GAM Run 10-044 MAG

by Mr. Wade Oliver

Edited and finalized by Shirley Wade to reflect statutory changes effective September 1, 2011.

Texas Water Development Board
Groundwater Availability Modeling Section
(512) 936-0883
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Cynthia K. Ridgeway, the Manager of the Groundwater Availability Modeling Section, is responsible for oversight of work performed by employees under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G. 471 on July 9, 2012.

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EXECUTIVE SUMMARY:

The modeled available groundwater for the Carrizo-Wilcox Aquifer as a result of the desired future conditions adopted by the districts within Groundwater Management Area 12 increases from approximately 196,000 acre-feet per year to 257,000 acre-feet per year between 2010 and 2060. This is shown divided by county, regional water planning area, and river basin in Table 2 for use in the regional water planning process. The modeled available groundwater has been summarized by county (Tables 3 through 7), regional water planning area (Tables 8 through 12), river basin (Tables 13 through 17), and groundwater conservation district (Tables 18 through 22). The modeled available groundwater estimates were taken from model simulation "GAM12_7B" completed for Groundwater Management Area 12 by consultants retained by the districts to assist in developing desired future conditions. The Texas Water Development Board confirmed that this model simulation achieves the desired future conditions adopted by the districts of Groundwater Management Area 12.

REQUESTOR:

Mr. Gary Westbrook of Post Oak Savannah Groundwater Conservation District on behalf of Groundwater Management Area 12.

DESCRIPTION OF REQUEST:

In a letter dated August 12, 2010, Mr. Gary Westbrook provided the Texas Water Development Board (TWDB) with the desired future conditions of the Carrizo-Wilcox Aquifer adopted by the districts of Groundwater Management Area 12. The desired future conditions for the Carrizo-Wilcox Aquifer, as presented in Appendix B of the resolution and adopted August 11, 2010 by the groundwater conservation districts within Groundwater Management Area 12, are shown in Table 1 (Groundwater Management Area 12, 2010).

Table 1. Desired future conditions (in feet of average aquifer drawdown measured from January 2000 to December 2059) for the Carrizo-Wilcox Aquifer adopted by districts of Groundwater Management Area 12. Negative values indicate a water-level rise.

Groundwater Conservation District or County	Carrizo	Calvert Bluff (Upper Wilcox)	Simsboro (Middle Wilcox)	Hooper (Lower Wilcox)
Brazos Valley	47	106	270	170
Fayette County	60	-	-	-
Lost Pines	47	99	237	129
Mid-East Texas	55	70	115	95
Post Oak Savannah	65	140	300	180
Falls County	-	-	0	20
Limestone County	-	9	43	40
Navarro County	-	0	1	1
Williamson County	-	-10	50	55

As stated in Appendix B of the resolution adopted by the districts of Groundwater Management Area 12, the desired future conditions are considered to be "compatible and physically possible if the difference between modeled drawdown results for model Run 12_7B and the [desired future condition] drawdown targets are within 5 feet or 5 percent of the [desired future condition] drawdown targets" (Groundwater Management Area 12, 2010).

In response to receiving the adopted desired future conditions, the TWDB has estimated the modeled available groundwater for the Carrizo-Wilcox Aquifer that is consistent with the above desired future conditions for each groundwater conservation district within Groundwater Management Area 12.

METHODS:

Groundwater Management Area 12 contains the central portion of the Carrizo-Wilcox Aquifer, a major aquifer in Texas as defined in the 2007 State Water Plan (TWDB, 2007). The location of Groundwater Management Area 12, the Carrizo-Wilcox Aquifer, and the groundwater availability model cells that represent the aquifer are shown in Figure 1.

The groundwater conservation districts making up Groundwater Management Area 12 retained several consultants for assistance in developing desired future conditions for the Carrizo-Wilcox Aquifer. Through this process, a model simulation was performed using the groundwater availability model for the central portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers. The pumping used for this model simulation, referred to as "GAM12_7B" (Groundwater Management Area 12, 2010) in Appendix B of the resolution adopted by the districts of Groundwater Management Area 12, was delivered to the TWDB on September 10, 2010 by James Beach of LBG-Guyton Associates. The TWDB then performed an independent analysis confirming that the desired future conditions are physically possible and that the levels of pumping considered by the districts of Groundwater Management Area 12 in the pumping file for "GAM12_7B" (Groundwater Management Area 12, 2010) achieve the desired future conditions within the tolerances stated above. A comparison of the desired future conditions and the drawdowns calculated by the TWDB using the pumping file from model simulation "GAM12_7B" (Groundwater Management Area 12, 2010) is shown as an appendix to this report.

Since the model results using the pumping file for "GAM12_7B" (Groundwater Management Area 12, 2010) were consistent with the above desired future conditions they were used for the modeled available groundwater below. This pumping was then divided by county, regional water planning area, river basin, and groundwater conservation district. These areas are shown in Figure 2.

PARAMETERS AND ASSUMPTIONS:

The parameters and assumptions for the model run using the groundwater availability model for the central portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers are described below:

- Version 2.02 of the groundwater availability model for the central portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers was used for this analysis. See Dutton and others (2003) and Kelley and others (2004) for assumptions and limitations of the groundwater availability model.

- This groundwater availability model includes eight layers, that generally correspond to (from top to bottom):

  1. the Sparta Aquifer (Layer 1),
  2. the Weches Confining Unit (Layer 2),
  3. the Queen City Aquifer (Layer 3),
  4. the Reklaw Confining Unit (Layer 4),
  5. the Carrizo Aquifer (Layer 5),
  6. the Upper Wilcox Aquifer (Calvert Bluff Formation Layer 6),
  7. the Middle Wilcox Aquifer (Simsboro Formation Layer 7), and
  8. the Lower Wilcox Aquifer (Hooper Formation Layer 8).

- The root mean squared error (a measure of the difference between simulated and measured water levels during model calibration) in the groundwater availability model is 22 feet for the Sparta Aquifer, 27 feet for the Queen City Aquifer, 36 feet for the Carrizo Aquifer, and 31 feet for the Simsboro Aquifer for the calibration period (1980 through 1989) and 24, 33, 32, and 43 feet for the same aquifers, respectively, in the verification period (1990 through 1999) (Kelley and others, 2004).

- Cells were assigned to individual counties, river basins, regional water planning areas, and groundwater conservation districts as shown in the August 3, 2010 version of the file that associates the model grid to political and natural boundaries for the Carrizo-Wilcox, Queen City, and Sparta aquifers. Note that some minor adjustments were made to the file to better reflect the relationship of model cells to political boundaries.

- The recharge used for the model run represents average recharge as described in Kelley and others (2004).

Modeled Available Groundwater and Permitting

As defined in Chapter 36 of the Texas Water Code, "modeled available groundwater" is the estimated average amount of water that may be produced annually to achieve a desired future condition. Groundwater conservation districts are required to consider modeled available groundwater, along with several other factors, when issuing permits in order to manage groundwater production to achieve the desired future condition(s). The other factors districts must consider include 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. The estimated amount of pumping exempt from permitting, which the TWDB is required to develop after soliciting input from applicable groundwater conservation districts, will be provided in a separate report.

RESULTS:

The modeled available groundwater for the Carrizo-Wilcox Aquifer in Groundwater Management Area 12 consistent with the above desired future conditions increases from approximately 196,000 acre-feet per year to 257,000 acre-feet per year between 2010 and 2060. This has been divided by county,

regional water planning area, and river basin for each decade between 2010 and 2060 for use in the regional water planning process (Table 2).

The modeled available groundwater is also summarized for the Carrizo-Wilcox Aquifer as a whole and each unit of the aquifer shown in the above desired future conditions (Carrizo, Calvert Bluff, Simsboro, and Hooper). In Tables 3 through 7, the modeled available groundwater in the aquifer as a whole and each unit of the aquifer is summarized by county. In Tables 8 through 12, modeled available groundwater is summarized by regional water planning area. Tables 13 through 17 contain modeled available groundwater summarized by river basin. Finally, Tables 18 through 22 contain modeled available groundwater in each unit summarized by groundwater conservation district. In Tables 18 through 22, note that the modeled available groundwater has been totaled both excluding and including areas outside of a groundwater conservation district.

LIMITATIONS:

The groundwater model used in developing estimates of modeled available groundwater is the best available scientific tool that can be used to estimate the pumping that will achieve the desired future conditions. Although the groundwater model used in this analysis is the best available scientific tool for this purpose, it, like all models, has limitations. 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 develop estimates of modeled available groundwater is the need to make assumptions about the location in the aquifer where future pumping will occur. As actual pumping changes in the future, it will be necessary to evaluate the amount of that pumping as well as its location in the context of the assumptions associated with this analysis. Evaluating the amount and location of future pumping is as important as evaluating the changes in groundwater levels, spring flows, and other metrics that describe the condition of the groundwater resources in the area that relate to the adopted desired future condition.

Given these limitations, users of this information are cautioned that the modeled available groundwater numbers should not be considered a definitive, permanent description of the amount of groundwater that can be pumped to meet the adopted desired future condition. 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 future groundwater pumping as well as whether or not they are achieving their desired future conditions. Because of the limitations of the model and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine the modeled available groundwater numbers given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future.

REFERENCES AND ASSOCIATED MODEL RUNS:

Dutton, A.R., Harden, B., Nicot, J.P., and O'Rourke, D., 2003, Groundwater availability model for the central part of the Carrizo-Wilcox Aquifer in Texas: Contract report to the Texas Water Development Board, 295 p.

Groundwater Management Area 12, 2010, Resolution to Adopt Desired Future Conditions for Aquifer(s) in Groundwater Management Area 12, 62 p.

Kelley, V. A., Deeds, N. E., Fryar, D. G., and Nicot, J. P., 2004, Groundwater availability models for the Queen City and Sparta aquifers: Contract report to the Texas Water Development Board, 867 p.

Texas Water Development Board, 2007, Water for Texas – 2007—Volumes I-III; Texas Water Development Board Document No. GP-8-1, 392 p.

Table 2. Modeled available groundwater in acre-feet for the Carrizo-Wilcox Aquifer in Groundwater Management Area 12 by county, regional water planning area, and river basin.

County	Regional Water Planning Area	Basin	Year					
			2010	2020	2030	2040	2050	2060
Bastrop	K	Brazos	6,302	4,864	4,013	4,497	4,293	4,372
		Colorado	10,559	15,109	16,647	19,641	22,360	22,734
		Guadalupe	5	6	6	695	1,365	1,392
Brazos	G	Brazos	33,925	38,835	44,847	49,421	53,970	57,169
Burleson	G	Brazos	3,750	23,249	28,047	32,518	36,492	38,701
Falls	G	Brazos	865	867	875	884	895	895
Fayette	K	Colorado	683	683	683	683	683	683
		Guadalupe	317	317	317	317	317	317
Freestone	C	Brazos	874	885	869	863	848	848
		Trinity	4,264	4,420	4,448	4,452	4,414	4,411
Lee	G	Brazos	21,363	23,036	22,341	23,513	25,464	25,989
		Colorado	896	987	1,061	1,111	1,363	1,391
Leon	H	Brazos	4,431	3,612	3,403	3,325	3,351	3,356
		Trinity	10,251	10,863	11,244	11,567	11,821	11,840
Limestone	G	Brazos	11,321	11,306	11,436	11,616	11,918	11,918
Madison	H	Brazos	377	379	369	350	333	332
		Trinity	2,461	2,480	2,399	2,304	2,219	2,210
Milam	G	Brazos	38,183	23,923	20,206	19,112	21,359	22,319
Navarro	C	Trinity	15	15	15	15	15	15
Robertson	G	Brazos	44,886	45,435	45,814	46,238	46,582	46,583
Williamson	G	Brazos	7	7	7	7	7	7
		Colorado	0	0	0	0	0	0
Total			**195,735**	**211,278**	**219,047**	**233,129**	**250,069**	**257,482**

Table 3. Modeled available groundwater for the Carrizo-Wilcox Aquifer summarized by county in Groundwater Management Area 12 for each decade between 2010 and 2060. Results are in acre-feet per year.

County	Year					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Bastrop	16,866	19,979	20,666	24,833	28,018	28,498
Brazos	33,925	38,835	44,847	49,421	53,970	57,169
Burleson	3,750	23,249	28,047	32,518	36,492	38,701
Falls	865	867	875	884	895	895
Fayette	1,000	1,000	1,000	1,000	1,000	1,000
Freestone	5,138	5,305	5,317	5,315	5,262	5,259
Lee	22,259	24,023	23,402	24,624	26,827	27,380
Leon	14,682	14,475	14,647	14,892	15,172	15,196
Limestone	11,321	11,306	11,436	11,616	11,918	11,918
Madison	2,838	2,859	2,768	2,654	2,552	2,542
Milam	38,183	23,923	20,206	19,112	21,359	22,319
Navarro	15	15	15	15	15	15
Robertson	44,886	45,435	45,814	46,238	46,582	46,583
Williamson	7	7	7	7	7	7
Total	**195,735**	**211,278**	**219,047**	**233,129**	**250,069**	**257,482**

Table 4. Modeled available groundwater for the Carrizo portion of the Carrizo-Wilcox Aquifer summarized by county in Groundwater Management Area 12 for each decade between 2010 and 2060. Results are in acre-feet per year.

County	Year					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Bastrop	1,646	2,143	2,446	2,999	3,769	3,845
Brazos	3,253	3,721	3,728	3,741	3,764	3,766
Burleson	3,706	4,385	4,824	5,701	5,920	6,578
Falls	-	-	-	-	-	-
Fayette	1,000	1,000	1,000	1,000	1,000	1,000
Freestone	200	199	197	195	191	190
Lee	4,964	5,475	5,912	6,264	8,031	8,207
Leon	8,717	8,278	8,220	8,272	8,349	8,356
Limestone	-	-	-	-	-	-
Madison	2,838	2,859	2,768	2,654	2,552	2,542
Milam	319	321	353	417	433	481
Navarro	-	-	-	-	-	-
Robertson	1,732	1,707	1,697	1,712	1,729	1,730
Williamson	-	-	-	-	-	-
Total	**28,375**	**30,088**	**31,145**	**32,955**	**35,738**	**36,695**

Table 5. Modeled available groundwater for the Calvert Bluff portion of the Carrizo-Wilcox Aquifer summarized by county in Groundwater Management Area 12 for each decade between 2010 and 2060. Results are in acre-feet per year.

County	Year					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Bastrop	1,510	1,943	2,343	2,888	3,613	3,685
Brazos	0	0	0	0	0	0
Burleson	42	91	91	91	91	91
Falls	-	-	-	-	-	-
Fayette	0	0	0	0	0	0
Freestone	756	741	724	719	707	707
Lee	275	283	290	295	299	300
Leon	2,649	2,824	2,957	3,069	3,194	3,205
Limestone	215	218	223	228	235	235
Madison	0	0	0	0	0	0
Milam	460	947	947	947	947	947
Navarro	0	0	0	0	0	0
Robertson	1,777	1,762	1,756	1,756	1,755	1,755
Williamson	0	0	0	0	0	0
Total	**7,684**	**8,809**	**9,331**	**9,993**	**10,841**	**10,925**

Table 6. Modeled available groundwater for the Simsboro portion of the Carrizo-Wilcox Aquifer summarized by county in Groundwater Management Area 12 for each decade between 2010 and 2060. Results are in acre-feet per year.

County	Year					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Bastrop	12,585	14,514	14,209	16,900	18,094	18,423
Brazos	30,672	35,114	41,119	45,680	50,206	53,403
Burleson	1	17,687	21,616	25,103	28,858	30,409
Falls	139	140	141	143	146	146
Fayette	0	0	0	0	0	0
Freestone	3,348	3,560	3,570	3,569	3,536	3,535
Lee	16,971	18,217	17,153	18,016	18,450	18,826
Leon	3,316	3,373	3,470	3,551	3,629	3,635
Limestone	9,652	9,706	9,803	9,944	10,187	10,187
Madison	0	0	0	0	0	0
Milam	36,506	20,781	16,283	14,938	17,169	18,092
Navarro	4	4	4	4	4	4
Robertson	41,053	41,647	42,044	42,453	42,782	42,782
Williamson	2	2	2	2	2	2
Total	**154,249**	**164,745**	**169,414**	**180,303**	**193,063**	**199,444**

Table 7. Modeled available groundwater for the Hooper portion of the Carrizo-Wilcox Aquifer summarized by county in Groundwater Management Area 12 for each decade between 2010 and 2060. Results are in acre-feet per year.

County	Year					
	2010	2020	2030	2040	2050	2060
Bastrop	1,125	1,379	1,668	2,046	2,542	2,545
Brazos	0	0	0	0	0	0
Burleson	1	1,086	1,516	1,623	1,623	1,623
Falls	726	727	734	741	749	749
Fayette	0	0	0	0	0	0
Freestone	834	805	826	832	828	827
Lee	49	48	47	49	47	47
Leon	0	0	0	0	0	0
Limestone	1,454	1,382	1,410	1,444	1,496	1,496
Madison	0	0	0	0	0	0
Milam	898	1,874	2,623	2,810	2,810	2,799
Navarro	11	11	11	11	11	11
Robertson	324	319	317	317	316	316
Williamson	5	5	5	5	5	5
Total	**5,427**	**7,636**	**9,157**	**9,878**	**10,427**	**10,418**

Table 8. Modeled available groundwater for the Carrizo-Wilcox Aquifer summarized by regional water planning area in Groundwater Management Area 12 for each decade between 2010 and 2060. Results are in acre-feet per year.

Regional Water Planning Area	Year					
	2010	2020	2030	2040	2050	2060
C	5,153	5,320	5,332	5,330	5,277	5,274
G	155,196	167,645	174,634	184,420	198,050	204,972
H	17,520	17,334	17,415	17,546	17,724	17,738
K	17,866	20,979	21,666	25,833	29,018	29,498
Total	**195,735**	**211,278**	**219,047**	**233,129**	**250,069**	**257,482**

Table 9. Modeled available groundwater for the Carrizo portion of the Carrizo-Wilcox Aquifer summarized by regional water planning area in Groundwater Management Area 12 for each decade between 2010 and 2060. Results are in acre-feet per year.

Regional Water Planning Area	Year					
	2010	2020	2030	2040	2050	2060
C	200	199	197	195	191	190
G	13,974	15,609	16,514	17,835	19,877	20,762
H	11,555	11,137	10,988	10,926	10,901	10,898
K	2,646	3,143	3,446	3,999	4,769	4,845
Total	**28,375**	**30,088**	**31,145**	**32,955**	**35,738**	**36,695**

Table 10. Modeled available groundwater for the Calvert Bluff portion of the Carrizo-Wilcox Aquifer summarized by regional water planning area in Groundwater Management Area 12 for each decade between 2010 and 2060. Results are in acre-feet per year.

Regional Water Planning Area	Year					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
C	756	741	724	719	707	707
G	2,769	3,301	3,307	3,317	3,327	3,328
H	2,649	2,824	2,957	3,069	3,194	3,205
K	1,510	1,943	2,343	2,888	3,613	3,685
Total	**7,684**	**8,809**	**9,331**	**9,993**	**10,841**	**10,925**

Table 11. Modeled available groundwater for the Simsboro portion of the Carrizo-Wilcox Aquifer summarized by regional water planning area in Groundwater Management Area 12 for each decade between 2010 and 2060. Results are in acre-feet per year.

Regional Water Planning Area	Year					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
C	3,352	3,564	3,574	3,573	3,540	3,539
G	134,996	143,294	148,161	156,279	167,800	173,847
H	3,316	3,373	3,470	3,551	3,629	3,635
K	12,585	14,514	14,209	16,900	18,094	18,423
Total	**154,249**	**164,745**	**169,414**	**180,303**	**193,063**	**199,444**

Table 12. Modeled available groundwater for the Hooper portion of the Carrizo-Wilcox Aquifer summarized by regional water planning area in Groundwater Management Area 12 for each decade between 2010 and 2060. Results are in acre-feet per year.

Regional Water Planning Area	Year					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
C	845	816	837	843	839	838
G	3,457	5,441	6,652	6,989	7,046	7,035
H	0	0	0	0	0	0
K	1,125	1,379	1,668	2,046	2,542	2,545
Total	**5,427**	**7,636**	**9,157**	**9,878**	**10,427**	**10,418**

Table 13. Modeled available groundwater for the Carrizo-Wilcox Aquifer summarized by river basin in Groundwater Management Area 12 for each decade between 2010 and 2060. Results are in acre-feet per year.

Basin	Year					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Brazos	166,284	176,398	182,227	192,344	205,512	212,489
Colorado	12,138	16,779	18,391	21,435	24,406	24,808
Guadalupe	322	323	323	1,012	1,682	1,709
Trinity	16,991	17,778	18,106	18,338	18,469	18,476
Total	**195,735**	**211,278**	**219,047**	**233,129**	**250,069**	**257,482**

Table 14. Modeled available groundwater for the Carrizo portion of the Carrizo-Wilcox Aquifer summarized by river basin in Groundwater Management Area 12 for each decade between 2010 and 2060. Results are in acre-feet per year.

Basin	Year					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Brazos	16,871	17,602	18,221	19,376	21,148	22,007
Colorado	3,118	3,682	4,047	3,970	4,337	4,413
Guadalupe	320	321	321	1,010	1,680	1,707
Trinity	8,066	8,483	8,556	8,599	8,573	8,568
Total	**28,375**	**30,088**	**31,145**	**32,955**	**35,738**	**36,695**

Table 15. Modeled available groundwater for the Calvert Bluff portion of the Carrizo-Wilcox Aquifer summarized by river basin in Groundwater Management Area 12 for each decade between 2010 and 2060. Results are in acre-feet per year.

Basin	Year					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Brazos	3,505	4,083	4,104	4,125	4,122	4,127
Colorado	1,462	1,875	2,260	2,795	3,531	3,601
Guadalupe	1	1	1	1	1	1
Trinity	2,716	2,850	2,966	3,072	3,187	3,196
Total	**7,684**	**8,809**	**9,331**	**9,993**	**10,841**	**10,925**

Table 16. Modeled available groundwater for the Simsboro portion of the Carrizo-Wilcox Aquifer summarized by river basin in Groundwater Management Area 12 for each decade between 2010 and 2060. Results are in acre-feet per year.

Basin	Year					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Brazos	142,336	149,143	153,108	161,705	173,057	179,179
Colorado	6,478	9,902	10,489	12,704	14,068	14,323
Guadalupe	1	1	1	1	1	1
Trinity	5,434	5,699	5,816	5,893	5,937	5,941
Total	**154,249**	**164,745**	**169,414**	**180,303**	**193,063**	**199,444**

Table 17. Modeled available groundwater for the Hooper portion of the Carrizo-Wilcox Aquifer summarized by river basin in Groundwater Management Area 12 for each decade between 2010 and 2060. Results are in acre-feet per year.

Basin	Year					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Brazos	3,572	5,570	6,794	7,138	7,185	7,176
Colorado	1,080	1,320	1,595	1,966	2,470	2,471
Guadalupe	0	0	0	0	0	0
Trinity	775	746	768	774	772	771
Total	**5,427**	**7,636**	**9,157**	**9,878**	**10,427**	**10,418**

Table 18. Modeled available groundwater for the Carrizo-Wilcox Aquifer summarized by groundwater conservation district (GCD) in Groundwater Management Area 12 for each decade between 2010 and 2060. Results are in acre-feet per year.

Groundwater Conservation District	Year					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Brazos Valley GCD	78,811	84,270	90,661	95,659	100,552	103,752
Fayette County GCD	1,000	1,000	1,000	1,000	1,000	1,000
Lost Pines GCD	39,125	44,002	44,068	49,457	54,845	55,878
Mid-East Texas GCD	22,658	22,639	22,732	22,861	22,986	22,997
Post Oak Savannah GCD	41,933	47,172	48,253	51,630	57,851	61,020
Total (excluding non-district areas)	**183,527**	**199,083**	**206,714**	**220,607**	**237,234**	**244,647**
No District	12,208	12,195	12,333	12,522	12,835	12,835
Total (including non-district areas)	**195,735**	**211,278**	**219,047**	**233,129**	**250,069**	**257,482**

Table 19. Modeled available groundwater for the Carrizo portion of the Carrizo-Wilcox Aquifer summarized by groundwater conservation district (GCD) in Groundwater Management Area 12 for each decade between 2010 and 2060. Results are in acre-feet per year.

Groundwater Conservation District	Year					
	2010	2020	2030	2040	2050	2060
Brazos Valley GCD	4,985	5,428	5,425	5,453	5,493	5,496
Fayette County GCD	1,000	1,000	1,000	1,000	1,000	1,000
Lost Pines GCD	6,610	7,618	8,358	9,263	11,800	12,052
Mid-East Texas GCD	11,755	11,336	11,185	11,121	11,092	11,088
Post Oak Savannah GCD	4,025	4,706	5,177	6,118	6,353	7,059
Total (excluding non-district areas)	**28,375**	**30,088**	**31,145**	**32,955**	**35,738**	**36,695**
No District	-	-	-	-	-	-
Total (including non-district areas)	**28,375**	**30,088**	**31,145**	**32,955**	**35,738**	**36,695**

Table 20. Modeled available groundwater for the Calvert Bluff portion of the Carrizo-Wilcox Aquifer summarized by groundwater conservation district (GCD) in Groundwater Management Area 12 for each decade between 2010 and 2060. Results are in acre-feet per year.

Groundwater Conservation District	Year					
	2010	2020	2030	2040	2050	2060
Brazos Valley GCD	1,777	1,762	1,756	1,756	1,755	1,755
Fayette County GCD	0	0	0	0	0	0
Lost Pines GCD	1,785	2,226	2,633	3,183	3,912	3,985
Mid-East Texas GCD	3,405	3,565	3,681	3,788	3,901	3,912
Post Oak Savannah GCD	502	1,038	1,038	1,038	1,038	1,038
Total (excluding non-district areas)	**7,469**	**8,591**	**9,108**	**9,765**	**10,606**	**10,690**
No District	215	218	223	228	235	235
Total (including non-district areas)	**7,684**	**8,809**	**9,331**	**9,993**	**10,841**	**10,925**

Table 21. Modeled available groundwater for the Simsboro portion of the Carrizo-Wilcox Aquifer summarized by groundwater conservation district (GCD) in Groundwater Management Area 12 for each decade between 2010 and 2060. Results are in acre-feet per year.

Groundwater Conservation District	**Year**					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Brazos Valley GCD	71,725	76,761	83,163	88,133	92,988	96,185
Fayette County GCD	0	0	0	0	0	0
Lost Pines GCD	29,556	32,731	31,362	34,916	36,544	37,249
Mid-East Texas GCD	6,664	6,933	7,040	7,120	7,165	7,170
Post Oak Savannah GCD	36,507	38,468	37,899	40,041	46,027	48,501
Total (excluding non-district areas)	**144,452**	**154,893**	**159,464**	**170,210**	**182,724**	**189,105**
No District	9,797	9,852	9,950	10,093	10,339	10,339
Total (including non-district areas)	**154,249**	**164,745**	**169,414**	**180,303**	**193,063**	**199,444**

Table 22. Modeled available groundwater for the Hooper portion of the Carrizo-Wilcox Aquifer summarized by groundwater conservation district (GCD) in Groundwater Management Area 12 for each decade between 2010 and 2060. Results are in acre-feet per year.

Groundwater Conservation District	**Year**					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Brazos Valley GCD	324	319	317	317	316	316
Fayette County GCD	0	0	0	0	0	0
Lost Pines GCD	1,174	1,427	1,715	2,095	2,589	2,592
Mid-East Texas GCD	834	805	826	832	828	827
Post Oak Savannah GCD	899	2,960	4,139	4,433	4,433	4,422
Total (excluding non-district areas)	**3,231**	**5,511**	**6,997**	**7,677**	**8,166**	**8,157**
No District	2,196	2,125	2,160	2,201	2,261	2,261
Total (including non-district areas)	**5,427**	**7,636**	**9,157**	**9,878**	**10,427**	**10,418**

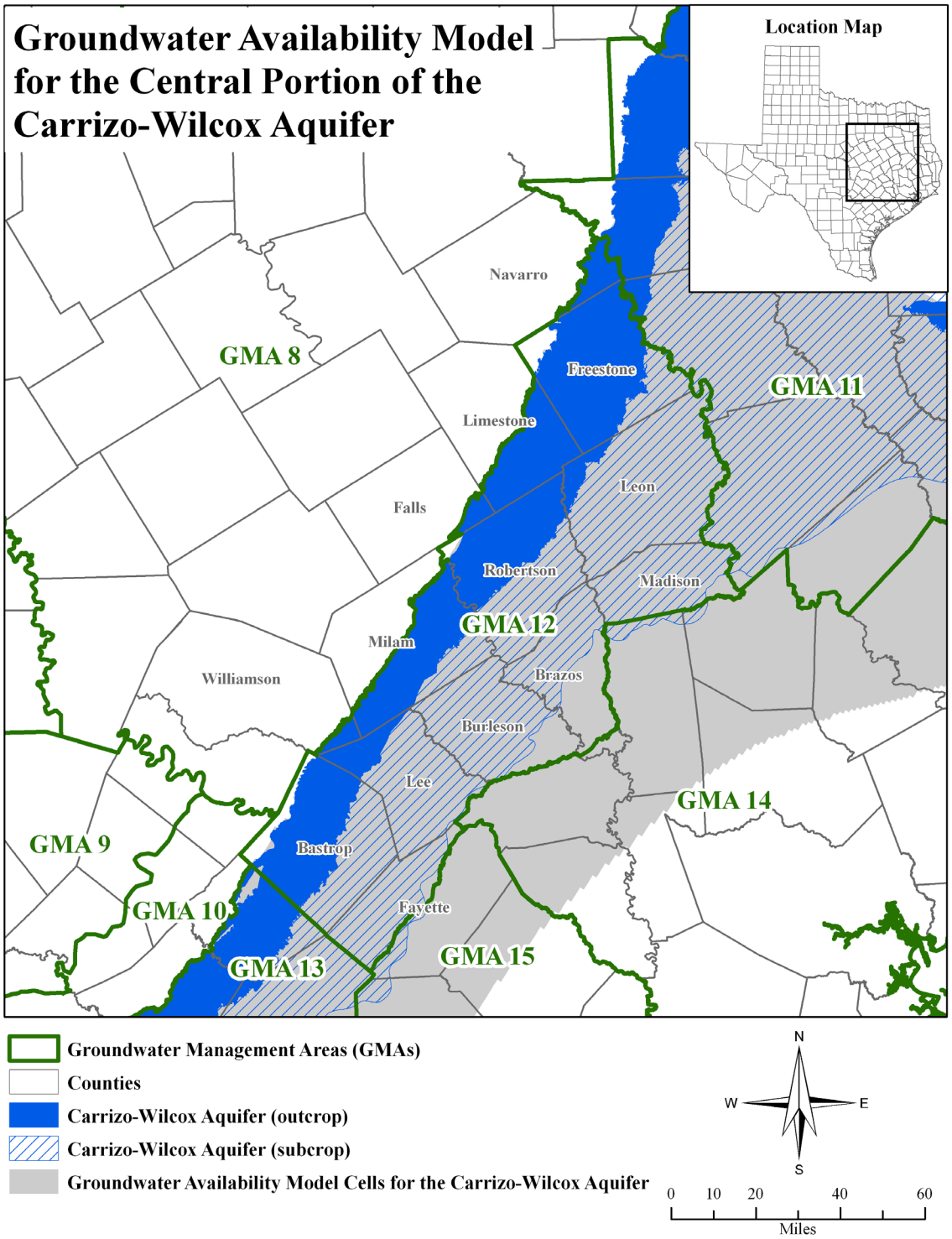

Figure 1. Map showing the areas covered by the groundwater availability model for the central portion of the Carrizo-Wilcox Aquifer and the boundary of Groundwater Management Area 12.

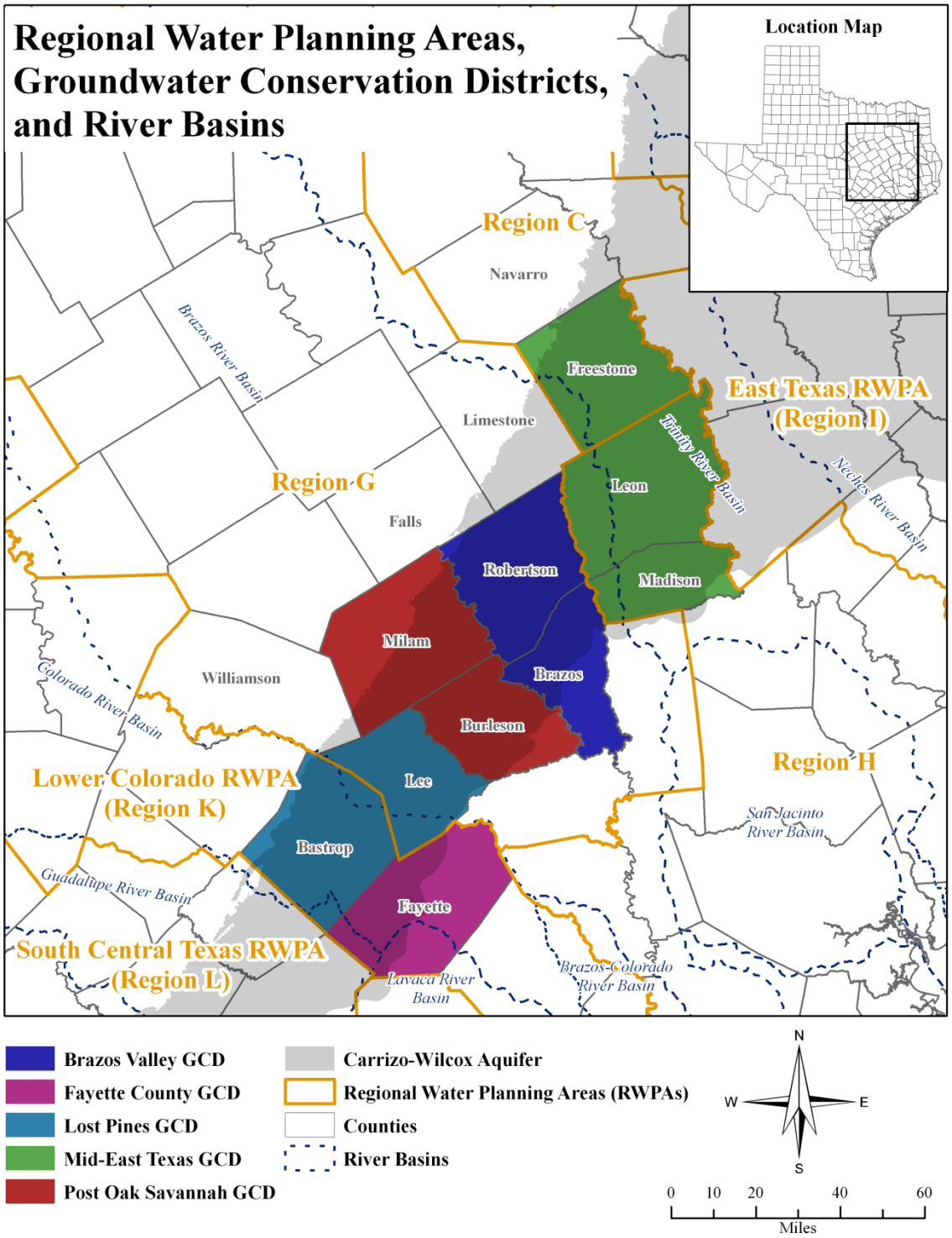

Figure 2. Map showing regional water planning areas (RWPAs), groundwater conservation districts (GCDs), counties, and river basins in and neighboring Groundwater Management Area 12.

Appendix

Comparison of Model Results to Desired Future Conditions

Table A-1. Comparison table showing Groundwater Management Area 12 adopted desired future conditions for the units of the Carrizo-Wilcox Aquifer, associated drawdowns presented in Appendix B of the desired future condition resolution, and the drawdowns calculated by the TWDB using the same pumping (well) file (Groundwater Management Area 12, 2010). All values are in feet of drawdown between January 2000 and December 2059.

Groundwater Conservation District or County	Aquifer Unit	Desired Future Condition	Calculated Drawdowns in Appendix B of Resolution	TWDB Calculated Drawdowns	Difference Between Desired Future Condition and TWDB Calculated Drawdowns
Brazos Valley	Carrizo	47	48	48	-1
	Calvert Bluff	106	109	109	-3
	Simsboro	270	271	271	-1
	Hooper	170	177	177	-7
Fayette County	Carrizo	60	59	59	1
	Calvert Bluff	-	126	126	-
	Simsboro	-	220	219	-
	Hooper	-	172	172	-
Lost Pines	Carrizo	47	47	47	0
	Calvert Bluff	99	94	94	5
	Simsboro	237	236	236	1
	Hooper	129	133	133	-4
Mid-East Texas	Carrizo	55	53	53	2
	Calvert Bluff	70	67	67	3
	Simsboro	115	114	114	1
	Hooper	95	96	96	-1
Post Oak Savannah	Carrizo	65	61	61	4
	Calvert Bluff	140	137	136	4
	Simsboro	300	298	297	3
	Hooper	180	178	178	2
Falls County	Carrizo	-	-	-	-
	Calvert Bluff	-	-	-	-
	Simsboro	0	-1	-1	1
	Hooper	20	20	20	0
Limestone County	Carrizo	-	-	-	-
	Calvert Bluff	9	9	10	-1
	Simsboro	43	43	43	0
	Hooper	40	40	40	0
Navarro County	Carrizo	-	-	-	-
	Calvert Bluff	0	-1	-1	1
	Simsboro	1	1	4	-3
	Hooper	1	1	4	-3
Williamson County	Carrizo	-	-	-	-
	Calvert Bluff	-10	-11	-11	1
	Simsboro	50	47	47	3
	Hooper	55	56	55	0