GMA 12 UPDATE TO THE GROUNDWATER AVAILABILITY MODEL FOR THE CENTRAL PORTION OF THE SPARTA, QUEEN CITY, AND CARRIZO-WILCOX AQUIFERS

Update to Improve Representation of the Transmissive Properties of the Simsboro Aquifer in the Vicinity of the Vista Ridge Well Field

Prepared for Groundwater Management Area 12 Members:
Brazos Valley Groundwater Conservation District
Fayette County Groundwater Conservation District
Lost Pines Groundwater Conservation District
Mid-East Texas Groundwater Conservation District
Post Oak Savannah Groundwater Conservation District

Prepared by GMA 12 Consultants:
INTERA Incorporated
D.B. Stephens & Associates
Ground Water Consultants, LLC

October 2020

GMA 12 UPDATE TO THE GROUNDWATER AVAILABILITY MODEL FOR THE CENTRAL PORTION OF THE SPARTA, QUEEN CITY, AND CARRIZO-WILCOX AQUIFERS

Update to Improve Representation of the Transmissive Properties of the Simsboro Aquifer in the Vicinity of the Vista Ridge Well Field

by:

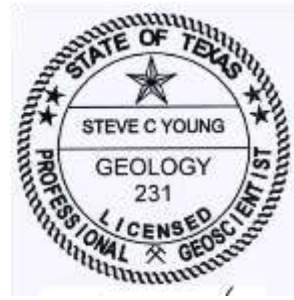
Steven C. Young, Ph.D, PE, PG
Ross Kushnereit, GIT
INTERA Inc
Austin, TX 78759

Contributors:

Andy Donnelly, D.B. Stephens & Associates
John Seifert, Ground Water Consultants, LLC
Neil Deeds, INTERA Inc

Geoscientist and Engineering Seal

Dr. Steven Young was the technical lead responsible for developing the approach modified the groundwater model. He supervised the development and application of PEST for model calibration and the analysis of the aquifer pumping test.



September 25, 2020

EXECUTIVE SUMMARY

In April 2020, the POSGCD and Groundwater Management Area (GMA) 12 obtained the aquifer pumping test data from Vista Ridge production wells, which are located in Burleson County. POSGCD compared the transmissivity values from these aquifer pumping tests to the transmissivity in the Groundwater Availability Model for the Central Portion of the Sparta/Queen City/ Carrizo-Wilcox aquifers. The comparison showed that the transmissivity values for the Carrizo Aquifer in the GAM closely matched those from the aquifer pumping tests but that the transmissivity values for the Simsboro Aquifer in the GAM do not closely match those from the Vista Ridge project pumping tests. On July 24, 2020, GMA 12 members unanimously voted to have the GMA 12 consultants revise the GAM so that it would better predict drawdown caused by pumping by the Vista Ridge Simsboro Aquifer screened wells.

The GMA 12 consultants agreed to modify the GAM by adjusting the hydraulic conductivity values of the Simsboro Aquifer in the vicinity of the Vista Ridge well field. The adjustments of the hydraulic conductivity values were determined by using the parameter optimization software called PEST (Doherty, 2018). These adjustments improved the capability of the GAM to simulate the results of the aquifer pumping tests at nine Vista Ridge wells pumping water from the Simsboro Aquifer. The objective function used by PEST included two criteria. One criterion was the match between measured and modeled drawdown. The other criterion was the match between the transmissivity values determined from the measured and simulated drawdown from the aquifer pumping test data using analysis method called the Cooper-Jacob Straight-Line method.

The primary modification of the GAM consisted of changing the hydraulic conductivity of the Simsboro Aquifer by an average ratio of 1.5 within a radial distance of about 15 miles of the Vista Ridge well field. The improved performance of the Modified GAM to reproduce the transmissivity values of the aquifer tests is summarized by the results provided in Tables ES-1 and ES-2 below.

Table ES-1 Average Transmissivity values calculated from the actual and simulated drawdown data from 36-hour aquifer tests conducted at the Nine Vista Ridge Simsboro Production Wells

Number of Wells	Aquifer Test		Transmissivity (ft^2/day)		
	Pumping Rate (gpm)	Duration (hrs)	Aquifer Tests	Modified GAM	Original GAM
9	3,008 to 3,503	36	15,195	15,207	6,599

Table ES-2 Transmissivity values calculated from the actual and simulated 23-day aquifer test conducted at the Vista Ridge Simsboro Production Well # 13

Well	Aquifer Test		Transmissivity (ft^2/day)		
	Pumping Rate (gpm)	Duration (days)	Aquifer Test	Modified GAM	Original GAM
PW-13	3110	36	15,871	15,756	8,453

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ACROYNMS AND ABBREVIATIONS

%	percent
AFY	acre-ft/year
CJSL	Cooper-Jacob Straight-Line method
ft^2/day	square feet per day
The GAM	Groundwater Availability Model for the Central Portion of the Sparta/Queen City/ Carrizo-Wilcox aquifers
GMA	Groundwater Management Area
gpm	gallons per minute
POSGCD	Post Oak Savannah Groundwater Conservation District
PW	Pumping Well
TWDB	Texas Water Development Board

1.0 INTRODUCTION

One of largest groundwater water supply projects in the state is the Vista Ridge Project which delivers water from the Simsboro Aquifer in Burleson County to San Antonio, Texas. The Vista Ridge Project has permits from the Post Oak Savannah Groundwater Conservation District (POSGCD) to pump approximately 35,000 acre-ft/year (AFY) and approximately 15,000 AFY of groundwater from the Simsboro and Carrizo Aquifers, respectively.

In April 2020, the POSGCD and Groundwater Management Area (GMA) 12 obtained the aquifer pumping test data from 18 of the Vista Ridge production wells, 9 of which were installed in the Carrizo Aquifer and 9 of which were installed in the Simsboro Aquifer. POSGCD compared the transmissivity values from these aquifer pumping tests to the transmissivity in the Groundwater Availability Model for the Central Portion of the Sparta/Queen City/ Carrizo-Wilcox aquifers (Young and others, 2018) (henceforth called the GAM). The comparison indicates that the transmissivity values for the Carrizo Aquifer in the GAM closely matches those from the aquifer pumping test but that the transmissivity values for the Simsboro Aquifer in the GAM do not closely match those from the field tests.

On July 24, 2020, GMA 12 members unanimously voted to have the GMA 12 consultants revise the GAM so that it would better predict drawdown caused by pumping by the Vista Ridge Simsboro wells.

2.0 VISTA RIDGE AQUIFER PUMPING TEST DATA

Figure 1 shows the locations of the nine Vista Ridge Simsboro wells. In April 2020, Blue Water Systems LP provided POSGCD data from a 36-hour pumping test for each well. In addition, Blue Water Systems LP provided a 23-day aquifer pumping test for well Pumping Well (PW) 13. The data from each of these nine aquifer tests have been added to an updated geodatabase and submitted to the Texas Water Development Board (TWDB) in a separate correspondence.

The transmissivity values from the GAM for the Simsboro Aquifer in the vicinity of the Vista Ridge production field are less than 10,000 square feet per day (ft^2/day). The analysis of the Vista Ridge aquifer tests yield transmissivity values between 11,000 ft^2/day and 20,000 ft^2/day.

3.0 GAM MODIFICATION IMPROVE SIMULATION OF RESULTS FROM AQUIFER PUMPING TESTS

The GAM was modified by adjusting the hydraulic conductivity values of the Simsboro aquifer within a radial distance of about 15 miles from the Vista Ridge well field. The radial distance of 15 miles is based on an estimated radius-of-influence determine from a 23-day aquifer pumping tests at Well PW-13 using the equations developed by Dagron, (1998). The adjustments of the hydraulic conductivity values were determined by the parameter optimization software called PEST (Doherty, 2018). The adjustments were made to improve the capability of the GAM to simulate the results of the aquifer pumping tests. PEST adjusted the hydraulic conductivity values using the pilot points at the locations shown in **Figure 2**. The objective function used by PEST included two criteria. One criterion was to minimize the difference between measured and modeled drawdown values during the pumping tests. The other criterion was to minimize the difference between the transmissivity values determined from the measured and modeled drawdown from the aquifer pumping test data using the Cooper-Jacob Straight-Line method (CJSL) (Cooper and Jacob, 1949). The modified version of the GAM is referred to as the Modified GAM throughout this report. **Figure 3** and **Figure 4** shows the Simsboro transmissivity values in the GAM (Young and others, 2018) and the Modified GAM, respectively.

Table 1, Figure 5 and **Figure 6** compare the transmissivity values calculated using drawdowns from the actual and simulated aquifer pumping tests. The aquifer tests were simulated by setting the initial conditions equal to the steady-state conditions and then performing the transient pumping simulation using 1-hour time steps. Table 1 compares the transmissivity values calculated from each well based on the 36-hour pumping tests. Table 1 shows that the average transmissivity value of 15,207 ft^2/day from Modified GAM provides a much better match to the average transmissivity value of 15,195 ft^2/day from the actual aquifer tests than does the average transmissivity value of 6,599 ft^2/day from the GAM. Figure 5 compares the transmissivities calculated at each of the nine wells using the measured water levels and the simulated water levels generated by the GAM (Young and others, 2018). Figure 6 compares the transmissivities calculated at each of the nine wells using the measured water levels and the simulated water levels generated by the Modified GAM. The results in Table 1 and in Figures 5 and 6 show that the Modified GAM provides a significantly better representation of the Simsboro transmissivity values than does the GAM.

Table 1 Transmissivity values calculated from the actual and simulated 36-hour aquifer tests conducted at the nine Vista Ridge Simsboro production wells

Well	Aquifer Test		Transmissivity (ft^2/day)		
	Pumping Rate (gpm)	Duration (hrs)	Aquifer Test	Modified GAM	GAM
PW-9	3110	36	10,928	11,648	5,607
PW-10	3008	36	13,906	15,709	5,979
PW-11	3110	36	17,335	15,709	5,979
PW-12	3110	36	19,785	17,034	7,326
PW-13	3110	36	14,559	16,142	7,036
PW-14	3,008	36	14,664	16,776	7,297
PW-15	3503	36	15,215	13,583	7,175
PW-16	3110	36	10,736	14,552	7,011
PW-17	3110	36	19,629	15,709	5,979
		Average	15,195	15,207	6,599

Figures 7 through **15** show the measured drawdown values and the simulated drawdown values using the Modified GAM for the 36-hour aquifer tests for the nine wells listed in Table 1. The aquifer pumping tests were simulated using the Connected Linear Network (CLN) package in MODFLOW-USG (Panday and others, 2015) to account for radial flow to a well and to account for well efficiencies less than 100 percent (%). The use of the CLN package does not affect the transmissivity values calculated by the CJSL

method but it allows for a more realistic simulation of drawdown, resulting in a better fit to data measured in a pumping well. The average value efficiency used for the nine wells is 91%.

Besides the 36-hour aquifer pumping tests, Blue Water Systems provided POSGCD with a 23-day pumping test conducted in Well PW-13. The water level data collected during the 23-day test indicate that aquifer hydraulic parameters remained consistent and no recognizable boundary to flow was encountered. **Table 2** compares the transmissivity calculated using the CJSL method on the measured water levels and the simulated water levels using the Modified GAM and the GAM (Young and others, 2018). The transmissivity from the aquifer pumping test is 15, 871 ft^2/day. The transmissivity from the simulation using the Modified GAM is less than 1% different from the transmissivity calculated from the aquifer pumping test data whereas the transmissivity from the simulation using the GAM is about 45% lower than the transmissivity calculated from the aquifer pumping test data. **Figure 16** shows the measured drawdown values and the simulated drawdown values using the Modified GAM for 23-day aquifer test at Well PW-13.

Table 2 Transmissivity values calculated from the actual and simulated 23-day aquifer tests conducted at the Vista Ridge Simsboro Production Well # 13

Well	Aquifer Test		Transmissivity (ft^2/day)		
	Pumping Rate (gpm)	Duration (days)	Aquifer Test	Modified GAM	GAM
PW-13	3110	23	15,871	15,756	8,453

4.0 IMPACT OF GAM MODIFICATIONS ON MODEL CALIBRATION STATISTICS

This section describes that process of calibration to historical values of hydraulic heads and documents how the modifications to the GAM impacts the calibration statistics reported by Young and others (2018).

4.1 Calibration Metrics for Hydraulic Head Targets

Conventional calibration metrics associated with simulating hydraulic heads are based on residuals (Anderson and Woessner, 1992). A residual, *r*, is defined as the difference between an observed and a simulated hydraulic head per Equation 4-1.

$$r = h_o - h_s \qquad \text{(Equation 4-1)}$$

where:

r = residual,
h_o = observed hydraulic head, and
h_s = simulated hydraulic head.

The root mean square error, which is traditionally the basic measure of calibration for hydraulic heads, is defined as the square root of the average square of the residuals and is expressed mathematically by Equation 4-2. Although the root mean square error is useful for describing model error on an average basis, it does not provide insight into spatial trends in the distribution of the residuals. Information about the average error or bias is provided by the mean error and the mean absolute error. The mean error, which is described in Equation 4-3, is the average of the residuals. The absolute mean error, which is described in Equation 4-4, is the average of the absolute value of the mean error.

$$\text{Root Mean Squared Error} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(h_o - h_s)_i^2} \quad \text{(Equation 4-2)}$$

$$\text{Mean Error} = \frac{1}{n}\sum_{i=1}^{n}(h_o - h_s)_i \quad \text{(Equation 4-3)}$$

$$\text{Absolute Mean Error} = \frac{1}{n}\sum_{i=1}^{n}|h_o - h_s|_i \quad \text{(Equation 4-4)}$$

where:

n = number of observations

A typical calibration criterion for hydraulic heads is that the root mean square error and the mean absolute error are less than or equal to 10% of the observed hydraulic head range in the hydrogeologic unit being simulated. The mean absolute error is useful for describing model error on an average basis but does not provide insight into spatial trends in the distribution of residuals. Examination of the distribution of residuals is necessary to determine if they are randomly distributed over the model grid and not spatially biased. The goodness or acceptability of a set of residuals and their statistics is model- and site-dependent and based on the wide range of possible sources of error and uncertainty in a model simulation.

4.2 Statistics for Hydraulic Head Residuals for Steady-State Conditions

The hydraulic head data set used to check the calibration of the Modified GAM for the 1930 steady state condition is identical to the data set used by Young and others (2018) to calibrate the GAM. **Table 3** presents the calibration statistics for steady-state conditions in 1930 for the entire model domain for both the GAM and the Modified GAM. The results in Table 3 show the Modified GAM produces root-mean square errors for the hydrogeologic unit that are within a few tenths of a foot of the calibration statistics produced by the GAM. The calibration statistics were calculated using the routines in Groundwater Vistas (Rumbaugh and Rumbaugh, 2017).

Table 3 Calibration statistics for steady-state conditions for all hydraulic heads in the entire model domain

Hydrogeologic Unit	Count	Mean Error (ft)		Mean Absolute Error (ft)		Root Mean Square Error (ft)		Measured Range (ft)
		GAM	Modified GAM	GAM	Modified GAM	GAM	Modified GAM	
Alluvium	8	11.4	11.4	12.6	12.6	15.3	15.3	21
Sparta	61	-2.5	-2.5	19.9	19.9	25.4	25.4	323
Weches	15	1.5	1.5	13.3	13.3	16.4	16.4	333
Queen City	163	-5.2	-5.2	15.5	15.5	21.0	21.0	310
Reklaw	18	-2.9	-2.9	19.3	19.3	24.9	24.9	218
Carrizo	39	-7.0	-7.0	24.2	24.2	31.5	31.5	285
Calvert Bluff	144	9.1	9.1	20.4	20.4	26.1	26.1	296
Simsboro	17	21.3	21.1	22.7	22.5	29.9	29.8	220
Hooper	57	-5.2	-5.2	13.7	13.7	18.2	18.2	290
All	522	0.3	0.3	18.1	18.1	23.9	23.9	401

4.3 Statistics for Hydraulic Head Residuals for Transient Conditions

The hydraulic head data set used to check the calibration of the Modified GAM over the time period from 1930 to 2010 is identical to the data set used by Young and others (2018) to calibrate the GAM. **Table 4** presents the calibration statistics for the transient calibration for the entire model domain for both the GAM and the Modified GAM. The results in Table 5 show the Modified GAM produces root-mean square errors for the hydrogeologic units that are within a few tenths of a foot of the calibration statistics produced by the GAM except for the Simsboro Aquifer. The Modified GAM's root-mean square error of 23.5 ft for the Simsboro Aquifer is approximately 0.4 feet greater than the root-mean square error of 23.1 produced by the GAM for the Simsboro Aquifer. However, the Modified GAM's root-mean square error of 23.5 ft for the Simsboro Aquifer is only about 4% of the range of 609 ft in the entire Simsboro Aquifer. The Modified GAM's root-mean square error of 22.7 ft for all aquifers is approximately 3% of the range of 845 ft in all aquifers. The calibration statistics were calculated using the routines in Groundwater Vistas (Rumbaugh and Rumbaugh, 2017)

Table 4 Calibration statistics for transient conditions based on the equal-by-observed-head weighting scheme for the entire model domain

Hydrogeologic Unit	Count	Mean Error (ft)		Mean Absolute Error (ft)		Root Mean Square Error (ft)		Measured Range (ft)
		GAM	Modified GAM	GAM	Modified GAM	GAM	Modified GAM	
`Alluvium	802	-1.3	-1.4	4.4	4.4	5.7	5.7	81
Sparta	1,167	-3.0	-3.0	13.1	13.1	18.4	18.4	446
Weches	105	-1.9	-1.9	5.9	5.9	7.6	7.6	226
Queen City	1,493	-4.2	-4.2	13.6	13.6	19.9	19.9	414
Reklaw	505	-6.1	-6.1	12.3	12.3	16.3	16.3	423
Carrizo	3,392	-3.1	-3.1	18.0	18.0	29.6	29.7	727
Calvert Bluff	1,759	-2.8	-2.8	12.1	12.0	16.8	16.8	579
Simsboro	1,132	-8.7	-9.8	18.7	19.0	23.1	23.5	609
Hooper	1,023	-11.0	-11.0	17.6	17.6	24.1	24.1	308
All	11,378	-4.5	-4.6	14.7	14.7	22.6	22.7	845

5.0 REFERENCES

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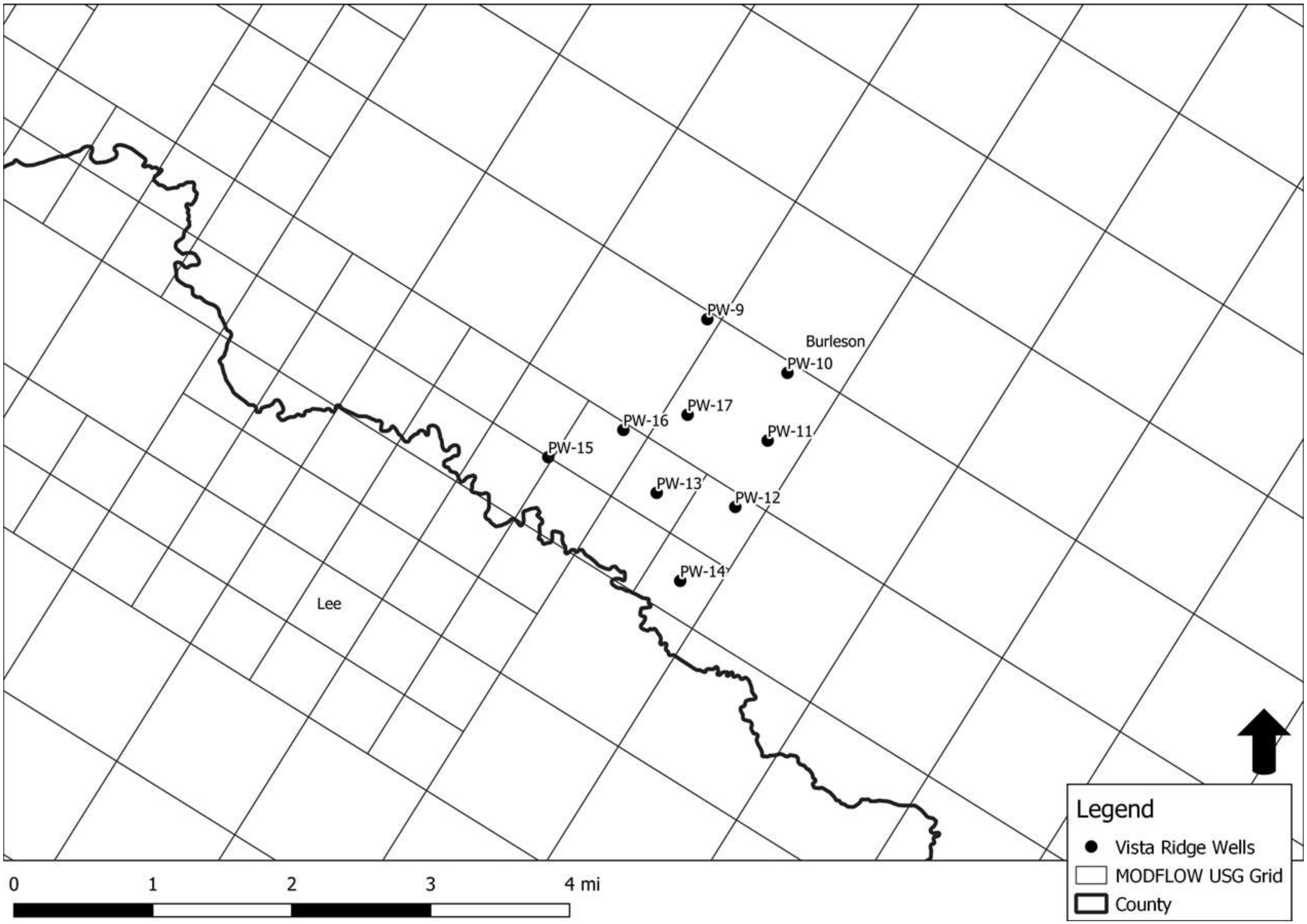

Figure 1 Locations of the nine Vista Ridge Simsboro wells in Burleson County overlaid on the MODFLOW-USG numerical grid used by the Groundwater Availability Model

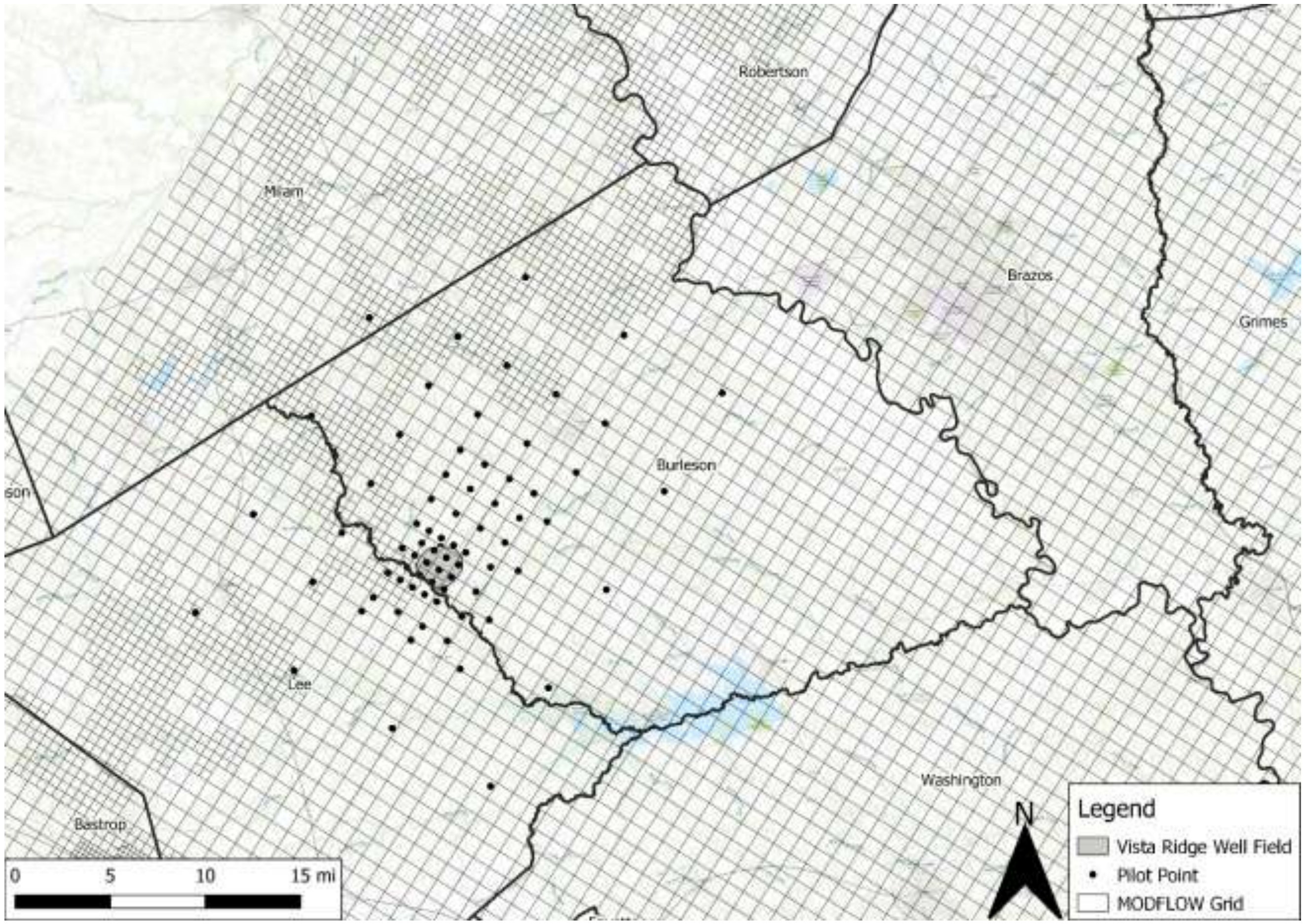

Figure 2 Locations of the pilot points used in PEST to adjust the hydraulic conductivity values during modeling calibration

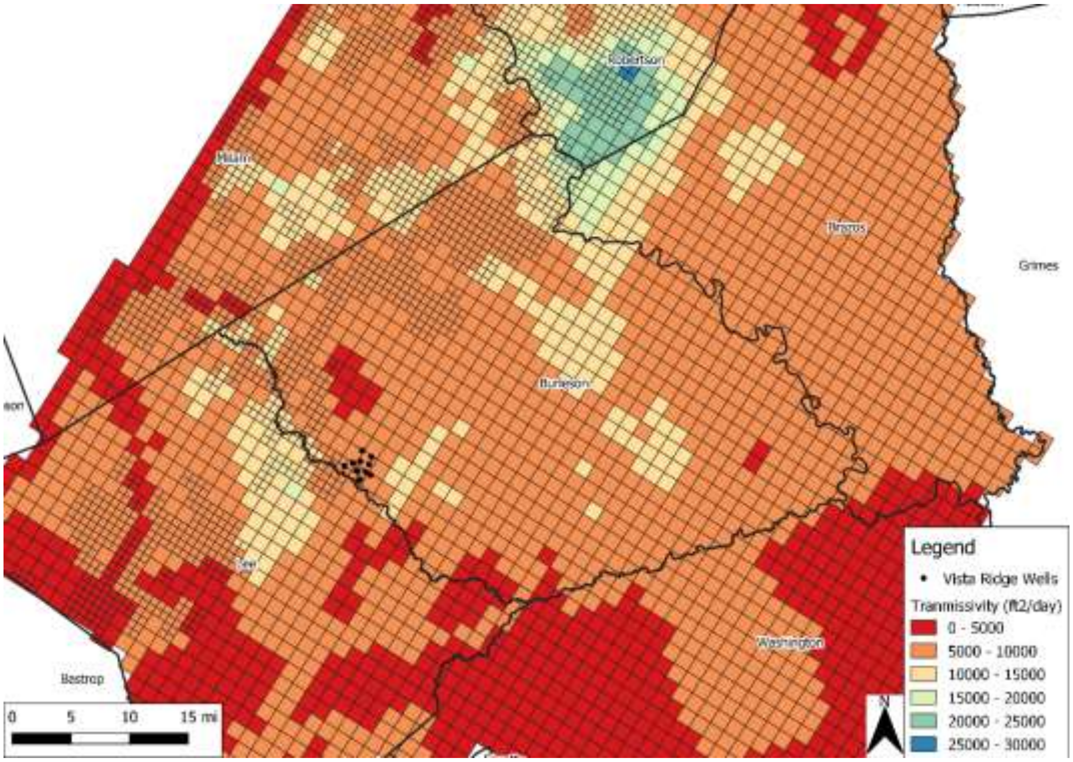

Figure 3 Simsboro Transmissivity Field in the GAM (Young and others, 2018)

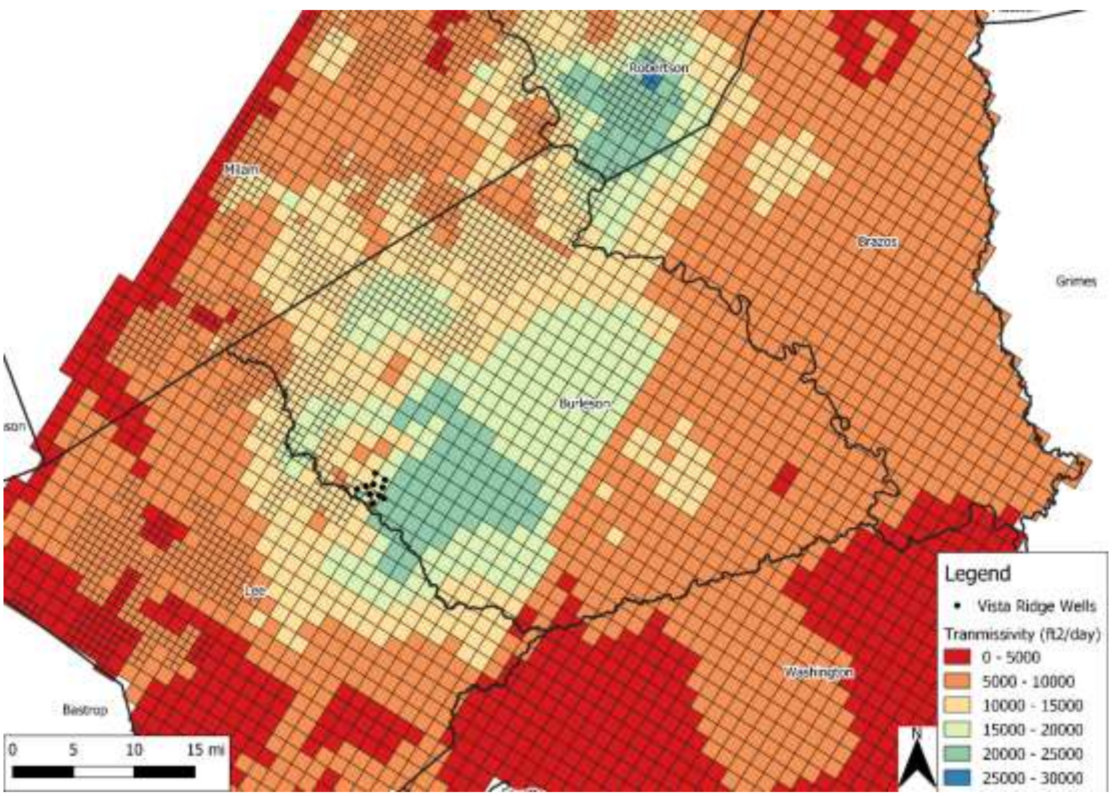

Figure 4 Simsboro Transmissivity Field in the Modified GAM

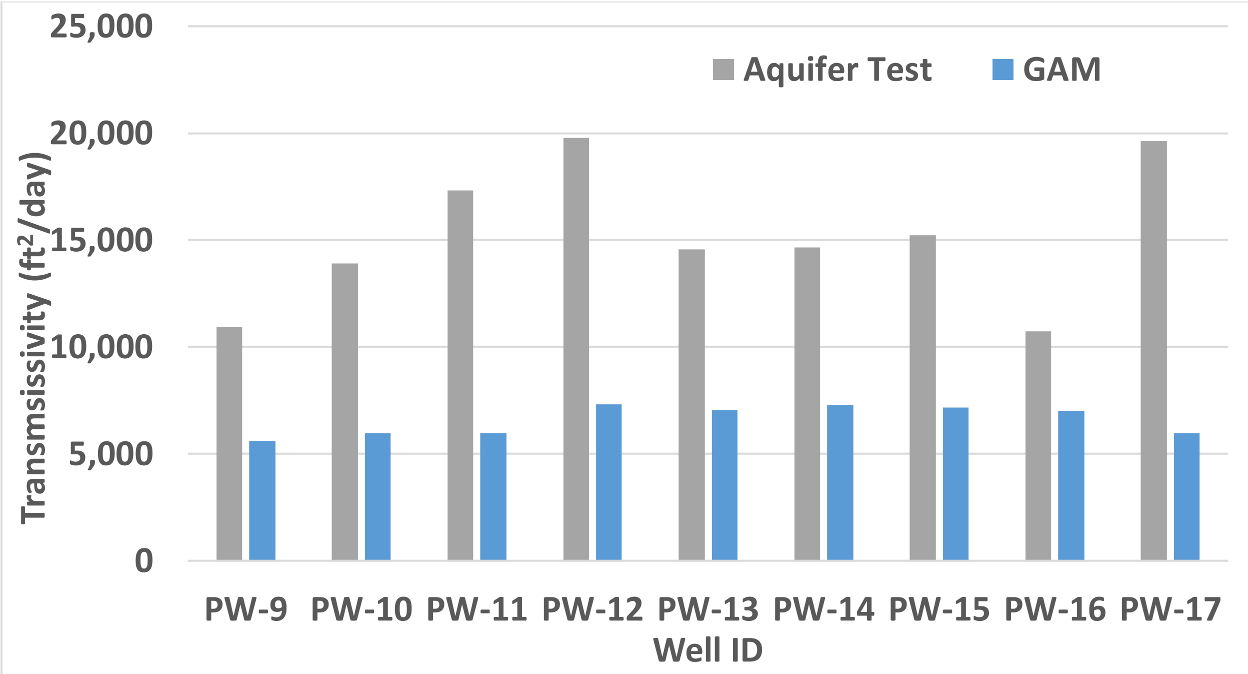

Figure 5 Transmissivity Values calculated using measured and simulated water levels from 36-hour aquifer tests at nine Vista Ridge Production Wells. The simulated water levels were produced using the GAM

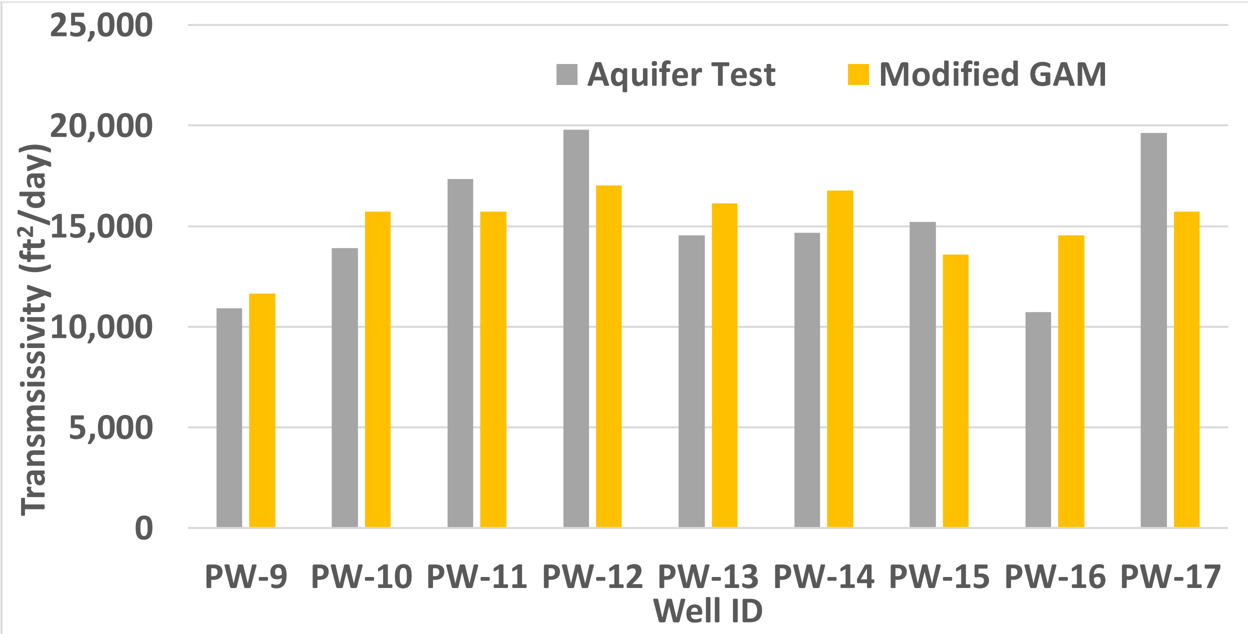

Figure 6 Transmissivity Values calculated using measured and simulated water levels from 36-hour aquifer tests at nine Vista Ridge Production Wells. The simulated water levels were produced using the Modified GAM

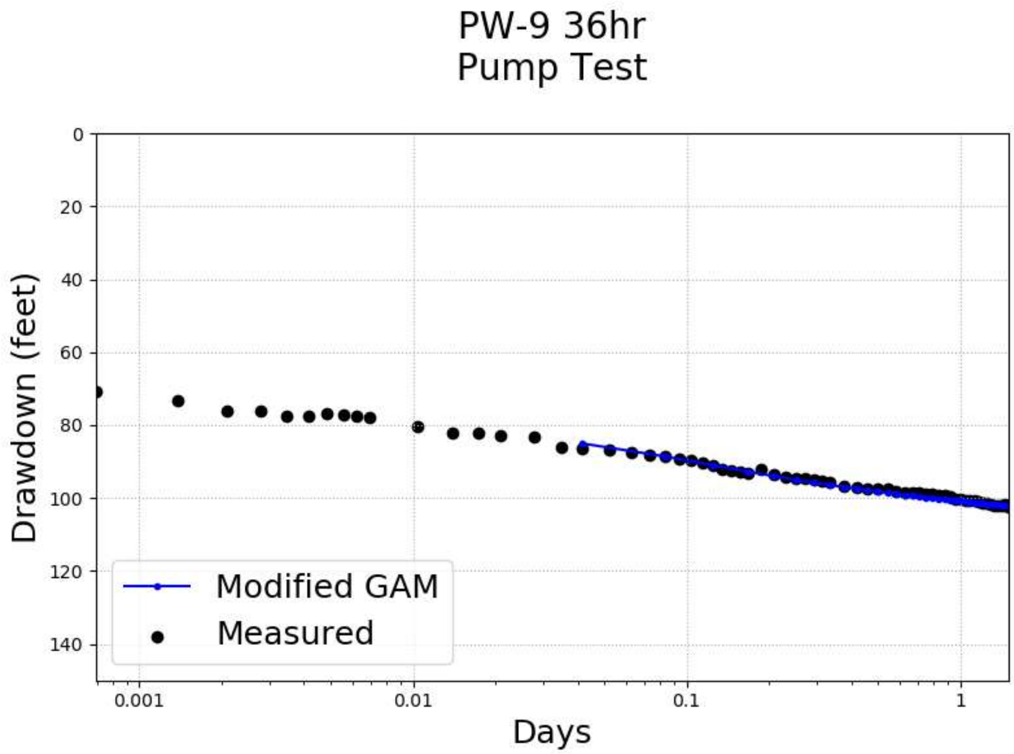

Figure 7 Measured and Simulated water levels for the 36-hour aquifer pumping test performed at Well PW-9

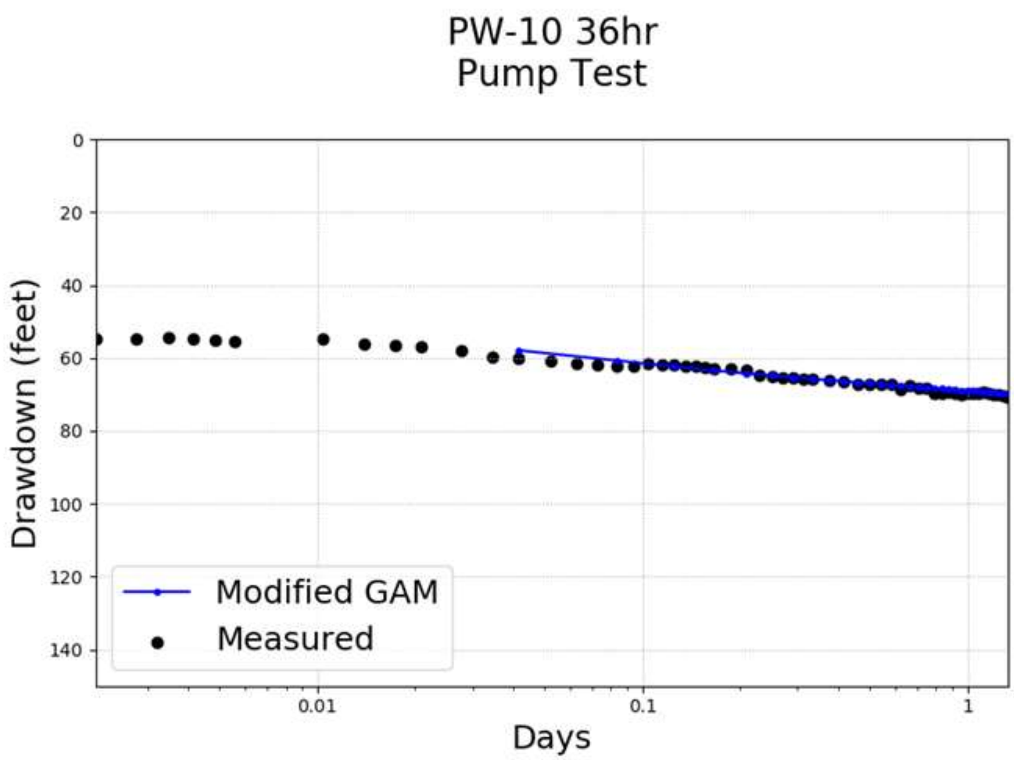

Figure 8 Measured and Simulated water levels for the 36-hour aquifer pumping test performed at Well PW-10

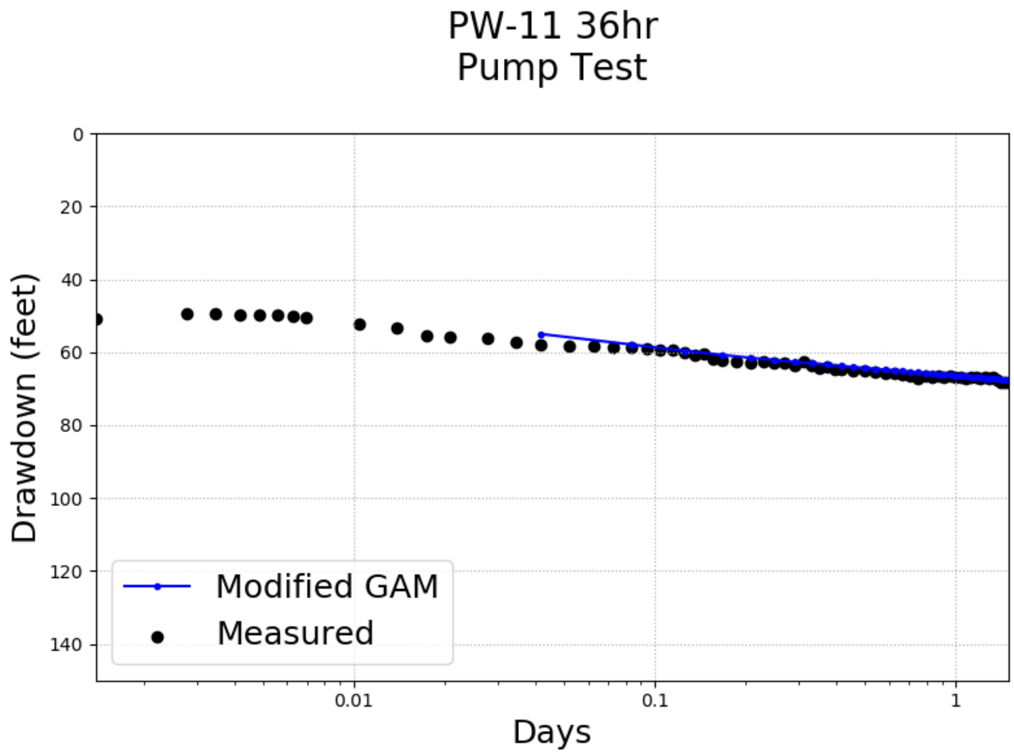

Figure 9 Measured and Simulated water levels for the 36-hour aquifer pumping test performed at Well PW-11

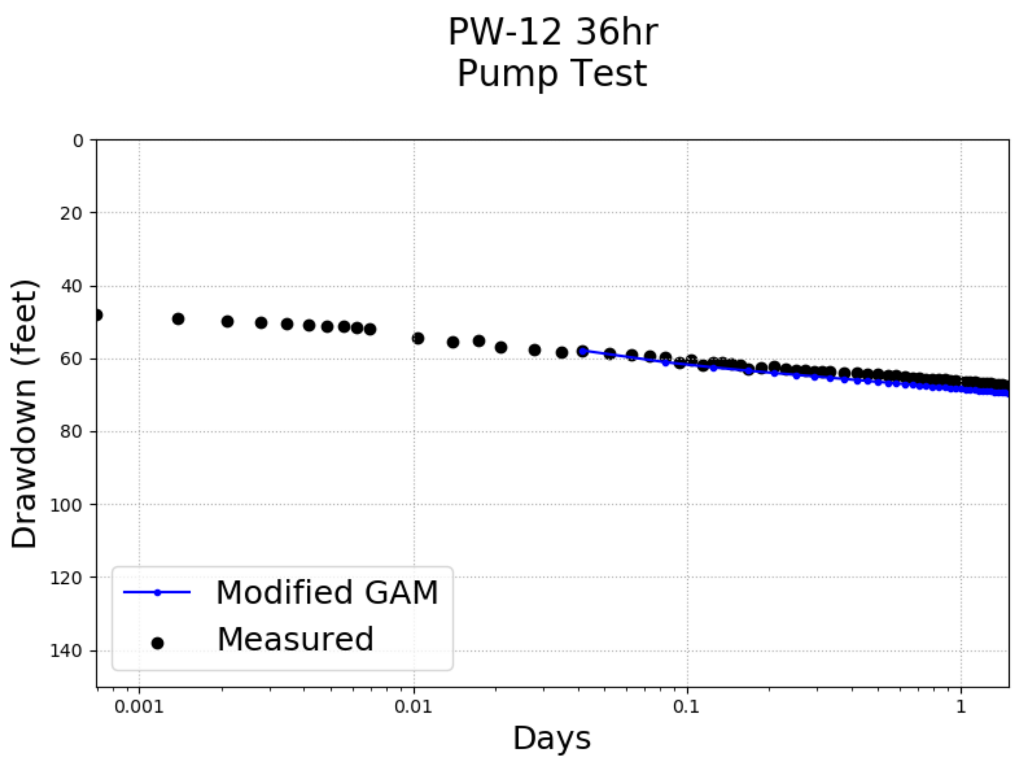

Figure 10 Measured and Simulated water levels for the 36-hour aquifer pumping test performed at Well PW-12

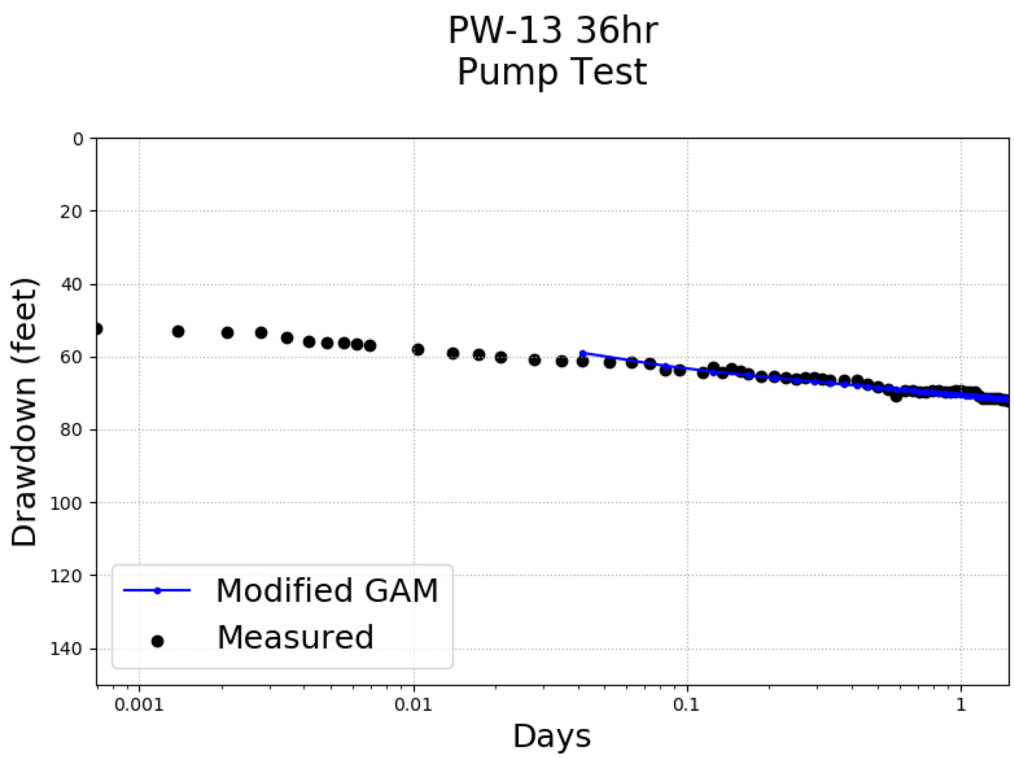

Figure 11 Measured and Simulated water levels for the 36-hour aquifer pumping test performed at Well PW-13

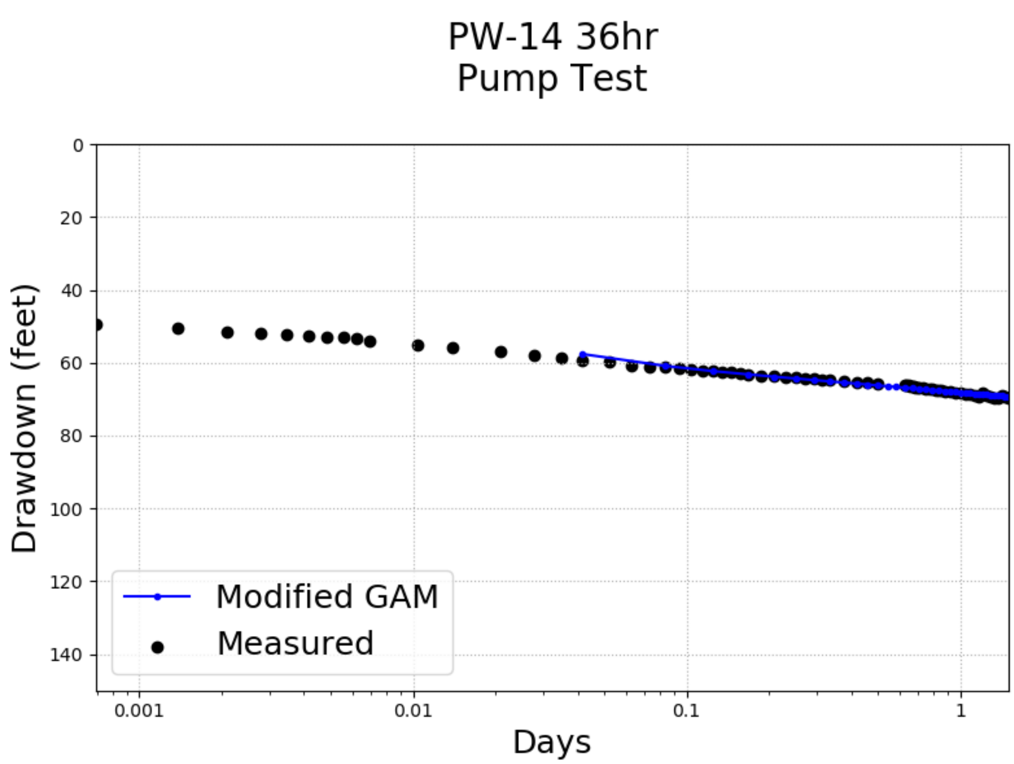

Figure 12 Measured and Simulated water levels for the 36-hour aquifer pumping test performed at Well PW-14

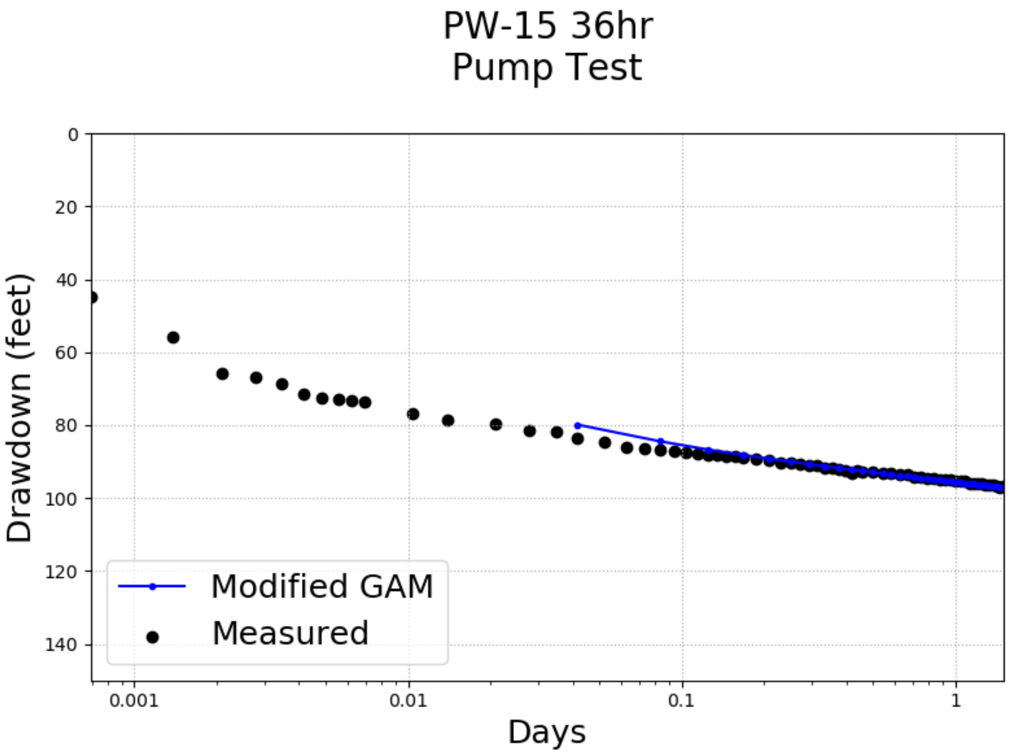

Figure 13 Measured and Simulated water levels for the 36-hour aquifer pumping test performed at Well PW-15

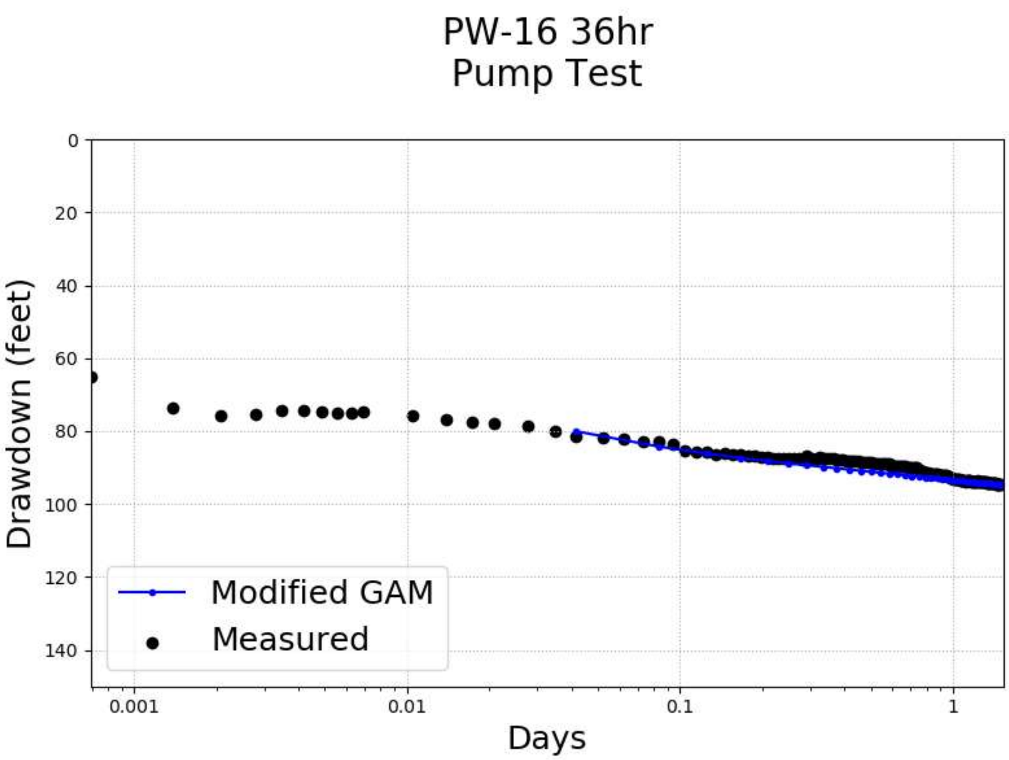

Figure 14 Measured and Simulated water levels for the 36-hour aquifer pumping test performed at Well PW-16

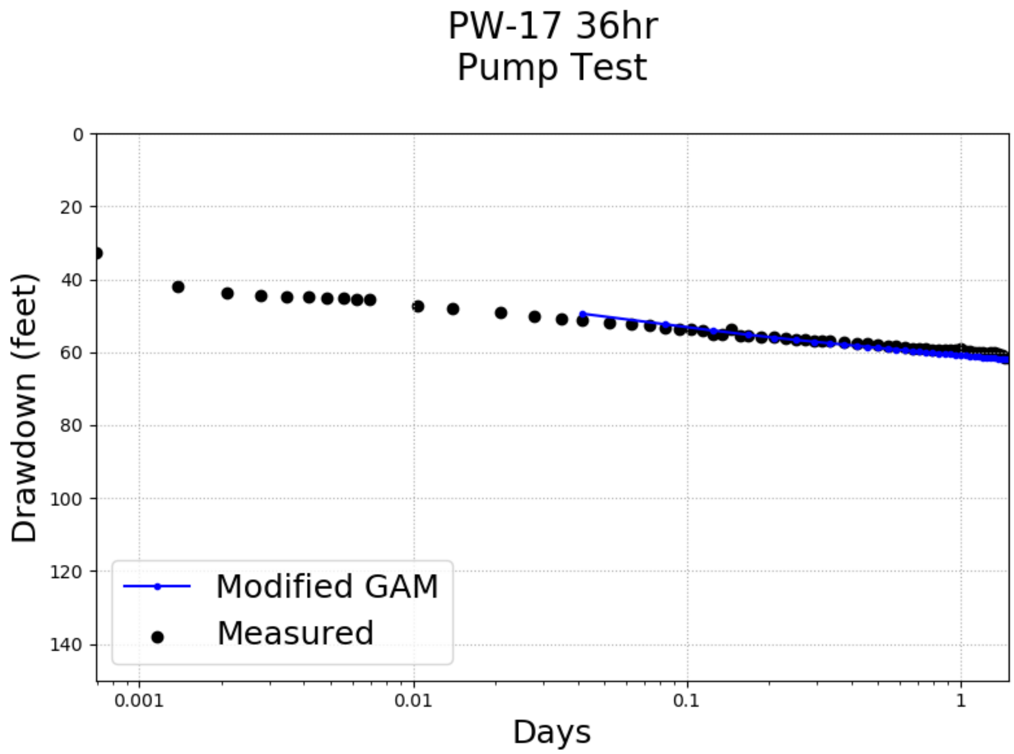

Figure 15 Measured and Simulated water levels for the 36-hour aquifer pumping test performed at Well PW-17

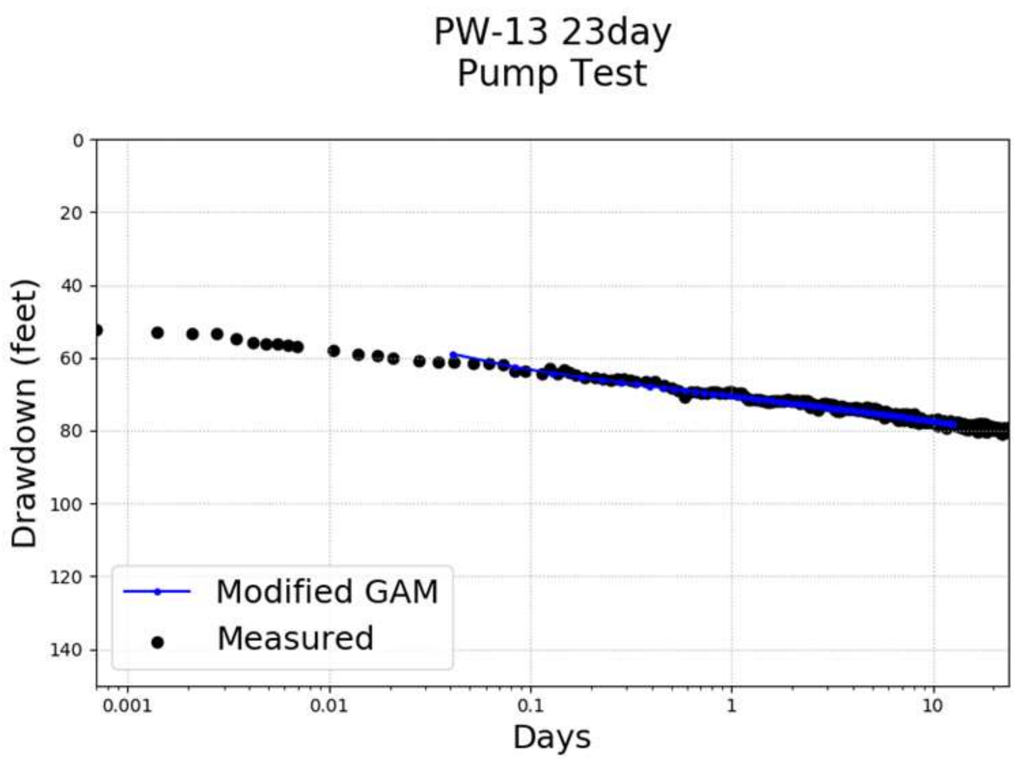

Figure 16 Measured and Simulated water levels for the 23-day aquifer pumping test performed at Well PW-13

Post Oak Savannah Groundwater Conservation District

310 East Avenue C
P. O. Box 92
Milano, Texas 76556

Phone: 512-455-9900
Fax: 512-455-9909
Email: gwestbrook@posgcd.org
Website: www.posgcd.org

Gary Westbrook, General Manager

September 25, 2020

Mr. Larry French
Director, Groundwater Division
Texas Water Development Board
Austin Texas 78711

Subject: Response to TWDB Comments on GMA 12 Submittal of Documentation for the Modification of Groundwater Availability Model for the Central Portion of the Sparta,Queen City, and Carrizo-Wilcox Aquifers

Dear Larry:

In your September 17 email to me, the TWDB provided comments on our initial submittal. I forwarded the comment to our consultants to address the comments. Attachment A provides the responses provided by INTERA.

The additional model files requested by the TWDB have been uploaded to the One Drive location where INTERA provided TWDB with the initial set of model files. Attachment B provides the signed GMA 12 meeting minutes that TWDB requested.

GMA 12 appreciates the opportunity to work with the TWDB to keep our GMAs kept up to date to represent the best available scientific principles and data.

Sincerely,

Gary Westbrook
General Manager
Post Oak Savannah GCD
c: District Files

ATTACHMENT A
RESPONSE TO COMMENTS

Comments on Report:

1. Page i, List of Figures: Figures 5 and 6 captions have extra text or comments after the caption text. Suggest removing “Can you add a square that indicates blue bars are from the GAM” and “Can you add a square that indicates yellow bars are from the Modified GAM”

Response: Report has been modified per the comment.

2. Page 6, last sentence: The root-mean-squared error for the Simsboro Aquifer in GMA 12 in Table 6 is 21.9 feet rather than 25.4 feet. The percentage is 21.9 /425 or 5 % rather than 6 %.

Response: We have updated the report using calibration statistics generated by Groundwater Vistas. For the original report, INTERA used a program called MODS2OBS to calculate the statistics.

3. The last attachment says it is for the model files but the document that follows discusses the geodatabase not the model files. Suggest updating with, “The site to download the model files will be sent to TWDB by email on September 14, 2020.”

Response: No action taken because the comment does not apply to our updated deliverables.

Comments on Model Files:

4. The Groundwater Vistas file does not contain the updated hydraulic conductivity values for the Simsboro. It contains the values from the original (2018) GAM. Please update the Groundwater Vistas file so it is consistent with the updated model.

Response: We have updated the Groundwater Vista files with the revised hydraulic conductivity values. The Groundwater Vistas files are available for download on the INTERA One-Drive site.

5. Targets are not loaded into Groundwater Vistas and the program used to analyze the calibration statistics was not provided with the model files so it is not possible to verify the documented calibration statistics. Please provide the program used to analyze the calibration statistics. |

Response: We have submitted a two Groundwater Vista files on the INTERA One Drive. One file includes calibration targets for steady state . The other file includes transient calibration targets.

Comments on Geodatabase:

6. The calibration statistics tables for the steady-state and transient runs are not updated in the new geodatabase. Please replace the statistics tables in the geodatabase with the statistics for the modified GAM so it is consistent with the Modified GAM.

Response: We have replaced the geodatabase with the updated calibration statistics. The new geodatabase is on the INTERA One Drive.

We also noted the following items are missing or incomplete:

7. The program used to calculate the model calibration statistics was not provided

Response: We have provided the GWV Vista files for calculating the model calibration statistics.

8. The geodatabase was not updated with the new calibration statistics tables

Response: See response to comment #6.

9. The Groundwater Vistas file was not updated with the new hydraulic conductivity values

Response: See response to comment #4.

10. The meeting minutes are unsigned. We suggest that this item can be addressed as part of the GMA 12 joint planning meeting on Friday, September 18.

Response: The signed minutes are provided in Attachment B.

Attachment B

GMA 12 Meeting Minutes For July 24, 2020

GROUNDWATER MANAGEMENT AREA 12 MEETING
This meeting was held virtually and the meeting recording may be viewed at
https://posgcd.org/gma-12-agendas-minutes/

July 24, 2020 – 10:00 am

GMA 12 Members Present	
Gary Westbrook	POSGCD
Jim Totten	LPGCD
David Van Dresar	FCGCD
David Bailey	METGCD
Alan Day	BVGCD

GMA 12 Members Absent
None

Others Present	**Entity**
Doug Box	POSGCD
Bobby Bazan	POSGCD
John Seifert	WSP
Steve Young	Intera
Darren Thompson	SAWS
Rebecca Batchelder	Lower Colorado River Authority (LCRA)
David Stratta	BVGCD
Blaire Parker	SAWS
Natalie Ballew	TWDB
Megan Haas	BVGCD
Andy Donnelly	DBS&A
Steve Box	Environmental Stewardship
Robert Bradley	TWDB
James Beach	WSP
Larry French	TWDB
Bob Harden	Harden
Steven Siebert	SAWS
Jayson Barfknecht	City of Bryan
Cindy Ridgeway	TWDB
Shirley Wade	TWDB
Matt Uliana	Intera
Lyn Clancy	LCRA

MINUTES

1. **Invocation**
   The invocation was given by David Bailey.

2. **Pledge of Allegiance**
   David Van Dresar lead the pledges to the flags of the United States and Texas.

3. **Call meeting to order and establish quorum**
   Gary Westbrook, serving as chair for this meeting, called the meeting to order at 10:03 a.m. and noted that all voting members of GMA 12 were present online.

4. **Welcome and introductions**
   Mr. Westbrook welcomed everyone to the virtual meeting and thanked them for their attendance.

5. **Public Comment on Agenda Items**
   Mr. Westbrook reminded everyone the GMA encouraged comment and questions on each item and invited public comment on agenda items at this time. No Public Comment was offered.

6. **Minutes of January 29, 2020 Groundwater Management Area (GMA 12) Meeting**
   Mr. Westbrook asked for consideration of the minutes of the January 29, 2020 meeting. After brief discussion, a motion was made by David Van Dresar to approve the minutes. The motion was 2nd by Jim Totten. Mr. Westbrook noted that due to the nature of virtual meetings it might be more efficient to ask for dissenting votes than to ask for verbal votes or perform role call votes, so he would proceed in that manner unless there was a desire from the voting members to do otherwise. All agreed. Mr. Westbrook asked for dissenting votes. There were none. The motion passed unanimously.

7. **Update from Groundwater Conservation Districts (GCDs) of GMA 12 on joint planning, water level monitoring, and compliance with Chapter 36.108, State Water Code**
   Mr. Westbrook reported POSGCD had completed its early Spring water level measurements and some additional measurements, and was now evaluating the monitoring wells in its network for information quality assurance and control (QA/QC).
   Mr. Day reported BVGCD had finished its second round of water level measurements and is evaluating certain areas for the addition of wells, as well as evaluating information of certain wells.
   Mr. Bailey reported adding monitor wells in the Simsboro, Calvert Bluff, and Hooper formations.
   Mr. Totten reported 95% completion of Spring measurements being completed and performing QA/QC on information of monitoring wells.
   Mr. Van Dresar reported completion of measurements prior to the pandemic with additional work to resume in the Fall.

8. **Discussion on expressions of Desired Future Conditions (DFC's) and compatibility between GCD's in GMA 12**
   Mr. Westbrook stated that this is a constant agenda item and there was no specific information reported on this item.

9. **Discussion of comments received from stakeholders**
Mr. Westbrook asked if any of the districts had received any new comments from stakeholders since the last GMA 12 meeting. All agreed there had been no new submissions received. Mr. Westbrook reminded all that the form created specifically for submitting comments to GMA 12 could be easily accessed on the posgcd.org website at the top of the GMA 12 page.

10. **Evaluation and discussion of future pumping scenarios using the Sparta/Queen City/Carrizo-Wilcox GAM and results, including predicted water levels and water budgets, and instruction to consultants concerning Joint Planning in GMA 12**
Mr. Westbrook introduced this item and reminded that GMA 12 consultants had been instructed to consider possible improvements to the GAM where localized information might prove useful to improve accuracy in the GAM. He invited Dr. Steve Young with Intera to report on communications with the Texas Water Development Board (TWDB) on this subject. Dr. Young gave a presentation entitled, "Proposed Modifications to the Central Portion of the Sparta/Queen City/Carrizo-Wilcox GAM". He discussed differences of the results of actual production and monitoring versus GAM predictions in the area of the Vista Ridge well field, as well as possible improvements to the GAM in that area. He also addressed the comments received from TWDB on the process of improvements to the GAM in that area. Mr. Westbrook invited Larry French of TWDB to provide comment and discussion on required steps to complete this task. Mr. Westbrook then asked if anyone else on the meeting had any questions. No questions were offered. After questions and discussion from GMA 12 representatives, Mr. Day moved to submit the new information and a request for improvements and updates to the GAM to TWDB. Mr. Totten seconded the motion. Mr. Westbrook asked for discussion. With none offered he called for the vote and asked if there were any GMA 12 representatives who with a dissenting vote. None were offered. The motion passed unanimously.

11. **Discuss requirements of Chapter 36.108(d) in adopting Desired Future Conditions:**
    a. **aquifer uses or conditions within the management area, including conditions that differ substantially from one geographic area to another;**

Mr. Westbrook invited Andy Donnelly of DBS&A to present information on this agenda item for consideration by the GMA. Mr. Donnelly gave a presentation entitled: "Aquifer Uses and Conditions Consideration Discussion." Mr. Westbrook invited questions and discussion from the GMA 12 representatives.

b. the water supply needs and water management strategies included in the state water plan;

Mr. Westbrook invited Steve Young of Intera to present information on this agenda item for consideration by the GMA. Dr. Young gave a presentation entitled: "GMA 12: Needs and Strategies." Mr. Westbrook invited questions and discussion from the GMA 12 representatives.

c. the impact on subsidence.

Mr. Westbrook invited Matt Uliana of Intera to present information on this agenda item for consideration by the GMA. Mr. Uliana gave a presentation entitled: "Evaluation of the Potential Impact of Subsidence in GMA 12." Mr. Westbrook invited questions and discussion from the GMA 12 representatives.

12. **Public Comment on non-agenda items**
Mr. Westbrook invited comment from the public. No comment was offered.

13. **Update from Texas Water Development Board**
Natalie Ballew of the Texas Water Development Board (TWDB) reported TWDB had recently updated the guidance documents and submission checklist for the GMA process and now includes information for non-relevant aquifers, and these documents are available on the TWDB website. She also reported new educational videos available on the TWDB website under "Texas Water News Room."

14. **Agenda items and Date for next meeting**
The next GMA 12 meeting will be scheduled for late August-September, 2020. Agenda items will include continuation of discussion of improvements to the GAM, any unresolved items from this agenda, and continuation of consideration of the nine factors included in Section 36.108(d) of the Texas Water Code.

15. **Adjourn**
The meeting was adjourned at 11:20 am.

THE ABOVE MINUTES OF THE MEETING OF GROUNDWATER MANAGEMENT AREA 12 HELD ON JULY 24, 2020, WERE APPROVED AND ADOPTED BY GMA 12 ON SEPTEMBER 18, 2020.

ATTEST:

Mid-East Texas Groundwater Conservation District

Fayette County Groundwater Conservation District

Brazos Valley Groundwater Conservation District

Lost Pines Groundwater Conservation District

Post Oak Savannah Groundwater Conservation District