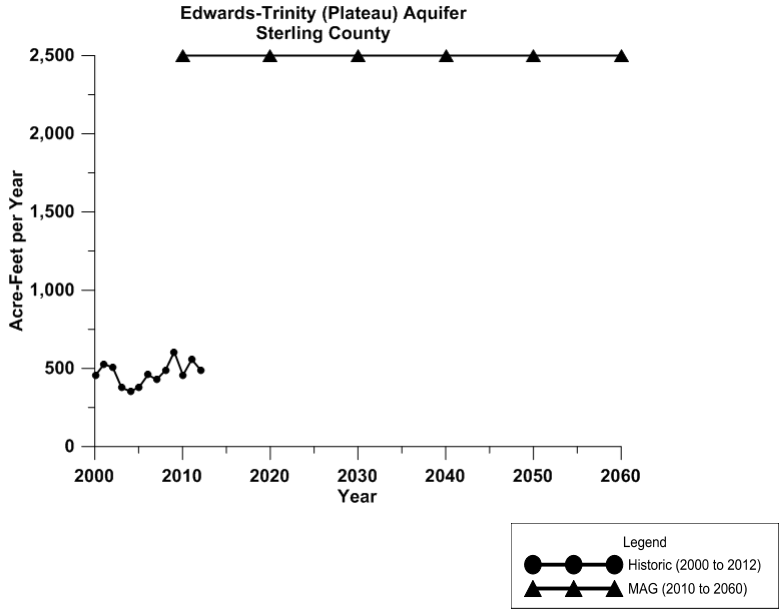

Edwards-Trinity (Plateau) Aquifer
Nolan County
Acre-Feet per Year
4,000
3,000
2,000
1,000
0
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)

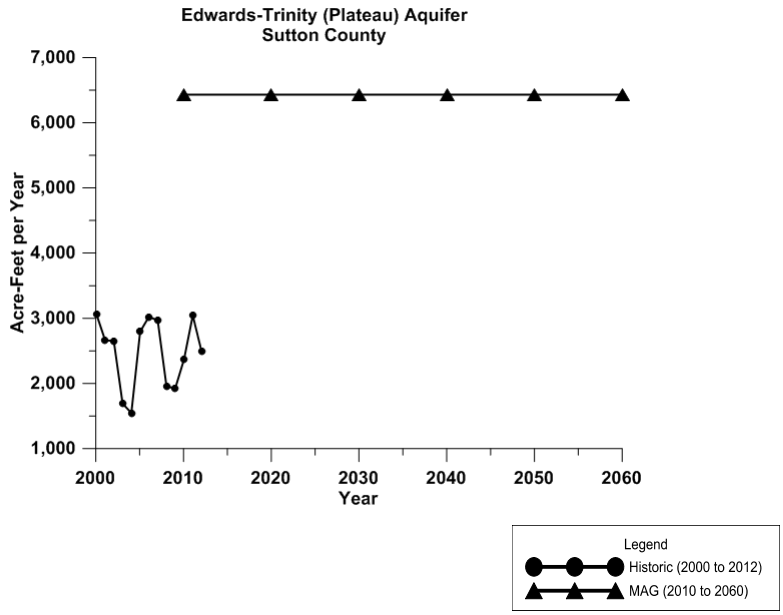

Edwards-Trinity (Plateau) Aquifer
Pecos County
Acre-Feet per Year
120,000
100,000
80,000
60,000
40,000
20,000
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)

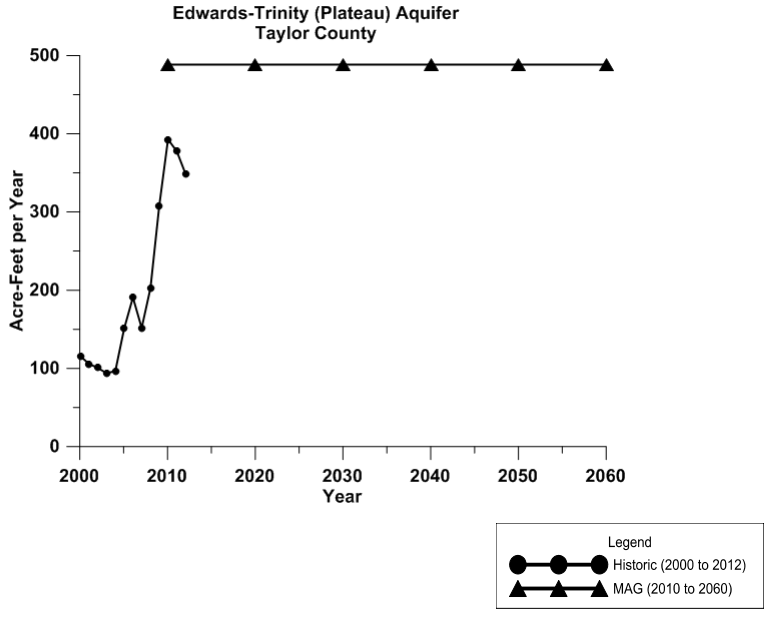

Edwards-Trinity (Plateau) Aquifer
Reagan County
80,000
60,000
40,000
20,000
0
Acre-Feet per Year
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)

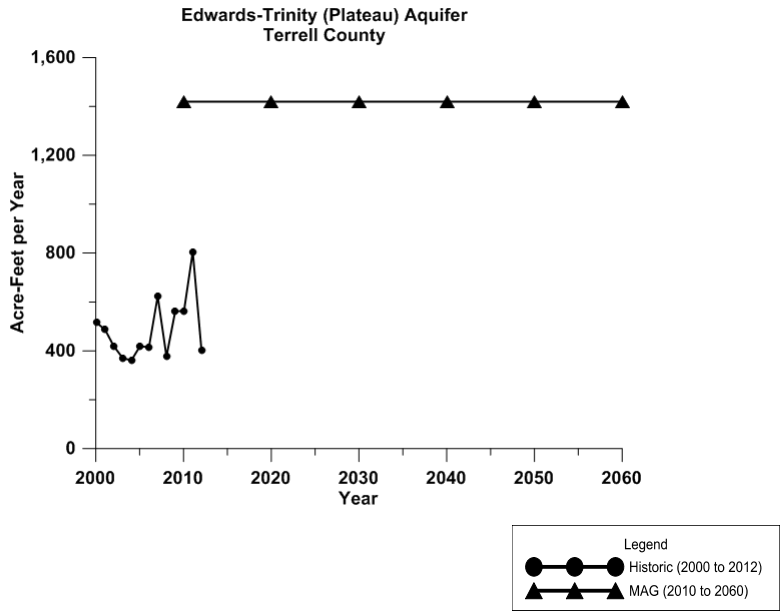

Edwards-Trinity (Plateau) Aquifer
Real County
8,000
6,000
4,000
2,000
0
Acre-Feet per Year
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)

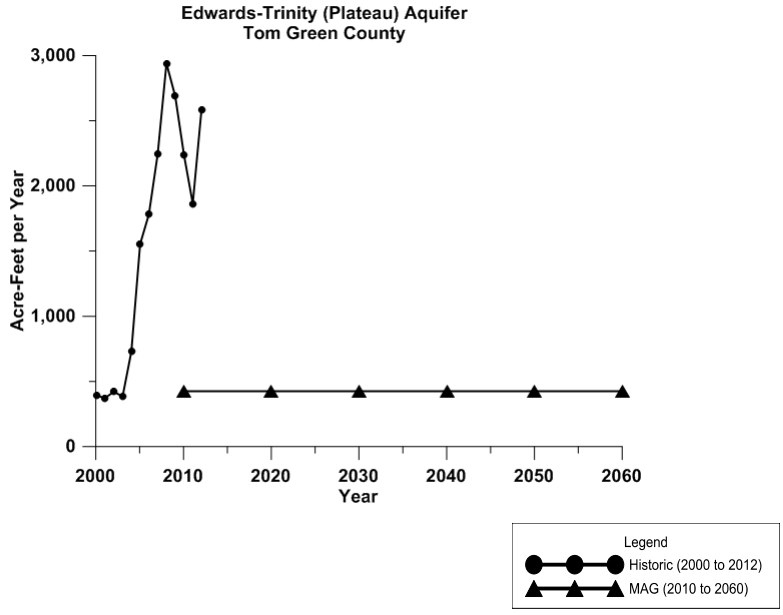

Edwards-Trinity (Plateau) Aquifer
Schleicher County
10,000
8,000
6,000
4,000
2,000
0
Acre-Feet per Year
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)

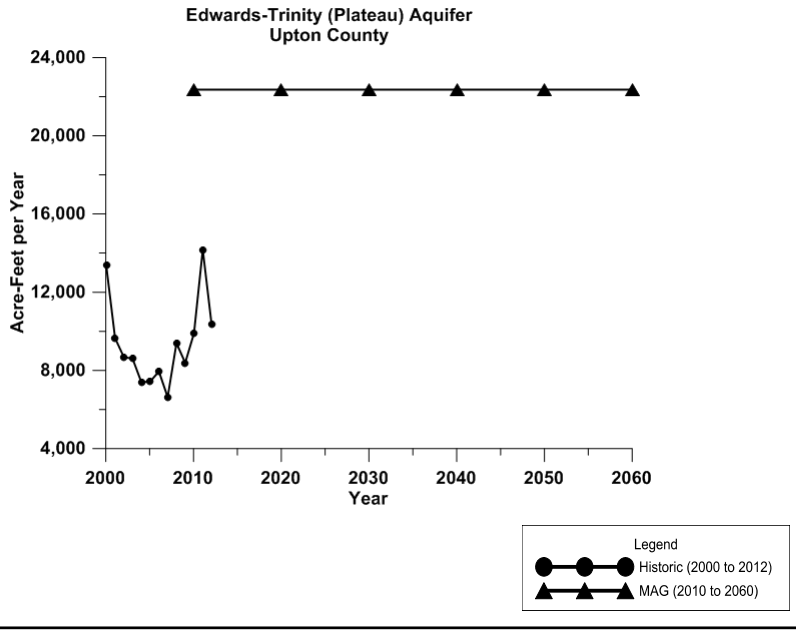

Edwards-Trinity (Plateau) Aquifer
Sterling County
2,500
2,000
1,500
1,000
500
0
Acre-Feet per Year
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)

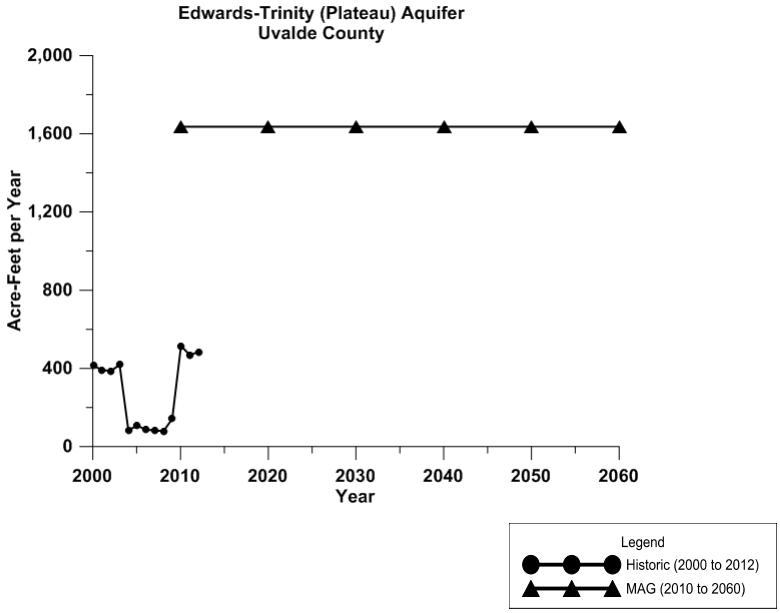

Edwards-Trinity (Plateau) Aquifer
Sutton County
Acre-Feet per Year
7,000
6,000
5,000
4,000
3,000
2,000
1,000
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)

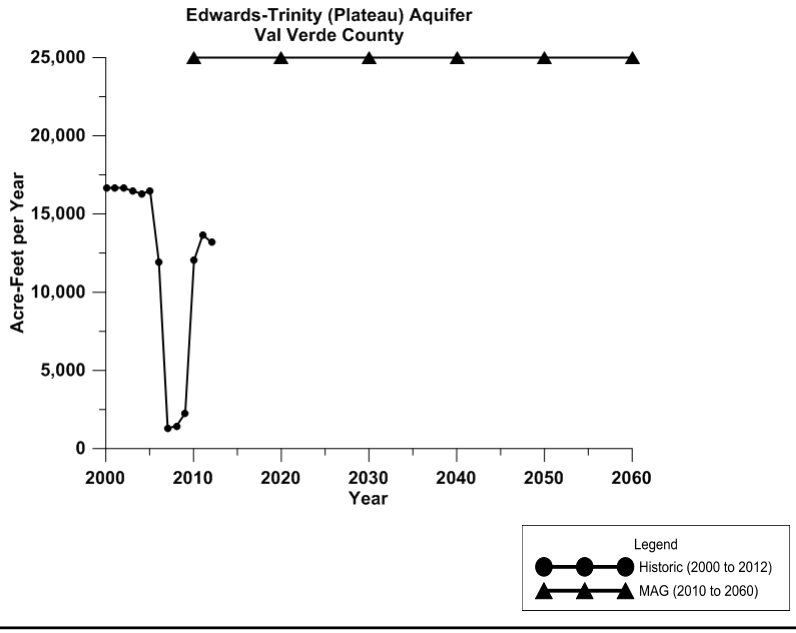

Edwards-Trinity (Plateau) Aquifer
Taylor County
Acre-Feet per Year
500
400
300
200
100
0
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)

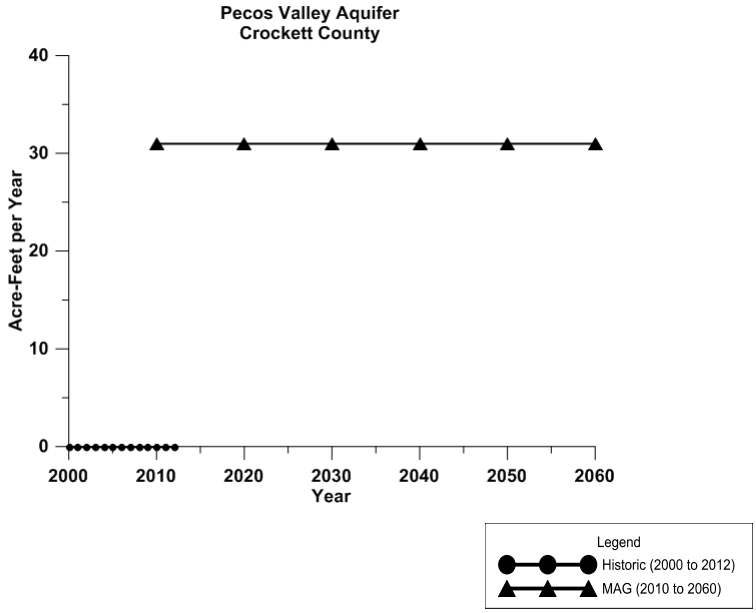

Edwards-Trinity (Plateau) Aquifer
Terrell County
Acre-Feet per Year
1,600
1,200
800
400
0
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)

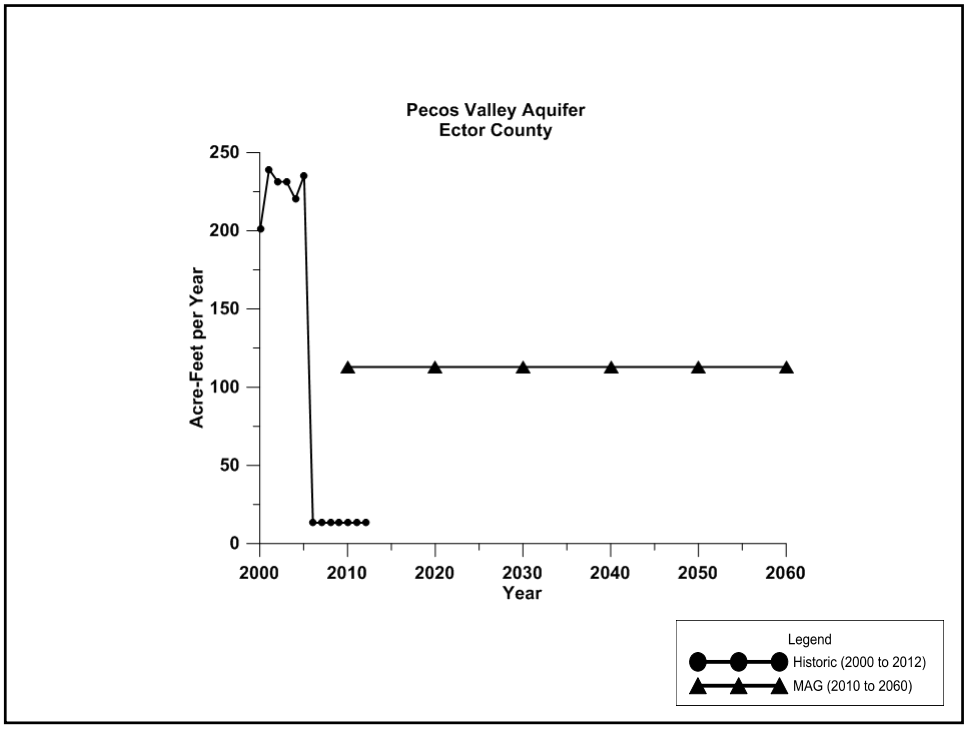

Edwards-Trinity (Plateau) Aquifer
Tom Green County
Acre-Feet per Year
3,000
2,000
1,000
0
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)

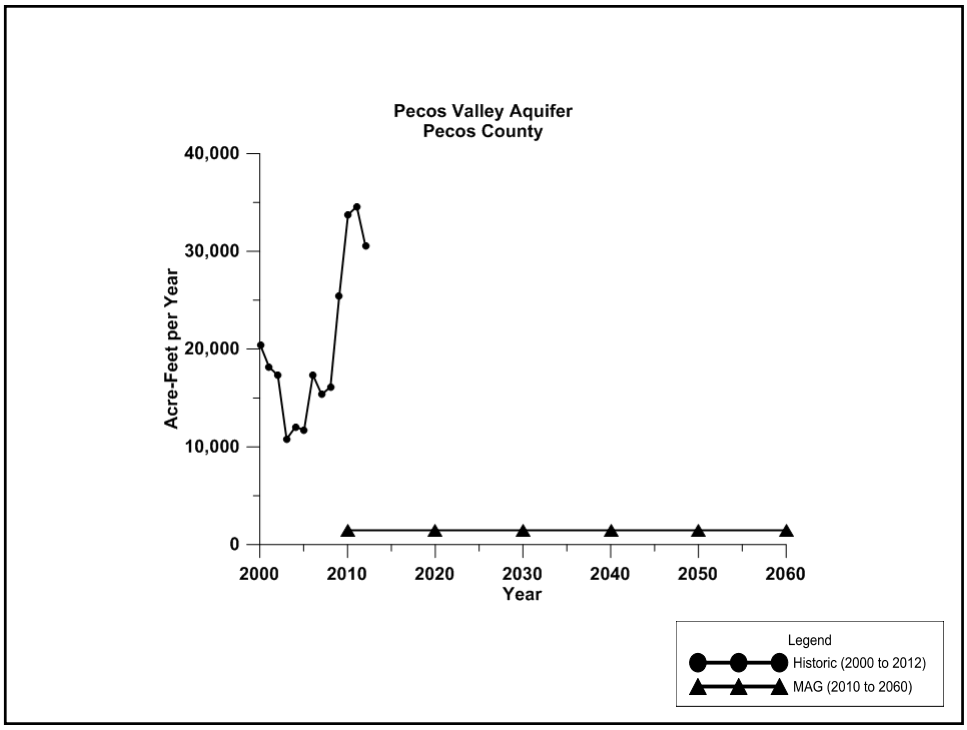

Edwards-Trinity (Plateau) Aquifer
Upton County
24,000
20,000
16,000
12,000
8,000
4,000
Acre-Feet per Year
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)

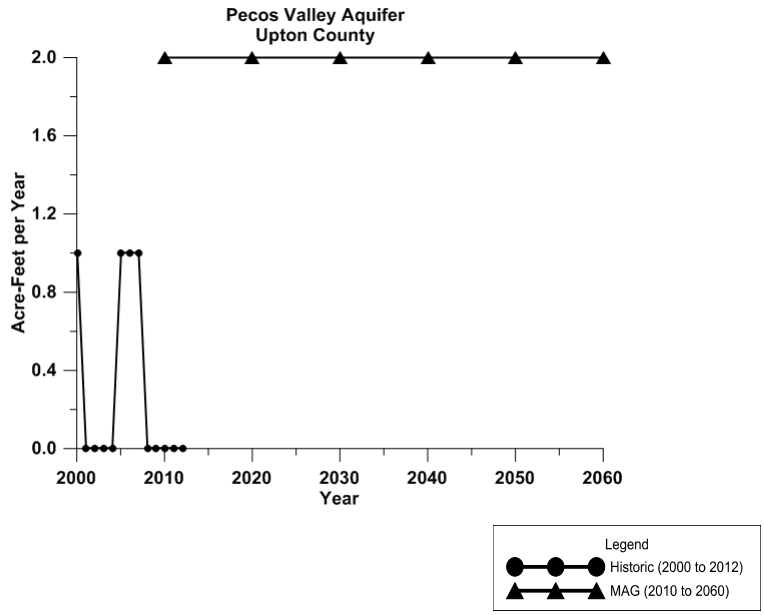

Edwards-Trinity (Plateau) Aquifer
Uvalde County
2,000
1,600
1,200
800
400
0
Acre-Feet per Year
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)

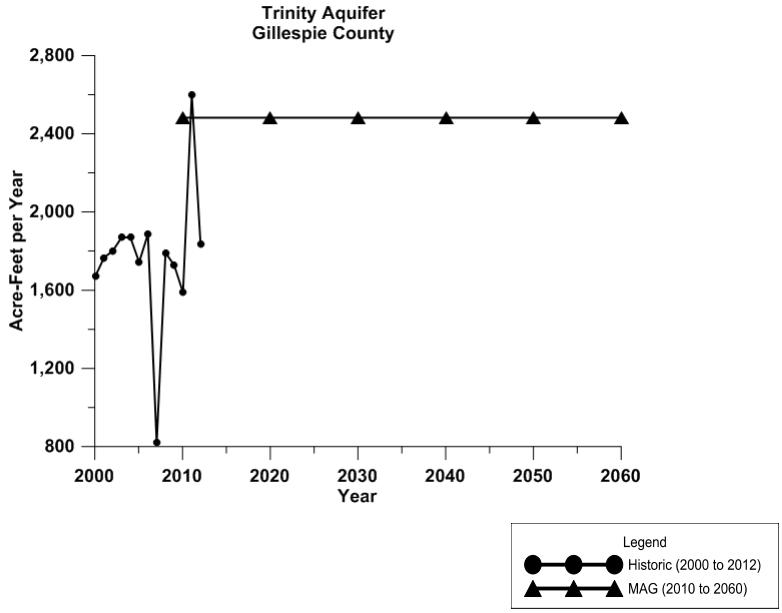

Edwards-Trinity (Plateau) Aquifer
Val Verde County
Acre-Feet per Year
25,000
20,000
15,000
10,000
5,000
0
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)

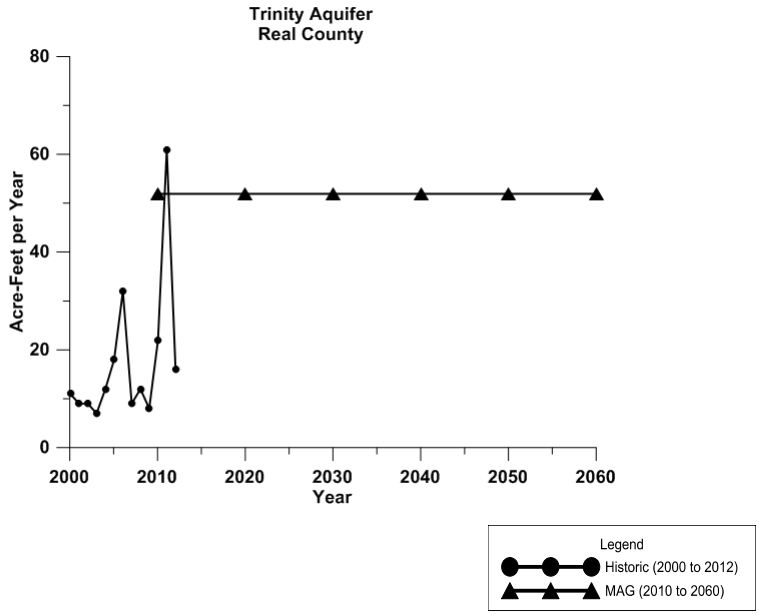

Pecos Valley Aquifer
Crockett County
Acre-Feet per Year
40
30
20
10
0
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)


Pecos Valley Aquifer
Ector County
Acre-Feet per Year
250
200
150
100
50
0
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)


Pecos Valley Aquifer
Pecos County
Acre-Feet per Year
40,000
30,000
20,000
10,000
0
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)


Pecos Valley Aquifer
Upton County
Acre-Feet per Year
2.0
1.6
1.2
0.8
0.4
0.0
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)


Trinity Aquifer
Gillespie County
Acre-Feet per Year
2,800
2,400
2,000
1,600
1,200
800
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)


Trinity Aquifer
Real County
Acre-Feet per Year
80
60
40
20
0
2000
2010
2020
2030
2040
2050
2060
Year
Legend
Historic (2000 to 2012)
MAG (2010 to 2060)

Appendix C

Draft GAM Run 09-035 (Version 2)

Draft GAM Run 09-035 (version 2)

by William R. Hutchison, Ph.D, P.E., P.G.
Texas Water Development Board
Groundwater Resources Division
(512) 463-5067
August 7, 2010

This document is released for the purpose of interim review under the authority of William R. Hutchison, P.E. 96287, P.G. 286 on August 7, 2010

EXECUTIVE SUMMARY:

Eleven simulations of groundwater pumping were run using the modified and recalibrated groundwater availability model of the Edwards-Trinity (Plateau) and Pecos Valley aquifers. Scenario 1 represents pumping that is consistent with the requested pumping by the groundwater conservation districts in both Groundwater Management Areas 3 and 7. Scenario 2 represents an increase of ten percent in pumping in each county of Groundwater Management Area 7 as compared to Scenario 1. Scenarios 3, 4 and 5 represent 20, 30, and 40 percent pumping increases in each county in Groundwater Management Area 7 as compared to Scenario 1, respectively. The results from Scenario 1 to 5 were summarized and distributed at the July 29, 2010 meeting of Groundwater Management Area 7. At the meeting, representatives of the groundwater conservation districts provided updates to their requested pumping on a county by county basis, pumping was adjusted in the model, and the results discussed. Scenarios 6 to 10 were run during the meeting, and were based on input from the groundwater conservation districts.

In Groundwater Management Area 7, the average drawdown in Scenario 1 is 6 feet. Scenarios 2 to 5 (run prior to the July 29 meeting of Groundwater Management Area 7) resulted in a foot of additional drawdown for each ten percent increase in pumping. Scenarios 6 to 10 resulted in average drawdown of seven feet in Groundwater Management Area 7.

Subsequent to the Groundwater Management Area 7 meeting, representative of interested parties in Groundwater Management Area 3 reviewed the model calibration and the model runs, including the first draft version of this report. As a result of that review and subsequent conversations, Scenario 11 was run for use in the establishing desired future conditions in Groundwater Management Area 3. Average drawdown in Groundwater Management Area 3 in Scenario 11 is estimated to be 28 feet.

REQUESTOR:

Ms Caroline Runge, General Manager of the Menard County Underground Water Conservation District, on behalf of Groundwater Management Area 7 requested a series of runs that involved running the groundwater availability model for the Edwards-Trinity (Plateau) and Pecos Valley aquifers under a variety of pumping scenarios to estimate drawdown in each county in Groundwater Management Area 7. As a result of limitations with the existing groundwater availability model, the existing model was modified and recalibrated subsequent to the initial requests.

During the work associated with the modification and recalibration, presentations to the groundwater conservation districts in Groundwater Management Area 7 were made at the April, May and June meetings of Groundwater Management Area 7. As a result of those presentations, the scope of the request runs was simplified. Prior to the July 29, 2010 meeting of Groundwater Management Area 7, a summary table with the results of one

simulation were transmitted to the groundwater conservation districts in Groundwater Management Area 7.

On the basis of the results of the initial simulation, Mr. Scott Holland and Mr. Allan Lange requested additional scenarios. At the July 29, 2010 meeting of Groundwater Management Area 7, the results of five scenarios were presented. During the meeting, an additional five scenarios were run based on input from the groundwater conservation districts. This report summarizes the results of the ten scenarios.

Because the modified and recalibrated model also covers all of Groundwater Management Area 3, the model runs also provide results that can be used in the consideration of desired future condition adoption in Groundwater Management Area 3. The initial requests for Groundwater Management Area 3 were developed through public meetings held by the Middle Pecos Groundwater Conservation District (the only groundwater conservation district in Groundwater Management Area 3) in May and June of 2010.

Subsequent to the Groundwater Management Area 7 meeting, representative of interested parties in Groundwater Management Area 3 reviewed the model calibration and the model runs, including the first draft version of this report. As a result of that review and subsequent conversations, Scenario 11 was run for use in the establishing desired future conditions in Groundwater Management Area 3.

DESCRIPTION OF REQUEST:

Eleven simulations of groundwater pumping were run using the modified and recalibrated groundwater availability model of the Edwards-Trinity (Plateau) and Pecos Valley Alluvium aquifers. Each scenario was completed under the assumption of average groundwater recharge conditions. Scenarios 1 to 5 were run prior to the July 29, 2010 meeting of Groundwater Management Area 7. Scenarios 6 to 10 were run during the meeting, and were based on input from the groundwater conservation districts. The objective of running the model at the meeting was to provide an opportunity for the groundwater conservation districts to evaluate the effects of changes in pumping on their own district and neighboring districts and facilitate communication among the districts on these impacts. Scenario 11 was run as a result of discussions with interested parties in Groundwater Management Area 3.

A county-by-county summary of pumping for the Groundwater Management Area 7 portion of the model area is presented in Table 1. Please note that pumping in Pecos County in Table 1 represents pumping for the entire county, even though part of Pecos County is located in Groundwater Management Area 3. Pumping in the rest of Groundwater Management Area 3 did not change in these ten scenarios, and is summarized in Table 2. Pumping in Winkler County for Scenarios 1 to 10 was 50,000 acre-feet per year for Scenarios 1 to 10, and 40,000 acre-feet per year in Scenario 11.

Table 1. Summary of pumping in GMA 7 counties.
Note that Pecos County pumping includes all pumping in GMA 3 and GMA 7

County	Pumping (AF/yr)									
	1	2	3	4	5	6	7	8	9	10
Coke	300	330	360	390	420	300	1,000	1,000	1,000	1,000
Concho	350	385	420	455	490	490	490	490	490	490
Crockett	5,475	6,023	6,570	7,118	7,665	5,475	5,475	5,475	5,475	5,475
Ector	5,534	6,087	6,641	7,194	7,748	5,534	5,534	5,534	5,534	5,534
Edwards	7,782	8,560	9,338	10,117	10,895	4,000	4,000	4,000	5,659	5,659
Gillespie	5,000	5,500	6,000	6,500	7,000	5,000	5,000	5,000	5,000	5,000
Glasscock	59,252	65,177	71,102	77,028	82,953	59,252	59,252	65,177	65,177	65,177
Irion	2,300	2,530	2,760	2,990	3,220	2,300	2,300	2,300	2,300	2,300
Kimble	1,000	1,100	1,200	1,300	1,400	1,400	1,400	1,400	1,400	1,400
Kinney	65,000	71,500	78,000	84,500	91,000	65,000	65,000	65,000	65,000	65,000
McCulloch	150	165	180	195	210	150	150	150	150	150
Mason	20	22	24	26	28	20	20	20	20	20
Menard	1,843	2,027	2,212	2,396	2,580	2,580	2,580	2,580	2,580	2,580
Midland	21,130	23,243	25,356	27,469	29,582	21,130	21,130	23,243	23,243	23,243
Nolan	500	550	600	650	700	700	700	700	700	700
Pecos	220,000	242,000	264,000	286,000	308,000	240,000	240,000	240,000	240,000	240,000
Reagan	62,039	68,243	74,447	80,651	86,855	62,039	62,039	68,243	68,243	68,243
Real	11,468	12,615	13,762	14,908	16,055	4,000	4,000	4,000	7,533	7,533
Schelicher	6,200	6,820	7,440	8,060	8,680	8,060	8,680	8,680	8,680	8,060
Sterling	2,500	2,750	3,000	3,250	3,500	2,500	2,500	2,500	2,500	2,500
Sutton	4,000	4,400	4,800	5,200	5,600	6,450	6,450	6,450	6,450	6,450
Taylor	350	385	420	455	490	490	490	490	490	490
Terrell	1,031	1,134	1,237	1,340	1,443	1,443	1,443	1,443	1,443	1,443
TomGreen	2,000	2,200	2,400	2,600	2,800	2,800	2,800	2,800	2,800	2,800
Upton	20,341	22,375	24,409	26,443	28,477	20,341	20,341	22,375	22,375	22,375
Uvalde	2,000	2,200	2,400	2,600	2,800	2,000	2,000	2,000	2,000	2,000
ValVerde	25,000	27,500	30,000	32,500	35,000	25,000	25,000	25,000	25,000	25,000

Table 2. Simulated pumping in Groundwater Management Area (GMA) 3 counties (except for Pecos County) for all ten scenarios.

GMA 3 counties	**Simulated pumping (AF/yr) Scenarios 1 to 10**	**Simulated pumping (AF/yr) Scenario 11**
Crane	5,000	5,000
Loving	3,000	3,000
Reeves	190,000	190,000
Ward	50,000	50,000
Winkler	50,000	40,000

Pumping in counties outside of Groundwater Management Area 3 and Groundwater Management Area 7 did not change in these ten scenarios, and is summarized in Table 3.

Table 3. Simulated pumping in counties outside of Groundwater Management Area 3 and Groundwater Management Area 7 for all eleven scenarios.

Counties outside of GMA 3 and GMA 7	**Simulated pumping (AF/yr)**
Andrews	1,200
Bandera	2,600
Bexar	11,000
Blanco	744
Brewster	1,200
Burnet	700
Comal	3,058
Culberson	37
Hays	7,000
Howard	700
Jeff Davis	140
Kendall	4,500
Kerr	6,000
Martin	250
Medina	1,843
Travis	3,000
Outside of Texas	20

METHODS:

Scenarios 1 to 10 were developed in response to various model run requests by the groundwater conservation districts in Groundwater Management Area 7 as later modified in discussions during Groundwater Management Area 7 meetings in April, May and June 2010. These requests revolved around certain county by county future pumping scenarios and general management goals regarding the amount of drawdown in various portions of Groundwater Management Area 7. In summary, relatively high drawdown was anticipated in the western portion of Groundwater Management Area 7, and essentially no drawdown was anticipated in the eastern portion of Groundwater Management Area 7 in order to maintain groundwater discharge to surface water.

Scenario 1 represents pumping that is consistent with the requested pumping by the groundwater conservation districts in both Groundwater Management Areas 3 and 7. Scenario 2 represents an increase of ten percent in pumping for each county located in Groundwater Management Area 7 as compared to Scenario 1. Scenarios 3, 4 and 5 represent 20, 30, and 40 percent pumping increases in each county in Groundwater Management Area 7 as compared to Scenario 1, respectively. The results from Scenario 1 to 5 were summarized and distributed at the July 29, 2010 meeting of Groundwater Management Area 7. At the meeting, representatives of the groundwater conservation districts provided updates to their requested pumping on a county by county basis, pumping was adjusted in the model, and the results discussed. Scenarios 6 to 10 were run during the meeting, and were based on input from the groundwater conservation districts.

Scenario 11 was developed after discussions with Mr. Neil Blandford of Daniel B. Stephens & Associates, Inc., representing the Colorado River Municipal Water District. Mr. Blandford had reviewed the model subsequent to the July 29, 2010 Groundwater Management Area 7 meeting, and reviewed the first draft of this report. Mr. Blandford expressed concerns regarding the specific storage parameter in Crane, Ward, and Winkler counties. He had prepared hydrographs that demonstrated the sensitivity of this parameter to drawdown in these counties.

As a result of Mr. Blandford's comments, a detailed sensitivity analysis was completed on specific storage in those counties. Increases in specific storage up to ten times the values specified in the model used in Scenarios 1 to 10 in Crane, Ward, and Winkler counties resulted in some minor changes to the model calibration statistics. Although increasing specific storage generally resulted in a worse calibration based on the statistics, they were generally deemed insignificant. However, analysis of hydrographs based on the results of the sensitivity analysis suggested that drawdown in some wells was better simulated when specific storage was slightly increaased as compared to the model used in Scenarios 1 to 10. The resulting changes in specific storage are summarized below in terms of storativity (specific storage times saturated thickness).

County	Average storativity used in Scenarios 1 to 10 (dimensionless)	Average storativity used in Scenario 11 (dimensionless)
Crane	0.00234	0.01420
Ward	0.01359	0.05919
Winkler	0.00669	0.03254

Because field data on specific storage (or storativity) is sparse, all the values listed above are considered reasonable given the uncertainty in this parameter. Because the historic pumping in these counties is substantially less than that requested in the predictive runs, the increased pumping will undoubtedly cause substantial drawdown in these area. However, there is considerable uncertainty associated with estimating the drawdown as evidenced by the sensitivity analysis which demonstrated that small changes in storativity can result in differences in drawdown in the tens of feet.

Scenario 11 was run with the alternative specific storage values listed above as input into the process of establishing desired future conditions in Groundwater Management Area 3. These changes did not affect the results of adjacent areas of Groundwater Management Area 7.

PARAMETERS AND ASSUMPTIONS:

- The recently modified and calibrated groundwater flow model of the Edwards Trinity (Plateau) and Pecos Valley aquifers (Hutchison and Jones, 2010) was used for these simulations. The model was calibrated based on groundwater elevation data from 1930 to 2005. Scenarios 1 to 10 used the calibrated model. As discussed above, specific storage values were modified in Crane, Ward, and Winkler counties for Scenario 11.

- The model has one layer which represents the Pecos Valley Aquifer in the northwest portion of the model area, the Edwards-Trinity (Plateau) Aquifer in the southeast portion of the model area, and a lumped representation of both aquifers in the relatively narrow area where the Pecos Valley Aquifer overlies the Edwards-Trinity (Plateau) Aquifer.

- As further detailed in the model report (Hutchison and Jones, 2010), model calibration statistics for the entire model domain for groundwater elevation is summarized below. Note that the calibrated model statistics are presented as well as the statistics for the modified model used in Scenario 11.

Statistic	Calibrated Model Used in Scenarios 1 to 10	Modified Model Used in Scenario 11
Average residual	-1.3 feet	-2.9 feet
Standard deviation	70 feet	70 feet
Range of measurements	3058 feet	3058 feet
Standard deviation divided by range	0.02	0.02

- Eleven different pumping scenarios were used as described above
- Each simulation consisted of 55 annual stress periods. Pumping for the first five stress periods (2006 to 2010) was set equal to pumping estimated during model calibration for 2005. Pumping in stress periods 6 to 55 (2011 to 2060) was set equal to the values previously presented in Tables 1, 2 and 3, based on the scenario.
- Drawdown was calculated based on the difference between an initial condition at the end of 2010 (stress period 5) and the end of stress period 55 (2060).
- Recharge in each stress period was assumed to be equal to average recharge during the calibration period (1930 to 2005).
- Other model inputs were based on average recharge conditions, and did not vary during the simulations.
- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).

RESULTS:

Groundwater Management Area 7 Results

Estimated drawdown in 2060 for the ten scenarios on a county basis is presented in Table 4. Note that the drawdown estimate for Pecos County is limited to the portion of Pecos County that is in Groundwater Management Area 7. Also listed is the average drawdown for each scenario averaged over all of Groundwater Management Area 7. Note that the average drawdown in Scenario 1 is 6 feet. Scenarios 2 to 5 (run prior to the July 29 meeting of Groundwater Management Area 7) resulted in a foot of additional drawdown for each ten percent increase in pumping. Scenarios 6 to 10 resulted in average drawdown of seven feet, and the differences between scenarios can be seen in individual county drawdown estimates due to changes in pumping in individual counties.

Table 4. Estimated drawdown in feet from 2010 conditions for ten scenarios. Groundwater Management Area 7

County	Drawdown in 2060 (ft)									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Coke	0	0	0	0	0	0	0	0	0	0
Concho	0	0	0	0	0	0	0	0	0	0
Crockett	8	9	10	12	13	8	9	9	9	9
Ector	7	7	7	8	8	7	7	7	7	7
Edwards	2	2	3	3	3	1	1	1	2	2
Gillespie	5	5	6	6	6	5	5	5	5	5
Glasscock	31	34	38	42	45	31	31	34	34	34
Irion	8	9	11	12	14	8	9	10	10	10
Kimble	1	1	1	1	1	1	1	1	1	1
Kinney	0	1	1	1	1	0	0	0	0	0
McCulloch	0	0	0	0	0	0	0	0	0	0
Mason	0	0	0	0	0	0	0	0	0	0
Menard	0	1	1	1	1	1	1	1	1	1
Midland	9	10	10	11	12	9	9	10	10	10
Nolan	0	0	0	0	0	0	0	0	0	0
Pecos (GMA 7 portion)	9	11	12	14	15	11	11	11	11	11
Reagan	32	37	42	47	51	33	33	37	37	37
Real	6	7	8	9	10	1	1	1	4	4
Schelicher	6	7	8	9	10	7	7	8	8	8
Sterling	5	6	7	8	9	5	5	6	6	6
Sutton	5	6	7	7	8	6	6	6	6	6
Taylor	0	0	0	0	0	0	0	0	0	0
Terrell	2	2	3	3	3	2	2	2	2	2
TomGreen	2	2	2	3	3	2	2	2	2	2
Upton	12	13	15	16	18	12	12	13	13	13
Uvalde	3	4	4	5	5	1	1	1	2	2
ValVerde	1	1	1	2	2	1	1	1	1	1
GMA 7 Average	**6**	**7**	**8**	**9**	**10**	**7**	**7**	**7**	**7**	**7**

Groundwater Management Area 3 Results

Estimated drawdown in 2060 for the counties in Groundwater Management Area 3 for Scenario 11 is presented in Table 5. Please note that the overall average drawdown in Groundwater Management Area 3 shown in Table 5 only includes the Groundwater Management Area 3 portion of Pecos County.

Table 5. Estimated drawdown in Groundwater Management Area (GMA) 3 based on Scenario 11

County	**Drawdown in 2060 (feet)**
Crane	50
Loving	5
Pecos (GMA 3 portion only)	12
Reeves	6
Ward	56
Winkler	113
GMA 3 Average	**28**

REFERENCES:

Harbaugh, A.W., Banta, E.R., Hill, M.C., and McDonald, M.G., 2000, MODFLOW-2000, The U.S. Geological Survey modular ground-water model-user guide to modularization concepts and the ground-water flow process: U.S. Geological Survey Open-File Report 00-92, 121 p.

Hutchison, William R., and Jones, Ian, 2010 (in preparation). Evaluation of Groundwater Flow in Groundwater Management Areas 3 and 7 Using a MODFLOW-2000 Model. Texas Water Development Board Unpublished Report.